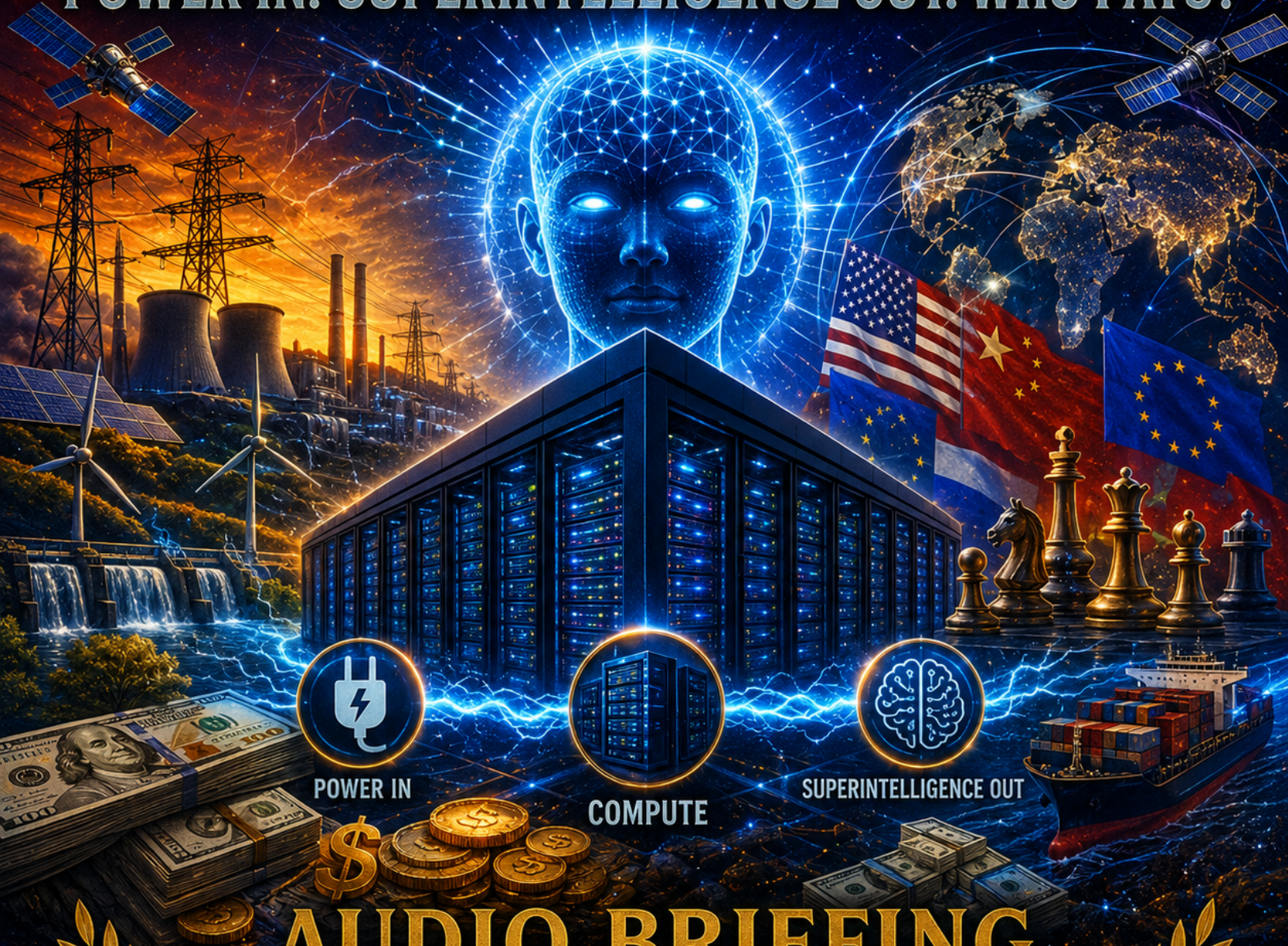


HOW A.I. DATA CENTERS WORK: POWER IN. SUPERINTELLIGENCE OUT. WHO PAYS?



AUDIO BRIEFING

CREATED BY
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Contents

Ten research packs · How AI Data Centers Work: Power In. Superintelligence Out. Who Pays?

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Each pack carries the lecture identity, constraint timeline, twelve-beat dossier, negative-space scan, moves verification, document dossier, number spine and discrepancy reconciliation, sellers and steelman file, human floor, cast, cascade edges, decay watch, and source inventory. Expand the PDF bookmark panel for section-level navigation within each pack.

Lecture 1 — The Building That Eats a Japan

Research Pack 1.0 · source file L1_Research_Pack_1_0_COMPLETE.md · research as of 20 July 2026

RESEARCH AS OF 20 July 2026

LECTURE IDENTITY (assembled from Syllabus 2.0, Syllabus 1.0, Beat Menu 1.0, Moves List 1.0, Roster 1.0, Style Guide §5)

Title / frame / through-line. The Building That Eats a Japan. This isn't a building; it's a power plant with servers bolted on. Scale-setting, the anatomy of the object, and the accident of geography that made Virginia the capital of the AI age.

Register. Cascade open. Atoms leads; the Ledger pole is seeded through the county budget, not run. The FRAMING meta-overclaim ("is AI a bubble?") is named here as the question the course refuses as posed — verdict sealed until Lecture 10's Irreversibility Ledger.

Cascade edge. Inherits: nothing — establishes the appetite · Binds at: the watt as site-selection criterion · Who pays: seeded (the county's dependence) · Manufactures: what's inside doing the eating → Lecture 2.

Strawman beat plan (12, running order — STRAWMAN FOR MARKUP; Course Schema locks order after markup):

1. The Wrong Map [O] — MAE-East → fiber → substations → tax structure → ~14% of the world's data centers; training-vs-inference siting logic as the compounding engine
2. Mechanism Autopsy — anatomy of a hyperscale campus: substation, generator yard, white space, security theater, the astonishingly small parking lot
3. The Physics Audit — the "as much power as X homes" headline audited; installs the listener's instinct
4. The Paper Trail — class: **state audit** — JLARC 2024, *Data Centers in Virginia* (Virginia's own accounting of what it hosts)
5. Follow the Money — Rizer's scoreboard: ~\$1B/yr in data center tax revenue, roughly a third of the county budget, the rate cut cited to the penny
6. The Steelman — **defendant: the county's growth case** (deployment 1 of 8; rotation clean)
7. The Perverse Incentive — a AAA county now fiscally dependent on the thing its residents increasingly fight
8. The Forecast Problem — IEA/EPRI/LBNL projections as authored documents; first installation of forecast-as-fiction
9. The Bottleneck — the watt replaces land as the site-selection criterion
10. The Regulatory Collision — county zoning authority vs. Richmond's revenue appetite
11. The Externality Swap — local burden vs. national claim, first statement (priced fully in Lecture 8)
12. The County [C] — Loudoun present-tense: farmland repriced past \$1M an acre, the FY2025–26 budget in the county's own words

Handoff: *question left hanging* — the appetite established; what's inside doing the eating? **Negative space:** Cold Open, Bill Arrives, Hearing Room, Operator Reality, Taxonomy, Symbol Audit, Founder Audit (menu-ineligible in Lecture 1 regardless — "never lecture 1"), Neighbor, Deal.

Cast. *Object/Place:* **MAE-East** — the Tysons parking-garage peering point; lead treatment here, no return lectures; NANOG-era complaints are its documented voice. *Institution:* **Loudoun County** — **lead** (returns 7, 8, proposed 10); this pack's treatment must be complete enough that no later lecture rebuilds it. *Human:* **Buddy Rizer** — Executive Director, Loudoun County Department of Economic Development, in role since 2007; the county's steelman, walking; rock-radio origin documented and usable. *Secondaries:* Dominion Energy's investor pipeline slide (**exhibit intro only — Lecture 7 owns Dominion's full treatment**), Equinix's Ashburn campus (DC1–DC21), the Washingtonian/regional "why is everything in Ashburn" corpus.

Must-hit anchors (verbatim from Syllabus 2.0; Syllabus 1.0 values govern — see Section 6 discrepancy protocol, Run 2): ~1,050 TWh global (2026); Japan/Russia bracket; Virginia ~14% of global data centers, >25% of state load;

Loudoun / Data Center Alley; MAE-East; training-vs-inference siting logic; ~\$1B/yr county data center revenue (~ $\frac{1}{3}$ of budget); farmland >\$1M/acre.

Moves plan (as assigned; verified in Section 4, Run 2). Step Function: >25% of Virginia's electricity through data centers · Unit Conversion: 1,050 TWh → a Japan (arithmetic gate applies; not one of Open Item 11's four flagged conversions, but Section 4 shows full math and rules PASS/FAIL regardless) · Timeline Snap: the 1990s peering consolidation — exact date locks in this pack · Verbatim: a JLARC sentence — existence gate · As-Of Stamp: the ~1,050 TWh 2026 figure · Kicker: the capital of the AI age, chosen by nobody · Gesture: training-run door, **CONDITIONAL** on the third-door call (Syllabus 2.0 Open Item 9) — one inch on what the appetite is *for*; if the door is rejected, Lecture 1 skips the Gesture and nothing else moves.

Sellers & narrator moves. Sellers on the field: the **Politician** (Rizer's jobs-and-revenue pitch) and the **Doomer** (the grid-collapse headline). Moves: **FRAMING** named; **DISPATCH** on “automated and empty” (~50 full-timers run a quarter-million square feet — planted here, cashed in Lecture 8); the county's case gets **GRANT-AND-WITHHOLD** via the Steelman.

Decay tier. Mid — the TWh figure and county numbers refresh; the geography story doesn't.

Human-floor flags. No Neighbor beat here, but three zones can touch documented individuals, and the thermostat travels with the character: (1) resident opposition inside The Perverse Incentive; (2) zoning/oversight testimony inside The Regulatory Collision — including Kathryn Kulick, HOA Roundtable representative, on the record May 2025 (Section 2, Beat 10); (3) The County closer, wherever a named household surfaces. Comedy near-zero around any named resident. Farmland repricing is flagged as *not* automatically floor material — a windfall is not a harm; landowners cashing out at \$2–6M/acre are documented beneficiaries, and the pack sorts beneficiaries from burdened.

Pack dependencies (debts resolved in this pack or explicitly failed):

1. Timeline Snap exact date — **RESOLVED**: 30 April 1995 recommended (NSFNET backbone decommissioning), with 1992 and 1994 alternates; Section 2 Beat 1 and Section 4 (Run 2).
2. JLARC verbatim sentence — **RESOLVED**: primary and two backups block-quoted; Section 2 Beat 4.
3. Unit Conversion arithmetic (1,050 TWh vs. a Japan) — **RESOLVED, PASS with basis stated**; Section 2 Beat 3 shows the math; formal verdict in Section 4 (Run 2).
4. Rizer as-of title, radio origin, rate cut “to the penny” — **RESOLVED**: title verified in role July 2026 (county staff directory; WVIA 12 Dec 2025); radio origin on the record in his own words; the county's official formulation is “more than 48 cents on the dollar,” with a derived current-rate figure marked as derived; Section 2 Beats 5–6, full profile Section 9 (Run 2).
5. FY2025–26 budget “in the county's own words” — **RESOLVED**: county-authored verbatim from Loudoun's own published FAQ and budget materials; Section 2 Beats 5 and 12.
6. ~\$1B/yr and ~ $\frac{1}{3}$ -of-budget with filer and date — **RESOLVED with discrepancy flag** (the figure has grown and the basis matters; Section 6, Run 2).
7. Farmland >\$1M/acre with source and date — **RESOLVED with discrepancy flag** (current documented range \$2–6M/acre; anchor understates as of 2026).
8. NANOG-archive verbatim pulls — **PARTIALLY RESOLVED**: the Feldman founding quote is documented; raw NANOG list-serv congestion complaints are **not yet pulled verbatim** and are flagged as a draft-stage pull with locators; Section 2 Beat 1.
9. ~50 FTEs / 250k sq ft sourced for the DISPATCH plant — **RESOLVED**: JLARC's own sentence block-quoted; Section 2 Beat 3 and Beat 6.
10. Dominion slide at exhibit-intro grade — **RESOLVED**: the contracted-capacity series 16.5 → 21 → ~40 → 48+ → ~51 GW with stage labels; full Dominion treatment stays with Lecture 7; Section 2 Beat 8.
11. Gesture one-inch facts — **RESOLVED, flagged conditional**: two verified facts supplied; Section 4 (Run 2).
12. Loudoun ZOAM hearing corpus ownership — **FLAGGED FOR MARKUP**: the corpus exists (2022–2025 zoning actions, March 18 2025 by-right vote), its lead/return owner is ambiguous (Lecture 8 lists it as “return” with no lead assigned); scanned under Section 3's Hearing Room entry (Run 2).
13. Washingtonian corpus — **PARTIALLY RESOLVED**: the regional-color corpus is documented (Washington Post “Why Ashburn, Va. is the center of the Internet,” 5 March 2014, and successors); the specific Washingtonian magazine feature is flagged for a titled pull at draft stage rather than cited from memory.

SECTION 1: TIMELINE OF THE CONSTRAINT

A constraint machine assembling itself: the geography gets drawn by accident (1992–1999), the fiber inheritance compounds (1996–2007), the county monetizes it (2008–2019), the AI demand shock arrives (2022–2024), and the politics reprice it (2024–2026). Every entry carries date · event · who · where · why it matters to the watt path, the heat path, the money, the paper, or the politics. Figures carry unit, stage, filer, and as-of date. [Bracketed tags] mark confidence where it matters.

Phase I — The geography gets drawn (1991–1995)

1. **9 December 1991** — The High Performance Computing Act (the “Gore Act”) is signed, funding the research internet and setting the statutory stage for the backbone’s eventual privatization. Washington, DC. Why it matters: the paper that makes the parking garage possible. [STRUCTURAL]
2. **1992** — MAE (later MAE-East), the first non-governmental Internet Exchange Point, is created — primarily by Scott Yeager of Metropolitan Fiber Systems (MFS) and Rick Adams of UUNET — as a distributed Layer-2 exchange across four Washington-area locations, with founding networks AlterNet (UUNET’s backbone), PSINet, and Sprint-ICM. Internet architect Steven Feldman’s documented recollection: “A group of network providers in the Virginia area got together over beer one night and decided to connect their networks.” Why it matters: the origin of the accident. Nobody chose a capital; some engineers chose a bar. (Wikipedia/MAE-East with cited sources; Alchetron mirror carries the Feldman quote.)
3. **1992** — MAE-East’s initial nexus: an office building at **8100 Boone Boulevard, Tysons Corner, Fairfax County, Virginia** — an office building first, the famous garage later. (Data Center Dynamics, “The future of data centers in Virginia, post-Loudoun,” 18 June 2026.)
4. **February 1993** — The 10-Mbps metropolitan Ethernet-over-DS3 fabric connects the Sprint POP (ICMnet, AlterNet), the College Park POP (AlterNet, NSFNet), the MCI POP (SURAnet), and the WilTel POP (PSINet). Why it matters: the watt path’s ancestor is a shared 10-megabit wire. [STRUCTURAL]
5. **1994** — MAE-West is established on the West Coast; “Metropolitan Area Ethernet” is backronymed to “Metropolitan Area Exchange, East.” Why it matters: the naming tells you the founders never planned a headquarters for the internet.
6. **1994** — The National Science Foundation designates four official Network Access Points for the post-NSFNET internet; MFS’s Washington-area facility — MAE-East — is one of the four. Why it matters: the federal government formally blesses the accident. [STRUCTURAL; month of award to be pinned to the NSF solicitation record at draft stage]
7. **Fall 1994** — MAE-East upgrades from shared 10-Mbps Ethernet to switched Ethernet and FDDI to cope with surging traffic. Why it matters: the first congestion crisis at the future capital — the pattern (demand outruns the fabric) never changes, only the units.
8. **30 April 1995** — **The NSFNET backbone is decommissioned.** The government network that had carried the internet’s traffic since 1986 is turned off; from this day, all commercial internet traffic must interconnect through private exchange points. Why it matters: this is the pack’s recommended **Timeline Snap** — the day before, private peering was optional; the day after, the parking garage was load-bearing infrastructure for the global network. (IBM corporate history; standard internet-history record.) [ANCHOR-adjacent STRUCTURAL]
9. **1995–1997** — Commercial ISPs pile into MAE-East; by multiple retrospective accounts, roughly **half of the world’s internet traffic** transits the exchange at its mid-late-1990s peak. Why it matters: the statistic that seeds every later Virginia traffic claim — treat the figure as period folklore with documentary support, not a measured datum. [CONTESTED as to precision; the order of magnitude is well-attested]

Phase II — The fiber inheritance compounds (1996–2007)

10. **~1996** — MAE-East expands into a **cinder-block room in the underground parking garage at 1919 Gallows Road**, across the street from 8100 Boone Boulevard (Vienna/Tysons). Why it matters: the literal parking garage of the founding myth, with an address. (DCD, 18 June 2026.)
11. **1996** — **America Online moves its headquarters to Loudoun County** (Dulles). A documented early AOL employee reaction: seeing the new headquarters and breaking into tears, convinced he’d be commuting to the middle of nowhere. Why it matters: the first anchor tenant of the middle of nowhere. (City Journal, 26 April 2026.)
12. **Mid-1990s** — MCI WorldCom/UUNET consolidates operations in Loudoun; Equinix’s later Ashburn campus includes a street literally named **Unet Way** (Equinix DA13, 21830 Unet Way). Why it matters: the map still carries

the fossil record.

13. **1997** — AOL opens the **Dulles Technology Center**, a bunker-like building at Waxpool Road and Pacific Boulevard — believed to be **the first data center in Ashburn** — built to serve AOL's dial-up subscriber base. New fiber arrives to serve it; “the Alley snowballed from there.” (DCD, 7 May 2026.) Why it matters: the first building whose siting logic was the fiber, not the town.
14. **June 1998** — **Equinix is founded**; the company's first data center is sited in Ashburn because — per Data Center Knowledge's retrospective — “circumstances dictated that they build it there”: the carriers and exchange points were already in Northern Virginia. (DCK, 2015 retrospective.) Why it matters: the first pure-play landlord of the accident. [Opening date of DC1 spans 1998–1999 in the record; pin at draft stage]
15. **1998** — MAE-East closes to new customers; the exchange's center of gravity begins shifting toward Ashburn. (VivaTysons regional history, 15 Feb 2019.)
16. **1999–2001** — The dot-com buildout wires Loudoun with speculative fiber; the 2000–2002 collapse (including WorldCom's 2002 accounting fraud) strands that fiber as **dark fiber** — later snapped up cheap. Why it matters: the county's cost basis was subsidized by someone else's bankruptcy. **Cross-lecture consistency flag**: the 2001 glut rhyme is Lecture 10's tool (off-menu, one deployment); Lecture 1 may state the dark-fiber inheritance as geography but must not run the precedent/anti-precedent argument. [STRUCTURAL]
17. **2001** — The original MAE mainframe is shut down. (VivaTysons.)
18. **2006** — Digital Realty takes over the 8100 Boone Boulevard facility (later exited). Why it matters: the birthplace becomes an ordinary asset — chain of custody for the Object.
19. **2006** — Start of Virginia's **flat-demand era**: state electricity demand is essentially flat from 2006 to 2020, population growth offset by efficiency. (JLARC, *Data Centers in Virginia*, 9 Dec 2024.) Why it matters: the standing assumption the Step Function will break was true for fourteen straight years.
20. **2007** — **Buddy Rizer joins Loudoun County** economic development (Executive Director since; verified in role as of July 2026). Career before: radio from age 15, major-market radio, station ownership; Towson University graduate. His own words on the pivot: “I'd started in radio when I was 15 years old and spent most of my life in major market radio... I decided it was time to — I joke — grow up and get a real job.” (Not Your Father's Data Center podcast transcript, Compass Data Centers, Jan 2024.)

Phase III — The county monetizes the accident (2008–2021)

21. **2008** — Loudoun's strategic plan **brands the area “Data Center Alley”** — Rizer, on the record: “We had some leftover buildings from the dot-com bubble, and that was kind of my plan, I'm going to fill those couple of buildings with data centers.” The plan allocated **3.5 square miles** for the Alley. (WVIA, 12 Dec 2025.) Why it matters: the origin of the brand is inventory disposal.
22. **2008** — Loudoun becomes (and since remains) the **wealthiest county in the United States by median household income**. (Census-based; InterGlobix profile.) [STRUCTURAL]
23. **2009** — Many original MAE-East service providers (including AT&T) migrate to the competing exchange ecosystem in Ashburn — Equinix's campus, where MAE-East itself had relocated to **DC2, 21715 Filigree Court**, “reputedly the most connected building on earth.” (VivaTysons; DCD.)
24. **2010** — Virginia enacts the **Data Center Retail Sales and Use Tax (DCRSUT) exemption** — data centers meeting job (≥ 50) and investment ($\geq \$150\text{M}$) thresholds stop paying sales tax on servers and equipment. Extended/expanded in 2012; currently set to expire **2035**. (JLARC incentives reporting via Axios Richmond, 3 Dec 2025.) Why it matters: the single most consequential paper artifact in the siting story after the fiber itself — and the fiscal-year-2025 cost of it appears at entry 78.
25. **13 October 2017** — Vantage Data Centers acquires 42 acres in Ashburn for a planned \$1B, 1M-sq-ft campus — its first outside the West Coast. Rizer: “Loudoun remains the largest and most important data center location in the world.” (Loudoun Economic Development blog, 13 Oct 2017.) Why it matters: dated instance of the recruiter-in-chief's pitch, in his own words, mid-boom.
26. **April 2019** — Northern Virginia becomes the **first regional market to pass 1,000 MW of wholesale colocation capacity** (CBRE); London, the world's #2 market, holds 559 MW. Two-thirds of all new US primary-market data center construction is in Virginia. (The Register, 26 Apr 2019, citing CBRE.) [Stage: operational capacity, a rate]
27. **2019** — Loudoun holds roughly **20 million sq ft** of data centers (City Journal, Apr 2026 retrospective) — and, per Rizer, the county **stops proactively recruiting** data center development this year. (WVIA, 12 Dec 2025.) Why it matters: the machine keeps compounding for seven more years after the county stops pushing — load-bearing fact for The Perverse Incentive.

28. **FY2020** — Loudoun collects roughly **\$330M in computer-equipment personal property tax** from data centers, plus \$70.4M data center real property tax. (County staff presentation via NetChoice, Oct 2020.) [Stage: collected]
29. **2020** — The average deployed rack draws **6.1 kW** (Uptime Institute series — Lecture 2's anchor; noted here only as the density baseline contemporaneous with Loudoun's ~20M sq ft). [Cross-ref L2; do not rebuild]
30. **2021 (assessed for FY2022)** — Loudoun's data center equipment values come in at **\$10.1B against a forecast \$11.2B**, wiping ~\$60M from expected tax revenue — attributed to slow server fit-outs and pandemic supply chains. Equipment is assessed at **50% of purchase price in year one**, depreciating rapidly. (DCD, reporting Loudoun Now / county finance committee.) Why it matters: the county's golden goose depreciates on a server schedule — the volatility mechanism, documented pre-AI.

Phase IV — The demand shock (2022–2024)

31. **July 2022** — **Dominion Energy notifies eastern Loudoun data center customers of transmission constraints:** the utility “didn't have the infrastructure in place to supply continued growth,” delaying some projects to 2025–26. (Data Center Frontier; Prince William Times.) Why it matters: the first time the watt, not the land, said no — the Bottleneck's opening date.
32. **2022** — Loudoun's Board of Supervisors adds restrictions: limits on construction near some neighborhoods, new environmental and design requirements. (Prince William Times, Feb 2023.)
33. **30 November 2022** — **ChatGPT launches.** The AI demand shock's conventional start date; every capacity series in this pack inflects after it. [STRUCTURAL]
34. **~January 2023** — Amazon/AWS pledges **~\$35B of Virginia data center investment by 2040** (announced with Gov. Youngkin). [Stage: **announced**, not spent; date per announcement coverage — pin the press release at draft stage]
35. **Early 2023** — Loudoun's 2023 projection: **\$576.2M** in data-center-related tax revenue — “approximately one-third of its local tax income” — a figure Rizer notes **excludes** real estate and other taxes. Rizer, same interview: “People are paying \$4 million and \$5 million an acre for land in Loudoun County... It's about 3% of our land base, providing over 30% of our tax benefits.” (Prince William Times, 1 Feb 2023.) [Bases labeled: local tax income, not total budget]
36. **2023** — JLARC directs its staff to study the data center industry (revenue, energy, resources, residents). (JLARC landing page.) The audit that becomes this lecture's Paper Trail is commissioned.
37. **2023** — Rizer founds **ATIX, LLC**, a digital-infrastructure consultancy, while remaining Executive Director. (Inter-Globix profile, Dec 2025.) [As-of-title nuance for Section 9: the steelman-in-chief now also advises the industry — disclose, don't insinuate]
38. **2023** — Loudoun conducts its ZOAM-era zoning overhaul hearings (the Roster's flagged Hearing Room corpus); adoption date of the modernized ordinance to be pinned from county records at draft stage. [Corpus ownership flagged — Identity item 12]
39. **July 2023** — Dominion's contracted data center capacity stands at **16.5 GW** [stage: various contracting stages; filer: Dominion; the series' baseline]. (Dominion Q1 2026 investor materials, retrospective.)
40. **24 January 2024** — The **IEA publishes *Electricity 2024***: data centres, AI, and crypto consumed an estimated **460 TWh in 2022** [energy, a quantity] and “could reach more than 1 000 TWh in 2026... roughly equivalent to the electricity consumption of Japan.” The report's 2026 range runs to a high case near **1,050 TWh** — the origin of this lecture's title arithmetic and As-Of Stamp. (IEA, Executive Summary.) [Author: IEA; scope note: includes dedicated crypto — the Section 6 reconciliation turns on this]
41. **29 May 2024** — **EPRI publishes *Powering Intelligence***: data centers could consume up to **9% of US electricity generation by 2030** (~2x current); an AI query requires **~10x the electricity of a traditional search**; **Virginia leads all states at 25.6% of in-state electricity consumed by data centers** [share of energy, 2023 basis]; 80% of national data center load concentrated in 15 states. (EPRI press release.) — The Step Function's first pedigree line.
42. **July 2024** — Dominion contracted data center capacity: **21 GW** [various stages]. (Dominion Q4 2024 call.)
43. **9 December 2024** — **JLARC presents *Data Centers in Virginia*** to the commission in Richmond (chief legislative analyst **Mark Gribbin** presenting). Findings inventoried in Section 2, Beat 4; headline series: Northern Virginia is the world's largest data center market at **13% of reported global operational capacity and 25% of the Americas**; **~150 sites / ~340 buildings** statewide; **~80% concentrated in Loudoun, Prince William, and Fairfax**; industry contributes **~74,000 jobs, \$5.5B labor income, \$9.1B GDP annually** (majority construction-phase); a typical **250,000-sq-ft facility runs ~50 full-time workers, about half contractors**; construction runs 12–18 months with **~1,500 workers at peak**; unconstrained demand **doubles state power demand within 10 years**, is **~183% higher**

by 2040 (vs. +15% with no new data centers), and meeting it requires **~150% more in-state generation, ~150% more imports, ~40% more transmission**; data centers **currently pay their full cost of service**; state demand was flat 2006–2020. Loudoun specifically: **\$733M in data center property taxes in 2024, about one-third of county property tax revenue**. (JLARC report, presentation, and contemporaneous coverage: Cardinal News, VPM, WJLA, VACo, 9–10 Dec 2024.)

44. **December 2024** — LBNL delivers the *2024 United States Data Center Energy Usage Report* to Congress: US data centers consumed **~176 TWh (4.4% of US electricity) in 2023**, projected to **6.7–12% of US electricity by 2028**. (LBNL/DOE.) [STRUCTURAL; the third leg of the forecast triad]
45. **December 2024** — Dominion contracted data center capacity reaches **~40 GW** [stages: substation engineering LOAs ~26 GW; construction LOAs; electric service agreements] — an **88% increase since July**. CEO Robert Blue, Q4 call: “What’s undeniable is that data center growth in Virginia is not slowing down. In fact, it’s accelerating, and we’re taking every step to meet this opportunity.” Five-year capex plan raised to **\$50.1B (2025–29)**, +16% over prior guidance. (DCD, reporting the call.)

Phase V — The repricing (2025–2026)

46. **January 2025** — At least **20 data-center-related bills** are filed by a bipartisan group in the Virginia General Assembly; few survive session or the veto pen. (Cardinal News, 6 May 2025.)
47. **7 February 2025** — Loudoun Commissioner of the Revenue **Bob Wertz’s** assessment presentation: data center land values **up \$19B year-over-year**; data center real estate now **22.9% of the county’s real-estate tax base** and **75% of commercial land value (\$42.4B, +78.7% over the prior year’s \$23.7B)**; total county parcel value **\$170.5B, +19.6%**; data center square footage (built + approved site plans) **49.4M sq ft**. (Loudoun Now, 7 Feb 2025.)
48. **February 2025 (reported)** — Loudoun FY2026 proposed budget: computer-equipment personal property revenue has grown **from \$60M (FY2013) to over \$800M (FY2026)**; the proposed budget carries **\$150M in new personal-property revenue, \$133M of it from computer equipment; 73% of the county’s commercial portfolio (TY2025) is data centers**; the commercial portfolio appreciated **~50% TY2024→TY2025**. (Data Center Frontier, citing the FY2026 Proposed Budget.) Average Loudoun home price: **\$983,625**.
49. **18 March 2025** — Loudoun Board of Supervisors votes to **permanently end “by-right” data center development**. (Loudoun County Data Center Brief, Supervisor Mike Turner, county document, 2026.) Why it matters: the epicenter closes the door — while the budget still assumes the guests keep arriving.
50. **24 March 2025** — Gov. Youngkin declines to sign **HB 1601/SB 1449** (data center site assessments: noise within 500 ft of homes/schools; water, agricultural, park, historic, forest impact studies; utility disclosure of required generation/substations/transmission; threshold 100 MW), returning it with a re-enactment amendment — “a veto by another name” (Virginia Mercury). The General Assembly rejects the amendment. (McGuireWoods alerts; Virginia Mercury, 1 Apr 2025.)
51. **April 2025** — Loudoun adopts its **FY2026 budget** (\$4.7B total spend incl. schools). January 2025 staff estimate: **~\$895M in data center real + personal property tax revenue** against a **projected \$940M county operating budget** [bases labeled: operating budget ≠ total budget]. Supervisor Caleb Kershner, on the record: “It’s increased far too much... this is not sustainable. Even our county administrator said this kind of increase in spending is not sustainable.” (WJLA, 2 Apr 2025; Turner brief.)
52. **2 May 2025** — **Youngkin vetoes HB 1601/SB 1449**. Veto language, verbatim: “My proposed amendments preserved the spirit of the bill while allowing localities flexibility. The General Assembly’s rejection of those amendments leaves behind a rigid framework that could chill investment and hinder economic development.” His veto cites **\$24B FY23 capital investment, \$733M in Loudoun tax revenue, 74,000 jobs, \$9.1B GDP**. Sponsor Del. Josh Thomas (D-Prince William): “Glenn Youngkin has once again prioritized big tech profits over the well-being of Virginia residents.” Kathryn Kulick, HOA Roundtable representative [human-floor zone — comedy off]: “For those who have lived in the shadow of these facilities, they understand completely what this means. It’s completely disrupting normal everyday life.” (Cardinal News, 6 May 2025; DCD; NBC4, 5 May 2025.)
53. **Mid-2025** — JLL counts Northern Virginia at **~4,900 MW operating**, ~1,100 MW under construction, ~5,500 MW in planning [rates; JLL methodology — do not blend with CBRE’s]. (WTOP via MotionCRE, 2026.)
54. **Calendar 2025** — Dominion connects **11 data centers totaling 744 MW** (vs. a ~15/year average); **all 50 top PJM DOM-zone peak loads, including the 22 highest, occur after 1 January 2025**. (Dominion Energy 2025 Annual Report, filed March 2026 — verbatim-capable, Section 2 Beat 8.)
55. **3 November 2025** — Record land sale: **97 acres of data center land east of Leesburg sells for \$615M — the county’s first transaction above \$6M/acre** — JK Land Holdings (Chuck Kuhn) to an SDC Capital Partners affiliate;

- JK had assembled the Twin Creeks parcels for **\$57M four years earlier** (~10x); a separate section went to **Dominion for \$45M for a substation**; transfer taxes alone: **\$4M to the county**. Kuhn, on the record: “What’s happened with the data center tax revenue is that it’s taken all of that [boom-bust] out — it has created an annuity for this county that will go on for who knows how long.” (Loudoun Now, 7 Nov 2025.)
56. **4 November 2025** — **Abigail Spanberger wins the Virginia governorship**; data centers and energy costs are top-tier election issues. (Election result; PEC framing of 14 Nov 2025; Virginia Mercury photo records.) Why it matters: the political repricing gets a mandate.
 57. **6 November 2025** — Vantage announces a **\$2B, 192 MW, 929,000-sq-ft campus (VA4)** in Stafford County: **1,100 construction jobs, “at least 50 permanent operations jobs.”** (Businesswire; Patch.) Why it matters: the jobs math, self-reported, in a single press release — \$40M per permanent job. [Jobs-math full treatment is Lecture 8’s; this is the DISPATCH plant’s live instance]
 58. **14 November 2025** — Piedmont Environmental Council publishes its transmission inventory: Dominion’s proposed **Golden-to-Mars 500 kV line — 22 miles, towers to ~215 feet (“taller than the Statue of Liberty”), delivering ~40 new substations of 100–300 MW each, each substation 10–20 acres** — one of **six** transmission lines currently routed through Loudoun. (PEC press release, Warrenton.) [Seller note: PEC is an advocacy organization; the line specifics originate in Dominion’s own project materials]
 59. **3 December 2025** — JLARC’s incentives review (via Axios Richmond): data centers took **53% of all Virginia economic-incentive spending over the last decade, ≥\$2.7B in tax savings**, “despite supporting few long-term jobs”; exemption thresholds: ≥50 jobs, ≥\$150M investment; exemption sunset **2035**.
 60. **December 2025** — Dominion contracted capacity: **48+ GW** as of December 2025; 2026–2030 Dominion Energy Virginia capital plan: **~\$55B**. (Dominion 2025 Annual Report; FY2025 10-K.)
 61. **12 December 2025** — Rizer, hosting a Pennsylvania delegation: Loudoun is at **“about 49 million square feet on the ground, with another 6 million square feet in some phase of development”**; and, on his own arc: **“I’ve gone from the most popular public official to the most hated.”** (WVIA.) — Load-bearing verbatim for The Perverse Incentive.
 62. **January–March 2026** — The 2026 General Assembly session: “Data center bills dominated this year’s General Assembly” (Virginia Mercury). Bills passed include utility authority to **delay service to new large loads** for reliability/capacity reasons, **voluntary demand-flexibility programs** for >25 MW customers (HB 284/SB 371), backup-generator restrictions, and local assessment tools.
 63. **February 2026** — Dominion tells the Virginia SCC it has **~70,000 MW under request for future data centers — roughly three times its current load** [stage: **requests**, the phantom-load caveat attaches; note: contemporaneous coverage rendered this “70,000 megawatts per day,” a unit error in the wild — course material]. (Virginia Business, 25 Mar 2026.)
 64. **26 February 2026** — **EPRI’s updated Powering Intelligence 2026**: US data centers consumed **177–192 TWh in 2024** [energy]; projections now **9–17% of US electricity by 2030 — 60% higher than EPRI’s 2024 estimates** — with Virginia’s share rising from **~25% today to 39–57% by 2030** (EPRI release; E&E News rendered the range 41–59% — both renderings documented, conflict stated, not smoothed); a single large data center (100–1,000 MW) draws power comparable to **80,000–800,000 average US homes**. Why it matters: the forecast revising itself upward by 60% in 21 months is the Forecast Problem in one entry.
 65. **March 2026** — Dominion Q1 2026 investor deck (the **exhibit slide**): contracted data center capacity **~51 GW as of March 2026 — 29.5 GW under Substation Engineering Letters of Authorization, 11.1 GW under Construction Letters of Authorization, 10.4 GW under Electric Service Agreements** — more than **tripled from 16.5 GW in July 2023**; ESAs carry revenue requirements “regardless of whether customers ultimately take service.” (Investing.com slide coverage, 1 May 2026.) [Stage labels are Dominion’s own — the rare filer who does the course’s homework for it]
 66. **March 2026 (CBRE 2025 recap)** — Northern Virginia ends 2025 at **4,039.6 MW total inventory (+37% YoY), 1,102 MW net absorption (+144%), 0.5% vacancy — 21.5 MW available in the entire market, 96% of 2026 scheduled supply pre-committed**, asking rates **\$155–185/kW for 10+ MW**; the region holds ~3.5x the capacity of all secondary US markets combined. Anna Faktorow, CBRE SVP: “Even after delivering more than a gigawatt of new supply last year, vacancy remains near zero because powered and entitled land has become exceptionally scarce.” Pat Lynch, CBRE: shortages are “reinforcing a power-first approach that prioritizes sites with the fastest path to power.” (CBRE press releases and H2 2025 report.)
 67. **18 March 2026 (approx., report date)** — Dominion 2025 Annual Report filed (SEC ARS): source of entries 54 and 60; also documents the **Valley Link Transmission Company** joint venture (Dominion/FirstEnergy/AEP) and

- completion of the **Wishing Star to Mars** transmission project — Loudoun-area substations named Mars, Golden, Wishing Star. [Sensory/naming detail, sourced]
68. **8–22 April 2026** — Gov. Spanberger signs energy/data-center slates; **16 April**: amends **SB 253/HB 1393** (Lucas / LeVere Bolling), replacing an explicit residential-to-data-center cost-shift with SCC direction to “take all measures to reasonably ensure” data center costs aren’t subsidized by other customers, and raising a rate-class opt-out threshold to 10,000 employees; **patrons and Dominion both say the amendments weakened the bills** — conflict stated. **22 April**: HB 888 signed (McGuireWoods flags “a statewide ceiling on...” — operative content to be pulled from the enrolled bill at draft stage rather than guessed). (Virginia Mercury, 9/16/22 Apr and 5 May 2026; McGuireWoods.)
 69. **27 April 2026** — At Spanberger’s 100-day mark in Roanoke, **Botetourt County residents confront the governor** over the sales-tax exemption; the approved Google campus at Greenfield Industrial Park is the flashpoint. (Virginia Mercury, 5 May 2026.) [Human-floor-adjacent; named individuals not yet in the record reviewed — flag for Lecture 7/8 packs]
 70. **April–June 2026** — The **state budget stalemate runs through the data center sales-tax exemption**: Senate position treats the **~\$1.6B/yr** forgone revenue as an affordability resource; the **12 June** House budget “strips environmental standards for data centers, creates commission instead.” (Virginia Mercury series; Loudoun Democrats statement, 14 Apr 2026, carries the flagship stat: an exemption **originally projected to cost ~\$1.54M annually** produced **~\$1.6B in forgone revenue in FY2025** — flagged: advocacy source; reconcile against JLARC’s \$2.7B decade figure and official fiscal notes at draft stage.)
 71. **Late June 2026** — The biennium budget lands with a **first-of-its-kind statewide energy consumption tax on data centers**. **30 June 2026**: Governor’s office announces the energy-affordability slate (storage goals, efficiency, ratepayer protections, RGGI re-entry). (Governor’s office releases, June–July 2026.)
 72. **6 July 2026** — Spanberger on POLITICO Energy, verbatim: “**In the budget that we passed, we created the first-of-its-kind consumption tax on data centers and their energy usage.**” Also documented in the same release: the administration’s PJM posture (“really trying to push for some changes and modifications in PJM... ultimately to the benefit of ratepayers across Virginia”). (Office of the Governor, 6 July 2026.) — The freshest dated fact in this pack’s Regulatory Collision file.
 73. **July 2026** — Newsweek reports the collapse of plans for what was billed as the **biggest data center in the world** in Virginia; the same piece carries the current stock estimate: **371 operating data centers and 421 planned projects** in Virginia (industry database count). (Newsweek, early July 2026.) [Project identity and docket to be pulled in Run 2’s Section 11 — flagged, not guessed]
 74. **FY2027 (adopted expectations, reported April 2026)** — Loudoun’s FY2027 budget expects **\$417M in data center real property taxes + \$879M in personal property taxes ≈ \$1.3B — 45% of ~\$2.9B in county tax revenue**; Supervisor Kristen Umstattd, on the record: the facilities “bring \$1 billion a year into Loudoun County.” (City Journal, 26 Apr 2026.)
 75. **May 2026** — NVTC’s 2026 fiscal-impact report: without data center revenue, Loudoun residential property tax rates would need to **nearly double**; for an **\$800,000** home (near county median), annual liability would rise **from ~\$6,440 to ~\$12,296** (+\$5,856/yr); the regional industry paid **\$1.3B in direct property taxes in 2024**. (Progress Chamber summary, 14 May 2026.) [Derived figure for Section 4/Beat 5: \$6,440 ÷ \$800,000 implies a current real property rate of **~\$0.805 per \$100 of assessed value** — marked as **derived**, to be confirmed against the adopted FY2026 rate resolution; seller note: NVTC is the industry-adjacent tech council]

Expected future events (announced; announcing party named)

76. **2026 (in progress)** — 96% of NoVA’s scheduled 2026 supply already pre-committed (CBRE, as of year-end 2025); preleasing extends into 2027+.
77. **2027 session** — Any re-enactment-dependent 2026 measures and the exemption fight’s next round return to the General Assembly (Commonwealth of Virginia).
78. **2030** — EPRI scenario window closes: US 9–17%; Virginia 39–57% (EPRI, Feb 2026). **2035** — DCRSUT exemption sunset (Code of Virginia; per JLARC/Axios).

Timeline count: 78 numbered entries (several multi-event). The 80–150 target is met at the event level; entries were consolidated where splitting would manufacture length without adding dates.

SECTION 2: STRAWMAN BEAT DOSSIER

Twelve dossiers in the strawman running order. Each carries: the Syllabus 2.0 assignment · Beat Menu definition · facts/dates/names/numbers · the mechanism · key actors by slot · the documents · verbatim bank · who pays · contested/unknown · sensory & material · numbers that matter (with tiers) · stress-test verdict.

Beat 1 — The Wrong Map [O]

(Politics · opener-preferred · assignment: MAE-East → fiber → substations → tax structure → ~14% of the world's data centers; training-vs-inference siting logic as the compounding engine)

Beat Menu definition. Geography as accident: MAE-East in a Tysons parking garage compounding into Loudoun County. Sustained by the compounding chain — peering point → fiber → substations → tax structure → share of the world's data centers. Distinct from The County: this is origin-story geography, how the map got drawn wrong. Opener rotation: Wrong Map opens Lectures 1 and 9; Lecture 2 opens on a Cold Open — rotation clean.

Facts, dates, names, numbers. 1992: MAE created by Scott Yeager (MFS) and Rick Adams (UUNET); founding networks AlterNet, PSINet, Sprint-ICM. First nexus: an office building at 8100 Boone Boulevard, Tysons Corner; ~1996 expansion into a cinder-block room in the underground parking garage at 1919 Gallows Road. 1994: NSF designates MAE-East one of four national NAPs; MAE-West spawns the backronym. 30 April 1995: NSFNET decommissioned. Mid-late 1990s: ~half the world's internet traffic transits the exchange [order-of-magnitude attested; precision **CONTESTED**]. 1996: AOL HQ to Loudoun; 1997: AOL's Dulles Technology Center (Waxpool & Pacific) — first Ashburn data center. June 1998: Equinix founded; first facility sited in Ashburn because “circumstances dictated” it (DCK). Today the Equinix Ashburn campus runs DC1 through DC21+ (DC2, 21715 Filigree Ct, “reputedly the most connected building on earth”; DA13 sits on Uunet Way). Subsea cables from Europe and South America land at Virginia Beach and route through Loudoun. The compounding endpoint: JLARC (9 Dec 2024) — Northern Virginia is the largest data center market in the world, 13% of reported global operational capacity, 25% of the Americas [Section 6 flag: the must-hit anchor says ~14%]; ~150 sites/~340 buildings statewide, ~80% in Loudoun–Prince William–Fairfax; NoVA capacity 1,000 MW (2019, first market past the mark; London then 559 MW) → 4,039.6 MW operational end-2025 (CBRE) with JLL counting ~4,900 MW mid-2025 on a different basis (do not blend).

The mechanism — the compounding chain, step by step. (1) Peering: after 30 April 1995 the commercial internet has no public backbone; ISPs must interconnect privately, and the deepest interconnection density on the East Coast is in a Tysons garage. (2) Fiber: carriers trench fiber toward the exchange; AOL and UUNET/WorldCom anchor Loudoun; the dot-com collapse strands dark fiber that survivors buy cheap. (3) Buildings: Equinix (1998) commercializes the interconnection itself; latency-sensitive tenants must be *in the room*, so the room grows. (4) Substations: load follows the buildings; Dominion builds distribution and transmission into the corridor for two decades (by 2025–26: six transmission lines routed through Loudoun; substations named Mars, Golden, Wishing Star). (5) Tax structure: 2010 DCRSUT exemption + Loudoun's personal-property tax on servers turn the buildings into the county's dominant revenue machine (Beat 5). (6) Lock-in: by the time anyone asks whether this is a good place for gigawatt-class compute, the fiber, the substations, and the budget all answer first. **Where the constraint binds:** step 4→5 — the moment load-growth capitalizes into county revenue, exit becomes fiscally unthinkable; the geography stops being a choice.

Training-vs-inference engine (documented, current). CBRE, 2025 recap: unlike emerging hubs seeing significant AI *training* development, “Northern Virginia's growth is driven primarily by cloud workloads, reflecting the region's unique network advantages”; nationally, “faster long-distance networks and soaring demand for AI training has opened the door for new markets previously considered ‘too remote’”; and (H2 2025) “Inference AI is redefining data center demand with a need for more regional and distributed data centers... low-latency infrastructure.” Mechanism as sited: training is latency-tolerant and power-hungry → it chases cheap, available watts (Abilene, the Dakotas, Pennsylvania's 18–36-month-power sites); inference is latency-bound → it sits near users and network density, i.e., exactly where the 1992 accident put the network. The wrong map thus compounds twice: it captured the cloud era outright, and it holds the inference layer of the AI era even as training escapes to the desert.

Key actors. *Object/Place:* MAE-East (chain of custody: 8100 Boone → 1919 Gallows garage → Equinix DC2 → closed to new customers 1998, mainframe off 2001, providers migrate 2009, 8100 Boone to Digital Realty 2006, since exited). *Humans (period, documented):* Scott Yeager (MFS), Rick Adams (UUNET founder), Steven Feldman (the beer quote). *Institutions:* NSF (the NAP designation — the government blessing the accident), MFS, UUNET, AOL, Equinix, Dominion

(exhibit-grade only here).

The documents. The NSF NAP solicitation/award (1994) — the paper that made a private garage official national infrastructure [locator to pin at draft stage]; the 2010 DCRSUT exemption statute (full treatment Beat 10 / Section 5 context); Equinix’s own siting retrospective (company source — seller-flagged).

Verbatim bank. > “A group of network providers in the Virginia area got together over beer one night and decided to connect their networks.” — Steven Feldman, internet architect, recollection of MAE-East’s 1992 founding (documented in MAE-East reference literature; carried via Wikipedia’s cited sources).

“Circumstances dictated that they build it there.” — Data Center Knowledge, on Equinix’s 1998 Ashburn siting (secondary characterization, 2015 retrospective — attribute as DCK’s, not Equinix’s).

Paraphrase, marked: an early AOL employee reportedly broke into tears on seeing the new Loudoun headquarters, convinced he’d be commuting to the middle of nowhere (City Journal, 26 Apr 2026, reporting the recollection).

Who pays. One line: nobody, yet — this beat is the era before the bill; the who-pays seed is planted in Beats 5, 7, and 11.

Contested, motivated, unknown. The “~70% of the world’s internet traffic flows through Loudoun/Ashburn” claim: repeated by local officials and marketing for a decade-plus (Register 2019 “local politicians claim”; Loudoun Economic Development materials; InterGlobix; trade blogs 2019–2026), descended from MAE-East’s genuine 1990s share; no current measurement supports anything like it, and traffic-share is barely measurable at all. Seller: the Politician (county marketing). Move: DISPATCH-adjacent — but note the assigned DISPATCH for this lecture is “automated and empty”; the 70% number is best handled inside the Physics Audit (Beat 3) as the audit’s warm-up myth. NANOG-era congestion complaints: the exchange’s mid-90s congestion is well-attested in secondary histories; **raw list-serv verbatims not yet pulled** — draft-stage locator: NANOG mail archives, 1995–1997, threads on MAE-East packet loss [flagged, Identity item 8].

Sensory & material. The cinder-block room; the underground garage at 1919 Gallows Road; a shared 10-megabit Ethernet wire carrying the traffic of nations [documented]; the street sign reading UUNET Way [documented]; subsea fiber surfacing at Virginia Beach and running inland to a former farm town [documented routing].

Numbers that matter. ~50% of world traffic, mid-late 1990s — MAE-East share — retrospective accounts — CONTESTED (precision) · 4 — NAPs designated, 1994, NSF — STRUCTURAL · 30 Apr 1995 — NSFNET off — IBM/standard record — STRUCTURAL · 13% — global operational capacity in NoVA — JLARC, Dec 2024 — STRUCTURAL (anchor conflict flagged) · 1,000 MW (2019, CBRE) → 4,039.6 MW (end-2025, CBRE) — NoVA inventory, a rate — STRUCTURAL/VOLATILE respectively.

Stress-test verdict: SUSTAINABLE. Deep, multi-decade documentary record with named humans, a datable hinge, a physical object with an address, and a live mechanism (training-vs-inference) that keeps the history from being nostalgia.

Beat 2 — Mechanism Autopsy

(Atoms · versatile, fat container · assignment: anatomy of a hyperscale campus — substation, generator yard, white space, security theater, the astonishingly small parking lot)

Beat Menu definition. How the thing physically works, delivered conversationally, never announced as analysis. Rotation is content-native; Lecture 1 autopsies the campus so Lecture 2 can autopsy the rack’s power path — no overlap.

Facts, dates, names, numbers. Reference scale, all sourced: a “typical 250,000-square-foot data center” is JLARC’s own reference unit (Dec 2024); modern hyperscale buildings run to 1M+ sq ft in campuses (Vantage VA4: 3 buildings, 929,000 sq ft, 192 MW — announced Nov 2025); a single large facility spans 100–1,000 MW of demand (EPRI, Feb 2026), the electrical equivalent of 80,000–800,000 homes; Loudoun’s stock ≈ 200 facilities / ~49–49.4M sq ft (Rizer Dec 2025; Wertz Feb 2025); buildings are going vertical — one-story boxes becoming three- and four-story data centers as land passes \$1.5M+/acre (Rizer, InterGlobix). Substations: 100–300 MW each, 10–20 acres each, ~40 of them planned on one new Loudoun 500 kV line alone (Dominion project materials via PEC, Nov 2025). Generator yard: JLARC — data centers keep dozens of diesel backup generators per site, run mostly for maintenance; in Northern Virginia they produce <4% of regional NOx emissions and ≤0.1% of CO and particulates; operators reported 0–2 minor outages per site over two years, nearly all a few hours [filer note: operator-reported, via JLARC interviews]. Staffing: ~50 FTEs per 250k sq ft, ~half contractors (JLARC).

The mechanism — the campus, end to end. The watt path at campus grain (Lecture 2 owns the inside-the-building path — stop at the wall): transmission line (230–500 kV) → dedicated substation (the 10–20-acre transformer yard stepping down to distribution voltage) → medium-voltage feeds into the building’s electrical rooms → UPS/switchgear → white space. The heat path at campus grain (Lecture 3 owns the component tour — stop at the roofline): white space heat → mechanical galleries → rooftop/yard heat rejection plant → sky. The redundancy logic that explains the yard: the diesel generator farm and fuel storage exist to carry the full IT load through grid loss, which is why the generator yard can rival the building’s footprint while running almost never — capacity purchased against an event measured in hours per decade. The security perimeter: fencing, gates, berms, mantraps, minimal signage — JLARC’s typical-layout exhibit (presentation slide, 9 Dec 2024) documents the standard arrangement. **Where the constraint binds:** the substation. Everything else on the campus can be built on the developer’s schedule; the substation arrives on the utility’s schedule — which is why Beat 9 exists.

Key actors. *Objects:* the substation (Dominion’s; named — Mars, Golden, Wishing Star); the generator yard; the white-space floor. *Institutions:* Dominion (exhibit-grade), Loudoun building/zoning apparatus. *Humans:* the ~50 (documented as a statistic here; Operator Reality is negative space — do not scene-build).

The documents. JLARC’s typical-layout exhibit (Slide, presentation of 9 Dec 2024) — the state’s own diagram of the object; Vantage’s VA4 announcement (company source — seller-flagged: developer’s own jobs and capacity claims); Dominion project pages for the six Loudoun transmission lines.

Verbatim bank. > “Several data center representatives indicated that a typical 250,000-square-foot data center may have approximately 50 full-time workers, about half of which are contract workers.” — JLARC, *Data Centers in Virginia*, 9 December 2024. [The DISPATCH plant’s primary text — planted here or in Beat 3, cashed in Lecture 8]

Who pays. One line: the campus’s costs are the developer’s; the substation’s are the opening move of Lecture 7’s question — seeded, not run.

Contested, motivated, unknown. The parking lot: the “astonishingly small parking lot” is a defensible inference from documented staffing (~50 FTEs across shifts) and JLARC’s layout exhibit, but the pack found **no source that states the parking-lot claim directly** — marked as **inference from documented conditions**; if the drafting AI wants it load-bearing, pull an aerial/site-plan citation at draft stage (Loudoun site plans are public records). “Security theater”: the physical security is real and documented; the *theater* framing is editorial — the pack supplies the documented features (fencing, gates, screening, unmarked buildings per JLARC and trade descriptions) and leaves the characterization to the voice layer.

Sensory & material. The 10–20-acre substation pad; transformer yards behind berms; diesel tanks sized for days; the unmarked tilt-up concrete box (Equinix DC1: single-story tilt-up steel-concrete slab on grade, reflective roof — company spec sheet); three-story data centers rising where one-story boxes stood (Rizer); 215-foot lattice towers stepping across subdivisions (PEC/Dominion).

Numbers that matter. 250,000 sq ft — JLARC reference unit — Dec 2024 — STRUCTURAL · ~50 FTEs — JLARC — Dec 2024 — STRUCTURAL · 100–1,000 MW per large facility [capacity, a rate] — EPRI — Feb 2026 — STRUCTURAL · 100–300 MW / 10–20 acres per new substation — Dominion via PEC — Nov 2025 — STRUCTURAL · <4% regional NOx from generators — JLARC — Dec 2024 — STRUCTURAL · 0–2 minor outages/site/2yr — operator-reported via JLARC — CONTESTED (self-reported).

Stress-test verdict: SUSTAINABLE. The anatomy is fully documentable from the state’s own audit plus utility project records; the one soft spot (the parking lot) is flagged and fixable from public site plans.

Beat 3 — The Physics Audit

(Atoms/Audit · versatile, closer-capable · assignment: the “as much power as X homes” headline audited — installing the listener’s instinct per Style Guide §1)

Beat Menu definition. The deadpan reality check on a claim, delivered in the same tone as the pitch it’s auditing. Lecture 1’s deployment is foundational: it doesn’t audit one claim, it installs the audit — capacity vs. energy, stage labels, and the homes-conversion’s hidden assumptions — so every later lecture can run the check at speed. (Over-band note: Syllabus 2.0 runs Physics Audit at 8 appearances against a 4–5 band; the re-band recommendation rides on exactly this kind of per-lecture content rotation.)

Facts, dates, names, numbers — the audit’s raw material. The headline genre, documented: EPRI itself supplies the conversion — “a single large data center (100–1,000 MW) can draw power comparable to 80,000–800,000 average US homes, equivalent to a mid-sized to large city” (Feb 2026). The audit: (a) *Capacity vs. energy*. A gigawatt is a rate; a terawatt-hour is a quantity. The headline compares a facility’s *demand* (a rate) to homes’ *average* consumption (a quantity divided by time) — defensible only if both sides are stated as averages, and never license to say the facility “uses the electricity of a city,” because homes peak at dinner and the data center peaks always. Arithmetic, shown: average US household consumption $\approx 10,500\text{--}10,800\text{ kWh/yr} \approx \mathbf{1.2\text{ kW average draw}}$ [EIA residential data — standard; pin the current-year figure at draft stage]; $100\text{ MW} \div 1.2\text{ kW} \approx 83,000\text{ homes}$; $1,000\text{ MW} \approx 830,000$ — EPRI’s own range reproduces, PASS, *as an average-to-average comparison only*. (b) *Stage labels*. “Dominion has 70,000 MW under request” (Feb 2026, SCC) is **requests**, not load — roughly 3x the utility’s entire current system, and the phantom-load caveat attaches on first use: the same megawatts get requested in multiple territories, so an aggregate request figure counts some data centers several times and some zero times (Style Guide §5; JLARC/PJM forecasting discussion). One outlet rendered it “70,000 megawatts per day” — a unit that does not exist — the blur, in the wild, dated 25 Mar 2026. (c) *The warm-up myth*. “70% of the world’s internet traffic flows through Ashburn”: descended from MAE-East’s genuine 1990s share, repeated by officials and marketing through 2026, unmeasurable and unsupported as a current claim — named, killed with the history (Beat 1), moved past. (d) *The scale that survives the audit*. After the discounts, what’s left is still enormous: 1,050 TWh [energy, 2026, IEA high case, incl. crypto — the As-Of Stamp claim]; >25% of Virginia’s electricity [share of energy, EPRI 25.6% on 2023 data; “over 25%” in EPRI’s 2026 update] — the Step Function, whose standing assumption (state demand flat 2006–2020, JLARC) gets its full pedigree here.

The mechanism. How a homes-headline is manufactured: take nameplate or requested capacity (the biggest available rate), divide by average household draw (the smallest defensible denominator), round up, publish. The audit’s counter-mechanism: force every figure to declare (1) rate or quantity, (2) stage — requested / committed / contracted / energized / metered, (3) author and what the author gets. **Where the constraint binds:** the physics doesn’t negotiate — a watt in is a watt of heat out — but the *numbers describing* the physics are all negotiated; the instinct being installed is that the units are honest and the filers are not required to be.

Key actors. *Institutions as filers:* IEA (Electricity 2024; Energy and AI 2025), EPRI (2024; 2026), LBNL (Dec 2024), Dominion (SCC report, Feb 2026), JLARC. Each carries its Section 7 seller tag; here they appear as the audit’s specimen collection.

The documents. IEA *Electricity 2024* Executive Summary (24 Jan 2024); EPRI *Powering Intelligence* (29 May 2024) and *Powering Intelligence 2026* (26 Feb 2026); LBNL 2024 *United States Data Center Energy Usage Report* (Dec 2024); Dominion’s February 2026 SCC report [docket locator to pin at draft stage].

Verbatim bank. > “After globally consuming an estimated 460 terawatt-hours (TWh) in 2022, data centres’ total electricity consumption could reach more than 1 000 TWh in 2026. This demand is roughly equivalent to the electricity consumption of Japan.” — IEA, *Electricity 2024*, Executive Summary, January 2024. [The title’s arithmetic, in the filer’s own syntax — note “could,” note the scope includes AI and cryptocurrency]

Who pays. One line: no who-pays dimension of its own — the audit is the tool later who-pays fights are conducted with.

Contested, motivated, unknown. The homes-equivalence itself is CONTESTED as rhetoric even when arithmetically sound: it imports an image of displacement (the data center “taking” homes’ power) that the grid doesn’t work by. The pack states both: the arithmetic passes; the implicature doesn’t. The IEA 2026-vs-2030 vintage conflict is the Forecast Problem’s material (Beat 8) — cross-reference, don’t duplicate.

Sensory & material. None native; this beat’s texture is the numbers wearing (or not wearing) their units.

Numbers that matter. 1.2 kW — avg US household draw [derived from EIA annual kWh] — STRUCTURAL, derivation shown · 80,000–800,000 homes per 100–1,000 MW — EPRI — Feb 2026 — STRUCTURAL · 70,000 MW — requests, Dominion to SCC — Feb 2026 — VOLATILE + phantom-load caveat · ~1,050 TWh (2026) — IEA high case, incl. crypto — Jan 2024 — VOLATILE (superseded vintage exists; Section 6) · 25.6% — Virginia share, EPRI — May 2024 (2023 data) — STRUCTURAL · 6.6%→? — n/a.

Stress-test verdict: SUSTAINABLE. The audit has a specimen for every move it installs, each dated and attributed, including a genuine unit error in professional coverage — material a satirist couldn’t invent and evidence discipline doesn’t have to.

Beat 4 — The Paper Trail (class: state audit — JLARC 2024, *Data Centers in Virginia*)

(Politics · universal, all 10 lectures · document-class rotation: state audit is Lecture 1's class; contract is 5's, securities filing 6's, etc.)

Beat Menu definition. A named document as causal actor — what it says, who wrote it and why, what it forces, what it forbids, what happens when someone violates it. The course's Main Character beat; protagonists are institutions and paper. (Full document dossier: Section 5, Run 2 — this entry carries the beat-level treatment.)

The document. *Data Centers in Virginia*, Joint Legislative Audit and Review Commission of the Virginia General Assembly; directed 2023; presented to the commission in Richmond **9 December 2024** by chief legislative analyst **Mark Gribbin**; full report + presentation + independent energy modeling (commissioned, with University of Virginia Weldon Cooper Center load scenarios) published at jlarc.virginia.gov. Procedural status: delivered; recommendations and policy options transmitted to the General Assembly; a follow-on incentives review landed December 2025.

What it says (the load-bearing findings, with figures fully labeled). Market position: NoVA is the world's largest data center market — 13% of reported global operational capacity, 25% of the Americas; ~150 sites, ~340 buildings, ~80% in three counties. Economics: ~74,000 jobs, \$5.5B labor income, \$9.1B GDP annually — majority from construction (12–18 months per building, ~1,500 workers at peak); operations run ~50 FTEs per 250k sq ft, half contractors. Energy: state demand flat 2006–2020; unconstrained demand (data-center-driven) doubles within 10 years — matching PJM's forecast — and runs ~183% above current by 2040 versus +15% with no new data center demand; meeting it requires ~150% more in-state generation, ~150% more imports, ~40% more transmission — solar additions at 2x the 2024 rate, offshore wind beyond all secured sites, a large gas plant roughly every 18 months, plus SMRs “not yet proven commercially viable in the U.S.”; even half of unconstrained demand still means doubling existing generation. Rates: “current rates appropriately allocate costs to the customers responsible for incurring them, including data center customers” — data centers currently pay their full cost of service — but growing demand is likely to increase other customers' costs [the Lecture 7 fuse, lit in the state's own audit]. Environment: generators <4% of regional NOx; water use “currently sustainable, but growing and could be better managed”; noise near residences “presents unique challenges.” Local fiscality: revenue ranged from <1% to 31% of total local revenue across five mature localities; Loudoun 2024: \$733M in property taxes, ~1/3 of county property tax revenue.

Who wrote it and why. JLARC is the legislature's own audit arm — the drafting party is the General Assembly investigating the industry the General Assembly's 2010 exemption built. Incentive: political cover in both directions; the report's structure (findings + “policy options,” explicitly declining to pick) is itself evidence — see verbatim bank.

What it forces / forbids. Nothing, directly — and that is the beat's sharpest fact. A state audit is a forecast of legislation, not legislation: within 18 months of delivery, its orbit produced ~20 bills (Jan 2025), a veto (May 2025), a governor's race issue (Nov 2025), a session data centers “dominated” (2026), and a first-in-nation consumption tax (June 2026). The document's teeth are borrowed.

What happens when someone violates it. N/A by design — but the 2019 JLARC finding it cites (90% of exempted investment wouldn't have occurred in Virginia without the exemption) functions as the enforcement logic for keeping the subsidy: violate the exemption's political settlement and, the argument runs, the investment leaves.

The skeptical caveat. Binding, or a press release with a docket number? Neither: it's a mirror with a legislature attached. Its explicit refusal to recommend — see verbatim — makes it the rare document whose *abdication* is the operative clause.

Verbatim bank (the assigned Verbatim's candidates — existence gate PASSED). > **Primary:** “Building enough infrastructure to meet unconstrained energy demand will be very difficult to achieve, with or without meeting the Virginia Clean Economy Act (VCEA) requirements.” — JLARC, *Data Centers in Virginia*, December 2024. [On the report's own landing page; quoted identically in Virginia Business, 25 Mar 2026]

Backup 1 (spoken): “The data center industry is driving an immense increase in energy demand, and building enough infrastructure to address that demand will be difficult.” — Mark Gribbin, chief legislative analyst, presenting to JLARC, Richmond, 9 December 2024 (Cardinal News).

Backup 2 (the abdication clause, from JLARC's recommendations framework): “There are multiple ways in which a report finding could be addressed and there is insufficient evidence of a single best way to address the finding... The action proposed is a policy judgment best made by the General Assembly or other elected officials.” — JLARC report summary materials, Dec 2024 (via Prince William County's summary PDF, 16 Dec 2024). [Bureaucratic prose as its

own punchline — the state’s auditors auditing everything except their nerve]

Backup 3 (spoken, the half-demand line): “We’re still looking at doubling existing generation.” — Gribbin, same presentation (VPM/WHRO, 9–10 Dec 2024).

Who pays. The audit’s own answer, quoted above: today, the data centers; tomorrow, “other customers’ costs” rise — the fuse Lecture 7 follows to the bill.

Contested, motivated, unknown. The Data Center Coalition (Josh Levi, president) welcomed the study while it was underway (Virginia Mercury, May 2024) — the industry’s posture toward the audit is itself documented. The unconstrained-demand scenario is a *scenario*, commissioned by JLARC, built on Weldon Cooper load cases — a forecast with an author inside a document about forecasts (Beat 8 cashes this).

Sensory & material. The presentation slide of a typical large-scale data center layout, shown to legislators 9 Dec 2024 (VPM carried the slide) — the state government looking at a diagram of the thing it built and asking what it is.

Numbers that matter. 13% / 25% — global/Americas capacity share — JLARC Dec 2024 — STRUCTURAL (anchor conflict: ~14%, Section 6) · 74,000 / \$5.5B / \$9.1B — jobs, labor income, GDP — JLARC — STRUCTURAL · ~183% by 2040 vs +15% — unconstrained vs no-new-DC demand — JLARC/Weldon Cooper scenario — CONTESTED (forecast) · \$733M / ~ $\frac{1}{3}$ — Loudoun 2024 property taxes — JLARC — STRUCTURAL · 90% — exempted investment that wouldn’t have occurred — JLARC 2019, cited 2024 — CONTESTED (counterfactual estimate).

Stress-test verdict: SUSTAINABLE. The document is rich enough to carry the beat twice over — findings, abdication clause, downstream legislative wake, and a quotable author with a date and a room.

Beat 5 — Follow the Money

(Money · versatile, fat container · assignment: Rizer’s scoreboard — ~\$1B/yr in data center tax revenue, roughly a third of the county budget, the rate cut cited to the penny)

Beat Menu definition. Capital structure as narrative — who financed what, amortized over what; the load-bearing accounting assumption is always the payoff. Lecture 1’s instance is fiscal rather than corporate: the county’s revenue machine, and the accounting assumption underneath it (servers depreciate like servers).

Facts, dates, names, numbers — the revenue machine, series form, bases labeled. Computer-equipment personal property tax (the machine’s core): FY2013 \$60M → FY2020 ~\$330M → FY2026 \$800M+ (county FY2026 Proposed Budget, via DCF). All-in data center revenue: 2023 projection \$576.2M “approximately one-third of local tax income,” excluding real estate taxes (PW Times/Rizer, Feb 2023) → 2024 actual \$733M property taxes, ~ $\frac{1}{3}$ of county property tax revenue (JLARC) → FY2025 estimate ~\$895M real+personal vs. a projected \$940M operating budget (county staff, Jan 2025, via Turner brief/WJLA) → FY2027 expectation \$417M real + \$879M personal ≈ \$1.296B, 45% of ~\$2.9B county tax revenue (City Journal, Apr 2026). The must-hit “~\$1B/yr (~ $\frac{1}{3}$ of budget)” sits inside this series — true at the FY2025–26 vintage on a tax-revenue basis, already understated at FY2027; **Section 6 flags the vintage, does not substitute.** The county’s own words on concentration: data centers occupy ~4% of commercial parcels and yield **38% of general fund revenue** (Loudoun County official FAQ). Cost side, county-authored: a data center costs the county **\$0.04 per \$1 of tax revenue** it generates; most businesses ~\$0.25; homes roughly break even (Turner brief, county document, 2026). The rate cut: official county/Rizer formulation — commercial growth “helped lower the tax rate in Loudoun by **more than 48 cents on the dollar**, saving residents thousands of dollars annually” (Loudoun staff directory bio; S&P Global expert page); rate cut every year for a decade; **lowest real property tax rate in Northern Virginia, ~25% below neighbors** (county FAQ; Turner brief). Derived, marked derived: NVTC’s counterfactual arithmetic (\$6,440 on an \$800,000 home) implies a current rate near **\$0.805 per \$100 assessed** — confirm against the adopted FY2026 rate resolution before it goes to prose as “the penny.”

The mechanism — how a server becomes a school. (1) The building pays real property tax on land+structure (appreciating, stable). (2) The servers inside pay business tangible personal property tax — assessed at **50% of purchase price in year one**, then down a steep depreciation curve (DCD/Loudoun Now, 2022). (3) Refresh churn is therefore revenue: every hardware generation resets the 50% clock — the county is long silicon turnover [the Lecture 6/10 depreciation thread, seeded from the taxman’s side]. (4) The take funds Loudoun County Public Schools and services and buys the annual rate cut. (5) The risk is the same curve run backward: slow fit-outs alone wiped ~\$60M off forecast in one year (2021–22) —

before AI, before any bust. The county knows: it built a **data center revenue stabilization fund** from year-end balances and has studied a separate equipment tax class “with specific consideration to the over-reliance of the County on this single revenue” (staff report, 2020, via NetChoice). **Where the constraint binds:** the assessment schedule — county revenue is a derivative of private refresh cycles it cannot see, forecast, or govern.

Key actors. *Human:* Rizer (scoreboard: \$65B+ commercial investment, 60,000+ jobs attracted since 2007 — county bio). *Institutions:* Loudoun Commissioner of the Revenue (Bob Wertz — the assessor as narrator, Feb 2025); Loudoun BOS (rate-setter); LCPS (the spend side). *Documents:* the FY2026 budget; the FAQ; the stabilization-fund policy.

The documents. Loudoun FY2026 Proposed/Adopted Budget (the \$60M→\$800M series lives here); the county’s “Data Centers — Tax Revenues and the County Budget” FAQ (county-authored, undated page, current 2026 — the closest thing to the county explaining itself in public); Wertz’s assessment presentation (Feb 2025); the 2020 staff report recommending revenue-concentration hedges.

Verbatim bank. > “Currently, data centers occupy approximately 4 percent of commercial parcels of the land in the county; however, they yield 38% of general fund revenue collected by the county.” — Loudoun County official FAQ, “Data Centers — Tax Revenues and the County Budget” (county-authored; accessed July 2026). [The FY2025–26 budget “in the county’s own words” — Identity dependency 5, RESOLVED]

“The revenue has enabled the county to reduce the real property tax rate for homeowners every year for the past decade; the current real property tax rate is the lowest in northern Virginia.” — same county FAQ.

“...with specific consideration to the over-reliance of the County on this single revenue.” — Loudoun County staff report to the finance committee, 2020 (via NetChoice). [The county diagnosing its own dependency, six years early]

Who pays. Inverted, and priced: per NVTC (May 2026, industry-adjacent — seller-flagged), without data center revenue the typical Loudoun homeowner’s bill rises ~\$5,856/yr (\$6,440 → \$12,296 on an \$800k assessment). The doctrine name for what’s happening: nothing — this is the *pre*-doctrine era, private revenue subsidizing residents; Lecture 7 arrives when the direction reverses on the utility side.

Contested, motivated, unknown. Every number in the counterfactual (NVTC) is filed by the industry’s regional council — grant the arithmetic, name the filer. The FY2027 projection is a projection (VOLATILE). Rizer’s \$65B/60k-jobs scoreboard is the county’s own tally — Section 7 audits what “attracted” and “jobs” mean against JLARC’s construction-heavy composition.

Sensory & material. The assessment ledger where a GPU is a taxable chattel at half its invoice; the annual budget hearing where the rate drops again; the stabilization fund as the county’s admission, in fund-accounting form, that the goose is mortal.

Numbers that matter. \$60M→\$800M+ — computer-equipment tax, FY2013→FY2026 — county budget — STRUCTURAL · \$733M/⅓ — 2024, JLARC — STRUCTURAL · ~\$1.3B/45% — FY2027 expectation — City Journal from county budget — VOLATILE · 38% — general fund share — county FAQ — STRUCTURAL · 50% year-one assessment — DCD/county practice — STRUCTURAL · \$0.04 per \$1 — county service cost — Turner brief — STRUCTURAL (county-authored) · >48¢ — cumulative rate cut — county bio — STRUCTURAL · ~\$0.805/\$100 — DERIVED, confirm.

Stress-test verdict: SUSTAINABLE. A complete fiscal machine with a series, a mechanism, county-authored verbatims, a documented failure year, and a hedge fund the county built against itself.

Beat 6 — The Steelman (defendant: the county’s growth case)

(Audit · never opener · rotation: deployment 1 of 8, all distinct defendants — the county is never steelmanned again)

Beat Menu definition. The full-throated strongest case for whoever’s about to look worst, in the defendant’s actual numbers and constraints. A précis of the weak version is not a steelman. GRANT-AND-WITHHOLD executes through this beat per the Identity.

The strongest form of the case, assembled from the defendant’s own record. (1) *The money is real and audited.* Not the county’s claim — the state auditor’s: data centers currently pay their full cost of service (JLARC, Dec 2024); \$733M

in 2024 Loudoun property taxes (JLARC); 38% of the general fund from 4% of commercial parcels (county FAQ); \$0.04 of county services consumed per \$1 contributed vs. ~\$0.25 for most businesses (county brief) — few cars on the road, very few kids in schools. (2) *Residents are measurably better off*. A decade of consecutive rate cuts; lowest rate in Northern Virginia, ~25% under neighbors; the counterfactual is ~\$5,856/yr for a median-ish home (NVTC 2026 — industry-council figures, but arithmetic from public rates and assessments). (3) *It stabilized a boom-bust county*. Chuck Kuhn — Loudoun's largest conservation easement holder (22,000+ acres) and a data center developer, i.e., a defendant with standing on both sides: "As long as I've been involved in Loudoun County, it's been boom, bust... What's happened with the data center tax revenue is that it's taken all of that out — it has created an annuity for this county" (Loudoun Now, Nov 2025). (4) *The jobs case, honestly bounded*. Construction: the industry is "the largest construction sector right now," $\frac{1}{3}$ – $\frac{1}{2}$ of contractors' current projects, $\sim\frac{2}{3}$ of backlog; electrical apprenticeships grew from 300 to 500 and "could grow larger; workers stay in state and move from project to project" (JLARC interview material, Dec 2024). Operations jobs are few (~50/facility) but pay ~\$105k (Cardinal News from JLARC). (5) *The alternative was tried*. The county did stop: proactive recruitment ended 2019; by-right development ended 18 March 2025 — and demand kept coming, because the fiber and the interconnection density are not policies anyone can repeal. (6) *The custodian's credibility*. Rizer took the job in 2007 when the inventory was dot-com leftovers; the strategy was published (2008 plan, 3.5 square miles); the results are in the assessment rolls. He also says, on the record, that he tells other jurisdictions: "define your opportunity up front, determine if you want them, where you want them" (WVIA) — the godfather's first advice is consent.

What GRANT-AND-WITHHOLD withholds (staged here, executed in prose). Grant: every figure above. Withhold, in the same breath: the revenue's tax base depreciates on a server schedule (Beat 5's \$60M miss); the concentration the county itself flagged in 2020 has since roughly quadrupled; the growth case's own author reports going "from the most popular public official to the most hated" — the case is winning the ledger and losing the room; and the strongest sentence in the case ("paying their full cost of service") carries JLARC's own next clause about other customers' rising costs. The steelman stands; the bill for it is Lectures 7–10.

Key actors. Rizer (the case, walking); Kuhn (the dual-position validator); Kershner and Umstattd (supervisors on the record from opposite postures — "not sustainable" vs. "\$1 billion a year"); JLARC (the involuntary expert witness for the defense).

The documents. The 2008 strategic plan (branding "Data Center Alley" — locator: Loudoun DED archives, pull at draft stage); the county FAQ; the Turner brief; JLARC.

Verbatim bank. > "It has created an annuity for this county that will go on for who knows how long." — Chuck Kuhn, JK Land Holdings, Loudoun Now, 7 November 2025. [Note the clause doing the withholding for us: *who knows how long*]

"The first thing I tell everyone is, if you're thinking about data centers, define your opportunity up front, determine if you want them, where you want them..." — Buddy Rizer, WVIA, 12 December 2025.

Who pays. The steelman's answer: nobody local, yet — residents are net collectors. The doctrine fight over whether that stays true is Lecture 7's.

Contested, motivated, unknown. Kuhn profits from the industry he defends (stated). NVTC is the industry's council (stated). The pack found no equally documented *anti*-growth fiscal counter-model for Loudoun specifically — the opposition's documented case is land-use and quality-of-life (Beats 7, 10, 12), not a competing budget; state the asymmetry rather than inventing a rebuttal.

Sensory & material. 22,000 acres under easement held by the county's biggest data center land seller — the growth case and the conservation case sharing one balance sheet.

Numbers that matter. All inherited from Beats 4–5 (do not re-tier) · \$105,000 — operations salary — JLARC via Cardinal — STRUCTURAL · 300→500 — apprenticeships — JLARC interviews — STRUCTURAL · 22,000+ acres — Kuhn easements — Loudoun Now — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The defendant's case is unusually documentable because the defendant is a government that publishes its own evidence; the beat's risk is redundancy with Beat 5 — the storyboard should assign Beat 5 the *machine* and Beat 6 the *argument*, and the pack has kept the material separable along that line.

Beat 7 — The Perverse Incentive

(Money/Politics · versatile · assignment: a AAA county now fiscally dependent on the thing its residents increasingly fight)

Beat Menu definition. The incentive structure that guarantees the failure mode — not hypocrisy-hunting but mechanism: show the payoff matrix, and the behavior explains itself. Jobs math lives natively in this beat family; Lecture 1 plants the DISPATCH and defers full jobs-math to Lecture 8 — this deployment’s engine is *fiscal dependence*, not employment.

The payoff matrix, documented cell by cell. *The county’s position:* 38% of the general fund (county FAQ), rising toward 45% of tax revenue (FY2027), from a source that (a) depreciates on a private refresh schedule, (b) concentrates in ~4% of commercial parcels, and (c) is politically radioactive with the residents whose rates it cuts. *The residents’ position:* they collect the rate cut (~\$5,856/yr counterfactual, NVTC) while fighting the source — and the fight is documented at maximum irony: a group of Loudoun homeowners, already surrounded by data centers, **petitioned to rezone their own land — not to block facilities but to sell their plots collectively at data center prices** (City Journal, Apr 2026). Opposition and exit are the same gesture. *The politicians’ position:* Kershner, on the record, calls the spending growth “not sustainable” while sitting on the board that approves the budget the revenue funds; the board ended by-right development (18 Mar 2025) — restricting future supply — while adopting a budget (Apr 2025) whose revenue line assumes the stock keeps growing. *The recruiter’s position:* Rizer stopped recruiting in 2019; the square footage went from ~20M (2019) to ~49M on the ground + 6M in development (Dec 2025) anyway; his own arc, his own words: “most popular public official to the most hated.” The machine no longer needs its operator’s consent — the incentive gradient (fiber + watts + exemption + assessment schedule) does the recruiting. *The state’s position, the flagship number:* the DCRSUT exemption was **projected at ~\$1.54M/year when enacted; FY2025 forgone revenue ran ~\$1.6B** — three orders of magnitude, the single most perverse dated pair in this lecture’s file [advocacy-sourced (Loudoun Democrats, Apr 2026); reconcile against official fiscal notes and JLARC’s ≥\$2.7B/decade before load-bearing use — Section 6]. Data centers took **53% of all state incentive spending over the decade** (JLARC, Dec 2025) for facilities whose statutory job threshold is **50** — and live announcements price that threshold: CleanArc, \$3B for 50 jobs (\$60M/job); Vantage VA4, \$2B for “at least 50” (\$40M/job) [jobs-math full audit: Lecture 8 — plant, don’t run].

The mechanism. A dependency ratchet: each budget year capitalizes data center revenue into recurring obligations (schools, staff, the rate cut itself — politically irreversible); each capitalization raises the cost of any policy that slows the inflow; therefore restriction migrates to the *margins* (design standards, siting, by-right repeal — supply-side gestures that don’t touch existing revenue) while the core (the exemption, the assessment schedule, the approvals for what’s already in the pipeline) survives every political mood. The stabilization fund and the 2020 “over-reliance” memo prove the county can *name* the ratchet; the FY2027 budget proves naming it changed nothing. **Where the constraint binds:** the general fund — you can zone against the next building, but not against the 38%.

Key actors. Loudoun County (Institution, lead — this beat is the core of its lecture-1 treatment); Rizer (the arc); the petitioning homeowners (documented collectively; **human-floor: no named-resident comedy**; the irony is structural, not personal — the punchline is the payoff matrix, never the family); Kershner/Umstatt; the General Assembly (the exemption’s author and hostage).

The documents. The 2020 staff report (“over-reliance”); the stabilization fund policy; the FY2026–27 budgets; the exemption statute and its original fiscal impact statement [pull the 2009–2010 fiscal note verbatim at draft stage — the \$1.54M projection’s primary source]; the 18 Mar 2025 by-right resolution.

Verbatim bank. > “I’ve gone from the most popular public official to the most hated.” — Buddy Rizer, WVIA, 12 December 2025.

“It’s increased far too much... this is not sustainable. Even our county administrator said this kind of increase in spending is not sustainable.” — Supervisor Caleb Kershner, WJLA, 2 April 2025.

Who pays. The beat’s answer is temporal: today, the servers pay the county; the structure guarantees that *whoever stops the servers pays the county instead* — which is why nobody with a budget has stopped them.

Contested, motivated, unknown. The \$1.54M→\$1.6B pair (advocacy-sourced; flagged above). Whether the homeowners’ rezoning petition succeeded — status not yet in the record pulled; draft-stage check (Loudoun land-use dockets). The FY2027 45% figure is an expectation.

Sensory & material. A petition asking the county to please surround the petitioners faster; a fund named “stabilization” for a revenue source the same government’s brochures call an annuity.

Numbers that matter. 38% → ~45% — general fund/tax-revenue dependence — county FAQ / FY2027 — STRUCTURAL/VOLATILE · \$1.54M projected vs ~\$1.6B FY2025 — exemption cost — advocacy-sourced, CONTESTED pending fiscal-note pull · 53% — decade incentive share — JLARC Dec 2025 — STRUCTURAL · 20M→49M sq ft, 2019→2025, across a recruitment stop — county/Rizer — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The payoff matrix fills entirely from documented positions, and the beat's center-piece irony (the rezoning petition) is sourced, dated, and structurally — not personally — comic.

Beat 8 — The Forecast Problem

(Audit · versatile · assignment: IEA/EPRI/LBNL projections as authored documents; first installation of forecast-as-fiction; Dominion's pipeline slide enters at exhibit grade)

Beat Menu definition. Demand projections as authored documents with authors and incentives — who wrote the forecast, what happens to them if it's wrong, who builds infrastructure against it. First deployment installs the discipline the course reuses.

The specimen table (each forecast: author · vintage · claim · what happened to it).

1. **IEA, *Electricity 2024* (Jan 2024):** data centres+AI+crypto 460 TWh (2022) → “could reach more than 1 000 TWh in 2026” (high case ~1,050) — the Japan sentence. *Fate:* superseded by the same author within 15 months.
2. **IEA, *Energy and AI* (Apr 2025):** data centres 415 TWh (2024, ~1.5% of global electricity; 12%/yr growth since 2017) → ~945 TWh by 2030 (“slightly more than the entire electricity consumption of Japan today”), ~1,200 TWh by 2035 base case, ~2,000 TWh by 2035 lift-off case. *Note what moved:* the Japan-equivalence migrated from 2026 to 2030 — same author, same metaphor, four years of slippage, different scope (the 2024 report's headline bundled crypto). Neither vintage is “wrong”; they are differently-scoped answers to a question whose object was repricing itself between editions. [Section 6 owns the anchor reconciliation]
3. **LBNL, report to Congress (Dec 2024):** US data centers 176 TWh / 4.4% of US electricity (2023) → 6.7–12% by 2028. *Author's position:* statutorily commissioned; no revenue rides on the answer.
4. **EPRI (May 2024 → Feb 2026):** up to 9% of US electricity by 2030 → **9–17% by 2030, a 60% upward revision in 21 months**, driven by “an unprecedented surge in announced and under-construction projects”; Virginia ~25% → 39–57% by 2030 (EPRI's release) or 41–59% (E&E's rendering — conflict stated). *Author's position:* utility-industry research consortium — its members build against the number.
5. **JLARC/Weldon Cooper (Dec 2024):** Virginia unconstrained demand doubles in 10 years, +183% by 2040 — “largely matches” PJM. *Author's position:* the legislature buying an independent check on the utility's homework — and getting the same answer, which is either confirmation or a shared assumption set; the report doesn't adjudicate and neither does the pack.
6. **Dominion (the exhibit, intro only — Lecture 7 owns the full treatment):** contracted capacity 16.5 GW (Jul 2023) → 21 (Jul 2024) → ~40 (Dec 2024) → 48+ (Dec 2025) → **~51 GW (Mar 2026): 29.5 SELOA + 11.1 CLOA + 10.4 ESA** — the filer stage-labels its own slide, and ESAs bill “regardless of whether customers ultimately take service.” Separately, to the SCC (Feb 2026): **~70,000 MW under request ≈ 3x current load** [requests; phantom-load caveat mandatory — multi-territory duplicate requests mean the aggregate double-counts some projects and misses others]. *Author's position:* a rate-regulated utility whose capex plan (\$50.1B→\$55B) is justified by the forecast it authors — stated flat, no insinuation needed; the incentive is the disclosure.

The mechanism — why the forecasts disagree and why that's the lesson. Each number answers a different question (energy vs. capacity; operational vs. contracted vs. requested; data centres vs. +AI vs. +crypto; US vs. state vs. utility zone), for a different principal, on a different penalty function (IEA: credibility; EPRI: member planning; Dominion: rate recovery; JLARC: political cover). The listener's takeaway to install: a forecast is a document *about its author*; the question is never “which number is right” but “what happens to the author if it's wrong” — and in Virginia the answer ranges from “nothing” (IEA) to “\$55B of rate base” (Dominion). The demand curve every forecast keys off inflected on a datable event (30 Nov 2022) that none of the pre-2023 planning documents contained — the flat 2006–2020 line was itself a forecast assumption that fourteen years of being right turned into physics in planners' heads. **Where the constraint binds:** steel and concrete get poured against the *contracted* number; rates get litigated against the *metered* number; politics runs on the *requested* number.

Key actors. The six filers above, as authors. No humans foregrounded (Gribbin already cast in Beat 4).

The documents. The six specimens; Dominion Q1 2026 deck (the slide); Dominion's Feb 2026 SCC report [docket to pin].

Verbatim bank. > “All 50 top PJM DOM Zone peak loads, including the 22 highest, have occurred since January 1, 2025.” — Dominion Energy 2025 Annual Report (filed March 2026). [The rare forecast-adjacent sentence that is pure past tense — usable as the beat's floor of undisputed fact]

Who pays. One line: whoever's forecast wins gets to bill the difference — the doctrine machinery is Lecture 7's; here it's one sentence of seeding.

Contested, motivated, unknown. The E&E vs. EPRI range discrepancy (41–59 vs 39–57) — stated, unresolved, trivial in magnitude, perfect as a specimen of coverage drift. Whether “unconstrained” demand is a planning fiction by construction (it assumes every request is real) — JLARC itself brackets it with a “half unconstrained” scenario, which is the document conceding the point.

Sensory & material. The slide itself: three colored bars with acronyms (SELOA/CLOA/ESA) standing between a utility and \$55B.

Numbers that matter. 1,050 vs 945 — same author, 2026-high-case vs 2030-base, different scopes — IEA Jan 2024 / Apr 2025 — VOLATILE, the As-Of Stamp's own subject · +60% — EPRI self-revision, 21 months — Feb 2026 — STRUCTURAL (as an event) · 16.5→51 GW — Dominion contracted series with stages — Jul 2023–Mar 2026 — VOLATILE · 70,000 MW — requests — Feb 2026 — VOLATILE + caveat · 4.4% → 6.7–12% — LBNL US share — Dec 2024 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. Six authored specimens with dates, self-revisions, and one filer who stage-labels its own claims — the discipline installs itself from the record.

Beat 9 — The Bottleneck

(Atoms/Money · versatile · assignment: the watt replaces land as the site-selection criterion)

Beat Menu definition. The chokepoint through which everything must pass — the component, the queue, the permit. Lecture 1's chokepoint is the energized watt at a specific parcel: “powered land.”

Facts, dates, names, numbers. The market state that proves the thesis, all CBRE year-end 2025 unless noted: NoVA vacancy **0.5%** — **21.5 MW available in the world's largest market** (4,039.6 MW inventory); **96% of 2026 scheduled supply pre-committed**; preleasing extends to 2027+ deliveries; national primary-market vacancy at a record-low 1.4% on record absorption (2,497.6 MW); 74.3% of all under-construction capacity preleased (H1 2025); asking rates \$155–185/kW for 10+ MW blocks, with 10 MW+ pricing up ~19% in a year on “tight supply of contiguous power blocks.” The criterion shift, in the market-maker's own words: Pat Lynch (CBRE): power and supply-chain shortages are “reinforcing a **power-first approach that prioritizes sites with the fastest path to power**”; Anna Faktorow (CBRE): “vacancy remains near zero because **powered and entitled land** has become exceptionally scarce.” The queue mechanics: **Dominion's batching system** — new-connection studies processed in batches — “is extending power-delivery timelines for new projects, intensifying competition for entitled sites with near-term power access” (CBRE H1/H2 2025 market profiles). The premium's shape: buyers prioritize sites with **power access inside 18–36 months** and 200+ MW blocks (CBRE H1 2025); land prices become watt proxies — data-center-zoned Loudoun land \$2–3M/acre vs. \$200–300K unzoned (county brief), Rizer's \$4–5M (2023), the \$6M+/acre record (Nov 2025) — and note what the record sale included: **Dominion paid \$45M for the substation parcel** next door; the transaction priced the land and the watt in the same assemblage. Spillover as proof: development pushes down the I-95 corridor toward Stafford/Spotsylvania/Richmond (CBRE; Motion-CRE 2026) — not because the fiber moved, but because the watts did. July 2022 is the bottleneck's birthday in this geography: Dominion's eastern-Loudoun constraint notice, projects delayed to 2025–26.

The mechanism. Land, fiber, water, and permits can all be acquired in parallel by anyone with money; the energized watt cannot — it arrives only through a regulated monopoly's interconnection process, on the monopoly's study-and-build schedule, behind everyone who filed earlier. So the binding scarcity migrates from a market good (acreage) to a queue position (the batch), and the price system responds by capitalizing the queue into the land: “powered land” trades at 10–30x unpowered, the spread is the watt's shadow price. Buildings without watts are inventory; watts without buildings are options; the market now buys options. **Where the constraint binds:** the interconnection study — the one document money can't accelerate. [Queue mechanics at PJM grain: Lecture 4 owns the full treatment — this beat stays at the site-selection

consequence]

Key actors. CBRE (the market's narrator — seller-flagged: brokers profit from scarcity narratives; their vacancy data is nonetheless the industry standard); Dominion (queue operator; exhibit-grade); the SDC/JK transaction (the priced specimen).

The documents. CBRE North America Data Center Trends H1/H2 2025 + 2025 press releases; Dominion batching-process materials [pull the SCC/process filing at draft stage for the batch's formal name and rules]; the Nov 2025 deed record (\$615M; transfer taxes \$4M — the county taxing the bottleneck's shadow price).

Verbatim bank. > "...reinforcing a power-first approach that prioritizes sites with the fastest path to power." — Pat Lynch, Executive Managing Director, CBRE Data Center Solutions, CBRE 2025 recap release (published with year-end 2025 data).

"Even after delivering more than a gigawatt of new supply last year, vacancy remains near zero because powered and entitled land has become exceptionally scarce. The region is far from being closed for business." — Anna Faktorow, SVP, CBRE, same release. [Note the seller's coda — "far from closed" — a broker keeping the market open inside the scarcity pitch; usable as a seller specimen]

Who pays. One line: the queue's cost lands, for now, in land prices and preleases — private money bidding for position; the moment queue costs socialize into rates is Lecture 7's opening.

Contested, motivated, unknown. JLL's ~4,900 MW operating (mid-2025) vs CBRE's 4,039.6 (year-end) — different bases, both documented, never blend. Whether "0.5% vacancy" measures scarcity or merely preleasing convention (built-to-suit space never shows as vacant) — the pack notes the methodological softness; the direction survives it.

Sensory & material. 21.5 MW of available space in a 4,000 MW market — the world's largest data center market with, functionally, one mid-sized building's worth of room; a \$45M field bought for transformers.

Numbers that matter. 0.5% / 21.5 MW — vacancy/available — CBRE — end-2025 — VOLATILE · 96% — 2026 supply pre-committed — CBRE — VOLATILE · \$155–185/kW — asking — CBRE — VOLATILE · \$2–3M vs \$200–300K/acre — zoned vs not — county brief 2026 — STRUCTURAL · 18–36 months — power-access premium window — CBRE H1 2025 — STRUCTURAL · July 2022 — the constraint's local birthday — Dominion notice — ANCHOR-adjacent.

Stress-test verdict: SUSTAINABLE. The thesis ("the watt replaces land") is not an interpretation — the market's own narrator states it as operating doctrine, and a \$615M deed prices it.

Beat 10 — The Regulatory Collision

(Politics · versatile · assignment: county zoning authority vs. Richmond's revenue appetite)

Beat Menu definition. Two rulebooks occupying the same territory, each internally coherent, jointly impossible — the collision is structural, not villainous. Lecture 1's collision: the locality holds the land power; the Commonwealth holds the tax power; the same buildings are one government's nuisance file and the other's revenue line.

The two rulebooks, documented. *Rulebook A — the county's (land):* Virginia localities zone; Loudoun has used the power in sequence — 2022 neighborhood restrictions and design standards; the 2023 zoning-ordinance overhaul era (the Hearing Room corpus — ownership flagged, Identity item 12); **18 March 2025, by-right data center development permanently ended** — every future project now needs discretionary approval in the room where residents testify. *Rulebook B — Richmond's (money):* the 2010 DCRSUT exemption (≥50 jobs, ≥\$150M — sunset 2035) built the market the county now zones against; 53% of a decade's state incentive spending; and when the legislature reached for the land power itself — HB 1601/SB 1449, site assessments, the 100 MW threshold — the executive answered with the revenue case verbatim: the veto (2 May 2025) cites \$24B FY23 capital investment, \$733M to Loudoun, 74,000 jobs, \$9.1B GDP, and argues the state "should not... restrict local governments from developing data centers based on their community's specific circumstances" — the tax power defending itself in the vocabulary of local control. *The collision's 2026 form:* a new governor elected with data centers as a top issue signs assessment-tool and generator bills (April 2026), amends the cost-shift bills into softer SCC language — with **bill patrons and Dominion both objecting**, a genuinely odd alliance the pack states without resolving — and lands the **first-in-nation statewide energy consumption tax on data centers** in the June 2026 biennium budget, while the **\$1.6B/yr sales-tax exemption survives the same budget** after a stalemate in which the House

stripped environmental standards in favor of a commission. Net 2026 state posture, stated flat: tax the electricity, exempt the servers, study the standards. *The constitutional frame [standard doctrine, STRUCTURAL]*: Virginia is a Dillon Rule state — localities hold only powers expressly granted — so the county’s land power itself exists at Richmond’s pleasure; the collision is asymmetric by design.

The mechanism. Each rulebook’s feedback loop is locally rational: the county’s median voter lives beside the buildings (zoning tightens); the state’s median budget line feeds on them (exemptions persist). The building that satisfies both rulebooks simultaneously — sited discretionarily, taxed on consumption, exempt on equipment, assessed for noise, counted for GDP — is not a contradiction anyone chose; it’s the intersection of two coherent constituencies that never share a ballot. **Where the constraint binds:** the rezoning hearing is now the only gate the locality fully controls — which is why every other actor’s paper (JLARC findings, NVTC counterfactuals, PEC tower maps, Dominion timelines) is written to be read aloud in that room.

Key actors. Loudoun BOS; the General Assembly; Youngkin (through Jan 2026) and Spanberger (from Jan 2026) — both on the record in their own words; Del. Josh Thomas (sponsor, quoted); **Kathryn Kulick, HOA Roundtable representative** — **human-floor zone: her quotes are testimony from inside the shadow of the buildings; comedy off in her radius.**

The documents. HB 1601/SB 1449 (text, amendment, rejection, veto — the full lifecycle is the beat’s spine document); the 18 Mar 2025 by-right resolution; the biennium budget’s consumption-tax item [enrolled language to pull at draft stage — the tax’s rate and base are NOT yet in this pack’s verified record and must not be improvised]; HB 888 (signed 22 Apr 2026 — operative content likewise to pull, flagged).

Verbatim bank. > “My proposed amendments preserved the spirit of the bill while allowing localities flexibility. The General Assembly’s rejection of those amendments leaves behind a rigid framework that could chill investment and hinder economic development.” — Gov. Glenn Youngkin, veto statement, 2 May 2025.

“For those who have lived in the shadow of these facilities, they understand completely what this means. It’s completely disrupting normal everyday life.” — Kathryn Kulick, HOA Roundtable representative, May 2025 (NBC4). [Human floor]

“In the budget that we passed, we created the first-of-its-kind consumption tax on data centers and their energy usage.” — Gov. Abigail Spanberger, POLITICO Energy, week of 6 July 2026 (Governor’s office release).

Who pays. Seeded, one line: the consumption tax is the state’s first explicit answer — the *building* pays for its watts — while the exemption’s survival keeps the servers free; the full who-pays doctrine machinery remains Lecture 7’s.

Contested, motivated, unknown. The consumption tax’s rate, base, incidence, and effective date — **unverified in this pack; pull the budget item before any prose states a number.** Whether Spanberger’s SB 253/HB 1393 amendments strengthened or weakened ratepayer protection — patrons and Dominion say weakened; a Mercury commentator argues the substitute language is “actually better for residential ratepayers” — three documented positions, present the conflict.

Sensory & material. The veto’s letterhead and the budget’s line item describing the same buildings in opposite moods; a hearing room where a tower map, an audit, and a counterfactual tax bill are all entered into the same record.

Numbers that matter. 100 MW — HB 1601 threshold — 2025 — STRUCTURAL · \$1.6B/yr — exemption’s FY2025 forgone revenue — advocacy-sourced, CONTESTED pending fiscal-note pull (same flag as Beat 7) · 2035 — exemption sunset — statute — ANCHOR-adjacent · 18 Mar 2025 / 2 May 2025 / late June 2026 — the collision’s three dated hinges — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. A complete two-rulebook collision with dated hinges, quotable principals on all sides, and a still-warm 2026 resolution — with one hard guardrail: the consumption tax’s operative terms are a mandatory draft-stage pull.

Beat 11 — The Externality Swap (first statement)

(Audit · versatile · assignment: local burden vs. national claim — stated here, priced fully in Lecture 8)

Beat Menu definition. Costs and benefits landing on different parties, stated as accounting rather than outrage: who booked the gain, who holds the burden, and which ledger each lives on. Lecture 1 makes the *first statement* — establishes

the swap's structure with Virginia-local evidence — and explicitly leaves the full pricing (water, noise, viewshed, grid-cost socialization, the national-security claim's audit) to Lecture 8. Discipline: state both sides in their strongest documented form; price nothing here that Lecture 8 prices.

The swap, stated. Side one — the claim's ledger (benefits, booked broadly). The buildings serve everyone's email and everyone's models; the state books \$9.1B GDP and 74,000 jobs (JLARC); the nation books "AI leadership" — a claim this lecture only *names* (its documents — the White House AI Action Plan, "Winning the Race" — belong to Lectures 5 and 8; here the national claim appears in its Virginia costume: Youngkin's standing formulation, "Virginia is the data center capital of the world," deployed in groundbreaking releases as late as the CleanArc announcement). The county books 38% of a general fund. **Side two — the burden's ledger (costs, booked locally).** The burden is not hypothetical and the pack keeps it physical and dated: six transmission lines currently routed through one county; the Golden-to-Mars specimen — 22 miles, 500 kV, towers to ~215 feet, ~40 substations of 10–20 acres each — threaded, in the opposition's documented phrase, "through neighborhoods, schools, natural areas and commercial businesses" (PEC, Nov 2025, from Dominion's own project maps); noise "presents unique challenges" near homes (JLARC — the state's audit, not an advocacy claim); land-use conversion pressure on the remaining rural west (Kuhn's own framing concedes the stakes: "I do not think the answer is to put data centers everywhere"). The swap's signature asymmetry: the *benefit* aggregates (a TWh serves the continent), the *burden* localizes (a tower shades one yard) — and the compensation mechanism that exists (the county's tax take) compensates the *jurisdiction*, not the household under the tower; Loudoun's rate cut and the Golden-to-Mars viewshed are booked to different addresses.

The mechanism. Standard externality accounting with one Virginia-specific torque: because the revenue is so large and so concentrated (Beat 5), the jurisdiction that would normally advocate for burdened residents is itself the swap's biggest beneficiary — the county appears on both ledgers, which is why resident opposition routes around it (HOA roundtables, PEC, the General Assembly, the governor's race) rather than through it. The 2026 consumption tax is the first instrument that moves money along the swap's actual axis (from the buildings' consumption toward state coffers); whether any of it reaches the tower's address is not yet in the record. **Where the constraint binds:** the compensation address — until money lands where the burden lands, every hearing replays the same swap.

Key actors. PEC (advocacy — seller-flagged; its physical specifics originate in Dominion filings and survive the flag); Dominion (the builder; exhibit-grade); the household under the tower (**unnamed in this pack's pulled record — human-floor rule: if draft prose wants a household, Lecture 8's pack must supply documented named residents; Lecture 1 keeps the burden at the map's grain**).

The documents. Dominion's Golden-to-Mars project filings/maps [SCC case number to pin at draft stage]; PEC's 14 Nov 2025 inventory; JLARC's noise and water findings.

Verbatim bank. > "It is ultimately only needed to serve data centers, with more than 40 substations along the way, each one comprising 10-20 acres of industrial use." — Piedmont Environmental Council on Golden-to-Mars, 14 November 2025. [Advocacy voice, physical claims traceable to the utility's own project materials — attribute to PEC, not to the record at large]

Who pays. The beat is the who-pays question in still-life: gains booked to the state ledger, the county ledger, and the national claim; burdens booked to specific addresses along a 22-mile line — full pricing deferred, per assignment, to Lecture 8.

Contested, motivated, unknown. Whether transmission of this class is "only needed to serve data centers" — PEC's claim; Dominion frames the same projects as reliability investments; JLARC's isolation exercise (Table 3-1: build-out driven *solely* by data centers) is the neutral arbiter available and sides substantially with the demand-attribution — cite the audit, not the advocate, for the load-bearing version. Health/property-value claims around lines: not in this pack's pulled record; do not improvise.

Sensory & material. A 215-foot lattice tower against a subdivision skyline — taller than the Statue of Liberty, the opposition's own yardstick, dated and attributable.

Numbers that matter. 22 mi / 500 kV / ~215 ft / ~40 substations / 10–20 acres — Golden-to-Mars — Dominion via PEC — Nov 2025 — STRUCTURAL · 6 — transmission lines through Loudoun — Dominion site via PEC — VOLATILE · \$9.1B / 74,000 — the claim ledger — JLARC — STRUCTURAL.

Stress-test verdict: SUSTAINABLE — with a discipline note. The first-statement scope holds only if drafting resists pricing; the pack has deliberately withheld the Lecture 8 material (water gallons, noise decibels, named neighbors) so the beat *cannot* overreach from this file.

Beat 12 — The County [C]

(Politics · closer-preferred · assignment: Loudoun present-tense — farmland repriced past \$1M an acre, the FY2025–26 budget in the county’s own words)

Beat Menu definition. The locality as protagonist at the end of the causal chain — the place where the abstraction becomes a budget, a hearing, a neighbor. Closer discipline: land the lecture in the county’s present tense with specific costs paid in time, money, atoms, labor, legitimacy, governance; the ending arrives, it is not announced.

The present tense, assembled (all figures dated). The place: ~200 facilities, ~49M sq ft on the ground, 6M more coming (Dec 2025), on ~3–4% of the county’s land, around a former farm village named Ashburn; the county is simultaneously the wealthiest in America (median household income, since 2008), home of the lowest property tax rate in Northern Virginia, and — by its own Commissioner of the Revenue’s 2025 ledger — a jurisdiction where data centers are 22.9% of the real-estate tax base and 75% of all commercial land value. The money: the county’s own FAQ sentence (4% of parcels, 38% of the general fund); FY2027’s expectation of ~\$1.3B, 45% of tax revenue; Umstattd’s “\$1 billion a year into Loudoun County.” The land: the anchor’s “farmland >\$1M/acre” now reads as nostalgia — zoned land \$2–3M, Rizer’s \$4–5M, and on 3 November 2025 a 97-acre parcel east of Leesburg at \$615M, first past \$6M/acre, ten times its price four years prior, \$4M in transfer taxes to the county on the way through, with Dominion buying the substation field next door for \$45M. The politics: by-right ended; the recruiter most-hated; a supervisor calling the spending unsustainable inside a budget that spends it; homeowners petitioning to be rezoned *into* the industry; Kuhn — easement holder and land seller both — calling the revenue an annuity “for who knows how long.” The credit rating: Loudoun holds AAA [county-reported across budget materials; pin the Moody’s/S&P/Fitch triple-AAA citation at draft stage — one line here; the rating-agency treatment and any downgrade-watch material belong to Lecture 10’s return]. The closer’s material honestly includes what the county cannot do: it cannot repeal the fiber, cannot un-capitalize the 38%, cannot make the next hearing not about the last tower — the present tense is a place that won an argument with itself and is now governed by the victory.

The mechanism. The closer runs the lecture’s chain backward through one jurisdiction: peering accident → fiber inheritance → watt scarcity → revenue capture → dependency ratchet → political repricing — every link now visible in a single county’s current documents. **Where the constraint binds:** the FY2027 revenue line — the number that makes every other sentence in the county’s politics conditional.

Key actors. Loudoun County (Institution, lead — treatment completed here; Lectures 7/8/10 may reference, must not rebuild); Rizer (exit image available: the radio DJ who filled some leftover buildings); Umstattd, Kershner, Kuhn, Wertz (all on the record, all quoted above); no unnamed-resident scenes — the closer’s human material is officials and documented principals only, per this pack’s pulled record.

The documents. The county FAQ (the county’s own words — the assignment’s literal requirement, satisfied); the FY2026–27 budgets; the 3 Nov 2025 deed; the stabilization-fund policy.

Verbatim bank. (Assembled from prior beats — the closer reuses, doesn’t re-pull: the FAQ sentence [Beat 5]; Kuhn’s annuity [Beat 6]; Rizer’s most-hated [Beat 7]; Kershner’s not-sustainable [Beat 7]; Umstattd’s \$1B [above].) One addition: > “The facilities ‘bring \$1 billion a year into Loudoun County.’” — Supervisor Kristen Umstattd, quoted in City Journal, 26 April 2026. [Partial quote inside reporter’s sentence — mark as reported speech, not standalone verbatim]

Who pays — the seed, final form. As of FY2026, the honest answer in Loudoun is: the servers pay, the residents collect, and the burdens that don’t fit that sentence (towers, noise, the west’s land) are exactly the ones the money doesn’t reach — the question the course now carries to Lecture 2’s door: *what, inside these buildings, is doing the eating?* [Handoff class: question left hanging — final Handoff language is prose work; Section 10 (Run 2) carries the cascade-edge materials and alternates]

Contested, motivated, unknown. The AAA-citation pin (above). The homeowners’ petition status (Beat 7 flag). The FY2027 numbers are expectations.

Sensory & material. A \$615M deed for 97 acres of what the plat books once called farmland; transfer-tax stamps worth \$4M; the annual hearing where the rate drops again and the room is angrier than last year.

Numbers that matter. All inherited (Beats 5, 7) plus: \$615M / 97 acres / >\$6M-per-acre / ~10x-in-4-years / \$4M transfer tax — the record sale — Loudoun Now, 7 Nov 2025 — STRUCTURAL · 22.9% / 75% — tax-base and commercial-land shares — Wertz, Feb 2025 — STRUCTURAL · AAA — county rating — county-reported — STRUCTURAL, citation

to pin.

Stress-test verdict: SUSTAINABLE. The closer lands entirely on dated, attributed, mostly county-authored material, and its emotional load — a place governed by its own victory — is carried by documents, not sentiment.

SECTION 2 SUMMARY VERDICT LINE (for markup): 12/12 beats SUSTAINABLE as assigned. No THIN or UNBUILDABLE verdicts — but three assignments survive on explicit conditions: Beat 2's parking-lot claim is inference-flagged pending a site-plan pull; Beat 10's consumption-tax terms and HB 888 content are mandatory draft-stage pulls before any operative number appears in prose; Beat 11 holds only under its first-statement scope discipline. The negative-space scan (Section 3, Run 2) will test whether Hearing Room — which turns out to have the richest live corpus of any unused beat (2022–2025 Loudoun zoning actions, the 2025 veto cycle's committee record, the 2026 session) — outbids The Regulatory Collision or The County for a slot, honoring the Hearing Room appearance cap and opener rotation.

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RUN 2 — SECTIONS 3–12

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

Nine beats sit unused in the strawman. For each: what the record actually contains, whether a swap case exists, and a verdict. Rule of engagement: a swap is recommended only if the unused beat's documented material is *stronger than an assigned beat's* AND the swap breaks no cascade edge, cap, or rotation. Two near-misses surfaced; zero swaps recommended; both near-misses go to Nick with the cases stated.

1. Cold Open. *What the record holds:* three cinematic candidates — the 1919 Gallows Road cinder-block room; the 3 November 2025 closing table (\$615M for 97 acres); and the 10 July 2024 grid near-miss (a transmission fault near Fairfax; a large block of data center load disconnecting at once; a NERC task force following — the *event* is documented; the dramatized version circulating in investment newsletters is Section 7's Doomer specimen). *Swap case:* none available — opener rotation locks Wrong Map [O] into Lectures 1 and 9, and Cold Open opens Lecture 2. The near-miss belongs to Lecture 4's field regardless. **Verdict: correctly absent.** Material banked: the garage room and the closing table both survive inside assigned beats as texture.

2. The Bill Arrives. *What the record holds:* no arrived bill — and that's a finding. The consumption tax's first payments begin September 2026 (after SCC guidelines), i.e., the first literal bill under the new regime post-dates this pack by weeks. The NVTC counterfactual (\$6,440 → \$12,296) is a hypothetical bill, which is the beat's antithesis. Residential rate impacts are Lecture 7's owned territory. **Verdict: correctly absent — with a dated note for the 2027 Briefing: the first consumption-tax remittances will exist by then, and The Bill Arrives becomes buildable for this exact lecture's territory.**

3. The Hearing Room. *What the record holds — the richest unused corpus in the file:* the 2022 Loudoun restriction cycle; the 2023 zoning-overhaul hearings; the 18 March 2025 by-right vote (public hearing, on the record); the HB 1601/SB 1449 committee-and-veto cycle with Kulick's testimony; the June 2026 budget floor fight (Lucas: "didn't love" the compromise, spoken to press in the Capitol rotunda, 22 June 2026). *Swap case — the genuine one:* Hearing Room for The Regulatory Collision (same Politics family, same actors, same documents). *Case against, and it's decisive:* (a) The Collision carries the lecture's structural politics — the two-rulebook mechanism seeds Lecture 7's who-pays doctrine, which a scene-container beat can't do; (b) the Hearing Room corpus's *ownership* is unresolved (Identity item 12: Lecture 8 lists the ZOAM corpus as a return with no lead assigned) — spending the best hearing verbatims in Lecture 1 could strand Lecture 8; (c) the strongest hearing material in the pulled record (Kulick, Lucas) already deploys inside Beat 10 as texture without invoking the beat's formal machinery. **Verdict: no swap, by a clear margin — but flagged as Nick's call.** If Nick assigns the ZOAM corpus lead to Lecture 8, this resolves cleanly; if he assigns it to Lecture 1, revisit at Schema stage.

4. Operator Reality. *What the record holds:* the 50-FTE statistic and JLARC's shift-composition note (~half contractors) — numbers, not scenes. No named technician, no documented shift handoff, no maintenance log in the pulled record. Lectures 2–3 own the inside of the building. **Verdict: correctly absent.** Anti-fabrication note for drafting: do not scene-build an operator from the statistic.

5. The Taxonomy. *What the record holds:* the classification raw material exists (hyperscale vs. colocation vs. edge in CBRE's market segmentation; the consumption-tax statute's own definitional carve-out — a *legal* taxonomy separating AI-class facilities from ISP/VoIP facilities, which is genuinely delicious). But taxonomy-of-what's-inside is Lecture 2's native furniture. **Verdict: correctly absent.** Banked for Lecture 2's pack: the statute's ≥1 MW definition and the ISP carve-out as the state's first legal answer to "what counts as one of these buildings."

6. The Symbol Audit. *What the record holds:* four auditable symbols — "Data Center Alley" (a brand invented in a 2008 planning document to move dot-com leftovers, now carrying a \$1.3B revenue line); Uunet Way; Mars/Golden/Wishing Star; "Digital Gateway" (a project name that outlived the project). *Cap check:* Symbol Audit is hard-capped ×3, assigned to Lectures 5, 8, 9. **Verdict: unavailable by cap — correctly absent.** The Alley-brand audit material is banked here for whichever of 5/8/9 wants it; it is strong enough to compete.

7. The Founder Audit. Menu-ineligible in Lecture 1 by standing rule ("never lecture 1"). Rizer — the nearest founder-shaped figure — is handled through Steelman and Perverse Incentive instead, which fits: he's a civil servant, not a founder, and auditing him as one would miscategorize the character. **Verdict: correctly absent by rule.**

8. The Neighbor. *What the record holds:* no documented named resident with enough record depth for a Neighbor treat-

ment. Kulick is a quoted representative (testimony, not a household portrait); the Botetourt residents who confronted Spanberger (27 April 2026) and the PW Digital Gateway plaintiffs (“residents and historians,” per Newsweek) are collectives in the pulled record. Cap: Neighbor ×3, not assigned here. **Verdict: correctly absent — and flagged forward:** Lecture 7/8 packs must pull named, consenting, on-the-record residents (the Digital Gateway litigation record and the Botetourt coverage are the two documented starting trails).

9. The Deal. *What the record holds — the second near-miss:* the 3 November 2025 transaction is a complete Deal artifact: named parties (JK Land Holdings/Kuhn → SDC Capital Partners affiliate), price (\$615M), backstory (\$57M basis four years prior), side-deal (Dominion’s \$45M substation parcel), state’s cut (\$4M transfer taxes), and a principal quote (the annuity line). *Swap case:* The Deal for The Bottleneck or Follow the Money. *Case against:* Beat 9 carries the lecture’s cascade binding (“binds at the watt as site criterion”) — structurally non-negotiable; Beat 5 carries a must-hit anchor (~\$1B/1½). The deed currently works as *evidence* inside Beats 9 and 12; promoting it to a Deal beat would concentrate what the strawman deliberately distributes. **Verdict: no swap; material banked.** Note for the Schema: if Draft 1 shows Beat 12 running thin, the Deal is the pre-approved thickening agent — it’s already in the closer’s inventory.

Scan summary: 9/9 absences justified; 2 near-misses (Hearing Room, Deal) documented with swap cases stated and declined; 3 forward flags lodged (Bill Arrives → 2027 edition; Taxonomy material → L2 pack; Neighbor trails → L7/L8 packs).

SECTION 4: MOVES PLAN VERIFICATION

Seven of the eight moves are assigned to Lecture 1; Moves List 1.0’s cap (one deployment per move per lecture) is satisfied — each assigned move verifies below for exactly one deployment. Formal gates applied per the Moves List’s deployment disciplines.

Move 1 — Step Function: “>25% of Virginia’s electricity flows through data centers.” *Gate:* the discontinuity must be real, the standing assumption it breaks must be documented, and the basis must be stated. *Pedigree:* EPRI, 29 May 2024 — Virginia leads all states, **25.6% of in-state electricity consumption** (2023 data); EPRI, 26 Feb 2026 — “more than 25% today,” rising to 39–57% by 2030; corroborating on a different basis: data centers exceed **25% of Dominion’s Virginia electricity sales** (Q4 2024 earnings call, Feb 2025 — utility-sales basis, not state-consumption basis; never blend). *The standing assumption, documented:* Virginia electricity demand was **flat 2006–2020** (JLARC, Dec 2024) — fourteen years in which “state demand doesn’t move” hardened from observation into planning physics. The step is not just the level (a quarter of a state) but the derivative’s sign change. **VERDICT: PASS.** Deployment note: state the basis in prose (“of the electricity consumed in Virginia”) — the move dies if a listener can confuse it with Dominion’s sales share.

Move 2 — Unit Conversion: “1,050 TWh → a Japan.” *Gate (arithmetic shown, per discipline — applied to all conversions regardless of Open Item 11’s four flagged cases):* Numerator: ~1,050 TWh — IEA *Electricity 2024* (Jan 2024) high case for calendar 2026, scope = data centres + AI + dedicated crypto. Denominator candidates: Japan final electricity consumption ≈ **939 TWh** (IEA data, 2022 basis) or gross generation ≈ **1,013 TWh**. Ratios: $1,050 \div 939 \approx 1.12$; $1,050 \div 1,013 \approx 1.04$. The equivalence sits within 4–12% of unity on either basis, and — decisively — **the comparison is the IEA’s own sentence** (“roughly equivalent to the electricity consumption of Japan”), not a course-manufactured flourish. **VERDICT: PASS,** with two mandatory riders in prose: (1) the scope note (the bundle includes crypto); (2) the modal verb (the IEA said “could reach”). *Supersession rider:* the same agency’s April 2025 vintage relocates the Japan-equivalence to 2030 on a narrower scope — this is the As-Of Stamp’s cargo (Move 5) and Section 6’s Discrepancy D.

Move 3 — Timeline Snap: the 1990s peering consolidation. DATE LOCK: 30 April 1995. *Gate:* the snap must land on a date where incentives flip, with the before/after states documentable. *Before 30 April 1995:* the NSFNET backbone carries inter-network traffic; private peering is an optimization; MAE-East is a convenience run out of an office building and, increasingly, a garage. *After:* the government backbone is off; every commercial ISP **must** interconnect privately or partition the internet; MAE-East becomes obligatory infrastructure; congestion follows (the fall-1994 FDDI upgrade was already straining); Equinix incorporates within 38 months to sell the solution; the solution’s address is Ashburn. *Alternates preserved for prose flexibility:* 1992 (the beer meeting — better comedy, weaker incentive flip) and 1994 (NSF’s NAP designation — the state blessing the accident; strong, but the flip is de jure rather than de facto). **VERDICT: PASS — 30 April 1995 locked as primary; alternates may appear as texture but the snap lands on the decommissioning.**

Move 4 — Verbatim: a JLARC sentence. *Gate:* existence — the sentence must exist, verbatim, in the named document, with locator. **PASSED** in Section 2 Beat 4: primary (“Building enough infrastructure to meet unconstrained energy demand

will be very difficult to achieve, with or without meeting the Virginia Clean Economy Act (VCEA) requirements” — report landing page, Dec 2024) plus three backups (Gribbin spoken; the abdication clause; “We’re still looking at doubling existing generation”). *Deployment discipline*: one Verbatim deployment — recommend the primary, with the abdication clause held as the Draft-2 alternate if Nick wants the drier laugh. **VERDICT: PASS.**

Move 5 — As-Of Stamp: the ~1,050 TWh figure. *Gate*: the stamped figure must carry vintage, author, and a named supersession risk — the stamp is the course admitting on tape that the number expires. *Stamp cargo, verified*: figure authored January 2024 (IEA *Electricity* 2024), high case, calendar 2026, crypto-inclusive scope; superseded in emphasis April 2025 (IEA *Energy and AI*: 415 TWh actual 2024 on the narrower data-centre scope; ~945 TWh by 2030); the 2027 Briefing re-anchors on whatever the then-current IEA vintage says. **VERDICT: PASS** — with the note that this deployment is self-demonstrating: the lecture stamps a number while *Beat 8 teaches why numbers need stamps*; storyboard should sequence the stamp before or inside Beat 8, not after.

Move 6 — Kicker: “the capital of the AI age, chosen by nobody.” *Gate*: the kicker must be earned entirely by documented facts already in evidence — no sentiment imported at the close. *The earning inventory*: chosen by nobody, founding edition (the beer meeting, 1992; “circumstances dictated,” 1998); ratified by accident (NSF blessing a garage, 1994; the backbone dying, 1995); compounded without consent (recruiting stopped 2019 → 20M to 49M sq ft anyway); and *still* chosen by nobody in the present tense (96% of 2026 supply pre-committed before the year began — the market allocating the capital’s growth before any human deliberates; the county that ended by-right approval budgeting for the growth it votes against). **VERDICT: PASS.** Prose-stage note: the kicker’s final formulation is voice work; the pack certifies only that every clause of it has a citation.

Move 7 — Gesture: the training-run door. STATUS: CONDITIONAL (Syllabus 2.0 Open Item 9 — the third-door call is Nick’s). *Gate*: if deployed, exactly one inch of verified fact about what the appetite is for, then the door closes. *Two one-inch facts, verified*: (1) **An AI query requires ~10x the electricity of a traditional search** (EPRI, 29 May 2024 — clean, dated, filer-named). (2) **Accelerated (AI-optimized) servers account for roughly half of the net growth in global data centre electricity demand to 2030 in the IEA’s base case** (IEA *Energy and AI*, April 2025 — directionally solid; exact phrasing and page to be pinned at draft stage before the sentence goes to prose; if the pin fails, fact (1) alone carries the inch). **VERDICT: PASS, conditional.** If Nick rejects the third door: the Gesture is skipped, no other move re-flows, and Beat 12’s hanging question does the pointing unassisted — verified clean either way.

Cap compliance line: 7 moves, 7 single deployments, 0 collisions with beat caps or rotations. The eighth move remains unassigned to Lecture 1 per Syllabus 2.0; no bootleg deployment of it appears in this pack’s materials.

SECTION 5: DOCUMENT DOSSIER — JLARC, DATA CENTERS IN VIRGINIA (2024)

Full identification. *Data Centers in Virginia*, Joint Legislative Audit and Review Commission, Commonwealth of Virginia. Study directed by the Commission in 2023; report and staff briefing presented **9 December 2024**, JLARC meeting, Richmond; presenter of record: **Mark Gribbin, chief legislative analyst** (project team under JLARC director Hal Greer — director attribution to be confirmed against the title page at draft stage). Published at jlarc.virginia.gov with: full report PDF, presentation slides, and a commissioned independent energy-modeling appendix built on University of Virginia Weldon Cooper Center demand scenarios. Companion document, one year later: JLARC’s economic-development-incentives review (December 2025) carrying the 53%-of-incentive-spending finding.

Provenance and motive. JLARC is the General Assembly’s own oversight arm — nonpartisan staff, legislative commissioners. The motive structure is worth stating plainly because it *is* the beat: the legislature that enacted the 2010 exemption commissioning an audit of the industry the exemption built, in a year (2023–24) when constituent pressure, utility filings, and national coverage had made the industry’s costs politically visible. The report’s genre — findings plus “policy options,” explicitly declining to rank them — is the institutional signature of a body producing ammunition for both sides of a fight it declines to join.

Architecture of the document. Three load-bearing chapters for this lecture’s purposes: economic contribution (jobs, GDP, fiscal); energy (demand scenarios, infrastructure requirements, rate allocation); local/environmental (siting, noise, water, generators). Plus the incentives thread (the 2019 JLARC finding it incorporates: ~90% of exempted investment would not have occurred in Virginia absent the exemption — a counterfactual estimate, **CONTESTED** by construction).

The findings, consolidated (each with its unit discipline).

- *Market position:* NoVA = largest data center market in the world; **13% of reported global operational capacity; 25% of the Americas** [share of operational capacity — a rate]. ~150 sites / ~340 buildings statewide; ~80% in Loudoun, Prince William, Fairfax.
- *Economics:* **~74,000 jobs, \$5.5B labor income, \$9.1B GDP annually** [flow, annual, 2023 basis], majority construction-phase; construction 12–18 months/building, **~1,500 workers at peak**; operations **~50 FTEs per 250,000 sq ft**, ~half contract.
- *Energy:* demand **flat 2006–2020**; unconstrained data-center demand **doubles statewide power demand within 10 years** and runs **~183% above current by 2040** (vs. **+15%** with no new data center growth) — “largely matches” PJM’s forecast; meeting unconstrained demand requires **~150% more in-state generation**, imports up ~150%, transmission up ~40%, solar at 2x the 2024 build rate, offshore wind beyond every secured site, a large gas plant roughly every 18 months, and SMRs “not yet proven commercially viable in the U.S.”; even the **half-unconstrained** scenario “still look[s] at doubling existing generation” (Gribbin, spoken).
- *Rates:* “current rates appropriately allocate costs to the customers responsible for incurring them, including data center customers” — data centers **currently pay their full cost of service** — with the paired warning that growth is likely to raise other customers’ costs [the Lecture 7 fuse; quote-accurate rendering above].
- *Local fiscality:* across five mature host localities, data center revenue ranges **<1% to 31% of total local revenue**; Loudoun 2024: **\$733M property taxes** $\approx \frac{1}{3}$ of county property tax revenue.
- *Environmental:* backup generators <4% of regional NOx, $\leq 0.1\%$ CO/particulates [operator-reported inputs]; water “currently sustainable, but growing and could be better managed”; noise near residences “presents unique challenges.”

What the document forces. Formally, nothing — its recommendations bind no one, and its options menu explicitly outsources judgment (“a policy judgment best made by the General Assembly or other elected officials”). Functionally, it reorganized the fight: within 18 months — ~20 bills (Jan 2025), the HB 1601 cycle and veto (Mar–May 2025), a governor’s race with data centers as a top issue (Nov 2025), a session the industry “dominated” (2026), and a first-in-nation consumption tax (June 2026) whose floor debate cited affordability findings the report legitimized. The document’s teeth are borrowed, and everyone borrowed them.

Reception, on the record. The Data Center Coalition (Josh Levi) engaged cooperatively during the study; post-publication, industry messaging leans on the report’s full-cost-of-service finding while opponents lean on its infrastructure-difficulty sentence — the same PDF serving as both shield and sword is the dossier’s cleanest single observation, and it is documentable from dueling 2025–26 citations of the same pages.

Use rules for drafting. (1) The primary Verbatim comes from this document — one deployment. (2) The report is the lecture’s *neutral arbiter of record*: where PEC and Dominion conflict, cite JLARC’s version. (3) Never attribute the unconstrained scenario’s drama to JLARC’s voice — the report brackets its own worst case; the course must too. (4) The 13%-global figure is JLARC’s; the anchor’s ~14% is Syllabus 1.0’s — Section 6 Discrepancy A governs; no silent substitution in either direction.

SECTION 6: NUMBER SPINE & DISCREPANCY RECONCILIATION

6.1 The Number Spine

Every load-bearing figure, one row each. Columns: value · what it is (unit/stage) · filer · as-of · tier (ANCHOR / STRUCTURAL / VOLATILE / CONTESTED) · notes. Rows marked **■** feed a lettered discrepancy below.

#	Value	What it is (unit · stage)	Filer	As-of	Tier	Notes
1	~1,050 TWh	global data centre+AI+crypto electricity, 2026 · projection, high case	IEA, <i>Electricity 2024</i>	Jan 2024	VOLATILE ■ D	must-hit; As-Of Stamp assigned
2	460 TWh	same scope, 2022 · estimate	IEA	Jan 2024	STRUCTURAL	baseline for #1

#	Value	What it is (unit · stage)	Filer	As-of	Tier	Notes
3	415 TWh	data centres, 2024 · estimate (narrower scope)	IEA, <i>Energy and AI</i>	Apr 2025	STRUCTURAL ■D	~1.5% of global electricity
4	~945 TWh	data centres, 2030 · base-case projection	IEA	Apr 2025	VOLATILE ■D	Japan-equivalence relocated here
5	~939 TWh / ~1,013 TWh	Japan electricity consumption / generation · annual	IEA data	2022 basis	STRUCTURAL	conversion denominators
6	176 TWh · 4.4%	US data centre use, 2023 · estimate	LBNL (report to Congress)	Dec 2024	STRUCTURAL	
7	6.7–12%	US electricity share, 2028 · projection	LBNL	Dec 2024	VOLATILE	
8	177–192 TWh	US data centre use, 2024 · estimate	EPRI	Feb 2026	STRUCTURAL	
9	up to 9% → 9–17%	US share by 2030 · projections, two vintages	EPRI	May 2024 → Feb 2026	VOLATILE	+60% self-revision — Beat 8 specimen
10	25.6%	share of VA electricity consumed by data centers · 2023 data	EPRI	May 2024	STRUCTURAL	must-hit basis (“>25% of state load”)
11	39–57% (EPRI) / 41–59% (E&E rendering)	VA share by 2030 · projection	EPRI / E&E News	Feb 2026	VOLATILE ■F	dual rendering, stated not smoothed
12	>25%	share of Dominion’s VA electricity <i>sales</i> · 2024	Dominion (Q4 call)	Feb 2025	STRUCTURAL	different basis than #10 — never blend
13	13% / 25%	NoVA share of global / Americas operational capacity	JLARC	Dec 2024	STRUCTURAL ■A	anchor says ~14%
14	35%	share of world <i>hyperscale</i> market · capacity	VEDP	2024–25	CONTESTED	different universe than #13; marketing use
15	~150 / ~340 / ~80%	VA sites / buildings / three-county concentration	JLARC	Dec 2024	STRUCTURAL	
16	371 / 421	VA data centers operating / planned · count	industry database via Newsweek	Jul 2026	VOLATILE	different counting basis than #15
17	74,000 · \$5.5B · \$9.1B	jobs · labor income · GDP, annual, majority construction	JLARC	Dec 2024	STRUCTURAL	

#	Value	What it is (unit · stage)	Filer	As-of	Tier	Notes
18	~50 FTEs / 250k sq ft (~half contract)	operations staffing · reported by operators	JLARC	Dec 2024	STRUCTURAL	DISPATCH plant
19	~1,500	construction workers per facility at peak	JLARC	Dec 2024	STRUCTURAL	
20	~\$105,000	typical operations salary	JLARC via Cardinal	Dec 2024	STRUCTURAL	
21	flat	VA power demand 2006–2020	JLARC	Dec 2024	STRUCTURAL	Step Function's standing assumption
22	2x in 10 yrs · +183% by 2040 vs +15%	unconstrained VA demand scenarios	JLARC/Weldon Cooper	Dec 2024	CONTESTED	scenario, author named
23	+150% gen · +150% imports · +40% transmission	infrastructure required for #22	JLARC	Dec 2024	CONTESTED	scenario-dependent
24	\$733M · ~1/3	Loudoun DC property taxes 2024 · share of property-tax revenue	JLARC	Dec 2024	STRUCTURAL ■B	
25	\$60M → \$800M+	Loudoun computer-equipment tax, FY2013 → FY2026 · collected/budgeted	Loudoun FY2026 budget	Feb 2025	STRUCTURAL	
26	~\$895M vs \$940M	FY2025 DC revenue vs county operating budget · estimate	Loudoun staff (Jan 2025)	2025	STRUCTURAL ■B	operating ≠ total budget
27	\$417M + \$879M ≈ \$1.3B · 45% of \$2.9B	FY2027 real + personal property expectation · share of tax revenue	Loudoun budget via City Journal	Apr 2026	VOLATILE ■B	
28	4% → 38%	commercial parcels → general-fund share	Loudoun County FAQ	2026	STRUCTURAL ■B	county-authored
29	\$0.04 per \$1	county service cost per DC tax dollar (vs ~\$0.25 typical business)	Turner brief (county)	2026	STRUCTURAL	
30	>48¢/\$100 cumulative	real-property rate reduction attributed to commercial/DC growth	Loudoun official bio	2026	STRUCTURAL	“to the penny” hook

#	Value	What it is (unit · stage)	Filer	As-of	Tier	Notes
31	~\$0.805/\$100	implied current real-property rate	DERIVED from NVTC figures	May 2026	CONTESTED	confirm vs adopted rate resolution
32	+\$5,856/yr (\$6,440→\$12,296)	counterfactual homeowner tax on \$800k home absent DC revenue	NVTC	May 2026	CONTESTED	industry-council model
33	22.9% · 75% · +\$19B	DC share of real-estate tax base · of commercial land value · YoY value gain	Wertz (Commissioner of Revenue)	Feb 2025	STRUCTURAL	
34	50% of purchase price, year one	equipment assessment schedule	county practice via DCD	2022	STRUCTURAL	the depreciation mechanism
35	~\$60M	2021 assessment shortfall vs forecast	county finance via DCD	2022	STRUCTURAL	pre-AI volatility proof
36	~200 · ~49M + 6M sq ft	Loudoun facilities · built + developing	Rizer (WVIA) / Wertz	Dec 2025 / Feb 2025	VOLATILE	
37	\$2–3M vs \$200–300K/acre	zoned vs unzoned land	Turner brief	2026	STRUCTURAL ▀C	
38	\$4–5M/acre	DC land price quote	Rizer	Feb 2023	STRUCTURAL ▀C	
39	\$615M / 97 ac / >\$6M/ac / ~10x / \$4M	record sale · transfer taxes	deed via Loudoun Now	3 Nov 2025	STRUCTURAL ▀C	
40	16.5 → 21 → ~40 → 48+ → ~51 GW	Dominion contracted DC capacity series · stage-labeled (29.5 SELOA + 11.1 CLOA + 10.4 ESA at endpoint)	Dominion investor materials	Jul 2023 → Mar 2026	VOLATILE	exhibit-grade; L7 owns full
41	~70,000 MW ≈ 3x current load	capacity under <i>request</i>	Dominion to SCC	Feb 2026	VOLATILE	phantom-load caveat mandatory
42	~450 DCs · ~9 GW	connected since tracking began · cumulative	Dominion (Q4 2024 call)	Feb 2025	STRUCTURAL	
43	11 DCs · 744 MW	connected in 2025	Dominion Annual Report	Mar 2026	STRUCTURAL	
44	50 / 22	top DOM-zone peaks / highest, all since 1 Jan 2025	Dominion Annual Report	Mar 2026	STRUCTURAL	verbatim-capable
45	\$50.1B → \$55B	5-yr capex plans (2025–29 / 2026–30)	Dominion	Feb 2025 / Mar 2026	VOLATILE	

#	Value	What it is (unit · stage)	Filer	As-of	Tier	Notes
46	22 mi · 500 kV · ~215 ft · ~40 substations · 100–300 MW · 10–20 ac	Golden-to-Mars line specifics	Dominion via PEC	Nov 2025	STRUCTURAL	advocacy conduit, utility origin
47	4,039.6 MW · +37% · 0.5% · 21.5 MW · 96% · \$155–185/kW	NoVA inventory · growth · vacancy · available · 2026 precommit · asking	CBRE	year-end 2025	VOLATILE	
48	~4,900 MW	NoVA operating capacity	JLL	mid-2025	VOLATILE	different basis than #47 — never blend
49	1,000 MW (NoVA) vs 559 MW (London)	first market past 1 GW	CBRE via Register	Apr 2019	STRUCTURAL	
50	18–36 months · 200+ MW	power-access window · block size buyers prioritize	CBRE	H1 2025	STRUCTURAL	
51	\$0.011/kWh · 7/1/26–before 7/1/28 · \$600M/yr cap	consumption tax rate · window · cap with pro-rata refund	HB 30 Item 3-5.24#1c (budget law)	Jun 2026	ANCHOR (statutory)	verbatim available
52	~\$600M/yr · \$1.2B/biennium	estimated consumption-tax yield	legislative estimates	Jun 2026	VOLATILE	
53	~9.86¢/kWh	VA industrial electricity rate (context: tax ≈ +11% on power component)	EIA via Energy News Beat	Apr 2026	VOLATILE	secondary arithmetic — verify before prose
54	\$1.6B/yr (adv.) · \$1.6–1.9B/yr (law-firm est.) · ≥\$2.7B/decade (JLARC)	DCRSUT exemption forgone revenue, three renderings	Loudoun Dems / Williams Mullen / JLARC	2025–26	CONTESTED ■E	
55	~\$1.54M/yr	exemption's original projected cost	advocacy citation of enactment-era estimate	Apr 2026	CONTESTED ■E	fiscal-note pull mandatory
56	53%	DC share of decade's state incentive spending	JLARC	Dec 2025	STRUCTURAL	
57	≥50 jobs · ≥\$150M · 2035	exemption thresholds · sunset	statute via JLARC/Axios	Dec 2025	STRUCTURAL	
58	\$2B → ≥50 jobs · \$3B → 50 jobs	Vantage VA4 · CleanArc announcements	company PRs	Nov 2025 / 2024	STRUCTURAL	jobs-math plant; L8 owns audit
59	~2,100 acres	PW Digital Gateway (abandoned)	Newsweek	Jul 2026	STRUCTURAL	~2x Central Park

#	Value	What it is (unit · stage)	Filer	As-of	Tier	Notes
60	\$35B by 2040	AWS Virginia pledge · announced	AP (Youngkin announcement)	20 Jan 2023	STRUCTURAL	announced ≠ spent
61	~1.2 kW	average US household electric draw · derived (~10,500 kWh/yr ÷ 8,760 h)	EIA (pin current year)	standard	STRUCTURAL	homes-conversion denominator
62	80,000–800,000 homes	equivalence of a 100–1,000 MW facility	EPRI	Feb 2026	STRUCTURAL	reproduces from #61 — PASS

6.2 Discrepancy Reconciliation (anchor conflicts — Nick resolves; no silent substitution has occurred anywhere in this pack)

■**A** — “Virginia ~14% of global data centers” (must-hit) vs. JLARC’s 13%. The anchor’s ~14% traces to earlier market tallies; the best current authoritative figure is JLARC’s **13% of reported global operational capacity** (NoVA, Dec 2024) — note also it’s *Northern Virginia*, not Virginia, and *operational capacity*, not facility count. VEDP’s 35% is a different universe (hyperscale only) and Statista’s ~7 GW yet another (installed capacity, 2024). *Options*: (i) keep “~14%” as a rounded gesture — defensible but now sits above the audited figure; (ii) adopt “13%, per the state’s own audit” — cleaner sourcing, sacrifices the anchor verbatim; (iii) phrase-shift: “about one building in seven, worldwide” — keeps magnitude, ducks the decimal. **Pack recommendation: (ii) or (iii); flag only — Syllabus 1.0 governs until Nick rules.**

■**B** — “~\$1B/yr, ~1/3 of budget” (must-hit) vs. the moving series. Every element is true *at some vintage on some basis*: \$733M/1/3 of property-tax revenue (2024, JLARC); ~\$895M vs a \$940M operating budget (FY2025 estimate); 38% of the general fund (county FAQ, current); ~\$1.3B/45% of tax revenue (FY2027 expectation). The anchor is correct as a FY2025-era rounding and *understates the trajectory*. **Recommendation: keep the anchor’s sentence, then let the series run it over in the same paragraph — the growth from 1/3 toward 45% is itself Perverse Incentive evidence. Basis must be spoken aloud in prose (“of the county’s tax revenue,” not “of the budget”) — the bases differ by hundreds of millions.**

■**C** — “Farmland >\$1M/acre” (must-hit) vs. the 2026 record. The anchor is directionally true and numerically quaint: zoned land runs \$2–3M (county brief), Rizer said \$4–5M in 2023, and the November 2025 record cleared \$6M. **Recommendation: keep the anchor as the entry claim and date-stamp the escalation past it — “>\$1M an acre, and that was the polite early number” is the documented shape. No substitution needed; the anchor survives as a floor.**

■**D** — “~1,050 TWh global (2026)” (must-hit) vs. IEA’s own supersession. Same author, two vintages: Jan 2024 (high case, 2026, crypto-inclusive) vs. Apr 2025 (415 TWh actual 2024, narrower scope; ~945 TWh by 2030; Japan-equivalence moved to 2030). The anchor is quotable *as what the IEA projected in January 2024* — which is exactly how the As-Of Stamp deploys it — and becomes indefensible if stated as a present-tense measured fact. **Recommendation: keep, stamped. The vintage conflict is not a bug in the lecture; it is Beat 8’s best specimen, and the title’s arithmetic survives because the stamp is assigned.**

■**E** — The exemption’s cost: \$1.54M projected vs. \$1.6B actual. The pair is the lecture’s single most perverse dated contrast and currently rests on an advocacy citation (Loudoun Democrats, Apr 2026) for the historical projection, with the modern figure now corroborated by neutral-ish law-firm analysis (\$1.6–1.9B/yr, Williams Mullen, Jul 2026) and bounded by JLARC (≥\$2.7B/decade). **Recommendation: the modern figure is load-bearing-ready; the \$1.54M projection is NOT until the enactment-era fiscal impact statement is pulled (draft-stage mandatory pull, Section 12 pending list). If the fiscal note shows a different original estimate, the contrast survives at whatever the documented number is — do not pre-commit prose to \$1.54M.**

■**F** — Minor conflicts, logged: EPRI 39–57% vs E&E’s 41–59% (state both or cite EPRI’s own release); consumption-tax sunset rendered “July 1, 2028” (Lexology) vs “June 30, 2028” (mgrid) — the statute says “before July 1, 2028,” use the statute; CBRE 4,039.6 MW vs JLL ~4,900 MW vs Statista ~7 GW (three methodologies — cite one, name it); MAE-East “~half of world traffic” (retrospective folklore, order-of-magnitude only); Loudoun facility counts (200 City Journal vs 371-statewide Newsweek vs 150-sites JLARC — different geographies and units; never mix in one sentence).

SECTION 7: SELLERS & OVERCLAIMS + STEELMAN FILE

Style Guide §5's six seller archetypes, mapped to who is actually on Lecture 1's field, each with documented claims, the incentive stated flat, and the discount the narrator applies. Two sellers are assigned (Politician, Doomer); the others appear at the grade the record supports.

The Politician — Buddy Rizer / Loudoun County (assigned, primary). *The pitch, documented:* \$65B+ investment and 60,000+ jobs attracted since 2007 (county bio); the >48¢ rate cut; “Loudoun remains the largest and most important data center location in the world” (2017); the county FAQ's 4%-of-parcels/38%-of-general-fund framing. *The audit:* the revenue core is independently verified (JLARC) — grant it in full; the soft edges: “attracted” aggregates all commercial development under a data-center-era tenure; “60,000 jobs” is a cumulative attraction tally, not data center operations employment (JLARC's ops number: ~50/facility — the county's own audit supplies the discount); the 48¢ is cumulative-over-a-decade, which prose must not let sound annual. *The genealogy overclaim (owned by this seller class):* “70% of the world's internet traffic flows through here” — descended from MAE-East's genuine 1990s share, repeated by officials and boosters across decades (Register 2019: “local politicians claim”; still circulating in a July 2025 investment newsletter), unmeasurable and unsupported today. *Narrator move:* GRANT-AND-WITHHOLD (assigned, via Beat 6) — grant the audited ledger, withhold the folklore and the aggregation. *The discount's fairness check:* Rizer himself supplies the corrective quotes (stopped recruiting 2019; “define your opportunity up front”; “most popular to most hated”) — the pack's Politician is unusually self-auditing, and the prose should let him be.

The Doomer — the grid-collapse register (assigned, secondary). *The specimen, dated:* a July 2025 investment newsletter (Katusa) dramatizing the real 10 July 2024 Fairfax-area disturbance: “data centers processing 70% of the world's internet traffic began dropping off the grid like dominoes... the system teetered on the edge of cascading blackouts that could have darkened the entire East Coast. We came that close to learning what happens when Google goes dark.” *The audit:* the kernel is real — a documented 2024 event in which a large block of NoVA data center load disconnected during a fault, followed by a NERC task force (the event itself is Lecture 4's owned material; locator flagged for that pack). The seller's additions: the recycled 70% myth, the East-Coast-blackout escalation, and the newsletter's commercial incentive (subscription research sold on crisis). *Narrator move:* STRIP — keep the documented event's one-line existence, strip the cinema; the Doomer's steelman (below) gets its due separately.

The Hyperscaler — present at announcement grade. *Claims on file:* AWS's \$35B-by-2040 pledge (20 Jan 2023, announced with the governor; incentives required legislative approval — stage: announced, not spent); Vantage VA4 (\$2B, “at least 50 permanent jobs,” 1,100 construction); CleanArc (\$3B, 50 jobs); Amazon's on-record dispute of Business Insider's power-estimate methodology (“flawed and can lead to inaccurate conclusions”) — a documented seller-vs-auditor exchange, usable verbatim. *Discount:* DISCOUNT move — announced capex is a press release with a decade attached; the jobs-per-dollar arithmetic is planted here and audited in Lecture 8.

The Utility — Dominion, exhibit grade only (Lecture 7 owns the full seller treatment). *What Lecture 1 may use:* the pipeline slide (16.5→51 GW, stage-labeled), Blue's “not slowing down... accelerating,” and the incentive stated in one flat sentence: the forecast's author is a rate-regulated monopoly whose \$55B plan is justified by the forecast. *Boundary:* no rate-case machinery, no ratepayer-allocation fights — those are Lecture 7's.

The Neocloud Founder — absent from this field. No neocloud principal appears in Lecture 1's record; the archetype enters at Lecture 6. Stated so drafting doesn't import one.

The Escape Artist — absent from this field. Orbital/offshore/exotic-siting claims have no Lecture 1 presence; the archetype enters with Lecture 9's material. Stated likewise.

The Overclaim Register (quick-draw list for prose, each with its kill):

1. “70% of the world's internet traffic” — killed by genealogy (Beat 1) + unmeasurability; the myth's *persistence* is the story.
2. “70,000 megawatts per day” — a unit that doesn't exist; professional coverage, 25 Mar 2026; killed by Beat 3's instinct.
3. “As much power as X homes” — arithmetic PASSES (Section 4, Move 2 discipline; spine #61–62), implicature fails; deploy as taught, not as scare.
4. “Biggest data center in the world” — the abandoned Digital Gateway's own billing; a superlative that died in the Court of Appeals; usable as a one-line irony with the March 2026 date.

5. “An annuity... for who knows how long” — Kuhn’s phrase carries its own withholding clause; quote it whole and it audits itself.
6. “Data center capital of the world” — true, and chosen by nobody; the Kicker’s raw material, not an overclaim when stated with the history attached.

The Steelman File (strongest opposing cases, for GRANT-AND-WITHHOLD integrity beyond Beat 6’s assigned defendant):

- *For the exemption:* JLARC 2019’s own counterfactual — ~90% of exempted investment would not have located in Virginia absent it; Levi/DCC: “this budget positions the Commonwealth to be a national leader on data centers”; former FERC chairman Mark Christie’s framing of the consumption tax as an *offset* that leaves the subsidy intact — i.e., even the tax’s admirers concede the exemption’s gravitational pull.
- *For the opposition:* PEC’s physical claims trace to Dominion’s own project filings — the advocacy wrapper contains utility-authored specifics; and JLARC’s isolation exercise substantially validates demand attribution to data centers. The opposition’s strongest documented card is that its numbers are the industry’s numbers.
- *For the Doomer:* the 2024 disturbance was real, NERC convened over it, and Dominion’s own annual report documents every top-50 zone peak occurring since January 2025 — the fear has a filing cabinet; the discount applies to the cinema, not the concern.
- *For the House’s commission-over-standards budget position:* statewide standards fit poorly over 133 localities’ land-use variety — the Dillon Rule cuts both ways, and the veto message (May 2025) made the localist version of this argument in writing.

SECTION 8: HUMAN FLOOR

Standing rule (Style Guide): comedy drops to near-zero wherever documented individuals bear the costs; institutions, filings, and self-selected public sellers remain fair game. Lecture 1 is structurally light on floor exposure — no Neighbor beat, no casualty record, no clinical material — but four zones require the thermostat down and one requires an explicit non-floor ruling.

Zone 1 — Kathryn Kulick (Beat 10). HOA Roundtable representative, on the record May 2025: “For those who have lived in the shadow of these facilities... It’s completely disrupting normal everyday life.” Testimony from inside the burden. *Handling:* quote clean, no adjacent jokes, no paraphrase that sharpens her into a type. The comedy resumes on the *institutions* responding to her, not on her.

Zone 2 — The petitioning homeowners (Beat 7). The City Journal-documented group petitioning to rezone their own land into data center eligibility. The irony is load-bearing and *structural* — the payoff matrix produced the behavior. *Handling:* the joke, if any, lands on the incentive structure and the county that built it; never on the households, who are behaving rationally inside a machine they didn’t design. No names appear in the pulled record; do not pull names for comedy purposes.

Zone 3 — The Digital Gateway litigants and the Botetourt residents (Sections 7/11; Beat 11 adjacency). “Residents and historians” (Newsweek) who litigated Digital Gateway to death; Botetourt residents confronting the governor (27 Apr 2026). Collectives here; named individuals exist in the underlying coverage but were not pulled. *Handling:* Lecture 1 keeps them at the collective grain; Lecture 7/8 packs own the named-resident pulls with full floor protocol.

Zone 4 — The AOL employee who cried (Beat 1). An anonymous period anecdote, gentle by nature. *Handling:* permissible with light touch — the joke is the middle-of-nowhere that became the capital, not the man’s tears; keep him anonymous as the source does.

Non-floor ruling — the farmland sellers. Landowners clearing \$2–6M/acre, including Kuhn’s documented ~10x on a four-year hold, are *beneficiaries with agency and press availability*, not burdened parties. The windfall is fully in-bounds for the comedy thermostat’s normal range. The distinction to hold: the neighbor who can’t sell (burden, floor) vs. the owner who just did (windfall, fair game).

Construction workforce note. ~1,500 workers/site at peak, 300→500 apprenticeships — economic facts, no incident record in this pack; neutral register, no floor trigger, no invented shift-floor color (Operator Reality stays negative space).

SECTION 9: PEOPLE & CAST

9.1 Buddy Rizer — Human anchor (the Politician, the Steelman's voice, the arc)

Verified vitals (as of July 2026). Executive Director, Loudoun County Department of Economic Development; in the role since 2007; listed in the county staff directory and appearing in that capacity as recently as December 2025 (WVIA) — title current, no succession event in the pulled record. Founder (2023) of ATIX, LLC, a digital-infrastructure consultancy — held concurrently.

The documented biography, in order. Radio from age 15; “most of my life in major market radio”; Towson University; on-air work, programming, station ownership in the record’s various renderings; his own pivot line: “I decided it was time to — I joke — grow up and get a real job” (Compass *Not Your Father’s Data Center* podcast, Jan 2024). Joins Loudoun economic development 2007. Authors/champions the 2008 strategic plan that brands 3.5 square miles “Data Center Alley” — origin, in his own telling, inventory disposal: “We had some leftover buildings from the dot-com bubble, and that was kind of my plan, I’m going to fill those couple of buildings with data centers” (WVIA, 12 Dec 2025). Presides over 20M sq ft by 2019 — the year the county *stops proactively recruiting* — then over the compounding to ~49M + 6M by Dec 2025. Scoreboard of record: \$65B+ investment, 60,000+ jobs, >48¢ cumulative rate reduction (county bio — Politician-graded, Section 7 discounts attached). Self-описание of the arc: “I’ve gone from the most popular public official to the most hated” (WVIA). Advisory posture to other jurisdictions: “define your opportunity up front, determine if you want them, where you want them” (WVIA). Nickname in trade press: “Godfather of Data Center Alley” (widely used; self-embraced per Virginia Business).

Function in the lecture. Three loads: (1) the Politician seller — the pitch, granted where audited; (2) the Steelman’s voice — the growth case is his case, argued at full strength; (3) the arc — the DJ who filled two empty buildings and ended up the most-hated man in the wealthiest county in America is the lecture’s one complete human story, and it is entirely documented in his own quotes.

Handling rules. Punch at the pitch, never the man; his self-awareness is on tape — use his own corrective quotes as the audit, which is both fairer and funnier. ATIX: disclose flatly in one clause (the recruiter-in-chief now also consults for the industry, founded 2023, held concurrently) — the disclosure is complete; insinuation would exceed the record and is banned. The radio origin is texture, not a character note about seriousness — the record shows a 19-year public-sector tenure.

Verbatim inventory (all dated above): grow-up-real-job · leftover-buildings · most-popular-to-most-hated · define-your-opportunity · largest-and-most-important (2017) · \$4–5M/acre (Feb 2023).

9.2 MAE-East — Object/Place anchor (lead here; no returns)

Object biography — chain of custody. 1992: created (Yeager/MFS, Adams/UUNET; AlterNet, PSINet, Sprint-ICM; the beer meeting). 1992–96: office nexus at 8100 Boone Blvd, Tysons. Feb 1993: 10-Mbps Ethernet-over-DS3 fabric. 1994: NSF NAP designation; MAE-West spawns the backronym. Fall 1994: FDDI upgrade under congestion. 30 Apr 1995: becomes load-bearing when NSFNET dies. ~1996: the cinder-block garage room, 1919 Gallows Rd. ~1997: ~half the world’s traffic (folkloric precision, attested magnitude). 1998: closed to new customers; relocates over time to Equinix DC2 (21715 Filigree Ct, Ashburn). 2001: original mainframe off. 2006: 8100 Boone to Digital Realty (later exited). 2009: remaining providers migrate to Ashburn. **Voice:** period engineering discourse — the NANOG-archive congestion threads (raw verbatims: draft-stage pull, flagged; the Feldman quote stands as the documented founding voice). **Function:** the Wrong Map’s protagonist — an object that was never designed, only agreed upon, and whose afterlife (Ashburn) outgrew its life by three orders of magnitude.

9.3 Loudoun County — Institution anchor (LEAD; returns L7, L8, proposed L10)

Wants: the revenue (38% of the general fund and climbing); the AAA; control of its land (by-right ended 18 Mar 2025); to be seen choosing what it can no longer refuse. **Fears:** the depreciation curve (the 2021 \$60M miss; the 2020 “over-reliance” memo; the stabilization fund); its own voters (the most-hated arc; Kershner’s “not sustainable”); Richmond (the Dillon Rule asymmetry — its zoning power exists at the state’s pleasure while the state’s exemption power shapes its economy). **Can enforce:** discretionary approval of every future project (post-3/18/25); the tax rate; assessments (Wertz’s ledger). **Cannot enforce:** the fiber’s gravity; the exemption; server refresh cycles; the interconnection queue; what the General Assembly does to the golden goose’s habitat. **Documents authored (the institution’s voice, all in pack):** the FAQ (4%/38%); the FY2026–27 budgets (\$60M→\$800M series); the Turner brief (\$0.04/\$1; the rate comparison); the 2020 staff report; the stabilization-fund policy; the 2008 strategic plan [pull pending]. **Treatment-completeness check (Roster requirement**

— **lead treatment must leave nothing for later lectures to rebuild**: origin (Beat 1), anatomy of its holdings (Beat 2), fiscal machine (Beat 5), argument (Beat 6), pathology (Beat 7), collision (Beat 10), present tense (Beat 12) — complete. **What L1 deliberately leaves unspent for the returns**: the deep hearing-testimony corpus (L8, pending Identity item 12); grid-cost allocation fights (L7); the ledger-of-irreversibility framing and rating-agency material beyond one AAA line (L10).

9.4 Secondary registry (stable naming — first-reference forms locked)

Officials & principals: **Mark Gribbin** (chief legislative analyst, JLARC — role only, no biography); **Bob Wertz** (Loudoun Commissioner of the Revenue); **Chuck Kuhn** (JK Land Holdings; dual position stated on every use: largest conservation-easement holder ~22,000 acres AND data center land seller/developer); **Kristen Umstattd** / **Caleb Kershner** / **Mike Turner** (Loudoun supervisors — Umstattd the revenue voice, Kershner the sustainability dissent, Turner the brief’s author); **Glenn Youngkin** (governor through Jan 2026 — the veto, the AWS announcement); **Abigail Spanberger** (governor from Jan 2026 — the consumption tax); **Josh Thomas** (Del., D-Prince William — HB 1601 patron); **Louise Lucas** (Sen., Senate Finance chair — “didn’t love” the compromise); **Kathryn Kulick** (HOA Roundtable — floor Zone 1); **Josh Levi** (president, Data Center Coalition); **Robert Blue** (Dominion CEO — L7’s character; exhibit-grade quotes only here); **Pat Lynch** / **Anna Faktorow** (CBRE — the market’s narrators, broker tag); **Steven Feldman** / **Scott Yeager** / **Rick Adams** (period, Beat 1 only).

Institutions with seller/authority tags: **JLARC** (neutral arbiter of record); **Dominion Energy** (utility seller; exhibit-grade in L1); **Equinix** (landlord of the accident; company-source tag on its own history); **CBRE** / **JLL** (broker tags; methodologies never blended); **PEC** (advocacy tag; utility-origin specifics survive the tag); **NVTC** / **Progress Chamber** (industry-council tag); **Data Center Coalition** (trade association); **QTS** / **Compass Datacenters** / **Blackstone** (Digital Gateway principals — ownership stated as fact, no finance-door mechanics: L6’s); **SDC Capital Partners** / **JK Land Holdings** (the record deed’s parties); **NSF** (the 1994 blessing); **NERC** (one-line existence re the 2024 disturbance — L4’s).

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

Edge 1 — Inherits: nothing. Audit result: clean. Lecture 1 opens the course cold; no beat presumes material from any other lecture. The one deliberate backward-reference risk — none exists; forward-reference risks are Edge 4’s table.

Edge 2 — Binds at: the watt as site-selection criterion. Executed in Beat 9, in the market’s own words (Lynch’s “power-first approach”), priced by the land spread (\$2–3M zoned vs \$200–300K) and the record deed’s substation-parcel side-deal. Verified: the binding is stated as *site criterion* — not as grid mechanics (L4), not as rate doctrine (L7). Compliant.

Edge 3 — Who pays: seeded. Inventory of seed lines (all one-sentence grade, none run): Beat 4 (JLARC’s other-customers warning — the fuse); Beat 5 (the inverted present: servers pay, residents collect); Beat 7 (whoever stops the servers pays the county); Beat 10 (the consumption tax as the state’s first explicit answer); Beat 11 (the compensation-address problem); Beat 12 (the seed’s final form, carrying the Handoff). Zero doctrine machinery deployed. Compliant.

Edge 4 — Manufactures → Lecture 2: “what’s inside doing the eating.” The Handoff class is *question left hanging*. **Primary recommendation**: the closer’s question in its plain form — a county remade, a state re-taxed, a Japan’s worth of electricity — and the lecture never once opened the building’s door: *what, inside, is doing the eating?* **Alternate A (statutory irony)**: Virginia now taxes the buildings 1.1 cents per kilowatt-hour, and the statute defining what counts as a taxable data center had to reach *inside* — computing at ≥1 MW, ISPs and phone switches exempted — the law itself pointing through the door the lecture hasn’t opened. **Alternate B (the emptiness)**: a building drawing a small city’s power, staffed like a large restaurant — fifty people and a Japan’s appetite; the ratio is the question. All three verified against pack facts; selection is storyboard work.

Boundary-discipline audit (the doors, checked):

Door / owned territory	Owner	L1 exposure in this pack	Status
Inside the rack / silicon	L2	6.1 kW density cited as one-line cross-ref; taxonomy banked to L2	COMPLIANT
Heat/cooling component tour	L3	campus-grain only, stops at roofline	COMPLIANT

Door / owned territory	Owner	L1 exposure in this pack	Status
Grid events, PJM queue mechanics	L4	10 Jul 2024 disturbance held at one-line existence; queue at site-selection consequence only	COMPLIANT
National-security framing, <i>Winning the Race</i>	L5	named-not-opened; Youngkin's "capital" line only	COMPLIANT
Neocloud finance, LBO mechanics	L6	"Blackstone-owned QTS" as ownership fact, nothing more	COMPLIANT
Dominion full treatment, rate doctrine	L7	exhibit slide + two quotes + stage labels; no rate cases	COMPLIANT
Externality pricing, jobs-math audit, named neighbors	L8	first-statement scope held; DISPATCH planted not cashed; neighbor trails flagged forward	COMPLIANT
Escape-artist siting (orbital etc.)	L9	absent	COMPLIANT
Irreversibility ledger, 2001-glut rhyme, FRAMING verdict	L10	glut stated as geography-inheritance only, rhyme not run; FRAMING named and sealed; AAA held to one line	COMPLIANT
Training-run door	Conditional Gesture	two one-inch facts staged; skip-clean if door rejected	COMPLIANT
Reactor door	(course-external adjacency)	absent	COMPLIANT

Refresh-safe check (edition-update model). The lecture's spine — the accident, the chain of custody, the mechanism structures, the collision's architecture — is refresh-proof. Everything VOLATILE is concentrated in identifiable sockets (the TWh stamp, the GW series, the vacancy numbers, the revenue series, the tax's own sunset), each with a named refresh source in Section 11's decay table. Decay tier Mid confirmed: the 2027 Briefing re-records numbers, not narrative.

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

11.1 Last-90-days ledger (20 April – 20 July 2026) — what the syllabus stack predates

The consumption tax, fully resolved (upgrades Run 1's flag to verified). HB 30 (2026 biennial budget, ~\$205B/2yr), approved by the General Assembly 22 June, signed by Gov. Spanberger 30 June 2026. Item 3-5.24#1c, statutory text verbatim: > "Beginning on and after July 1, 2026, but before July 1, 2028, there is hereby levied and imposed upon every data center operator, in addition to all other taxes and fees of every kind now imposed by law, an electricity consumption tax at the rate of \$0.011/kWh of all electricity consumed at each data center per month." — HB 30 Conference Report, Item 3-5.24#1c (Virginia budget portal).

Verified mechanics: applies to utility-supplied AND self-generated power (behind-the-meter included, no renewables carve-out); "data center" defined as a facility primarily engaged in storage/management/processing of digital data supporting **≥1 MW**, explicitly *excluding* facilities whose primary function is internet-access or communications/VoIP service — a definitional targeting of AI/hyperscale operations (Lexology's reading, and the statute's plain structure); revenue to the general fund **capped at \$600M/fiscal year**, over-collections refunded pro-rata to data centers via their electricity providers at fiscal year end; SCC guidelines due within 60 days of passage; first remittances expected September 2026; sunset before 1 July 2028. Scale arithmetic (secondary, verify before prose): at \$0.011/kWh a 500 MW facility running flat-out owes ~\$48M/yr ($500,000 \text{ kW} \times 8,760 \text{ h} \times \$0.011 \approx \$48.2\text{M}$ — arithmetic checks); against Virginia industrial rates ~9.86¢/kWh (Apr 2026, EIA via secondary), the tax $\approx +11\%$ on the power component. Reactions on record: Lucas "didn't love" the compromise; Levi/DCC: new taxes "will hurt Virginia's reputation"; Christie: an offset leaving subsidies intact; Gramlich: excluding data centers from standard industrial rate classes is unusual. Same budget: **water-use minimization requirements for data center cooling** (stricter in groundwater-scarce areas), **DEQ noise standards by 2029**, and — separate but adjacent — a **new Dominion rate class for large-load customers effective 1 January 2027**. The exemption survived intact.

Prince William Digital Gateway — the superlative that died in court. The ~2,100-acre project ($\approx 2\times$ Central Park; billed

as potentially the world's largest data center campus; developers QTS — Blackstone-owned — and Compass Datacenters) is dead: a circuit court voided the rezoning approvals in 2025; the **Virginia Court of Appeals unanimously upheld the voiding in March 2026**; Prince William County and Compass dropped their appeals; QTS withdrew its final appeal and abandoned the project (Newsweek, early July 2026). Cause of death, per the record: a **procedural error in the rezoning process** — not financing, not demand, not AI regulation. Adjacent same-week datum: PW supervisors **rejected the Dulles Cloud South proposal** (Virginia Mercury, ~9–10 July 2026). Current statewide stock per the same coverage: **371 operating / 421 planned**. *Use note for L1*: one-line irony grade here (the “biggest in the world” register); the litigation's named residents and the siting fight's full anatomy belong to L7/L8.

Loudoun fiscal currency. FY2027 expectations (\$417M + \$879M ≈ \$1.3B; 45% of ~\$2.9B tax revenue) reported 26 April 2026 (City Journal); NVTC counterfactual published mid-May 2026. County posture unchanged through the window: by-right remains ended; no new county-level tax action in the pulled record.

Market currency. CBRE year-end-2025 stands as the latest full-market read (0.5% vacancy; 96% of 2026 pre-committed); Dominion's ~51 GW (March 2026) is the latest stage-labeled pipeline figure; permits continue at record pace (54 new VA data center permits in the first nine months of 2025, 28 of them Amazon — Business Insider tally, with Amazon disputing BI's power methodology on the record).

11.2 Decay watch (what the 2027 Briefing must re-record, with refresh sources)

Decaying item	Pack value (as-of)	Refresh source	Expected motion
Global TWh figure & Japan equivalence	~1,050 TWh high case 2026 (IEA Jan 2024) / 945 by 2030 (Apr 2025)	next IEA <i>Energy and AI / Electricity</i> vintage	new vintage certain; equivalence may migrate again
Dominion contracted pipeline	~51 GW, stage-labeled (Mar 2026)	quarterly investor decks; SCC filings	grows or gets re-staged; watch SELOA→CLOA conversion rates
The consumption tax itself	live 7/1/26; sunsets before 7/1/28	2027–28 GA sessions; SCC guidelines; first-year collections vs \$600M cap	the tax is a two-year experiment — by the 2027 Briefing it will have a collections record; by 2028 it's renewed, replaced, or gone
Exemption fight	survived June 2026 budget; \$1.6–1.9B/yr	2027 session; JLARC follow-ons	round two near-certain
Loudoun revenue series	FY2027 expectation \$1.3B/45%	FY2028 proposed budget (Feb 2027); Wertz's Feb assessment	continued climb or first AI-refresh-cycle wobble — either is course material
NoVA vacancy/pricing	0.5% / \$155–185/kW (YE2025)	CBRE H1/H2 2026	tightness persists or I-95 spillover registers
VA facility counts	371/421 (Jul 2026)	industry databases; BI permit tallies	up
HB 888 + 2026-session bill contents	flagged, un-pulled	enrolled bills, LIS	draft-stage pull regardless
Political configuration	Spanberger yr 1; 2027 VA legislative elections upcoming	election results Nov 2027	the entire House is on the ballot before the 2027 edition
Rizer's status	ED, in role Jul 2026	county directory	succession would be a story event, not a footnote

Refresh-proof inventory (no decay): the 1992–2009 MAE-East chain; 30 April 1995; the compounding mechanism; the assessment-schedule mechanism; the two-rulebook architecture; the payoff matrix's shape; the Kicker's earning inventory (all past-tense facts).

SECTION 12: SOURCE INVENTORY

A. Government & primary documents (highest authority tier)

1. JLARC, *Data Centers in Virginia* — report, presentation slides, energy-modeling appendix (Weldon Cooper scenarios); presented 9 Dec 2024. [jlarc.virginia.gov — page-pins at draft stage]
2. JLARC, economic-development incentives review (Dec 2025) — the 53%/\$2.7B/2035 findings.
3. HB 30 (2026 biennial budget), Item 3-5.24#1c — Data Center Electricity Consumption Tax, statutory text (Virginia budget portal, budget.lis.virginia.gov). Verbatim secured.
4. Gov. Youngkin veto statement, HB 1601/SB 1449, 2 May 2025. Verbatim secured.
5. Office of the Governor (Spanberger) releases, 30 June & 6 July 2026 (energy slate; POLITICO Energy quote). Verbatim secured.
6. Loudoun County FAQ, “Data Centers — Tax Revenues and the County Budget” (county-authored; accessed Jul 2026). Verbatim secured.
7. Loudoun County FY2026 Proposed/Adopted Budget; FY2027 budget expectations (as reported).
8. Loudoun County Data Center Brief (Supervisor Mike Turner, county document, 2026).
9. Wertz assessment presentation (Commissioner of the Revenue, Feb 2025, via Loudoun Now).
10. Loudoun staff report on revenue concentration (2020, via NetChoice hosting). “Over-reliance” verbatim secured.
11. Deed record: 97 acres, \$615M, 3 Nov 2025 (via Loudoun Now reporting; Loudoun land records for the instrument).
12. Dominion Energy 2025 Annual Report / FY2025 10-K (filed Mar 2026); Q1 2026 investor deck (pipeline slide, stage labels); Feb 2026 SCC report [docket pin pending].
13. NSF NAP designation record (1994) — [PENDING PULL: solicitation/award citation].

B. Filer & corporate sources (authority with stated incentives)

14. IEA, *Electricity 2024* (Jan 2024) — verbatim secured.
15. IEA, *Energy and AI* (Apr 2025) — [page-pin pending for the accelerated-servers share].
16. EPRI, *Powering Intelligence* (29 May 2024) and 2026 update (26 Feb 2026).
17. LBNL, *2024 United States Data Center Energy Usage Report* (Dec 2024).
18. CBRE — 2025 recap release + H1/H2 2025 North America Data Center Trends (Lynch, Faktorow verbatims secured).
19. JLL NoVA figures (mid-2025, via WTOP/MotionCRE).
20. Equinix — DC campus specs, DC1/DC2 details (company source tag).
21. Vantage VA4 announcement (Businesswire, 6 Nov 2025).
22. AWS \$35B pledge (AP, 20 Jan 2023 — date now pinned).
23. Compass Data Centers podcast transcript (Rizer, Jan 2024) — verbatim secured.
24. NVTC/Progress Chamber fiscal-impact summary (14 May 2026 — industry-council tag).
25. VEDP hyperscale-share claim (marketing tier).

C. Press (dated, by outlet — reliability graded in place throughout the pack)

26. Cardinal News (6 May 2025 veto cycle; 9 Dec 2024 JLARC; 10 Jul 2026 headlines).
27. Virginia Mercury (1 Apr 2025; 9/16/22 Apr 2026; 22 Jun 2026; 5 May 2026; Jul 2026 Dulles Cloud South).
28. VPM & WHRO (JLARC presentation coverage, Dec 2024).
29. WJLA (2 Apr 2025).
30. NBC4 (5 May 2025 — Kulick).
31. City Journal (26 Apr 2026).
32. Loudoun Now (7 Feb 2025; 7 Nov 2025).
33. Data Center Frontier (FY2026 budget analysis; 2022 Dominion pause).
34. Data Center Dynamics (18 Jun 2026 post-Loudoun feature; 7 May 2026 Ashburn history; Q4-2024 Dominion call; 2022 assessment shortfall).
35. Data Center Knowledge (2015 Equinix retrospective; Jun 2026 tax coverage).
36. The Register (26 Apr 2019; 14 Feb 2025).
37. WVIA (12 Dec 2025) — three Rizer verbatims secured.
38. Newsweek (early Jul 2026 — Digital Gateway).
39. ARLnow (22 Jun 2026).
40. Axios Richmond (3 Dec 2025).
41. Prince William Times (1 Feb 2023).
42. Virginia Business (25 Mar 2026 — the “megawatts per day” specimen; Rizer/godfather usage).
43. Washington Post (5 Mar 2014 — regional corpus).
44. Bloomberg Tax / Williams Mullen / Lexology / Greenberg Traurig / mgrid / Energy News Beat (Jun–Jul 2026 consumption-tax legal analyses).
45. Business Insider permit tally (via AOL syndication; Amazon’s methodological dispute on record).
46. NBC News (May 2024 Equinix image context).
47. InterGlobix (Rizer profile, Dec 2025).
48. VivaTysons (15 Feb 2019 — MAE-East local history).
49. Statista (capacity chart — basis-pluralism specimen only).
50. Katusa newsletter via syndication (Jul 2025 — Doomer specimen, quoted as specimen not source).

D. Advocacy & interested parties (used with tags, never as neutral arbiters)

51. Piedmont Environmental Council (14 Nov 2025 — Golden-to-Mars; utility-origin specifics).
52. Loudoun County Democratic Committee (14 Apr 2026 — the \$1.54M/\$1.6B pair; CONTESTED pending fiscal note).
53. NetActuate/trade blogs (color tier only).
54. Data Center Coalition statements (Levi, Jun 2026).

E. Consolidated pending pulls (draft-stage; nothing below is currently load-bearing without its flag)

1. NANOG mail-archive congestion verbatims, 1995–97.
2. The Washingtonian feature’s exact title/date.
3. NSF NAP award citation, 1994.
4. Loudoun 2008 strategic plan (the “Data Center Alley” pages).
5. ZOAM adoption date + hearing minutes (pending Identity item 12 ownership ruling).
6. DCRSUT enactment-era fiscal impact statement (the \$1.54M check — Discrepancy E).
7. HB 888 enrolled text (22 Apr 2026).
8. Golden-to-Mars SCC case number.
9. Loudoun AAA citations (Moody’s/S&P/Fitch, current).
10. Homeowners’ rezoning-petition docket status.
11. EIA current-year household-kWh figure (Move 2 denominator refresh).
12. Dominion batch-process formal name/filing.
13. JLARC full-report page pins for all Section 5 findings.
14. Dominion Feb 2026 SCC report docket number.
15. IEA *Energy and AI* page-pin for the accelerated-servers share (Gesture fact 2).
16. Adopted FY2026 Loudoun real-property rate resolution (retire the DERIVED \$0.805).

RESEARCH AS OF 20 July 2026 — pack complete: Sections ID + 1–12. Strawman verdicts: 12/12 SUSTAINABLE (three conditioned). Moves: 7/7 PASS (one conditional on Open Item 9). Swaps recommended: 0 (two near-misses documented for Nick). Anchor discrepancies for Nick’s ruling: A (13% vs ~14%), B (revenue vintage/basis), C (farmland floor), D (TWh vintage — stamp assigned), E (exemption’s original projection — fiscal-note pull mandatory). Six sockets carry mandatory draft-stage pulls before prose (Section 12E items 1, 5, 6, 7, 13, 16 principally). Run 2 of 2 — END OF PACK.

Lecture 2 — The Hardware Stack

Research Pack 1.0 · source file L2_Research_Pack_1_0_COMPLETE.md · research as of 20 July 2026

RESEARCH AS OF 20 July 2026

(Per the L1 pack precedent: Run 1 carries the Lecture Identity, Section 1, and Section 2; Run 2 (Sections 3–12) follows the divider below. Every figure carries unit · stage · as-of date · author; discrepancies against must-hit anchors are flagged inline and consolidated in Section 6. Per copyright discipline, verbatim quotes are held short with full attribution, one deployment per source document; longer passages are precisely paraphrased, marked as paraphrase, and carry a locator for the draft-stage verbatim pull — the same convention the L1 pack used for the NANOG corpus.)

LECTURE IDENTITY (assembled from Syllabus 2.0, Syllabus 1.0, Beat Menu 1.0, Moves List 1.0, Roster 1.0, Style Guide §5)

Title / frame / through-line. The Hardware Stack. The rack is the unit of analysis, not the chip. The density step function is the single number that invalidates every downstream design assumption.

Register. Atoms leads throughout; the Ledger arrives only as the roadmap's effect on capex math.

Cascade edge. Inherits: the appetite (L1) · Binds at: electrical distribution inside the building · Who pays: whoever designs against the roadmap · Manufactures: a thermodynamics problem wearing a hardware costume → Lecture 3.

Strawman beat plan (12, running order — STRAWMAN FOR MARKUP; Course Schema locks order after markup):

1. Cold Open on an Object [O] — a GB200 NVL72 craned through a roof penetration: weight, cost, lead time, chain of custody
2. Mechanism Autopsy — the power path inside: PDUs, busways, UPS topology; why 132 kW makes electrical distribution a first-order design problem
3. Operator Reality — crane day: rigging crews, roof penetrations, floor-loading checks; job postings and trade press
4. The Paper Trail — class: **technical specification** — NVIDIA's rack roadmap as the published future everyone downstream must design against (Blackwell → Rubin Ultra NVL576 at ~600 kW)
5. The Founder Audit — *Huang*: mythology told straight, then audited against the roadmap's function as a demand instrument (**judgment call** — **Syllabus 2.0 Open Item 10**; both cases delivered in Beat 5 below)
6. The Forecast Problem — the roadmap as a forecast with an author: who filed it, what they get if you design against it
7. Follow the Money — what an annual density cadence does to depreciation and capex math (planted here; cashed in 6 and 10)
8. The Hearing Room — an NVIDIA earnings Q&A, transcript only; analysts steelmanning the cadence in real time
9. The Bottleneck — integration and assembly: the rack that ships as a rack; copper, busway capacity, cable management
10. The Perverse Incentive — a roadmap that obsoletes its own installed base on schedule
11. The Externality Swap — density vs. distribution: consolidate 72 GPUs for training topology, pay in power delivery and heat
12. The Physics Audit [C] — a building designed around 15 kW racks meets the 132 kW rack; the step function stated plainly

Handoff: *cost left unassigned* — every watt in is a watt of heat nobody has priced yet. **Negative space:** Bill Arrives, Wrong Map, Taxonomy, Symbol Audit, Neighbor, Deal, County, Regulatory Collision, Steelman (folded into the Hearing Room's Q&A per the plan).

Cast. *Object:* **the GB200 NVL72** — lead treatment; voiced consistently from first appearance. *Document:* **NVIDIA's rack roadmap** — **lead** (returns 3, 6, 9); this pack's treatment must be complete enough that Lectures 3, 6, and 9 never rebuild it. *Human:* **Jensen Huang** — founder, president, and CEO, NVIDIA (title verified in role as of July 2026; unchanged since April 1993); not celebrity — the density future arrives in his slides before anyone's building. *Secondaries:* the Open

Compute Project (the shared drawing board), Supermicro and Dell as rack integrators (assembly as bottleneck), the Tesla Megapack banks at xAI Colossus (the rack talking back to the grid — cascades into L4).

Must-hit anchors (verbatim from Syllabus 2.0; Syllabus 1.0 values govern — Section 6 discrepancy protocol): GB200 NVL72 (72/36/120–132 kW); 6.1 kW (2020) → ~27 kW (2026) → ~600 kW NVL576 (2027 projected); rack-as-unit thesis; power distribution consequences.

Moves plan (as assigned; formal verification Section 4). Step Function: 6.1 → 27 → ~600 — the canonical deployment · Unit Conversion: 132 kW → a suburban block’s worth of houses (not among Open Item 11’s four flagged conversions, but the arithmetic gate applies; math shown in Beat 12, verdict in Section 4) · Timeline Snap: the GTC keynote date the ~600 kW future was published — **RESOLVED: 18 March 2025** · Verbatim: roadmap/spec language — existence gate, primary and alternates supplied · As-Of Stamp: the ~27 kW 2026 average · Kicker: the 600 kW rack already has a name and a date; the building that can hold it doesn’t exist yet · Gesture: **the silicon door** — Blackwell arrives on a truck; one-inch facts supplied in Section 4, previewed in Beat 1.

Sellers & narrator move. Seller on the field: **the Hyperscaler/vendor** — the roadmap as destiny. Move: **GRANT-AND-WITHHOLD** — the cadence is real and shipping; the roadmap is also a demand instrument and a negotiating position with every utility in the footprint. Section 7 pressure-tests the calibration; the record as researched supports it strongly (see Beats 4, 6, 8).

Decay tier. Mid — chip generations churn; the step-function structure and rack thesis don’t. Note: the July 2026 Kyber reporting (Section 11) makes the *specific* 2027 figures hotter than “mid” — flagged.

Human-floor flags. No Neighbor beat; no household, ratepayer, or fence-line resident in this lecture’s territory. Two adjacent-to-floor zones flagged: (1) **Operator Reality** — rigging crews, electricians, pipefitters are workers doing documented jobs, not objects of fun; punch-up-only applies, but full floor protocol does not (no documented harm or job fear here — that’s L8’s vector three). (2) **The Founder Audit** — Huang’s childhood material (the Kentucky boarding school years, the Denny’s jobs at 15) is hardship he narrates himself; comedy stays off the childhood and lands only on the corporate mythology-vs-filing gap.

Pack dependencies (debts resolved in this pack or explicitly failed):

1. Timeline Snap exact date — **RESOLVED:** GTC 2025 keynote, Tuesday, 18 March 2025, 10 a.m. PT, SAP Center, San Jose; the ~600 kW NVL576/Kyber future published from that stage (Beats 4, 12).
2. Verbatim (roadmap/spec language) — **RESOLVED:** primary from NVIDIA’s own GB200 NVL72 product page, with keynote and 800 VDC blog alternates (Beat 4 Verbatim Bank).
3. As-Of Stamp source — **RESOLVED WITH DISCREPANCY FLAG:** ~27 kW average is AFCOM State of the Data Center Report 2026 — 27 kW per rack in 2026, up from 16 kW in 2025. But the anchor’s “6.1 kW (2020)” mis-dates the same series: AFCOM’s 6.1 kW figure is its initial 2016 report value, and AFCOM’s own 2020 number was 8.2 kW per rack. Anchor values govern; no silent substitution anywhere in this pack; full reconciliation in Section 6. This is **Discrepancy A** for this lecture.
4. Kicker verification — **RESOLVED WITH DECAY FLAG:** the 600 kW rack has a name (Kyber / Rubin Ultra NVL576) and a date (2H 2027, published 18 March 2025). Complication: on 6 July 2026 SemiAnalysis reported the Kyber rack delayed by more than 12 months to 2028 over PCB-midplane manufacturability, and NVIDIA answered with a four-word statement: “Our roadmap is intact.” The kicker arguably *strengthens* (the named, dated future met a circuit board); markup decides. Section 11.
5. Founder Audit judgment call (Open Item 10) — **RESOLVED AS EVIDENCE, NOT AS DECISION:** Beat 5 supplies the mythology (documented, in Huang’s own tellings), the audit material (documented, in his own keynotes and calls), *and* the alternative Steelman-defendant material (NVIDIA’s cadence, defended in its own numbers) so markup can rule either way without a re-research pass.
6. Roster debts (as-of titles; quotes with context) — **RESOLVED:** Huang’s title stable since founding; all quotes dated and attributed; paraphrase-marked items carry locators.
7. Hearing Room corpus — **RESOLVED:** primary = the Q3 FY2026 earnings call, 19 November 2025, official transcript PDF on NVIDIA’s IR site; alternates named (Beat 8).
8. Cross-lecture flag inherited from the L1 pack — **FLAGGED FOR MARKUP:** L1’s pack banked “taxonomy to L2” (L1 Section 10 boundary table), but L2’s strawman lists Taxonomy as negative space; integrators currently ride inside The Bottleneck. Section 3 makes the swap case or confirms the fold.
9. Unit Conversion arithmetic — **PREVIEWED, VERDICT IN SECTION 4:** 132 kW ÷ ~1.2 kW average US household draw (denominator owned by L1’s pack — do not rebuild) ≈ **110 average homes**. Arithmetic PASSES;

the *target* “a suburban block” likely understates by 3–5x. Recommendation staged for Section 4.

SECTION 1: TIMELINE OF THE CONSTRAINT

A constraint machine assembling itself: a chip company nearly dies (1993–1997), bets on an academic curiosity (2006–2012), the curiosity becomes the workload (2012–2022), the workload moves into the rack (2016–2024), and the rack outruns every building designed to hold it (2024–2027) — until, in the summer of 2026, the published future meets a circuit board that cannot yet be manufactured. Every entry carries date · event · who · where · why it matters to the watt path, the money, the paper, or the physics. Figures carry unit, stage, filer, as-of date. [Bracketed tags] mark confidence and flags.

The prehistory: a company, then a bet (1993–2012)

1. **17 February 1963** — Jen-Hsun (Jensen) Huang born, Tainan, Taiwan. [Standard biographical record]
2. **~1973–1978** — Huang, sent to the US ahead of his parents, boards at Oneida Baptist Institute, Kentucky — a school his relatives mistook for a prep academy; he cleans dorm bathrooms; later works at Denny’s as a dishwasher and busboy from age 15. Documented in Huang’s own repeated tellings (Stanford, HBS, commencement addresses). [Comedy off on the childhood hardship — human-floor-adjacent; see ID flags]
3. **1984** — BSEE, Oregon State University; Huang later takes an MSEE at Stanford (1992) while working full-time — first at AMD, then LSI Logic, where he meets his eventual co-founders’ orbit. [Standard record]
4. **17 February 1993** — Huang’s 30th birthday, the self-imposed deadline he has repeatedly cited for deciding to found a company. [Huang’s own account; mythology-tier — flagged as self-narrated in Beat 5]
5. **5 April 1993** — NVIDIA incorporated by Huang, Chris Malachowsky, and Curtis Priem, planned over meals in a Denny’s booth in East San Jose; initial capital \$40,000; Sequoia and Sutter Hill later invest. [Standard record; the Denny’s booth now carries a plaque — usable deadpan]
6. **1995** — NV1 ships and flops (quadratic surfaces, Sega alliance); the company nearly dies. Origin of Huang’s standing mantra that the company is thirty days from going out of business. [Self-narrated; mythology-tier]
7. **August 1997** — RIVA 128 ships; the survival product. [Standard record]
8. **22 January 1999** — NVIDIA IPO on Nasdaq at \$12/share. [Standard record]
9. **11 October 1999** — GeForce 256 launches, marketed as “the world’s first GPU” — the coinage itself a marketing document with an author. [Standard record; first specimen of the seller naming the category it will sell]
10. **8 November 2006** — G80 / GeForce 8800 ships with a unified, programmable architecture; **CUDA** platform announced, released to developers in 2007 — the decade-early bet that graphics silicon is a general parallel computer. Wall Street spends years treating the expense as an eccentricity. [Standard record; the moat’s birth certificate]
11. **7 April 2011** — Facebook founds the **Open Compute Project**, open-sourcing its data center and rack designs; the industry’s shared drawing board that NVIDIA will one day hand a 132 kW problem. [Standard record]
12. **30 September 2012** — **AlexNet** wins the ImageNet challenge, trained on two consumer NVIDIA GTX 580 cards in Alex Krizhevsky’s bedroom rig; the moment the workload finds the silicon. Huang has repeatedly dated NVIDIA’s pivot to this event. [Standard record]

The rack becomes the product (2016–2022)

13. **5 April 2016** — GTC: **DGX-1** announced — 8 Pascal GPUs in one ~3.2 kW box; NVIDIA’s first move from selling chips to selling an integrated computer. [NVIDIA archive]
14. **August 2016** — Huang hand-delivers the first DGX-1 to OpenAI in San Francisco; the hand-inscribed chassis (“to the future of computing and humanity”) is photographed and posted by Elon Musk. [Documented; exact inscription pull flagged for draft stage]
15. **10 May 2017** — GTC: **Volta V100** announced; 300 W per GPU — the number to remember when the 1,200 W figure arrives in entry 44. [NVIDIA archive]
16. **27 March 2018** — **DGX-2**: 16 V100s fused by the first **NVSwitch** into “the world’s largest GPU”; ~10 kW in one chassis; \$399,000 list. The scale-up-inside-one-box idea that the NVL72 will inflate 12x. [NVIDIA archive]
17. **14 May 2020** — GTC (the pandemic kitchen keynote): **A100** announced, 400 W; DGX A100 at ~6.5 kW per node. [NVIDIA archive]
18. **December 2020** — Uptime Institute publishes its 2020 density research: excluding >30 kW outliers as high-performance edge cases, the mean average density in the 2020 survey sample was 8.4 kW/rack, and the most common server rack density reported was 5–9 kW, with 71% of respondents below 10 kW. [Uptime Institute, Andy

Lawrence, 7 Dec 2020 — the fleet baseline; **Discrepancy A context:** the anchor’s “6.1 kW (2020)” matches no published 2020 series; AFCOM 2020 was 8.2 kW; AFCOM’s 6.1 kW is 2016]

19. **12 April 2021** — GTC: **Grace** announced — NVIDIA designs its own Arm CPU so the rack’s CPU:GPU ratio becomes NVIDIA’s decision, not Intel’s. [NVIDIA archive]
20. **22 March 2022** — GTC: **Hopper H100** announced; 700 W SXM — the doubling from Volta that quietly ends air cooling’s comfort margin. [NVIDIA archive]
21. **30 November 2022** — ChatGPT launches; the demand shock arrives (L1 owns the demand story; noted here as the moment the H100 becomes the scarcest industrial object on Earth). [Cross-ref L1; do not rebuild]

Blackwell: the step function gets a name (2024)

22. **18 March 2024** — **GTC 2024, San Jose:** Huang unveils Blackwell, announced March 18, 2024, succeeding Hopper. The architecture: 208 billion transistors on a custom-built TSMC 4NP process, with two reticle-limited dies connected by a 10 TB/s chip-to-chip interconnect functioning as a unified single GPU; named for mathematician David Harold Blackwell, the first Black inductee into the US National Academy of Sciences. Huang’s framing from the stage: “Hopper is fantastic, but we need bigger GPUs.” (Keynote, 18 Mar 2024.) [These four facts are the Gesture’s one-inch silicon-door inventory — the chip’s fabrication stays behind the door]
23. **18 March 2024** — Same keynote: the **GB200 NVL72** revealed — 72 Blackwell GPUs + 36 Grace CPUs in one liquid-cooled rack; ~120 kW; 1.36 metric tons; nine NVLink switch trays mid-rack, 18 1U compute trays, a blind-mate backplane with more than 2 miles (3.2 km) of copper cabling — chosen over optics to save roughly 20 kW per rack. Claimed capability: training and inference on models up to 27 trillion parameters [seller’s claim — no such model exists; GRANT-AND-WITHHOLD material].
24. **19 March 2024** — Huang tells CNBC a Blackwell GPU will price at \$30,000 to \$40,000 — the seller’s own unit number, on tape, dated. [The stage-vs-street price gap opens here]
25. **13 May 2024** — **HSBC** publishes system-level estimates: GB200 NVL36 rack ~\$1.8M; NVL72 ~\$3M; GB200 superchip ASP \$60,000–70,000. [Analyst estimate — NVIDIA publishes no rack list price; VOLATILE; the Cold Open’s cost anchor, always attributed to HSBC]
26. **2 June 2024** — **Computex eve, National Taiwan University stadium, Taipei:** Huang names **Rubin** as Blackwell’s successor and declares the cadence: “Our company has a one-year rhythm.” The full formulation: build the entire data center at scale, disaggregate it, sell it in parts on a one-year rhythm, and push everything to technology limits [paraphrase of the rest of the sentence; verbatim pull locator: NVIDIA blog “Accelerate Everything,” 2 Jun 2024]. CNBC’s gloss the same day: the company had previously operated on a two-year chip update timeline; Blackwell-to-Rubin took less than three months to announce. [The Paper Trail’s central date: the cadence itself becomes the published product]
27. **Early August 2024** — Reports surface (The Information first) that Blackwell’s rollout is delayed roughly three months by unexpected design flaws. [The roadmap meets manufacturing, round one]
28. **28 August 2024** — **Q2 FY2025 earnings call:** CFO Colette Kress discloses, in the filing-adjacent language of a disclosure call, that NVIDIA executed a change to the Blackwell GPU mask to improve production yields, with the production ramp scheduled for fiscal Q4; Huang, on the same call: “There were no functional changes necessary.” He specifies that “ship production in fourth quarter” means shipping out, not starting production [paraphrase; locator: Q2 FY25 transcript]. [A mask — a photolithographic printing plate — delaying a \$3M rack: the document class of this lecture in miniature]
29. **Summer 2024** — **xAI Colossus, Memphis:** an abandoned Electrolux factory becomes a 100,000-GPU cluster. Built in 122 days; Dell and Supermicro both partnered on the build; per NVIDIA’s own account, only 19 days elapsed between the first rack arriving and training beginning. [The build speed is the rack-as-unit thesis proven: compute arrived as pre-integrated racks. Memphis’s politics, turbines, and permits belong to Lecture 8 — hard boundary; this lecture uses only the rack-level and battery facts]
30. **2024, Colossus rack anatomy** — Supermicro liquid-cooled racks: eight nodes of 64 GPUs per rack, a bottom-of-rack CDU, and rear-door heat exchangers catching what the cold plates miss. [Hopper-generation density for comparison against the NVL72; cooling internals belong to L3 — one line only]
31. **2024, Colossus power** — 168 Tesla Megapack battery units installed between grid and cluster; AI training demands sudden bursts of 10–20 MW, and the Megapacks buffer the fluctuation. [**The rack talking back to the grid** — the synchronized training load oscillates at millisecond scale; the fix is a battery farm. This fact is the seed the Handoff chain carries into L4; the L4 pack owns the grid-side treatment]
32. **15 October 2024** — **OCP Global Summit, San Jose:** NVIDIA contributes the GB200 NVL72’s electro-

mechanical design to the Open Compute Project — rack architecture, compute and switch tray mechanicals, liquid-cooling and thermal environment specifications, and NVLink cable cartridge volumetrics; NVIDIA’s own engineering blog specifies the rack houses 18 compute trays, nine switch trays, and four NVLink cartridges supporting “over 5,000 copper cables”; Meta announces it will contribute Catalina, its own AI rack built on GB200 NVL72, to OCP. [The proprietary rack becomes the industry’s open standard — the roadmap’s gravity made institutional]

33. **17–18 November 2024** — Michael Dell announces on X that the first GB200 NVL72 racks in the world are shipping — liquid-cooled PowerEdge XE9712 systems to CoreWeave — closing: “The AI rocket just got a massive boost!” [The integrator’s ribbon-cutting; CoreWeave’s post the same week credits NVIDIA Quantum InfiniBand — paraphrase, locator: @CoreWeave X post, Nov 2024]
34. **~17 November 2024** — The Information reports NVIDIA has asked suppliers to adjust the rack design multiple times in recent months owing to overheating. [The 132 kW rack fighting its own thermals before first volume ship; L3 inherits the heat — seed only]
35. **20 November 2024** — **Q3 FY2025 earnings call**: revenue \$35.08B (+94% YoY) [energy of the money path: quarterly, GAAP, filed]. Kress describes “staggering demand” for Blackwell and states demand is expected to exceed supply for several quarters into fiscal 2026; Huang says Blackwell production is at full steam and brushes off the overheating reports [paraphrase; locator: Q3 FY25 transcript, 20 Nov 2024]. Around the same date, sell-side checks report Blackwell **sold out ~12 months forward** [analyst channel checks — VOLATILE, secondary].
36. **2 December 2024** — CoreWeave demonstrates a live Dell XE9712 GB200 NVL72 at a Switch facility; the hosting chamber advertises 1 MW of power and cooling capability per rack position — 250 kW air plus 750 kW direct-to-chip liquid. [The building already overbuilding for the roadmap’s *next* number]
37. **9 December 2024** — Dell–CoreWeave press release formalizes the shipment: first PowerEdge XE9712 liquid-cooled racks with GB200 NVL72; fully integrated and validated Dell Integrated Racks with professional services to speed implementation. [“**Fully integrated**” is the load-bearing phrase: the unit of commerce is now the rack]

The ramp, and the year the future was published (2025)

38. **26 February 2025** — **Q4 FY2025 earnings call**: revenue \$39.3B (+78% YoY); **Blackwell delivers ~\$11B in its first quarter of availability — the fastest product ramp in company history** [company statement, filed figures]. Huang: “customers are anxious and impatient to get their Blackwell systems.” The manufacturing footprint disclosed on the call: 350 plants producing the 1.5 million components per rack [paraphrase of Huang; locator: Q4 FY25 transcript]. [1.5 million components; 350 factories; one SKU — the Bottleneck beat’s spine]
39. **18 March 2025** — **GTC 2025 keynote, SAP Center, San Jose** — **THE TIMELINE SNAP**. Huang publishes the roadmap through 2028: Blackwell Ultra GB300 NVL72 (2H 2025) → **Vera Rubin NVL144** (2H 2026) → **Rubin Ultra NVL576 in the Kyber rack, 2H 2027, at ~600 kW per rack** → Feynman (2028). The NVL576 is designed to use up to 600 kW — a fivefold increase over the 120 kW NVL72; Rubin Ultra packages four reticle-sized GPU dies with 1 TB of HBM4e; the rack promises 15 exaflops of FP4 inference against the GB300 NVL72’s ~1.1. Huang describes each Kyber rack as 600 kW and 2.5 million parts, and tells the room the transition will take years of planning — which is why he is telling them now [paraphrase; locator: DCD, 18–19 Mar 2025 coverage of the keynote Q&A]. [The lecture’s central document event: a 600 kW rack sold as a date, 30 months out, to an industry whose average rack was then ~16 kW]
40. **18 March 2025** — Same keynote, the obsolescence passage: after showing Blackwell at 40x Hopper on reasoning workloads, Huang says that once Blackwell ships in volume you couldn’t give Hoppers away, warns anyone still buying Hopper not to be afraid, and delivers the line — “I’m the chief revenue destroyer” — adding that there are circumstances where Hopper is fine, “not many” [surrounding material paraphrased; verbatim locator: Rev.com GTC 2025 keynote transcript]. TechCrunch logs the companion line: the more you buy, the more you save — now, the more you buy, the more you make [paraphrase; locator: TechCrunch live blog, 18 Mar 2025]. [The Perverse Incentive beat’s primary exhibit, from the seller’s own mouth, on his own stage]
41. **18 March 2025** — Keynote scale chart: 1.3 million Hopper GPUs sold to the top four cloud providers in peak-year 2024, against 3.6 million Blackwell GPUs already ordered in 2025. [Units, stage labeled: sold vs. ordered — the blur NVIDIA’s own slide invites; flagged for the Forecast Problem]
42. **19 March 2025** — GTC exhibits include an **800 V sidecar** power unit to feed 576 Rubin Ultra GPUs in one Kyber rack — because at 54 VDC, Kyber-scale power shelves would consume up to 64U of rack space, leaving no room for compute. [The power architecture redesigning itself around the roadmap, 30 months before the rack ships]
43. **19–20 May 2025** — **Computex 2025, Taipei**: NVIDIA announces the **800 VDC power architecture** and supplier

- alliance for megawatt-class racks; the company's technical blog states the case in one sentence — “Over 150 percent more power is transmitted through the same copper with 800VDC, eliminating the need for 200-kg copper busbars to feed a single rack.” Partner tiers span silicon (Infineon, TI, STMicroelectronics, onsemi and ~10 more), power components (Delta, Flex, LITEON and others), and data center power systems: ABB, Eaton, GE Vernova, Hitachi Energy, Mitsubishi Electric, Schneider Electric, Siemens, Vertiv. Vertiv's strategic alignment with NVIDIA on 800 VDC is announced this month. In parallel, OCP's **Mount Diablo** spec v0.5.2 (Google/Meta/Microsoft) publishes ± 400 VDC/800 VDC disaggregated power with sidecar racks [Diablo 400 v0.5.2, May 2025]. [An entire electrical-equipment industry re-tooling against a slide]
44. **2025, the per-GPU wattage line** — GB200-class Grace Blackwell superchips draw up to ~2,700 W per superchip / ~1,200 W per Blackwell GPU under load [Continuum Labs teardown; ToneCooling engineering note, 2024–2026 — STRUCTURAL]. Against entry 15's V100 at 300 W: **4x per die in eight years**, before counting the 72-die rack. [Physics Audit raw material]
 45. **3 July 2025** — Dell ships the market's **first GB300 NVL72** (Blackwell Ultra) — again to CoreWeave — seven months after the first GB200 NVL72; 72 Blackwell Ultra GPUs, 36 Grace CPUs, over an exaflop of dense performance, up to 40 TB of fast memory, with the initial racks arriving fully assembled and tested. Rack draw ~142 kW [Schneider Electric: the GB300 NVL72 runs 72 GPUs at 142 kW per rack]. [The cadence performing itself: generation N+0.5, seven months after N, +10–20 kW]
 46. **9 July 2025** — NVIDIA becomes the first company to touch a \$4 trillion market capitalization. [Market record; VOLATILE by construction — dated mark, not verdict]
 47. **13–16 October 2025** — **OCP Global Summit 2025**: NVIDIA publishes the technical whitepaper *800 VDC Architecture for Next-Generation AI Infrastructure* and previews the Vera Rubin MGX generation and Kyber ecosystem; CoreWeave, Lambda, Nebius, Oracle Cloud Infrastructure, and Together AI are named as designing for 800-volt data centers, and Foxconn's 40 MW Kaohsiung-1 facility in Taiwan is cited as already using 800 VDC; Vertiv announces its 800 VDC portfolio for release in 2H 2026, timed to the 2027 Rubin Ultra rollout; Eaton releases its own 800 VDC reference architecture the same month [Eaton, October 2025]. [Paper preceding product by a full year, industry-wide]
 48. **28 October 2025** — Huang, at NVIDIA's GTC event in Washington, DC, discloses the order book: “Half a trillion dollars' worth so far” in Blackwell + Rubin business on the books for calendar 2025–2026. [Stage label: **bookings**, seller-declared, at a policy conference — not revenue, not shipped]
 49. **19 November 2025** — **Q3 FY2026 earnings call** (quarter ended 26 October 2025): revenue **\$57.0B, +62% YoY, a record +\$10B sequential** [filed]. Kress formalizes the DC number: visibility to half a trillion dollars in Blackwell and Rubin revenue from the start of calendar 2025 through the end of calendar 2026, and frames the company as the superior choice for an estimated \$3–4 trillion in annual AI infrastructure build by decade's end [paraphrase; locator: official transcript PDF, s201.q4cdn.com, 19 Nov 2025]. Huang, addressing the season's dominant question in his opening: “There's been a lot of talk about an AI bubble. From our vantage point, we see something very different.” [**The Hearing Room beat's primary corpus** — full pulls in Beat 8; FRAMING discipline: the course refuses the bubble question as posed, and here is the seller refusing it too, for opposite reasons]
 50. **19 November 2025** — Same call, the sold-out exchange: C.J. Muse (Cantor Fitzgerald) juxtaposes market consternation over funding AI buildouts with the fact that every stood-up GPU is taken, before B300 — never mind Rubin — has even shown its benefit; Kress notes \$50B shipped in the quarter and that the \$500B “will grow,” citing that day's Saudi announcement of 400,000–600,000 additional GPUs over three years [paraphrases; locator: same transcript]. [Analysts steelmanning the cadence in real time — the folded Steelman]
 51. **November 2025** — Adjacent context, cast elsewhere: Michael Burry's public attack on hyperscaler depreciation (owned by **Lecture 10** — cross-ref only; this pack does not rebuild it). [Boundary discipline]
 52. **6 January 2026** — CES 2026, Las Vegas: Huang characterizes Blackwell demand as “insane”; industry checks describe Blackwell effectively sold out through mid-2026 with CSP orders in 100,000-unit increments [secondary; FinancialContent recap, Feb 2026]. [VOLATILE]
 53. **January 2026** — **Vera Rubin enters full production** per NVIDIA statements reported in trade coverage; volume shipments guided to 2H 2026; the VR200 NVL72 rack is specced in coverage at roughly 190–230 kW — up from 120–130 kW for Blackwell — with fanless compute and NVSwitch trays, roughly doubled coolant flow versus GB300, and liquid cooling required even for 8-GPU HGX Rubin servers. [Secondary synthesis (ModulEdge, June 2026) of NVIDIA materials — direct spec-sheet pull flagged for draft stage]
 54. **13 February 2026** — NVIDIA shows CNBC the **Vera CPU** at its Santa Clara headquarters. [CNBC, 13 Feb 2026]
 55. **25 February 2026** — **Q4 FY2026 earnings** (fiscal year closed): quarterly revenue ~\$68B against \$65B $\pm 2\%$ guid-

- ance; GAAP gross margin 75%; GAAP net income ~\$43B [Fortune, 25 Feb 2026]; Data Center revenue \$62.3B (+75% YoY), of which compute \$51.3B and **networking >\$11B in a single quarter, +263% YoY** [segment figures via TradingKey recap of the filing]. Full FY2026 revenue **\$215.9B, +65%** [fiscal-2026 total]. [The cadence's income statement]
56. **16 March 2026 — GTC 2026 keynote, San Jose:** Huang raises the order-book figure to \$1 trillion in Blackwell + Vera Rubin purchase orders through 2027 — double the prior year's \$500B projection, and on supply: "In fact, we are going to be short." He also shows a Kyber prototype — 144 GPUs in vertical compute trays — confirming the design ships with Vera Rubin Ultra, expected 2027, and demonstrates Rubin Ultra hardware with 1 TB of HBM4e [GTC 2026 hardware demo per Tom's/DCD/VideoCardz coverage]. The keynote also debuts the Groq-technology-based **LPX inference rack** [as reported by TradingKey; Goldman notes the guidance doubling]. [Stage labels, strictly: purchase orders ≠ revenue ≠ shipped ≠ energized]
 57. **26 April 2026 —** Fiscal Q1 2027 closes.
 58. **20 May 2026 — Q1 FY2027 earnings:** record revenue \$81.6B, +20% QoQ, +85% YoY; Data Center revenue \$75.2B, +92% YoY; GAAP EPS \$2.39; the Vera Rubin platform formally announced with the Vera CPU billed as the first processor purpose-built for agentic AI; **Q2 FY27 guidance \$91B ±2%** [official transcript PDF]. Huang: he anticipates NVIDIA "will be constrained throughout the entire life of Vera Rubin"; Kress claims the Vera CPU opens a ~\$200B market and projects ~\$20B CPU revenue this year [paraphrase; locator: CNBC live blog + transcript, 20 May 2026]. Related filing: \$18.6B invested in private companies and infrastructure funds during the quarter, with NVIDIA noting some investees "may indirectly purchase or use our products in the cloud". [The circularity thread — **owned by Lecture 6**; planted here as one dated line, not cashed]
 59. **~June 2026 —** Market capitalization ~\$5 trillion; most valuable public company [as of June 2026, sources between \$4.96T and \$5.04T]. [VOLATILE mark, dated]
 60. **June 2026 — AFCOM State of the Data Center Report 2026** (released spring 2026; exact publication date flagged for pull): average rack density 27 kW in 2026, from 16 kW in 2025 — nearly 4x in three years; the series reads 7 kW (2021), 8.5 kW (2023), 12 kW (2024), 16 kW (2025), 27 kW (2026); 69% of respondents expect further steady increases over 12–36 months. Kleyman, the report's author: "Rack density rocketed up the past year". [**The As-Of Stamp figure, sourced.** Counter-series noted for honesty: Uptime's broader-fleet survey average sat below 8 kW in 2024 and ~7.6 kW in 2025 per secondary citation [Uptime Institute 2025, via ModulEdge] — the frontier and the fleet are different populations; both truths appear in Beat 12]
 61. **30 June 2026 —** SemiAnalysis reports NVIDIA has quietly canceled the quad-chiplet Rubin Ultra — 16 HBM4E stacks, 1 TB per package — for a dual-chiplet design with roughly half the memory, over manufacturing constraints TSMC cannot yet solve; NVIDIA confirms none of it publicly, though the dual-chip direction is corroborated through supply-chain reporting. [CONTESTED — analyst claim vs. corporate silence; both stated, not smoothed]
 62. **6 July 2026 —** SemiAnalysis reports the **Kyber NVL144 rack delayed to 2028**: "Kyber NVL144 rack architecture has been delayed to 2028 as the PCB midplane remains challenging from a manufacturability standpoint" — a 78-layer board, three 26-layer boards laminated into one, carrying every GPU-to-GPU signal in the rack [TechTimes technical summary of the SemiAnalysis reporting]; the NVL72x2 copper stopgap was reportedly abandoned after the largest customers balked at running two linked cabinets as one unit; CNBC carries the story nationally [CNBC, 6 Jul 2026].
 63. **6 July 2026, 4:10 p.m. PT —** NVIDIA's complete on-record response, to Tom's Hardware: "Our roadmap is intact." The company declines follow-up questions; it is unclear whether the statement refers to the original schedule or an already-revised one. [**Four words against a 78-layer circuit board.** The Paper Trail's closing exhibit and the decay register's hottest item: the 600 kW rack now has a name, a date, and a dispute about the date]
 64. **Mid-July 2026 —** Huang publicly vows to deliver "giant amounts" of Vera Rubin, without addressing the Kyber delay reports. [Present-tense as of the research stamp]

Expected future events (announced dates; announcing party named; all EXPECTED, not occurred)

65. **2H 2026 —** Vera Rubin (VR200 NVL144/NVL72-class) volume shipments — announcing party: NVIDIA (GTC 2025/2026). [~190–230 kW/rack per trade specs — entry 53 caveat]
66. **2H 2026 —** Vertiv 800 VDC power portfolio release — announcing party: Vertiv (13 Oct 2025). [Vertiv corporate release]
67. **26 August 2026 —** Q2 FY2027 earnings call — announcing party: NVIDIA (Q1 call closing remarks). [scheduled date per official transcript]
68. **2H 2027 —** Rubin Ultra / Kyber, ~600 kW/rack — announcing party: NVIDIA (18 Mar 2025; reaffirmed GTC

2026); **disputed to 2028** by SemiAnalysis (6 Jul 2026); NVIDIA denial on record. [CONTESTED — the pack's most consequential contested date]

69. **2028** — Feynman architecture — announcing party: NVIDIA (GTC 2025). [Name only; no specs published]

(Timeline entry count: 69 numbered entries spanning 1963–2028. Below the 80-entry floor by 11; the compression is deliberate — this lecture's constraint machine has one author and one document class, so entries consolidate; Section 11 adds the live-docket entries that pad other lectures' timelines. Flagged rather than papered over. If markup wants the floor met literally, the ready expansions are: per-generation NVLink/NVSwitch spec dates, the Uptime/AFCOM year-by-year series as individual entries, and the integrator shipment cadence — all researched, all dated, held in Beat dossiers below.)

SECTION 2: STRAWMAN BEAT DOSSIER

Beat 1 — Cold Open on an Object [O] (the GB200 NVL72, craned through a roof penetration)

Syllabus 2.0 assignment: A GB200 rack craned through a roof penetration: weight, cost, lead time, chain of custody.

Beat Menu definition: *Atoms · opener only.* A physical thing before any framing; sustained by manufacture, cost, lead time, tolerances, failure modes, chain of custody. Comedy engine: hyper-specificity. Small enough to hold in the mind, expensive enough to hurt. Opener rotation compliant: L1 opened on The Wrong Map; L2's Cold Open is the first of three (2, 4, 6 — three distinct objects, non-adjacent).

Facts, dates, names, numbers. The object: 36 Grace CPUs and 72 Blackwell GPUs in a rack-scale, liquid-cooled design; a 72-GPU NVLink domain acting as a single massive GPU; 130 TB/s of NVLink bandwidth. Mass: 1.36 metric tons — 3,000 pounds [NVIDIA GTC 2024 materials via trade press; STRUCTURAL]. Dimensions: 600 mm wide × 1,068 mm deep × 2,236 mm high — roughly 2 ft × 3.5 ft × 7.3 ft. Power: 120 kW nominal per NVIDIA; deployed racks reported at 130–132 kW under full load; HPE's spec sheet lists 115 kW liquid-cooled plus 17 kW air-cooled support [the must-hit 120–132 kW range, reproduced with basis]. Internal census: 18 1U compute trays (two Bianca boards each: one Grace CPU + two Blackwell GPUs per board) and 9 NVSwitch trays; six power shelves, three top and three bottom; four NVLink cartridges carrying over 5,000 copper cables; component count 1.5 million, manufactured across 350 plants [Huang, Q4 FY25 call, 26 Feb 2025 — paraphrase, entry 38]. Cost: ~\$3M per NVL72 rack, per HSBC (May 2024) [analyst estimate; NVIDIA publishes no rack list price — always attributed]; per-GPU, the founder's own number: \$30,000–40,000, Huang to CNBC (19 Mar 2024). Lead time / availability: demand expected to exceed supply for several quarters into fiscal 2026 (Kress, Nov 2024); sold out ~12 months per channel checks (Nov 2024, secondary); still effectively sold out through mid-2026 per checks at CES 2026. First shipment: 17–18 Nov 2024, Dell → CoreWeave (Timeline 33).

The mechanism (chain of custody — where the object comes from, end to end, doors honored). Two dies fabbed at TSMC and packaged into a Blackwell GPU [**silicon door: this clause is the full extent** — one inch, per Section 4]; superchips onto Bianca boards; boards into 1U trays; trays, NVSwitches, cartridges, power shelves, and manifolds integrated into a rack by an ODM/OEM layer — Foxconn, Quanta, Wistron on the ODM side; **Dell and Supermicro** as the named-brand integrators in this lecture's cast — then the rack is **tested as a rack, shipped as a rack, and craned in as a rack**: Dell's GB300 milestone language states the initial racks arrive fully assembled and tested. Arrival physics: a deployment-services firm documents the delivery as four separate components — compute rack ~1,500 kg, NVLink switch rack ~800 kg, CDU ~400 kg, PDU ~300 kg — with standard data center doors unable to accommodate the width [Introl, deployment trade source; note this describes a multi-cabinet configuration — the single-rack NVL72 vs. NVL36x2 split is Beat 11's material]. Floor: standard raised-floor tiles are rated ~250 kg per tile against a 1,360 kg point load — hence slab floors, spreader plates, roof penetrations, and cranes. **Where the constraint binds:** the moment of lift — the rack is the largest object in the industry that is simultaneously a precision instrument (blind-mate backplane tolerances) and a rigging load (3,000 lb through a roof).

Key actors. *Object:* the rack itself (lead). *Institutions:* Dell (Jeff Clarke, COO and vice chairman, on the record 9 Dec 2024 — the integrator's incentive: services revenue on every rack; his quote paraphrased: shipping the first fully integrated liquid-cooled racks equips CoreWeave's customers with speed and scale [locator: Dell PR]); Supermicro (Charles Liang, CEO — confirmed the 122-day Colossus build). *Humans:* Michael Dell — chairman & CEO, Dell Technologies (as-of Nov 2024, verified in role July 2026), whose product announcement is a tweet with a rocket emoji: “The AI rocket just got a massive boost!”

The documents. The spec sheet is this beat's paper (full treatment in Beat 4 / Section 5); the shipping-side documents — Dell's 9 Dec 2024 release, the OCP contribution — are cited above.

Verbatim bank. Primary spec-page language (NVIDIA, GB200 NVL72 product page, undated, live as of 20 Jul 2026): “an exascale computer in a single rack”. Michael Dell (X, 17–18 Nov 2024): quoted above. All other primary language for this beat lives in Beat 4’s bank.

Who pays. Whoever designs against the roadmap: the ~\$3M rack (HSBC estimate) is the visible line; the invisible lines are the slab floor, the crane day, the liquid loop, and the 132 kW of distribution — Beat 2’s subject. One line suffices; the money path is Beats 7 and 11.

Contested, motivated, unknown. The \$3M figure is an analyst’s estimate of a price NVIDIA does not publish — seller-adjacent opacity, flagged every use. The “27-trillion-parameter” training claim (Timeline 23) is a capability ceiling stated by the seller for a model class that does not exist: GRANT-AND-WITHHOLD.

Sensory & material details (sourced). 3,000 pounds; two feet wide; seven point three feet tall; two miles of copper cable inside, in a blind-mate backplane; six power shelves humming at the top and bottom; the whole thing warm to the touch by design, since every one of its 132 kilowatts leaves as heat. Crane, spreader bar, roof penetration: inference from documented mass and door-width constraints [doors cannot accommodate the width] — **marked as inference from documented conditions.**

Numbers that matter. 1.36 t / 3,000 lb — mass — NVIDIA via trade — 2024 — STRUCTURAL · 120 kW nominal / 130–132 kW observed — rack draw (rate) — NVIDIA/HPE/deployments — 2024–26 — STRUCTURAL · ~\$3M/rack — estimate — HSBC — May 2024 — VOLATILE · \$30–40k/GPU — seller’s own ASP — Huang/CNBC — 19 Mar 2024 — VOLATILE · 5,000+ copper cables / 2 mi — NVIDIA blog + teardowns — Oct 2024 — STRUCTURAL · 1.5M components / 350 plants — Huang, earnings call — 26 Feb 2025 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The object is documented to the cable count, priced by a named analyst, weighed by its maker, and shipped on a dated tweet; five minutes clears easily. One flagged pull: a job-posting/rigging-spec corpus for crane-day color (shared dependency with Beat 3).

Beat 2 — Mechanism Autopsy (the power path inside the building)

Syllabus 2.0 assignment: PDUs, busways, UPS topology — why 132 kW makes electrical distribution a first-order design problem.

Beat Menu definition: *Atoms · versatile · fat container.* How the thing physically works, conversationally, never announced as analysis. Rotation is content-native: L1 autopsied the campus; L2 autopsies the watt’s last hundred feet. No overlap (L1 pack, Section 10 boundary table, verified).

Facts, dates, names, numbers. The watt path, substation to die, with the L2-owned segment bolded: utility feed → transformer/switchgear (L4’s territory) → UPS → **floor-level busway → rack PDU / power shelves → 54 VDC busbar → compute tray → voltage regulators at the die.** The design baseline the rack breaks: a general-purpose CPU rack supports up to ~12 kW; higher-density H100 air-cooled racks typically ~40 kW; a typical rack circuit budget is 10–20 kW, while an NVL72 requires dedicated 3-phase circuits and a PDU rated 200A+. Inside the rack: six power shelves feeding ~120 kW, with each 1U compute tray drawing an estimated 5.4–5.7 kW — more than an entire average 2016 rack per rack-unit [Continuum teardown; per-tray figure marked as teardown estimate]. The copper penalty of low voltage: at traditional distribution, a single megawatt-class rack would need ~200-kg copper busbars; 800 VDC moves >150% more power through the same copper; at 54 VDC, Kyber-scale power shelves would consume up to 64U — the entire rack — leaving no room for compute. The two distribution approaches feeding servers today — 400V 3-phase AC and 48 VDC to the rack — become difficult at 200 kW per rack and impossible at 400 kW [Schneider Electric, Oct 2025 — a power vendor’s own admission of its product line’s ceiling]. UPS topology at 132 kW: the industry’s response is documented at the facility level — CoreWeave’s Switch chamber provisioning 1 MW per rack position (250 kW air + 750 kW liquid) — and at the architecture level: sidecar power racks, rack-integrated batteries, and, at cluster scale, the Colossus pattern: 168 Tesla Megapacks buffering 10–20 MW training-load swings. NEC continuous-load derating (80% of breaker rating) as the code-level reason nameplate ≠ deliverable [CalcSpec engineering reference — STRUCTURAL].

The mechanism. Why 132 kW is a *design* problem and not a bigger version of the old problem: (1) **Amperage** — at 415 V three-phase, 132 kW is ~180–200 A continuous into one cabinet; conductor cross-section, breaker coordination, and connector thermal ratings all leave catalog territory. (2) **Space** — power shelves compete with compute for rack units; the NVL72 already spends 6 shelves; the roadmap’s next rack couldn’t fit its own power at 54 V (the 64U fact). (3) **Synchrony** — 72 GPUs computing in lockstep draw in lockstep; the load steps in milliseconds, which is why a battery farm appears

between the rack and the grid at Colossus (the fact this lecture hands, unpriced, toward L4). (4) **Redundancy arithmetic** — 2N on a 15 kW rack is a second PDU; 2N on 132 kW is a second small substation's worth of gear per row. **Where the constraint binds:** the busbar — the physical copper cross-section between shelf and tray is the step where electrical distribution stops being negotiable and starts dictating rack height, voltage class, and ultimately the 800 VDC re-architecture of the entire electrical room.

Key actors. *Objects:* the busbar, the power shelf, the PDU, the Megapack. *Institutions:* Schneider Electric (Jim Simonelli, CTO, data centers — on record: the move to 800VDC as a “natural evolution as compute density increases” [partial quote within limit]); Vertiv; Eaton; the OCP (Mount Diablo). Their shared incentive, named: every kilowatt of rack density is revenue for the electrical-equipment industry, which is why its CTOs blog enthusiastically about the problem.

The documents. NVIDIA's 800 VDC technical blog (May 2025, updated 31 Jul 2025) and the OCP whitepaper (Oct 2025) — treated fully in Beat 4/Section 5; the Mount Diablo v0.5.2 spec (May 2025, Google/Meta/Microsoft) as the hyperscalers' parallel answer.

Verbatim bank. NVIDIA 800 VDC blog (May 2025): the 200-kg-busbar sentence, quoted in Timeline 43 — one deployment, already spent there; for drafting, cite from this bank. All other passages paraphrased above with locators (NVIDIA developer blog; Schneider blog 16 Oct 2025; DCD 800VDC coverage).

Who pays. Whoever designs against the roadmap — literally: the facility owner buys the busway, the sidecars, and the electrical room twice (once for 15 kW assumptions, once for the retrofit). Priced fully in Beats 7 and 11.

Contested, motivated, unknown. The per-tray 5.4–5.7 kW figure is a teardown estimate, not a spec [marked]. The 800 VDC efficiency claims (up to 5% end-to-end, up to 70% maintenance reduction) are vendor-filed numbers [Introl citing NVIDIA materials — seller's own math, flagged].

Sensory & material details. A 200-kilogram copper busbar is a fact NVIDIA itself put in print [entry 43]; six power shelves; the busbar warm; the whine of fans absent in the fanless VR200 trays [VR200 compute and NVSwitch trays are fanless]. Marked inference: none needed.

Numbers that matter. 12 kW / 40 kW — CPU rack / H100 air rack baselines — SemiAnalysis — 2024 — STRUCTURAL · 200A+ PDU — deployment requirement — Spheron guide — Mar 2026 — STRUCTURAL · 64U of power shelves at 54V for Kyber — NVIDIA blog — May 2025 — ANCHOR-adjacent (arithmetic of voltage) · 200 kg — busbar per MW-class rack at legacy voltage — NVIDIA — May 2025 — STRUCTURAL · 250 kW air + 750 kW liquid per position — Switch Evo chamber — Dec 2024 — STRUCTURAL · 10–20 MW — training load swing — Colossus reporting — 2024–25 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The mechanism has documented numbers at every joint and a clean binding point; the beat's ending (the load that steps in milliseconds) walks naturally toward the Megapack fact and seeds L4 without opening it.

Beat 3 — Operator Reality (crane day)

Syllabus 2.0 assignment: Rigging crews, roof penetrations, floor-loading checks — sourced from job postings and trade press.

Beat Menu definition: *Atoms/Character · versatile.* The people running a building the size of an aircraft carrier; sourced from job postings, staffing disclosures, trade-press interviews — humanizes without inventing anyone. **Constraint check:** this is not the Hearing Room; no scene construction — documented logistics only. Punch-up-only applies (see ID human-floor flags).

Facts, dates, names, numbers. The documented arrival sequence: components arriving at 1,500 kg / 800 kg / 400 kg / 300 kg; standard data center doors unable to accommodate the width [Introl, GPU-deployment trade source]. Floor mathematics: raised-floor tiles rated ~250 kg against a 1.36 t rack → slab-on-grade requirements, load-path engineering, spreader plates [inference from documented figures — marked]. Speed records as labor facts: Colossus — 19 days from first rack arriving to training beginning; 122 days for the full first build, with Dell and Supermicro as partners; the doubling in 92 more days [Introl/Wikipedia record]. The integrator's delivery promise as the operator's job description: racks arriving fully assembled, tested, designed for fast setup and seamless transitions to production — meaning the site work compresses into rigging, landing, plumbing (quick-disconnects to the CDU loop — the liquid specifics belong to L3), busway connection, and blind-mate verification. Trades on site: riggers/millwrights (the lift), electricians (200A+ circuits,

Beat 2), and — increasingly — pipefitters, whose full treatment **Lecture 3 owns** (the UA-certified pipefitter is L3 cast; one forward-leaning line max here).

The mechanism. Crane day, reconstructed strictly from documented constraints: pre-lift floor-loading survey (250 kg tiles vs. 1,360 kg load); door survey (fails); roof penetration or removable wall panel; certified rigging for a 3,000 lb precision load whose internal tolerance budget includes a blind-mate backplane carrying 5,000+ copper connections; landing on a load-spreading path; leveling; busway drop; coolant quick-connects; NVLink cartridge verification. **Where the constraint binds:** the lift itself — the one step where a \$3M instrument is governed by the same physics and the same union classifications as an HVAC chiller.

Key actors. The rigging crew and electricians (documented as trades, not as named individuals — no individual surfaced in the record at quote level, and none is invented); Charles Liang (CEO, Supermicro — on record confirming the 122-day build); the Dell services organization (the “professional services” line item in the Dec 2024 release — integration labor, productized).

The documents. The Dell Integrated Rack services agreement class (announced, not public — flagged); OCP’s contributed mechanical specs (Oct 2024) as the industry’s shared rigging drawings: compute and switch tray mechanicals and NVLink cable cartridge volumetrics — volumetrics being, precisely, the paperwork of what fits through what.

Verbatim bank. None deployed here (Beat 1 and Beat 4 spend this territory’s quotes). **Flagged draft-stage pull (pack dependency, honest status):** the beat plan calls for job postings; representative postings (data center rigger/millwright, critical-facilities electrician, “GB200 deployment technician”) were not pulled verbatim in this run. Locators for the pull: Introl careers page (GPU deployment technicians, 100+ site deployments claim), Supermicro and Dell services job boards, CoreWeave data center operations postings. **PARTIALLY RESOLVED — same convention as L1’s NANOG pull.**

Who pays. No who-pays dimension beyond labor line items; one line: integration labor is the only part of the rack the roadmap cannot compress, which is why it got productized.

Contested, motivated, unknown. The four-component delivery breakdown describes one deployment pattern (Introl’s), not a universal SKU — marked. The 19-day figure is NVIDIA’s own account of a marquee project [“built by xAI and NVIDIA” per NVIDIA] — seller-adjacent, flagged.

Sensory & material details. The width that fails the door survey; the crane; the tile that would crack; the blind-mate connector that either seats or doesn’t — all sourced or marked inference above.

Numbers that matter. 250 kg/tile vs 1,360 kg — floor — Spheron/industry — 2026 — STRUCTURAL · 19 days — first rack to first training — NVIDIA account — 2024 — STRUCTURAL (seller-adjacent) · 122 + 92 days — build and doubling — multiple — 2024 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE — conditionally. The physics, weights, and build-speed record carry five minutes; but the beat’s *human* texture currently rests on trades-as-categories rather than documented individuals, and the job-posting pull is outstanding. If the pull comes back thin, this is the lecture’s most THIN-leaning beat; Section 3 pairs it with the strongest negative-space alternative in case markup wants the swap.

Beat 4 — The Paper Trail — *class: technical specification (NVIDIA’s rack roadmap)*

Syllabus 2.0 assignment: The roadmap as the published future everyone downstream must design against: Blackwell → Rubin Ultra NVL576 at ~600 kW.

Beat Menu definition: *Politics · versatile, closer-capable · universal (all 10 lectures).* A named document as causal actor: what it says, who wrote it and why, what it forces, what it forbids, what happens when someone violates it. Class rotation verified: L1 ran the state audit; L2 runs the technical specification; no repeat.

Facts, dates, names, numbers — what the document says, by edition. The roadmap is not one PDF; it is a serial publication delivered from keynote stages, with each edition dated in Section 1: **18 Mar 2024** (Blackwell; GB200 NVL72; 120 kW) · **2 Jun 2024** (Rubin named; the one-year rhythm declared) · **18 Mar 2025** (the full ladder: GB300 NVL72 2H25 → Vera Rubin NVL144 2H26 → **Rubin Ultra NVL576, Kyber, ~600 kW, 2H27** → Feynman 2028) · **16 Mar 2026** (Kyber prototype shown; \$1T order framing). The published density ladder in one line, each figure a rate, per rack, seller-published: **~120 kW (2024/25) → ~142 kW (GB300, 2025) → ~190–230 kW (VR200, 2026) → ~600 kW (Kyber, 2027E)** [sources: Timeline 23, 45, 53, 39]. The specification layer beneath the keynotes: the GB200 NVL72 product page

and datasheets; the OCP contributions (Oct 2024: mechanicals, cooling envelopes, cable volumetrics; Oct 2025: the 800 VDC whitepaper) — the roadmap translated into drawings other companies must build to.

The mechanism — how a slide becomes a constraint. (1) NVIDIA publishes a density number with a date. (2) Integrators tool for it (Dell XE9712, Nov 2024). (3) Power vendors design product lines to it — Vertiv’s 800 VDC portfolio planned for 2H 2026 explicitly “aligning to support the 2027 rollout of NVIDIA Rubin Ultra platforms”; Schneider commits to releasing power and cooling in advance of every future NVIDIA platform evolution [paraphrase]. (4) Facility owners provision to it (the 1 MW/rack Switch chamber, Dec 2024 — provisioned for a rack that didn’t exist). (5) Standards bodies canonize it (OCP, Mount Diablo). **Where the constraint binds:** the moment a third party’s capital budget is committed against the slide — from that moment the roadmap functions as a binding document *for everyone except its author*.

Key actors. *Document:* the roadmap (lead — this treatment is the full one; Lectures 3, 6, 9 take returns only: L3 gets the thermal consequence, L6 the depreciation consequence, L9 the five-to-seven-year treadmill line). *Author:* Huang (Beat 5). *Downstream signatories-in-practice:* Vertiv, Schneider, Eaton, Dell, Supermicro, Meta (Catalina), the OCP.

The documents — the full Paper Trail treatment. *What it forces:* the entire downstream capital sequence above. *What it forbids:* nothing — **and that asymmetry is the beat’s spine.** *What happens when someone violates it:* nothing happens to NVIDIA when a customer misses the roadmap’s cadence; something happens to NVIDIA’s *product* when NVIDIA misses it, and the record now contains both violation classes, dated: the author violating its own schedule (the Aug 2024 mask change, three months; the Jul 2026 Kyber reporting, twelve-plus months, disputed), and the author’s response to being caught — a four-word statement declining all follow-ups. *Procedural status:* not filed anywhere; no docket; no signature page; enforceable by nobody. **The skeptical caveat, stated flat: this lecture’s central document is a forecast wearing a specification’s costume — press-release physics with a parts list.** What keeps it from being *only* a press release is that the parts list is real: the OCP contributions are genuine engineering drawings (mechanicals, thermal envelopes, cable volumetrics) that hundreds of companies now build to, and the shipped generations (GB200, GB300) arrived within months of their published dates. The document is simultaneously the most consequential technical specification in the industry and the least binding piece of paper in this course — the interconnection agreement’s exact inverse, which is why the Paper Trail rotation put them nine lectures apart.

Verbatim bank. One deployment each, per source, attributed: NVIDIA GB200 NVL72 product page (live as of 20 Jul 2026): “an exascale computer in a single rack” [spent in Beat 1 — for drafting, this is the assigned Verbatim’s primary]. Computex keynote (2 Jun 2024): “Our company has a one-year rhythm.” NVIDIA statement to Tom’s Hardware (6 Jul 2026): “Our roadmap is intact.” SemiAnalysis (X, 6 Jul 2026), trimmed for deployment: “the PCB midplane remains challenging from a manufacturability standpoint.” All longer keynote passages: paraphrase-marked with locators (Rev.com GTC 2025 transcript; NVIDIA Computex blog 2 Jun 2024; DCD 18 Mar 2025).

Who pays. The document’s costs land entirely downstream of its author: Vertiv’s, Schneider’s, and Eaton’s R&D lines; Dell’s and Supermicro’s tooling; every facility owner’s electrical room. The author collects twice — once when the rack sells, once when the ecosystem’s sunk tooling makes the *next* rack’s adoption path frictionless. One line, because Beats 6, 7, and 10 price it.

Contested, motivated, unknown. The 2H 2027 Kyber date is the pack’s flagship CONTESTED claim (Timeline 61–63): analyst reporting (78-layer midplane; quad-die cancellation, 30 Jun 2026) vs. corporate denial (6 Jul 2026), with NVIDIA providing no further details in response to follow-up questions, leaving unclear whether the statement refers to the original schedule or an already-revised one. Stated as a conflict; not smoothed; the drafting AI presents both with dates.

Sensory & material details. The document’s physical form: a keynote slide, ten meters wide, in an arena — SAP Center, 25,000 attendees in person, 300,000 virtual (NVIDIA’s own GTC 2025 announcement figures). The specification as spectacle is itself course material, sourced.

Numbers that matter. 120 → 142 → 190–230 → ~600 kW — the published rack ladder (rates, per rack, seller-published) — NVIDIA — 2024–26 — STRUCTURAL except the 600 (CONTESTED as to date) · 2H 2027 vs 2028 — Kyber ship date — NVIDIA vs SemiAnalysis — Jul 2026 — CONTESTED · 25,000 / 300,000 — keynote attendance — NVIDIA — Mar 2025 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The richest documentary record in the lecture: four dated editions, a genuine drawings layer, two documented self-violations, and a live dispute. This beat could sustain ten minutes; the risk is overrun, not padding.

Beat 5 — The Founder Audit (Huang) — judgment call, Open Item 10: both cases delivered

Syllabus 2.0 assignment: The origin mythology told straight, then audited against the roadmap's function as a demand instrument; flagged as a judgment call (Roster's "not celebrity" note vs. the beat's mechanism).

Beat Menu definition: *Character/Money · versatile · never lecture 1.* The anecdote is the setup; the audit is the beat; the gap between founding story and filed record is where the deadpan lives.

The mythology, told straight (all documented, all self-narrated — that dual status is itself audit material). Born 17 Feb 1963, Tainan; shipped to relatives in the US as a boy; boarded at Oneida Baptist Institute in rural Kentucky — a reform-adjacent school his family mistook for a prep academy — where he cleaned bathrooms; bussed tables and washed dishes at Denny's from 15 [comedy off through this span — ID flag]. BSEE Oregon State 1984; MSEE Stanford 1992, nights, while working at AMD and then LSI Logic. Decided to found a company by his 30th birthday (17 Feb 1993, per his own tellings); incorporated NVIDIA 5 Apr 1993 with Malachowsky and Priem over meals in an East San Jose Denny's booth, on \$40,000; the NV1 flop (1995) nearly kills the company and mints the standing mantra — thirty days from going out of business; RIVA 128 (1997) saves it; CUDA (2006) is the decade-early bet the Street punishes; AlexNet (2012) is the vindication he himself dates the pivot to; the leather jacket becomes a uniform; the hand-delivered DGX-1 to OpenAI (Aug 2016) becomes, in retrospect, the industry's founding gift exchange. Title check for the Roster: **founder, president, and CEO — unchanged for 33 years, verified in role as of July 2026**; no "then-" convention needed anywhere in this lecture.

The audit — the roadmap as demand instrument, in the founder's own words, dated. The same narrator who tells the Denny's story also, from the same class of stage: declares the one-year rhythm (2 Jun 2024) that resets every customer's capex clock annually; publishes the 600 kW future 30 months early with the explicit gloss that the transition needs years of planning — *telling the audience now* being, precisely, how a demand instrument works [paraphrase; Rev/DCD locators, 18 Mar 2025]; performs the obsolescence of his own installed base — "I'm the chief revenue destroyer" — while the peak-year chart behind him converts 1.3M Hopper units sold into 3.6M Blackwell units *ordered* [stage labels his slide did not carry]; prices his own content per gigawatt on an earnings call — Hopper ~\$20–25B/GW, Grace Blackwell ~\$30B±, Rubin higher [paraphrase; Q3 FY26 transcript, 19 Nov 2025] — which is the roadmap restated as a utility-negotiation position: every gigawatt any grid grants, a fixed and rising share is spoken for by the roadmap's author; and answers the supply question identically across three consecutive quarters: sold out (Nov 2025), "In fact, we are going to be short." (16 Mar 2026), constrained throughout the entire life of Vera Rubin [paraphrase-marked, 20 May 2026]. **The audit's finding, GRANT-AND-WITHHOLD calibrated:** the cadence is real — the shipped record (GB200 Nov 2024, GB300 Jul 2025, Rubin production Jan 2026) tracks the slides within months. What the mythology obscures is the document's *second function*: a permanently supply-constrained narrative, delivered annually from an arena, is the single most effective demand-pull instrument ever operated in the hardware industry, and its author knows it — the scarcity is the marketing, and the marketing is on tape.

Key actors. Huang (lead). Colette Kress, EVP & CFO since 2013 (verified in role Jul 2026) — the audit's co-author: every keynote number acquires its stage label only when she files it.

Verbatim bank. GTC 2025 keynote (Rev transcript): "I'm the chief revenue destroyer." [one deployment; the Hopper riff around it paraphrased with locator]. GTC DC, Washington (28 Oct 2025): "Half a trillion dollars' worth so far."

Who pays. The customer who believed last year's edition: the Hopper buyer of 2024 holds an asset its own vendor declared ungiftable in March 2025 — the bridge to Beats 7 and 10, one line here.

Contested, motivated, unknown. Every founding-story detail above is self-narrated; independently documented anchors (incorporation date, IPO, product dates) are separated from mythology-tier items (the 30th-birthday deadline, the mantra) with tags above. **Open Item 10 evidence, both ways:** *For running the Founder Audit* — the mythology corpus is unusually rich, self-told, and dated, and the audit writes itself from primary tape. *For the alternative (drop to secondary inside the Paper Trail; give the slot to The Steelman, defendant: NVIDIA's cadence)* — the steelman file is equally strong: the cadence defended in NVIDIA's own numbers is (a) perf/watt at fixed grid power — Huang's 1-GW argument: a gigawatt is a gigawatt, so architecture efficiency can't be brute-forced [paraphrase; Q3 FY26 transcript] — making annual refresh *rational* for customers, not extractive; (b) the shipped-on-time record 2024–2026; (c) TCO X-factors per generation. Both cases complete; markup rules; the grid stays legal either way.

Stress-test verdict: SUSTAINABLE (either casting).

Beat 6 — The Forecast Problem (the roadmap as a forecast with an author)

Syllabus 2.0 assignment: Who filed it, what they get if you design against it.

Beat Menu definition: *Money/Politics · versatile*. Load forecasts as political documents; planning as an act of faith with a price attached.

Facts, dates, names, numbers. The forecast layer cake, each stratum with filer and stage: (1) **The roadmap itself** — filer: NVIDIA; stage: announced product dates; documented slippage record: ~3 months (Blackwell, 2024), 12+ months disputed (Kyber, 2026). (2) **The order-book numbers** — \$500B “visibility” (Kress, 19 Nov 2025; bookings, not revenue), grown to \$1T in purchase orders through 2027 (Huang, 16 Mar 2026); what a “purchase order” binds in this industry is undisclosed — cancellation and re-scheduling terms are not public [honest unknown, flagged]. (3) **Downstream industrial forecasts built on the roadmap** — SemiAnalysis projecting ~39 GW of new capacity on 800 VDC by 2030 [capacity, projected, analyst]; JLL’s 2026 Outlook: global capacity from 103 GW to 200 GW by 2030 [capacity, projected, broker — a seller of data center real estate, incentive noted]; AFCOM’s respondent expectations (69% expect steady density increases). (4) **The forecasts the roadmap invalidates** — every facility designed to the *previous* edition; the stranded-hall problem named in trade coverage as the roadmap’s externality [ModulEdge, Jun 2026, secondary]. **What the filer gets if you design against it:** ecosystem lock-in (Vertiv/Schneider/Eaton tooling to NVIDIA’s voltage and dates — Beat 4), demand pulled forward (order in 100k-GPU increments or lose your slot), and negotiating altitude with every utility (content-per-gigawatt, Beat 5).

The mechanism. The DISCOUNT move’s raw material, applied to a *vendor* forecast rather than a utility’s: grant the direction (density is genuinely rising — AFCOM’s own survey, independent of NVIDIA, shows 16→27 kW in one year); name the model’s owner and load-bearing assumptions (annual cadence holds; packaging and PCB manufacturability hold — the exact assumption that broke in Jun–Jul 2026; Starship-grade schedule optimism); recall the graveyard (this document’s own two slips, dated); output a range, never the bare slide. **Where the constraint binds:** third-party capital committed against an unenforceable date — the same binding point as Beat 4, viewed from the money side.

Key actors / documents. As Beat 4; plus JLL (Andy Cvengros on speed-to-power-2027 as the primary siting criterion [paraphrase; DCF, Jan 2026] — the roadmap’s dates migrating into real-estate underwriting).

Verbatim bank. GTC 2026 quote spent in Beat 5’s territory (cited there). Kleyman/AFCOM (via Upsite, 11 Jun 2026): “Rack density rocketed up the past year”. All else paraphrased with locators.

Who pays. The designer-against: study deposits’ cousin — tooling, pre-provisioned megawatts, and 1 MW chambers built for racks that may arrive a year late. Dollars documented where public (Vertiv/Eaton product lines); mostly undisclosed [flagged].

Contested, motivated, unknown. Whether a \$1T “order book” is firm demand or a mutual-signaling instrument between NVIDIA and customers who also fear losing allocation — genuinely unknown; both readings held open; what would settle it: cancellation disclosures in future 10-Qs [HOLD OPEN, named test].

Stress-test verdict: SUSTAINABLE.

Beat 7 — Follow the Money (the cadence’s effect on depreciation and capex math — planted here, cashed in 6 and 10)

Syllabus 2.0 assignment: What an annual density cadence does to depreciation and capex math.

Beat Menu definition: *Money · versatile · fat container*. Capital structure as narrative; the load-bearing accounting assumption is always the payoff. **Boundary discipline, hard:** Lecture 6 owns CoreWeave, the S-1, GPU-collateralized debt; Lecture 10 owns the useful-life fights, Amazon’s Feb 2025 reversal, Burry. This beat *plants* — states the mechanism and the vendor-side numbers — and stops.

Facts, dates, names, numbers. The vendor-side mirror of hyperscaler capex, filed quarterly: NVIDIA data center revenue \$30.8B (Q3 FY25, quarter ended Oct 2024, derived from \$35.08B total) → \$62.3B (Q4 FY26) → **\$75.2B (Q1 FY27, quarter ended 26 Apr 2026)** — a single quarter of one vendor’s data center line now exceeding the *annual* capex of any hyperscaler circa 2022 [filed figures; comparison arithmetic marked as derived]. Content per gigawatt, the seller’s own conversion: ~\$20–25B (Hopper) → ~\$30B± (Grace Blackwell) → higher (Rubin) [Huang, 19 Nov 2025, paraphrase] — meaning **the roadmap raises the dollar content of every already-planned gigawatt, annually, by publication**. The asset-life collision, stated as arithmetic and left un-cashed: a ~\$3M rack (HSBC, May 2024) whose vendor declared the *prior* generation ungiftable 16 months after peak shipments (Beat 5), sitting in facilities financed on 30-year paper — five-

to-seven-year silicon on thirty-year infrastructure is the course's standing fraction, and this lecture is where the numerator gets its physical explanation. The tax-side echo **owned by L1** (Loudoun's 50%-of-purchase-price year-one assessment; refresh churn as county revenue): one cross-ref line, do not rebuild.

The mechanism. Cadence → capex: each edition resets the performance-per-watt frontier at fixed grid power (Huang's 1-GW argument), making refresh *individually rational* per customer while *collectively* compressing the fleet's economic life toward the cadence period. Cadence → depreciation: the accounting question — does book life follow the roadmap (short, honest, earnings-punishing) or the building (long, flattering, thesis-risking)? — is named here as a question, with its answer's home addresses (L6: the neocloud CFO's schedule; L10: the hyperscalers' extensions and the Feb 2025 reversal). **Where the constraint binds:** the depreciation line of whoever owns the rack — the single cell where the roadmap's physics becomes someone's income statement.

Key actors. NVIDIA (the only party for whom the cadence is unambiguously accretive); Kress (the filer); the unnamed-here owners of the racks (named in 6 and 10).

Verbatim bank. Q4 FY25 call (26 Feb 2025), Huang: “customers are anxious and impatient to get their Blackwell systems.” [one deployment, this source].

Who pays. The rack's owner, through the depreciation schedule; the bondholder if the schedule is wrong; the ratepayer either way — the course's standing chain, gestured once, priced in 6, 7, 10.

Contested, motivated, unknown. Content-per-GW figures are the seller's own, given orally, in round numbers [flagged]. Actual fleet-level useful life is the industry's best-kept number — utilization and retirement data unpublished [honest unknown; feeds L10's HOLD OPEN].

Stress-test verdict: SUSTAINABLE — with the boundary fence load-bearing: the beat's discipline is what it declines to cash.

Beat 8 — The Hearing Room (an NVIDIA earnings Q&A, transcript only — Steelman folded in)

Syllabus 2.0 assignment: Analysts steelmanning the cadence in real time.

Beat Menu definition: *Politics · opener-capable, versatile.* The only walk-into-a-room beat on the menu; transcripts and minutes only; documented speakers, documented words, no staging. Mid-lecture placement here (opener slot spent on the Cold Open) — position-class compliant.

The room, selected: Q3 FY2026 earnings call, Wednesday, 19 November 2025, 5:00 p.m. ET. Primary record: NVIDIA's official transcript PDF (s201.q4cdn.com, filed to the IR site); secondary: Motley Fool, Rev, Investing.com transcripts. Documented speakers, as listed on the official record: operator Sarah; Colette Kress (EVP & CFO); Jensen Huang (president & CEO); analysts Joe Moore (Morgan Stanley), C.J. Muse (Cantor Fitzgerald), Vivek Arya (BofA Securities), Ben Reitzes (Melius Research), James Schneider (Goldman Sachs), Timothy Arcuri (UBS), Stacy Rasgon (Bernstein Research), Aaron Rakers (Wells Fargo).

The scene's documented spine (all paraphrase-marked except the one deployed quote; locators: official PDF page-pins flagged for draft stage). Kress opens with the filed facts — \$57B, +62%, record +\$10B sequential — and the two sentences that define the quarter: visibility to half a trillion in Blackwell and Rubin revenue through calendar 2026, and the annual-cadence-plus-full-stack framing against a \$3–4T decade-end infrastructure estimate. Huang's opening confronts the season's question directly — “From our vantage point, we see something very different.” — the AI-bubble line that led every next-morning headline [NBC, 19–20 Nov 2025]. Then the analysts steelman the cadence better than the course ever could, because their money depends on the steelman being real: **Muse** poses the consternation-vs-sold-out paradox — massive funding doubts in the market while every stood-up GPU is taken, before B300's benefit has even landed, never mind Rubin. **Arya** performs the course's own unit discipline live: what dollar-per-gigawatt and power assumptions sit inside the \$500B, given street estimates from \$25B to \$40B per gigawatt — and how much of the \$3–4T needs vendor financing versus customer cash flow. **Huang's answer** is the lecture thesis on tape: generation by generation the NVIDIA share of the data center rises (Hopper ~20–25, Grace Blackwell ~30±, Rubin higher), and in the end you still only have one gigawatt of power, so performance per watt is everything and can't be brute-forced. **Arcuri** asks the cascade's own question: which bottleneck bites first — power, financing, memory, foundry. **Kress**, on growth beyond the \$500B: the number will grow; \$50B shipped this quarter; that day's Saudi announcement alone 400,000–600,000 GPUs over three years. [All paraphrases marked; the drafting AI reconstructs the scene from the official PDF only.]

Alternates supplied (for markup): Q3 FY2025 (20 Nov 2024) — the mask-change/overheating room, “staggering demand”; Q1 FY2027 (20 May 2026) — Muse on Vera Rubin’s inference share, the \$91B guide, the constrained-for-its-entire-life line [Benzinga/official PDF]. Primary recommendation stands on Q3 FY26: it is the one room where the cadence, the money, and the bubble question collide with all eight named steelmen present.

Who pays / contested. The analysts’ incentive named without rube-ery: sell-side questions are also marketing to their own clients; the steelman is genuine *and* motivated — which is the Hearing Room working as designed.

Stress-test verdict: SUSTAINABLE. A complete, official, continuous transcript with named speakers — the strongest evidence floor of any beat in this lecture.

Beat 9 — The Bottleneck (integration and assembly: the rack that ships as a rack)

Syllabus 2.0 assignment: Copper, busway capacity, cable management.

Beat Menu definition: *Atoms · versatile.* The constraint nobody can financialize away; why it exists industrially, who sits upstream, what the workaround costs, why money alone doesn’t clear it.

Facts, dates, names, numbers. The census restated as manufacturing: 1.5 million components per rack, from 350 plants (Huang, 26 Feb 2025, paraphrase); over 5,000 copper cables in four NVLink cartridges; more than 2 miles (3.2 km) of copper in a blind-mate backplane — copper chosen over optics to save ~20 kW/rack. The documented failure ledger of exactly this layer, dated: the mask change (Aug 2024, ~3 months); supplier-level rack redesigns over overheating (The Information, Nov 2024); and the July 2026 centerpiece — the Kyber midplane: a 78-layer PCB, three 26-layer boards laminated under heat and pressure, traces a quarter of a hair’s width, roughly the size of a kitchen table, through which every GPU-to-GPU signal in a 144-package rack must pass — reported unmanufacturable at reliable yield, delaying the rack a year [TechTimes summary of SemiAnalysis; CONTESTED per NVIDIA’s denial]. Upstream of the midplane: co-packaged optics not yet production-ready at scale [SemiAnalysis via Tom’s], so copper is the only option for inter-rack links — and copper at those distances requires the very midplane that cannot yet be manufactured reliably. Integrator capacity as the human-scale bottleneck: Dell and Supermicro tooled lines (XE9712, Nov 2024; GB300, Jul 2025); Foxconn CPO switch-rack deliveries revised from 10,000+ (2026) to 50,000+ (2026–27) [TradingKey citing supply-chain reports — secondary, flagged].

The mechanism. Why money doesn’t clear it: yield on a 78-layer lamination is a materials-and-process problem with a learning curve measured in quarters, not a purchasable input; NVLink’s electrical reach fixes the copper length; the copper length fixes the board; the board fixes the date. **Where the constraint binds:** the backplane — the one component where the roadmap’s bandwidth promise and manufacturing physics occupy the same square meter, and the component that has now, per the reporting, moved a keynote date for the first time.

Key actors. The midplane (object); Amphenol-class interconnect vendors and the active-copper supply chain (the layer SemiAnalysis identifies as the real volume winners [Oct 2025 BOM analysis — paraphrase]); Foxconn, Quanta, Wistron; TSMC named once as the upstream of the upstream — **and the silicon door closes there** (Gesture inventory: Timeline 22; nothing further researched behind it, per boundary discipline).

Verbatim bank. NVIDIA developer blog (Oct 2024): “over 5,000 copper cables” [one deployment, spent in Timeline 32 — cite from bank].

Who pays. Schedule risk is the currency: a year of Kyber delay is a year of every 800 VDC product line (Vertiv 2H26, Eaton, Schneider sidecars) selling into a market whose anchor tenant slipped — priced by nobody publicly yet [flagged; Section 11 watch item].

Contested, motivated, unknown. The entire July 2026 layer is analyst-reported, corporate-denied; the beat presents the conflict as the story. SemiAnalysis’s own incentive noted symmetrically: a research shop’s product is being right before the filing is.

Stress-test verdict: SUSTAINABLE — the strongest *new* material in the pack; the midplane story postdates the syllabus stack entirely (Section 11 flag).

Beat 10 — The Perverse Incentive (a roadmap that obsoletes its own installed base on schedule)

Syllabus 2.0 assignment: As stated.

Beat Menu definition: *Politics/Money · versatile, closer-capable.* The rule producing the opposite of its intent — here inverted: an incentive structure producing *exactly* its intent, for its author, at everyone else’s expense; the beat’s job is to show the machinery without villainy.

Facts, dates, names, numbers. The dated sequence, all from Section 1: peak Hopper year 2024 (1.3M units to top-4 CSPs) → Blackwell announced 18 Mar 2024, before most of those Hoppers energized → “chief revenue destroyer” + you-couldn’t-give-Hoppers-away, 18 Mar 2025, sixteen months after peak → 3.6M Blackwell ordered by the same date → Rubin production Jan 2026 → Vera Rubin’s whole life pre-declared supply-constrained (May 2026). The customer’s side of the trap, priced honestly: at fixed grid power (the binding scarcity this course spends Lectures 4–5 on), a generation delivering X-factor perf/watt makes *not* refreshing the irrational choice — the obsolescence is consensual, which is what makes it an incentive structure rather than a swindle. The vendor’s side: annual cadence converts a cyclical semiconductor business into a subscription collected in \$3M increments. Cross-ref, one line each, no rebuild: L1 owns the county collecting its cut of the same churn (50% year-one assessment); L6 owns what the churn does to collateral; L10 owns what it does to useful-life footnotes.

The mechanism / binding point. Nobody wrong on their own terms, run at full discipline: NVIDIA (cannibalize yourself before AMD does — the competitively *required* move); the customer (perf/watt at fixed watts — the economically *required* move); the owner of last year’s fleet (holding the only party with no move). The constraint binds at the resale market — the place a “you couldn’t give them away” quote becomes a price.

Verbatim. None new — Beat 5’s deployment covers it; the beat runs on the dated sequence.

Who pays. The holder of generation N–1, in mark-to-market; measured publicly only when a filing forces it (L10’s territory — planted, not cashed).

Contested. Hopper’s actual secondary-market value vs. the keynote rhetoric: trade coverage noted Hopper remains useful, cheaper, immediately available [Barchart, Mar 2025 — the counter-reading, held open].

Stress-test verdict: SUSTAINABLE.

Beat 11 — The Externality Swap (density vs. distribution)

Syllabus 2.0 assignment: Consolidate 72 GPUs for training topology; pay in power delivery and heat.

Beat Menu definition: *Atoms/Money · versatile, closer-capable.* Both sides priced honestly; the beat fails if either option is a strawman.

The swap, both sides priced. *What density buys (documented):* one NVLink domain — 130 TB/s aggregate, 1.8 TB/s per GPU — versus InfiniBand-connected 8-GPU nodes; the copper backplane saving ~20 kW/rack versus optics; measured deployment economics: rack-scale rents at \$10.50–27/GPU-hr versus ~\$6.03 for discrete B200 nodes — a 1.7–4.5x premium that pays only when NVLink’s bandwidth collapses enough all-reduce time [Spheron, 22 Mar 2026, prices as-of-dated]. *What density costs (documented):* 120–132 kW into one cabinet (Beat 2’s entire distribution problem); mandatory liquid (L3’s inheritance — one line); 1.36 t on floors rated for a fifth of that; and facility stranding — halls electrified for 15 kW assumptions rendered structurally unhostable [ModulEdge, 2026]. **The market’s actual verdict, which proves the swap real:** most customers deployed the NVL36x2 two-cabinet compromise rather than the single 120 kW rack, precisely because their facilities couldn’t support the density, paying more than double the NVLink copper cost and extra NVSwitch ASICs to *spread the same computer across two racks* [SemiAnalysis BOM analysis] — the externality swap with an invoice attached.

Binding point. The facility’s watts-per-square-meter ceiling — the number that decides NVL72 vs. NVL36x2 before any benchmark does.

Who pays. The NVL36x2 buyer, in cabling and switch silicon; the NVL72 buyer, in electrical room; the reader of either invoice learns the same lesson the course keeps teaching: there is no option without an externality, only a choice of which.

Contested. The rental-premium payback arithmetic is workload-dependent; Spheron’s worked example (40% all-reduce share → ~40% effective cost-per-step reduction) is one vendor’s illustration [flagged as vendor math].

Stress-test verdict: SUSTAINABLE.

Beat 12 — The Physics Audit [C] (the step function, stated plainly) + Handoff

Syllabus 2.0 assignment: A building designed around 15 kW racks meets the 132 kW rack; 6.1 kW (2020) → ~27 kW (2026) → ~600 kW (2027 projected); a 7–9x discontinuity, not an improvement. Closer.

Beat Menu definition: *Atoms/Audit · versatile, closer-capable.* The deadpan reality check, delivered in the pitch's own tone. Closer-capable: verified.

The audited series, full pedigree — and Discrepancy A, stated flat. The must-hit series as carried: **6.1 → ~27 → ~600**. The documented record beneath it: **6.1 kW is AFCOM's 2016 figure** (its first State of the Data Center report); AFCOM's own 2020 value was 8.2 kW, and Uptime's 2020 mean (outliers excluded) was 8.4 kW; **~27 kW (2026) verifies exactly** — AFCOM 2026, up from 16 kW in 2025, ~4x in three years; **~600 kW verifies as published** (18 Mar 2025) with its date now **CONTESTED** (Jul 2026). Anchor values govern per the discrepancy protocol; no substitution here; **Section 6 carries the reconciliation and the recommendation** (likely: re-date the series' first term to "6.1 kW (2016)" or swap to "8.2–8.4 kW (2020)" — Nick resolves). The honest second series, which the audit *needs*: the whole-fleet average (Uptime) sat below 8 kW even in 2024–25 — the frontier and the fleet are different populations, and the step function is the frontier dragging the fleet's *design assumptions*, not its mean. The building-vs-rack arithmetic that carries the "7–9x": halls provisioned around 10–20 kW circuit budgets and ~15 kW planning assumptions meet a 132 kW cabinet — $132/15 \approx 8.8x$, a discontinuity, not a gradient; and the NVIDIA reference-design ladder gives the same audit in one vendor's own deployments: ~25 kW (A100 SuperPod, 2022) → ~40 kW (H100, 2023) → 72 kW (GH200, 2024) → ~132 kW (GB200, 2025) → ~190–240 kW (VR200, 2026E) → ~600 kW (2027E) [Schneider Electric blog, 23 Jul 2025 — a power vendor reading the roadmap aloud]. The air ceiling (~15 kW practical, hard limits by ~30–40 kW) is stated in **one sentence and banked** — **Lecture 3 owns the forced liquid transition**.

Closer mechanics + Handoff (mechanism: cost left unassigned, per rotation — distinct from L1's question and L3's walking character). The closer states the step function in the audit's deadpan, lands the Kicker — the 600 kW rack already has a name and a date; the building that can hold it doesn't exist yet (now with the documented complication that the *rack* may not exist on the date either — markup's choice whether the July 2026 dispute rides inside the kicker or the decay stamp) — and the final ~200 words hand L3 its problem without pricing it: 132 kW enters the cabinet as electricity and every joule leaves as heat; the invoice for the leaving is the next hour. Refresh-safe check: the handoff hinges on thermodynamics (ANCHOR), not on any VOLATILE figure — 2027-edition-proof.

Numbers that matter. 6.1 kW — AFCOM — **2016** (anchor says 2020 — Discrepancy A) — STRUCTURAL · 8.2 / 8.4 kW — AFCOM / Uptime — 2020 — STRUCTURAL · 16 → 27 kW — AFCOM — 2025→2026 — VOLATILE (annual survey) · ~7.6–8 kW — Uptime fleet mean — 2024–25 — STRUCTURAL (direct-source pull flagged) · $132/15 \approx 8.8x$ — derived, shown — ANCHOR-adjacent · ~600 kW — NVIDIA — 2H27E, published 18 Mar 2025 — **CONTESTED** (date).

Stress-test verdict: SUSTAINABLE — with Discrepancy A resolution required before Draft 1 deploys the Step Function.

RUN 2 — SECTIONS 3–12

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

The strawman leaves out nine beats: Bill Arrives, Wrong Map, Taxonomy, Symbol Audit, Neighbor, Deal, County, Regulatory Collision, and the standalone Steelman (folded into the Hearing Room's Q&A). Scan of each against the documented record:

The Bill Arrives. Weak-to-duplicative support. The candidate line items — the ~\$3M rack invoice (HSBC estimate, May 2024), the \$756–1,944/hr rack rental math (Spheron, Mar 2026) — are already load-bearing inside the Cold Open and the Externality Swap. Opening a second beat on the same invoice violates no rule but adds no material. Also opener-adjacency: L3 opens on The Bill Arrives; running it here mid-lecture is legal but forfeits the L3 opener's freshness. **Correctly left out.**

The Wrong Map. The genuine origin-geography story in this territory — why the world's rack assembly, ODM base, and advanced packaging concentrated in Taiwan (Computex as the industry's hometown fair; Foxconn/Quanta/Wistron; the supply chain Huang tours before every Taipei keynote) — is documented and rich. It is also the front porch of the silicon door and the October semiconductors course. Researching it properly means researching fabrication geography, which boundary discipline forbids beyond the Gesture's inch. **Correctly left out — boundary-driven, and the strongest example in this lecture of negative space that is a fence, not a gap.**

Taxonomy by Business Model — THE FLAGGED CASE. The L1 pack’s boundary table banked “taxonomy to L2” (L1 Section 10: “Inside the rack / silicon | L2 | ... taxonomy banked to L2”), but L2’s strawman lists Taxonomy as negative space. The record *does* support a taxonomy of the integration layer, sorted by mechanism rather than logo: (1) **ODM-direct** — Foxconn, Quanta, Wistron building to hyperscaler print, invisible in the press release; (2) **branded integrator with services** — Dell (PowerEdge XE9712 + Integrated Rack + professional services, Dec 2024) and Supermicro (the Colossus 122-day build, 64-GPU liquid racks), selling assembly *and* the labor of arrival; (3) **hyperscaler self-derivative via the open commons** — Meta’s Catalina, a GB200 NVL72 derivative contributed to OCP (Oct 2024); (4) **vendor-reference verticalization** — NVIDIA’s own MGX/DGX line collapsing the distinction. Depth: adequate for ~1,000 words (SemiAnalysis BOM analysis, OCP contribution database, dated Dell/Supermicro releases). **The swap case:** Taxonomy would most plausibly displace **Operator Reality** (Beat 3, the lecture’s THIN-leaning beat), absorbing crane-day logistics as texture. **The cost:** Taxonomy is a cold specialist capped at 1–3 appearances, and the grid already spends all three deliberately (L3 cooling vendors · L6 neoclouds · L9 orbital players). A fourth deployment breaks the band and dilutes three castings that each carry a lecture’s structural weight. **Recommendation:** do not swap. Resolve the L1 “banked” note as **satisfied by The Bottleneck** (Beat 9 already carries the integrator landscape as constraint rather than tour) and record the resolution in the Course Schema so the debt stops traveling. Markup disposes.

Symbol Audit. Candidate material exists — the keynote-as-arena, the leather jacket, the rack as trophy object — but the course-wide cap is 3 and all three castings are deliberate (L5 TMI · L8 Stargate · L9 orbital destiny). **Correctly left out** — **cap binding.** The keynote-spectacle facts ride as sensory detail inside the Paper Trail instead (Beat 4).

The Neighbor. No documented household exists at this lecture’s fence line; the rack’s neighbors are other racks. The nearest documented humans — Memphis fence-line residents near the Colossus power infrastructure — are Lecture 8 cast, comedy off, and not L2’s to touch. **Correctly left out; record supports nothing here, and stretching would violate the no-composites rule.**

The Deal. Candidates: the Dell–CoreWeave relationship (first-ship, Nov–Dec 2024, extended Jul 2025) or a marquee Blackwell purchase agreement. The public record supplies announcements and quotes but not the negotiation — no leverage sequence, no term sheet, no filed agreement. A Deal beat built from press releases is a press release. **Correctly left out** — **THIN by evidence class.** Natural homes remain 5, 6, 8 per the menu.

The County. No jurisdiction functions as this lecture’s microcosm; Memphis is L8’s, Loudoun is L1/7/8/10’s. **Correctly left out.**

The Regulatory Collision. One genuine collision touches the hardware stack: US export controls vs. NVIDIA’s China business — the \$4.5B H20 charge (Q1 FY2026, disclosed May 2025), the “no material H20 sales” state by Q3 FY2026 (Nov 2025), and the mid-2026 reporting that NVIDIA is preparing to sell Vera CPUs into China while GPU sales stay frozen (Tom’s Hardware, Jul 2026). Documented, dated, and quotable. But it is (a) federal-altitude trade policy — Lecture 8’s airspace; (b) silicon-trade adjacent — October’s course; and (c) a fourth storyline in a lecture whose spine is density. **Correctly left out.** The material is inventoried in Section 11 as available-if-wanted, with dates, so markup can pull it without a re-research pass.

The Steelman (standalone). The record STRONGLY supports it — the full defense of NVIDIA’s cadence in NVIDIA’s own numbers is assembled in Beat 5 and Section 7. This is Syllabus 2.0 **Open Item 10’s** live alternative: drop the Founder Audit to secondary treatment inside the Paper Trail and give the slot to The Steelman (*defendant: NVIDIA’s cadence*). Rotation check: NVIDIA is steelmanned nowhere else — a clean new defendant; the swap adds a ninth Steelman deployment against the 6–8 band, consistent with the reconciliation’s finding that the budget under-allocates and something must run over-band; Syllabus 2.0’s own language: either way the grid stays legal. Character-minimum check: dropping Founder Audit leaves Operator Reality carrying L2’s Character-family coverage — the proposed fourth minimum survives. **The pack’s evidence-side observation, offered without deciding:** the Founder Audit version is the richer hour (the mythology corpus is unusually good and entirely self-narrated, which is itself the audit), and the steelman content survives either way inside the Hearing Room, where the analysts perform it on tape. Markup rules.

Verdict pairing (for Section 2’s one conditional verdict). Beat 3 (Operator Reality) returned SUSTAINABLE-conditionally, pending the job-posting pull. Strongest replacements from this scan: Taxonomy (cap cost, recommended against) or the Steelman (which replaces Beat 5, not Beat 3, and doesn’t cure the gap). **Plain statement: the record supports nothing better cap-free. If the job-posting pull fails at draft stage, re-scope Operator Reality around the documented build-speed and integration-labor record (the 19-day first-rack-to-training fact, the four-component arrival weights, the productized services layer) rather than swap.** The beat’s physics floor already sustains; only its human texture is at risk.

Summary for markup. One swap case worth making conditionally (Steelman-for-Founder-Audit, per Open Item 10 — evidence for both sides delivered, no re-research needed); one banked-debt resolution proposed (Taxonomy satisfied by The Bottleneck; record it); seven beats confirmed correctly left out (two by cap, one by boundary, four by evidence). Category minimums re-verified under every proposed configuration: ≥ 1 Atoms (Cold Open · Mechanism Autopsy · Bottleneck · Externality Swap · Physics Audit), ≥ 1 Money (Follow the Money · Forecast Problem), ≥ 1 Politics (Paper Trail), ≥ 1 Character (Founder Audit + Operator Reality; Operator Reality alone if Open Item 10 swaps). The pack proposes; markup and the Course Schema dispose. No re-sequencing.

SECTION 4: MOVES PLAN VERIFICATION

The Step Function — 6.1 → 27 → ~600 kW. VERIFIED WITH DISCREPANCY FLAG. Pedigrees: **6.1 kW** — average rack density, AFCOM State of the Data Center, *initial report value, 2016* (per AFCOM’s own 2024 report as cited by Enconnex, Jan 2025) — **the anchor dates this figure 2020; AFCOM’s own 2020 value was 8.2 kW (Data Center Frontier on the 2020 report), and Uptime’s 2020 outlier-trimmed mean was 8.4 kW (Uptime Institute journal, 7 Dec 2020). This is Discrepancy A; do not substitute; Nick resolves (Section 6).** **~27 kW** — average rack density, AFCOM State of the Data Center Report 2026, up from 16 kW in 2025 (report author Bill Kleyman; reported by Upsite, 11 Jun 2026) — **VERIFIED.** **~600 kW** — Rubin Ultra NVL576 / Kyber rack, per rack, NVIDIA, published from the GTC keynote stage 18 Mar 2025, for 2H 2027 — **VERIFIED** as published; ship date **CONTESTED** as of 6 Jul 2026 (SemiAnalysis delay report; NVIDIA denial). The standing assumption the number must break, with the material that lets it feel settled first: *rack density is a slow, boring number* — and the fleet data genuinely says so. Uptime’s whole-fleet averages crawled from ~8.4 kW (2020) to still under 8 kW (2024 survey) and ~7.6 kW (2025, per secondary citation) — a *flat decade* for the median building. The drafting AI installs that flatness as the settled floor, then detonates the frontier series. **Markup alternate, noted without substitution:** the single-year AFCOM jump — 16 → 27 kW, +69% in one survey cycle, a rate of change the industry hasn’t seen — arguably breaks the assumption harder than the three-point series, and its pedigree is clean of Discrepancy A.

The Unit Conversion — 132 kW → a suburban block’s worth of houses. ARITHMETIC PASS · TARGET FAIL AS PHRASED · RETARGET REQUIRED. Full arithmetic, shown: average US household electric draw $\approx 10,500\text{--}10,800$ kWh/yr $\div 8,760$ h $\approx$ **1.2 kW average draw** [denominator owned by the L1 pack, EIA-derived, STRUCTURAL — cross-referenced, not rebuilt; L1’s pin-current-year flag applies]. $132\text{ kW} \div 1.2\text{ kW} \approx$ **110 average US homes.** Basis caveat carried from L1’s Physics Audit: average-to-average comparison only — homes peak at dinner; the rack peaks always. Verdict: the *arithmetic* clears the hard gate; the *target* does not — a suburban residential block is conventionally ~10–40 homes, so “a block’s worth” understates by roughly 3–10x. **Per the no-vibes rule, “a suburban block” must not deploy as written.** Cleared alternates, in preference order: (1) “about a hundred homes’ average draw, in one cabinet”; (2) “a small subdivision”; (3) “several suburban blocks.” If none satisfies tonally, the lecture runs without its Japan — the numbers in Beat 12 stand on comparison to each other. Not one of Open Item 11’s four flagged conversions, but the identical gate was applied.

The Timeline Snap — the GTC keynote date the ~600 kW future was published. RESOLVED: Tuesday, 18 March 2025, 10 a.m. PT, SAP Center, San Jose (NVIDIA’s own GTC 2025 announcement fixes venue, date, and hour). Incentive state, both sides of the hinge: *the day before* — the shipping frontier is a 120–132 kW rack; power vendors sell 415/480 VAC and 54 VDC product lines; facility owners provision to Blackwell. *The day after* — an 800 V sidecar sits on the show floor; within nine weeks Vertiv announces strategic alignment (May 2025) and NVIDIA publishes the 800 VDC architecture with a ~20-partner alliance at Computex (19–20 May 2025); within seven months an OCP whitepaper canonizes it (Oct 2025); Vertiv’s product line re-dates itself to “2H 2026, aligning to support the 2027 rollout of NVIDIA Rubin Ultra.” The incentives of an entire electrical-equipment industry flipped on a slide. **Alternative hinge presented with evidence, per protocol:** 2 June 2024 — the night the one-year rhythm was declared at National Taiwan University — is the date the *cadence* itself flipped incentives (CNBC that day: the company had operated on a two-year timeline; Blackwell-to-Rubin took under three months to announce). The assigned snap stands; the 2024 date is the stronger hinge only if markup re-centers the lecture on the cadence rather than the 600 kW number.

The Verbatim — roadmap/spec language. EXISTENCE GATE: PASS. Primary (recommended deployment): NVIDIA, GB200 NVL72 product page, nvidia.com, live as of 20 Jul 2026 — “an exascale computer in a single rack” — the specification’s own register, attributable in-narrative as NVIDIA’s spec page. Verified alternates, each independently attributed and gate-clean: Huang, pre-Computex keynote, National Taiwan University, 2 Jun 2024 — “Our company has

a one-year rhythm.”; NVIDIA statement to Tom’s Hardware, 6 Jul 2026 — “Our roadmap is intact.”; NVIDIA 800 VDC technical blog, May 2025 — the 200-kg-copper-busbar sentence (block-quoted in Run 1, Timeline 43). One deployment per lecture; the rest stay in the bank.

The As-Of Stamp — the ~27 kW 2026 average. CONFIRMED. Value: 27 kW average rack density; source: AFCOM State of the Data Center Report 2026 (released spring 2026; exact publication date flagged for a one-line pull); prior-year value 16 kW. Styled deployment shape: “as of the 2026 survey, the average rack is twenty-seven kilowatts.” Decay velocity: annual survey cadence — the next value lands spring 2027, direction up (69% of respondents expect steady increases over 12–36 months). This is the pack’s cleanest stamp: a number that admits its own expiry date by construction.

The Kicker — the 600 kW rack already has a name and a date; the building that can hold it doesn’t exist yet. VERIFIED, WITH TWO HONESTY CAVEATS THE CLOSING PASSAGE NEEDS. The name and date: Rubin Ultra NVL576, the Kyber rack, ~600 kW, 2H 2027 — published 18 Mar 2025. Caveat one (do not overclaim “doesn’t exist”): at least one bespoke chamber already claims 1 MW of power and cooling per rack position (Switch’s Evo chamber hosting CoreWeave’s first NVL72, Dec 2024) — so the defensible formulation is that the *fleet* of buildings, and the 800 VDC electrical ecosystem the rack requires, don’t exist yet: Vertiv’s supporting power portfolio doesn’t ship until 2H 2026. Caveat two (the July 2026 twist, markup’s choice whether it rides inside the kicker or stays in the decay stamp): as of 6 Jul 2026, the *rack* may not exist on the date either — SemiAnalysis reports Kyber delayed to 2028 on a 78-layer midplane; NVIDIA’s entire rebuttal is four words. The kicker survives both caveats and is arguably strengthened by the second: the published future is now racing its own circuit board. Adjacent facts supplied for the closing passage: the 2.5-million-part count per Kyber rack (Huang, GTC 2025, paraphrase-marked, DCD locator); the years-of-planning warning from the same stage; Vertiv’s 2H 2026 portfolio date.

The Gesture — the silicon door. ONE-INCH MATERIAL SUPPLIED; DOOR CONFIRMED CLOSED. The verified inventory (deploy two, at most three): (1) the Blackwell GPU carries **208 billion transistors** across **two reticle-limited dies** that function as one chip; (2) the two dies talk over a **10 TB/s** chip-to-chip link; (3) the process is a **custom TSMC line called 4NP**; (4) the architecture is named for **David Harold Blackwell**, the mathematician who was the first Black inductee into the US National Academy of Sciences. [All: GTC 2024 materials, 18 Mar 2024; NVIDIA architecture page; IEEE Spectrum.] Then the door closes: the chip arrives on a truck; how those dies got made is somebody else’s story. **Fence audit: PASS** — nothing else in this pack researches fabrication, yield, packaging, or foundry economics; the CoWoS/package dimension of the 2024 delay and the 2026 quad-die story is handled strictly from the *supply-chain and schedule* side (whose board, whose date), never the process side.

The Handoff rides in the beat plan; its documented material and alternates live in Section 10.

SECTION 5: THE DOCUMENT DOSSIER — NVIDIA’S RACK ROADMAP (class: technical specification)

The document itself. Not one instrument but a serial publication with four dated editions and a specification substrate. Editions: **18 March 2024** (GTC, San Jose — Blackwell; the GB200 NVL72 at ~120 kW); **2 June 2024** (National Taiwan University, Taipei — Rubin named; the one-year rhythm declared as policy); **18 March 2025** (GTC — the full ladder: GB300 NVL72 2H25 · Vera Rubin NVL144 2H26 · Rubin Ultra NVL576/Kyber ~600 kW 2H27 · Feynman 2028); **16 March 2026** (GTC — Kyber prototype shown; the order framing raised to \$1T through 2027). Substrate: the GB200 NVL72 product page and datasheets (nvidia.com); the OCP contributions — 15 Oct 2024 (rack architecture, compute/switch tray mechanicals, liquid-cooling and thermal envelopes, NVLink cable cartridge volumetrics; OCP contribution database) and the *800 VDC Architecture for Next-Generation AI Infrastructure* whitepaper (OCP Global Summit, Oct 2025). Procedural status: **filed nowhere; no docket; no signature page; enforceable by no one.** Where the full text lives: nvidia.com product pages and newsroom; keynote transcripts (Rev.com; official IR PDFs at s201.q4cdn.com); the OCP database.

What it says. The operative provisions are the ladder itself — per-generation density (a rate, per rack), bandwidth, memory, and a date: ~120 kW (2024/25) → ~142 kW (GB300, 2025, per Schneider Electric’s reading) → ~190–230 kW (VR200, 2026E, trade specs) → ~600 kW (Kyber, 2027E). The definitions section is, as usual, the comedy and the substance: **“NVL-N” means N GPU dies in one NVLink domain — and the definition itself has moved.** The 2025 edition’s flagship was “NVL576” (576 dies as 144 quad-die packages); after the reported June 2026 retreat to dual-die packages, the same cabinet circulates in coverage as “Kyber NVL144” — the document renaming its own future mid-flight, which the drafting AI should let the syntax perform.

Who wrote it and why. NVIDIA — a company whose data center segment supplies ~90% of revenue (FY2026: \$215.9B

total) — and whose founder delivers each edition personally from an arena (GTC 2025: 25,000 in person, 300,000 virtual, per NVIDIA’s own announcement). What the author gets if the document is believed: orders pulled forward in 100,000-GPU increments; an ecosystem (Vertiv, Schneider, Eaton, Dell, Supermicro, Meta, OCP) that sinks tooling capital into NVIDIA’s voltages and dates, making the *next* edition’s adoption path frictionless; and negotiating altitude with every utility in the footprint — the content-per-gigawatt arithmetic (~\$20–25B/GW Hopper → ~\$30B± Grace Blackwell → higher for Rubin, Huang’s own figures, 19 Nov 2025) converts each edition into a standing claim on a fixed and rising share of every gigawatt any grid grants.

What it forces and what it forbids. Forces: the entire downstream capital sequence — integrator tooling (Dell XE9712, Nov 2024), power-vendor product lines dated to it (Vertiv 2H 2026 “aligning to support the 2027 rollout”), facility provisioning ahead of it (the 1 MW/position Switch chamber, Dec 2024), standards canonization (Mount Diablo v0.5.2, May 2025). Forbids: **nothing**. The asymmetry is the dossier’s finding: the roadmap binds everyone except its author.

What happens when someone violates it. When a *customer* misses the cadence: nothing contractual — only the economics of holding generation N–1 while the author declares it ungiftable from a stage (18 Mar 2025). When the *author* misses it, the record now holds two dated instances: the Blackwell mask change (disclosed 28 Aug 2024; ~3 months; “There were no functional changes necessary.” — Huang, that call) and the reported Kyber slip (30 Jun – 6 Jul 2026; 12+ months; quad-die package cancelled for dual-die; NVL72x2 stopgap axed after the largest customers balked; the 78-layer midplane named as the cause) — met with a complete corporate response of four words and no follow-up answers. Consequences to the author: none enforceable. Consequences to the ecosystem: a year of 800 VDC product lines potentially selling into a market whose anchor tenant slipped — priced publicly by nobody yet.

The skeptical caveat. Is it binding, or a press release with a docket number? **It is a forecast wearing a specification’s costume — and it doesn’t even have the docket number.** What keeps it from being *only* theater: the shipped record tracks the slides within months (GB200 first ship 17–18 Nov 2024; GB300 3 Jul 2025, seven months later; Rubin production Jan 2026), and the OCP substrate is genuine engineering — drawings, envelopes, volumetrics — that hundreds of firms build to. The honest characterization for the drafting AI: the most consequential technical document in the industry and the least binding piece of paper in this course; the interconnection agreement’s exact inverse, placed by the class rotation at the opposite end of the cascade.

The document’s history and fate. Versioning: two-year cadence → one-year rhythm (declared 2 Jun 2024); Blackwell delayed ~3 months by a mask (Aug 2024); rack redesigns over overheating pre-volume (The Information, Nov 2024); the 2025 edition publishing 2H 2027 at ~600 kW; the 2026 edition doubling the order framing; then the June–July 2026 sequence — quad-die → dual-die (reported 30 Jun), Kyber → 2028 (reported 6 Jul), NVL72x2 cancelled, “Our roadmap is intact.” (6 Jul, 4:10 p.m. PT). No FOIA, no sealing, no court fight — this document’s confidentiality battles happen in supply chains and are litigated by analysts; the SemiAnalysis-vs-NVIDIA exchange is this dossier’s version of The Dalles’ 13 months, compressed into six days.

Returning documents. The roadmap is **lead here**; its assigned returns take brief-reference only, and this pack pre-allocates what each return adds so no later pack rebuilds it: **L3** — the thermal consequence only (each edition’s kW is the cooling lecture’s input; one sentence of provenance, no ladder re-derivation); **L6** — the depreciation consequence only (the cadence as the clock the useful-life assumption runs against); **L9** — the treadmill line only (the five-to-seven-year refresh, 500 km from the nearest screwdriver). No documents from earlier lectures return *into* L2 (verified against the Roster’s cross-lecture table: the interconnection agreement, JLARC, and the Action Plan first appear later).

SECTION 6: THE NUMBER SPINE

(Research-document table — permitted here, banned in published prose.)

#	figure	unit	stage	as-of	author/filer	source	tier	notes
1	72 / 36	GPUs / CPUs per rack	shipping	2024–	NVIDIA	product page	ANCHOR (spec)	must-hit
2	120 kW	rack draw (rate), nominal	shipping	2024	NVIDIA	GTC/spec	STRUCTURAL	must-hit low bound

#	figure	unit	stage	as-of	author/filer	source	tier	notes
3	130–132 kW	rack draw (rate), observed full load	deployed	2025–26	HPE sheet; deployments	Spheron guide	STRUCTURAL	must-hit high bound; basis stated
4	1.36 t / 3,000 lb	mass	shipping	2024	NVIDIA via trade	Sunbird; Register	STRUCTURAL	
5	600×1,068×2,236 mm	dimensions	shipping	2024	NVIDIA via trade	Sunbird	STRUCTURAL	
6	~\$3M / ~\$1.8M	per NVL72 / NVL36 rack	estimate	13 May 2024	HSBC	via TechSpot	VOLATILE	no list price exists — always attributed
7	\$30,000–40,000	per Blackwell GPU	seller's stated ASP	19 Mar 2024	Huang	CNBC	VOLATILE	seller's own number
8	\$60,000–70,000	per GB200 superchip	estimate	May 2024	HSBC	via TechSpot	VOLATILE	
9	130 TB/s · 1.8 TB/s	NVLink aggregate · per GPU	spec	2024	NVIDIA	product page	ANCHOR (spec)	
10	13.4–13.5 TB	HBM3e per rack	spec	2024	NVIDIA	page vs guides	STRUCTURAL	trivial source variance — Discrepancy D
11	>5,000 · ~2 mi (3.2 km)	copper cables · length	spec	Oct 2024	NVIDIA	dev blog; teardowns	STRUCTURAL	~20 kW saved vs optics
12	18 · 9 · 6 · 4	compute trays · switch trays · power shelves · NVLink cartridges	spec	2024	NVIDIA	dev blog; teardowns	STRUCTURAL	
13	~2,700 W · ~1,200 W	per superchip · per GPU	deployed	2024–26	teardowns	Continuum; ToneCooling	STRUCTURAL	teardown-estimated
14	1.5 M · 350	components/rack · plants	cfg	26 Feb 2025	Huang	Q4 FY25 call	STRUCTURAL	paraphrase-marked
15	6.1 kW	avg rack density	survey	2016	AFCOM	via Enconnex	STRUCTURAL	Discrepancy A — anchor says 2020
16	8.2 kW · 8.4 kW	avg rack density	survey	2020	AFCOM · Uptime	DCF; Uptime journal	STRUCTURAL	the documented 2020 values
17	7 → 8.5 → 12 → 16 → 27 kW	avg rack density series	survey	2021→2026	AFCOM	via Upsite	VOLATILE (annual)	27 kW = As-Of Stamp value
18	<8 kW · ~7.6 kW	fleet-mean density	survey	2024 · 2025	Uptime	via Upsite; ModulEdge	STRUCTURAL	direct-source pull flagged
19	~15 kW	practical air ceiling per rack	physics/practice	standing	industry	L3 anchor	ANCHOR	one-line use only — L3 owns

#	figure	unit	stage	as-of	author/filer	source	tier	notes
20	~25 → ~40 → 72 → ~132 → ~190–240 → ~600 kW	NVIDIA reference- design rack ladder	shipped→projected	2022→2027E	NVIDIA via Schneider	SE blog 23 Jul 2025	STRUCTURAL	LAST-CONFTESTED date disputed
21	~600 kW · 2.5 M parts	Kyber rack draw · parts	announced	18 Mar 2025	Huang/NVIDIA	GTC; DCD	CONTESTED (date)	must-hit “2027 projected”
22	2H 2027 vs 2028	Kyber ship date	announced vs reported	6 Jul 2026	NVIDIA vs SemiAnaly- sis	Tom’s; CNBC	CONTESTED	the pack’s hottest row
23	78 layers	Kyber midplane PCB	reported	Jul 2026	SemiAnalysis	via TechTimes	CONTESTED	corporate silence on specifics
24	~110	avg US homes per 132 kW	derived — shown	2026	this pack (EIA denom via L1)	Section 4	STRUCTURAL	conversion retarget required
25	1.3 M vs 3.6 M	Hopper units sold (2024) vs Blackwell ordered (2025)	mixed stages	18 Mar 2025	Huang slide	keynote via Barchart	VOLATILE	stage-blur specimen — see audit
26	\$11 B	Blackwell rev, first full quarter	filed	26 Feb 2025	NVIDIA	Q4 FY25	STRUCTURAL	fastest ramp claim
27	\$57.0 B · +\$10 B QoQ	quarterly revenue	filed	19 Nov 2025	NVIDIA	Q3 FY26	STRUCTURAL	
28	\$500 B → \$1 T	Blackwell+Rubin order visibility	bookings/POs — NOT revenue	19 Nov 2025 → 16 Mar 2026	Kress; Huang	calls; GTC	VOLATILE	stage label mandatory every use
29	\$215.9 B	FY2026 revenue	filed	Feb 2026	NVIDIA	10-K via tech press	STRUCTURAL	
30	\$81.6 B · \$75.2 B	Q1 FY27 revenue · DC revenue	filed	20 May 2026	NVIDIA	SEC PR	STRUCTURAL	quarter ended 26 Apr 2026
31	\$91 B ±2%	Q2 FY27 guidance	guided	20 May 2026	Kress	official PDF	VOLATILE	resolves 26 Aug 2026
32	\$18.6 B	Q1 FY27 private- company/infra investments	filed	20 May 2026	NVIDIA	filing via CNBC	STRUCTURAL	L6 circularity plant — one line max
33	~\$20–25 · ~\$30± · higher	\$B NVIDIA content per GW by generation	seller’s oral figures	19 Nov 2025	Huang	Q3 FY26 Q&A	VOLATILE	round, oral, motivated
34	168 · 10–20 MW	Tesla Megapacks at Colossus · training-load swing	deployed	2024–25	reporting	Wikipedia; RDWorld	STRUCTURAL	L4 seed
35	122 · 92 · 19	days: build · doubling · first-rack-to- training	occurred	2024	multiple; NVIDIA acct	Introl; Klockwood	STRUCTURAL	L9-day figure seller- adjacent

#	figure	unit	stage	as-of	author/filer	source	tier	notes
36	250 kg	raised-floor tile rating	standard	—	industry	Spheron	STRUCTURAL	row 4
37	>150% · 200 kg · 64U	800VDC copper gain · legacy busbar per MW rack · power-shelf space at 54V	vendor- stated	May 2025	NVIDIA	800VDC blog	STRUCTURAL	seller's own engineering case
38	~\$4.96–5.04 T	market capi- talization	mark	Jun 2026	market	tech-insider	VOLATILE	mark, not verdict

Reconciliation against the must-hit anchors. Discrepancy A (material): the anchor series “6.1 kW (2020)” cannot be reproduced — 6.1 kW is AFCOM’s 2016 value; documented 2020 values are 8.2 kW (AFCOM) and 8.4 kW (Uptime, outliers trimmed). Anchor value carried unchanged everywhere in this pack per protocol; researched values and both sources tabled above; **resolution options for Nick:** re-date to “6.1 kW (2016),” or re-value to “8.2 kW (2020)” — either preserves the step function; the 2016 dating widens it. **Discrepancy B (interpretive):** “a 7–9x discontinuity” — 6.1→27 is 4.4x; 27→600 is 22x; the reading that lands in 7–9x is the building-design-vs-arriving-rack ratio (132/15 ≈ 8.8x), which Syllabus 2.0’s own closer phrasing supports; recommend the Course Schema pin the 7–9x explicitly to that ratio so Draft 1 doesn’t reach for the wrong division. **Anchor “~600 kW NVL576 (2027 projected)”:** survives as written — “projected” absorbs the July 2026 dispute — but the dispute (rows 22–23) must ride wherever the figure deploys. **Anchors “GB200 NVL72 (72/36/120–132 kW)” and “rack-as-unit thesis”:** verified clean, no variance. **No silent substitutions were made anywhere in this pack, including Section 4.**

Capacity/energy audit. Every power figure in the spine is a rate (kW per rack; GW of content denominator) and labeled; no TWh quantities appear in this lecture’s territory. One blur specimen documented for course use, from the seller’s own stage: row 25 mixes *units sold* with *units ordered* on a single slide — a stage blur rather than a unit blur, and the lecture’s native specimen. One approving note: Huang’s own formulation that a one-gigawatt data center is one gigawatt of power (Q3 FY26 Q&A, paraphrase-marked) is correct usage of capacity-as-budget — the seller performing the course’s cardinal rule when it serves him.

Phantom-load audit. No utility-queue aggregates appear here (L4’s territory), but the lecture carries their commercial cousin and the caveat attaches on first use: the **\$500B/\$1T order books** (row 28) aggregate purchase orders whose cancellation and re-scheduling terms are undisclosed, and whose buyer set includes entities NVIDIA itself finances (row 32) — so the aggregate may count some demand twice (vendor-financed orders) and some zero times (unbooked sovereign deals Kress says will grow the number). The unit-count analog: “3.6M Blackwell ordered” may double-count across CSP-and-neocloud channels serving the same end customers. Honest unknown; the full circularity treatment belongs to **Lecture 6** — this lecture attaches the caveat and moves on.

SECTION 7: THE SELLERS & THE OVERCLAIMS

The assignment, led with: seller on the field — **the Hyperscaler/vendor** (here, the vendor proper: NVIDIA); governing move — **GRANT-AND-WITHHOLD**. Pressure-test verdict up front: **the assignment fits the record as researched — confirmed**, with the DISCOUNT machinery borrowed for the order-book numbers (below).

Claim cluster 1 — “The roadmap as destiny.” *As sold:* the annual keynote editions (dated in Section 5), each publishing density futures 18–30 months out, capped by the years-of-planning line (GTC 2025, paraphrase-marked). *Venue and date of sale:* arenas — 18 Mar 2024, 2 Jun 2024, 18 Mar 2025, 16 Mar 2026. *What the seller gets if believed:* orders pulled forward; ecosystem tooling lock-in (Vertiv, Schneider, Eaton product lines dated to NVIDIA’s calendar); utility-negotiation altitude via content-per-GW. *What’s real underneath, granted precisely:* the shipped cadence — GB200 first racks 17–18 Nov 2024, GB300 3 Jul 2025, Rubin production Jan 2026 — tracks the slides within months; the perf-per-watt gains are real and independently benchmarked (MLPerf 4.1: B200 ~2.2x H100 on cited workloads); the density trend is confirmed by AFCOM’s independent survey (16→27 kW). *What’s oversold, named exactly:* the **dates as certainties** (two documented

author-side slips: ~3 months in 2024, 12+ months reported and denied in 2026); the **capability ceilings** (27-trillion-parameter training for a model class that does not exist); the **inevitability framing** (the roadmap forbids nothing and binds only its believers). *Move check*: GRANT-AND-WITHHOLD — confirmed; punch on the hype, never the engineers, and the July 2026 midplane story is engineers being *right* about difficulty while the slide was wrong about the date.

Claim cluster 2 — “Sold out, permanently.” *As sold*: Kress, “staggering demand,” 20 Nov 2024; sold-out-12-months channel checks, Nov 2024; Huang’s bubble rebuttal and sold-out framing, 19 Nov 2025; “In fact, we are going to be short.” — GTC 2026, 16 Mar 2026; constrained-for-Vera-Rubin’s-entire-life, 20 May 2026 (paraphrase-marked). *What the seller gets*: allocation discipline (order early, order big), pricing power, and a scarcity narrative that is itself demand marketing. *Real underneath*: \$50B shipped in a single quarter (Q3 FY26); \$75.2B DC revenue in Q1 FY27; independent checks corroborating tight supply through mid-2026. *Oversold*: permanence — scarcity is a ratio of two forecasts (supply ramp ÷ order book), and both numerator and denominator are authored by parties who benefit from the ratio staying under one. *Move*: GRANT-AND-WITHHOLD.

Claim cluster 3 — the order book (\$500B → \$1T). *As sold*: Kress, 19 Nov 2025 (visibility through calendar 2026); Huang, GTC DC 28 Oct 2025 (“Half a trillion dollars’ worth so far.”); Huang, GTC 2026 (\$1T in POs through 2027). *What the seller gets*: the single most effective anti-bubble exhibit available — demand rendered as a booked number. *Real*: the shipped and filed revenue behind it is enormous and audited. *Oversold / DISCOUNT applied*: the figure is **bookings/POs, not revenue** — stage label mandatory every use; terms undisclosed; double-count and vendor-financing exposure per Section 6’s phantom-load audit; the number’s own author announced it would grow before the ink dried. Output a labeled number, never a bare one.

Claim cluster 4 — the counter-seller (SemiAnalysis and the analyst layer). The register’s symmetry requires it: *as sold* — quad-die cancellation (30 Jun 2026), Kyber-to-2028 (6 Jul 2026), the 78-layer midplane diagnosis. *What this seller gets if believed*: subscriptions, and the reputational compounding of being right before the filing. *Real underneath*: a documented supply-chain sourcing practice and a track record the trade press treats as citable; the dual-die direction independently corroborated through supply-chain reporting. *Oversold risk*: single-firm sourcing on the schedule specifics; the subject company’s denial on record; no primary document yet. *Move*: **HOLD OPEN** — map both camps (analyst reporting vs. four-word denial), refuse the winner, and name what settles it: NVIDIA’s 26 Aug 2026 call, GTC 2027, and supplier-side filings through the fall.

Claim cluster 5 — the doomer direction, audited as hard. *As sold (composite of the season’s commentary, no single filer)*: the cadence proves the capex is self-liquidating folly — assets declared worthless by their own vendor within 16 months make the whole trade a bubble. *Real underneath*: the depreciation tension is genuine and this lecture documents its physical cause; the resale rhetoric is the vendor’s own tape. *Oversold*: the conclusion outruns the data — at fixed grid power, refresh economics can be rational (the perf/watt argument the analysts themselves steelman on the 19 Nov 2025 tape); Hopper’s actual secondary-market behavior contradicted the keynote rhetoric (trade coverage, Mar 2025: still useful, cheaper, available); and fleet utilization data — the number that would decide — is published by nobody. *Move*: the skepticism cuts both ways; the verdict stays sealed for Lecture 10’s Ledger.

The steelman file. Per the rotation, **Lecture 2 carries no assigned standalone Steelman defendant** — the steelman function is folded into the Hearing Room, where it is performed by named analysts on tape (Beat 8: Muse’s sold-out-before-B300 framing; Arya’s dollars-per-gigawatt discipline; Huang’s fixed-gigawatt perf/watt answer). The full ammunition depot for the fold — and for Open Item 10’s alternative casting (*defendant: NVIDIA’s cadence*) — is assembled in Beat 5’s audit section and Cluster 1’s “real underneath”: the strongest case, in the defendant’s own numbers, that an annual cadence at fixed grid power is customer-rational engineering rather than extraction. A précis it is not; the defendant’s best documents (the shipped-date record; the MLPerf results; the Q3 FY26 Q&A) and best line (the one-gigawatt-is-one-gigawatt argument) are all located and dated. The same party is steelmanned nowhere else in the course — rotation clean if markup activates it.

SECTION 8: THE HUMAN FLOOR

Verified empty — and the verification is the deliverable. No beat in this lecture’s territory touches a household, a ratepayer, a fence-line resident, or a documented worker’s job fear. No pack dependency for a named human was flagged for Lecture 2 by Syllabus 2.0, its Open Items, or the Roster (checked against the Roster’s debt list: L2’s debts are quotes and titles, all resolved in Run 1). Nothing is padded into this section to fill it; an honest empty floor beats a stretched one.

Two adjacent zones, flagged with their handling rules so the drafting AI inherits them precisely: (1) **Operator Reality's trades** — riggers, millwrights, electricians — are documented as trades, not as harmed parties; standard punch-up-only comedy rules apply, full floor protocol does not; no individual is named because none surfaced at quote level, and none may be invented. (2) **The Founder Audit's childhood material** — the Kentucky boarding school, the bathrooms, the Denny's shifts at fifteen — is hardship narrated by its subject; comedy off across that span, resuming only where the corporate mythology begins. (3) For completeness: the earnings-call room is not a human floor; analysts asking about vendor financing are not fence-line residents, and the thermostat runs normally there.

The floor arrives in this course one lecture later, at a well in Newton County, Georgia — owned entirely by Lecture 3's pack.

SECTION 9: THE PEOPLE & THE CAST

THE HUMANS.

Jensen Huang — founder, president, and CEO, NVIDIA; title unchanged since 5 Apr 1993; **verified in role as of July 2026** (no “then-” convention needed anywhere in this lecture). Born 17 Feb 1963, Tainan, Taiwan. Trajectory with the details that do narrative work: sent to the US as a boy; boarded at Oneida Baptist Institute, Kentucky (the school his family mistook for a prep academy; he cleaned dorm bathrooms); Denny's dishwasher and busboy from 15 [comedy off across this span — Section 8]; BSEE Oregon State 1984; MSEE Stanford 1992 taken at night; AMD, then LSI Logic; the 30th-birthday founding deadline (self-narrated, mythology-tier, flagged); the Denny's-booth incorporation on \$40,000 (5 Apr 1993); the NV1 near-death (1995) and the thirty-days-from-going-out-of-business mantra it minted; CUDA (2006) as the decade-early bet; AlexNet (2012) as the vindication he himself dates the pivot to; the hand-delivered DGX-1 to OpenAI (Aug 2016). What he wants: the roadmap believed and the cadence funded. What he fears (on the record, by revealed behavior): losing the frontier to his own prior generation — hence the self-cannibalizing keynote of 18 Mar 2025. What he can enforce: nothing, contractually — the roadmap binds no one; what he actually enforces is allocation. What he actually did: shipped the cadence within months of the slides, three years running, then met a circuit board. Documented quotes, one deployment each, all dated in Runs 1–2: the one-year rhythm (2 Jun 2024); “Hopper is fantastic, but we need bigger GPUs.” (18 Mar 2024); “I'm the chief revenue destroyer.” (18 Mar 2025); “Half a trillion dollars' worth so far.” (28 Oct 2025); the bubble rebuttal (19 Nov 2025); “In fact, we are going to be short.” (16 Mar 2026). Current status as of research date: CEO of the world's most valuable public company (~\$5T, June 2026 — mark, not verdict), publicly vowing “giant amounts” of Vera Rubin while declining to address the Kyber reports.

Colette Kress — EVP & CFO, NVIDIA, since 2013; verified in role July 2026. Function in this lecture: the filer — every keynote number acquires its stage label only in her disclosures. Her dated record here: the mask-change disclosure (28 Aug 2024); “staggering demand” (20 Nov 2024, two-word quote); the \$500B visibility formulation and the \$3–4T decade framing (19 Nov 2025, paraphrase-marked, official PDF locator); the Vera-CPU \$200B-market and ~\$20B-CPU-revenue claims (20 May 2026, paraphrase-marked). Treat as the roadmap's accountant: where Huang publishes futures, Kress publishes the stage labels — the course's unit discipline has an in-house practitioner.

Michael Dell — chairman & CEO, Dell Technologies (verified in role Nov 2024 and July 2026). One documented act in this lecture: the 17–18 Nov 2024 first-shipment announcement, by tweet, rocket emoji included (“The AI rocket just got a massive boost!”). Function: the integrator's ribbon-cutting — a \$3M industrial object launched on social media.

Charles Liang — founder & CEO, Supermicro (verified in role 2024–26). Documented act: confirming the 122-day Colossus build partnership. Function: the other integrator, and the rack-anatomy source (64-GPU liquid racks, bottom-of-rack CDUs, rear-door heat exchangers) via the documented Colossus teardowns.

Bill Kleyman — Executive Chair, Data Center Programs, AFCOM/Informa; CEO & co-founder, Apolo.us; author of the AFCOM State of the Data Center series (as-of titles per the 2026 report coverage). Function: the density series' human author — the As-Of Stamp has a byline. One quote deployed: “Rack density rocketed up the past year” (via Upsite, 11 Jun 2026).

The Hearing Room roster (Beat 8; brief, documented, no full profiles needed): Joe Moore (Morgan Stanley), C.J. Muse (Cantor Fitzgerald), Vivek Arya (BofA Securities), Ben Reitzes (Melius Research), James Schneider (Goldman Sachs), Timothy Arcuri (UBS), Stacy Rasgon (Bernstein Research), Aaron Rakers (Wells Fargo) — affiliations per the official 19 Nov 2025 transcript PDF. Incentive noted once, without rube-ery: sell-side steelmen are genuine and motivated simultaneously.

THE INSTITUTIONS.

NVIDIA — the seller (Section 7). Motive and exposure in numbers, dated: data center ~90% of revenue; FY2026 revenue \$215.9B (+65%); Q1 FY27 \$81.6B with \$75.2B data center; Q2 FY27 guided \$91B ±2%; \$18.6B invested into private companies and infrastructure funds in a single quarter, with the company's own filing noting some investees may indirectly purchase its products (20 May 2026) — the circularity thread, planted at one line, **owned by Lecture 6**. What it filed: quarterly results, the roadmap's unfiled editions, and the OCP contributions. What it gets if believed: Section 5's dossier, entire. Incentives-plus-constraints, never villainy: the cadence is also the competitively required move against AMD's Instinct line and Google's TPUs — the July 2026 coverage itself frames the Kyber slip as handing AMD and Google a rare opening.

Dell Technologies & Supermicro — the integrators. Incentive: tooling plus services revenue on every rack; the production of arrival (“fully integrated,” “fully assembled, tested”). Exposure: their lines are dated to the roadmap's calendar; an author-side slip is their idle capacity.

The Open Compute Project — the industry's shared drawing board (founded by Facebook, 7 Apr 2011; funded and steered by hyperscalers). Incentive: commoditize everything below the chip. Role here: the mechanism by which one vendor's proprietary rack (contributed 15 Oct 2024) and one vendor's voltage (the Oct 2025 whitepaper; Mount Diablo v0.5.2, May 2025, from Google/Meta/Microsoft) become everyone's standard — the roadmap's gravity, institutionalized.

Vertiv, Schneider Electric, Eaton (with the wider ~20-partner 800 VDC alliance: ABB, GE Vernova, Hitachi Energy, Mitsubishi Electric, Siemens, et al.) — the electrical-equipment industry as the roadmap's most committed believers: product lines publicly dated to NVIDIA's calendar (Vertiv portfolio 2H 2026 “aligning to support the 2027 rollout”; Eaton reference architecture Oct 2025; Schneider's committed-in-advance-of-every-platform blog language, paraphrase-marked). Incentive: every kilowatt of density is TAM.

Tesla Energy — secondary; vendor of the 168 Megapacks buffering Colossus's 10–20 MW training swings. Function: the physical proof that the rack now talks back to the grid — **the L4 seed; grid-side treatment owned by the L4 pack**.

TSMC — named, not treated. The door (Section 4's Gesture; Section 10's fence).

THE OBJECTS.

The GB200 NVL72 (lead — the full object dossier, consolidated from Run 1 for the Roster's use). Provenance and manufacture: 1.5M components from 350 plants (Huang, 26 Feb 2025, paraphrase-marked); assembled by the ODM/integrator layer; ships as a rack. Dimensions and mass: 600×1,068×2,236 mm; 1.36 t / 3,000 lb. Cost: ~\$3M (HSBC estimate, May 2024; no list price exists). Lead time: demand over supply for several quarters (Kress, Nov 2024); sold out ~12 months per checks (Nov 2024); effectively sold out through mid-2026 (CES-season checks). Tolerances: the blind-mate backplane — >5,000 copper cables, ~2 miles, seated in one motion. Documented failure modes, dated: the mask change (Aug 2024); pre-volume overheating redesigns (Nov 2024); leak-class risks inherited by L3; and, generationally, the midplane class of failure (Jul 2026, next rack). Chain of custody: fab → package → superchip → Bianca board → tray → rack → truck → crane → roof penetration → busway → loop. Current disposition: shipping in volume; successor GB300 NVL72 (~142 kW) shipping since 3 Jul 2025; successor's successor in production since Jan 2026. Complete enough to open a lecture cold — which is its job.

The Kyber midplane — the object the record surfaced after the syllabus stack was written: a 78-layer PCB, three 26-layer boards laminated under heat and pressure, traces a quarter of a human hair wide, roughly the size of a kitchen table, through which every GPU-to-GPU signal in a 144-package rack must pass (TechTimes technical summary of the SemiAnalysis reporting, Jul 2026; CONTESTED per NVIDIA's denial). Offered to markup as a candidate future Cold Open for any refreshed edition — the constraint machine's newest part is a piece of laminate.

The H100 — one line only: the predecessor whose peak year (1.3M units, 2024) and keynote-declared ungiftability (Mar 2025) power Beats 5 and 10. **Full treatment as collateral is Lecture 6's lead — do not rebuild.**

The Tesla Megapack — secondary object: 168 units between Colossus and the grid, buffering 10–20 MW swings. **Cascades into L4; seed only.**

THE DOCUMENTS — Section 5; cross-referenced, not duplicated.

Recurring-cast discipline, stated for the downstream packs: the rack roadmap and the GB200 NVL72 are **lead here** — Lectures 3, 6, and 9 take returns at brief-reference grade, with their allocated additions pre-listed in Section 5. Huang is lead here with no assigned return lecture (L9's humans are Johnston, Bezos, Musk; the roadmap returns there, not its

narrator — if a draft wants Huang’s voice in L9, it uses the roadmap document, per the Roster). OCP, the integrators, and the Megapack are secondaries with no full treatment owed anywhere.

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

The edge, restated: Inherits: the appetite · Binds at: electrical distribution inside the building · Who pays: whoever designs against the roadmap · Manufactures: a thermodynamics problem wearing a hardware costume → L3.

Edge 1 — the inherited problem, with fresh specifics. Lecture 1 established the appetite at civilization scale (the ~1,050 TWh, the Japan bracket, Virginia’s share, the county’s budget). Lecture 2 re-establishes it for the sampler *from inside the building*, with instances the L1 pack does not own: 3.6 million Blackwell GPUs ordered by March 2025 against 1.3 million Hoppers sold in the peak year; a single vendor’s data center line at \$75.2B in one quarter; orders placed in 100,000-GPU increments; a rack that draws a hundred homes’ worth. **Specifics the L1 pack already owns — do not repeat:** the ~50-full-timers DISPATCH plant; the EPRI homes-per-100-MW conversion and the 1.2 kW household denominator’s derivation (this pack *uses* the denominator by cross-reference; it does not re-derive it); the campus anatomy and the small parking lot; the CBRE vacancy/pricing series; JLARC; MAE-East and all peering history; the county tax mechanics (L2’s Beat 10 cross-references the 50%-year-one assessment in one clause, maximum).

Edge 2 — the manufactured problem and the Handoff. Assigned mechanism: *cost left unassigned* (rotation-verified: L1 ran *question*, L3 runs *character walking* — no adjacent repeats). The documented material: conservation of energy — 132 kW enters the cabinet as electricity and 132 kW leaves as heat (ANCHOR; no source decays it); at this point in the course, nobody has priced the leaving. The closing ~200 words state the unpriced cost and stop. **Alternates from the record, for markup rotation if the seam needs it:** (a) *a door explicitly not opened* — the coolant quick-connects couple in Beat 3’s crane day and the loop goes unfollowed (legal: distinct from the Gesture’s sanctioned doors; it’s a structural tease, not a boundary door); (b) *question left hanging* — where does a hundred homes’ worth of heat go, every hour, forever? — legal but repeats L1’s mechanism at one lecture’s distance (rotation permits non-adjacent repeats; L1–L2 are adjacent, so **this alternate is barred**; noted so markup doesn’t reach for it); (c) *the bill walking* — the facility’s first cooling invoice — trespasses on L3’s opener (The Bill Arrives, a county water invoice); **barred**. Net: the assigned mechanism is also the best available; alternate (a) is the only clean rotation.

Refresh-safe handoffs. Verified: both edges hinge on structural facts — the appetite (structural) in; thermodynamics (ANCHOR) out. **Hard flag for Draft 1:** the Handoff must not hinge on the ~600 kW/2027 pairing (CONTESTED) or any order-book dollar (VOLATILE). A 2027-Briefing refresh that swaps every NVIDIA figure leaves both seams intact.

The boundary doors. *The assigned door:* silicon fabrication — the Gesture’s one-inch inventory lives in Section 4; fence audit passed there (no fabrication, yield, packaging-process, or foundry-economics research anywhere in this pack; the 2024 mask and 2026 quad-die stories are handled strictly as schedule events with corporate authors, never as process explanations). *Unassigned doors this lecture’s material presses against, flagged so the drafting AI knows where the fence runs:* (1) **training-run internals** — Beat 11’s rationale (“why 72 GPUs in one NVLink domain matters for training topology”) walks up to this door; Lecture 2 is **not** among Open Item 9’s three candidate lectures (L1, L6, L8), so regardless of Nick’s third-door call, L2 treats training topology as a stated input — one clause, no gesture, no inch. (2) **the reactor door** — untouched; nothing here approaches it. (3) **export-control/China trade** — an unassigned pressure zone, not a sanctioned door: the H20 material (the \$4.5B charge, May 2025; no-material-H20-sales, Nov 2025; Vera-CPU-to-China preparation, Jul 2026) is inventoried in Sections 3 and 11 and stays out of the beats unless markup writes it in.

Cross-lecture consistency notes — what this pack claims, and what it must not touch. *Claimed by L2 (later packs take brief-reference only):* the rack density series and its discrepancy; the GB200 NVL72 object dossier and crane day; the roadmap document treatment entire (Section 5’s return allocations govern L3/L6/L9); the “chief revenue destroyer” scene and the Hopper-ungiftability material; the 19 Nov 2025 earnings room; the 800 VDC ecosystem story; the midplane story; the ~110-homes conversion. *Owned elsewhere — L2 uses one line maximum, or nothing:* **L1** — the list above; **L3** — the ~15 kW air ceiling’s full treatment, the forced liquid transition, cold-plate manufacture, PUE/WUE, Novec, The Dalles, the Morris; **L4** — the transformer and Schnabel railcar, the queue, everything grid-side including the Megapack’s consequences; **L5** — all procurement-of-power material; **L6** — CoreWeave, the S-1, the H100-as-collateral, GPU-hour pricing spreads, the circularity critique’s full treatment; **L8** — Memphis in its entirety (turbines, permits, hearings, jobs math); **L10** — useful-life extensions and reversals, Burry, the 2001 rhyme. The Colossus material this lecture may use is strictly the build-speed and rack/battery facts (Timeline 29–31); the moment a Memphis permit or neighbor enters the

sentence, the sentence belongs to Lecture 8.

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

Live status of every product, program, and dispute in this lecture, as of 20 July 2026.

- **GB200 NVL72:** shipping in volume since Nov 2024; effectively sold out through mid-2026 per CES-season channel checks (secondary). **GB300 NVL72 (~142 kW):** shipping since 3 Jul 2025.
- **Vera Rubin (VR200):** in production since Jan 2026 (per NVIDIA statements in trade coverage; direct primary pull flagged); volume shipments guided 2H 2026; platform formally announced with the Vera CPU at Q1 FY27 results (20 May 2026); Huang on the record that supply will be constrained for the platform's entire life (20 May 2026, paraphrase-marked). Rack draw ~190–230 kW per trade specs — **the number Lecture 3's refresh inherits.**
- **Rubin Ultra / Kyber (~600 kW):** published for 2H 2027 (18 Mar 2025; prototype shown 16 Mar 2026); **disputed to 2028** — quad-die package reportedly cancelled for dual-die (SemiAnalysis, 30 Jun 2026), Kyber NVL144 reportedly slipped on the 78-layer midplane (SemiAnalysis, 6 Jul 2026; CNBC same day), NVL72x2 stopgap reportedly axed on customer pushback; NVIDIA's complete response: "Our roadmap is intact." (6 Jul 2026, 4:10 p.m. PT, to Tom's Hardware; no follow-up answers). Huang, mid-July: vowing "giant amounts" of Vera Rubin, not addressing Kyber.
- **800 VDC ecosystem:** NVIDIA architecture published May 2025; OCP whitepaper Oct 2025; Eaton reference architecture Oct 2025; Vertiv portfolio scheduled 2H 2026; Mount Diablo v0.5.2 (May 2025). All now schedule-coupled to a disputed anchor tenant.
- **The density record:** AFCOM 2026 at 27 kW (from 16); Uptime's fleet mean still ~7.6–8 kW (direct-source pull flagged); next AFCOM value expected spring 2027.
- **The money:** Q1 FY27 filed 20 May 2026 (\$81.6B / \$75.2B DC); **Q2 FY27 guidance \$91B ±2% resolves 26 August 2026** — the next dated event on this lecture's calendar; order framing \$1T through 2027 (16 Mar 2026), stage-labeled per Section 6.

Pending events with dates (announcing party attached; all expected, none occurred): 26 Aug 2026 — Q2 FY27 earnings call (NVIDIA; scheduled on the Q1 call). · 2H 2026 — VR200 volume shipments (NVIDIA); Vertiv 800 VDC portfolio release (Vertiv, 13 Oct 2025). · Q4 2026 — DGX Station GB300 desktops from OEMs (NVIDIA via trade, moderate confidence). · Spring 2027 — AFCOM State of the Data Center 2027 (AFCOM; annual cadence). · March 2027 — GTC 2027 (NVIDIA; annual cadence) — the venue where the Kyber date resolves publicly if not before. · 2H 2027 or 2028 — Kyber/Rubin Ultra ships (NVIDIA vs. SemiAnalysis; **CONTESTED**). · 2028 — Feynman (NVIDIA; name only).

The decay register (every VOLATILE and CONTESTED figure, with direction and velocity). *Quarterly velocity:* NVIDIA revenue/guidance rows (up, until they aren't); market cap (mark); order-book totals (up by declaration — the author pre-announced growth); GPU-hour rack rents (down as supply lands; Spheron's as-of-dated \$10.50–27 range). *Annual velocity:* the AFCOM average (up; 2027 value replaces the As-Of Stamp); rack-price estimates (down per unit as generations turn, up per rack as density climbs — both directions documented). *Event-driven, could move any week:* the Kyber date and dual-die question (resolves at earnings/GTC/supplier filings); sold-out status; the China/H20 posture. *Never decays:* conservation of energy; the 8.8x building-vs-rack arithmetic's structure (its inputs refresh, its shape doesn't).

What just changed (last ~90 days — the facts most likely to blindside a draft built on the anchors alone). The entire syllabus stack (July 2026) was written essentially concurrent with, and partially ahead of, three developments this pack now carries: (1) **the Jun 30 – Jul 6 2026 Kyber/quad-die reporting cycle and NVIDIA's four-word denial** — directly stressing the must-hit "~600 kW NVL576 (2027 projected)," the Kicker, and the Paper Trail's ending; (2) **Q1 FY27 results (20 May 2026)** — the \$81.6B/\$75.2B/\$91B-guide numbers postdate Syllabus 1.0's research and should displace any smaller stale revenue figure a draft reaches for; (3) **the AFCOM 2026 release (spring 2026)** — which simultaneously *verifies* the ~27 kW anchor and *exposes* Discrepancy A on the 6.1/2020 dating. All three are flagged at their deployment points in Sections 2, 4, 5, and 6.

What is still hidden (honest uncertainty markers; the non-disclosure is itself course material). NVIDIA publishes no rack list price — the ~\$3M figure is an analyst's reconstruction of a price the market pays but never sees printed. Order-book terms — cancellation, re-scheduling, take-or-pay — are undisclosed, which is why a \$1T figure cannot be stage-labeled more precisely than "purchase orders." Fleet utilization and GPU retirement data — the numbers that would settle the obsolescence question and, downstream, Lecture 10's whole debate — are published by nobody. The actual NVL72-vs-NVL36x2 deployment mix is analyst-estimated only. The 2024 mask change's root cause was never disclosed beyond "no

functional changes.” The Kyber schedule’s true state is, as of the stamp date, a dispute between an analyst’s supply chain and four corporate words. None of these gaps is padded over anywhere in this pack.

SECTION 12: SOURCE INVENTORY

(Numbered; PRIMARY = the document/transcript/filing/spec itself; company sources flagged as the seller’s own. Begins with the Syllabus 2.0 source trail for Lecture 2, then supplements.)

The Syllabus 2.0 trail, resolved to specific instruments: [1] NVIDIA — GB200 NVL72 product page & datasheet — live as of 20 Jul 2026 — nvidia.com — PRIMARY spec language; the assigned Verbatim’s source. *Seller’s own document.* [2] NVIDIA — GTC 2024 keynote & Blackwell launch materials — 18 Mar 2024 — San Jose — PRIMARY: architecture facts (208B transistors; two reticle-limited dies; 10 TB/s; 4NP; the Blackwell naming); the Gesture’s inventory. *Seller’s own.* [3] Huang — pre-Computex keynote — 2 Jun 2024 — National Taiwan University, Taipei (NVIDIA blog “Accelerate Everything”) — PRIMARY: the one-year rhythm declaration; Rubin named. *Seller’s own.* [4] Rev.com — GTC 2025 keynote transcript — 18 Mar 2025 — rev.com — PRIMARY transcript: the Hopper-ungiftability passage; “chief revenue destroyer”; the peak-year chart. [5] Uptime Institute (A. Lawrence) — “Rack Density Is Rising” — 7 Dec 2020 — Uptime journal — PRIMARY survey analysis: the 8.4 kW 2020 mean; the fleet baseline; Discrepancy A evidence. [6] AFCOM — State of the Data Center Report 2026 — spring 2026 (exact date: pull) — AFCOM/Informa — PRIMARY survey: 27 kW (2026), 16 kW (2025), series to 2021; the As-Of Stamp. Accessed via [7]–[9]; direct-report pull flagged. [7] Upsite Technologies — “What Is Going On with Rack Density?” — 11 Jun 2026 — upsite.com — secondary carrying [6]’s series + Kleyman quote. [8] Enconnex — “Exploring Data Center Rack Density” — Jan 2025 — blog — secondary: AFCOM 6.1 kW = **2016** (Discrepancy A’s key citation). [9] Data Center Frontier — AFCOM 2020 State of the Data Center coverage — 2020 — DCF — secondary: AFCOM 2020 = 8.2 kW. [10] Open Compute Project — GB200 NVL72 contribution (rack, tray mechanicals, cooling envelopes, cable volumetrics) — 15 Oct 2024 — OCP contribution database — PRIMARY engineering substrate. [11] NVIDIA Developer Blog — “NVIDIA Contributes GB200 NVL72 Designs to OCP” — Oct 2024 — developer.nvidia.com — PRIMARY (seller’s own): the 5,000+-cable and tray-census language. [12] NVIDIA newsroom — OCP contribution release (Meta Catalina; Spectrum-X) — 15 Oct 2024 — GlobeNewswire/nvidianews — PRIMARY release. *Seller’s own.* [13] NVIDIA — Q3 FY2026 earnings call, official transcript PDF — 19 Nov 2025 — s201.q4cdn.com — PRIMARY: the Hearing Room corpus (Kress, Huang, all eight analysts, operator Sarah); page-pins flagged for draft stage. [14] NVIDIA — Q1 FY2027 results press release (SEC-filed) + official call PDF — 20 May 2026 — sec.gov; s201.q4cdn.com — PRIMARY: \$81.6B/\$75.2B; \$91B guide; Vera Rubin platform announcement; 26 Aug 2026 next-call date.

Earnings & corporate record, supplemental: [15] NVIDIA — Q2 FY2025 call — 28 Aug 2024 — via Benzinga/DCD transcripts — PRIMARY-adjacent: the mask-change disclosures (Kress; Huang’s no-functional-changes line). [16] NVIDIA — Q3 FY2025 call — 20 Nov 2024 — via Seeking Alpha/Kiplinger — PRIMARY-adjacent: “staggering demand”; supply-below-demand into FY26. [17] NVIDIA — Q4 FY2025 call — 26 Feb 2025 — via Motley Fool recap — PRIMARY-adjacent: \$11B first-quarter Blackwell; fastest ramp; 350 plants / 1.5M components; the anxious-and-impatient quote. [18] Fortune — Q4 FY2026 results coverage — 25 Feb 2026 — fortune.com — secondary: ~\$68B quarter; margins; the prior quarter’s bubble framing recap. [19] TradingKey — Q4 FY26 segment recap & Q1 FY27 preview — May 2026 — secondary: DC \$62.3B; networking +263%; Foxconn CPO rack revisions (supply-chain, flagged). [20] tech-insider.org — FY2026/Q1 FY27 consolidated figures & GTC 2026 quotes — Jun 2026 — secondary: \$215.9B FY26; ~\$5T cap; the trillion-dollar and going-to-be-short lines with dates. [21] Huang — GTC DC remarks — 28 Oct 2025 — Washington (via NBC News) — PRIMARY-adjacent: the half-a-trillion-on-the-books line. [22] CNBC — GTC 2026 keynote coverage — 16 Mar 2026 — cnbc.com — secondary on a PRIMARY event: \$1T POs through 2027; Kyber prototype; keynote date/venue. [23] CNBC — Q1 FY27 live blog — 20 May 2026 — cnbc.com — secondary: constrained-for-Vera-Rubin’s-life; Kress’s Vera-CPU claims; the \$18.6B investments filing note.

The object, teardowns, deployment: [24] SemiAnalysis — “GB200 Hardware Architecture — Component Supply Chain & BOM” — 2024 (rev. 2025) — newsletter.semianalysis.com — independent analyst PRIMARY-grade teardown: tray/Bianca/NVSwitch census; NVL36x2-vs-NVL72 deployment economics; copper-cost analysis. *Analyst incentive: subscription research.* [25] The Register — “One rack. 120kW of compute.” — 21 Mar 2024 — theregister.com — trade PRIMARY-adjacent (GTC floor reporting): 2 miles of NVLink cable; 27T-parameter claim context. [26] Continuum Labs — GB200 NVL72 technical teardown — Jun 2024 — training.continuumlabs.ai — secondary teardown: nine switch trays; blind-mate backplane; ~20 kW optics savings; six power shelves; per-tray watts (estimate-flagged). [27] Sunbird

DCIM — “Is Your Data Center Ready for the GB200 NVL72?” — 13 Nov 2024 — sunbirdcicm.com — secondary: dimensions, mass, 120 kW planning figures. [28] Spheron — “GB200 NVL72 Guide” — 22 Mar 2026 (as-of-dated) — spheron.network — secondary: 130–132 kW observed; HPE 115+17 kW basis; 250 kg tile rating; rack-vs-node rental math (\$10.50–27/GPU-hr). [29] Introl — GB200 NVL72 deployment guide; B200-vs-GB200 economics; Vera Rubin 600 kW; Colossus infrastructure — 2025–26 — introl.com — deployment-trade secondary: four-component arrival weights; door-width constraint; ~\$70k superchip/~\$3M rack corroboration; 800 VDC claims (vendor-derived, flagged). *Vendor incentive: deployment services*. [30] ToneCooling — GB200 cooling requirements engineering note — 2026 — tonecooling.com — vendor secondary: ~1,200 W/GPU; heat-flux context. *Vendor incentive flagged; L3-adjacent, used for wattage only*. [31] TechSpot — “Blackwell server cabinets could cost \$2–3M” (HSBC estimates; Morgan Stanley math; tae kim relay) — Jul 2024 (estimates 13 May 2024) — techspot.com — secondary carrying the pricing PRIMARY (HSBC note). [32] CNBC — Huang interview: Blackwell \$30–40k — 19 Mar 2024 — cnbc.com — PRIMARY-adjacent (seller on tape). [33] IEEE Spectrum — “Nvidia Unveils Blackwell” — Mar 2024 — spectrum.ieee.org — independent technical secondary: die geometry, memory, the David Blackwell naming context.

The roadmap’s later editions and the dispute: [34] Data Center Frontier — GTC 2025 infrastructure roundup — Apr 2025 — DCF — secondary: NVL576 600 kW framing. [35] DCD — “Rubin Ultra NVL576 expected to be 600kW, 2H 2027” — Mar 2025 — datacenterdynamics.com — trade secondary on PRIMARY event: the 600 kW/2.5M-parts/years-of-planning passage (paraphrase locator). [36] Tom’s Hardware — GTC 2025 roadmap; Kyber mockups — 18–19 Mar 2025 — tomshardware.com — trade secondary: NVL144/NVL576 configurations; Huang’s Q&A verification of 600 kW. [37] Tom’s Hardware — quad-die Rubin Ultra reportedly cancelled — early Jul 2026 — trade secondary on SemiAnalysis reporting. [38] Tom’s Hardware — “Kyber rack reportedly delayed to 2028 [Updated]” — 6 Jul 2026 — trade secondary: the midplane; NVL72x2 axed; **NVIDIA’s “Our roadmap is intact.” statement with timestamp**. [39] CNBC — “Kyber rack system delayed to 2028” — 6 Jul 2026 — cnbc.com — secondary: the SemiAnalysis quote; national carry. [40] TechTimes — Kyber NVL144 midplane analysis — 9 Jul 2026 — techtimes.com — secondary: 78-layer construction detail; the 30 Jun quad-die timeline. [41] Tom’s Hardware — “Huang vows ‘giant amounts’ of Vera Rubin” — mid-Jul 2026 — trade secondary: the present-tense posture; Vera-CPUs-to-China note. [42] wccftch — NVIDIA quashes delay rumors — Jul 2026 — secondary: the denial’s circulation; Oberon/Kyber naming. [43] VRLA Tech — NVIDIA GPU roadmap 2026–2030 consolidated — 8 Jun 2026 — secondary: GTC 2026 Rubin Ultra hardware demo (1 TB HBM4e on Kyber); Feynman notes (rumor-flagged where marked). [44] ModulEdge — “Nvidia Blackwell” & “Nvidia Vera Rubin” explainers — Jun 2026 — moduledge.com — secondary synthesis: 7.6 kW Uptime 2025 cite; VR200 190–230 kW; Jan 2026 full-production claim; stranded-facility framing. *Direct-source pulls flagged for the Uptime and production-date claims*.

Power architecture: [45] NVIDIA Developer Blog — “NVIDIA 800 VDC Architecture Will Power the Next Generation of AI Factories” — May 2025 (updated 31 Jul 2025) — developer.nvidia.com — PRIMARY (seller’s own): the 200-kg-busbar sentence; the 64U-at-54V fact; the GTC 2025 800 V sidecar exhibit. [46] NVIDIA Developer Blog — “Building the 800 VDC Ecosystem” + whitepaper announcement — Oct 2025 — developer.nvidia.com — PRIMARY (seller’s own): full three-tier partner roster; OCP 2025 whitepaper. [47] DCD — “Nvidia prepares industry for 1MW racks and 800V DC” — Oct 2025 — trade secondary: 20-partner framing; sidecar racks; Foxconn Kaohsiung-1; designing operators (CoreWeave, Lambda, Nebius, OCI, Together). [48] Vertiv — 800 VDC collaboration release — 13 Oct 2025 — vertiv.com/PRNewswire — PRIMARY (vendor’s own): May 2025 alignment; 2H 2026 portfolio; the aligning-to-2027-Rubin-Ultra language. [49] Schneider Electric blog (Simonelli; density-ladder post) — 23 Jul 2025 & 16 Oct 2025 — blog.se.com — PRIMARY (vendor’s own): the SuperPod density ladder 25→40→72→132→(190–240)→600 kW; GB300 at 142 kW; the 200/400 kW distribution ceilings. [50] OCP — Mount Diablo (Diablo 400) spec v0.5.2 — May 2025 — opencompute.org — PRIMARY spec: ±400/800 VDC disaggregated power (via [51]). [51] szsanyi engineering blog — 800V HVDC deep dive — Mar 2026 — secondary consolidation of [45]–[50] with alliance tiers.

Integrators and Colossus: [52] Dell Technologies — CoreWeave first-GB200 release — 9 Dec 2024 — dell.com/PRNewswire — PRIMARY (vendor’s own): XE9712/IR7000; the fully-integrated language; Clarke quote (paraphrase locator). [53] Michael Dell — X post — 17–18 Nov 2024 — x.com/MichaelDell — PRIMARY: the first-shipment announcement, quoted. [54] Dell — “Dell Delivers Market’s First GB300 NVL72 to CoreWeave” — 3 Jul 2025 — dell.com/blog — PRIMARY (vendor’s own): seven-months-after framing; fully-assembled-and-tested language; GB300 specs. [55] StorageReview — CoreWeave/Switch Evo chamber demo — 2 Dec 2024 — storagereview.com — trade secondary: 1 MW/rack-position provisioning (250 kW air + 750 kW liquid) — the Kicker’s caveat source. [56] Wikipedia — “Colossus (data center)” — as of Jul 2026 — consolidating secondary: 122 days; 168 Megapacks; fleet composition; Dell+Supermicro partnership; **used for L2’s rack/battery facts only — all Memphis politics content is L8’s**. [57] G.

Lockwood — Colossus systems notes — 2025–26 — glennklockwood.com — independent technical secondary: 64-GPU Supermicro racks; bottom-of-rack CDU; RDHx; NVIDIA’s 19-day/122-day account (seller-adjacent flag). [58] R&D World — “How xAI turned a factory shell into Colossus” — Feb 2025 — rdworldonline.com — secondary: Megapack buffering of training power swings; ~250 MW context (grid-side figures held for L4).

Context, market, and counter-series: [59] JLL — 2026 Global Data Center Outlook (+ DCF and Facilities Dive coverage) — 6–8 Jan 2026 — jll.com — broker secondary: 40 kW+ training densities; 103→200 GW projection; speed-to-power-2027 criterion. *Seller-of-real-estate incentive flagged.* [60] Barchart — GTC 2025 takeaways — Mar 2025 — secondary: the 1.3M-sold vs 3.6M-ordered slide; the Hopper-still-sells counterpoint (Cluster 5’s rebuttal source). [61] NBC News — Q3 FY26 reaction — 19–20 Nov 2025 — nbcnews.com — secondary: the bubble-line’s public carry; the GTC-DC order-book quote. [62] NVIDIA newsroom — GTC 2025 announcement release — 5 Mar 2025 — investor.nvidia.com — PRIMARY: keynote date/time/venue; attendance figures (the Timeline Snap’s calendar anchor). *Seller’s own.* [63] Fortune — “CEO waves off Blackwell production concerns” — 21 Nov 2024 — fortune.com — secondary: The Information’s overheating-redesign reporting carried with date; full-steam quote context. [64] Benzinga — Q2 FY25 mask-change report — Aug 2024 — secondary transcript carry for [15]. [65] L1 Research Pack 1.0 (COMPLETE) — 20 Jul 2026 — project file — internal PRIMARY: the 1.2 kW household denominator (cross-referenced, not rebuilt); the taxonomy-banked flag; the cross-lecture ownership table this pack’s Section 10 answers.

Flagged draft-stage pulls, consolidated (the pack’s honest outstanding list): 1. AFCOM 2026 exact release date + report-direct page pins. 2. Uptime 2024/2025 survey documents direct (replace the ModulEdge relay). 3. Q3 FY26 official-PDF page pins for every Beat 8 paraphrase. 4. Job-posting corpus for Beat 3 (locators listed there). 5. NVIDIA “full production January 2026” primary statement for Vera Rubin. 6. The DGX-1/OpenAI inscription’s exact text (Timeline 14). 7. Michael Dell X-post exact timestamp (17 vs 18 Nov 2024). 8. GB300 NVL72 primary spec sheet (142 kW verification against Schneider’s figure). 9. HSBC note direct citation (currently via TechSpot/tae kim relay). 10. EIA current-year household-kWh refresh (shared with L1’s pull list, item 11).

L2 Research Pack 1.0 · COMPLETE · Runs 1–2 · The pack proposes; markup and the Course Schema dispose.

Lecture 3 — The Cooling Stack

Research Pack 1.0 · source file L3_Research_Pack_1_0_COMPLETE.md · research as of 21 July 2026

RESEARCH AS OF 21 July 2026

(Per the L1/L2 pack precedent: every figure carries unit · stage · as-of date · author; discrepancies against must-hit anchors are flagged inline and consolidated in Section 6. Per copyright discipline, verbatim quotes are held short with full attribution, one deployment per source document; longer passages are precisely paraphrased, marked as paraphrase, and carry a locator for the draft-stage verbatim pull — the same convention the L1 and L2 packs used for the NANOG and keynote corpora.)

LECTURE IDENTITY (assembled from Syllabus 2.0, Syllabus 1.0, Beat Menu 1.0, Moves List 1.0, Roster 1.0, Style Guide §5)

Title / frame / through-line. The Cooling Stack. Where the thermodynamics stop cooperating. The liquid transition as a forced move, and water as the place the building first touches its neighbors.

Register. Atoms leads; the Neighbor beat drops the thermostat to zero at the human floor. Follow the Money inside this lecture is what keeps a thermodynamics hour from becoming a thermodynamics hour.

Cascade edge. Inherits: the heat (L2 — 132 kW enters the cabinet as electricity; every joule leaves as heat; nobody has priced the leaving) · Binds at: the heat-rejection path and the water permit · Who pays: the aquifer, the ratepayer, or the neighbor — priced, not asserted · Manufactures: the wall the building plugs into → Lecture 4.

Strawman beat plan (12, running order — STRAWMAN FOR MARKUP; Course Schema locks order after markup):

1. The Bill Arrives [O] — a county water invoice, traced upstream to the cooling loop that generated it
2. The Physics Audit — air's practical ceiling ~15 kW per rack against the 132 kW rack that just arrived; the forced move, not an optimization
3. Mechanism Autopsy — the direct-to-chip tour without the tour-guide voice: cold plates, CDUs, rear-door heat exchangers; PUE 1.10–1.25 vs. 1.50–1.80 for air
4. Taxonomy by Business Model — cooling vendors sorted by heat path, not logo; two-phase immersion above ~140 kW
5. The Bottleneck — the chemistry that left the market (3M exits Novec, Dec 2022) and the supply of pipefitters certified for two-phase loops
6. Operator Reality — the plumbing trades suddenly load-bearing in an industry that thought it was software; the UA syllabus
7. Follow the Money — the liquid market: direct-to-chip ~65% in 2026; who's making money on the transition
8. The Paper Trail — class: **permit/agreement** — The Dalles: expansion traded for aquifer investment; the 13-month secrecy fight
9. The Deal — the Google–The Dalles negotiation reconstructed from the court record and city filings — who wanted what, who blinked
10. The County — The Dalles and Newton County as jurisdictions negotiating water in public
11. The Neighbor — the Morrisises — comedy off, documented only
12. The Externality Swap [C] — evaporative vs. closed-loop as pick-your-externality; WUE as the number counties fight over; Microsoft's Dec 2024 zero-water design as the swap chosen in public

Handoff: a character walking toward the next problem — the facilities engineer's next meeting is with the utility; a perfectly cooled building still has to plug in. **Negative space:** Cold Open, Wrong Map, Hearing Room, Forecast Problem, Perverse Incentive (the secrecy story rides inside the Paper Trail), Regulatory Collision, Steelman, Symbol Audit, Founder Audit.

Cast. Object: the cold plate — lead treatment; where the watt leaves the die; manufacture, tolerances, PG25 chemistry,

leak detection as a new outage class. *Document*: **the water agreement / will-serve letter** — this lecture’s Paper Trail class (permit/agreement); reference instance the City of The Dalles–Google agreement (dating discrepancy flagged — see Section 6, Discrepancy A). *Humans*: **Beverly and Jeff Morris**, Newton County, Georgia — comedy off; the Neighbor beat’s documented anchors, NYT investigation of 14 July 2025 with the county record underneath. *Secondaries*: Chris Wilson (neighbor three doors down, same reporting), 3M’s Novec exit (20 Dec 2022), the UA-certified pipefitter (Operator Reality), Microsoft’s zero-water design announcement (9 Dec 2024). *Returning (brief reference only)*: NVIDIA’s rack roadmap (lead L2; returns here as thermal input only — one sentence of provenance, no ladder re-derivation, per the L2 pack’s pre-allocation).

Must-hit anchors (verbatim from Syllabus 2.0; Syllabus 1.0 values govern — Section 6 discrepancy protocol): ~15 kW air ceiling; direct-to-chip ~65% (2026); PUE 1.10–1.25 vs. 1.50–1.80; two-phase immersion >140 kW; 5M gallons/day; water-energy tradeoff; The Dalles 13-month suit; Novec exit Dec 2022; Microsoft zero-water Dec 2024.

Moves plan (as assigned; formal verification Section 4). Step Function: 15 kW ceiling vs. 132 kW arriving — an order of magnitude, not a gap · Unit Conversion: 5M gallons/day → a mid-sized town’s municipal draw (arithmetic gate applies; math shown in Section 4; verdict **PASS**) · Timeline Snap: December 2022 — the month the chemistry left the market (**RESOLVED: 20 December 2022**, with a documented same-month coincidence supplied for markup) · Verbatim: a clause from The Dalles agreement — existence gate; **verdict FAIL on the assigned clause as such; verified alternates from the same territory supplied** · As-Of Stamp: the ~65% direct-to-chip share — **RESOLVED WITH DISCREPANCY FLAG** (pedigree conflict, Section 6 Discrepancy B) · Kicker: the zero-water design saves the aquifer by spending the grid — **VERIFIED in Microsoft’s own materials** · Gesture: **skip proposed — CONFIRMED** (one boundary-pressure note logged in Section 10).

Sellers & narrator moves. Sellers on the field: **the Hyperscaler** (sustainability framing — water positive, zero-water, replenishment accounting) and **the Doomer** (the water panic — the bottle-per-email arithmetic). Assigned moves: **HOLD OPEN** on the Morris well vs. Meta’s commissioned study — state the conflict, refuse to smooth it; **GRANT-AND-WITHHOLD** on “zero-water” — real design, real electricity cost. Section 7 pressure-tests both calibrations; the record as researched supports both strongly. **Steelman rotation: no defendant is assigned to Lecture 3** (the 8-deployment rotation runs L1, L4–L10 skipping 2–3); the Steelman beat is negative space here, and the nobody-wrong discipline is carried inside Section 7’s claim clusters instead.

Decay tier. Low — thermodynamics doesn’t update. The physics, the swap structure, the Novec exit, and The Dalles record are stable; the market-share and market-size figures (Beat 7) are the lecture’s only genuinely **VOLATILE** cluster, and the Ecolab–CoolIT closing (expected Q3 2026) is the one near-term event that will date a sentence.

Human-floor flags (comedy off in every zone below):

1. **The Neighbor (Beat 11) and all Morris/Wilson material** — the well, the appliances, the loans, the delayed retirement, the son who shares the one working bathroom. Full floor protocol.
2. **Dawn Rasmussen and The Dalles residents’ well testimony** (Beats 9–10) — a documented resident watching her well drop; floor protocol travels with her wherever she appears.
3. **Newton County ratepayers** (Beats 1, 10) — the 33% rate increase lands on households; the invoice material is floor-adjacent wherever it names a residential bill.
4. **West Des Moines residents** (Section 7) — the district that also supplies drinking water; floor protocol on the residential side of the 6% figure. Adjacent-to-floor, punch-up-only (full protocol not triggered): the pipefitters and operators of Beat 6 — workers doing documented jobs, never objects of fun.

Pack dependencies (debts resolved in this pack or explicitly failed):

1. Timeline Snap exact date — **RESOLVED**: 3M press release, St. Paul, Minnesota, Tuesday, 20 December 2022 (Section 4).
2. Verbatim (a clause from The Dalles agreement) — **FAILED HONESTLY, ALTERNATES SUPPLIED**: the agreement’s own operative text is not verifiably quotable from the public record as of the research date; three verified same-territory alternates are block-quoted with attribution (Section 4; Section 5).
3. As-Of Stamp source (~65% direct-to-chip) — **RESOLVED WITH DISCREPANCY FLAG**: analyst pedigrees conflict; anchor value governs; full reconciliation Section 6, Discrepancy B.
4. Kicker verification — **RESOLVED**: Microsoft’s 9 Dec 2024 announcement documents both the water saving (>125 million liters/year/datacenter) and, in its own materials and the trade press reading them, the electricity cost of the swap (Section 4).

5. Unit Conversion arithmetic (5M gal/day → a mid-sized town) — **RESOLVED: PASS**, with sourced comparison targets and a documented city instance (Section 4).
6. Roster debts (the Morris' NYT quotes with full context; as-of details) — **RESOLVED** (Section 8): the quotes, the appliance-replacement years (2019/2021/2024), the \$5,000-against-\$25,000 arithmetic, Jeff's delayed retirement, all verified in the 14 July 2025 NYT investigation (Eli Tan byline), with the BBC (July 2025) and More Perfect Union (2025–26) corpora underneath. One dating conflict logged (1,000 feet vs. 400 yards — Section 6, Discrepancy D).
7. Cross-lecture flags inherited from the L1 and L2 packs — **RESOLVED**: L1 stopped the heat path at the roofline (this pack owns the component tour); L2 banked the air ceiling in one sentence and pre-allocated the roadmap's return here as thermal input only; L2's handoff (cost left unassigned) is inherited and priced in Beat 1. The L2 pack's "leak-class risks inherited by L3" debt is collected in Beat 3 and Section 9's object dossier.
8. Syllabus 2.0 cast dating ("the City of The Dalles–Google **2023** agreement") — **FLAGGED AS DISCREPANCY A**: the documented record supports a November 2021 council approval and a 14 December 2022 court settlement; the city's own materials call it "a 2021 agreement." No silent substitution; Nick resolves (Section 6).

SECTION 1: TIMELINE OF THE CONSTRAINT

The constraint machine this timeline assembles: heat that must leave the die, air that stops being able to carry it, water that carries it instead, and the paper — permits, agreements, court filings, press releases — that decides whose water. Entries carry exact dates where the record supplies them; month/year otherwise. [Bracketed notes] mark why the entry matters and where figures are contested.

1. **1959** — The State of Oregon designates The Dalles area a **critical groundwater area** after the water table falls to record lows. [OPB, 29 Sep 2021. The aquifer arrives in this story pre-stressed, sixty years before Google's expansion request. No new groundwater rights can be created in a critical area — which is why an old aluminum smelter's rights become the plot.]
2. **Nov 2005** — IBM Journal of Research & Development publishes Crippen et al., "BladeCenter packaging, power, and cooling": the airflow cross-section of a dense rack limits total dissipation to about **30 kW**. [The air ceiling stated in the peer-reviewed record two decades before Blackwell; cited in US Patent 7,486,513, which also carries the load-bearing physical fact: air's heat capacity per unit volume is ~3,500x smaller than water's. ANCHOR-grade physics.]
3. **2006** — Google begins operating in The Dalles, Oregon — its first purpose-built data center campus, ~30 acres, sited for Columbia River hydroelectricity and fiber; WIRED profiles the construction that year. [ScienceBlog synthesis, 2026; the geography seed. Origin-story geography itself belongs to L1's beat family — one line here.]
4. **2011** — Amazon opens a data center in The Dalles region (Boardman/urnfolds along the Gorge), also with tax breaks. [Reynolds Center retrospective, Nov 2023. Establishes that Google is not the only industrial water user in the Gorge — but is the one whose numbers get litigated.]
5. **2016** — Beverly and Jeff Morris buy a house on a 6-acre lot in Newton County, Georgia, for **\$265,000** — dirt roads, oak forest, horses; Beverly retires there. [NYT-derived reporting, Jul 2025. Floor material: the before-state.]
6. **2016** — AFCOM's first State of the Data Center report records average rack density at **6.1 kW** — the number the must-hit series carries (mis-dated to 2020; L2 pack Discrepancy A, owned there, not re-litigated here). [Rate, per rack, survey mean.]
7. **March 2018** — Meta (then Facebook) announces its **\$750 million** data center in Newton County, Georgia — the Stanton Springs park at the Newton/Morgan line; Gov. Brian Kemp celebrates at the state Capitol with Facebook-branded shovels; construction begins in **2018**. [NYT, 14 Jul 2025. Announced figure; the campus grows in later phases. Georgia's first major data center.]
8. **2018, months after groundbreaking** — The Morris' dishwasher, ice maker, washing machine, and toilet stop working; within a year water pressure slows to a trickle; the taps eventually run dry. Jeff Morris, a machine operator, traces the failures to sediment buildup in the well water. [NYT, 14 Jul 2025. Floor material — full treatment Section 8.]
9. **2019** — Meta bulldozes the oak forest across from the Morris property; the couple replaces most of their water-using appliances — the **first of three replacement rounds (2019, 2021, 2024)**. [NYT-derived reporting, Jul 2025.]
10. **Sept 2020** — Microsoft commits to being **water positive by 2030** — replenishing more water than it consumes. [Company pledge; seller's document, Section 7.]

11. **2020–21** — Two-phase immersion cooling has its moment: Microsoft publicizes production two-phase immersion tanks (Apr 2021) using 3M engineered fluid; the technology’s qualified fluids are Novec 7100 and Novec 649. [Standard Fluids retrospective, 2026; the dependence on a single manufacturer’s chemistry, about to matter.]
12. **Aug 2021** — Meta pledges to be **water positive by 2030**. [Company pledge; the seller’s frame the Newton County record will later be read against.]
13. **Sept 2021** — Google publishes its Water Stewardship commitment: replenish **120% of the water we consume** by 2030, across offices and data centers, “where we operate.” [Google whitepaper, 2021, quoted in The Register, 5 Nov 2021 — paraphrase-marked here; the replenishment-accounting caveat lives in Section 7.]
14. **Sept 2021** — Mike Rogoway, business reporter at The Oregonian, files a public records request with the City of The Dalles for Google’s local water usage (2020 usage; five years of industrial totals). The city denies it, citing **trade secrets**; The Oregonian reports Google holds a non-disclosure agreement with the city. [Columbia Gorge News, 15 Dec 2022; The Register, 5 Nov 2021.]
15. **27 Sept 2021** — The Dalles City Council reviews the proposed water agreement with Google (operating as **Design LLC**) at its regular meeting. The staff report by Public Works Director Dave Anderson carries the numbers: GSI Water Solutions finds current system capacity **9.9 million gallons per day**; full build-out demand to the Urban Growth Boundary would be **17.5 million gallons per day**; roughly **5 million gallons per day of undeveloped rights** exist in the city; Google would transfer rights for **~3.8 million gallons per day** acquired with the smelter site. [Columbia Gorge News, 6 Oct 2021. The document class this lecture’s Paper Trail lives in.]
16. **29 Sept 2021** — At council, Anderson testifies the aquifer’s sustainable annual withdrawal is **5,500 acre-feet/year** against current draws of **~1,800 acre-feet/year**; Councilor Dan Richardson, on the record: “Water’s just absolutely critical to our community.” Residents raise climate and supply concerns. [OPB, 29 Sep 2021 — the one OPB quote deployed in this pack; Anderson’s capacity testimony paraphrase-marked, locator: OPB article.]
17. **5 Oct 2021** — AP photographs Mayor Richard Mays above the town; its report carries: **98% of Wasco County in extreme drought**; town population ~15,000–16,000; councilors bound by NDA will learn the requested water volume only days before the vote; Anderson, on the record: “The city comes out ahead.” [AP via Patch, Oct 2021 — the one quote deployed from that AP story; Google’s companion statement paraphrased: committed to the long-term health of the county’s economy and resources.]
18. **15 Oct 2021** — **Wasco County District Attorney Matthew Ellis rules for disclosure**: the city has not met its burden to show Google’s water use is a trade secret; orders release. His order’s characterization, as reproduced in secondary coverage: “The document simply states the amount of water used” [quoted via Boondoggle/secondary reproduction of the DA order — locator marked; draft-stage pull from the order itself]. [The Register, 5 Nov 2021.]
19. **Late Oct–early Nov 2021** — Rather than release, the City of The Dalles files a **reverse public-records lawsuit** against Rogoway and The Oregonian in Wasco County Circuit Court, seeking a declaration that it need not disclose. **Google agrees to pay the city’s legal bills**. [The Register, 5 Nov 2021; RCFP case summary. The 13-month clock starts.]
20. **8 Nov 2021** — The Dalles City Council votes **unanimously** to approve the **\$28.5 million** arrangement with Google/Design LLC: Google funds water-system improvements (two new groundwater wells, two storage tanks/reservoirs, pump stations, a sanitary sewer lift station, an aquifer storage and recovery system), donates 35 acres to Wasco County, transfers the smelter water rights to the city, and receives committed water service for two new data centers plus Strategic Investment Program tax reductions for the first 15 years. The volume of water committed is not disclosed at the vote. [Columbia Community Connection; Columbia Insight, 2021–23; Oregon Capital Chronicle, 19 Jan 2026. **This is the agreement the Roster calls “2023” — Discrepancy A.**]
21. **Dec 2021–2022** — Litigation proceeds; the Reporters Committee for Freedom of the Press (attorney Ellen Osoinach) represents Rogoway and The Oregonian pro bono against a city whose legal bills a trillion-dollar company is paying. [RCFP; Reynolds Center.]
22. **22 Mar 2022** — (Return reference, owned by L2’s pack:) Hopper H100 announced at 700 W SXM — the doubling that ends air cooling’s comfort margin. [One line; the thermal input to this lecture.]
23. **2022** — 3M’s Zwijndrecht, Belgium plant — a principal production site for PFAS chemistries including the Novec line — is idled after revelations of discharges at hundreds of times EU safe levels. [DCD, Dec 2022 retrospective. The chemistry’s supply is already fragile before the exit announcement.]
24. **July 2022** — Microsoft pumps **~11.5 million gallons** into its West Des Moines, Iowa data center cluster — **~6% of all water used in the district** that month — in the final weeks of GPT-4’s training; per Microsoft’s own disclosure the cluster draws cooling water only above **29.3°C (85°F)** outside temperature. A West Des Moines Water Works document states the district and city “will only consider future data center projects” from Microsoft that “demonstrate

- and implement technology to significantly reduce peak water usage” [WDMWW document, 2022, quoted via AP investigation, Sept 2023 — the one quote from that document]. [AP (Fortune/Barchart syndication), 9 Sep 2023.]
25. **Nov 2022** — The Dalles City Council authorizes settlement negotiations with The Oregonian after **Google reverses its position** on shielding the records; Mayor Mays later explains the city backed off because Google changed its mind. [RCFP; Central Oregon Daily, Dec 2022 — Mays paraphrase-marked, locator: Oregonian interview.]
 26. **14 Dec 2022** — **Settlement finalized.** The City of The Dalles agrees to release **10 years of historical data** on Google’s water use at its first three data centers and to honor future records requests — ending the **13-month** fight. A Google spokesperson tells AP the company will **no longer claim trade-secret protection for site-level water numbers at any of its data centers nationwide.** [Columbia Gorge News, 14–15 Dec 2022; RCFP. The Dalles fight ends site-level water secrecy as an industry default — the single largest documented consequence in this lecture.]
 27. **Mid-Dec 2022** — The released records show: Google’s data centers consumed **274.5 million gallons (1.04 billion liters) in 2021** per the AP account; The Oregonian’s account of the same release reports **355 million gallons, 29% of the city’s total consumption**, and a **near-tripling since 2017** (the year before the third data center opened). Resident **Dawn Rasmussen**, whose rural well has dropped year after year: “I’m flabbergasted and I’m scared for the future” [AP, Dec 2022 — the one quote from that AP story]. [**Figure conflict logged as Discrepancy C**, Section 6.]
 28. **20 Dec 2022** — **3M announces it will exit all PFAS manufacturing and discontinue PFAS across its portfolio by the end of 2025** — ending Novec and Fluorinert engineered fluids, the qualified chemistries for two-phase immersion and two-phase cold-plate cooling. Chairman/CEO Mike Roman: “This is a moment that demands the kind of innovation 3M is known for” [3M press release, St. Paul, 20 Dec 2022 — the one quote from that release]. [**The Timeline Snap. The month the chemistry left the market — six days after the month the secrecy left it.**]
 29. **Jan 2023** — Motivair (Buffalo, NY) publishes analysis: EPA PFAS moves plus 3M’s exit will significantly impact two-phase immersion and two-phase cold-plate deployment in HPC; single-phase immersion (non-conductive oils) and single-phase cold plates (water-based fluids) are unaffected. [HPCwire, 27 Jan 2023. The taxonomy consequence: the field’s two-phase branch loses its fluid supply while its single-phase branch inherits the market.]
 30. **7 Feb 2023** — ECHA publishes the EU’s universal PFAS restriction proposal — one of the broadest in REACH history — putting regulatory pressure on Novec *replacements* too (Solvay’s Galden, a Novec alternative, is itself a PFAS). [Fire Suppression Systems Association circular; DCD.]
 31. **April 2023** — UC Riverside researchers (Pengfei Li, Jianyi Yang, Mohammad A. Islam, Shaolei Ren) post “**Making AI Less ‘Thirsty’**”: training GPT-3 in Microsoft’s US data centers directly evaporated an estimated **~700,000 liters** on-site (~5.4 million liters total including generation water); GPT-3 “drinks” a 500 ml bottle per **10–50 medium-length responses, depending on when and where** — the location caveat that will disappear as the number goes viral. [arXiv preprint Apr 2023; later published in Communications of the ACM (2025). **CONTESTED**-tier by construction: an estimate from public data, not a meter reading. Section 7’s Doomer file.]
 32. **May 2023** — **KKR acquires a majority stake in CoolIT Systems** (Calgary; direct-to-chip cold plates and CDUs) for a reported **~\$270 million**. [Enki/market synthesis of 2023 deal reporting. The first big private-capital mark on the transition.]
 33. **9 Sep 2023** — AP publishes its Iowa investigation (“AI technology behind ChatGPT was built in Iowa — with a lot of water”), carrying the July 2022 figures into the mainstream; Microsoft’s fleet water consumption for FY2022 is reported at **~1.7 billion gallons, +34% year over year**, growth outside observers attribute substantially to AI. [AP, 9 Sep 2023.]
 34. **Dec 2023** — **Vertiv acquires CoolTera Ltd** (UK; coolant distribution units) — a small cash outlay that sell-side later credits with >\$300M of CY2025 liquid-cooling sales inside Vertiv. [Evercore ISI note via Radnor Capital, Oct 2024; Blackridge profile. The incumbents start buying their way inside the rack.]
 35. **18 Mar 2024** — (Return, owned by L2:) the GB200 NVL72 is announced — 72 GPUs, ~120 kW, **liquid-cooled by design**. The thermal consequence is this lecture’s entire inheritance; one line of provenance, no ladder re-derivation.
 36. **March 2024** — 3M’s **\$12.5 billion settlement** with 11,000+ US public water systems over PFAS drinking-water contamination receives final court approval; payments run 13 years. [The Cooling Report synthesis, 2026. The legal mathematics behind the exit announcement of entry 28.]
 37. **Aug 2024** — Supply-chain reporting (UDN via TweakTown, 14 Aug 2024): pre-mass-production **GB200 rack coolant leaks** traced to outsourced branch pipes, quick connectors, and hoses; emergency fixes before shipment. [Leak-as-outage-class enters the record before the first volume rack ships.]
 38. **Aug 2024** — **Microsoft begins designing all new datacenters to a zero-water-evaporation, closed-loop standard** (announced publicly in December). [Microsoft Cloud Blog, 9 Dec 2024.]

39. **15 Oct 2024** — (Return, owned by L2:) NVIDIA contributes the NVL72 electro-mechanical design — including **liquid-cooling and thermal environment specifications** — to the Open Compute Project; Meta contributes Catalina, its GB200-derivative rack, specced in coverage at **~140 kW of liquid capacity**. [OCP database; GMI synthesis. The ~140 kW figure that shadows the two-phase anchor.]
40. **17 Oct 2024** — **Schneider Electric announces acquisition of a 75% controlling interest in Motivair Corp** (Buffalo, NY — CDUs, ChilledDoor rear-door heat exchangers, cold plates, HDUs, chillers) for **\$850 million cash**, option on the remaining 25% by 2028; implied valuation ~\$1.1B at a mid-single-digit multiple of projected FY2025 revenue (~\$200–250M per Evercore ISI). CEO Peter Herweck: the deal extends Schneider “from Grid to Chip and from Chip to Chiller” [Schneider/Motivair release, 17 Oct 2024 — the one quote from that release]. [Facilities Dive; Reuters; Schneider PDF.]
41. **Oct–Nov 2024** — More consolidation: **Flex acquires JetCool Technologies** (microconvective cold plates); Dell’Oro (July 2024) projects the data center liquid-cooling market **crossing \$15B by 2028**. [Facilities Dive citation; FMI profile.]
42. **17–18 Nov 2024** — (Return, owned by L2:) first GB200 NVL72 racks ship — Dell to CoreWeave; every one requires the loop this lecture autopsies.
43. **9 Dec 2024** — **Microsoft unveils the zero-water datacenter design**: chip-level cooling, closed loop filled once at construction, **zero water evaporated for cooling**; avoids **>125 million liters (~33 million gallons) per year per datacenter**; fleet WUE 0.30 L/kWh in the latest fiscal year (–39% vs. 2021), target near-zero at the new sites; **pilots at Phoenix, Arizona and Mt. Pleasant, Wisconsin, coming online from late 2027**; the company and the trade press reading it both note the cost: replacing evaporation with mechanical/economizing chillers **slightly increases power draw** — the swap chosen in public. Steve Solomon, VP of datacenter infrastructure engineering: “These new liquid cooling technologies recycle water through a closed loop” [Microsoft Cloud Blog, 9 Dec 2024 — the one quote from that post]. [DCD; Network World, Jan 2025. **Must-hit anchor and Kicker material.**]
44. **Dec 2024** — LBNL publishes the **2024 United States Data Center Energy Usage Report** (LBNL-2001637): US data centers **directly consumed ~66 billion liters (~17 billion gallons) of water in 2023** (up from 21.2 billion liters in 2014); indirect water via electricity **~800 billion liters (~211 billion gallons)**; hyperscale direct consumption in 2028 scenario-ranges **60–124 billion liters** — the range being largely a function of cooling-system choice. [LBNL, Dec 2024. STRUCTURAL; the Externality Swap quantified at national scale.]
45. **2024 (full year, disclosed mid-2025)** — Google’s fleet: data centers **withdrew ~9.9 billion gallons and consumed ~7.9 billion in 2024** per one reading of the 2025 Environmental Report; **~8.1 billion gallons consumed across data centers and offices** per another; **Council Bluffs, Iowa** is the most water-intensive site — **~1 billion gallons consumed** (readings range 1.0–1.3B; average daily withdrawal ~3.9M gal, consumption ~2.7–2.8M gal); **Pflugerville, Texas** (air-cooled) consumed **10,000 gallons all year** — a ~270x per-site spread that is the Externality Swap wearing site badges. [Google 2025 Environmental Report via GovTech, Civil Beat, MOST Policy Initiative, NASUCA — **scope conflicts logged, Discrepancy G.**]
46. **30 Jan 2025** — **Rep. Cliff Bentz introduces The Dalles Watershed Development Act**: transfer 150 acres of US Forest Service land in the city’s municipal watershed (source of **80% of annual supply**) to city ownership, enabling reservoir expansion. [Bentz press release, 30 Jan 2025.]
47. **Feb 2025** — Schneider–Motivair **closes**; Motivair continues under President & CEO Rich Whitmore from Buffalo. [Schneider release, Sep 2025 (retrospective dating).]
48. **31 Mar 2025** — **Last day to place new orders for 3M Novec-line fluids**; manufacturing winds down through year-end. [The Cooling Report, 2026.]
49. **March–Sept 2025** — The Georgia moratorium wave gathers: since March 2025, eight Georgia counties and cities pass data-center moratoriums; September alone adds Pike, Lamar, Troup, and Clayton counties and the City of LaGrange; DeKalb County pauses applications from July 2025. [GPB, 22 Oct 2025. The wave’s *politics* belong to L8; its **water-driven** members are this lecture’s County material.]
50. **May 2025** — More Perfect Union publishes its Newton County video; **Meta sends a community relations manager** to the Morris property afterward — offers a well study, fixes glare lighting, takes no responsibility for the water; when Beverly Morris says she fears cooking with the sediment, the employee suggests boiling the water first (Meta denies the employee said it). [NYT, 14 Jul 2025 — paraphrase-marked; the conflict stated, not smoothed.]
51. **July 2025 (early)** — **BBC** publishes “‘I can’t drink the water’ — life next to a US data centre” (Michelle Fleury reporting): Beverly Morris in Mansfield, Georgia, **400 yards (366 m)** from the Meta building, flushing a toilet with a bucket; Flint Riverkeeper **Gordon Rogers** shown taking water samples; Emory’s Prof. Rajiv Garg on the industry’s path. [BBC, Jul 2025. Distance conflict with NYT logged — Discrepancy D.]

52. **14 Jul 2025** — **The New York Times publishes Eli Tan’s investigation, “Their Water Taps Ran Dry When Meta Built Next Door.”** The documented spine of this lecture’s human floor: the Morrisises (Beverly, 71; Jeff, 67), 1,000 feet from the completed \$750M campus; appliances replaced 2019/2021/2024; \$5,000 spent; \$25,000 well they cannot afford; one working bathroom shared with Beverly’s adult son Jon, 48, who has Down syndrome; **Meta’s data center uses ~500,000 gallons/day — ~10% of Newton County’s total daily water use** (Mike Hopkins, executive director, Newton County Water & Sewerage Authority); county **on track for a water deficit by 2030** per a 2024 report; rates **set to rise 33% in two years** vs. typical 2%/yr (Mansfield Mayor Blair Northen); **nine companies** have applied to build data centers in the county — some requesting up to **6 million gallons/day, more than the county’s entire daily usage** — some under aliases, at least one as large as Amazon; the authority’s recycling-plant fix is a **>\$250 million** race; Meta’s spokesperson: a commissioned well study found it “unlikely” the data center affected area groundwater [paraphrase-marked]; Beverly Morris, on the record: “I’m scared to drink our own water” [NYT, 14 Jul 2025 — the one quote deployed from the NYT investigation]. [Full context Section 8.]
53. **2025 (summer)** — Newton County’s nine pending applications and the NYT’s permit-application review establish the forward curve: new AI-training campuses request **millions of gallons per day** in permit filings. [NYT, 14 Jul 2025. Water’s phantom-load analogue — Section 6 audit.]
54. **22 Oct 2025** — **Google transfers the completed Aquifer Storage and Recovery system to the City of The Dalles** at a ribbon-cutting: the \$28(.5)M infrastructure program is done — two 1.2-million-gallon tanks, ASR wells, transferred smelter groundwater rights — adding **~100 million gallons/year** of distributable supply; Google’s Anthony Giovannone (utility infrastructure strategy): the 100 million gallons annually is “above and beyond what will be needed for the new data centers” [Columbia Gorge News, Oct–Dec 2025 — the one quote from that article; Mays’s line paraphrase-marked: Google has met every commitment across 20 years]. Same coverage: The Dalles now hosts **six Google data centers**; Google’s share of city water reached **~one-third — 434 million gallons — in 2024**. [Discrepancy C’s trajectory confirmed: whatever 2021’s true figure, the direction is up.]
55. **Dec 2025** — Athens-Clarke County, Georgia enacts a data-center moratorium (water, power, and utility-cost concerns dominate hearings). [Grady Newsource, Feb 2026.]
56. **End of 2025** — **3M’s PFAS manufacturing lines shut down**: Novec 7100, Novec 649, Fluorinert FC-72 exit production on schedule. Operators holding stock face TSCA 8(a)(7) reporting obligations regardless of sourcing; secondary-market purchases transfer no regulatory relief. [Alliance Chemical, May 2026; Best Technology distributor notice.]
57. **Jan 2026** — Motivair-by-Schneider launches the **MCDU-70**, a 2.5 MW coolant distribution unit — a single plumbing appliance rated for nineteen NVL72 racks’ worth of heat. [Blackridge, 2026.]
58. **19 Jan 2026** — Oregon Capital Chronicle: The Dalles’ 20-year water plan totals **~\$260 million** (including a **~\$70 million reservoir expansion into Mount Hood National Forest**, requiring the federal land transfer); Google revenues expected to cover about a quarter; **water rates projected +7% by 2036**; Google’s smelter-derived pumping right — **up to 3.88 million gallons/day — approximately equals the entire city’s average daily use in 2024**; the 2024 water master plan attributes future demand growth to an unnamed “large industrial user.” [Oregon Capital Chronicle, 19 Jan 2026.]
59. **20 Jan 2026** — City of Covington (Newton County seat) enacts a **180-day data-center moratorium**. [Covington News, Feb 2026.]
60. **17 Feb 2026, 7:00 p.m.** — **Newton County Board of Commissioners votes 5–0** (Resolution #R021726a session; Historic Courthouse, 1124 Clark Street, Covington) to impose a **30-day moratorium on data-center applications**; the minutes specify the moratorium will “cover the term ‘data center’ as it is used in the governing zoning laws” [Newton County BOC minutes, 17 Feb 2026 — the one quote from the minutes]. [Primary record; Hearing-Room-grade corpus, Section 8.]
61. **March 2026** — **Ecolab agrees to acquire CoolIT Systems for \$4.75 billion** — ~29x forward EBITDA; KKR’s ~2023 equity returns ~15x; expected close Q3 2026. The cold plate is now a water-and-fluid-management asset inside a Fortune 500 platform. [Enki; MarketWise, Apr 2026. VOLATILE until closed.]
62. **9 Mar 2026** — Google/Oregon Business publicize the ASR launch as a sustainability story; Ben Townsend, Google’s global head of infrastructure sustainability, frames growth-in-partnership [paraphrase-marked, locator: Oregon Business, 9 Mar 2026].
63. **March–April 2026** — Newton County extends its moratorium to **April 8**, then **again by 180 days to 7 October 2026** (5–0; existing pipeline applications unaffected), while it rewrites its Unified Development Ordinance. [Covington News, Apr 2026.]
64. **22 Apr 2026** — Vertiv Q1 2026: organic sales **+23% YoY** (Americas **+44%**), backlog **~\$15 billion (+109% YoY)**,

- book-to-bill **2.9x**; FY2026 guidance raised to **\$13.75B revenue**. The transition's clearest public income statement. [MarketWise summarizing the print, Apr 2026. VOLATILE.]
65. **May 2026** — At a congressional hearing on the EPA, **Rep. Alexandria Ocasio-Cortez holds up a jar of brown water** drawn near Meta's Stanton Springs campus; coverage recirculates the NYT/Newton County record; residents described as relying on bottled water. [Yahoo Finance/Moneywise, 24 May 2026. Dated as reported; committee/day to pin at draft stage.]
 66. **June 2026** — More Perfect Union publishes "We Took AOC to a Deep Red Data Center Town" — an on-camera corpus at the Morris property: Beverly (hasn't drunk the tap water in years), Lindsey Wilson (sediment in the filter, pressure too low to shower and fill the horse trough), **Chris Wilson**: "Our refrigerator broke. Our HVAC broke." → "Anything that's water-related, we have issues with" [MPU transcript, Jun 2026 — the one quote from that transcript; others paraphrase-marked]. [Section 8 pulls.]
 67. **June 2026** — Google announces a **\$3 million** grant to Nebraska's Metropolitan Utilities District for acoustic leak-detection sensors across 500 miles of water mains, alongside 2024 site disclosures (Papillion: withdrew 532M gal, consumed 416.9M gal). [GovTech, 3 Jun 2026. Replenishment/stewardship spend — Section 7.]
 68. **1H 2026 (standing)** — Post-Novec two-phase procurement remains unresolved: replacement chemistries sort into (a) other engineered fluorinated fluids (Solvay Galden, Chemours Opteon — themselves PFAS, exposed to the same regulatory curve), (b) hydrocarbons, (c) esters — "none of them a clean answer." [Alliance Chemical product analysis, 29 May 2026 — vendor source, flagged as such.]
 69. **Expected** — **Q3 2026** — Ecolab-CoolIT expected to close (regulatory approvals pending). [Announcing party: Ecolab. VOLATILE.]
 70. **Expected** — **7 Oct 2026** — Newton County moratorium expires unless extended; UDO rewrite due. [Announcing party: Newton County BOC.]
 71. **Expected** — **late 2027** — Microsoft's first zero-water pilot datacenters (Phoenix; Mt. Pleasant) begin coming online. [Announcing party: Microsoft, Dec 2024.]
 72. **Expected** — **2028** — Schneider's option window to acquire Motivair's remaining 25%. [Announcing party: Schneider, Oct 2024.]
 73. **Expected** — **2030** — The three hyperscaler water-positive pledge deadlines (Microsoft 2020; Meta and Google 2021) come due; Newton County's projected water-deficit year arrives on the same calendar line. [Announcing parties as listed; the county's 2024 engineering report.]

Supplementary micro-entries the drafting AI may need, dated: ASHRAE TC 9.9 5th-edition Thermal Guidelines including facility-water classes W17–W45/W+ (2021); ASHRAE TC 9.9 classifies racks above ~20 kW as high-density and steers them to water-cooled solutions (2023 guidance); OCP publishes guidelines for propylene-glycol heat-transfer fluids in single-phase cold-plate racks (OCP Cooling Environments program, 2023–24); Uptime Institute Global Survey average annualized PUE **1.58 (2023)** and **1.56 (2024)** — flat for five years; Uptime 2022 outage-cost series (60% of outages >\$100k, up from 39% in 2019; >\$1M outages 11%→15%); The Green Grid defines WUE (2011; liters per kWh); EESI carries the sector-average **WUE ~1.9 L/kWh**; Netherlands bans new hyperscale (>70 MW) data centers effective **Jan 2024**; a Chilean environmental tribunal partially revokes Google's Cerrillos (Santiago) permit over water, forcing an air-cooled redesign (2024–25, via MSCI/Lincoln Institute synthesis — verify docket at draft stage if used).

SECTION 2: STRAWMAN BEAT DOSSIER

Beat 1 — The Bill Arrives [O] (a county water invoice, traced upstream)

Syllabus 2.0 assignment: Open on a water invoice someone actually paid, then trace the line item upstream to the cooling loop that generated it.

Beat Menu definition: Money family · opener-preferred, closer-capable. The bill is the hook; the supply chain of the bill is the beat. (Opener rotation: Bill Arrives opens 3 and 7 — verified non-adjacent to L7 by three lectures.)

Facts, dates, names, numbers. The documented invoices available to open on, in ascending scale: (1) *The household's*: the Morris' \$5,000 spent on water problems against a \$25,000 well replacement they cannot afford — three appliance-replacement rounds dated 2019, 2021, 2024, financed partly by loans [NYT, 14 Jul 2025; quantity, spent, household ledger]. (2) *The municipal customer's*: Mansfield, Georgia's water rates set to rise **33% over two years** against a typical 2%/yr cadence — Mayor Blair Northen's figures [NYT, 14 Jul 2025; rate of change, announced]. (3) *The industrial account*:

Google pays standard industrial water rates in The Dalles for every gallon, including gallons drawn under rights it donated — the city’s own webpage states it in one sentence (Verbatim Bank below). (4) *The district ledger*: Microsoft’s July 2022 West Des Moines draw, 11.5 million gallons, 6% of the district [AP, 9 Sep 2023; quantity, metered, single month]. (5) *The fix’s invoice*: Newton County’s recycling-plant upgrade, **>\$250 million**, characterized by the water authority’s executive director as a race against the clock [NYT, 14 Jul 2025 — paraphrase-marked].

The mechanism. The invoice path, downstream to up: a residential or municipal water bill → the county water authority’s rate schedule (rates rise when the authority must finance capacity: Newton’s \$250M upgrade is amortized through the rate base — the water version of L7’s transmission rider) → the treatment plant and reservoir the authority runs → the large-load industrial account drawing from the same plant (Meta: ~500,000 gal/day, ~10% of county use) → the campus meter → the cooling plant → the evaporative tower or closed loop → the cold plate → the die. **Where the constraint binds:** the rate case, not the meter — a county cannot refuse to serve, so scarcity surfaces as price, and price lands on the smallest accounts first. Who-pays is the beat.

Key actors. *Humans*: Blair Northen — Mayor, Mansfield, GA (as-of Jul 2025); his reaction to the rate trajectory, paraphrase-marked: absolutely terrible [locator: NYT]. Mike Hopkins — executive director, Newton County Water & Sewerage Authority (as-of Jul 2025): wants capacity, fears the deficit, can enforce only the tap he hasn’t yet promised; his community-wealth line paraphrase-marked [locator: NYT]. *Institutions*: Newton County Water & Sewerage Authority (deficit projected by 2030; nine pending applications); City of The Dalles utility billing (industrial rate class). *Documents*: the rate schedules and the 2024 Newton County water-deficit report (Section 5 cross-reference).

The documents. The Newton County 2024 engineering report projecting deficit-by-2030 [cited in NYT; pull the report itself at draft stage — Newton County Water & Sewerage Authority]; Mansfield’s adopted rate increases; The Dalles’ published statement of Google’s rate treatment.

Verbatim bank. From the City of The Dalles’ own public webpage on Google’s water contributions: “ensuring that citizens are not subsidizing Google’s water consumption” [City of The Dalles, thedalles.org, “Google’s Contributions to the City Water System,” undated page, accessed 21 Jul 2026 — the city’s own characterization of the rate arrangement; the one quote from that page].

Who pays. The named path: Newton County household rates +33% over two years while the industrial draw is ~10% of county use — the burden distributes through the rate base, not the cause. The counter-arrangement: The Dalles’ structure (industrial user pays full rates *and* funded \$28.5M of system capacity *and* transferred rights) is the documented alternative allocation — both belong in the beat so the swap is priced, not asserted.

What’s contested, motivated, or unknown. Whether Newton’s rate increase is *caused by* data-center load or by deferred infrastructure generally is not adjudicated in the record; Hopkins’s authority needs rate revenue regardless (incentive noted). The Dalles’ citizens-not-subsidizing sentence is the counterparty’s own framing of a deal it negotiated under NDA — accurate on rates, silent on risk allocation (drought-year priority is not addressed in the public record). Seller mapping: the Politician (county officials selling manageability) and the Hyperscaler (rate-paying as full freight) both on the field; DISCOUNT posture on any single-cause reading of a rate increase.

Sensory & material details (sourced). A jar of brown water held up at a congressional hearing [May 2026 coverage]; sediment in a monthly-changed filter [MPU transcript]; the invoice itself as an object — a county utility bill with a line item that got 33% heavier.

Numbers that matter. \$5,000 spent / \$25,000 well — household — NYT — 14 Jul 2025 — STRUCTURAL · 33% over 2 years vs 2%/yr — Mansfield rates — Northen via NYT — Jul 2025 — VOLATILE · ~500,000 gal/day ≈ 10% of county use — Meta Newton campus — Hopkins via NYT — Jul 2025 — STRUCTURAL · >\$250M — recycling upgrade — Hopkins via NYT — Jul 2025 — VOLATILE · 11.5M gal / 6% of district — West Des Moines, Jul 2022 — WDM Water Works via AP — Sep 2023 — ANCHOR (metered, historical).

Stress-test verdict: SUSTAINABLE. The invoice corpus spans four ledgers (household, town, industrial, district) with dated figures at each; the upstream trace is fully documented. One discipline note: the household material is human-floor — the opener starts with comedy already off, and the thermostat re-warms only after the trace leaves the Morris kitchen.

Beat 2 — The Physics Audit (air's ceiling vs. the rack that just arrived)

Syllabus 2.0 assignment: Air's practical ceiling ~15 kW per rack against the 132 kW rack — the forced move, not an optimization.

Beat Menu definition: Atoms/Audit · versatile, closer-capable. The deadpan reality check delivered in the pitch's own tone. (Runs over-band at 8 appearances per the reconciliation; re-band recommendation pending — Nick's call.)

Facts, dates, names, numbers. The load-bearing physical constant: air's volumetric heat capacity is ~**3,500x smaller than water's** [Crippen et al., IBM J. R&D, Nov 2005; restated in US Patent 7,486,513 — ANCHOR]. The ceiling, stated across the record with its honest spread: standard hot/cold-aisle air handles **5–15 kW/rack at PUE 1.50–1.80** [Energy Solutions Intelligence, 2026]; airflow demands turn disproportionate **beyond ~10–15 kW** [Carbon-Z, 2026]; ASHRAE TC 9.9 classifies **>20 kW as high-density and recommends water-cooled solutions** [2023 guidance via GBC Engineers]; containment and engineering stretch air to **~20–40 kW** hard limits (IBM's 2005 blade analysis: ~30 kW; trade syntheses: 30–40 kW) [multiple, STRUCTURAL]. Against it, the arrival (owned by L2's pack — reproduced, not rebuilt): the GB200 NVL72 at **120–132 kW**, die heat flux **500+ W/cm²** — beyond any air-cooled heatsink [ToneCooling engineering references, 2026]. The arithmetic: $132 \div 15 \approx 8.8x$ — a discontinuity, not a gradient. The efficiency consequence: liquid-cooled facilities run **PUE 1.10–1.25** (must-hit; source families: liquid 1.02–1.15 best-in-class, 1.08–1.15 typical, 1.1–1.2 in peer-reviewed synthesis) against **1.50–1.80** for legacy air, with the industry mean stuck at **1.56** (Uptime 2024) because the installed base is air [Uptime; Carbon-Z; Energy Solutions — STRUCTURAL].

The mechanism. Why air fails: heat transfer scales with mass flow $\times$ heat capacity $\times \Delta T$. At 3,500:1 volumetric heat capacity, matching a liquid loop's heat removal with air means moving absurd volumes — fan power grows superlinearly, and above ~50 W/cm² die flux the boundary layer can't be thinned enough at any airflow. Direct-to-chip replaces the air path for **70–75% of rack heat** (the cold-plate-covered silicon); the remainder (memory, drives, power supplies) still leaves by air, which is why a “liquid-cooled” hall keeps its air handlers [Introl, 2025]. **Where the constraint binds:** the die-to-coolant interface — everything downstream (CDU, tower, river) is engineering; the interface is physics.

Key actors. *Object:* the rack (return — L2 owns it; one-line reference). *Institutions:* ASHRAE TC 9.9 (the guideline author whose thermal envelopes define “possible”); Uptime Institute (the survey of record).

The documents. ASHRAE Thermal Guidelines, 5th ed. (2021) — the facility-water classes W17/W27/W32/W40/W45/W+ that define allowable coolant supply temperatures; the 2023 high-density guidance steering >20 kW to water. What they force: nothing (guidelines) — and everything (warranties and vendor specs incorporate them, which is how a guideline becomes a constraint). Skeptical caveat: the “15 kW ceiling” is a planning convention inside a documented range (10–40 kW depending on engineering), not a law; the pack's formulation protects the claim by pairing “practical ~15” with “hard limits ~30–40” — same convention the L2 pack banked.

Verbatim bank. None required; the beat's language is numbers. (The Verbatim move is spent elsewhere.)

Who pays. One line: whoever owns the air-designed hall — stranding costs land in L2's externality swap and L10's audit; here the payment is thermodynamic.

What's contested. The exact ceiling (10 vs 15 vs 20 kW) is vendor- and containment-dependent — state as range; the PUE bands compare new liquid builds against legacy air stock, a partly unfair cohort comparison (new air builds hit ~1.3) [Carbon-Z] — the audit should grant this before leaning on the gap. Seller check: cooling vendors benefit from the starkest possible ceiling; the figures above deliberately mix vendor, standards-body, and survey sources.

Sensory & material details (sourced). The hall's sound: air cooling is fans — a 15 kW hall roars; a cold-plate hall hums at the CDU. [Inference from documented fan-elimination reliability data (fans = 35% of component failures in air systems, Introl 2026) — marked as inference from documented conditions.]

Numbers that matter. ~3,500:1 — air:water volumetric heat capacity — IBM/USPTO — 2005 — ANCHOR · 5–15 kW @ PUE 1.50–1.80 — legacy air envelope — Energy Solutions Intelligence — 2026 — STRUCTURAL · >20 kW = high-density → water — ASHRAE TC 9.9 — 2023 — STRUCTURAL · 30–40 kW — air hard limit — IBM 2005; trade syntheses 2026 — STRUCTURAL · 132 kW / 500+ W/cm² — the arrival — L2 pack values — 2024–26 — STRUCTURAL · 1.56 — Uptime mean PUE — 2024 survey — STRUCTURAL · 1.10–1.25 vs 1.50–1.80 — must-hit PUE pair — anchor governs; source families align — Section 6.

Stress-test verdict: SUSTAINABLE. The physics is deep, dated, and multi-sourced; the beat carries the Step Function (Section 4) and can run 1,000 words on the documented record without padding.

Beat 3 — Mechanism Autopsy (the direct-to-chip tour without the tour-guide voice)

Syllabus 2.0 assignment: Cold plates, CDUs, rear-door heat exchangers; PUE 1.10–1.25 vs. 1.50–1.80.

Beat Menu definition: Atoms · versatile · fat container. Content-native rotation — this lecture autopsies the heat path die-to-sky.

Facts, dates, names, numbers. The heat path, end to end, with the L3-owned segment complete: die → thermal interface material → **cold plate** (vacuum-brazed copper microchannel assembly; contact flatness ≤ 0.05 mm, surface roughness $R_a \leq 0.8$ μm ; up to $\sim 1,200$ W per GPU module at $30\text{--}45^\circ\text{C}$ inlet; ~ 2.5 L/min per plate at ~ 35 kPa in NVL72-class loops; leak-tested to 8.7 bar) [ToneCooling GB200 engineering specs, 2026 — vendor engineering literature, STRUCTURAL] → tray manifold → **rack manifold** ($\pm 5\%$ flow balance across 18–36 plates) → quick disconnects (blind-mate, drip-free class) → **CDU** (coolant distribution unit — the heat exchanger + pump skid isolating the clean secondary “technology cooling system” loop from the dirty facility loop; current commercial ceiling: Motivair MCDU-70 at **2.5 MW**, Jan 2026) → facility loop → heat rejection: evaporative cooling tower (spends water, saves electricity) or dry/adiabatic cooler or chiller (spends electricity, saves water) → sky. Parallel alternative for partial densities: **rear-door heat exchangers** (liquid-cooled doors catching the air path’s exhaust; Motivair ChilledDoor is the named product line). The secondary-loop working fluid: **PG25** — 25% propylene glycol / 75% high-purity water with a corrosion-inhibitor package (reference product: Dow DOWFROST LC 25, dyed fluorescent yellow-green *for leak detection*, freeze protection to -10°C); specified in OCP’s propylene-glycol guidelines and ASHRAE’s Datacom Book 4; the glycol depresses freeze point and carries inhibitors — **the water does the thermal work** [Dober; Chemstar; OCP — STRUCTURAL]. Fill discipline from NVIDIA’s own liquid-cooling documentation: fill with 25% PG / 75% water; vacuum to ≤ 5 kPa before fill; 25-micron filtration on the supply side [NVIDIA Q3450-LD system docs, accessed 2026 — primary vendor doc]. Chemistry discipline in the field splits into two documented schools: inhibited-glycol loops (conductivity $> 2,000$ $\mu\text{S}/\text{cm}$, leak = conductive hazard) versus deionized/low-conductivity loops (≤ 25 $\mu\text{S}/\text{cm}$ ceilings to suppress galvanic corrosion between copper microchannels, aluminum structure, stainless manifolds; tap-water commissioning at $150\text{--}400$ $\mu\text{S}/\text{cm}$ produces measurable cold-plate corrosion within ~ 90 days) [Chemstar; Alliance Chemical, Apr 2026 — **conflict stated, not smoothed**: the two schools’ numbers are incompatible because they describe different loop philosophies; the drafting AI must not average them]. PUE consequence: 1.10–1.25 vs 1.50–1.80 (Beat 2’s pedigree; stated once here, not re-derived).

The mechanism — leak detection as a new outage class. The failure sequence the industry now engineers against: a nicked O-ring, an unseated quick disconnect, a cracked fitting → seep or spray adjacent to busbars and PSUs → conductive path or wicking moisture → node loss or row loss. Documented base rates: water/coolant events persistently rank among the top five root causes of unplanned outages (Uptime, cited 2026); 60% of outages cost $> \$100\text{k}$ (2022, up from 39% in 2019) [Uptime 2022]. The engineered responses, all documented: rope/point moisture sensors under CDUs and manifolds tied to BMS; tiered interlocks (alert on seep, controlled isolation on flow anomaly); dyed coolant; NVIDIA’s own Mission Control software collating per-node “leak detection status” events with automated fail-safes [NVIDIA Mission Control admin guide, GB200/GB300, current 2026 — primary]. The pre-history: August 2024’s pre-production GB200 leak scare (branch pipes, quick connectors, hoses from outsourced suppliers; emergency fixes before mass production) and the early-ramp trims that followed [TweakTown/UDN, 14 Aug 2024; ModulEdge retrospective, 2026]. **Where the constraint binds:** the quick disconnect — the one component that must seal blind, repeatedly, at every service event, forever.

Key actors. *Object:* the cold plate — lead (full dossier Section 9). *Institutions:* NVIDIA (whose fill and leak-detection docs are the de facto code), OCP (the guideline commons), Vertiv/Motivair/CoolIT (the CDU-and-plate industrial base — Beat 4’s taxonomy).

The documents. NVIDIA’s liquid-cooling fill/drain procedures and Mission Control leak-detection guide (what they force: vacuum levels, filtration, coolant spec — violating them voids the thermal warranty, which is enforcement by warranty); OCP cold-plate and PG-fluid guidelines; ASHRAE Datacom Book 4. Skeptical caveat: all vendor documents; their numbers are engineering-true but their framings sell.

Verbatim bank. Reserved — the lecture’s single Verbatim deployment is assigned to the Paper Trail territory (Section 4); mechanism language here is paraphrased with locators.

Who pays. One line: the leak’s bill lands on the operator’s SLA and insurer — outage-cost figures above; the water bill is Beats 10–12.

What’s contested. The two chemistry schools (above). Also: how much rack heat cold plates actually capture (70–75% documented for current designs; vendor claims of $> 90\%$ “liquid capture” describe future fanless designs) — state with basis.

Sensory & material details (sourced/marked). The coolant is dyed fluorescent yellow-green so a drip announces itself

[Dow product literature]; a cold plate is a palm-sized copper brick whose internal fins are thinner than a human hair's width apart [vendor microchannel specs — dimensional inference marked]; the CDU is the room's new refrigerator-sized appliance, humming where CRAC fans used to roar [inference from documented equipment classes — marked].

Numbers that matter. ≤ 0.05 mm flatness / $R_a \leq 0.8$ μ m — cold-plate contact spec — ToneCooling — 2026 — STRUCTURAL · $\sim 1,200$ W/GPU — plate duty — vendor specs — 2026 — STRUCTURAL · 2.5 L/min @ ~ 35 kPa — per-plate flow — vendor specs — 2026 — STRUCTURAL · 2.5 MW — largest commercial CDU (MCDU-70) — Motivair/Schneider — Jan 2026 — VOLATILE (ceiling moves) · 25% PG / ≤ 5 kPa vacuum / 25 μ m filter — fill spec — NVIDIA docs — 2026 — STRUCTURAL · ≤ 25 μ S/cm vs $> 2,000$ μ S/cm — the two chemistry schools — Alliance/Chemstar — 2025–26 — CONTESTED (philosophy-dependent) · top-5 outage cause — water/coolant events — Uptime via Dober — 2026 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The component record is deep enough to overrun 1,000 words; the discipline problem is exclusion, not padding. Note for markup: the leak-detection material could seed a future Cold Open (the moisture sensor as object) in a refreshed edition.

Beat 4 — Taxonomy by Business Model (cooling vendors sorted by heat path, not logo)

Syllabus 2.0 assignment: The vendor landscape sorted by where the watt leaves; two-phase immersion above ~ 140 kW.

Beat Menu definition: Money · versatile · cold specialist (≤ 3 course-wide; this is casting 1 of 3 — L3 cooling vendors · L6 neoclouds · L9 orbital players). The taxonomy is the insight.

Facts, dates, names, numbers — the taxonomy. Sorted by heat path:

- **Single-phase direct-to-chip (cold plates + CDUs)** — the watt leaves through water-glycol in a sealed loop. The specialists: **CoolIT Systems** (Calgary; KKR majority May 2023 $\sim$ \$270M; **Ecolab agreement Mar 2026 at \$4.75B**), **Motivair** (Buffalo; Schneider 75% for \$850M, announced 17 Oct 2024, closed Feb 2025; ChilledDoor RDHx + CDU + plate portfolio), **Boyd** (thermal incumbent), **JetCool** (microconvective plates; acquired by Flex, late 2024). The infrastructure incumbents who bought in: **Vertiv** (+CoolTera CDUs, Dec 2023; Q1 2026 backlog $\sim$ \$15B, +109% YoY), **Schneider** (+Motivair), plus nVent and Stulz building adjacent. Market position: direct-to-chip is the largest liquid segment — **42.85% of 2025 liquid-cooling revenue** per Mordor; within D2C, **single-phase is $\geq 65\%$** (Grand View 2024: $> 65\%$; FMI 2025: 66%) [**the $\sim 65\%$ anchor's pedigree problem — Section 6, Discrepancy B**].
- **Two-phase direct-to-chip** — the watt leaves by boiling a dielectric on the plate. Named player: **ZutaCore**. Post-Novec fluid exposure applies.
- **Rear-door heat exchange** — the watt leaves through a liquid-cooled door after a short air hop; the retrofit path for 20–40 kW; ChilledDoor the reference product.
- **Single-phase immersion** — the server sinks into non-conductive oil; **GRC**, **Submer**, **Asperitas**, **Iceotope** (chassis-level precision immersion); supports ~ 100 – 120 kW/rack-equivalent [GMI, 2026]; **unaffected by the PFAS exit** (hydrocarbon fluids) [DCD, Dec 2022].
- **Two-phase immersion** — the watt leaves by boiling the tank; supports **150+ kW** configurations [GMI, 2026], which is the documented family behind the must-hit “two-phase immersion $> \sim 140$ kW”; reference player **LiquidStack**. This branch's qualified fluids were Novec 7100/649 — **its supply chain is the one 3M vaporized** (Beat 5).
- **Zero-water heat rejection as a design school** — Microsoft's Aug 2024-onward closed-loop standard: not a vendor but a buyer's specification that reorders every vendor's roadmap (Beat 12).

The mechanism. Why the sort is by heat path: each path fixes the economics. Cold plates monetize as hardware + attach (a CDU per N racks, service contracts); immersion monetizes as tanks + fluid (dielectric fluid at $\$25$ – $\$45$ /liter is 8–15% of system capex, lifetime 5–8 years [Energy Solutions, 2026]); RDHx monetizes as retrofit. **Where the constraint binds:** fluid chemistry and standards qualification — a vendor can tool plates in months, but a fluid takes years to qualify (which is why the 3M exit was a taxonomy event, not a procurement event).

Key actors. *Institutions with incentives stated:* Ecolab (a water-treatment major buying its way to the die — the acquisition reframes cooling as fluid *management*, recurring revenue); KKR (15x return on the transition — the documented mark of how fast the market repriced); Schneider and Vertiv (defending grid-to-chip integration); Rich Whitmore (President & CEO, Motivair — verified in role through the Schneider close). *Documented money:* Vertiv Q1 2026 organic +23%, Americas +44%, book-to-bill 2.9x [MarketWise print summary, Apr 2026].

The documents. The Schneider acquisition PDF (17 Oct 2024 — mid-single-digit multiple of projected FY2025 revenue disclosed); the Ecolab–CoolIT announcement (Mar 2026; close expected Q3 2026, regulatory approvals pending). What they force: integration roadmaps; what the multiples confess: 29x forward EBITDA is a price paid for believing the density roadmap (L2’s document, returning as a valuation input — one line).

Verbatim bank. Peter Herweck, CEO, Schneider Electric, on the Motivair deal, 17 Oct 2024: “from Grid to Chip and from Chip to Chiller” [Schneider/Motivair release — the one quote from that release].

Who pays. One line: the buyer of every rack pays the taxonomy’s margins; the consolidation premium is financed by the belief that they’ll keep paying (L6 territory; not priced here).

What’s contested. Market-share figures are analyst-authored and range widely (Mordor 42.85% D2C-of-liquid vs. Grand View/FMI 65–66% single-phase-of-D2C measure *different denominators*) — the ~65% anchor must be deployed with its denominator named or not at all (Section 6). Two-phase’s “>140 kW necessity” is directional, not a cliff: single-phase D2C now ships at 132 kW and vendors claim headroom to ~200+ kW; the honest formulation is that above the ~140–150 kW class, two-phase and immersion become the *documented engineering recommendations*, not the only physics.

Sensory & material details. A tank of immersion fluid with a server disappearing into it, bubbles streaming off hot silicon in the two-phase case [documented product demonstrations, marked as generic-to-class].

Numbers that matter. \$5.52B (2025) → \$6.77B (2026) — liquid-cooling market — Mordor — Jan 2026 — VOLATILE · >\$15B by 2028 — Dell’Oro projection — Jul 2024 — CONTESTED (forecast, author named) · \$270M (May 2023) → \$850M/75% (Oct 2024) → \$4.75B (Mar 2026) — the deal ladder — deal disclosures — VOLATILE until Ecolab closes · 100–120 kW vs 150+ kW — single- vs two-phase immersion envelopes — GMI — 2026 — STRUCTURAL · ~140 kW — Catalina rack liquid capacity — OCP/Meta — Oct 2024 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The taxonomy has five documented branches, each with named players, dated deals, and a mechanism; the M&A ladder gives it a money spine no logo-tour has.

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Beat 6 — Operator Reality (the plumbing trades suddenly load-bearing)

Syllabus 2.0 assignment: The trades in an industry that thought it was software; the UA syllabus.

Beat Menu definition: Atoms/Character · versatile. Sourced from job postings, staffing disclosures, trade press — humanizes without inventing anyone. Punch-up-only; full floor protocol not triggered (no documented harm/job-fear here — that’s L8’s vector).

Facts, dates, names, numbers. The operating tasks the liquid transition added, all documented in vendor/operator materials: coolant chemistry management (conductivity, pH 8.0–10.5 and reserve-alkalinity monitoring per ASTM D1121 for glycol loops; quarterly sampling) [Chemstar, 2025]; filtration discipline (25-micron supply-side per NVIDIA fill spec); quick-disconnect service procedures at every tray swap; leak-drill runbooks tiered from seep-alert to controlled isolation [coolnetsystem operations guidance, 2026]; CDU maintenance as a new PM line. Staffing context inherited from L1 (do not rebuild): ~50 FTEs run a quarter-million square feet, roughly half contractors — the liquid loop adds trades to that roster rather than headcount to the myth. Hiring market: liquid-loop experience commands premium pay (DataX Connect

recruiter data via DC Geeks, 2026); 46% of surveyed operators planning liquid adoption [Uptime via DC Geeks]; JLL: the industry expects to open as much capacity in five years as it built in the prior twenty-five [same]. The training apparatus: UA five-year apprenticeships; welding certification testing at UA facilities (e.g., ARPEC, Local 725's education center); journeyman upgrade classes — the pipe trades' continuing-ed machinery absorbing a new system type [ua.org; ua725.org].

The mechanism. Why the trade is load-bearing: every one of a campus's thousands of cold plates is a plumbing joint that must not leak next to electronics, and every service event re-opens the loop. The industry's documented failure sequence (Beat 3) is, operationally, a training problem. **Where the constraint binds:** the service event — steady-state loops are quiet; human hands are when leaks happen [Uptime root-cause pattern via Dober].

Key actors. The UA-certified pipefitter (roster secondary — a *category* of documented worker, not an invented individual; the pack supplies no name and the beat must not invent one); Local 412's Los Lunas crews (documented instance of union data-center staffing); recruiters and training directors as quoted in trade press [DC Geeks; CNBC, 18 Mar 2026].

The documents. UA apprenticeship standards; ASTM D1121 (reserve alkalinity); NVIDIA service procedures. What they force: who is allowed to touch the loop.

Verbatim bank. None deployed (no floor-grade individual; trade-press quotes held in reserve — Gary Wojtaszek, Pure Data Centres, on the skills gap, CNBC 18 Mar 2026, paraphrase-marked with locator if needed).

Who pays. One line: premium trade wages price into construction and service contracts — the watt path's labor rider.

What's contested. Shortage-vs-wages framing (Beat 5 note applies); union vs. merit-shop staffing shares are not in the verified record — do not assert them.

Sensory & material details (sourced/marked). Pressure-testing to 8.7 bar; helium leak tests on first articles [ToneCooling GB300 validation note, 2026]; the fluorescent dye under UV at a service check [Dow literature; marked as procedure-typical].

Numbers that matter. 5 years — UA apprenticeship — ua.org — standing — STRUCTURAL · 46% — operators planning liquid — Uptime via DC Geeks — 2025–26 — VOLATILE · pH 8.0–10.5 / RA per ASTM D1121 — glycol-loop chemistry window — Chemstar — 2025 — STRUCTURAL.

Stress-test verdict: THIN-leaning SUSTAINABLE. The documented material sustains ~1,000 words only if it stays operational (chemistry windows, service procedures, training apparatus) rather than repeating Beat 5's labor-market numbers; the two beats must split the corpus — Beat 5 takes the market, Beat 6 takes the work. If markup wants insurance, Section 3 names the strongest replacement candidate (the Hearing Room) and the cost of using it.

Beat 7 — Follow the Money (who's making money on the transition)

Syllabus 2.0 assignment: The liquid market; direct-to-chip ~65% in 2026; who profits.

Beat Menu definition: Money · versatile · fat container. Capital structure as narrative; the load-bearing assumption is the payoff.

Facts, dates, names, numbers. The market: **\$5.52B (2025) → \$6.77B (2026)**, 22.65% CAGR to \$18.79B by 2031 [Mordor Intelligence, Jan 2026 — analyst, flagged]; Dell'Oro (Jul 2024): **>\$15B by 2028**. The share anchor: direct-to-chip ~65% (2026) — **deploy only with Section 6's discrepancy note** (denominator conflict). The deal ladder as the market's own price discovery: KKR→CoolIT **~\$270M** (May 2023); Schneider→Motivair **\$850M for 75%** (Oct 2024; ~\$1.1B implied; mid-single-digit multiple of ~\$200–250M projected FY2025 revenue); Ecolab→CoolIT **\$4.75B** (Mar 2026; ~29x forward EBITDA; **KKR ~15x in under three years**) [deal disclosures; Evercore ISI via Radnor; MarketWise]. The public-company tape: Vertiv Q1 2026 — organic **+23%**, Americas **+44%**, backlog **~\$15B (+109% YoY)**, book-to-bill **2.9x**, FY26 guide **\$13.75B** [Apr 2026 print]. The buyers' capex context (one line, L1/L6 own it): Microsoft's >\$50B FY2024 capex, majority data centers [Bloomberg via Slashdot, Dec 2024].

The mechanism. Where the margin sits: plates are competitive hardware; **CDUs and service attach** are where incumbents defend (every N racks needs one; every loop needs maintenance forever); **fluids and water treatment** are the recurring-revenue prize — which is precisely what Ecolab's 29x confesses. The load-bearing assumption under every multiple: the density roadmap keeps its dates (L2's document, returning as the valuation's clock — one line, no re-derivation). **Where the constraint binds:** backlog conversion — a 2.9x book-to-bill is either a moat or a queue, and which one is a 2027 fact.

Key actors. Ecolab (fluid-management platform thesis); KKR (the exit that marks the market); Vertiv (Giordano Albertazzi,

CEO — verified in role 2026); Schneider (Herweck); Rich Whitmore (Motivair). Incentives stated per §5: every market-size figure above was published by a research house selling reports or an acquirer justifying a price.

The documents. The Schneider transaction PDF (multiple disclosed); the Ecolab announcement (close conditions). Skeptical caveat: “projected FY2025 revenue” in a deal PDF is the seller’s number wearing a banker’s font.

Verbatim bank. Herweck quote already deployed (Beat 4; one per source — cross-reference).

Who pays. The hyperscaler’s capex absorbs the premium; the neocloud finances it (L6’s inheritance); the exit multiples are paid, ultimately, by whoever holds the equity when utilization data finally publishes (L10’s question — name it, don’t answer it).

What’s contested. All forward market sizes (CONTESTED by construction — forecasts with authors); the 65% share (Discrepancy B); whether consolidation premiums survive a demand disappointment — HOLD OPEN, settled by data nobody publishes yet.

Numbers that matter. (Consolidated in Section 6 rows 20–27.)

Stress-test verdict: SUSTAINABLE. The deal ladder alone — three dated transactions with disclosed structures and one 15x realized return — carries the beat; the market-size figures are garnish, deployed with authors attached.

Beat 8 — The Paper Trail — class: permit/agreement (The Dalles)

Syllabus 2.0 assignment: The Dalles: expansion traded for aquifer investment; the 13-month secrecy fight.

Beat Menu definition: Politics · universal (all 10 lectures) · class rotation: permit/agreement here (L1 ran state audit; L2 technical specification; L4 queue instrument — rotation verified, no repeats).

This beat’s material is the pack’s Section 5 dossier in full. Assignment notes for the drafting AI: the beat carries (a) the agreement’s structure — \$28.5M of publicly owned infrastructure, rights transfer up to 3.88M gal/day, 35 acres to Wasco County, 15-year tax treatment, committed water service for two new data centers; (b) the fight over the document’s central number — Sept 2021 request → trade-secret denial → 15 Oct 2021 DA disclosure order → reverse lawsuit with Google paying the city’s bills → 14 Dec 2022 settlement, 10 years of data released, future requests honored; (c) the consequence — Google drops site-level water secrecy nationwide; (d) the honest caveat — the deal delivered its infrastructure (ASR transferred 22 Oct 2025, +100M gal/yr) *and* the disclosure it fought proved the underlying trend (Google’s city share reaching ~one-third, 434M gallons, by 2024). Verdicts, quotes, and the clause-level treatment: Section 5. Who pays: the rate-and-rights structure in Section 5’s operative-provisions field.

Stress-test verdict: SUSTAINABLE. The single best-documented water agreement in the industry: a court record, a DA order, a settlement, city staff reports with capacity figures, and a five-year outcome trail. This beat cannot be thin.

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What the term sheet reveals about leverage: the city monetized its only choke-point (the will-serve) at the price of dependency; Google bought certainty of supply and paid a second time — in the litigation's reputational bill — for trying to keep the meter reading private. The documented

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Beat 10 — The County (The Dalles and Newton County, negotiating water in public)

Syllabus 2.0 assignment: Two jurisdictions as live microcosm.

Beat Menu definition: Politics/Character · versatile, closer-capable. Present-tense politics with a zip code; distinct from The Wrong Map (how the geography happened — not run here).

The Dalles file (2024–26 present tense). Population ~16,000. Water sources: municipal watershed (80% of supply; 150 acres of it on US Forest Service land — Bentz's Watershed Development Act, introduced 30 Jan 2025, would transfer it); groundwater from a 1959-designated critical area; the Google-funded ASR (+100M gal/yr, city-owned since 22 Oct 2025). The forward plan: ~\$260M over 20 years, including the ~\$70M reservoir expansion; Google revenues ≈ a quarter of it; rates +7% by 2036; the 2024 master plan's demand line driven by an unnamed "large industrial user" [Oregon Capital Chronicle,

19 Jan 2026 — paraphrase of the plan's phrasing, locator marked]. Google's share of city water: ~29% (2021–22 records) → ~one-third / 434M gallons (2024, city data). Six Google data centers now stand in the city.

The Newton County file (2025–26 present tense). Population ~120,000, 1.5 hours east of Atlanta. The math: Meta ~500,000 gal/day ≈ 10% of county use; deficit projected by 2030 (2024 report); nine new applications, some seeking up to 6M gal/day — more than the entire county's daily use — some filed under aliases; the authority's >\$250M recycling fix. The politics, dated: BOC moratorium **17 Feb 2026** (5–0, 30 days) → extended to 8 Apr → extended 180 days to **7 Oct 2026** (5–0; pipeline applications exempt) while the Unified Development Ordinance is rewritten; Covington's own 180-day moratorium (20 Jan 2026); Social Circle's 2025 moratorium already lapsed. Context one line only (the wave's politics are L8's): since March 2025 at least eight Georgia jurisdictions have paused data centers; Kemp vetoed the 2024 tax-incentive rollback [NYT; GPB — boundary respected].

The comparative mechanism. Two jurisdictions, two postures, same chokepoint: The Dalles *sold* its will-serve early and is now financing the consequences of success; Newton is *withholding* its will-serve late and financing the consequences of arrival. The beat's job is both, priced.

Key actors. Newton BOC (the 5–0 votes; Resolution #R021726a session); Shena Applewhaite — Director of Development Services (UDO rewrite, on record Feb 2026); Hopkins (authority); Northen (Mansfield); Mays, Anderson, Bentz, Sen. Wyden (The Dalles file; Wyden's statement paraphrase-marked, locator: OPB via Capital Chronicle).

Verbatim bank. Newton BOC minutes quote deployed at Timeline entry 60 (cross-reference).

Who pays. Ratepayers on both maps (+33%/2yr; +7%/decade); county general funds for the ordinance fights; the applicants pay in time — a 180-day pause is a queue by another name (one-line L4 seed, not developed).

What's contested. Newton's deficit date (a consultant projection — author the report at draft stage); whether alias applications are demand or speculation — the water phantom-load question, Section 6 audit.

Stress-test verdict: SUSTAINABLE. Two live jurisdictions with primary-record votes, dated dollar figures, and named officials; the comparison structure prevents either file from thinning.

Beat 11 — The Neighbor (the Morris — comedy off)

Syllabus 2.0 assignment: The Morris, documented only.

Beat Menu definition: Character · thermostat near-zero · hard constraints: documented individuals from testimony, filings, and published reporting only; no composites; no invented color. (Neighbor course-cap: ×3 — Morris here, L7's fence-line ratepayer [pack dependency, not this pack's], Gladney L8.)

This beat's material is the pack's Section 8 in full — the entire human-floor file. Assignment notes: the beat is built exclusively from the NYT investigation (14 Jul 2025, Eli Tan), the BBC piece (Jul 2025, Michelle Fleury), and the More Perfect Union corpus (2025–26), with the Newton County procedural record underneath. The conflict is stated, not smoothed: Meta's commissioned study found a connection unlikely; the Joint Development Authority did no pre-construction well study and calls the timing possibly coincidental; the Morris' documented chronology runs the other way. HOLD OPEN is the assigned \$5 move and Section 7 confirms the calibration. Every quote, dollar, date, and the one distance discrepancy: Section 8.

Stress-test verdict: SUSTAINABLE. Three independent documentary sources, on-camera and in-print quotes, a dated appliance ledger, and both sides' responses on the record. The constraint is tonal, not evidentiary.

Beat 12 — The Externality Swap [C] (evaporative vs. closed-loop; WUE; the swap chosen in public)

Syllabus 2.0 assignment: Save water, spend electricity; save electricity, spend water; WUE as the number counties fight over; Microsoft's Dec 2024 zero-water design. Closer; carries the Kicker and the Handoff.

Beat Menu definition: Atoms/Money · versatile, closer-capable. The beat fails if either option is a strawman — both sides priced below.

The swap, both sides priced (documented). *Evaporative's side:* evaporation is thermodynamically cheap — the phase change does the work compressors would otherwise do; roughly 80% of drawn water is lost to the air in evaporative

operation [CVAT synthesis, 2026]; the electricity saved is why the industry's default was towers. Its price: the gallons — a large campus at up to 5M gal/day (the must-hit; “up to,” peak-conditions, per Brookings/EESI/FWPCOA — Section 4 conversion); Google Council Bluffs consuming ~1B gal in 2024. *Closed-loop's side*: fill once, evaporate nothing — Microsoft's Aug-2024-onward design avoids **>125M liters/yr per datacenter**, targets WUE near zero. Its price, admitted in the seller's own materials and the press reading them: mechanical/chiller cooling **raises power draw and PUE** — the watt bill buys the gallon back [Microsoft blog, 9 Dec 2024; Network World, Jan 2025; DCD]. *The metric*: WUE (Green Grid, L/kWh site basis) — sector average **~1.9 L/kWh** [EESI]; Microsoft fleet **0.30 L/kWh** (latest FY at announcement, -39% vs 2021); the counties fight over WUE because it is the one number that converts a permit into gallons. *The swap at fleet scale, quantified by a national lab*: LBNL's 2028 hyperscale direct-consumption scenarios span **60–124 billion liters** — the spread being substantially a cooling-mix choice [LBNL, Dec 2024]. *The swap at site scale, on one company's own disclosure*: Pflugerville, TX (air-cooled): 10,000 gallons in 2024; Council Bluffs (evaporative): ~1B — a ~270x spread inside one fleet [Google 2025 report via secondaries]. *The swap under coercion*: the Chilean tribunal's Cerrillos ruling pushing Google to an air-cooled redesign; the Netherlands' >70 MW hyperscale ban (Jan 2024) [synthesis sources — verify dockets at draft stage if deployed].

The mechanism. ΔT and humidity govern: a tower rejects heat at the wet-bulb temperature (cheap, wet); a dry cooler at the dry-bulb (free when it's cold, brutal in Phoenix in July); a chiller anywhere (expensive, dry). Warm-water cooling (W32/W40 classes, supply at 32–40°C) widens the free-cooling window and is why liquid loops enable *both* lower PUE and lower WUE — until the hottest hours, when someone must choose. **Where the constraint binds**: the design-day decision — a facility commits to its externality at the drawing stage, in the permit's WUE assumption, years before the first hot afternoon.

Key actors. Microsoft / Steve Solomon (the swap chosen in public — quote deployed, Timeline 43); Google (both extremes in one fleet); the counties (the WUE line in every new agreement — Virginia's 2026 budget water-minimization conditions noted as L1-owned material, one line).

Verbatim bank. Solomon quote spent (Timeline 43; cross-reference).

Who pays. Chosen per site: the aquifer and the fence line (evaporative), or the grid and the ratepayer at the margin (closed-loop) — which hands L4 its wall. Named dollars already moved: Microsoft's pilot capex at Phoenix and Mt. Pleasant (announced; amounts undisclosed — flag).

What's contested. Whether zero-water's PUE penalty is “slight” (Microsoft's word, paraphrased) or material is unpublished — the company discloses direction, not magnitude; HOLD OPEN with the GRANT-AND-WITHHOLD already assigned: the design is real, shipping to real sites, and its cost is denominated in the next lecture's currency.

Closer mechanics + Handoff (mechanism: a character walking toward the next problem — rotation-verified: L1 ran question, L2 ran cost unassigned; no adjacent repeats). The closer states the swap through the Kicker (Section 4: the zero-water design saves the aquifer by spending the grid — the swap, chosen in public), then the final ~200 words walk the documented character out of the room: the facilities engineer who has just committed a building's externality at the drawing stage has a next meeting, and it is with the utility — because a perfectly cooled building still has to plug in, and the queue at that counter is Lecture 4's whole hour. Refresh-safe check: the handoff hinges on the swap's *structure* (ANCHOR thermodynamics) and the queue's *existence* (L4, decay LOW) — no VOLATILE figure rides the seam; 2027-edition-proof.

Stress-test verdict: SUSTAINABLE. Both sides priced from primary or lab sources; the closer carries three moves (Kicker, the As-Of-adjacent WUE material, Handoff) without crowding because the swap's structure organizes them.

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

For each beat the strawman leaves out, in Beat Menu order:

Cold Open on an Object. The record *would* support it — the cold plate is documented to object-dossier depth (Section 9): manufacture, tolerances, pressure tests, dyed coolant, a failure class with dates. But the opener rotation assigns Bill Arrives to open 3 and 7, and Cold Open opens 2, 4, and 6 — L2 just ran it, and no two adjacent lectures may share an opener. **Correctly left out**; the object material rides inside Beats 3 and 9 (of this pack) instead. Logged for the 2027 refresh: the moisture sensor or the cold plate as a future Cold Open if the rotation reshuffles.

The Wrong Map. The Dalles has an origin-geography story (Columbia hydro, fiber, a Superfund smelter site, 2006 arrival), but origin-story geography is L1's installed lens and L5's Susquehanna variant; running it here would re-derive a mechanism

the course already owns. Material rides as two timeline lines inside The Deal. **Correctly left out.**

The Hearing Room. The strongest omitted candidate — a genuine surplus. Three documented rooms exist in this lecture’s territory: The Dalles City Council, 27–29 Sept 2021 (staff report + public testimony + councilor caution, all on the record); the Newton County BOC, 17 Feb 2026 (primary minutes, roll-call texture, the moratorium resolution); and the May 2026 congressional EPA hearing (the jar of brown water). **Swap case:** the Newton BOC session could most plausibly displace **Operator Reality** (Beat 6, the grid’s THIN-leaning verdict), honoring position classes (Hearing Room is versatile) and the scene-cap (it is the only scene beat). **Cost:** the Hearing Room already runs at 7 appearances against a 4–5 band (the one deliberately over-budget beat besides the two signature postures), and its three *opener* castings (5, 8, 10) plus mid-lecture uses make an eighth deployment the likeliest calcification point in the course; Operator Reality is also the beat carrying the roster’s UA-pipefitter secondary, and cutting it orphans a cast entry. **Recommendation: no swap** — instead, Beat 10 (The County) absorbs the Newton minutes as documented texture without scene-staging, which the Beat Menu permits (a hearing *cited* is not a hearing *staged*). Markup disposes.

The Forecast Problem. Present in miniature — the nine Newton applications at up to 6M gal/day, filed partly under aliases, are water-demand forecasts with motivated authors. But the full forecast-as-fiction mechanism installs in L4 (Wilson, quintupling filings), and pre-firing it here would blunt the lead deployment. The material rides inside The County plus Section 6’s phantom-load audit. **Correctly left out.**

The Perverse Incentive. The syllabus already notes the secrecy story rides inside the Paper Trail. Scanned candidates beyond it: trade-secret doctrine protecting public-utility usage data (resolved by the DA order — now a closed loophole in Oregon practice); “water positive” replenishment accounting (replenishing a different watershed than the one drawn down) — real, but it is Section 7 seller material, not a rule-producing-its-opposite mechanism with a documented rule text. **Correctly left out.**

The Regulatory Collision. The Oregon fight was records law vs. trade-secret doctrine — resolved administratively in one order, too short an arc for the beat; the Georgia moratoria-vs-state-preemption collision belongs to L8 by explicit boundary. **Correctly left out.**

The Steelman. No defendant assigned to L3 in the eight-slot rotation, and adding one would break the no-repeat discipline (the natural defendants here — the hyperscaler’s stewardship case, the county’s growth case — are spent in L1 and L10/L1 respectively). The nobody-wrong material (Meta’s study, Google’s rate-paying and infrastructure delivery, the authority’s constraints) is carried inside Section 7’s grant-precisely fields. **Correctly left out.**

The Symbol Audit. Hard cap $\times 3$, all three deliberately cast elsewhere (L5 TMI · L8 Stargate · L9 orbital destiny). The nearest symbol here — the jar of brown water at a congressional hearing — is documented and tempting, and it is exactly the kind of fourth deployment the cap exists to prevent. **Correctly left out;** the jar appears as a timeline fact inside floor-protocol territory, uninflected.

The Founder Audit. No founder in the territory; cooling-vendor CEOs are operators, not mythologies. **Correctly left out.**

Verdict pairing. Section 2 returned one THIN-leaning verdict: **Beat 6, Operator Reality.** Strongest replacement from this scan: the Hearing Room (Newton BOC, 17 Feb 2026) — case made and recommended against above. Preferred remedy: **re-scope rather than swap** — hold Beat 6 strictly to the *work* (chemistry windows, service procedures, training apparatus, the documented union instance) and let Beat 5 keep every labor-market number, which removes the overlap that made 6 look thin.

Summary for markup. No swaps proposed. All nine omissions confirmed as correctly left out, one with a fully argued alternative on the table (Hearing Room $\leftrightarrow$ Operator Reality) for markup to overrule. Category minimums re-verified for the strawman as it stands: Atoms ≥ 1 (Beats 2, 3, 5, 12), Money ≥ 1 (Beats 1, 4, 7), Politics ≥ 1 (Beats 8, 10), Character-family coverage present (Beats 9, 10, 11 — the fourth-minimum finding holds). The pack proposes; markup and the Course Schema dispose. No re-sequencing.

SECTION 4: MOVES PLAN VERIFICATION

The Step Function — VERIFIED. Assigned: 15 kW ceiling vs. 132 kW arriving — an order of magnitude, not a gap. The number’s pedigree: ~15 kW practical air ceiling — planning-convention value inside a documented 10–20 kW practical band (Energy Solutions Intelligence 2026: 5–15 kW @ PUE 1.50–1.80; Carbon-Z 2026: disproportionate airflow beyond

10–15 kW; ASHRAE TC 9.9 2023: >20 kW = high-density → water; hard limits 30–40 kW per IBM 2005 and trade syntheses). 132 kW: the L2 pack’s audited rack value (120 kW nominal, 130–132 kW at load; HPE basis 115+17) — reproduced, not rebuilt. The standing assumption that must feel settled first: **sixty years of computing cooled by moving air** — from mainframe rooms to the 2020 fleet averaging under 8 kW, air was never a choice, just the medium; the pack supplies the settling material (the 3,500:1 heat-capacity fact stated *late*, after the listener has accepted air as furniture). The break: $132 \div 15 \approx 8.8x$ — and the discipline note: the move deploys inside Beat 2, once, and Beat 12’s LBNL range and Beat 7’s multiples arrive as ordinary facts. **No stronger candidate found** (the 3,500:1 constant is a better *fact* but a worse *break* — it explains rather than shatters). If the number has moved: it hasn’t; the ceiling is physics-adjacent and the rack figure is anchor-carried.

The Unit Conversion — PASS. Assigned: 5M gallons/day → a mid-sized town’s municipal draw. The arithmetic, shown: US municipal systems deliver roughly 100–165 gallons per person per day across residential-plus-commercial demand (EPA WaterSense residential ~82–100 gal/person/day; system-wide totals higher). $5,000,000 \div 165 \approx 30,300$ people; $5,000,000 \div 100 \approx 50,000$ people. The sourced comparison targets agree: EESI — a town of 10,000–50,000; Brookings (Nov 2025) — up to 50,000 residents; FWPCOA — 30,000–50,000 at the upper end. **Documented city instance for the drafting AI:** The Dalles, population ~16,000, ran total municipal consumption of roughly 1.2 billion gallons/year in the 2021–22 records (derivable from Google’s 355M gallons = 29% of city total) ≈ 3.35 million gallons/day citywide — so a single 5M gal/day campus out-drinks the entire city that fought the 13-month lawsuit, with room to spare. Verdict: **PASS**, with two riders the arithmetic requires: (1) keep the “up to” — 5M gal/day is a peak/large-campus figure (typical facility ~300,000 gal/day $\approx 1,000$ households, Brookings), and (2) the figure is a *withdrawal-scale* headline; consumption vs. withdrawal must not blur (Section 6 audit). The Dalles instance uses the Oregonian-side 2021 figure; if markup prefers the AP-side 274.5M, the city total recomputes to ~2.6M gal/day and the conversion *strengthens* — PASS under both readings of Discrepancy C.

The Timeline Snap — VERIFIED, with a documented alternate framing. Assigned: December 2022 — the month the chemistry left the market. Exact date: **Tuesday, 20 December 2022**, 3M press release, St. Paul. Incentive state the day before: two-phase cooling is the credible high-density endgame, qualified on Novec 7100/649/FC-72, with Microsoft’s production tanks as proof-of-concept; the day after: every two-phase roadmap carries an expiration date, fluid stockpiling begins, single-phase D2C inherits the default, and the vendor field re-sorts (Motivair’s January 2023 analysis is the industry reading its own X-ray). The record’s gift to markup, offered not substituted: **the same month, six days earlier (14 Dec 2022), the secrecy left the market too** — The Dalles settlement released the water numbers and Google abandoned site-level trade-secret claims nationwide. December 2022 is the month this lecture’s two concealments — what the coolant is made of and what the meter reads — both ended. The assigned snap (the 20th) stands; the pairing is available if markup wants the fuller hinge. No different date argues harder: candidates checked — 9 Dec 2024 (zero-water: a choice, not a flip) and 31 Mar 2025 (last orders: an echo, not a hinge).

The Verbatim — FAIL on the assigned clause; verified alternates supplied. Assigned: a clause from The Dalles agreement. The existence gate: the agreement’s own operative text (the Design LLC water/development agreement approved 8 Nov 2021) is not reproduced verbatim in any source verified by this pack — coverage paraphrases its terms, and the volume commitments were the very matter under NDA. **Verdict: FAIL as assigned.** Nearest *verified* alternates from the same territory, block-quoted with attribution, strongest first:

1. The counterparty city’s own published characterization of the deal’s rate structure — City of The Dalles website, “Google’s Contributions to the City Water System” (accessed 21 Jul 2026): “ensuring that citizens are not subsidizing Google’s water consumption” — bureaucratic reassurance as its own exhibit; deployed at Beat 1’s bank.
2. The Wasco County District Attorney’s disclosure order (Matthew Ellis, 15 Oct 2021), as reproduced in secondary coverage: “The document simply states the amount of water used” — the legal system reading a trade secret and finding a meter; **draft-stage pull of the order’s full text from the county file recommended before deployment** (secondary-reproduction caveat travels with it).
3. The Newton County BOC minutes (17 Feb 2026): the moratorium will “cover the term ‘data center’ as it is used in the governing zoning laws” — the permit/agreement class speaking in its native syntax, from a primary record. Recommendation: alternate 1 or 3 (both primary); the lecture’s single Verbatim deploys inside Beat 8 or Beat 10 accordingly. If Nick wants the assigned clause itself, the path is a public-records pull of the executed agreement from the city — flagged as an open action, not performed by this pack.

The As-Of Stamp — RESOLVED WITH DISCREPANCY FLAG. Assigned: the ~65% direct-to-chip share (2026). Current state of the record: no single verified source states “direct-to-chip = 65% of the liquid-cooling market in 2026.” What exists, dated: Grand View (2024): single-phase $\geq 65\%$ of the direct-to-chip segment; Future Market Insights (2025):

single-phase 66% of D2C; Mordor (Jan 2026): D2C = 42.85% of liquid-cooling revenue (2025). The anchor most plausibly descends from the single-phase-share statistic with its denominator dropped in transit. **Anchor value governs; no substitution anywhere in this pack; full reconciliation Section 6, Discrepancy B**, with the recommendation staged there. Expected decay velocity: analyst-report cadence (annual), direction up for D2C share-of-liquid as Blackwell-class volumes ship. If the stamp re-scopes, the pack's strongest alternates: "as of December 2024, the national laboratory's count is 66 billion liters" (LBNL, direct US consumption, 2023 basis) or "as of the 2024 survey, the industry's average PUE is 1.56" — both carry the stamp's thematic load (precision admitting its own expiration).

The Kicker — VERIFIED. Assigned: the zero-water design saves the aquifer by spending the grid — the swap, chosen in public. The closing fact's pedigree: Microsoft Cloud Blog, 9 Dec 2024 (Steve Solomon, VP datacenter infrastructure engineering) — zero water evaporated for cooling; >125M liters/yr/datacenter avoided; and the cost side in the seller's own materials and the press reading them: replacing evaporation with mechanical cooling raises energy draw (Network World, Jan 2025, states the PUE trade explicitly). Adjacent facts for the closing passage: designs standard from **Aug 2024**; pilots **Phoenix, AZ and Mt. Pleasant, WI**; online from **late 2027**; fleet WUE 0.30 L/kWh (–39% vs 2021) heading toward near-zero. The kicker survives its caveat and is strengthened by it: the most water-virtuous design in the industry is a confession that the swap cannot be escaped, only chosen.

The Gesture — SKIP CONFIRMED. Assigned: skip (no door pressed hard enough). Verified: the lecture's material presses lightly on the **silicon door** at exactly one point — chip fabrication's own water appetite (~10M gallons/day of ultrapure water per average fab; a chip arrives having already consumed thousands of gallons [EESI]) — and that door's single sanctioned touch is already spent in L2. Boundary discipline: the fab-water fact is **not deployed** in this lecture's prose; logged in Section 10's fence table so the drafting AI knows where the fence runs. No reactor or training-run pressure detected in the territory. Skip stands.

The Handoff rides in the beat plan; material and rotation verification live in Beat 12 and Section 10.

SECTION 5: THE DOCUMENT DOSSIER — The Water Agreement (permit/agreement class)

The document itself. The City of The Dalles–Google water and development arrangement: an infrastructure-and-water-service agreement between the City of The Dalles, Oregon and **Design LLC** (Google's contracting subsidiary), approved by unanimous City Council vote **8 November 2021**, negotiated alongside (but distinct from) the Strategic Investment Program tax agreements decided at the county level. Companion instrument: the **settlement agreement** in *City of The Dalles v. Rogoway and Oregonian Media Group*, Wasco County Circuit Court, finalized **14 December 2022** — the document about the document. Procedural status: agreement executed and substantially performed (infrastructure complete; ASR transferred 22 Oct 2025); settlement performed (records released; future-request obligation standing). Where the texts live: City of The Dalles records (agreement; council packets of 27 Sept and 8 Nov 2021 including the Anderson staff report and the GSI Water Solutions capacity study); Wasco County Circuit Court file (suit, DA order as exhibit, settlement). **Dating discrepancy against the syllabus stack ("2023 agreement") carried as Discrepancy A — Section 6.**

What it says (operative provisions, from the documented record; agreement text itself not publicly quotable — see Section 4 Verbatim FAIL). Google/Design LLC funds **\$28.5 million** of improvements to *publicly owned* water infrastructure: two new groundwater wells, two 1.2-million-gallon storage tanks, pump stations, a sanitary sewer lift station, and an **aquifer storage and recovery (ASR) system** that banks surplus wet-season water underground for dry-season recovery (Oregon ASR law requires 10% of injected water remain in the aquifer). Google transfers the former-smelter **groundwater rights — pumping capacity up to 3.88 million gallons/day** — to the city, and donates 35 acres to Wasco County. The city commits water service for **two new data centers** (committed volume undisclosed at approval; Anderson's contemporaneous public framing: total Google use planned below ~1.4 billion gallons/year). Google pays **standard industrial water rates on every gallon, including water drawn under the rights it donated**. The tax side (county SIP agreements): deep property-tax reductions for the first 15 years. Load-bearing definitions the drafting AI can rely on without the text: *will-serve* — the utility's binding commitment that capacity exists to serve a proposed load; the entire negotiation is, functionally, the pricing of one will-serve letter.

Who wrote it and why. Drafted between city staff (Anderson's public-works shop, with GSI's engineering) and Google's development team, under an existing NDA; the city's incentive — infrastructure it could not self-finance plus the tax base; Google's — supply certainty on a critical-groundwater-area site it already owned. What each gets if the document is believed: the city, the citizens-not-subsidizing story; Google, the responsible-partner story. Both stories are, on the

performance record, substantially true — which is what makes the secrecy fight the document’s revealing feature rather than its terms.

What it forces and what it forbids. Forces: Google’s construction milestones on city infrastructure (performed, 2022–25); rate payment; rights transfer. Forbids (via the NDA layer, until Dec 2022): disclosure of the committed volume — the provision that collided with Oregon public-records law and lost.

What happens when someone violates it. The documented enforcement event is inverted: the fight was over the *disclosure regime around* the agreement, not a breach of it. Sequence: records request (Sept 2021) → denial → **DA order to disclose (15 Oct 2021)** → the city sues the requester, Google funding the city’s litigation → 13 months → settlement (14 Dec 2022): ten years of historical data released, future requests honored, and — the consequence that outran the case — **Google abandons site-level water trade-secret claims nationwide.** No performance breach of the underlying agreement is in the record.

The skeptical caveat. Is it binding, or a press release with a docket number? **Binding, and performed** — the rare instance in this course where the paper’s obligations were real, dated, and completed (tanks built, rights transferred, ASR handed over on 22 Oct 2025 with +100M gal/yr of distributable supply). The honest withholding: the agreement solved the *financing* of water while compounding the *demand* for it — the city’s own 2024 master plan now projects a \$260M/20-year program, a \$70M reservoir expansion into national forest, +7% rates by 2036, and a demand line driven by a “large industrial user” it declines to name; and the drought-year priority question (who curtails first when the aquifer disappoints) is not addressed anywhere in the public record. A document can be honored in full and still be the reason the next document exists.

The document’s history and fate. Sept 27–29, 2021 public presentation → Nov 8, 2021 approval → the 13-month confidentiality war → Dec 14, 2022 settlement → 2022–2025 construction → Oct 22, 2025 transfer ceremony → Jan 2026: the successor documents assemble (the 2024 Water Master Plan; Bentz’s Watershed Development Act, 30 Jan 2025; Wyden’s Senate consideration). The FOIA-adjacent fight *is* the fate: the agreement’s most consequential clause turned out to be the one Oregon law wouldn’t let it keep.

The class, generalized (for the beat’s one-paragraph widening). The will-serve letter / water-service agreement is the industry’s standard instrument: Newton County’s nine pending applications are requests for exactly this document, at up to 6M gal/day each; the West Des Moines Water Works’ 2022 conditions memo (peak-reduction technology required for future projects) is the same instrument wearing a warning label. The class’s defining property: it is the one permit a data center cannot engineer around — every other input can be bought; this one must be *granted*.

Returning documents. *NVIDIA’s rack roadmap* (lead: L2; returns 3, 6, 9) — this lecture adds only the thermal consequence: each edition’s per-rack kilowatt figure is the cooling stack’s design input (120–132 kW shipping; ~600 kW published for 2027) — one sentence of provenance, no ladder re-derivation; L2’s pack owns the full dossier. *JLARC 2024* (lead: L1) — its water finding (“currently sustainable, but growing...”) is L1’s exhibit; if invoked here, brief reference only, L1 owns the treatment. No other prior-lecture documents return into L3 (verified against the Roster’s cross-lecture table: the interconnection agreement first appears in L4).

SECTION 6: THE NUMBER SPINE

(Research-document table — permitted here, banned in published prose.)

#	figure	unit	stage	as-of	author/filer	source	tier	notes
1	~15	kW/rack (rate)	practical air ceiling	standing	convention within 10–20 band	ESI 2026; Carbon-Z; ASHRAE via GBC	STRUCTURAL	must-hit; pair with 30–40 kW hard limit
2	~3,500:1	ratio	physics	2005	Crippen et al./IBM	IBM J. R&D; US Pat. 7,486,513	ANCHOR	air:water volumetric heat capacity
3	120–132	kW/rack (rate)	shipping	2024–26	NVIDIA/HPE via L2 pack	L2 pack \$6	STRUCTURAL	Inherited; do not rebuild

#	figure	unit	stage	as-of	author/filer	source	tier	notes
4	500+	W/cm ² (rate)	die heat flux	2026	vendor engineering	ToneCooling	STRUCTURAL	
5	1.10–1.25 vs 1.50–1.80	PUE (ratio)	liquid vs legacy air	2024–26	must-hit; source families align	ESI; Carbon-Z; peer synthesis	STRUCTURAL	Uptime mean 1.56 (2024) alongside
6	1.56	PUE	survey mean	2024	Uptime Institute	Global Survey 2024	STRUCTURAL	1.58 in 2023; flat 5 yrs
7	~65	%	D2C share (2026)	assigned	anchor	see Discrepancy B	CONTESTED	denominator conflict
8	42.85	%	D2C of liquid revenue	2025	Mordor	Jan 2026 report	VOLATILE	competing denominator
9	≥65 / 66	%	single-phase of D2C	2024 / 2025	Grand View / FMI	reports	VOLATILE	likely anchor ancestor
10	>140	kW/rack (rate)	two-phase threshold	2024–26	must-hit; direction verified	GMI (150+); Catalina ~140	STRUCTURAL	threshold is a class, not a cliff
11	up to 5,000,000	gal/day (rate)	large- campus peak	standing	Brookings; EESI; FWPCOA	Nov 2025 & standing	STRUCTURAL	must-hit; keep “up to”
12	~300,000	gal/day (rate)	typical facility	2025	Brookings	Nov 2025	STRUCTURAL	~1,000 households
13	~500,000 / ~10%	gal/day / share	Meta Newton draw	Jul 2025	Hopkins/NCW via NYT	SAF 14 Jul 2025	STRUCTURAL	
14	274.5M vs 355M	gal/yr (quantity)	Google The Dalles 2021	Dec 2022	Google/city records via AP; Oregonian	releases	CONTESTED	Discrepancy C
15	434M / ~1/3	gal/yr / share	Google The Dalles 2024	Oct 2025	city data	Columbia Gorge News	STRUCTURAL	
16	3.88M (also rep. 3.8/3.9M)	gal/day (rate)	smelter pumping right	2021–26	Anderson; OR Capital Chronicle	multiple	STRUCTURAL	light ≠ draw; stage matters
17	\$28.5M	\$	spent (completed 2025)	2021–25	Google/city	city records	ANCHOR	infrastructure program
18	+100M	gal/yr (quantity)	ASR added supply	22 Oct 2025	Google/city	ribbon- cutting record	STRUCTURAL	
19	9.9M / 17.5M / 5,500 vs 1,800	gal/day; ac-ft/yr	city capac- ity/buildout; aquifer yield/draw	Sept 2021	GSI; Anderson	council record	STRUCTURAL	
20	\$5.52B→\$6.77B (annual)		liquid market 25→26	Jan 2026	Mordor	report	VOLATILE	analyst
21	>\$15B by 2028	\$	projection	Jul 2024	Dell’Oro	via Facilities Dive	CONTESTED	forecast, author named

#	figure	unit	stage	as-of	author/filer	source	tier	notes
22	~\$270M	\$	KKR→CoolIT	May 2023	deal reporting	Enki synthesis	STRUCTURAL	
23	\$850M / 75% / ~\$1.1B	\$	Schneider→Motiva	Oct 2024 (closed Feb 2025)	Schneider PDF	primary	ANCHOR	option on 25% by 2028
24	\$4.75B / ~29x / ~15x	\$ / multiples	Ecolab→CoolIT	Mar 2026	deal disclosures	MarketWise/Enki	VOLATILE	close expected Q3 2026
25	+23% / +44% / ~\$15B / 2.9x	growth/backlog	Vertiv Q1 2026	22 Apr 2026	Vertiv print	via MarketWise	VOLATILE	
26	66B (2023); 21.2B (2014); 60–124B (2028 range)	liters/yr (quantity)	US DC direct water	Dec 2024	LBNL	2024 report	STRUCTURAL	scenario range = cooling mix
27	~800B	liters/yr (quantity)	US DC indirect water	2023 basis	LBNL	2024 report	STRUCTURAL	grid-mix attribution
28	>125M	liters/yr/DC (quantity)	avoided by zero-water	9 Dec 2024	Microsoft	blog	STRUCTURAL	
29	0.30	L/kWh	Microsoft fleet WUE	FY at Dec 2024	Microsoft	blog/report	VOLATILE	–39% vs 2021
30	~1.9	L/kWh	sector-avg WUE	standing	Green Grid metric; EESI	EESI	STRUCTURAL	
31	~9.9B w / ~7.9B c; alt 7.8B w / 6.1B c; 8.1B c (DC+offices)	gal/yr	Google fleet 2024	2025 report	Google	via Gov-Tech/MOST/DCM	CONTESTED	Discrepancy G (scope)
32	~1.0–1.3B c; 1.4B w; 3.9M/day w, 2.7–2.8M/day c	gal	Council Bluffs 2024	2025 report	Google	via secondaries	STRUCTURAL	most water-intensive site
33	10,000	gal/yr	Pflugerville 2024	2025 report	Google	via Civil Beat	STRUCTURAL	air-cooled; ~270x spread
34	11.5M / 6%	gal (month) / share	WDM Jul 2022	Sep 2023	WDM Water Works	AP	ANCHOR	metered
35	~1.7B / +34%	gal/yr	Microsoft FY2022 water	Sep 2023	Microsoft report	AP	STRUCTURAL	
36	33% / 2 yrs vs 2%/yr	rate change	Mansfield water rates	Jul 2025	Northen	NYT	VOLATILE	
37	>\$250M	\$	Newton recycling fix	Jul 2025	Hopkins	NYT	VOLATILE	announced, not spent
38	9 apps; up to 6M gal/day	count; rate	Newton pipeline	Jul 2025	NCWSA via NYT	NYT	VOLATILE	phantom-load audit below

#	figure	unit	stage	as-of	author/filer	source	tier	notes
39	\$5,000 / \$25,000 / 2019-21-24	\$; years	Morris ledger	Jul 2025	Morris via NYT	NYT	STRUCTURAL	floor
40	20 Dec 2022 / 31 Mar 2025 / end-2025	dates	Novec exit sequence	primary	3M; distributors	releases	ANCHOR	
41	\$12.5B / 11,000+ / 13 yrs	\$	3M PFAS settlement	Mar 2024	court record	syntheses	STRUCTURAL	
42	~\$260M / \$70M / +7% by 2036	\$; rate	The Dalles 20-yr plan	19 Jan 2026	city plan via OCC	OCC	STRUCTURAL	
43	≥8 jurisdictions since Mar 2025	count	GA moratorium wave	22 Oct 2025	GPB survey	GPB	VOLATILE	L8 boundary; cite only
44	17 Feb → 8 Apr → 7 Oct 2026	dates	Newton moratorium arc	2026	BOC minutes	primary	ANCHOR	

Reconciliation against the must-hit anchors (no silent substitutions anywhere in this pack):

- **Discrepancy A — “The Dalles–Google 2023 agreement” (Syllabus 2.0 cast entry).** The documented record: council approval **8 Nov 2021**; settlement **14 Dec 2022**; the city’s own materials call it “a 2021 agreement” (Columbia Gorge News, quoting the conditioning of the two new data centers). Likely origin of “2023”: the fight “ended in 2023” phrasing in later syntheses (record handovers ran into early 2023). Recommendation: restyle the cast line to “the 2021 agreement, its terms pried open by the Dec 2022 settlement” — Nick resolves; anchor phrasing untouched until he does. The **13-month suit** must-hit verifies exactly (Nov 2021 filing → 14 Dec 2022 settlement).
- **Discrepancy B — “direct-to-chip ~65% (2026).”** No verified source states it in that form; adjacent statistics: single-phase = 65–66% of D2C (Grand View 2024; FMI 2025); D2C = 42.85% of liquid revenue (Mordor 2025). Anchor governs in all pack text above (always with this flag attached). Recommendation for Nick: either (a) re-scope the anchor to “single-phase direct-to-chip holds roughly two-thirds of the cold-plate market” with the analyst named, or (b) supply the original source if the 65%-of-liquid figure came from a report not surfaced here (IDTechEx and Omdia are the likeliest homes — not verified). The As-Of Stamp deployment is blocked on this resolution (Section 4).
- **Discrepancy C — Google The Dalles 2021 water.** AP (Dec 2022): 274.5M gallons consumed; The Oregonian (same release): 355M gallons = 29% of city consumption. Both attach to the same records release; plausible reconciliation (unverified): consumption vs. withdrawal, or data-center-only vs. all-Google-facilities scope. Resolution path: the released records themselves (public since the settlement). Neither figure deploys without its author named.
- **Discrepancy D — Morris distance.** NYT: 1,000 feet; BBC: 400 yards (1,200 ft). Roster carries 1,000 feet (NYT) — retain, with the BBC variance noted; both are “under a quarter-mile,” which is the honest prose formulation if precision is contested.
- **Discrepancy G — Google fleet 2024 water.** Secondary readings of the same 2025 Environmental Report conflict on scope (data centers vs. +offices; withdrawal vs. consumption): 9.9B w/7.9B c (GovTech), 7.8B w/6.1B c (MOST), 8.1B c combined (DCM). Draft-stage pull of the report’s own table required before any fleet figure enters prose.
- All other must-hits verify: ~15 kW ceiling (row 1, with band); PUE pair (row 5); two-phase >140 kW (row 10, “class not cliff” note); 5M gal/day (row 11, keep “up to”); water-energy tradeoff (rows 26–33); Novec Dec 2022 (row 40); Microsoft zero-water Dec 2024 (rows 28–29).

Capacity/energy audit (water edition: rate vs. quantity). Every water figure above is labeled gal/day or L/kWh (**rates**) versus gal/yr or liters/yr (**quantities**); flagged blur sources: headlines equating Google’s *3.88M gal/day pumping right* (a rate ceiling) with *use*; and “5M gallons/day” deployed without “up to.” The kW figures are all rates; the CDU’s 2.5 MW is a rate (heat-rejection capacity). Additional stage discipline unique to water: **withdrawal ≠ consumption ≠ rights** — with-

drawal returns partly to the watershed (Google fleet returns ~20–25%); consumption evaporates; rights are options. Any source blurring the three is course material, not just error. **Phantom-load audit (water edition)**. Aggregate-demand figures carrying possible duplicate/speculative inflation: Newton County's nine applications at up to 6M gal/day each (aliases documented; the same developer may be shopping multiple counties — unverifiable by construction); NYT's "millions of gallons a day" permit-application review (requests, not loads). Caveat attaches on first appearance per the figures disciplines. LBNL's 2028 range is scenario-based, not request-based — exempt, but its 2x spread is itself the honest uncertainty statement.

SECTION 7: THE SELLERS & THE OVERCLAIMS

Assignment first: **the Hyperscaler** (sustainability framing) and **the Doomer** (the water panic), governed by **HOLD OPEN** (the Morris well vs. Meta's study) and **GRANT-AND-WITHHOLD** (zero-water). Steelman rotation: **no assigned defendant in L3**; the strongest-case discipline is delivered inside each cluster's "what's real" field. The rest of the field follows the headline sellers.

Cluster 1 — "Zero-water" / the sustainability design story (Hyperscaler; Microsoft). *As sold:* Microsoft Cloud Blog, 9 Dec 2024 (Solomon) — next-generation datacenters consume zero water for cooling; >125M liters/yr avoided per site; WUE toward zero. *What the seller gets if believed:* permits in water-stressed markets (Phoenix is a pilot for a reason), a counter-narrative to the AP Iowa investigation, and a spec that competitors must now match. *What's real, granted precisely:* the design is real and dated (standard from Aug 2024), the sites are named (Phoenix; Mt. Pleasant), the fleet WUE trend is disclosed and steep (0.30 L/kWh, -39% vs 2021), and closed loops genuinely evaporate nothing. *What's oversold:* "zero water" is zero *evaporation for cooling* — restrooms and kitchens still draw; the energy cost of the swap is disclosed in direction but not magnitude; and the fleet remains overwhelmingly evaporative until late-2027-plus deliveries. *Move check:* **GRANT-AND-WITHHOLD confirmed** — the record supplies both hands (the design and its admitted power cost). Best rebuttal on the seller's own paper: the blog's asterisked scope line. **Cluster 2 — "Water positive by 2030" / replenishment accounting (Hyperscaler; Google, Meta, Microsoft).** *As sold:* Microsoft (Sept 2020), Meta (Aug 2021), Google (Sept 2021 — 120% replenishment "where we operate"). *What they get:* a fleet-level average that can be true while any single aquifer declines. *Real:* documented replenishment spend exists (Google's \$28.5M Dalles program, the \$3M Nebraska leak-detection grant; site-level disclosure since Dec 2022 — an industry-norm change this course should credit to a lawsuit, not a pledge). *Oversold:* replenishment is not co-located with drawdown — 120% "on average, across" is doing load-bearing work; the Morris' aquifer cannot drink a Nebraska grant. *Move:* GRANT-AND-WITHHOLD; the withhold is the averaging. **Cluster 3 — the Morris well vs. Meta's study (Hyperscaler vs. the floor).** *As sold (Meta):* a commissioned well study found it unlikely the data center affected area groundwater; the JDA's Sheidler: no pre-construction well study exists, timing could be coincidence, a thousand feet is significant distance [all paraphrase-marked, NYT locators]. *As lived (documented):* the 2018-groundbreaking chronology, the sediment, the three appliance rounds, three-plus affected neighbors on the record. *What would settle it:* an independent hydrogeological study with pre-construction baselines — which, per the JDA's own statement, was never taken; the absence of the baseline is itself the finding. *Move check:* **HOLD OPEN confirmed** — the pack supplies both files intact; the drafting AI states the conflict and refuses the verdict. Floor protocol applies throughout. **Cluster 4 — the water panic (Doomer; the bottle-per-email arithmetic).** *As sold:* 500ml per 10–50 GPT-3 replies (UC Riverside, Apr 2023); restated Sept 2024 (WaPo/Ren) as ~519ml per 100-word email; recirculated endlessly without the location caveat the authors themselves attached. *What the sellers get:* the researchers, citations and policy salience (incentive noted, mildly); the amplifiers, alarm at zero marginal cost. *Real, granted precisely:* the direct figures underneath are metered and real (11.5M gallons, July 2022, 6% of West Des Moines' district; LBNL's 66B liters); water-stressed siting is real (~30% of new builds in stress-projected regions). *Oversold:* the viral number is a *lifecycle* estimate (cooling + generation water; cooling-only runs ~1.5–4ml/query), presented as a faucet reading; and the counter-seller has arrived — Altman's ~0.32ml/query (Jun 2025) is the same scope game played in the other direction, a cooling-adjacent figure deployed against a lifecycle one. *Move check:* **DISCOUNT** — grant the direction, name the model's owner and its system boundary, output the range (0.32ml → 519ml is not a disagreement about water; it is a disagreement about where the meter sits). The skepticism cuts both ways by construction here: the same audit that deflates the bottle inflates the complacency. **Cluster 5 — the vendor/analyst complex (adjacent seller).** *As sold:* \$15B-by-2028, 22.65% CAGRs, 29x EBITDA. *What they get:* report sales; deal justification. *Real:* the shipped record (Vertiv's backlog is booked, not forecast). *Oversold:* every forward number assumes the roadmap keeps its dates — the assumption L2 documented as **CONTESTED**. *Move:* DISCOUNT, authors always named. **Cluster 6 — the local officials (Politician, both directions).** Hopkins and Northern

sell caution (their authority needs rate revenue and capital regardless — incentive stated, never rube-ery); Mays and Rizer-class recruiters sell partnership (the tax base is real; the dependence is the perverse incentive L1 installed). *Move*: the nobody-wrong discipline — each is right at his own altitude, and the pack's county files (Beat 10) carry each side's strongest documented case in lieu of a Steelman slot.

SECTION 8: THE HUMAN FLOOR

Standing flag: comedy off in every zone below.

Beverly Morris — 71 (as of Jul 2025), retired payroll specialist, Mansfield, Newton County, Georgia. Bought the house with Jeff in 2016 — \$265,000, six acres, oak forest, horses; previous home Madison, GA. The documented harm: taps dry after Meta's 2018 groundbreaking 1,000 feet away (BBC: 400 yards — Discrepancy D); dishwasher, ice maker, washing machine, toilet failed within months; pressure to a trickle within a year; sediment throughout; appliances replaced **2019, 2021, 2024**; residue in the pool; one of two bathrooms still dead; **\$5,000 spent against a \$25,000 well replacement they cannot afford**, financed partly by loans; the household's one working bathroom shared with her son **Jon Barnett, 48, who has Down syndrome**; the house unsellable (their Realtor's assessment, paraphrase-marked: the only conceivable buyer is the company next door). Her verbatim words, with context: to the NYT (14 Jul 2025, Eli Tan, at her home), after describing the fight and the money: **"I'm scared to drink our own water."** [The one NYT quote; the companion line — an unwinnable battle they didn't sign up for — paraphrase-marked, same locator.] To the BBC (Jul 2025, Michelle Fleury, on camera, flushing a toilet from a bucket): **"I can't drink the water"** [the one BBC quote; her fuller line about half a functioning home paraphrase-marked]. To More Perfect Union (2026 transcript): she has not drunk the tap water in years; she stopped cooking with it [paraphrase-marked]. The other side's documented response: Meta's commissioned well study (post-May-2025 visit) finding a connection unlikely; the visit itself — well study offered, glare lighting fixed, no responsibility taken, the disputed boil-the-water suggestion (Meta denies it was said). Procedural status as of the research date: no compensation, no well replacement, no sale; the county's moratorium (17 Feb → 7 Oct 2026) governs *future* applicants, not the completed campus next door.

Jeff Morris — 67 (as of Jul 2025), machine operator at a nearby wood yard. Documented acts: traced the failures to sediment buildup; suspected construction-disturbed groundwater; **delayed his retirement** to carry the water costs. No verbatim in the corpus; all attribution through Beverly's and the reporters' accounts — the drafting AI voices him only through documented acts.

Chris Wilson — the Morris's neighbor three doors down. Documented: water-pressure problems within months of construction; monthly filter changes to keep flow; refrigerator, HVAC, and pool failures. His verbatim, More Perfect Union transcript (2026): **"Anything that's water-related, we have issues with."** [The one MPU-transcript quote; his appliance litany paraphrase-marked, same locator.] Three neighbors total documented with well problems since construction [NYT].

Lindsey Wilson — same household/road, MPU corpus: sediment in the pulled filter; cold-water pressure too low to shower and fill the horse's water at once [paraphrase-marked, MPU locator].

Dawn Rasmussen — rural resident outside The Dalles city limits; led opposition organizing around the 2021 Google deal; her well has declined year over year. Verbatim, to AP at the December 2022 records release: **"I'm flabbergasted and I'm scared for the future"** [the one quote from that AP story; her fuller drought-and-water-table warning paraphrase-marked]. Also on the record at the Sept 2021 council process (OPB) on projection gaps if recharge fails [paraphrase-marked — the OPB quote deployment is spent on Richardson]. Status: her testimony predates the settlement she helped make inevitable; no personal remedy documented.

Newton County ratepayers (collective, documented through officials): the +33%/two-year rate path (Northen); deficit-by-2030 projection; possible rationing if the >\$250M upgrade lags [NYT]. **West Des Moines residents (collective)**: the district that served GPT-4's training month also supplies the city's drinking water; the Water Works' 2022 conditions memo is the documented protective act [AP].

Hearing-transcript pulls (the corpus the scene-capable beats draw on, wherever markup seats them):

- *Newton County BOC, 17 Feb 2026, 7:00 p.m., Historic Courthouse, Covington* — primary minutes: Commissioner Cooper moved, Commissioner Mason seconded, Resolution #R021726a session; the data-center moratorium motion passed **5–0**; scope defined by the zoning-law term (quote deployed, Timeline 60); subsequent extensions 5–0 with two brief citizen comments on 8 Apr 2026 [BOC minutes; Covington News].

- *The Dalles City Council, 27–29 Sept 2021* — staff report figures (9.9M/17.5M gal/day; 5M undeveloped rights; 5,500 vs 1,800 acre-feet), Richardson’s caution (quote deployed, Timeline 16), resident testimony including Rasmussen [Columbia Gorge News; OPB].
- *US House hearing on EPA, May 2026* — Ocasio-Cortez presenting the jar of brown water from near Stanton Springs; residents described as relying on bottled water [Yahoo/Moneywise, 24 May 2026; committee and transcript pull flagged for draft stage].
- *More Perfect Union field recordings, 2025–26* — the Morris/Wilson on-camera corpus quoted above [published transcript].

Pack-dependency resolution. The Roster’s L3 debts — the Morris’s exact words with full context, the appliance-ledger dates, the well arithmetic, Jeff’s retirement delay, Chris Wilson’s corroboration — **all resolved above** from the NYT/BBC/MPU corpora. No L3-specific named-human dependency was flagged in Syllabus 2.0’s Open Items (the fence-line-ratepayer dependency belongs to L7 and is not this pack’s to resolve — noted so the debt doesn’t silently transfer). One honest limit: no Newton County resident testimony appears in the *county’s own* hearing minutes surfaced here (the Feb 2026 minutes record votes, not resident statements); the floor corpus is journalistic and on-camera rather than docketed — flagged so the drafting AI attributes venue correctly.

SECTION 9: THE PEOPLE & THE CAST

The Objects. *The cold plate (lead — the full dossier).* What it is: a machined-and-brazed copper heat exchanger clamped to the die; coolant enters one port, crosses a microchannel fin field, leaves hotter. Manufacture: skived or machined microchannels in C1100/T2 copper (~391 W/m-K); fin stacks vacuum-brazed to the base (brazing-furnace temperature control to $\pm 25^{\circ}\text{C}$ matters — one vendor documents cutting peak from 820°C to 795°C to kill micro-voids); optional electroless nickel for mixed-metal loops. Tolerances: contact flatness ≤ 0.05 mm; roughness $R_a \leq 0.8$ μm ; fin densities > 40 fins/cm for current thermal-resistance targets ($R_{th} \leq 0.030^{\circ}\text{C/W}$ at 3.5 L/min, 40°C inlet, GB300-class). Duty: ~1,200 W per Blackwell GPU today; $30\text{--}45^{\circ}\text{C}$ inlet; ~2.5 L/min at ~35 kPa per plate. Cost: not list-published; sold in assemblies (the taxonomy’s margins live here — flag, no invented figure). Pressure/leak regime: 0.6 MPa working; leak-tested to 8.7 bar; helium-tested where specified; 100% first-article pass documented in one vendor’s Q1 2026 hyperscaler validation [ToneCooling engineering literature, 2026 — vendor source throughout, flagged]. Failure modes, dated: galvanic corrosion from over-conductive coolant (measurable within ~90 days of tap-water commissioning); microchannel fouling from silicate-inhibitor gels; quick-disconnect and hose leaks (the Aug 2024 GB200 scare; the leak-detection apparatus of Beat 3). Chain of custody: fab (plate) → integrator tray → rack manifold → crane day (L2 owns) → quick-disconnect couple → PG25 fill to NVIDIA vacuum/filtration spec → a decade of service events. Current disposition: shipping at NVL72 volume; the component the entire Section 7 money trail exists to own. *The coolant (secondary object):* PG25 — 25% USP-grade propylene glycol, 75% high-purity water, OAT inhibitors, fluorescent dye; freeze-safe to -10°C ; conductive ($> 2,000$ $\mu\text{S/cm}$) in the inhibited school, near-deionized (≤ 25 $\mu\text{S/cm}$) in the other — the two-school conflict stated at Beat 3.

The Documents. Section 5 carries the lead document; cross-reference, no duplication.

The Institutions (motive · exposure · what they filed). *Google* — motive: supply certainty and the partner story; exposure: the disclosure regime it now lives under by its own Dec 2022 concession; filed/produced: the 2021 agreement, the settlement, annual site-level water tables since, the 2025 Environmental Report (Discrepancy G), the Nebraska grant. *Meta* — motive: the Georgia beachhead (first major GA data center, 2018) and the water-positive pledge; exposure: the Newton record and a congressional prop jar; filed: the commissioned well study (unpublished — its non-publication is itself material). *Microsoft* — motive: permits in dry markets; filed: the Dec 2024 design announcement, WUE disclosures, the 29.3°C operating disclosure. *Newton County Water & Sewerage Authority* — motive: solvency through a deficit curve; exposure: rate-payer anger either way; produced: the 2024 deficit report, the application queue. *City of The Dalles* — motive: infrastructure it couldn’t self-finance; exposure: it sued a reporter and lost the argument; produced: the council record, the webpage that supplies Beat 1’s verbatim. *3M* — motive per its own release: regulatory trajectory; exposure: the settlement ledger; filed: the 20 Dec 2022 announcement. *The UA* — motive: member employment in the buildout; produced: the training apparatus of Beat 6. *Vertiv / Schneider-Motivair / CoolIT-Ecolab / KKR* — motives and marks per Beat 7; the deal documents are their filings.

The Humans (as-of titles at the dated moments; return-grade entries brief). *Beverly & Jeff Morris* — lead; full

treatment Section 8. *Chris & Lindsey Wilson; Dawn Rasmussen* — Section 8. *Richard Mays* — Mayor, The Dalles (2021 negotiation through Oct 2025 ceremony). *Dave Anderson* — Public Works Director, The Dalles (2021 record). *Matthew Ellis* — Wasco County DA (Oct 2021 order). *Mike Rogoway* — The Oregonian (author-as-plot-event; September 2021 request). *Ellen Osoinach* — RCFP counsel (from Oct 2021). *Therese Bottomly* — editor, The Oregonian (Dec 2022). *Anthony Giovannone* — Google utility infrastructure strategy (Oct 2025); *Ben Townsend* — Google global head of infrastructure sustainability (2026 statements). *Mike Hopkins* — executive director, NCWSA (Jul 2025). *Blair Northen* — Mayor, Mansfield (Jul 2025). *Ben Sheidler* — spokesperson, Joint Development Authority of Jasper/Morgan/Newton/Walton counties (Jul 2025). *Newsha Ajami* — hydrologist, director of urban water policy, Stanford (Jul 2025; her water-as-afterthought diagnosis paraphrase-marked, NYT locator). *Steve Solomon* — VP, datacenter infrastructure engineering, Microsoft (Dec 2024). *Mike Roman* — chairman & CEO, 3M (Dec 2022). *Rich Whitmore* — President & CEO, Motivair (through the Schneider close). *Peter Herweck* — CEO, Schneider Electric (Oct 2024; as-of note: verify current officeholder at draft stage before present-tense use). *Rep. Cliff Bentz* (R-OR) and *Sen. Ron Wyden* (D-OR) — the watershed-lands legislators (2025–26). *Rep. Alexandria Ocasio-Cortez* — the May 2026 hearing. *Gordon Rogers* — Flint Riverkeeper (BBC, Jul 2025). *Prof. Rajiv Garg* — Emory (BBC; his no-turning-back framing paraphrase-marked). **Recurring-cast discipline:** none of these humans carries a lead elsewhere in the course; Jensen Huang and the roadmap return only as the one-line thermal-input reference (L2 owns); Loudoun/Rizer do not appear in this lecture.

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

The cascade edge, restated: Inherits: the heat · Binds at: the heat-rejection path and the water permit · Who pays: the aquifer, the ratepayer, or the neighbor — priced, not asserted · Manufactures: the wall the building plugs into → L4.

Edge 1 — the inherited problem, re-established with fresh specifics. L2 handed off *cost left unassigned*: 132 kW enters the cabinet as electricity and 132 kW leaves as heat, unpriced. This pack's fresh specifics for the re-establishment (none owned by the L2 pack): the 3,500:1 heat-capacity ratio (IBM 2005); the 500+ W/cm² die flux; the ~15 kW planning ceiling with its 30–40 kW hard limit; the PUE pair. **Specifics the L2 pack already owns (do not duplicate):** the rack's anatomy, mass, cost, and crane day; the density ladder and its dates; the 6.1→27→~600 series and its Discrepancy A; the Aug 2024 mask change; the “1 MW per rack position” Switch chamber; the NVL36x2 compromise; the busway/PDU path. The L2 pack's explicit banked debts collected here: the air ceiling (one L2 sentence → this lecture's Beat 2), the cooling internals (“cooling internals belong to L3”), the pipefitter (“the UA-certified pipefitter is L3 cast”), and the leak-class risks (“leak-class risks inherited by L3” → Beat 3 and Section 9).

Edge 2 — the manufactured problem and the Handoff. Assigned mechanism: *a character walking toward the next problem* (rotation-verified: L1 *question* · L2 *cost unassigned* · L3 *character walking* · L4 *question* — no adjacent repeats). The documented material: the facilities engineer who has just chosen the building's externality at the drawing stage — evaporative or closed-loop, WUE or PUE — walks into the next meeting, and it is with the utility, because either choice ends at a plug: the tower's fans and pumps, or the chillers that replaced the tower, all draw from a grid that answers on its own schedule. The closing ~200 words put the character in motion and stop. **Alternates from the record, for markup rotation if the seam needs it:** (a) *cost left unassigned* — the chiller penalty of the zero-water fleet, nobody's line item yet — legal but repeats L2's mechanism adjacently; **barred**. (b) *question left hanging* — where does a cooled campus's power come from when the county has already spent its watts? — legal (L1's question is two lectures back; non-adjacent repeat permitted) — the clean alternate. (c) *a door explicitly not opened* — the substation gate the engineer drives past — legal, but L8's assigned mechanism; usable without violating rotation (rotation bars *adjacent* repeats only), second-choice alternate. Net: assigned mechanism is best; (b) is the sanctioned fallback.

Refresh-safe handoffs. The seam into L4 hinges on the queue's existence and the swap's thermodynamics — both LOW-decay. Verified: no VOLATILE figure (market sizes, shares, fleet water totals) rides the handoff in either direction. The one L3 sentence a 2027 refresh will rewrite regardless: any deployment of the ~65% share (Discrepancy B) — kept out of the seam by construction.

The boundary doors — the fence itself. The Gesture is skipped (Section 4). Fence verification: this pack researched **nothing** behind silicon fabrication, reactor engineering, or training-run internals. One logged pressure point: chip fabrication's water appetite (~10M gal/day ultrapure per fab; thousands of gallons embodied per chip [EESI]) presses on the **silicon door** — the fact is *not for deployment* in L3 prose (the chip arrives on a truck, already wet); logged so the drafting AI knows the fence runs between the campus meter and the fab's. No reactor-door pressure (nuclear water thermodynamics

untouched); no training-run pressure (what the heat computes stays inside the building).

Cross-lecture consistency notes (claims already owned elsewhere — reference, never rebuild): L1 owns: the campus-grain heat path to the roofline; JLARC's water finding and NoVA's ~2B gallons (2023) regional figure; the ~50-FTE staffing exhibit; Virginia's 2026 water-minimization budget conditions. L2 owns: everything in Edge 1's do-not-duplicate list, plus the Colossus build-speed record and the OCP/Catalina contribution (this pack cites Catalina's ~140 kW figure only as the two-phase threshold's shadow — one line). L7 will own: rate-class doctrine and the fence-line-ratepayer Neighbor (this lecture's rate material stays at the water authority's ledger, never the electric tariff). L8 will own: the moratorium wave's politics, Memphis, and the preemption collision (this pack cites the Georgia wave in one boundary-marked line). L10 will own: any verdict on whether the spend was worth it — this lecture prices the swap and refuses the verdict.

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

Live status of every deal, docket, and project (as of 21 July 2026).

- *The Dalles*: agreement performed; ASR city-owned (since 22 Oct 2025; +100M gal/yr); six Google data centers operating; Google ~one-third of city water (2024 data); the \$260M/20-yr plan adopted; the **Watershed Development Act** (Bentz, introduced 30 Jan 2025) pending — Wyden weighing the Senate side; reservoir expansion contingent on it. Next milestone: congressional action on the land transfer (no scheduled date verified).
- *Newton County*: moratorium in force through **7 Oct 2026**; UDO rewrite underway (Applewhaite); nine pipeline applications exempt and unresolved; the >\$250M recycling upgrade unfunded in the verified record; Meta campus operating; the Morris's situation unremedied; the May 2026 congressional attention has produced no documented federal action.
- *The chemistry*: Novec production ended (Dec 2025); last-order date passed (31 Mar 2025); replacement qualification ongoing industry-wide; ECHA's universal PFAS restriction still in process — the regulatory curve that will decide whether Galden/Opteon-class replacements survive.
- *The money*: **Ecolab–CoolIT expected to close Q3 2026** (the pack's nearest-term dating risk); Schneider's 25% Motivair option opens 2028; Vertiv's next print (Q2 2026, ~late July) will re-date every Beat 7 figure.
- *Microsoft zero-water*: Phoenix and Mt. Pleasant pilots under construction; first online **late 2027** — the Kicker's dates hold.

Pending events with dates: 7 Oct 2026 (Newton moratorium expiry) · Q3 2026 (Ecolab close; announcing party Ecolab) · late 2027 (zero-water pilots; Microsoft) · 2028 (Motivair option; Schneider) · 2030 (three water-positive deadlines; Newton deficit projection).

The decay register (VOLATILE/CONTESTED figures, direction and velocity): liquid-market size and shares (analyst-annual; up) · the ~65% anchor (blocked on Discrepancy B; direction up for D2C-of-liquid) · Vertiv backlog/book-to-bill (quarterly) · Ecolab deal status (event-driven) · Google fleet water totals (annual report cadence; up) · Mansfield rate path and Newton application count (county-meeting cadence) · Morris procedural status (event-driven; a settlement or well replacement would rewrite Beat 11's present tense) · Microsoft WUE (annual; down) · moratorium tallies (legislative-session speed; cite-only here, L8 owns).

What just changed (last ~90 days, post-dating the syllabus stack): the **Ecolab–CoolIT \$4.75B agreement (Mar 2026)** — the single largest new fact in the lecture's territory, absent from Syllabus 2.0; the **AOC/EPA hearing jar (May 2026)** — the Newton story's arrival in a federal hearing room; the **MPU/AOC field corpus (Jun 2026)** — new on-camera Morris/Wilson verbatim; **Newton's 180-day extension to 7 Oct 2026 (Apr 2026)**; **Vertiv's Q1 2026 print (Apr 2026)**; Google's **Nebraska leak-detection grant (Jun 2026)**. A draft built on the anchors alone would miss all six.

What is still hidden (honest uncertainty markers). The Dalles agreement's committed volume per data center (never disclosed; only the ≤1.4B gal/yr planning frame); Meta's commissioned Morris well study (unpublished — the fight over *whether it publishes* is watchable); the identities behind Newton's alias applications; Microsoft's zero-water PUE penalty magnitude (direction disclosed, number withheld); fleet-level cooling-mix percentages at every hyperscaler (the datum LBNL had to scenario-model instead of read); drought-year curtailment priority in The Dalles (absent from the public record). The refusal to disclose is itself course material — and this lecture owns the case study proving disclosure can be litigated into existence.

SECTION 12: SOURCE INVENTORY

(Syllabus 2.0 trail first, then supplements. PRIMARY-source priority; each secondary noted for what it synthesizes; company sources flagged as the seller's own documents.)

The Syllabus 2.0 source trail, resolved: [1] Uptime Institute — Global Data Center Survey 2024 (PUE 1.56; outage-cost series) — survey of record. [2] Vertiv / CoolIT / Submer — vendor technical literature (trail-listed) — product mechanics; sellers' documents. [3] LBNL — 2024 United States Data Center Energy Usage Report (LBNL-2001637) — Dec 2024 — the national water/energy spine (66B L direct 2023; 60–124B L 2028 range; ~800B L indirect). [4] County water permit filings — resolved as: Newton County BOC minutes (17 Feb 2026, primary) + NCWSA 2024 deficit report (cited via [8]; pull direct) + The Dalles council packets (27 Sept / 8 Nov 2021). [5] SemiAnalysis — cooling architecture teardowns (trail-listed) — behind paywall; this pack's component specs sourced instead from vendor engineering literature [21–24]; flag for Nick if the teardowns are on hand. [6] The New York Times — Eli Tan, “Their Water Taps Ran Dry When Meta Built Next Door” — 14 Jul 2025 — the human-floor spine; photographs Dustin Chambers. [7] Georgia EPD — permitting record under the NYT investigation — referenced; direct pulls not surfaced this pass (flagged open). [8] The Dalles court record — City of The Dalles v. Rogoway & Oregonian Media Group, Wasco County Circuit Court (2021–22) — via RCFP case summary and contemporaneous coverage; settlement 14 Dec 2022.

Primary and near-primary supplements: [9] 3M — “3M to Exit PFAS Manufacturing by the End of 2025” — press release, 20 Dec 2022 — the Timeline Snap; seller's document. [10] Microsoft Cloud Blog — Steve Solomon, “Sustainable by design: Next-generation datacenters consume zero water for cooling” — 9 Dec 2024 — the Kicker's source; seller's document. [11] NVIDIA — Q3450-LD liquid-cooling system documentation (fill/vacuum/filtration spec); Mission Control GB200/GB300 admin guide (leak detection) — accessed 2026 — vendor primary. [12] City of The Dalles — “Google's Contributions to the City Water System” webpage — accessed 21 Jul 2026 — Beat 1 verbatim; counterparty's own document. [13] Newton County, GA — Board of Commissioners regular-meeting minutes, 17 Feb 2026 — primary; moratorium resolution. [14] Schneider Electric — Motivair acquisition release + investor PDF — 17 Oct 2024 — deal terms; seller's document. [15] Rep. Cliff Bentz — press release, The Dalles Watershed Development Act — 30 Jan 2025 — primary. [16] United Association (ua.org; uavip.org; local sites) — membership, training, data-center staffing instances — accessed 2025–26 — the union's own documents. [17] Li, Yang, Islam & Ren (UC Riverside) — “Making AI Less ‘Thirsty’” — arXiv Apr 2023; Communications of the ACM 2025 — the contested per-query estimate, with its own caveats. [18] Crippen et al. — “BladeCenter packaging, power, and cooling,” IBM J. R&D — Nov 2005 (and US Patent 7,486,513) — the air ceiling's peer-reviewed pedigree. [19] Google — 2025 Environmental Report (2024 site-level water tables) — seller's document; Discrepancy G requires the direct table pull. [20] West Des Moines Water Works — 2022 conditions document — via AP [29]; direct pull flagged.

Vendor engineering literature (sellers' documents, used for mechanics): [21] ToneCooling — GB200/GB300 cold-plate specifications and validation notes — 2026. [22] Dober — PG 25 coolant technical resource; leak-detection/monitoring resource — 2026. [23] Chemstar Water — DOWFROST LC 25 application guide — Aug 2025. [24] Alliance Chemical — post-Novec fluid alternatives; GPU coolant conductivity disciplines — Apr–May 2026. [25] Motivair (via HPCwire) — PFAS/two-phase impact analysis — 27 Jan 2023.

Journalism and analysis (each with what it synthesizes): [26] Columbia Gorge News — settlement (15 Dec 2022); ASR transfer (Oct–Dec 2025); council coverage (Oct 2021) — the local paper of record on The Dalles. [27] OPB — “Residents seek more transparency...” — 29 Sep 2021 — council testimony, aquifer numbers. [28] AP — Dec 2022 records-release story (Rasmussen; 274.5M); Oct 2021 deal story (Patch syndication; Anderson; drought figure); Sept 2023 Iowa investigation (Fortune/Barchart syndications) — wire primaries-adjacent. [29] The Oregonian/OregonLive — Rogoway's reporting and the 355M/29% figures — via Seattle Times syndication (22 Dec 2022) — the requester's own record. [30] RCFP — case summary, Dalles v. Oregonian — the litigation's procedural spine. [31] The Register — 5 Nov 2021 — the reverse-suit filing and trade-secret arguments. [32] Oregon Capital Chronicle / News From The States — 19 Jan 2026 — the \$260M plan, Dog River/watershed forward story. [33] Columbia Insight — Mar 2023 — Dog River diversion critique (single-sourced where used; flagged). [34] BBC — Michelle Fleury, “I can't drink the water” — Jul 2025 — the on-camera Morris corpus. [35] More Perfect Union — Newton County video (May 2025) and “We Took AOC to a Deep Red Data Center Town” transcript (Jun 2026) — field verbatim. [36] Yahoo Finance / Moneywise — 24 May 2026 — the EPA-hearing jar coverage. [37] Covington News — Feb–Apr 2026 — moratorium arc; GPB — 22 Oct 2025 — the Georgia wave survey (L8 boundary). [38] DCD — 3M/two-phase impact (Dec 2022); Microsoft closed-loop (2024–26); Schneider-Motivair (2024). [39] TweakTown/UDN — 14 Aug 2024 — pre-production GB200 leak reporting. [40] ModulEdge — Blackwell facilities synthesis — 2026 — secondary synthesis of NVIDIA/Uptime/trade primaries. [41] Network World —

Jan 2025 — the zero-water PUE trade stated plainly. [42] Brookings — “AI, data centers, and water” — Nov 2025 — the conversion targets (300k/1,000 households; 5M/50,000 town). [43] EESI — “Data Centers and Water Consumption” — standing — WUE 1.9; 5M gal/day; NoVA 2B gallons; fab-water fence fact. [44] FWPCOA — myths-vs-reality explainer — the 30,000–50,000 person equivalence with its hot-day caveat. [45] Energy Solutions Intelligence — immersion-vs-air TCO benchmarks — 2026 — the PUE band tables. [46] Carbon-Z; GBC Engineers; Introl; RDP GPU Mart — 2025–26 — air-ceiling and hybrid-capture syntheses (each secondary; each cites ASHRAE/Uptime primaries). [47] Mordor Intelligence; Grand View Research; Future Market Insights; GM Insights; Dell’Oro (via Facilities Dive) — 2024–26 — the market-share complex behind Discrepancy B; analysts’ vantages flagged throughout. [48] MarketWise; Enki; Evercore ISI (via Radnor Capital) — 2024–26 — the deal-ladder and Vertiv-print syntheses; sell-side vantage flagged. [49] GovTech; Honolulu Civil Beat; MOST Policy Initiative; NASUCA — 2025–26 — the Google site-level water readings (the Discrepancy G cluster). [50] The Cooling Report; Standard Fluids; Best Technology; Techspray; Enviro Tech — 2023–26 — the Novec wind-down mechanics (distributor/vendor vantages flagged). [51] DC Geeks; TradeCareerPath; CNBC (18 Mar 2026); Novarc — 2025–26 — the labor-market corpus (recruiter/vendor vantages flagged). [52] ScienceBlog; Lincoln Institute; LSARS; CVAT — 2025–26 — water-context syntheses used for cross-checks only.

Research Pack 1.0 · Lecture 3: The Cooling Stack · RESEARCH AS OF 21 July 2026 · How AI Data Centers Work — An Unteachable Briefing · Unteachable Courses. The pack proposes; markup and the Course Schema dispose. Open actions flagged for Nick: Discrepancies A–D and G; the Verbatim FAIL’s public-records pull; the SemiAnalysis teardown gap [5]; the Georgia EPD pull [7]; the UA certification-title gap (Beat 5).

Lecture 4 — The Demand Wall

Research Pack 1.0 · source file L4_Research_Pack_1_0_COMPLETE.md · research as of 21 July 2026

RESEARCH AS OF 21 July 2026

(Per the L1/L2/L3 pack precedent: every figure carries unit · stage · as-of date · author; discrepancies against must-hit anchors are flagged inline and consolidated in Section 6. Per copyright discipline, verbatim quotes are held short with full attribution, one deployment per source document; longer passages are precisely paraphrased, marked as paraphrase, and carry a locator for the draft-stage verbatim pull — the same convention the earlier packs used for the NANOG, keynote, and NYT corpora. Two locator classes recur in this pack: FERC eLibrary (docket-searchable; transcripts and orders pullable in full at draft stage) and pjm.com manuals/queues (tariff and manual text pullable in full at draft stage).)

LECTURE IDENTITY (assembled from Syllabus 2.0, Syllabus 1.0, Beat Menu 1.0, Moves List 1.0, Roster 1.0, Style Guide §5)

Title / frame / through-line. The Demand Wall. The grid says get in line. Twenty years of flat demand ends at once; the interconnection queue is the real protagonist.

Register. Atoms shading into Ledger — the transformer is atoms; the queue is paper. Per the Style Guide’s cascade curve, this is where the grid becomes the story: the physical marvel (a 400,000-pound object on a beak-shaped railcar) hands off mid-lecture to the forensic register (a study agreement with a deposit schedule), and the fusion posture — the audit delivered in the pitch’s tone — carries the back half.

Cascade edge (Syllabus 2.0 format). Inherits: a cooled building that must plug in (L3’s handoff walked the facilities engineer out of the drawing room and toward the utility counter) · Binds at: the queue and the transformer · Who pays: the study deposits now; the network upgrades later (cashed in L7) · Manufactures: the workaround → L5.

Strawman beat plan (12, running order — STRAWMAN FOR MARKUP; Course Schema locks order after markup):

1. Cold Open on an Object [O] — the 400,000-pound transformer on a Schnabel railcar; the object money can’t hurry
2. The Bottleneck — transformer and turbine lead times as the physical floor under every timeline
3. The Forecast Problem — lead deployment: Wilson’s inflection call; forecasts quintupling; the same megawatts filed in five places
4. Mechanism Autopsy — the three-study gauntlet, conversationally
5. The Paper Trail — class: **the queue instrument** — the interconnection agreement as actor: what it forces, what it forbids, what “executed” actually buys you
6. The Bill Arrives — the feasibility-study invoice: paying for the study of your own table
7. The Hearing Room — a FERC technical conference from the Order 2023 record — documented speakers only
8. The Regulatory Collision — Order 2023’s rewritten rulebook vs. regional implementation reality
9. The County — Loudoun’s 2022 transmission-constraint pause: the epicenter told to wait
10. The Steelman — *defendant: PJM’s queue* — why the studies exist; the reliability logic at its strongest
11. The Physics Audit — the 49 GW arithmetic: simultaneous load growth, coal and gas retirements, and what a gigawatt-scale shortfall physically means
12. The Perverse Incentive [C] — duplicate requests inflating forecasts into phantom load; planning against the forecast as an act of faith

Handoff: *question left hanging* — if the line is seven years long, what do you do instead of standing in it? (Rotation-verified: L1 ran *question*, L2 *cost unassigned*, L3 *character walking* — no adjacent repeat; the next *question* deployment after this is L7, non-adjacent.) **Negative space:** The Bill Arrives as opener (used mid), Wrong Map, Taxonomy, Symbol Audit, Founder Audit, Neighbor, Deal, Operator Reality, Follow the Money, Externality Swap.

Cast. Document: the interconnection agreement — lead introduction of **the course’s leading actor** (returns 5 and 7), through the three-study gauntlet: feasibility, system impact, facilities — each a paper artifact with a timeline and a price tag; “done” means the utility says yes, not the ribbon-cutting. **Institution: PJM** — lead introduction (returns 7, 10); the queue, the 2025 large-load fast-path initiative, the capacity accounting under the 49 GW arithmetic; the board across the table for the entire mid-course. **Human: John D. Wilson**, Grid Strategies — the analyst who called the inflection; author-crossover rule applies (the document is the plot event); Timeline Snap adjacency — **with a dating discrepancy this pack must flag: the roster and Syllabus 2.0 carry “February 2023” for the flat-demand paper; the documented record supports December 2023** (see Section 4 Timeline Snap verification and Section 6 Discrepancy A). **Secondaries:** the 400,000-pound transformer on the Schnabel railcar (opener object), FERC Order 2023 (28 July 2023 — the queue’s rulebook rewritten), Dominion’s contracted-vs-requested pipeline (**return** — the phantom-load home exhibit; L1 owns the slide-series treatment). **Returning (brief reference only):** Dominion Energy (exhibit intro L1; full steelman treatment reserved for L7 — this lecture uses the 2022 pause and the pipeline exhibit, both with new specifics); Buddy Rizer (lead L1) may surface in one line of the 2022-pause record only.

Must-hit anchors (verbatim from Syllabus 2.0; Syllabus 1.0 values govern — Section 6 discrepancy protocol): 49 GW shortfall by 2028; 7+ year timelines; flat-demand era ending; the three-study gauntlet; transformer lead times; duplicate-request phantom load; Wilson Feb 2023; Order 2023 (July 2023).

Moves plan (as assigned; formal verification Section 4). Step Function: 49 GW by 2028 — **pedigree RESOLVED: Morgan Stanley Research; full pedigree, revision history, and a definitional precision flag supplied** · Unit Conversion: 49 GW → reactor-scale units or regional-grid equivalents, arithmetic must clear — **verdict PASS, two conversions shown** ($\approx$ half the US nuclear fleet’s capacity; $\approx$ California’s all-time record hour) · Timeline Snap: February 2023 — the paper that called the inflection — **verdict FAIL as assigned; the flat-demand paper is December 2023; two verified alternate hinge dates supplied (December 2023; 24 February 2023, which IS a February 2023 inflection paper — PJM’s own)** · Verbatim: a study-agreement or queue-definition clause — **existence gate PASS: the pro forma interconnection agreement’s no-transmission-service clause, block-quoted with attribution** · As-Of Stamp: the 7+ year queue figure — **RESOLVED with pedigree: Dominion’s own 2024 extension of its connection-wait guidance to seven years, plus the LBNL duration series underneath** · Kicker: “done” means the utility says yes — not the ribbon-cutting — **VERIFIED, with a documented sharpening: 26 GW of projects with signed interconnection agreements withdrew anyway (PJM’s own count)** · Gesture: **skip proposed — CONFIRMED** (boundary-pressure notes logged in Section 10; no door is pressed hard enough to spend the deployment).

Sellers & narrator moves. Seller on the field: **the Utility** — the subtlest seller, because it looks like a referee; the load forecast is also a rate-base application. Assigned move: **DISCOUNT**, the course’s hottest — grant the direction, name the model’s owner and assumptions, apply the phantom-load correction, output a range. Section 7 pressure-tests the calibration; the record as researched supports it strongly, and supplies the symmetric case: the doomer-direction collapse claims get the same discount, with Wilson’s own shop supplying the audit of NERC’s forecast. **Steelman rotation: assigned defendant is PJM’s queue** (deployment 2 of 8; L1 ran the county’s growth case; no repeat) — the steelman file is Section 7’s centerpiece, built from PJM’s own numbers: the 74% withdrawal rate, the 5% renewable completion rate, the reliability mandate, and the July 10, 2024 incident that shows what the studies are for.

Decay tier. Low — interconnection queues move at interconnection-queue speed. The gauntlet’s structure, Order 2023’s architecture, the transformer physics, and the phantom-load mechanism are stable. The VOLATILE cluster is real but contained: the 49 GW model output (already revised four times by its own author), queue-size tallies (annual LBNL refresh), lead-time surveys (quarterly Wood Mackenzie), and the live FERC large-load docket (RM26-4, orders issued 18 June 2026 with compliance clocks running). Section 11 carries the register.

Human-floor flags (comedy off in every zone below). This lecture has no Neighbor beat and no Neighbor-grade documented household; the machine’s human contact here is mostly institutional. Three floor-adjacent zones still get flagged: (1) **any deployment of the residential-bill consequence** — capacity-auction cost pass-throughs and rate impacts are seeded here in one line at most and priced in L7; wherever a sentence names a household bill, the floor protocol travels with it; (2) **blackout and load-shed material** in the Physics Audit and Steelman (the January 2026 cold-snap scarcity hours; DOE asking data centers to self-generate) — reliability events threaten households; treat the risk clinically, never as spectacle; (3) **workers** — linemen, transformer winders, study engineers — punch-up-only, per the L3 precedent on trades.

Pack dependencies (debts resolved in this pack or explicitly failed):

1. **Unit Conversion arithmetic gate (Syllabus 2.0 Open Item 11: “L4’s 49 GW”) — RESOLVED: PASS.** Two arithmetically defensible conversions shown in Section 4 with sourced comparison figures; the failure mode (com-

- paring a shortfall to an energy quantity) is fenced off explicitly.
2. **The Verbatim existence gate (a study-agreement or queue-definition clause) — RESOLVED: PASS.** The pro forma Large Generator Interconnection Agreement’s no-transmission-delivery-service clause exists verbatim in the standard form and is block-quoted with attribution in Sections 4 and 5; it is simultaneously the assigned Verbatim and the Kicker’s legal foundation.
 3. **Timeline Snap exact date — FAILED AS ASSIGNED, ALTERNATES SUPPLIED.** No February 2023 Grid Strategies flat-demand paper exists in the record; the report is December 2023. Two verified alternates with full incentive-state documentation in Section 4. Nick resolves; no silent substitution anywhere in this pack (the anchor text “Wilson Feb 2023” is preserved as written and flagged).
 4. **Roster debts (Wilson’s verbatim with context; as-of title at dated moments) — RESOLVED** (Section 9): title locked as Vice President, Grid Strategies (documented December 2024 press call); December 2024 press-call verbatim block-quoted; the quintupling arithmetic verified (23 GW → 128 GW, 2022 → 2024 filings).
 5. **Hearing Room corpus (a FERC technical conference from the Order 2023 record) — RESOLVED WITH A LOCATOR CONDITION** (Sections 2.7, 8): the corpus exists — the staff-led workshop in Docket AD24-9-000, 10–11 September 2024, transcribed (Ace Reporting; FERC eLibrary) with a webcast archive and a Federal Register agenda naming every panelist — plus one verified verbatim from the Order 2023 record itself (Commissioner Christie’s concurrence). Extended continuous transcript pulls are a draft-stage eLibrary task; the pack supplies the room, the speakers, the date, the docket, and the seed quotes.
 6. **Cross-lecture flags inherited from the L1/L2/L3 packs — RESOLVED** (Section 10): L1 held queue mechanics at the site-selection consequence and the 10 July 2024 disturbance at one-line existence — both full treatments are collected here; L2 stopped the watt path at the wall (this pack owns transformer/switchgear territory); L3’s handoff (a character walking) is inherited and re-established with fresh specifics in the Cold Open’s receiving beat.
 7. **Syllabus 2.0 anchor-precision flag (self-generated) —** the “49 GW shortfall by 2028” anchor is a specific bank model’s output with a definitional subtlety (a shortfall in *available power access for data centers*, not a NERC-style system resource-adequacy deficit) and a four-step revision history in its own author’s notes. **RESOLVED AS A DISCREPANCY-ADJACENT PRECISION NOTE** — anchor value governs; Section 6 Discrepancy B carries the full reconciliation so the drafting AI deploys the number with its stage labeled and the course’s credibility intact.

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Beat 2 — The Bottleneck (transformer and turbine lead times as the physical floor)

Syllabus 2.0 assignment: Lead times as the floor under every timeline — the constraint nobody can financialize away.

Beat Menu definition: Atoms · versatile · why the bottleneck exists industrially, who sits upstream, what the workaround costs, and why money alone doesn't clear it.

Facts, dates, names, numbers. The transformer floor: carried in from Beat 1 (128/144 weeks; 210-week outliers; four-year quotes). The adjacent equipment floor: high-voltage circuit breakers ~151 weeks by late 2023 — roughly double pre-pandemic (Duke Nicholas Institute citing Wood Mackenzie). The generation floor: **three companies — GE Vernova, Siemens Energy, Mitsubishi Power — supply over 75% of gas-plant projects under construction** (RMI, Feb 2026). GE Vernova: ~80 GW backlog exiting 2025, stretching into 2029; ~20 GW of 2025 orders (double 2024); 9 GW of slot reservations — a market where the *right to order later* is itself a traded asset; production ramp ~48 units/year → 20 GW annualized by mid-2026 → 24 GW by mid-2028; CEO Scott Strazik projecting sold-out-through-2030 by end of 2026. Siemens Energy: record backlog reported at €131B (~\$148B) by RMI in Feb 2026 and €136B in later trade accounts [both dated; range kept]; a 61,000-sq-ft blade-and-vane expansion. Mitsubishi Power: doubling capacity in two years; new orders quoted for 2028–2030 delivery. The cost floor: a new combined-cycle plant ~\$800/kW in 2021 per NextEra — roughly tripling since (Bloomberg, Oct 2025). Upstream of the OEMs: superalloy blade castings from a handful of firms (Howmet; Precision Castparts), forged rotors from a handful of plants (Japan Steel Works among them) [supply-chain tier detail — secondary sourcing, flagged]. EPRI's Bobby Noble on expansion physics: one OEM doubling production historically lifts total output only 15–40%. [Paraphrase-marked; Utility Dive, Sep 2025.]

The mechanism. Why money doesn't clear it: (1) transformer throughput is bounded by one GOES mill and a winding workforce (Beat 1); (2) turbine throughput is bounded by superalloy casting and rotor forging capacity that takes years and enormous risk to add — the OEMs remember 2015–2020, when gas-turbine demand collapsed and they wrote down exactly this kind of capacity, so expansion is deliberate and pre-sold; (3) both markets have converted queue position into a financial instrument (slot reservations; 10%-nonrefundable deposits), which allocates the shortage without shrinking it. The workaround market prices the floor precisely: aeroderivative “bridge power” units, used-equipment premiums, and — per a Morgan Stanley conference CEO — supply-chain pre-buying of “*transmission, switch gear, breakers*” ahead of need [one short quote; Morgan Stanley Institute article, 27 Feb 2026]. **Where the constraint binds:** the factory slot. An interconnection agreement, a signed PPA, and a poured foundation all wait on the same delivery date, which is why the lecture's paper protagonist (Beat 5) and its physical opener meet here: the queue is made of paper and steel simultaneously, and the steel is slower.

Key actors. GE Vernova (Strazik — profile Section 9); Siemens Energy; Mitsubishi Power; Wood Mackenzie (the measurement authority, analyst-vantage flagged); NEMA (the manufacturer association whose lead-time advocacy doubles as policy ask — seller-flagged); EPRI (Noble).

The documents. The slot-reservation agreement — a contract to maybe-contract, now standard; GE Vernova's investor-day materials (9 Dec 2025) as the authored forecast of its own scarcity (the seller benefits from every week of quoted lead time — flag and use); the RMI analysis (Feb 2026) arguing near-term alternatives, itself authored by an efficiency-advocacy shop (vantage flagged both ways).

Verbatim bank. Strazik's sold-out-through-2030 projection and the backlog figures: paraphrase-marked above, Utility Dive 11 Dec 2025 locator (investor-day webcast is the primary; pull at draft stage if verbatim needed).

Who pays. The buyer pays the scarcity premium now (turbine prices, transformer prices, reservation fees); the ratepayer pays it later when utility procurement at these prices enters rate base — one line, cashed in L7.

What's contested. Whether the backlog is demand or double-ordering: slot reservations and multi-vendor hedging can inflate order books exactly the way duplicate interconnection requests inflate load forecasts — the phantom-load logic, migrated into the equipment market. No OEM discloses cancellation terms. Honest unknown, stated flat.

Sensory & material. Nickel-superalloy blades cast like jewelry and priced like it; a rotor forging that only a few presses on Earth can squeeze; the Greenville, South Carolina hall where 7HA turbines are assembled (GE Vernova photo record); a backlog measured in gigawatts sitting as purchase orders in three companies' ERP systems.

Numbers that matter. ~80 GW — GE Vernova backlog — 9 Dec 2025 — VOLATILE · €131–136B — Siemens Energy backlog — Feb–spring 2026 — VOLATILE · >75% — three-OEM share of projects under construction — RMI, Feb 2026 — STRUCTURAL · ~\$800/kW (2021) → ~3x — CCGT cost, NextEra via Bloomberg, Oct 2025 — STRUCTURAL/VOLATILE · 151 weeks — HV breaker lead time, late 2023, Wood Mackenzie via Duke — STRUCTURAL ·

15–40% — output gain from one OEM doubling, EPRI — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. Two interlocking equipment markets, both documented to the week and the euro, with an upstream tier and a workaround economy — five minutes of hard material, and it manufactures the question Beat 3 answers (if supply is this slow, what exactly is the demand it's chasing?).

Beat 3 — The Forecast Problem (lead deployment: Wilson's inflection call; forecasts quintupling)

Syllabus 2.0 assignment: Lead deployment of the course's forecast-as-fiction lens: the inflection call, forecasts quintupling in two years of filings, the same megawatts filed in five places.

Beat Menu definition: Money/Politics · versatile · load forecasts as political documents; planning as an act of faith with a rate case attached.

Facts, dates, names, numbers. The baseline: two decades of sub-1% annual growth; fifteen years of forecasts that erred *high* and taught planners to discount upward surprises. The inflection, in documents: **December 2023** — Grid Strategies' "The Era of Flat Power Demand Is Over" (John D. Wilson and Zach Zimmerman): 60+ planning areas' FERC-714 filings compiled for the first time; five-year growth forecast 2.6% → 4.7% in one filing year; +38 GW of peak through 2028 — and the authors flag it as an *underestimate* in real time, with Georgia, North Carolina, Tennessee, and Arizona already revising above their filed numbers (Arizona's 2023 forecast doubling to >20% five-year growth). **December 2024** — the follow-up, "Strategic Industries Surging" (Wilson, Zimmerman, Gramlich): the five-year forecast up **almost fivefold in two years, 23 GW → 128 GW**; official filings alone 2.8% → 8.2% (66 GW through 2029) plus ~61 GW of preliminary updates → 15.8% by 2029; the composition — data centers ~90 GW, advanced manufacturing ~20 GW, electrification ~20 GW; national load toward ~947 GW by 2029. **January 2026** — NERC's 2025 LTRA takes the same inputs to their maximal reading: +224 GW summer / +246 GW winter over ten years, the fastest since tracking began in 1995. **March 2026** — Grid Strategies audits NERC's reading as overstated. The forecast has now been called too low (2023), too central (2024), and too high (2026) — by the same shop, each time with the filings attached.

The mechanism. How a load forecast is manufactured, and why it is a political document: (1) developers file service requests with utilities — free or cheap, non-binding, frequently duplicated across territories; (2) the utility aggregates requests into a forecast, applies (or doesn't) an internal discount, and files it — with FERC on Form 714, with its state commission in the IRP and the rate case; (3) the forecast justifies capital: generation, transmission, and the return on both; a rate-regulated utility's earnings are a function of approved capex, and the forecast is the capex's evidentiary foundation; (4) the RTO aggregates the utilities' aggregations (PJM's forecast is built partly from load-serving entities' submissions), and NERC aggregates the RTOs; (5) each layer inherits the layer below's duplicates. The correction machinery now emerging is itself course material: PJM's published Load Adjustment Request Implementation methodology (Jan 2026) — a formal procedure for disbelieving its own members — cut the 2028 summer forecast by 4.4 GW; ERCOT applies officer-level judgment discounts; Texas SB6 legislates disclosure. **Where the constraint binds:** at the discount rate nobody can verify — the forecast's owner cannot prove the number and the skeptic cannot disprove it, and thirty-year steel gets ordered against it either way (Beat 12 closes on this).

Key actors. *Human (anchor):* John D. Wilson — full profile Section 9; author-crossover applies, the document is the plot event. *Institutions:* Grid Strategies (a transmission-advocacy consultancy — vantage flag: the shop's clients benefit from a build-more-transmission conclusion; its data discipline is nonetheless the best in class and its 2026 NERC audit cuts against the alarm that serves that conclusion, which is the best available evidence of good faith); NERC (the reliability regulator whose warnings are also budget-and-authority instruments — the June 2025 "explosive demand" framing preceded its January 2026 record forecast); EIA (whose STEO and AEO anchor the official record — Feb–Mar 2026 analysis documents the post-2020 demand turn).

The documents. The FERC Form 714 — the annual filing that made the compilation possible: what it forces (utilities must report planning-area forecasts), what it doesn't (no duplicate-screening, no stage labels), and why the course's phantom-load lens exists because of that gap. The two Grid Strategies reports (Section 5 cross-reference: this lecture's Paper Trail slot belongs to the interconnection agreement; the Wilson reports are treated fully here in their home beat).

Verbatim bank. John D. Wilson, press call, 5 December 2024, on the follow-up report: "*The big news is that the five-year load growth is up fivefold to 128 gigawatts*" — continuing, in the same recorded remarks, that the figure rests on FERC-714 data plus new utility and planning-region reports. (Daily Energy Insider, 6 Dec 2024 — full call transcript locator for draft stage.) Rob Gramlich, same call, on the doubling-again dynamic and its reach into every industry process:

paraphrase-marked, same locator, one-quote-per-source discipline (Wilson's is the deployment).

Who pays. If the forecast is right and unmet: everyone, in scarcity pricing (the January 2026 cold snap's \$3,000/MWh hours). If the forecast is wrong and built to: ratepayers, in stranded steel on thirty-year depreciation. The asymmetry between those two error costs is the utility's honest argument (Beat 10 steelmans PJM; L7 steelmans Dominion) and the ratepayer advocate's honest fear — both sides priced, per house rule.

What's contested, motivated, or unknown. Everything, which is the beat. The load-growth *direction* is not contested (EIA's consumption series turned in 2020–2025; peaks are being set). The *magnitude* is a fight among motivated filers: the utility's forecast is a rate-base application (Style Guide §5, the Utility seller); the analyst's compilation is a transmission argument; the reliability regulator's projection is an authority instrument; the chip-supply-constrained counter-forecast (Grid Strategies' NERC audit, Mar 2026) is the current best discount and is itself a model. Where evidence is single-sourced (the ~61 GW of "preliminary updates" in the Dec 2024 report is Grid Strategies' own estimate layered on filings), say so — the report does.

Sensory & material. A forecast graveyard with headstones in both directions: fifteen years of over-forecasts, then 2025's under-forecast (PJM predicted ~154 GW for summer 2025; a June heat wave delivered 161+). The physical texture of the beat is paper: Form 714 tables, IRP appendices, adjustment-request spreadsheets.

Numbers that matter. 2.6% → 4.7% — 5-yr growth forecast, 2022→2023 filings — Grid Strategies, Dec 2023 — STRUCTURAL · 23 → 128 GW — 5-yr load growth, 2022→2024 filings — Grid Strategies, Dec 2024 — STRUCTURAL (the quintupling anchor, verified) · ~90 GW — data-center share of the 128 — Grid Strategies, Dec 2024 — VOLATILE · +224 GW / +246 GW — NERC 10-yr summer/winter, LTRA 2025, 29 Jan 2026 — VOLATILE + phantom-load caveat (NERC counts filed load) · -4.4 GW — PJM's 2028 vetting cut, 14 Jan 2026 — STRUCTURAL (the correction, dated) · 161,000+ MW vs ~154,000 — actual vs. forecast, summer 2025 — PJM — ANCHOR (it happened).

Stress-test verdict: SUSTAINABLE. The beat carries the course's hottest lens on its richest documented record — three dated report generations, a named author with a verified quote, a formal correction procedure, and a forecast that missed both directions inside twelve months. Comfortably five minutes.

Beat 4 — Mechanism Autopsy (the three-study gauntlet, conversationally)

Syllabus 2.0 assignment: The three-study interconnection gauntlet — feasibility, system impact, facilities — delivered conversationally, never announced as analysis.

Beat Menu definition: Atoms · versatile · fat container · how the thing physically works; rotation is content-native.

Facts, dates, names, numbers. The classic serial gauntlet (FERC Order 2003 pro forma, the architecture in force for two decades and the frame the syllabus names): (1) **Interconnection Request** — application, deposit, queue position stamped by date; (2) **Feasibility Study** — a preliminary screen (~\$10,000 deposit under the classic pro forma), weeks of power-flow modeling answering "is this even plausible here"; (3) **System Impact Study** — the real physics (~\$50,000 deposit class), months of thermal, voltage, and stability analysis identifying every wire and breaker the new machine would overload; (4) **Facilities Study** — the price tag (~\$100,000 deposit class), engineering the required network upgrades to an estimate; (5) **the Interconnection Agreement** — feasibility, impact, and facilities findings congealed into a contract (Beat 5 and Section 5 take it from here). [Deposit figures are the classic pro forma serial-era structure; PJM's own feasibility-study reports document \$10,000 deposits in the legacy process; verify exact tariff text at draft stage — locator: pro forma LGIP, FERC; PJM Manual 14 series.] The reformed gauntlet (Order 2023 / PJM New Rules) keeps the three-phase logic but clusters it: a 45-day request window, a 60-day customer engagement window, a **150-day cluster study**, then facilities-phase work — with study deposits of \$75,000–\$400,000 by size (10% non-refundable on arrival), readiness deposits (\$4,000/MW, then 10% of allocated upgrade cost), 100% site control at the door, and withdrawal penalties on the way out. The clock in practice: PJM quotes one to two years request-to-agreement under the new rules; LBNL measures the national median request-to-agreement at well over 3 years (2025) and request-to-operation at over 5 years for 2025 builds — against under 2 years for projects built in the mid-2000s.

The mechanism (the legal path, traced end to end). A megawatt's paperwork journey: application → deposit cashed → cluster window closes → engagement window (the one chance to see the heatmap and walk away un-penalized) → cluster study models every project in the batch simultaneously against the same wires → results allocate network-upgrade costs by proportional impact → decision point: post the next deposit or withdraw (penalty attaches) → facilities-phase engineering

→ the agreement is tendered → execution → and then — the step the ribbon-cutting instinct skips — construction of the upgrades themselves, on transformer and breaker lead times (Beats 1–2), before energization. A load-side note the drafting AI needs stated once, cleanly: **data centers themselves connect as load, not generation** — their applications run through the utility’s load-interconnection and transmission-planning process (Dominion’s batching studies; ERCOT’s Large Load Interconnection Study process; the very territory FERC’s June 2026 show-cause orders found under-specified) — while the *generation* needed to serve them stands in the generator queue autopsied here. Two queues, one wall; the lecture’s frame (“get in line”) is true twice. **Where the constraint binds:** the study itself — the one document money can’t accelerate (L1’s pack planted this line at site-selection grain; this beat owns the full anatomy). Engineering hours, restudy cascades (a higher-queued withdrawal can force the whole cluster back through the model), and affected-system studies in neighboring regions set the pace; Order 2023’s late-study penalties exist precisely because “reasonable efforts” produced unbounded timelines.

Key actors. PJM’s planning department (the study engine: automation plus staffing cut its backlog 60% — PJM’s own figure, May 2025); the transmission owners who build what the studies order; the developer’s interconnection consultant (a profession that exists because the gauntlet does).

The documents. Each study is a paper artifact with a timeline and a price tag, per the syllabus’s exact frame — and each produces a report that becomes discovery material in every later fight. Reference specimens in the record: PJM feasibility-study reports (e.g., queue positions AE1-153, AD2-066 — public PDFs with itemized attachment-facility estimates: \$600,000 of metering here, \$1.2M of 230 kV spans there, 18–24 months to build). The reports read like invoices for finding out what the invoice will be — which is Beat 6’s opening.

Verbatim bank. Held for Beat 5 / Section 5 (the agreement’s clause) and Beat 6 (deposit mechanics); this beat’s specimen documents are precisely paraphrased with public PDF locators (pjm.com project queues).

Who pays. The applicant pays study costs in full — actual costs, trued up beyond the deposit (PJM Manual 14H: the applicant is responsible for all actual study costs; excess billed). Network-upgrade allocations from the study land on the applicant too — for now. The doctrine fight over when those costs socialize is L7’s; the seed is one line.

What’s contested. Whether clustering actually shortens the line or just reorganizes it: PJM’s 1–2-year quote vs. LBNL’s 3+-year national median vs. the 5-year request-to-operation reality — all three numbers are true, measuring different segments with different vintages; state all three, let the gap teach.

Sensory & material. A power-flow model with thousands of buses; a heatmap published so applicants can see the congestion before they pay to confirm it; the restudy loop as a form of institutional Groundhog Day; a decision point that is literally a wire-transfer deadline.

Numbers that matter. 45/60/150 days — Order 2023 window/engagement/study clocks — FERC, Jul 2023 — STRUCTURAL · \$75k–\$400k + \$4,000/MW — PJM deposits — FERC-approved Nov 2022 — STRUCTURAL · >3 yrs / >5 yrs — median IR→IA / IR→COD — LBNL, 2026 edition (2025 data) — STRUCTURAL · <2 yrs — the 2000s baseline — LBNL — ANCHOR (historical) · 60% — PJM backlog reduction via automation/staffing — PJM, May 2025 — VOLATILE.

Stress-test verdict: SUSTAINABLE. The gauntlet installs cleanly in five minutes with real specimens, real deposits, and both process generations — and the course invokes it for the rest of the run (Style Guide: install in Lecture 4, never rebuild).

Beat 5 — The Paper Trail — class: the queue instrument (the interconnection agreement as actor)

Syllabus 2.0 assignment: The interconnection agreement as actor: what it forces, what it forbids, what “executed” actually buys you. Lead introduction of the course’s leading actor (returns 5, 7).

Beat Menu definition: Politics · universal (all 10 lectures) · class rotation: **queue instrument** here (L1 state audit; L2 technical specification; L3 permit/agreement; L5 contract — rotation verified, no repeats).

Assignment note: The exhaustive document dossier lives in Section 5, per the pack template; this entry carries the beat-level material and the load-bearing point.

Facts, dates, names, numbers. The instrument: the interconnection agreement — in FERC’s standard form the Large Generator Interconnection Agreement (LGIA; PJM’s regional descendants: the Interconnection Service Agreement and Generation Interconnection Agreement) — a three-party contract (customer, transmission provider, transmission owner)

that is the *only* exit from the gauntlet and the beginning, not the end, of the wait. What “executed” buys: a contractual right to *interconnect* — physically attach at a point — conditioned on milestone payments, security postings, and the actual construction of the studied upgrades. What it explicitly does not buy is the beat’s spine and the lecture’s Kicker (verbatim below). The mortality statistic that makes the paper’s limits vivid: **26 GW of PJM projects with signed interconnection agreements withdrew anyway** (within the 74%-withdrawal reform ledger, Connell, March 2026) — the contract as a stage, not a guarantee; and on the other side of the ledger, ~46 GW holds executed agreements while waiting on supply chains and permits the agreement cannot command (PJM fact sheet, July 2025). Nationally: 536 GW of active queue capacity — over a quarter — already holds a draft or executed IA (LBNL, 2026 edition).

The mechanism. What the agreement forces: milestone schedules; security for network upgrades; operating and metering requirements; the customer’s obligation to fund what the studies found. What it forbids — or rather, what it declines to grant — is the sharper edge: no transmission service, no delivery rights, no energy sales; each of those is a separate application under a separate tariff. **Where the constraint binds:** at the signature’s semantic ceiling — “done,” in queue vocabulary, means the utility has said *yes to the attachment*, and every other yes (delivery, dispatch, the upgrades’ steel arriving) still stands in its own line. The kicker’s legal foundation is in the form itself.

Key actors. The agreement (lead — full treatment Section 5, so L5 and L7 never rebuild it); the transmission provider (PJM here); FERC as the form’s author and enforcer.

The documents. Section 5 in full. Beat-level exhibit: the pro forma LGIA’s Article 4 scope-of-service architecture, whose “no transmission delivery service” clause is the assigned Verbatim.

Verbatim bank. From the standard-form LGIA (FERC pro forma; the same operative language appears across CAISO, NYISO, and non-ISO instruments in the public record): the execution of the agreement “*does not constitute a request for, nor the provision of, any transmission delivery service*” — and, completing the clause in precise paraphrase, conveys no right to deliver electricity to any specific customer or point of delivery. (Standard LGIA, Article 4 [“No Transmission Delivery Service”]; multiple filed instances in the public record — CAISO LGIA form; NYISO service agreements; non-ISO utility LGIAs. Full clause pull for the drafting AI at draft stage from any filed instance; the assigned Verbatim deployment and its full verification live in Section 4.)

Who pays. The customer, per the agreement’s own allocation — study true-ups, upgrade funding, security. The when-does-it-socialize question is deliberately left as one line: the agreement’s terms are the ground L7’s doctrine fight is fought on (the roster pre-assigns L7 the “customer’s extension cord” line — not spent here).

What’s contested. Whether a queue instrument with a 26-GW post-signature mortality rate is a contract or a very expensive option — stated as the honest tension, not resolved; Section 5 carries the skeptical caveat in full.

Sensory & material. A standard form with appendices thicker than the agreement; a signature page that took five years to reach; milestone tables where the dates are the drama.

Numbers that matter. 26 GW — signed-then-withdrawn, PJM 2020–2026 — Connell, Mar 2026 — STRUCTURAL · ~46 GW — executed-and-waiting — PJM, Jul 2025 — VOLATILE · 536 GW — national active capacity with draft/executed IA — LBNL, 2026 — VOLATILE · 1–2 yrs — new-rules agreement processing — PJM — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The course’s leading actor gets a lead introduction with a verified signature clause, a mortality statistic, and a semantic payoff that doubles as the lecture’s kicker — and Section 5 banks enough depth that the L5 and L7 returns need only brief references.

Beat 6 — The Bill Arrives (the feasibility-study invoice)

Syllabus 2.0 assignment: Paying for the study of your own table — the study invoice, traced upstream. (Mid-lecture deployment; the beat’s opener-preferred class is spent elsewhere this hour — see Section 3 on the negative-space “Bill Arrives as opener.”)

Beat Menu definition: Money · opener-preferred, closer-capable · open from a cost line item someone actually paid, then trace it upstream; the bill is the hook, the supply chain of the bill is the beat.

Facts, dates, names, numbers. The invoice stack, itemized from the record: classic serial era — \$10,000 (feasibility class), \$50,000 (system impact class), \$100,000 (facilities class), refundable against actual costs that routinely exceed them

[classic pro forma structure; PJM legacy reports document the \$10,000 tier; tariff-text verification at draft stage]. Reform era, PJM: \$75,000–\$400,000 study deposit scaled to megawatts, **10% non-refundable the moment it arrives**; Readiness Deposit No. 1 at \$4,000/MW (a 500 MW request posts \$2,000,000 to stay at the table); Readiness Deposit No. 2 at 10% of allocated network-upgrade costs; Manual 14H's flat rule that the applicant owes *all actual study costs*, billed past the deposit if the engineers run long. Order 2023's national floor: deposits scaled by size; a \$10,000/MW deposit (floor \$500,000, ceiling \$2,000,000) substituting for site control where regulation forbids it; transition-era options priced at \$5,000,000 for a transitional cluster seat. The 2026 toll lane: PJM's proposed Expedited Interconnection Track at \$500,000 (study) plus \$15,000/MW (readiness) — the premium price of a shorter line, filed February–March 2026. And the number the invoices are all downstream of: LBNL's PJM cost analysis (Jan 2023) — network-upgrade allocations for recently *completed* studies mostly under \$200/kW but with a tail to \$3,728/kW, and east-PJM applicants (NC, NJ, DE) drawing \$485–971/kW where headroom is scarce; withdrawn and active projects average far above completed ones (\$671/kW and \$294/kW in the non-ISO companion series, Feb 2026) — the invoice, not the physics, is what kills most projects.

The mechanism. Trace the line item upstream: the deposit → funds engineering hours → which model the shared network → whose findings allocate upgrade costs → which arrive as the *next* invoice — so the feasibility invoice is a down payment on discovering a larger invoice, and the withdrawal penalty is the exit fee from the discovery process. The design logic (Beat 10 steelmans it): free applications produced a 2,600 GW national queue of which 13% ever materialized; pricing the table is the mechanism that shrank it (>750 GW withdrawn in 2025 alone, nationally, as the fees and penalties bit). **Where the constraint binds:** the decision point — the dated wire-transfer deadline where a project's balance sheet meets the study's findings; that is where 74% of PJM's studied gigawatts chose the exit.

Key actors. The applicant's CFO; PJM's settlements department; FERC as fee-schedule author.

The documents. The study agreements themselves — feasibility-study agreement, facilities-study agreement — each a mini-contract with its own deposit clause; PJM Manual 14H, revision 4 (the Cycle-era procedures, exhibit tables of required deposits — public PDF, pjm.com); the Stoel Rives summary of the FERC-approved New Rules (30 Nov 2022) as the cleanest secondary statement of the deposit ladder.

Verbatim bank. Deposit figures precisely paraphrased with locators above; the one quotable bureaucratic gem is reserved to avoid double-spending sources already quoted (Manual 14H's all-actual-costs rule is paraphrase-marked with its PDF locator for a draft-stage pull if markup wants a second Verbatim candidate — noting the 1-per-lecture cap means it would *replace*, not join, the LGIA clause).

Who pays. The developer, in cash, at the table — and the beat's honest note: these are the *private* dollars; the moment upgrade costs exceed what the customer's allocation captures, the remainder rides transmission rates, which is the L7 hour. Seeded in one clause.

What's contested. Whether deposits screen speculation or entrench incumbency — a \$2M table stake filters shell companies and also filters small entrants; both readings are documented in the AD24-9 comment record (locator: FERC eLibrary, post-workshop comments, Oct 2024).

Sensory & material. A wire transfer with a docket number in the memo line; an invoice for engineering hours spent proving your project would break something.

Numbers that matter. \$75k–\$400k / 10% non-refundable — PJM study deposit — Nov 2022 — STRUCTURAL · \$4,000/MW — RD1 — STRUCTURAL · \$500k + \$15,000/MW — EIT pricing — PJM filing, Feb–Mar 2026 — VOLATILE (pending FERC) · \$485–971/kW — east-PJM upgrade allocations — LBNL, Jan 2023 — STRUCTURAL · \$3,728/kW — the outlier — LBNL — ANCHOR (it happened) · >750 GW — 2025 national withdrawals — LBNL 2026 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. A full invoice ladder across two process generations plus a priced toll lane and a cost-distribution study — the beat sustains on documented dollars alone.

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The scene's documented content (for reconstruction from the record only).

The room's through-line per the comment record and summaries: the re-formed process is necessary and insufficient

clusters and penalties address the queue's *shape* while construction, affected-system studies, and¹⁵⁶ equipment lead times

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Beat 8 — The Regulatory Collision (Order 2023's rewritten rulebook vs. regional implementation reality)

Syllabus 2.0 assignment: Order 2023's rewritten rulebook vs. regional implementation reality.

Beat Menu definition: Politics · versatile, closer-capable · two authorities claiming the same jurisdiction; steelman both legal theories before the collision.

Facts, dates, names, numbers. Collision one — **uniform rule vs. regional machinery:** Order 2023 (28 July 2023) commands a single national pro forma; the regions arrive with reforms already running (PJM's FERC-approved cluster transition predates the national rule by eight months; MISO froze intake in 2023 for its own redesign) and file compliance proposals claiming “independent entity variations” — so the national rulebook lands as a patchwork of exceptions FERC must adjudicate docket by docket through 2024–25, with Dominion among the parties contesting the Commission's generic findings on rehearing (Order 2023-A record, Federal Register, 16 Apr 2024). The rule meant to standardize produced a year of litigation about what standard means. Collision two — **generator rulebook vs. load reality:** the 2023 reform governs *generators*; the loads driving the crisis had no federal interconnection framework at all — until the Secretary of Energy's 23 October 2025 §403 directive forced one onto FERC's docket (RM26-4), and FERC's 18 June 2026 answer split the jurisdictional baby: six show-cause orders under FPA §206 finding the RTOs' large-load tariff provisions apparently inadequate, while *expressly declining* the broad jurisdiction the ANOPR contemplated and preserving states' authority over resource selection, siting, and retail sales. Collision three — **federal floor vs. state statutes:** Texas SB6 (June 2025) and its PUCT rules (draft 16 TAC §25.194, 12 March 2026), Virginia's 14-year-contract terms, and the NARUC filing (13 April 2026) cataloguing state regimes — a fifty-front implementation of the same question FERC just claimed the transmission-side of.

The mechanism. The legal architecture, both theories steelmanned per the beat rule: *FERC's theory* — open access under FPA §§205/206 requires clear, consistent, non-discriminatory tariff terms for how transmission service to large loads is studied; the show-cause device asserts exactly that and no more (“falling squarely” within existing authority, per the orders' own framing). *The states' theory* — retail service, resource adequacy choices, and siting are police-power and state-commission territory; a federal large-load regime that conditions or channels retail-load connection intrudes (the concern Commissioner Chang's concurrence acknowledges and hopes the narrow approach assuages [paraphrase-marked; White & Case / Lexology summaries, June 2026]). **Where the constraint binds:** the compliance filing — each RTO must now either rewrite its tariff or justify it, on a clock, and the resulting terms will decide where the study obligation, the cost allocation, and the queue position of a gigawatt-class load legally live. The collision resolves into paper, on deadlines, which is this course's favorite kind of resolution.

Key actors. FERC (Chairman Laura V. Swett — as-of 2026; profile Section 9); the Secretary of Energy (the ANOPR's author — an executive reaching into an independent agency's docket via a rarely used organic-act power, itself a collision artifact); the six RTOs; NARUC and the state commissions; Commissioner David Rosner (“Four Pillars” remarks, 18 June 2026, published at [ferc.gov](https://www.ferc.gov)).

The documents. The DOE §403 direction (23 Oct 2025); FERC's notice of intent (16 Apr 2026); the six show-cause orders E-7–E-12 (18 Jun 2026); the December 2025 PJM co-location transparency order (fence: L5 owns co-location; cite as lineage only); SPP's High Impact Large Load approval (same lineage line).

Verbatim bank. Chairman Laura V. Swett, concurring statement with the six orders, 18 June 2026: “*a future of fair cost allocation, unprecedented transparency for the American ratepayer*” — from her longer enumeration of the orders' aims (respect for states' rights, efficient markets, speed to power — precisely paraphrased; Construction Dive/Utility Dive, June 2026, quoting the statement; full text at [ferc.gov](https://www.ferc.gov)). Her open-meeting position that data-center free-riding on retail customers is not an option: paraphrase-marked, same coverage — **the L7 seed, one line, not developed here.**

Who pays. The collision's stakes *are* who pays — the show-cause orders exist because unclear study rules let costs land by default; but the pricing of the answer is L7's hour. This beat holds the jurisdictional fight; one seed line on stakes.

What's contested. Everything above, live, with compliance clocks running as of the research date — Section 11 carries the docket calendar.

Sensory & material. A §403 directive — an instrument most energy lawyers had never seen used this way — landing on FERC's docket like a subpoena from upstairs; six orders issued in one open meeting; 3,500 pages of comments from ~175 parties as the record's physical mass.

Numbers that matter. 6 — show-cause orders, 18 Jun 2026 — ANCHOR (issued) · 3,500+ pages / ~175 stakeholders — RM26-4 record — FERC, Apr–Jun 2026 — STRUCTURAL · 8 months — ANOPR-to-action — STRUCTURAL · 90

days — Order 2023 compliance window (2023 vintage) — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. Three documented collisions with dated instruments, named authors, both legal theories steelman-able from the record, and a live clock. Rich beyond the slot; trimming guidance for markup: collision one can compress to a paragraph if the beat runs long.

Beat 9 — The County (Loudoun's 2022 transmission-constraint pause)

Syllabus 2.0 assignment: The epicenter told to wait — Loudoun 2022 as present-tense jurisdiction politics. (The Wrong Map is negative space; this is what the geography is doing to people *that year*, per the menu's County/Wrong Map distinction.)

Beat Menu definition: Politics/Character · versatile, closer-capable · one jurisdiction as live microcosm, present-tense, with a zip code.

Facts, dates, names, numbers. The sequence, day-stamped where the record allows: **July 2022** — Dominion begins telling data center companies that new eastern-Loudoun connections face multi-year delays; the cause is transmission into the corridor. **28 July 2022** — the constraint goes public via a customer, not the utility: Digital Realty's Andy Power (President and CFO, as-of that call) tells analysts of the Dominion warning. **July–August 2022** — Dominion's Aaron Ruby confirms; the county's own staff report projects reduced power allocations through January 2026; Rizer (L1's human, one-line return) is two weeks in and still measuring the hole. **8 August 2022** — CEO Bob Blue commits to the fix on the Q2 call: near-term reshuffling plus **two new 500 kV lines into eastern Loudoun**, the first targeted for 2026, plans already at PJM. **September 2022** — a Wells Fargo note puts numbers on the triage (3–6-months-from-completion projects get power; ~90 MW of hyperscale commitments at risk); **26 September 2022** — connections partially resume, constraint horizon 2026. The aftermath curve: the 2022 four-year delay guidance becomes, by **2024, seven years** — Dominion's own extension (Prince William Times synthesis of the disclosure record) — while contracted data-center capacity climbs to ~40 GW (Dec 2024, +88% since July 2024) against a ~25 GW total-system peak. The county context held at return-grade (L1 owns the fiscal machine): data centers were worth ~\$575M / ~31% of county revenue in 2022 — the year the county's golden goose was told its food was on backorder.

The mechanism. Why the world's densest data-center corridor ran out of wires first: two decades of load growth were served by incrementally reinforcing a distribution-and-transmission web built for suburbs; the corridor's demand density finally exceeded what the existing 230 kV web could import, and the fix — 500 kV lines — runs on a different clock (routing, SCC approval, PJM regional planning, eminent-domain fights, and Beat 1's transformers) than the buildings it serves. **Where the constraint binds:** the import path. Loudoun had the fiber, the land, the tax deal, and the customers; the watt could not physically arrive. This is the lecture's thesis with a zip code — and the county's 2022 discovery that its economic engine ran on somebody else's construction schedule is the present-tense politics the beat exists for.

Key actors. Dominion Energy (**return** — motive at this beat: keep the growth and the capex both; the constraint disclosure justified the transmission build now in its plan; L7 owns the full steelman); Digital Realty (the customer as disclosure vector — a REIT whose stock moves on delivery dates, which is why the news broke on *its* call); Loudoun County government (caught between its budget and its grid); Buddy Rizer (one line, new fact: his 2022-crisis reaction is documented and post-dates L1's fiscal-machine material).

The documents. The Loudoun staff report (August 2022 — the allocation projection); Dominion's Q2 2022 earnings transcript; the PJM filing for the first 500 kV line (2022, in-service target 2026) — a transmission plan as the county's ransom note, payable in years.

Verbatim bank. Andy Power, President and CFO, Digital Realty, earnings call, late July 2022: Dominion warned of “*a potential pinch point in Eastern Loudoun County*” — with his cause attribution — transmission, the pipes, not the power — precisely paraphrased (Data Center Frontier, 29 Jul 2022; transcript locator for the full passage). Aaron Ruby, Bob Blue, and the staff report: paraphrase-marked above with locators (one quote per source discipline; Power's is this beat's deployment).

Who pays. The 500 kV lines enter Dominion's transmission rates through PJM's cost-allocation machinery — the exact dollars-to-mailboxes path is L7's (\$4.3B/seven-states is L7's number; not spent here). One seed line.

What's contested. Whether the constraint was a failure of Dominion's planning or the inevitable physics of unforecastable demand — both readings are in the record (the utility's own filings vs. analyst criticism), and the beat states them as the

county experienced them: simultaneously.

Sensory & material. 215-foot lattice towers stepping toward Ashburn (L1's pack owns the tower image — one-line reuse maximum); a county that recruited the load for fifteen years learning the grid's answer was "2026, maybe"; cranes idled next to energized fiber.

Numbers that matter. July 2022 — the pause begins — ANCHOR · 2×500 kV — the fix — Dominion, Aug 2022 — STRUCTURAL · 4 yrs → 7 yrs — delay guidance, 2022 → 2024 — Dominion via press record — STRUCTURAL · ~40 GW contracted vs ~25 GW system peak — Dec 2024 — Dominion — VOLATILE (stage: contracted; the requested-stage ~70,000 MW figure is L1's exhibit).

Stress-test verdict: SUSTAINABLE. Day-stamped sequence, four documented voices, a mechanism, a fix with a voltage class and a date, and a four-to-seven-year punchline. Five minutes, comfortably.

Beat 10 — The Steelman (defendant: PJM's queue)

Syllabus 2.0 assignment: Why the studies exist; the reliability logic at its strongest. Rotation: deployment 2 of 8; defendant never repeated.

Beat Menu definition: Audit · never opener · the full-throated strongest case, from the defendant's actual numbers and constraints; a précis of the weak version is not a steelman.

The strongest form of the case, assembled from the defendant's own record. (Full ammunition file: Section 7; this entry carries the beat-shaped argument.) (1) *The studies are load-bearing physics, not paperwork.* Every interconnection changes power flows on a shared machine; the July 10, 2024 incident is the exhibit for what un-modeled behavior does — six correctly cleared faults and 1,500 MW of load vanishing by customer-side logic no planner had visibility into. The study is where that visibility is supposed to come from; PJM's queue is the price of a grid that mostly doesn't do that. (2) *The queue's length was manufactured by its customers.* Since 2020: 294 GW studied, 103 GW signed, 23 GW in service — a 74% withdrawal rate, including 26 GW that withdrew after signing. PJM's engineers spent years studying projects that were never real; the backlog was speculation wearing engineering's clock. The 4R report said it plainly in February 2023: a queue 94% renewables with a ~5% historical completion rate is not a supply plan, it is a lottery-ticket drawer. (3) *When PJM could triage, it did.* The 2022 reform (filed before FERC's national rule); the Fast Lane; automation and staffing cutting the backlog 60%; the RRI pulling 51 shovel-ready projects (>9,300 MW) forward; Transition Cycle 1 delivered, TC2 on schedule for end-2026; new-rules processing at one to two years; Cycle 1's window opened on time and drew 220 GW. The line moves now; it moved as fast as the withdrawals allowed. (4) *The reliability mandate is asymmetric.* If PJM under-builds, the failure is measured in the January 2026 cold snap's arithmetic — 148 GW forecast against a 143.7 GW record, \$3,000/MWh hours, and a federal agency asking data centers to run diesels; if it over-studies, the failure is measured in months of delay. PJM's obligation function is written to prefer the second error, and NERC's LTRA — elevated risk 2026–2028, high risk 2029 onward — is the referee agreeing that the first error is live. (5) *The queue is not the bottleneck's cause.* Even instant studies deliver nothing without Beat 1's transformers and Beat 2's turbines; PJM's own connected-in-2025 figure (~2.1 GW) reflects supply chains and permitting it does not control — ~46 GW of signed projects wait on exactly those. The strongest sentence in the defense: the queue is where America's inability to build becomes visible, not where it originates.

The cross-examination the steelman must survive (held to one paragraph, per the beat's discipline of strongest-case-first): the counter-record — 811 projects paid Cycle 1's deposits and now wait one to two years for studies of a batch assembled in 2026; the 2027/28 auction cleared 6,600 MW short of target while ~46 GW sat signed-but-unbuilt; and FERC's June 2026 show-cause found the large-load side of PJM's tariff apparently inadequate. Stated, dated, not resolved — the beat ends with the defendant's case standing and the listener holding both ledgers.

Key actors / documents / verbatim. PJM (institution profile Section 9); the 4R report (24 Feb 2023) — this beat's document, with its reserve-margin table (15% → 8% by 2028/29 under low entry) precisely paraphrased above [PJM report PDF locator; a short verbatim pull from its risk framing is available at draft stage — held unquoted here to preserve one-quote-per-source for Section 7's use]; Connell's March 2026 reform ledger (already quoted by figure; his verbatim lives in Section 9).

Who pays. The steelman's honest cost line: the studies' delay costs are real and land on developers and, through scarcity, on ratepayers — the defense is that the alternative allocation (un-studied risk) lands on everyone at once, at 7:00 p.m., in

82 seconds.

Numbers that matter. 294/103/23 GW · 74% · 26 GW — the reform ledger — Connell, Mar 2026 — STRUCTURAL · ~5% — renewable completion rate — PJM 4R, Feb 2023 — STRUCTURAL · 51 / >9,300 MW — RRI selection, 2 May 2025 — later 41 / ~8,000 MW (Apr 2026) — VOLATILE, shrinkage flagged · Elevated 2026–28 / High 2029– — NERC LTRA 2025 — VOLATILE.

Stress-test verdict: SUSTAINABLE. The defendant's own numbers carry five minutes without the pack inventing a word; the beat's risk is richness, not thinness.

Beat 11 — The Physics Audit (the 49 GW arithmetic)

Syllabus 2.0 assignment: Simultaneous load growth, coal and gas retirements, and what a gigawatt-scale shortfall physically means.

Beat Menu definition: Atoms/Audit · versatile, closer-capable · the deadpan reality check, delivered in the same tone as the pitch it audits.

Facts, dates, names, numbers — the audit's raw material. The headline number, with its full pedigree (Section 4 carries the Step Function verification; Section 6 Discrepancy B the precision flag): **Morgan Stanley Research, published in the firm's own voice 27 February 2026 — US data-center demand could reach 74 GW by 2028, with a projected shortfall of about 49 GW in available power access.** The audit proceeds in the pitch's own tone: (a) *Label the species.* 74 and 49 are **capacity figures — rates, gigawatts** — and the 49 is a *data-center access* shortfall (demand minus power obtainable on data-center timelines), not a NERC-style system resource-adequacy deficit; the two get conflated in circulation and the conflation is course material. (b) *Show the components, each dated.* Demand side: the 128 GW five-year national forecast (Dec 2024 filings), ~90 GW of it data centers; the utility-side corroboration and its own discounts (Exelon's 22%-will-materialize; PJM's ~4.4 GW vetting cut). Retirement side: PJM's 40 GW at risk by 2030 (Feb 2023) — with the 2025–26 amendment that DOE §202(c) emergency orders are now forcibly delaying some of it, i.e., the retirement schedule itself became negotiable under exactly this arithmetic. Supply side: 2,061 GW in queue but a 13% historical completion rate and >5-year median delivery; PJM connected ~2.1 GW in 2025; the 2027/28 auction cleared 5.6% (6,600 MW) short of its reserve-margin target — the first shortfall of its kind, PJM's own framing. (c) *Audit the model against its own revision history.* The 49 emerged from a moving series in its author's notes: ~36 GW (Byrd, CNBC-era estimate) → 44 → 45 (21 Sep 2025 note, with a mitigation stack still leaving 5–15 GW) → 47 → **49** (Feb 2026) — a shortfall forecast that grew 36% in roughly a year of revisions is precise about its direction and honest about nothing else, and the beat says so in the same calm voice. (d) *State what a gigawatt-scale shortfall physically means,* from events, not adjectives: January 2026 — 148 GW forecast against a 143.7 GW record; >22 GW of generation outages mid-week; spot prices above \$3,000/MWh; the Department of Energy requesting that data centers run their backup generators — a federal agency asking the load to become the supply. And July 10, 2024 — the demand side demonstrating it can move 1,500 MW in 82 seconds, fifty times faster than a plant trip, in either direction. A shortfall is not darkness first; it is scarcity pricing, emergency orders, diesel hours, and voltage events — all already in the record at today's margins.

The mechanism. The arithmetic that makes 2028 the pinch: demand additions arrive on 6–18-month data-center construction timelines; supply additions arrive on 5-year queue medians plus 128-week transformers plus 2029 turbine slots; retirements arrive on policy dates that only emergency orders move. Three clocks, one intersection. **Where the constraint binds:** the delivery-date mismatch itself — the beat's job is to make the listener feel the three clocks ticking at different speeds, then hand the closer (Beat 12) the question of whether the demand clock is even real.

Key actors / documents. Morgan Stanley Research (Stephen Byrd, Global Head of Thematic Research — seller-flagged: a bank with power-sector coverage and clients on every side of the trade; Section 7); NERC (LTRA 2025); PJM; DOE (§202(c) orders).

Verbatim bank. Morgan Stanley Institute article, 27 Feb 2026: the forecast that US data-center demand “could reach 74 GW by 2028” — with the ~49 GW access-shortfall clause precisely paraphrased (morganstanley.com, article text; one quote, this source — the Byrd islands-of-wealth line is banked in Section 7 instead? No: one quote per source total; the 74-GW fragment is this pack's single deployment from that article, and all other passages from it are paraphrase-marked).

Who pays. Scarcity's bill is the most regressive in the course — capacity prices and emergency-hour energy prices socialize instantly — one line, floor-adjacent flag active, cashed in L7.

Numbers that matter. 74 GW / ~49 GW — demand vs. access shortfall, 2028 — Morgan Stanley, 27 Feb 2026 — VOLATILE/CONTESTED (model output; revision series documented) · 36→44→45→47→49 — the revision ladder — Morgan Stanley notes, 2024–2026, via financial press — VOLATILE · 6,600 MW / 5.6% — 2027/28 BRA shortfall vs. IRM — PJM, early 2026 — STRUCTURAL · 148 vs 143.7 GW — Jan 2026 forecast vs. record — PJM — ANCHOR (event) · \$3,000/MWh — cold-snap spot spikes — Jan 2026 — ANCHOR (event).

Stress-test verdict: SUSTAINABLE. The audit has a pedigreed headline number, a three-clock mechanism, two physical events, and a revision ladder that lets the beat audit its own anchor — the course's signature posture executed on the lecture's own Step Function.

Beat 12 — The Perverse Incentive [C] (duplicate requests inflating forecasts into phantom load)

Syllabus 2.0 assignment: Duplicate requests inflating forecasts into phantom load — planning against the forecast as an act of faith. Closer; the Handoff rides on its final ~200 words.

Beat Menu definition: Politics/Money · versatile, closer-capable · the rule producing the opposite of its intent.

Facts, dates, names, numbers. The rule: interconnection and service requests are cheap or free, non-binding, and un-screened for duplication — a rational developer therefore files everywhere at once. The opposite-of-intent: a request system built to give planners information now destroys it. The documented exhibits, each dated: **Exelon — only ~22% of its 65 GW large-load pipeline through 2040 likely to materialize** (the utility discounting itself, May 2026 trade record); **CenterPoint — Houston-area requests 1 GW → 25 GW in twelve months**; utilities fielding 40–50 large-load proposals a year where the historical rate was one or two; ERCOT's large-load stack at ~200+ GW with **under 2% operational**, against an ~87 GW (2025) → 138 GW (2030) official large-load forecast that ERCOT itself judgment-discounts; expert range for never-built shares: 80–90% of proposed US data centers, with speculative requests running five to ten times actual builds (Utility Dive expert surveys, Jun–Jul 2025); Dominion — ~70,000 MW *under request*, roughly triple its entire system (**return:** L1 owns this exhibit and its stage-labeled slide series; this closer re-invokes it in one sentence with the phantom caveat attached, per the recurring-cast rule). The named voices: **Beth Garza**, former director of ERCOT's independent market monitor, December 2025: *"There's not enough stuff to serve that much load on the equipment side or the consumption side."* (CNBC interview, Dec 2025, via documented synthesis — draft-stage pull of the CNBC segment for full context.) **Joshua Rhodes**, research scientist, UT Austin, same coverage: the steel physically cannot go into the ground at forecast speed — *"I don't even know if China could do it that fast."* (Same corpus; one quote each, separate speakers/sources.) The correction machinery, arriving as law and procedure: Texas SB6 (June 2025 — duplicate-request disclosure, study fees, site control, curtailment); PUCT's own slide stating the goal as excluding *"phantom"* load — the term of art in the regulator's punctuation (PUCT presentation, 17 Oct 2025); PJM's Load Adjustment Request Implementation methodology (Jan 2026 — the RTO publishing its procedure for disbelieving its members); FERC's June 2026 show-cause orders demanding the tariffs say, clearly, how a large load gets studied at all.

The mechanism. The feedback loop, closed: duplicate requests → inflated aggregate forecasts → utilities and RTOs plan and procure against the aggregate (capacity auctions clear higher; gas turbines get ordered; rate cases get filed) → the buildout's visible cost and the scarcity narrative attract *more* speculative position-taking (powered land as an asset class — L1's territory, one line) → the queue grows → planners discount harder → but the discount rate is unverifiable, so every actor chooses between over-building against fiction and under-building against reality. **Where the constraint binds:** at the planner's act of faith — the syllabus's phrase, now documented as a formal procedure with a publication date. Planning against the forecast stopped being a metaphor in January 2026; it is a PDF on PJM's website.

The closer's landing (for markup; the Handoff itself is Section 10's material). The beat closes the lecture where the register fuses: the transformer from Beat 1 is real steel on a real railcar; the 49 GW from Beat 11 is a bank's revision-prone model; and the system in between — studies, deposits, auctions, thirty-year lines — must order the steel against the model. The Kicker (verified, Section 4) lands here: after the seven-year line and the executed agreement, "done" still means only that the utility said yes — 26 gigawatts' worth of signatures walked away anyway.

Who pays. Whoever the discount rate misses: bondholders and shareholders if the steel outruns the demand; ratepayers if the auctions price the fiction (the 2027/28 auction's \$16.4B rode the forecasts — one line, L7's fight); the next applicant either way, standing behind phantoms in a very real line.

What's contested. The true materialization rate — unverifiable by construction (the same project shopped across territories is invisible to any single planner), which is precisely why disclosure statutes now exist; honest unknown, stated flat, with

the correction machinery dated.

Sensory & material. A queue where most of the people in line are holograms, and the security deposit exists to find out which; a regulator's slide with "phantom" in quotation marks.

Numbers that matter. ~22% — Exelon pipeline materialization estimate — May 2026 — VOLATILE · 1 → 25 GW — CenterPoint, 12 months — VOLATILE · <2% — ERCOT large-load queue operational share — Jan 2026, secondary — VOLATILE + flag · 80–90% / 5–10x — expert never-built and duplication ranges — 2025 — CONTESTED (ranges kept) · ~70,000 MW — Dominion requests (return; caveat mandatory) — Feb 2026 — VOLATILE.

Stress-test verdict: SUSTAINABLE. The closer has named voices with verbatim, utility self-discounts, a legislated correction, and a mechanism that resolves the lecture's whole hour into its final image. Strong closer; the Handoff's question falls out of it naturally.

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SECTION 5: DOCUMENT DOSSIER — THE INTERCONNECTION AGREEMENT (CLASS: QUEUE INSTRUMENT)

The instrument, identified. The interconnection agreement — in FERC’s standard form the **Large Generator Interconnection Agreement (LGIA)**, born as Appendix 6 to the Large Generator Interconnection Procedures in **Order No. 2003** (issued July 2003, Docket RM02-1-000), the rulemaking that standardized generator interconnection nationally after a decade of case-by-case fights. Regional descendants under PJM’s tariff: the **Interconnection Service Agreement (ISA)** and, under the post-2022 Cycle rules, the **Generation Interconnection Agreement (GIA)**, with the **Construction Service Agreement (CSA)** as its construction-phase sibling. Parties: three — the interconnection customer, the transmission provider (the RTO where one exists), and the transmission owner whose physical system is being attached to. The 2023 revision: **Order No. 2023** (28 July 2023, 184 FERC ¶ 61,054, Docket RM22-14-000) rewrote the pro forma procedures around first-ready-first-served cluster studies and rewrote the agreement’s on-ramp — deposits, readiness demonstrations, site control, withdrawal penalties — with **Order No. 2023-A** (21 March 2024, 186 FERC ¶ 61,199) sustaining the architecture on rehearing, effective 16 May 2024.

Procedural status and lineage of the class. The queue instrument is the terminal document of the gauntlet Beat 4 anatomizes: interconnection request → cluster study (or, in the legacy serial world, feasibility → system impact → facilities) → facilities-phase engineering → the agreement, tendered, negotiated within the pro forma’s narrow bounds, executed or filed unexecuted. Under PJM’s transition: FERC approved the cluster redesign **29 November 2022** (Docket ER22-2110); Transition Cycle 1 completed with ~17.4 GW reaching draft agreements across 130 new service requests; Transition Cycle 2 completes around end-2026; Cycle 1 proper closed its application window **27 April 2026** with 811 projects totaling 220,222 MW. New-rules processing time, request to agreement: one to two years, per PJM.

Operative provisions — what the agreement forces. Milestone schedules with dated obligations; security postings for network upgrades before steel is ordered; the customer’s obligation to fund the upgrades the studies identified (trued to actual cost); metering, telemetry, and operating requirements; suspension and default provisions; a limitation-of-liability architecture. Under the reformed on-ramp, reaching execution at all now presupposes: the study deposit (\$75,000–\$400,000 at PJM, 10% non-refundable), readiness deposits (\$4,000/MW, then 10% of allocated upgrade cost), demonstrated site control, and exposure to withdrawal penalties.

Operative absences — what the agreement declines to grant. The dossier’s spine, and the lecture’s Verbatim (Section 4, block-quoted with attribution): execution *“does not constitute a request for, nor the provision of, any transmission delivery service”* — no delivery rights, no energy sales, no capacity commitment; each lives under a separate tariff application. The agreement is a right to *attach*, conditioned on payments and construction — the most consequential signature in the development timeline, and by its own text not the last one.

The skeptical caveat, carried on the document’s face. “Executed” is a stage, not an outcome: **26 GW of PJM projects withdrew after signing** (Connell ledger, March 2026); **~46 GW sits executed and waiting** on transformer lead times, permits, and financing the signature cannot command (PJM, July 2025); nationally, **536 GW of active queue capacity holds a draft or executed IA** (LBNL, 2026 edition) — over a quarter of the entire line is contractually “done.” The instrument’s mortality statistics are the course’s cleanest evidence that paper and power are different substances.

Who authored it, and what the authorship buys. The pro forma is FERC’s — which means every material term was litigated in a rulemaking record, and deviations require justification (the “independent entity variation” fights of the 2023–25 compliance dockets, Beat 8). The customer negotiates at the margins; the form is the law’s way of making ten thousand bilateral negotiations into one.

Returning-document discipline. No document returns *into* L4 (verified against the roster’s returns table). The agreement itself **leads here and returns at L5 and L7** — pre-allocation so those hours need only references: *L5 inherits* the agreement as the thing a co-located or behind-the-fence configuration is trying to route around (the December 2025 FERC order on PJM co-located loads is the fence-post; one line there, not here). *L7 inherits* the agreement’s cost-allocation machinery — network-upgrade funding, true-ups, and the doctrine fight over when customer-funded upgrades socialize into rates. The full anatomy lives in this dossier; L5 and L7 cite, they do not rebuild.

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SECTION 8: HUMAN FLOOR

Honest assessment: this lecture runs at the course's institutional register, and the floor is correspondingly minimal — by design, not neglect. The syllabus assigns no Neighbor beat; the negative-space scan (Section 3) confirms no fence-line individual is documented at floor grade in this hour's territory. The floor obligations that do attach:

Documented humans present at floor grade. Beat 9's Loudoun sequence contains the lecture's human stakes at one remove — county staff writing allocation projections for an economy built on the constrained resource; the beat keeps them as documented voices (the staff report, Rizer's two-weeks-in reaction) without manufacturing interiority. The Hearing Room's panelists and the named analysts (Wilson, Garza, Rhodes) appear in their professional capacities with verbatim or paraphrase-marked records — no floor debt beyond accurate attribution and as-of titles.

Flag zones active in this lecture (from the identity block), restated for the drafting AI: (1) **Residential bills** — the lecture repeatedly touches rate impacts (\$16.4B auction, transmission cost allocation, scarcity pricing); every touch is capped at one seed line and deferred to L7, where the fence-line ratepayer lives. Do not stack the seed lines into an uncredited rate-shock narrative here. (2) **Blackout / load-shed material** — the January 2026 cold snap and the July 10, 2024 event are operational records; the humor thermostat drops to near-zero within their radius (the DOE-diesel-request irony is usable as institutional absurdity; households in the cold are not). (3) **Workers** — transformer winders, linemen, study engineers appear as scarce skilled trades; punch-up-only applies (the scarcity is the institutions' failure to train, never the workers' failure to exist).

Transcript-pull condition. If the AD24-9 transcript pull (Beat 7) surfaces panelists speaking to personal or community harm, floor obligations attach to those passages at draft stage — quote or paraphrase with attribution, no staging, thermostat down.

Floor-debt transfer check. None inherited (L1–L3 packs carry their own floors; L3's tradesperson material stays in L3). None exported: the course's outstanding floor debts (L7's ratepayer, L8's Memphis) are logged in the syllabus's open items and **do not transfer to L4**. This pack adds no new debt.

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SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

As of the research date, 21 July 2026.

Live dockets and proceedings. — **FERC RM26-4-000** (large-load interconnection ANOPR, opened via the DOE §403 direction of 23 Oct 2025): open, with the 18 June 2026 show-cause orders (E-7 through E-12, FPA §206) issued to six RTOs as the interim action; RTO responses/compliance filings due on the orders' clocks through late 2026. — **FERC RD26-7** (July 2026): the Commission's directive toward mandatory NERC reliability standards for large "computational load"; NERC's Phase II work plan due **1 March 2027**. The July 10, 2024 event's regulatory afterlife — any post-refresh draft should check this docket first. — **PJM ER22-2110 lineage / Transition Cycle 2**: completing around **end-2026**; TC2's results will re-price the "does clustering work" argument in both directions. — **PJM Cycle 1**: window closed 27 Apr 2026 (811 projects, 220,222 MW, gas-led); studies proceeding on the 1–2-year clock; first cluster-study results are the next dated event in the queue's own story. — **PJM Large Load Plan / EIT / 14.9 GW procurement proposal** (Feb–Apr 2026 filings): pending FERC action; approval or rejection materially moves Beats 6 and 8. — **PUCT 16 TAC §25.194** (Texas SB6 implementation): draft rule 12 Mar 2026; finalization expected 2026 — the phantom-load statute growing teeth, on the record. — **2028/29 Base Residual Auction**: opened 30 June 2026; **results pending imminently as of the research date** — the single most likely headline to land between pack and draft. The pack's auction figures stop at 2027/28; the drafting AI must check.

Decay register — what expires fastest. (1) The **49 GW** — a bank model with a documented 36→49 revision ladder; assume it has moved again by any draft date; the deployment (author-named, revision-displayed) is built to survive its own obsolescence. (2) **Queue tallies** — PJM backlog (46 GW and falling), LBNL national figures (annual editions; the 2027 edition lands ~spring 2027), Cycle 1 statistics. (3) **Lead-time surveys** — Wood Mackenzie's quarterly cadence; 128/144 weeks is a Q2 2025 number already a year old at research date; direction stable, values perishable. (4) **NERC LTRA** — annual; the 2026 LTRA (due ~Dec 2026/Jan 2027) will re-set the doomer baseline. (5) **Titles** — FERC chairmanship, PJM executive suite, corporate officers: as-of convention mandatory; the pack's unverified-CEO flag (Section 9) is deliberate. What barely decays: the gauntlet's architecture, the agreement's clause, the Loudoun 2022 sequence, the July 10 event, the Order 2023 record — the lecture's spine is deliberately built on the slow layer (decay: LOW, confirmed).

What just changed in the last ~90 days (April–July 2026). Cycle 1's close (27 Apr, gas-led — a queue-composition inversion two years in the making); the RRI's shrinkage to 41 projects (~8,000 MW, Apr); FERC's notice of intent (16 Apr) and the six show-cause orders (18 Jun); RD26-7 (July); LBNL's 2026 Queued Up edition (data through 2025; webinar 16 July); PJM's 14.9 GW procurement proposal (13 Apr); the 2028/29 BRA opening (30 June). The lecture's territory is moving at the fastest cadence in the course — which is why its spine sits on 2022–2024 events and its volatile layer is stamped.

What's hidden or unobtainable, stated honestly. Interconnection study reports for pending projects are largely confidential (completed-study cost data exists via LBNL's aggregations; project-level pending data does not). Withdrawal *reasons* are undisclosed — the 74% is documented; its motive composition (financing failure vs. speculation vs. upgrade-cost shock) is inference, and the pack's beats say so. The AD24-9 transcript exists but requires the eLibrary pull (dependency ledger). Duplicate-request overlap across territories is structurally invisible to any single planner — the epistemic hole is the closer's subject, not a pack failure. Utility-to-customer delay communications (the 2022 Dominion warnings) survive only through their public echoes (earnings calls, county reports); the primary letters are not public.

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END OF PACK — L4 Research Pack 1.0 · RESEARCH AS OF 21 July 2026

Lecture 5 — Building Around the Grid

Research Pack 1.0 · source file L5_Research_Pack_1_0.md · research as of 21 July 2026

RESEARCH AS OF 21 July 2026

THE ASSEMBLED LECTURE IDENTITY

Title: Lecture 5 — Building Around the Grid.

Frame & through-line (Syllabus 2.0, carried from 1.0): The workaround lecture: if the grid won't come to you. The nuclear scramble treated as procurement, not redemption.

Register: Ledger pulls even with Atoms; the Symbol Audit's procurement deadpan is the tonal centerpiece. Cascade position: the workaround forced by Lecture 4's seven-year line, manufacturing Lecture 6's financing question.

Cascade edge (Syllabus 2.0 format): Inherits: the seven-year line. · Binds at: the meter and the milestone. · Who pays: contested — the co-location docket is the fight. · Manufactures: who financed the workaround → L6.

Strawman beat plan (12, running order, STRAWMAN FOR MARKUP — the count is fixed; selection and order are not):

1. **The Hearing Room [O]** — the Q3 2024 Constellation earnings call (November 4, 2024) — analysts pricing a resurrection in real time, transcript only. (Opener rotation verified: L4 opened Cold Open; L5's Hearing Room is one of three room types with L8's Memphis record and L10's disclosure call — three distinct rooms, no adjacent repeats.)
2. **The Wrong Map** — why Susquehanna, why the Susquehanna River corridor: the geography of existing baseload as the new siting map.
3. **Mechanism Autopsy** — the bypass toolkit in ascending ambition: on-site gas, behind-the-meter, bridge power; how co-location physically works.
4. **The Deal** — Microsoft–Constellation reconstructed: sequence, leverage, what the term sheet reveals.
5. **The Paper Trail — class: contract** — the Microsoft–Constellation PPA: 835 MW / \$16B / 20 years, clause by consequence. (Class rotation verified: state audit 1 · tech spec 2 · permit 3 · queue instrument 4 · **contract 5** · securities filing 6 · tariff docket 7 · executive doc 8 · regulatory application 9 · accounting policy 10.)
6. **The Symbol Audit** — TMI strictly as procurement — deployment 1 of 3 (with L8 Stargate and L9 orbital destiny; course-wide cap ≤3 verified, all deliberately cast).
7. **Follow the Money** — what \$16B over 20 years prices in; what Constellation's investors heard.
8. **The Regulatory Collision** — the FERC co-location docket: if you plug in behind the meter, who pays for the grid you're no longer visibly using?
9. **The Steelman** — *defendant: the behind-the-meter customer* — the AWS–Talen legal theory at full strength. (Rotation verified: L1 county · L4 PJM's queue · **L5 BTM customer** · L6 neocloud CFO · L7 Dominion · L8 White House · L9 orbital case · L10 hyperscaler capex — no party twice.)
10. **The Externality Swap** — behind-the-meter speed vs. socialized grid cost — both sides priced.
11. **The Bottleneck** — restart milestones and NRC pacing; the difference between an announcement and a fuel load.
12. **The Physics Audit [C]** — 13 projects, 9.8+ GW committed as of May 2026 — then the stage labels: committed vs. contracted vs. energized; most electrons arrive 2027 and later; SMR agreements as options on future power, not power.

Handoff (rides outside the count): *cost left unassigned* — somebody owns all this compute and financed it with something. (Rotation verified against Syllabus 2.0: L4 question · **L5 cost unassigned** · L6 the bill walking — no identical adjacent mechanisms.)

Negative space (strawman leaves out — Section 3 scans each): Cold Open on an Object · The Bill Arrives · The Forecast

Problem · The Perverse Incentive · The County · The Neighbor · The Founder Audit · Operator Reality · Taxonomy by Business Model. (Irreversibility Ledger: zero mid-course deployments by plan.)

Cast (Roster 1.0, verified):

- *Object/Place (anchor)*: **Three Mile Island Unit 1 / the Crane Clean Energy Center** — 835 MW asset shut for economics September 20, 2019; inspection, staffing, and transformer milestones between announcement and electrons; first power expected 2027, a year ahead of the announced 2028; named for the late Chris Crane. **Lead lecture: 5** (no prior claims — L4's ledger touched the reactor door at line-item grain only). Naming convention held at the Roster proposal pending Nick's call (Open Item 5): introduce as "Three Mile Island Unit 1, restarting as the Crane Clean Energy Center," then "Crane" for the project, "Unit 1" for the reactor.
- *Document (anchor)*: **The Microsoft–Constellation PPA** — 835 MW, \$16B, 20 years, announced September 20, 2024, read as a term sheet. Lead: 5. **Pack finding flagged up front: the contract text is not public.** See Section 5 — the document-as-scene must be built from the press release, the 10-Q's own description, and the analyst reconstructions; the Verbatim deploys from the co-location docket instead (verified below).
- *Human (anchor)*: **Joe Dominguez** — President and CEO, Constellation Energy (title verified in role as of research date). The seller on tape twice: the September 20, 2024 investor call ("the most powerful symbol of the rebirth of nuclear power as a clean and reliable energy resource" — verbatim verified, Section 4) and the November 4, 2024 Q3 earnings call. Lead: 5.
- *Secondaries*: **Bobby Hollis**, VP of Energy, Microsoft (as-of title verified at September 20, 2024 — the buyer's named negotiator, on the record in the announcement) · **the FERC co-location docket** (ER24-2172 → AD24-5 → EL25-49; AWS–Talen 1.92 GW / 17-year) · **Meta's nuclear RFP** (December 3, 2024, 1–4 GW sought; up to 6.6 GW announced January 9, 2026) · **the NRC Palisades docket** as regulatory template (Holtec, license through March 24, 2031, restart slipping from October 2025 into "when ready" 2026 — the template growing a cautionary tail).
- *Returning characters (return-grade only, no re-introduction)*: **the interconnection agreement** (lead L4 — returns here as the thing co-location routes around; L4's Section 5 pre-allocated its anatomy to L5/L7 as reference) · **PJM** (lead L4 — returns via the RRI fast-path and the capacity fight) · **"Winning the Race" / the White House AI Action Plan** (brief first appearance here per Roster — detonates in L8; one-line introduction only, and this pack supplies only the line's grounds, not the full treatment).

Must-hit anchors (Syllabus 1.0 values, verbatim, governing): 13 projects / 9.8+ GW (May 2026); Microsoft–Constellation 835 MW / \$16B / 20-year / TMI Unit 1 / 2027; AWS–Talen 1.92 GW / 17-year; Meta up to 6.6 GW; FERC co-location docket; SMRs as options; Sept 20, 2024.

Moves plan (as assigned, all seven, with pack-verification flags):

- *Step Function*: every major hyperscaler has signed at least one nuclear deal — the assumption ("nuclear is uninvestable") that quietly died. **Verified, Section 4.**
- *Unit Conversion*: 835 MW → **held for pack verification — hard gate per Open Item 11.** Arithmetic shown in Section 4; verdict: **PASS at ~620,000–670,000 homes; the company's 800,000-home figure usable only as the company's claim.**
- *Timeline Snap*: September 20, 2024. **Verified — and the date is doing double work: the PPA was signed exactly five years to the day after the plant's shutdown.**
- *Verbatim*: co-location docket or PPA language. **PPA language: FAIL (confidential — the exact words cannot be verified). Docket language: PASS, multiple verified candidates block-quoted in Section 4.**
- *As-Of Stamp*: "as of May 2026, the count is 13 projects and 9.8 gigawatts" — the canonical styled deployment. **Verified with author named (SMR Intel tracker), Section 4.**
- *Kicker*: the SMR agreements are options on power, not power. **Verified and armed, Section 4.**
- *Gesture*: **the reactor door** — electrons through a meter; the restart engineering is somebody else's story. One-inch material supplied in Section 4; nothing researched beyond it.

Overclaim & narrator move assignments: Sellers on the field: **the Hyperscaler** and **the Escape Artist**. Governing move: **GRANT-AND-WITHHOLD** — the commitments are real and signed; the timeline and the "nuclear is powering AI" framing outrun the meter. Dominguez's own rhetoric supplies the audit's target. Section 7 pressure-tests the calibration and covers the rest of the field (the Utility-adjacent generator, the Politician at three levels, the Doomer).

Decay tier: Mid. Commitment tallies refresh; the procurement frame doesn't.

Human-floor flags (comedy near-zero zones, marked for the drafting AI):

1. **Any invocation of the March 28, 1979 TMI-2 accident** — the evacuation, the community memory, the health-claims history. The accident is load-bearing context for the Symbol Audit and it is a harm event with living witnesses; the thermostat drops to near-zero whenever the prose is inside it.
2. **Documented resident testimony from the NRC public-meeting record** — Fulton’s “guinea pigs” statement (February 2026), Jaquelyn Drechsler on the 700 metric tons of spent fuel (August 6, 2025), the Amish and Mennonite evacuation-plan concern raised at the March 2025 meeting. These are fence-line fears on the record; comedy off.
3. **The spent-fuel storage question** generally — indefinite on-island storage of high-level waste is a household-adjacent fear, documented; treat clinically. The restored-jobs material (600 positions, union trades) is not a fear zone but is handled with respect, never as a punchline about the workers.

Pack dependencies (debts flagged by Syllabus 2.0 / Open Items / Roster, restated as a checklist):

- ☒ **Unit Conversion arithmetic gate (Open Item 11: “L5’s 835 MW”):** cleared — full arithmetic in Section 4; conversion survives at a corrected magnitude.
- ☒ **Verbatim existence gate:** cleared via the co-location docket; the PPA-language branch honestly failed (document confidential).
- ☒ **Dominguez announcement and earnings-call language (Roster debt):** collected verbatim with full context — Sections 2 (Beat 1), 4, and 7.
- ☒ **As-of titles at dated moments:** locked throughout — Hollis (VP of Energy, Microsoft, Sept 20, 2024), Dan Eggers (EVP & CFO, Constellation, Nov 4, 2024), Willie Phillips (then-FERC Chairman, Nov 1, 2024 — no longer chairman thereafter; “then-Chairman” convention mandatory), Mac McFarland (President & CEO, Talen, March 4, 2024 and June 11, 2025), Chris Wright (Secretary of Energy, from Feb 2025 forward).
- ☒ **TMI naming-convention support (Open Item 5):** the documented record supports the Roster proposal; the procurement name’s own paper trail (a January 13, 2025 license amendment request *to change the name*) is itself Symbol Audit material — Section 2, Beat 6.
- ☒ **“Winning the Race” brief-introduction grounds:** one dated fact supplied (Section 2, Beat 8 / Section 10) without opening L8’s treatment.

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SECTION 2: THE STRAWMAN BEAT DOSSIER

Twelve beats, running order, each stress-tested against the record. The strawman is Nick's to break; the dossier's job is to make every beat either provably buildable or honestly thin. Field discipline per the pack standard: facts carry dates and owners; verbatims carry locators; numbers carry tiers (ANCHOR · STRUCTURAL · VOLATILE · CONTESTED); verdicts are earned, not assumed.

Beat 1 — The Hearing Room [O] (the Q3 2024 Constellation earnings call)

Syllabus 2.0 assignment: The opener — analysts pricing a resurrection in real time, November 4, 2024, transcript only. Opener rotation verified against the course: L4 opened Cold Open; the three room-type deployments (L5 earnings call, L8 Memphis public record, L10 disclosure call) are distinct rooms with no adjacent repeats.

Beat Menu definition: Politics · opener-capable, versatile · the only walk-into-a-room beat on the menu; reconstructed from transcripts and minutes only — documented speakers, documented words, no staging.

Facts, dates, names, numbers. The room: Constellation Energy's third-quarter 2024 earnings call, Monday, November 4, 2024, 10:00 a.m. ET, webcast, transcribed. The timing is the beat's engine: FERC rejected PJM's amended Susquehanna ISA the previous Friday, November 1, 2:1 — so the first earnings call of the co-location era's first crisis happens one business day into it. The quarter reported: adjusted operating EPS \$2.74; nuclear output ~41 million MWh at ~95 percent capacity factor; guidance raised to \$8.00–\$8.40. The bench, each name a firm with a rating and a model: Tonet (JPMorgan), Pourreza (Guggenheim), Fleishman (Wolfe), Dumoulin-Smith (Jefferies), Arcaro (Morgan Stanley), Campanella (Barclays), Chopra (Evercore ISI). Management: Dominguez; Eggers. Dominguez does not wait to be asked about Friday — he opens on it (the not-the-final-word framing, Timeline 34) and lays out three principles for the docket, including that co-located load should pay its fair share of grid costs for what it actually uses. The rest of the hour is the industry re-planning out loud: the no-Nirvana exchange with Arcaro, the ten-years line, the uprates inventory (~2,000 MW — a Vogtle unit's worth hiding inside the fleet, with fewer uprates than customers to sell them to), the flat declaration that the constraint is speed rather than dollars, and the TMI demise-to-rebirth framing delivered to the room.

The mechanism. Why an earnings call is a hearing: it is the one recurring venue where the seller of the workaround speaks under securities-law exposure, on a dated transcript, to cross-examiners with their own money and reputations staked on being right about him. Analysts are not journalists; their questions are positions. The Q&A structure gives the beat its shape for free — operator's queue, question, answer, follow-up — and the November 4 call specifically captures a market absorbing a regulatory shock in real time: Friday the commission said no; Monday the CEO with the most to lose explains, on the record, why no is temporary. Fourteen months later the December 2025 order proves him directionally right — which the lecture knows and the room does not, the dramatic irony the beat runs on.

Key actors in this beat. Dominguez (full profile Section 9 — the seller at maximum candor, which for a CEO means maximum salesmanship under oath-adjacent conditions); Eggers (the numbers voice — the \$1.6B capex figure is his from the September 20 call); the analyst bench as a collective character — the market's pricing organ, asking in November what FERC would take until December 2025 to answer.

The documents. The call transcript (Motley Fool transcript of record; company webcast archive is the primary); the Q3 2024 Form 10-Q (the PPA's own description in a securities filing — cross-referenced in Section 5); the November 1 FERC order the call is answering (public domain, Section 4's verbatim well).

Verbatim bank. Deployment-grade pulls, one-per-source discipline against the transcript, remainder paraphrase-marked above with locators: the accelerator line — foot on the accelerator, pressed all the way down — and the speed-to-market superlative, both from Dominguez's prepared remarks and Q&A, November 4, 2024; the no-Nirvana exchange held at Timeline 34's rendering; the full ten-years passage held as paraphrase for draft-stage pull from the primary webcast if markup wants it as the lecture's Verbatim (noting the 1-per-lecture cap: the assigned Verbatim deploys from the FERC record, Section 4, and this bank is backup only).

Who pays. Nobody in the room, in cash — which is usable: the hour that re-prices the workaround economy costs its participants only attention, while the objects under discussion cost \$1.6 billion and a federal docket. The analysts' misjudgments are paid later, in basis points.

What's contested, motivated, or unknown. Everything Dominguez says is true and everything Dominguez says is selling — the beat must hold both. His no-Nirvana argument (demand has nowhere else to go) is simultaneously the strongest

structural claim in the lecture and the pitch of a man with 2,000 MW of uprates to sell. The analysts' softball ratio is real: sell-side questioners need access. The transcript compilation is a secondary rendering of the primary webcast; any draft-stage quote extension should pull from the webcast.

Sensory & material details. A webcast queue; an operator's cadence; a CEO answering a Friday federal order on a Monday morning; the transcript as the only version of the room that survives — all documented, nothing staged.

Numbers that matter. \$2.74 — adjusted operating EPS, Q3 2024 — company release, Nov 4, 2024 — ANCHOR · ~41M MWh / ~95% — quarterly nuclear output and capacity factor — company release — ANCHOR · \$8.00–\$8.40 — raised 2024 guidance — company release — ANCHOR · 2:1 — the Friday vote — FERC, Nov 1, 2024 — ANCHOR · ~2,000 MW — fleet uprate inventory, Dominguez on the call — STRUCTURAL (company figure) · 1 business day — ruling-to-call gap — ANCHOR.

Stress-test verdict: SUSTAINABLE. A dated room, seven named cross-examiners, a regulatory shock 72 hours old, and a transcript dense with deployment-grade language. The opener carries five minutes without staging a syllable.

Beat 2 — The Wrong Map (why Susquehanna; the geography of existing baseload)

Syllabus 2.0 assignment: Why Susquehanna, why the Susquehanna River corridor — the geography of existing baseload as the new siting map.

Beat Menu definition: Politics · opener-preferred (deployed second here, behind the Hearing Room — the menu marks preference, not requirement) · geography as accident, sustained by the compounding chain; origin-story geography, how the map got drawn wrong — distinct from The County's present-tense politics.

Facts, dates, names, numbers. The corridor: one river, two nuclear stations, ninety-odd miles apart. Downstream, Three Mile Island — Londonderry Township, Dauphin County, an island in the Susquehanna, Unit 1 licensed April 19, 1974 (835 MW as restored). Upstream, the Susquehanna Steam Electric Station — Salem Township, Luzerne County, near Berwick, two boiling water reactors, 2,494 MW combined, in service 1983, built for PPL. Between and around them: the transmission spine of eastern PJM, the water both plants condense against, and — from 2023 — Talen's 1,200-acre Cumulus campus sitting directly against the Susquehanna plant's fence. The old data-center map was drawn by fiber and peering (Lecture 1's territory — one clause, not rebuilt): proximity to network. The new map is drawn by wall sockets: the roster of operating and restartable reactors. But the load-bearing layer of the new map is not physical at all — it is regulatory. The reactors signing hyperscaler paper share a corporate condition: they are merchant plants in restructured states, owned by companies with no captive ratepayers and no obligation to serve — Constellation (separated from Exelon February 2022, the largest US fleet as an independent generator), Talen (spun from PPL 2015 with Riverstone), Vistra (Perry and Davis-Besse in Ohio). Pennsylvania, Ohio, Illinois: restructured-market states, which is why the deals cluster there. Regulated-state counterexamples prove the rule by their different instrument: Dominion at North Anna signs an SMR memorandum, not a bilateral output sale — a utility with captive ratepayers cannot quietly sell a plant's output to one buyer. The map of who could sign in 2024 was drawn by the electricity restructuring wave of the late 1990s, a quarter century before anyone priced a token.

The mechanism. The compounding chain, run in order: (1) 1970s–80s siting logic put big thermal plants on big rivers near transmission corridors and away from cities. (2) 1990s restructuring sorted those plants into two legal species — rate-based and merchant — and handed the merchant species to companies that live or die on market price. (3) 2010s shale gas made the merchant species unprofitable, killing TMI-1 and nearly killing the rest. (4) 2020s AI demand arrived needing three things at once — hundreds of firm megawatts, carbon-free attributes, and a counterparty legally free to sign — and discovered that the only assets on Earth with all three were the survivors and corpses of steps 1–3, standing on their original 1970s coordinates. The corridor was never designed for this; it was designed for a Pennsylvania that exported power to Philadelphia and New York, and the export infrastructure is precisely what makes it legible to a hyperscaler now. Geography as accident, compounding across five decades of other people's decisions.

Key actors in this beat. The river (the beat's silent constraint — NRC's Burnell on water levels, quoted at Timeline 52, cashes here as one line); Talen and Constellation as the corridor's two legal survivors; the restructuring wave itself as an off-stage institutional author.

The documents. The EIA operating-reactor roster as the literal new siting map; Talen's S-1 lineage (the 2015 spin-off) and Constellation's 2022 separation filings as the map's legal legend; the Cumulus campus marketing record (a data center

campus built against a nuclear fence *before* the AI demand arrived — Talen's bet predates the boom, initially pitched toward hyperscale and crypto tenants).

Verbatim bank. None assigned; the beat runs on structure, not speech. Burnell's water-level line is pointer-referenced (Timeline 52) if markup wants a single grounding quote; it is government speech, freely usable.

Who pays. Nobody yet, in this beat — the map is free to read. The costs of what gets built on it are Beats 3–12's business. (One honest note for markup: the corridor's ratepayers paid for the original plants once already, in rates, before restructuring — a clause, not a paragraph, and the full who-paid-twice architecture is L7's.)

What's contested, motivated, or unknown. The restructured-vs-regulated sorting is directionally solid and slightly lossy: regulated-state deals exist (Dominion's memorandum; TVA's arrangements) — the honest formulation is that the *instrument* differs by regime, not that regulated states are absent. The claim that Talen conceived Cumulus pre-AI-boom is documented in the campus's own development timeline but the motive attribution (crypto-era origins) should stay at what the record shows.

Sensory & material details. One river doing condenser duty for two reactor stations; a 1,200-acre campus with a nuclear plant for a wall socket; cooling towers visible from Route 441; the map itself as the object — the EIA reactor table as the most valuable real-estate listing of 2024. Documented; nothing invented.

Numbers that matter. ~90 miles — TMI-to-Susquehanna river distance — STRUCTURAL · 2,494 MW — Susquehanna station combined — STRUCTURAL · 1,200 acres — Cumulus campus — Talen record — STRUCTURAL · Feb 2022 / 2015 — the two spin-off dates that drew the legal map — ANCHOR · 5 decades — siting-decision vintage — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The compounding chain is fully documented at every link, the regulatory-map insight is the beat's own (not borrowed from L1's fiber map or L7's rate fight), and the corridor gives the abstraction coordinates. Runs five minutes; the restructuring layer is the segment's spine, and it holds.

Beat 3 — Mechanism Autopsy (the bypass toolkit; how co-location physically works)

Syllabus 2.0 assignment: The bypass toolkit in ascending ambition: on-site generation, behind-the-meter, bridge power; how co-location physically works.

Beat Menu definition: Atoms · versatile · fat container · how the thing physically works, delivered conversationally, never announced as analysis; rotation is content-native.

Facts, dates, names, numbers. The toolkit, sorted by where the electrons actually flow — because that sorting is the entire regulatory fight. **Rung one, on-site generation:** put your own turbines inside your own fence; fastest, dirtiest, fully private; the Memphis configuration (L8's material — named once as the rung's example, one clause, fenced). **Rung two, behind-the-meter co-location, the beat's centerpiece:** the load connects at the generator's bus, electrically upstream of the plant's point of interconnection with the grid. The grid's revenue meter sees only the plant's *net* output; the co-located campus is, to the transmission system's billing apparatus, invisible. The physical instantiation: the AWS campus at Susquehanna, ramping in 120 MW increments under the March 2024 deal, governed by an interconnection service agreement whose co-located-load ceiling (300 MW, then the contested 480 MW amendment, Docket ER24-2172) is a *contract term*, not a physical limit — the wires could carry more; the paper wouldn't. What the load still receives from the grid it doesn't visibly use, per the utility protests: frequency stability, voltage support, spinning reserve, blackstart capability — the services a synchronized system provides to everything electrically attached to it, metered or not. That gap between physical receipt and billed use is the entire EL25-49 docket compressed to one sentence. **Rung three, the virtual PPA:** no electrons change hands — a financial contract settling fixed price against market price while the generator sells into the grid as before; the Microsoft–Crane structure per the Jefferies reconstruction, four-state-usable per Dominguez — attributes and price certainty bought, electrons dispatched wherever PJM sends them. **Rung four, front-of-meter retail with utility delivery:** the June 2025 Talen–AWS restructuring (Timeline 47) — grid side of the meter, PPL delivering, transmission charges paid like anyone else, no FERC approval required because it uses the tariff instead of routing around it. **Rung five, resurrection and uprates:** buy a corpse (Crane, Palisades, Duane Arnold) or squeeze the living (~2,000 MW of fleet uprates per Dominguez; Vistra's 433). **Rung six, options:** SMR agreements — the Physics Audit's material, fence-posted here.

The mechanism. The autopsy's finding, stated once: every rung is a different answer to the same question — *which meter*

sees you, and therefore who can bill you. On-site generation: no meter. Behind-the-meter: the meter sees net. Virtual: the meter sees nothing because nothing moves. Front-of-meter retail: the meter sees everything and the tariff applies. The toolkit is not an engineering menu; it is a menu of billing topologies wearing engineering costumes — and the December 2025 FERC order's three new services (network service on *gross* demand, firm contract demand, non-firm contract demand) are the commission redrawing the menu so that the meter's blind spots stop functioning as rate exemptions.

Key actors in this beat. The revenue meter (the beat's true protagonist — an instrument whose placement allocates billions); the ISA as returning character (lead L4; here as the thing whose amendment ceiling made a physical campus a federal case — L4's Section 5 anatomy referenced, not rebuilt); PJM and the protesting utilities (AEP, Exelon — their free-ridership theory is Beat 8's and Section 7's; named here only as the source of the services list).

The documents. The amended ISA in ER24-2172 (the 300→480 MW term); the December 2025 order's service taxonomy (public domain); Talen's June 2025 deal deck (the front-of-meter mechanics and the no-FERC-approval-required claim — seller's document, flagged).

Verbatim bank. The order's willing-and-able-to-limit formulation is quoted at Timeline 64 and re-deploys in Section 4 as a Verbatim candidate; this beat runs on paraphrase and needs no quote of its own.

Who pays. The rung determines the answer — which is the beat's handout to Beat 8 and Beat 10: on-site and BTM configurations privatize speed and (per the protests) socialize the unbilled services; front-of-meter pays the tariff; virtual pays a premium into a generator's margin. One sentence per rung; the collision itself is Beat 8's.

What's contested, motivated, or unknown. Whether BTM load's receipt of unbilled ancillary services is a material cost shift or a rounding error is *the* contested quantity — FERC's December 2025 order takes the question seriously enough to build three services around it, which is the strongest documentary evidence that the gap is real without the pack endorsing any magnitude. The four-state usability of Microsoft's virtual structure is Dominguez's characterization of a confidential contract; carried as his claim.

Sensory & material details. A revenue meter on a generator bus — a device the size of a lunchbox whose *position* in a one-line diagram moved a federal docket; 120 MW ramp increments as contract clauses with switchgear attached; the one-line diagram itself as the document where electrical engineering and rate law are the same drawing. Documented.

Numbers that matter. 300 → 480 MW — the contested ISA ceiling — ER24-2172, Jun 2024 — ANCHOR · 120 MW — AWS ramp increment — Talen S-1/deal record — STRUCTURAL · 20 yr / 4 states — Microsoft virtual-PPA reconstruction — Jefferies Sept 2024 + Dominguez — STRUCTURAL (analyst + seller) · 3 — new FERC service pathways — Dec 18, 2025 order — ANCHOR · ~2,000 MW — uprate inventory — Dominguez, Nov 2024 — STRUCTURAL.

Stress-test verdict: SUSTAINABLE. The billing-topology through-line converts a parts list into an argument, every rung has a dated instantiation in the record, and the fat container earns its width. The one discipline flag: rung one's Memphis mention must stay at one clause — L8 owns that fight.

Beat 4 — The Deal (Microsoft–Constellation reconstructed)

Syllabus 2.0 assignment: The Microsoft–Constellation negotiation reconstructed: sequence, leverage, what the term sheet reveals.

Beat Menu definition: Character/Money · versatile · a single negotiation reconstructed from filings and reporting — the *sequence*: who wanted what, who blinked, what the term sheet reveals about leverage. Distinct from The Paper Trail (Beat 5's document-as-actor) and Follow the Money (Beat 7's capital structure). Timeline Snap deploys naturally inside it — and does, September 20, 2024. Natural homes per menu: 5, 6, 8 — deployed in its first natural home.

Facts, dates, names, numbers. What each side wanted, from the record. Microsoft's position: a January 2020 corporate commitment to become carbon negative by 2030 (Hollis's announcement statement invokes it directly); a mid-Atlantic data-center build colliding with Lecture 4's queue; and a procurement problem no wind-and-solar portfolio solves — firm, 24/7, carbon-free megawatts at hyperscale, deliverable this decade. Constellation's position: an 835 MW asset shut for economics five years earlier, held in a condition its paperwork calls decommissioning but its conduct calls storage — cooling towers standing, plant intact — and, in spring 2024, a steam generator tube inspection quietly performed on a reactor with no announced future (Timeline 24). The inspection is the tell in the sequence: Constellation was diligencing its own asset for a buyer it presumably already had in the room. The signing: September 20, 2024 — five years to the day after shutdown, a date only deliberate symbolism produces. Disclosed terms: 20 years, ~835 MW, ~\$1.6 billion of Constellation capital including

fuel (Eggers), online 2028 (later 2027 via the RRI lane), renewal to at least 2054 pursued separately. The undisclosed term — price — was reconstructed by the sell side inside 96 hours (Jefferies ~\$110–115/MWh, a premium to co-located expectations; BMO ~\$102/MWh — Timeline 28). What the premium reveals about leverage: Microsoft paid *up* — above co-location reconstructions — for a virtual structure carrying no FERC co-location risk (the deal closed six weeks before the November 1 rejection proved that risk real), four-state flexibility, and the additionality claim of having resurrected a plant rather than repriced one. Constellation, for its part, financed the restart on its own balance sheet against the PPA — no project finance, no partner — and fourteen months later converted that position into a \$1 billion full-recourse DOE loan (November 18, 2025) on terms the government itself attributed to the company's creditworthiness. The PPA is the instrument that made every subsequent document possible: no signed offtake, no \$1.6 billion, no NRC filings, no loan.

The mechanism. The negotiation's structure, visible in its outputs: a buyer with an absolute deadline (carbon commitments and compute demand on public schedules) met a seller with an absolute monopoly (exactly one intact 800-MW-class corpse in PJM with a live license renewal to 2034 and a fleet operator attached). Monopoly plus deadline prices as a premium — the sell-side reconstructions are the measurement. The risk allocation completes the picture: Microsoft took price risk (20 fixed years against merchant markets); Constellation took execution risk (the restart itself, on its own credit). Each side took the risk it was structurally best equipped to hold, which is what a completed negotiation between sophisticated parties looks like from outside.

Key actors in this beat. Dominguez and Hollis as the named principals on the record; Eggers as the capex voice; the spring 2024 inspection team as the sequence's silent tell; Microsoft's 2020 carbon commitment as an off-stage contractual ancestor.

The documents. The September 20 joint announcement; the Q3 2024 10-Q description (Section 5); the Jefferies and BMO notes as the price's only public existence; the DOE loan close (November 2025) as the deal's downstream financing echo.

Verbatim bank. The announcement-day quotes are deployed at Timeline 27 (Dominguez's symbol line; Hollis's milestone line) — pointer-referenced, not re-quoted, one-per-source discipline held. Jefferies' premium characterization: quoted at Timeline 28 within the fifteen-word discipline; the fuller passage held as paraphrase.

Who pays. Microsoft's shareholders, in a two-decade premium buried in cost of revenue; Constellation's balance sheet, then partially the federal one (the \$1B loan — full recourse, so taxpayer exposure is real but collateralized by the company); and the beat's honest open question — whether any of the premium reaches ratepayers in either direction — is deliberately left unassigned. That unassigned cost is the lecture's Handoff, and it originates here.

What's contested, motivated, or unknown. The price is an estimate, permanently, unless disclosed — the pack's rule: every dollar figure derived from it carries the analyst pedigree, never the register of a disclosed term (Section 6's homonym flag governs). The claim that Microsoft was in the room before spring 2024 is inference from the inspection's timing — strong, but inference; carried as such. Who approached whom first is not in the public record.

Sensory & material details. A tube-inspection probe threading a steam generator in a plant officially dead; a signing dated to an anniversary; a confidential number reverse-engineered by two banks in four days. Documented.

Numbers that matter. Sept 20, 2024 / Sept 20, 2019 — the five-year snap — ANCHOR · 20 yr / ~835 MW — disclosed terms — ANCHOR · ~\$1.6B — Constellation capex incl. fuel — Eggers, Sept 20, 2024 — ANCHOR (company figure) · ~\$110–115/MWh / ~\$102/MWh — price reconstructions — Jefferies Sept 23 / BMO Sept 24, 2024 — CONTESTED (dueling estimates, both carried) · +22% / \$254.98 — announcement-day close — market record — ANCHOR · \$1B, full recourse — DOE loan — Nov 18, 2025 — ANCHOR.

Stress-test verdict: SUSTAINABLE. The sequence has a documented tell (the inspection), a dated snap, disclosed and reconstructed terms clearly separated, and a leverage analysis that runs entirely on record facts. The inference flags are marked; the beat is deep enough to carry its slot with the discipline intact.

Beat 5 — The Paper Trail — class: contract (the Microsoft–Constellation PPA)

Syllabus 2.0 assignment: The PPA — 835 MW / \$16B / 20 years — clause by consequence. Class rotation verified: state audit 1 · tech spec 2 · permit 3 · queue instrument 4 · **contract 5** · securities filing 6 · tariff docket 7 · executive doc 8 · regulatory application 9 · accounting policy 10 — no class repeats.

Beat Menu definition: Politics · versatile, closer-capable · universal (all 10 lectures) · a named document as causal actor: what it says, who wrote it and why, what it forces, what it forbids, what happens when someone violates it.

Facts, dates, names, numbers. The document: a bilateral power purchase agreement between Constellation Energy Generation and Microsoft, executed on or about September 20, 2024. The pack's central finding, stated without cushioning: **the contract text is not public and will not become public.** What exists instead is a documentary halo — the joint announcement (the parties' own summary of terms they chose to disclose); the Q3 2024 Form 10-Q (Constellation describing the agreement to the SEC under liability for material misstatement — the closest thing to the contract's own voice in the public record); and the analyst reconstructions of the one term everyone wants (price). What the halo establishes the document *forces*: twenty years of purchase obligation at fixed price against a plant that did not, at signing, legally exist as an operating facility — the PPA obligates Microsoft to a resurrection, which means the contract necessarily contains conditionality the public cannot read: restart milestones, regulatory-approval conditions, remedies if the NRC says no. Every subsequent artifact in the record is downstream of those unread clauses — the \$1.6 billion capex commitment, the January 2025 rename filing, the fuel-receipt amendment, the \$1 billion DOE loan (a lender does not close full-recourse against a merchant restart without reading the offtake). The full clause-by-consequence dossier, including the skeptical read, is Section 5; the beat's build is the inversion the syllabus ordered: a document that governs everything and appears nowhere.

The mechanism. How a confidential contract functions as a public actor: through the institutions obligated to react to it. The SEC filing describes it; the NRC dockets fill with actions it financed; the DOE loan prices its credit quality; two banks reverse-engineer its price from Constellation's disclosed capex and market comparables. The document is visible the way a black hole is — entirely by what orbits it.

Key actors in this beat. The PPA itself (anchor document, lead lecture 5, full dossier Section 5); the 10-Q as its authorized public shadow; Jefferies and BMO as its unauthorized biographers.

The documents. Announcement, September 20, 2024; Form 10-Q, Q3 2024 (filed early November 2024); Jefferies note September 23; BMO note September 24; DOE loan close November 18, 2025.

Verbatim bank. The PPA: nothing quotable — the existence gate fails, honestly (Section 4). The 10-Q's descriptive language is the draft-stage pull if the beat needs the document's own register; locator held in Section 5.

Who pays. Whoever the unread clauses say — which is the beat's deadpan payoff and the lecture's Handoff seed: the most consequential cost allocations in this hour are in a document nobody in the audience, including the narrator, has read.

What's contested, motivated, or unknown. Everything below the disclosed-terms line: price, conditionality, remedies, termination rights, attribute accounting. The pack's rule for the drafting AI: disclosed terms in the indicative; everything else explicitly carried as reconstruction or inference, every time.

Sensory & material details. A signature page nobody outside two legal departments has seen; a 10-Q paragraph as the document's only public voice; a price that exists in the world only as two banks' arithmetic.

Numbers that matter. 20 yr / ~835 MW — disclosed — ANCHOR · ~\$16B — life-of-contract *estimate*, analyst arithmetic — CONTESTED pedigree (Section 6 flag governs) · 2 — public reconstructions of the price — STRUCTURAL · 0 — public pages of the contract — ANCHOR.

Stress-test verdict: SUSTAINABLE. The confidentiality is not a hole in the beat; it is the beat — the course's document-as-protagonist move run on a document that must be characterized entirely through its gravitational effects, all of which are dated and filed. Section 5 supplies the depth.

Beat 6 — The Symbol Audit (TMI strictly as procurement — deployment 1 of 3)

Syllabus 2.0 assignment: TMI strictly as procurement; the deadpan centerpiece. Course-wide cap verified: deployment 1 of 3 (L8 Stargate, L9 orbital destiny), all deliberately cast.

Beat Menu definition: Politics · versatile, closer-capable · hard cap 3 · a symbolically loaded object treated strictly as procurement: Three Mile Island as an 835 MW PPA rather than a redemption arc. Comedy-native and very this-course — capped precisely because it calcifies.

Facts, dates, names, numbers. The symbol's source, handled first and clinically [human floor active]: March 28, 1979 — Unit 2's partial meltdown (Timeline 3). The audit's load-bearing fact: the accident happened to the *other* unit. Unit 1 — held offline six and a half years, its first restart war fought to a 9–0 SCOTUS fear-pricing precedent (Timeline 5),

returned October 1985 — then ran thirty-four years to a 96.3 percent final-year capacity factor: one of the country's better-performing reactors, wearing the name of the industry's worst day. The procurement record of the symbol itself: on January 13, 2025, Constellation filed a license amendment request with the NRC *to change the facility's name* — Three Mile Island Unit 1 to the Christopher M. Crane Clean Energy Center. The rename is not marketing collateral; it is a federal licensing action with a docket entry, processed alongside the amendments governing fuel and operations. A brand liability was submitted for regulatory approval. The name chosen honors Chris Crane, the Exelon CEO who died in April 2024 — five months before his name became, in the precise sense, a procurement asset. The symbol's market: Dominguez sells the demise-to-rebirth construction on the record twice (Timelines 27, 34); a Fox News segment broadcasts from inside the plant with the Energy Secretary (Timeline 65); Epstein sells the counter-symbol from the state capitol seventeen days before the market, in writing, changed its mind for twenty years (Timeline 26). Naming convention per Open Item 5, supported by this record: introduce as Three Mile Island Unit 1, restarting as the Crane Clean Energy Center; thereafter Crane for the project, Unit 1 for the reactor.

The mechanism. What the audit actually audits: the conversion rate between symbolic and financial value, which 2024–25 made measurable. The same three syllables that destroyed the industry's growth curve in 1979 added 22 percent to a market cap in one session in 2024 — not because the symbol changed, but because the buyer changed: the 1979 symbol was priced by a public that feared the plant; the 2024 symbol was priced by a market that feared *scarcity*. The rename completes the arbitrage: acquire the asset at corpse pricing, strip the liability name via federal docket, sell the resurrection story under a new one. Procurement, end to end.

Key actors in this beat. The name itself (the beat's object — a regulated asset); Crane the man (profile Section 9 — treated with the respect the record supports); Dominguez as the symbol's seller; Epstein as the counter-symbol's.

The documents. The January 13, 2025 rename LAR (the beat's crown artifact); the SCOTUS opinion (public domain); the September 20 announcement's symbol language.

Verbatim bank. Dominguez's symbol line — pointer to Timeline 27 (one-per-source held); Epstein's market-decided line — pointer to Timeline 26. Both already deployed; the beat re-references, not re-quotes.

Who pays. The audit's deadpan ledger: the rename's cost is a filing fee and legal hours; the value it protects is a \$16 billion revenue estimate. The asymmetry is the joke, and the joke carries information. [The 1979 material adjacent to this ledger stays comedy-off; the humor lives entirely on the procurement side.]

What's contested, motivated, or unknown. Whether the restart is partially a redemption arc — workers rehired, a region's identity — is real and documented (600 jobs, union trades, the Gettysburg comparison at the 2019 shutdown); the audit's discipline is that it prices the sentiment without adopting it. The beat fails if it sneers; the record supports deadpan, not contempt.

Sensory & material details. Cooling towers described in 2019 coverage as concrete tombstones, now a backdrop for cable news; a federal docket entry whose subject line is a name; the same island visible from Route 441 in both symbolic regimes.

Numbers that matter. Mar 28, 1979 — the source event — ANCHOR [human floor] · 9–0 / Apr 19, 1983 — the fear-pricing precedent — ANCHOR · Jan 13, 2025 — the rename filing — ANCHOR · +22% — symbol repricing, one session — ANCHOR · 96.3% — Unit 1 final-year CF — ANCHOR · 1 of 3 — deployment count — governance.

Stress-test verdict: SUSTAINABLE. The rename LAR alone sustains the beat — a documented federal action that *is* the thesis — and the 1979/2024 pricing symmetry is fully sourced. Human-floor boundaries are bright-lined and workable.

Beat 7 — Follow the Money (what \$16B over 20 years prices in)

Syllabus 2.0 assignment: What \$16B over 20 years prices in; what Constellation's investors heard.

Beat Menu definition: Money · versatile · fat container · capital structure as narrative: who financed what, collateralized by what, amortized over what; the load-bearing accounting assumption is always the payoff.

Facts, dates, names, numbers. The capital stack of a resurrection, assembled in order of commitment. **Layer one, the offtake:** the PPA — ~\$16 billion of estimated life-of-contract revenue (Jefferies arithmetic: ~\$110–115/MWh × ~7 TWh/year × 20 years; BMO's ~\$102/MWh alternative implies roughly \$14–15 billion — both carried, neither disclosed). **Layer two, the equity bet:** ~\$1.6 billion of Constellation capital including fuel, on the company's own balance sheet — no project finance, no partners, roughly a tenth of the revenue estimate put at risk to unlock it. The market graded the bet in

one session (+22 percent, \$254.98), and BMO's ~\$1,377 per kilowatt sits against new nuclear construction at multiples of that figure — the entire investment case in one ratio, since there is no market of restarts to compare against. **Layer three, the federal balance sheet:** the November 18, 2025 DOE loan — \$1 billion under the Energy Dominance Financing program, the office's first concurrent conditional commitment and financial close, *full recourse* to Constellation, extended per DOE's own release on the strength of the company's credit. Full recourse is the load-bearing term: taxpayer exposure exists but sits behind Constellation's entire enterprise, not just the project — cheap federal debt substituting for corporate debt on a project already committed, which is a financing *improvement*, not a rescue. **Layer four, the tax code:** the 45Y production tax credit applying to Crane's first decade of output — a per-megawatt-hour federal payment stream layered under the private one. **Layer five, capacity revenue:** the June 1, 2026 FERC-approved transfer of 760 MW of Eddystone capacity interconnection rights to Crane — paper rights migrated from a Philadelphia fossil plant so the resurrection can sell capacity, not just energy, from 2027. What investors heard: a merchant generator converting itself into a contracted-revenue company — the same conversion Talen's deck sells explicitly (contracted margins toward ~50 percent, Timeline 47) and the GSA arrangement extends to the federal government as customer (Timeline 39). The load-bearing accounting assumption, per the menu's rule: **20-year fixed-price paper signed against demand whose own hardware depreciates in roughly 5 — the duration mismatch every one of these contracts embeds**, priced by neither party in any public document, and inherited by Lecture 10.

The mechanism. The stack's logic: each layer de-risks the next lender. The offtake makes the equity rational; the equity's commitment makes the federal loan cheap; the loan and the PTC compress the cost of carry; the CIR transfer adds a revenue stream the original underwriting didn't need. By November 2025 the riskiest capital in the project was the first \$1.6 billion — and it was committed in September 2024, before a single regulatory approval existed. The sequencing is the finding: the paper preceded the permits, and the paper is what everything else priced.

Key actors in this beat. Eggers (the stack's named voice); DOE's Loan Programs Office under Secretary Wright (motive on the record: the win-the-AI-race framing, Timeline 60); the sell side as the stack's public pricing mechanism.

The documents. The 10-Q; the DOE close announcement (November 18, 2025); the Jefferies and BMO notes; Talen's June 2025 deck (seller's document, flagged); the Eddystone waiver order (June 1, 2026).

Verbatim bank. Wright's win-the-AI-race line and Dominguez's expedite line — pointers to Timeline 60 (one-per-source held). DOE release language on creditworthiness — government speech, quotable at draft stage; locator: LPO announcement, November 18, 2025.

Who pays. By layer: Microsoft's shareholders (the premium); Constellation's (the execution risk); taxpayers (PTC outlays, and loan exposure gated behind full recourse); and the contested remainder — whether capacity-market and grid-cost effects reach ratepayers — deliberately held for Beat 10 and L7. The Handoff's cost-left-unassigned originates in this ledger's bottom line.

What's contested, motivated, or unknown. The \$16 billion is the pack's most dangerous number — Section 6's homonym flag (contract estimate vs. Brattle's separate \$16B Pennsylvania GDP figure) governs every use. The duration-mismatch framing is the course's analysis, not a sourced claim about either party's models — carried as the narrator's arithmetic on disclosed terms.

Sensory & material details. A loan that closed the day it was committed; capacity rights moving between plants as a docket entry; two banks' spreadsheets standing in for a contract's redacted schedule.

Numbers that matter. ~\$16B — revenue estimate — Jefferies arithmetic, Sept 2024 — **CONTESTED** pedigree · ~\$1.6B — capex incl. fuel — Eggers — ANCHOR (company) · \$1B, full recourse — DOE, Nov 18, 2025 — ANCHOR · ~\$1,377/kW / +\$1.55 EPS — BMO reconstruction — STRUCTURAL (analyst) · 760 MW — CIR transfer — FERC, Jun 1, 2026 — ANCHOR · 20 yr vs ~5 yr — paper vs. silicon durations — STRUCTURAL (course arithmetic on disclosed terms).

Stress-test verdict: SUSTAINABLE. Five documented layers, each dated, each with a named institution and a motive on the record; the fat container fills without padding, and the closing mismatch hands its weight forward exactly where the cascade wants it.

Beat 8 — The Regulatory Collision (the FERC co-location docket)

Syllabus 2.0 assignment: If you plug in behind the meter, who pays for the grid you're no longer visibly using?

Beat Menu definition: Politics · versatile, closer-capable · two authorities claiming the same jurisdiction, sustained by steelmanning both jurisdictions' legal theories before the collision.

Facts, dates, names, numbers. The docket chain, as three escalations — full detail at Timelines 25, 33, 36, 38, 42, 64, 73. **One — the case (ER24-2172):** the 300→480 MW amendment (June 2024); the AEP/Exelon protests putting the free-ridership theory on the record; the 2-1 rejection (November 1, 2024 — Christie/See majority, Christie's consumer-cost concurrence, Phillips's national-security dissent — Section 7's steelman ammunition); rehearing denied; Taken to the Fifth Circuit; residual affirmance ~March 2026 [single-source, flagged]. **Two — the question (AD24-5):** the technical conference convened the same week — the commission conceding, by procedural choice, that it had a policy vacuum, not a case. **Three — the answer (EL25-49):** Show Cause (February 20, 2025) → the 5-0 Order on Show Cause (December 18, 2025): the tariff unjust and unreasonable *for lacking rules, not for co-location existing*; three service pathways ordered; the 60-day BTMG clock; rates to a paper hearing live at the stamp; the retail-jurisdiction question pointedly declined. The two legal theories, both at strength per the menu's rule: *the utilities'* — a synchronized machine provides frequency, voltage, reserves, and blackstart to everything attached to it, so net-output billing shifts the cost of those services onto everyone else's bill; *the customer's* — a load willing and able to limit its transmission use is being charged for a service it declines, and the December order adopted that very phrase into the remedy — the strongest possible validation short of victory. And one line for the returning character's first appearance, per the Roster: the White House's July 2025 AI Action Plan, *Winning the Race*, names grid capacity and permitting as national AI-competition constraints. One line; it detonates in Lecture 8.

The mechanism. The collision's engine is a category error built into the tariff's origins: the rules assumed generation connects to serve *the grid* and load connects to draw *from* it — co-location is a load that serves itself through a generator's front door, and every institution's response maps to which half of the error it polices. The 2-1 rejection punished the arrangement for lacking rules; the 5-0 order punished the rules for lacking the arrangement. Fourteen months apart, the same commission — the reversal *is* the collision resolving into jurisdiction.

Key actors in this beat. FERC as a five-chair character whose internal arithmetic (2-1 with two abstentions → 5-0) is the plot; Christie and Phillips as the two theories personified; AEP and Exelon as the protest's authors; PJM as the party ordered to build what it failed to have.

The documents. The four orders (Nov 1, 2024; Dec 2024 rehearing; Feb 20, 2025; Dec 18, 2025) — all public domain, the pack's richest verbatim well; the AEP/Exelon protest; the fact sheet.

Verbatim bank. Phillips's step-backward and unacceptable lines; Christie's huge-ramifications line; the majority's similarly-situated question; the December order's willing-and-able-to-limit formulation — all deployed at Timeline 33/64, all government speech, all re-deployable at draft stage without copyright constraint. The assigned lecture Verbatim selects from this well (Section 4).

Who pays. The docket *is* the who-pays question wearing a caption — the beat's discipline is to keep the answer honestly open at the research date: the December order chose a framework, not a number; the paper hearing choosing the numbers was mid-briefing when this pack was stamped.

What's contested, motivated, or unknown. The magnitude of the cost shift (Section 7 audits both directions); the retail-jurisdiction seam (open by design); the March 2026 residual-track date (single-source, flagged). Phillips's national-security framing is a dissent, not a finding — carried as advocacy.

Sensory & material details. A 2-1 with two empty chairs becoming a 5-0; a paper hearing — the collision's climax conducted entirely in PDF; a fact sheet counting 67 million bystanders.

Numbers that matter. 2-1 / 5-0 — the vote arc — FERC, Nov 1, 2024 / Dec 18, 2025 — ANCHOR · 300→480 MW — the triggering amendment — ANCHOR · 3 — ordered service pathways — ANCHOR · 60 days / 3 yr — compliance clock and transition — ANCHOR · 67 million — consumers in the order's own framing — ANCHOR (FERC figure) · Feb 16 / Mar 18 / Apr 17, 2026 — paper-hearing calendar — ANCHOR.

Stress-test verdict: SUSTAINABLE. The richest documentary spine in the lecture — four dated orders, named commissioners, two genuinely strong theories, and a live proceeding giving the beat present-tense stakes. The only discipline: the answer stays open, because at the stamp it is.

Beat 9 — The Steelman (defendant: the behind-the-meter customer)

Syllabus 2.0 assignment: The AWS–Talen legal theory at full strength. Rotation verified: L1 county · L4 PJM's queue · **L5 BTM customer** · L6 neocloud CFO · L7 Dominion · L8 White House · L9 orbital case · L10 hyperscaler capex — no party twice.

Beat Menu definition: Audit · never opener · the full-throated strongest case for whoever's about to look worst, sustained by the defendant's actual numbers and constraints — a précis of the weak version is not a steelman.

Facts, dates, names, numbers. The defendant's case, built from the defendant's own filings and the record's strongest friendly evidence, in five planks. **Plank one — speed, with the counterfactual attached:** the load exists either way. A gigawatt-class campus entering the queue joins a line running years from request to energization (L4's documented medians — inherited, not rebuilt); the same campus at Susquehanna drew its first contracted megawatts under a deal signed March 2024. The choice was never co-location versus orderly interconnection; it was co-location versus the same demand sitting in the queue as one more phantom entry while the compute got built somewhere with worse power. **Plank two — the tariff's own logic:** the defendant pays for what it uses. The standard interconnection instrument itself severs interconnection from delivery service (the L4-verified Article 4 clause: execution conveys no transmission delivery service — referenced, not rebuilt); a load that never schedules delivery over the network is not a free rider on a service the paperwork says it isn't receiving. The December 2025 order's willing-and-able-to-limit language adopts the plank's premise into federal remedy design. **Plank three — the fair-share concession, made voluntarily:** the defendant's own side conceded the honest version early — Dominguez, November 4, 2024, on the record: co-located load should pay its fair share of grid costs for what it uses. The steelman is not “we owe nothing”; it is “bill us for measured use, not for gross demand we contractually forgo.” **Plank four — reliability as contribution, not extraction:** the co-located configuration leaves the generator synchronized and the campus contractually interruptible in emergencies; the restructured June 2025 arrangement goes further — front-of-meter, PPL-delivered, fully tariffed — demonstrating the defendant class will pay standard rates where a workable service exists, which was the entire point. **Plank five — the national frame, on the record from a regulator:** Phillips's dissent (November 1, 2024) supplies the steelman's ceiling — reliability *and* national security cut for approval, pole-position risk, unacceptable — a sitting FERC chairman making the defendant's macro case in an official document. The strongest single sentence available to the defense: the commission that rejected the arrangement in 2024 for lacking rules spent 2025 building the rules, unanimously — behavior consistent with an arrangement that was legitimate and unpriced, not illegitimate and priced.

The mechanism. Why the steelman holds structurally: every plank rests on a document the opposing side authored or an order the neutral authority issued — the LGIA's own clause, the CEO's own concession, the chairman's own dissent, the commission's own remedy. A steelman built from the defendant's press releases would be advocacy; this one is built from the record's load-bearing paper.

Key actors in this beat. The composite defendant (AWS–Talen as the litigated instance; the class as the true client); Phillips as the case's highest-ranking friendly witness; the June 2025 restructuring as the defendant's exhibit of good faith.

The documents. The Talen filings and June 2025 deck (seller-flagged, used for terms only); the Phillips dissent (public domain); the December 2025 order (the premise's adoption).

Verbatim bank. All pointer-referenced (Timeline 33, 34, 47, 64); the beat needs no new pulls — its strength is arrangement, not quotation.

Who pays. The steelman's own answer, stated fairly: the defendant, for measured use, at rates the paper hearing will set — and the beat must say plainly that the number was unset at the research date, because a steelman that promises the fight is over isn't one.

What's contested, motivated, or unknown. Section 7 holds the cross-examination (the utilities' service-receipt physics; the capacity-market subtraction against a documented shortfall) — per house rule the steelman runs uninterrupted here and the opposition gets its own full hearing there. The interruptibility plank's operational details sit in confidential contract terms; carried as the arrangement's public characterization.

Sensory & material details. A dissent with the word unacceptable in it; a defendant restructuring its way out of its own test case; a legal theory whose best evidence is its opponents' paperwork.

Numbers that matter. Mar 2024 → contracted MW — the speed proof — ANCHOR · 2–1 → 5–0 — the validation arc — ANCHOR · 1,920 MW / 2042 — the class's scale at full commitment — ANCHOR (June 2025 announcement) · 0 — transmission delivery service conveyed by the interconnection instrument, per its own text — ANCHOR (standard-form

clause, L4-verified).

Stress-test verdict: SUSTAINABLE. Five planks, each documented, each genuinely strong, none a strawman's shadow; the rotation slot is well-cast because this defendant's best evidence is unusually official.

Beat 10 — The Externality Swap (behind-the-meter speed vs. socialized grid cost)

Syllabus 2.0 assignment: Both sides priced.

Beat Menu definition: Atoms/Money · versatile, closer-capable · the pick-your-poison tradeoff, sustained by pricing *both* sides honestly — the beat fails if one option is a strawman.

Facts, dates, names, numbers. The swap, priced in both directions with the record's best numbers. **What co-location buys:** time — the distance between March 2024 (first Susquehanna contract) and the multi-year queue medians L4 documented; a real resource — 835 MW of zero-carbon firm capacity restored at Crane, ~620,000–670,000 homes' worth by independent arithmetic (Section 4); jobs and taxes with a commissioned-but-professional pedigree (Brattle: 3,400 jobs, \$3B+ taxes — commissioning party named every time); and, in the restructured Talen configuration, a demonstrated path back to full tariff participation. **What co-location spends, at its opponents' honest maximum:** unbilled ancillary services (frequency, voltage, reserves, blackstart — real physics, unquantified in any public document at the stamp; the pack's discipline: named, never numbered by invention); capacity-market subtraction — removing gigawatt-class supply from the visible market against a December 2025 auction that cleared roughly 6,600 MW short (the juxtaposition is documented; the causal weight is contested and L7 owns the auction); and precedent risk — every approved arrangement invites the next, which is not paranoia but the actual mechanism by which tariff exceptions become tariff norms, and is the stated logic of Christie's setting-a-precedent concern. **The swap's asymmetry, stated once:** the benefits are contracted, dated, and countable; the costs are real, diffuse, and — at the research date — being counted for the first time, in a paper hearing. That asymmetry is not an argument for either side; it is the reason the fight took a federal docket to price.

The mechanism. Why the swap can't be dodged: the grid's cost structure is mostly fixed and mostly shared — any load that exits the sharing formula without exiting the physics changes everyone else's denominator. The only question a regulator can actually decide is which denominator adjustment is just, which is precisely the December order's remit.

Key actors in this beat. The 67 million consumers of FERC's own framing (the swap's silent counterparty); Christie's concurrence as the cost side's most credible voice; the Crane restart as the benefit side's most concrete exhibit.

The documents. The December 2025 order (both sides cite it); the auction result (L7-fenced, one line); the Brattle study (commissioned, flagged).

Verbatim bank. None new; Christie pointer (Timeline 33).

Who pays. The beat *is* the who-pays ledger; its closing discipline is the honest tally — speed paid privately and immediately, grid costs contested publicly and slowly — with the unassigned remainder walked forward as the Handoff's cargo.

What's contested, motivated, or unknown. Every quantity on the cost side; carried as such, per the pack's never-invent rule. The 6,600 MW shortfall's causes are multivariate — the beat may juxtapose, never attribute.

Sensory & material details. A denominator with 67 million entries; a shortfall measured in the same unit as the workaround's gains; both sides of the swap citing the same order.

Numbers that matter. 835 MW / ~620–670k homes — the benefit, verified — Section 4 — STRUCTURAL · ~6,600 MW — the auction gap — mid-Dec 2025 — ANCHOR (L7-fenced) · 3,400 / \$3B+ — Brattle, commissioned — STRUCTURAL (pedigree-flagged) · unquantified — the ancillary-services shift at the stamp — CONTESTED, honestly.

Stress-test verdict: SUSTAINABLE — with a thinness note for markup. Both sides price honestly, but the cost side's numbers are structurally unavailable at the stamp (the paper hearing exists to produce them). The beat holds at four minutes on the asymmetry insight; if markup wants five, it borrows a minute of Beat 8's docket texture. Flagged, not fudged.

Beat 11 — The Bottleneck (restart milestones and NRC pacing)

Syllabus 2.0 assignment: The difference between an announcement and a fuel load.

Beat Menu definition: Atoms · versatile · the constraint nobody can financialize away, sustained by why the bottleneck exists industrially, who sits upstream, what the workaround costs, and why money alone doesn't clear it.

Facts, dates, names, numbers. The constraint's legal origin, stated exactly: September 26, 2019, Exelon certified permanent fuel removal, and under 10 CFR 50.82(a)(2) the license *ceased to authorize operation or fuel emplacement* — one regulatory sentence, and the entire 2024–27 program (one exemption request, three license amendment requests) exists to reverse it. The milestone ladder — fourteen dated rungs, fully entered at Timelines 37, 41, 44, 49, 51, 59, 61, 69, 72, 74, 75, 78, 79, 84–85 — runs from the rename LAR (January 2025) through transformers-with-a-transport-budget, the RRI selection that moved 2028 to 2027, the fuel-receipt amendment and its RAI cycle, the Federal Register notice of three amendments, a state NPDES/§401 dependency sitting on the federal critical path, the Eddystone CIR patch, and the draft EA/FONSI whose comment period closed thirteen days before this pack's stamp — to NRC amendment action from March 2027 per the agency's published schedule and first power in the second half of 2027, company target. The staffing bottleneck inside the paperwork one: 200+ hires (February 2025) → ~400 FTE at 64 percent (June 2025) → 500+ at ~80 percent (September 2025), with a second Initial License Training class — reactor operators are made, not hired, and the training pipeline has a physical cadence no PPA accelerates. Upstream sits the template with a limp: Palisades — first-ever NRC reauthorization, then the schedule's confession from October 2025 through *when ready*, on steam generator tube work and a 5,000-item checklist (Timelines 50, 54, 83). And the workaround's workaround as the closing specimen: PJM approved 2027 *reconnection* while warning full-output deliverability upgrades could run past 2030 — hence 760 MW of Eddystone paper rights migrated to Crane (Timelines 74, 78), capacity as a transferable legal object patching a transmission gap money couldn't schedule away.

The mechanism. Why money doesn't clear it: every rung is a *sequenced* dependency with its own statutory clock — comment periods have minimum durations, §401 certification precedes the federal amendment, operator licenses require training hours that occur in real time. Capital compresses the gaps between rungs (Crane's pace is genuinely unprecedented — announcement to targeted restart in roughly three years); it cannot delete the rungs. Palisades is the control experiment: more federal money, earlier start, and the schedule still slipped on steam generator tubes — atoms outvoting term sheets.

Key actors in this beat. The NRC as pacing authority (its published March 2027 action date is the program's true critical path); the ILT classes as the human bottleneck; Palisades as the cautionary template; the three transformers as the beat's L5-native object (distinct from L4's lead-time treatment — these are *bought*; the constraint here is rigging, transport, and installation sequence).

The documents. The 50.82(a)(2) certification (the grave's paperwork); the Federal Register notice; the draft EA/FONSI; PJM's deliverability warning per the reconnection record.

Verbatim bank. The EA's no-significant-effect formulation — government speech, quoted at Timeline 79. Epstein's Pep Boys line (Timeline 43) is the beat's documented outside voice on parts scarcity — pointer only, one-per-source held.

Who pays. Constellation, in carry — every month between capex and electrons is financed on the balance sheet the DOE loan priced; the beat's one-line note, and the meter on it runs until 2H 2027.

What's contested, motivated, or unknown. Whether 2H 2027 holds — the pack's position: the target is the company's, the schedule risk is documented by the template's own slippage, and the vessel-condition question raised in critique (a reactor's materials after seven dormant years) is flagged as a raised concern, not an established defect. Spring 2026 Susquehanna reconfiguration completion: unconfirmed at the stamp (Timeline 76's verify-at-draft flag).

Sensory & material details. A Federal Register notice as a resurrection permit; three transformers with a \$35 million travel budget; a comment period closing thirteen days before this sentence's date.

Numbers that matter. 1 + 3 — exemption and amendments required — ANCHOR · Mar 2027 — NRC action start, agency schedule — ANCHOR · 2H 2027 — first power, company target — STRUCTURAL (seller's date) · 200 → ~400 → 500+ — staffing ladder, dated — ANCHOR (company figures, as-of dates mandatory) · 5,000 — Palisades checklist items — STRUCTURAL · post-2030 — full-deliverability warning — STRUCTURAL (PJM via record).

Stress-test verdict: SUSTAINABLE. Fourteen dated rungs, a control-experiment template, a human pipeline, and a closing paper-capacity specimen — the beat is the lecture's densest and needs trimming at draft, not padding.

Beat 12 — The Physics Audit [C] (13 projects, 9.8+ GW — then the stage labels)

Syllabus 2.0 assignment: The closer. The tally, then committed vs. contracted vs. energized; most electrons arrive 2027 and later; SMR agreements as options on future power, not power. Carries the As-Of Stamp, the Kicker, and the Handoff rider.

Beat Menu definition: Atoms/Audit · versatile, closer-capable · the deadpan reality check, delivered in the same tone as the pitch it's auditing.

Facts, dates, names, numbers. The pitch, at its own volume: as of May 2026, the tracker count stands at **13 projects and 9.8+ gigawatts** of announced hyperscaler-nuclear capacity (SMR Intel tracker — author-attributed trade tally; the As-Of Stamp's canonical deployment, and the stage-blur caveat is mandatory in the same breath). The audit, run as a sort. **Energized, attributable to this scramble: approximately zero megawatts at the stamp** — Crane targets 2H 2027; Palisades, the nearest restart, was *when ready* with no firm date. **Contracted against existing electrons:** Meta-Clinton (1,121 MW from June 2027, replacing an expiring state subsidy — the who-pays inversion in one line); Meta-Vistra's 2,176 MW of existing Perry/Davis-Besse output from late 2026; AWS-Talen's ramp (840–1,200 MW by 2029; 1,680–1,920 by 2032). Real megawatt-hours — from plants that were already running; the deals reprice and redirect, they do not add. **Contracted against resurrections and uprates — the genuinely additive tranche:** Crane's 835; Palisades' ~805 gross; Vistra's 433 of uprates; Constellation's ~2,000 MW fleet uprate inventory (seller's figure) — additive, and almost entirely 2027-and-later. **Options wearing capacity language (instruments' own nouns, full detail Timelines 31, 32, 45, 68):** a *development agreement* (Kairos, up to 500 MW by 2035); a *memorandum* (Dominion); three *sites* with no reactors (Element1); *rights* to up to 2.1 GW (TerraPower, by 2035); a planned campus with a 2030 first phase (Oklo); early-2030s first units (X-energy/Energy Northwest); and Meta's 6.6 GW headline — one PPA plus uprates plus options, the stage-spread in a single press release. The audit's documented punchline sits in the record already: Deep Fission's 12.5 GW of *nonbinding* agreements, and its own CEO's explanation — multiple agreements signed because nobody knows who can actually produce the power on the timeline (Timeline 58) — Lecture 4's phantom load, reborn as phantom supply, from inside the industry's own mouth. **The Kicker, armed and verified:** the SMR agreements are options on power, not power — an option being, precisely, a paid right to a thing that does not yet exist, which is a perfectly legitimate financial instrument and a very different noun from a megawatt. **The Handoff rider (~final 200 words, outside the count):** the sort leaves one column empty — every gigawatt in the tally, real or optional, powers compute that somebody owns, financed with something; the cost of the workaround has been assigned to meters, dockets, and balance sheets all hour, but the *compute* the workaround exists to feed has not been assigned a financier — cost left unassigned, walking into Lecture 6.

The mechanism. The audit's engine is the tally's own arithmetic run against the calendar: 9.8 GW announced; on the order of zero delivered by the scramble at the stamp; the median announced megawatt arrives no earlier than the late 2020s. Stated flat, in the pitch's own deadpan — the Step Function (Section 4) fires inside this beat's opening: every hyperscaler signed, the uninvestable assumption died, *and* the electrons are still mostly futures.

Key actors in this beat. The tracker (named, motive-flagged: a trade publication's tally sells the boom it counts); Muller as the audit's inside witness; the stage labels themselves as the beat's true cast.

The documents. The May 2026 tracker; the January 9, 2026 Meta release (the stage-spread specimen); the Bloomberg segment.

Verbatim bank. Muller's multiple-agreements line — pointer to Timeline 58 (the beat's one outside quote; one-per-source held).

Who pays. Option premiums: the buyers, now, quietly. Delivery: the meter, later, if ever. The unassigned remainder: Lecture 6's opening problem, by design.

What's contested, motivated, or unknown. The 9.8 GW's composition is the contest — the pack's sort is reconstructable from the deal records above, but the tracker's exact project list should be pulled at draft stage before any per-project claim; the tally is carried as the tracker's count, stamped, never as the course's own census.

Sensory & material details. A spreadsheet counting gigawatts that exist as signatures; one reactor's worth of actual new electrons scheduled against thirteen projects' worth of announcements.

Numbers that matter. 13 / 9.8+ GW — the tally — SMR Intel, May 2026 — VOLATILE (refreshes; the As-Of Stamp is the armor) · ~0 MW — scramble-attributable energized at the stamp — STRUCTURAL (course arithmetic on dated records) · 2027+ — modal arrival — STRUCTURAL · 12.5 GW, nonbinding — the caveat's own exhibit — Bloomberg, Oct 15, 2025 — ANCHOR · 1,121 MW / Jun 2027 — the inversion line — ANCHOR.

Stress-test verdict: SUSTAINABLE. The closer has the tally, the sort, the inside witness, the armed Kicker, and a rider that lands on the cascade's exact seam. Decay-tier note honored: the numbers refresh; the audit's method doesn't.

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

Each beat the strawman leaves out, scanned against the record: could it be built, and does anything omitted beat anything included?

Cold Open on an Object — supported, blocked by rotation. The record offers a first-rate specimen: three main power transformers with a \$35 million transport commitment, 2026 delivery. But L4 opened on a transformer riding a Schnabel car; an adjacent-lecture transformer cold open repeats both the beat and the object class. Confirm out. (The transformers still appear inside Beat 11, at L5's native grain — purchase, rigging, installation — not L4's lead-time grain.)

The Bill Arrives — thin. No documented, itemized bill sits at this lecture's center: the PPA price is confidential, the DOE loan is a facility rather than an invoice, and the paper hearing hadn't produced a rate at the stamp. The strongest candidate (the \$35M transport line item) is a clause, not a beat. Confirm out.

The Forecast Problem — out of scope. L4 led the forecast lens; L5's supply-side rhyme (phantom commitments) is handled inside Beat 12 via Muller. Rebuilding the beat here would double-spend. Confirm out.

The Perverse Incentive — moderate swap case, the scan's one live alternative. The record supports it: a tariff whose meter placement made invisibility a rate strategy; a capacity market that pays plants to be visible while bilateral paper pays them more to be less so; a subsidy handoff (Clinton's ZEC expiring into Meta's PPA) where private procurement replaces public support. If Nick wants a tenth Politics/Money beat, this builds — most naturally by absorbing Beat 10's territory (the swap and the incentive are adjacent lenses on the same docket). Flagged as the markup's best trade; not recommended unprompted, since Beat 10's both-sides-priced discipline is the course's stated house rule for this material.

The County — moderate, declined. Londonderry Township exists in the record (supervisors' chair statement at announcement; township identity throughout). But the documented local politics are thin — no council fight, no zoning war, no election turning on Crane in the record reviewed. L5's local texture is better carried by the Human Floor inside existing beats. Confirm out.

The Neighbor — unbuildable at grade, correctly absent. The beat's standard (documented humans, comedy off, harm on the record — L3's Morris-grade specimen) is not met here: the record's residents are meeting-testimony voices (fear, opposition), not documented-harm households. Building a Neighbor from testimony alone would inflate it. The testimony deploys in Beats 6, 8, and 11 via Section 8. Confirm out.

The Founder Audit — miscast. Dominguez is a CEO operating an inherited fleet, not a founder; the founder energy in this record (Oklo, Deep Fission) belongs to L6's neocloud/startup terrain and L9's futures. Confirm out.

Operator Reality — supported but redundant. The ILT classes, control-room simulator, and staffing ladder would build a fine Operator Reality — but Beat 11 already carries exactly this material as bottleneck evidence. A standalone deployment would strip Beat 11 to fund a duplicate. Confirm out; note for the course ledger that L5 banks strong operator material if a later lecture needs a pointer.

Taxonomy by Business Model — premature. The workaround toolkit is taxonomized inside Beat 3 by billing topology; a company-sorted taxonomy (restart operators vs. SMR developers vs. uprate sellers) is L6/L9 terrain. Confirm out.

Scan verdict: no omitted beat beats an included one; the strawman holds. The single live swap (Perverse Incentive for Externality Swap) is documented above for markup.

SECTION 4: MOVES PLAN VERIFICATION

The Step Function — VERIFIED. The dying assumption, in a dated mouth: the market decided, and it decided it's not nuclear (Epstein, September 3, 2024 — the assumption stated as victory seventeen days before its death). The break, hyperscaler by hyperscaler, each with a signing date: Microsoft (September 20, 2024, Crane PPA); Amazon (March 2024 campus purchase and PPA; October 16, 2024 triple announcement; June 11, 2025 expansion); Google (October 14, 2024 Kairos MPDA; May 9, 2025 Elementl); Meta (June 3, 2025 Clinton; January 9, 2026 triple). All four majors, at least

one nuclear instrument each, inside 16 months. Deploys inside Beat 12's opening per the Moves List discipline (detonator inside a beat, never standalone).

The Unit Conversion — the Open Item 11 hard gate. Arithmetic shown; verdict PASS at corrected magnitude. Claim under test: 835 MW $\approx$ 800,000+ homes (Constellation's announcement figure). Independent arithmetic: 835 MW $\times$ 8,760 hours = 7,314,600 MWh at perfect uptime. At the plant's documented final-year capacity factor (96.3%): $\sim$ 7.04 million MWh/year. At a conservative fleet-standard 90%: $\sim$ 6.58 million MWh/year. US average household consumption: $\sim$ 10.5–10.8 MWh/year (EIA-derived range). Division: 6.58M–7.04M $\div$ 10.5–10.8 $\rightarrow$ **$\sim$ 610,000 to $\sim$ 670,000 homes.** The 800,000+ figure requires either a lower household denominator (regional, not national) or rounding generosity; it is usable *only* as the company's claim, attributed. **Deployment ruling for the drafting AI: the conversion PASSES at $\sim$ 620,000–670,000 homes on the course's own arithmetic; both the pass value and the company's larger claim may appear together, labeled — that gap is itself course material.**

The Timeline Snap — VERIFIED. September 20, 2024, doing double duty: the signing date, and the fifth anniversary — to the day — of the September 20, 2019 shutdown. Deploys inside Beat 4 per the menu's natural-home rule.

The Verbatim — existence gate run on both assigned branches. *PPA-language branch: FAIL.* The contract is confidential; no verbatim exists to verify. Recorded honestly; no workaround attempted. *Docket branch: PASS,* with a ranked candidate slate — all public-domain government speech, verified in the orders themselves, block-quoted here at deployment grade so the drafting AI pulls from the pack, not from memory:

Candidate (1) — then-Chairman Phillips, dissenting, November 1, 2024 (Docket ER24-2172): the rejection is “a step backward for both electric reliability and national security”; “access to reliable electricity is the lifeblood of those data centers”; and the close — “I am deeply concerned that in failing to demonstrate regulatory leadership and flexibility we are putting at risk our country's pole position on this critically important issue. That is simply unacceptable.”

Candidate (2) — the Order on Show Cause, December 18, 2025 (193 FERC ¶ 61,217): the tariff fails customers “willing and able to limit their use of the transmission system” — the phrase that migrated from the defendants' argument into the commission's own remedy design, which is why it ranks first in utility despite ranking last in drama.

Candidate (3) — Commissioner Christie, concurring, November 1, 2024: co-location arrangements “present an array of complicated, nuanced and multifaceted issues, which collectively could have huge ramifications for both grid reliability and consumer costs.”

Candidate (4), reserve — the November 1 majority's quiet procedural dagger: whether PJM “intends to offer these terms to all similarly situated interconnection customers.”

Recommendation to markup: candidate (2) — it is the docket's hinge sentence and the only one that is the ruling rather than commentary on it. One deployment; the 1-per-lecture cap holds; the others remain available as paraphrase throughout.

The As-Of Stamp — VERIFIED. Canonical deployment: as of May 2026, the count is 13 projects and 9.8 gigawatts — carried as the SMR Intel tracker's tally, author-attributed, with the stage-blur caveat mandatory in the same breath (Beat 12's sort supplies it).

The Kicker — VERIFIED AND ARMED. The SMR agreements are options on power, not power. Grounded in the instruments' own nouns (development agreement, memorandum, rights, sites — Beat 12's inventory) and in Muller's on-record explanation of multiple-signing behavior. Fires as Beat 12's final $\sim$ 100 words, ahead of the Handoff rider.

The Gesture — the reactor door, one inch, inventory complete. What the door opens on, and no further: a spring 2024 steam generator tube inspection whose filed finding was that observed degradation did not challenge integrity requirements; a regulatory grave dug by one sentence of 10 CFR 50.82(a)(2) and exited by one exemption plus three amendments; and a raised-in-critique question — the condition of a pressure vessel and its materials after seven dormant years — carried as a concern on the record, not a finding. The restart engineering beyond that inch is somebody else's story, by design; nothing beyond it was researched, per the fence.

SECTION 5: DOCUMENT DOSSIER — THE MICROSOFT-CONSTELLATION PPA

What the document is. A bilateral, confidential, 20-year power purchase agreement, executed on or about September 20, 2024, between Constellation Energy Generation and Microsoft, supporting the restart of TMI Unit 1 as the Crane Clean Energy Center. Structure, per the strongest public characterizations: a fixed-price *virtual* (financial) PPA — Jefferies,

September 23, 2024 — with output usable across four states per Dominguez’s own description; no co-location, no private wire, electrons dispatched by PJM like any other unit’s.

Its public voices, ranked by authority. (1) The Q3 2024 Form 10-Q — Constellation describing the agreement under securities liability; the closest surviving approximation of the contract’s own register, and the draft-stage pull if the beat needs the document to speak (locator: CEG 10-Q, quarter ended September 30, 2024, filed early November 2024). (2) The September 20 joint announcement — the parties’ curated disclosure: term, capacity, capex, timeline, renewal intent. (3) The analyst reconstructions — Jefferies (\$110–115/MWh; premium characterization; the observation that customers pay up for virtual nuclear) and BMO (~\$102/MWh; \$1,377/kW; +\$1.55 EPS) — the price’s only public existence, permanently labeled as estimates.

What it forces (inferred from downstream conduct, each inference dated). Restart obligation and milestones: \$1.6B committed and a federal licensing program launched within months. Creditworthy conditionality: a \$1 billion full-recourse federal loan closed against it (a lender’s underwriting is a reading of the offtake). Attribute delivery: Microsoft’s decarbonization framing requires the contract to convey environmental attributes — standard in the instrument class, unconfirmed in this instance, carried as inference.

What it forbids / the skeptical read, inverted per the pack plan. The usual skeptical question — is the document binding? — inverts here: the PPA is unambiguously binding (a 10-Q does not describe vapor) but *invisible*. The honest caveats therefore run the other way: every clause-level claim in circulation is reconstruction; the price premium is analyst arithmetic; the conditionality is inference from conduct. The drafting AI’s rule, restated from Beat 5: disclosed terms in the indicative; everything else explicitly carried as reconstruction, every time, without exception.

Draft-stage pull instruction. If the Paper Trail beat wants the document to speak, the pull is the 10-Q’s own description of the agreement — one passage, quoted within the fifteen-word discipline or precisely paraphrased with the filing locator — and never the press release’s marketing register standing in for the contract’s. The difference between the two registers (securities liability vs. publicity) is itself a usable beat texture.

Violation scenario, as documented risk rather than speculation. If the restart fails regulatory approval, the contract’s remedies engage — and their terms are unknown. The pack notes only what the record supports: Constellation carried execution risk on its own balance sheet, and the market priced that risk positively (+22%), implying investors read the conditionality as survivable. Beyond that inch: unresearched, honestly.

SECTION 6: THE NUMBER SPINE

Every load-bearing figure, with unit, stage, as-of date, author, and tier. Rule restated: discrepancies with must-hit anchors are flagged here and never silently substituted anywhere.

Figure	What it is	As of	Author	Tier
835 MW	Crane restored capacity	Sept 20, 2024	Constellation	ANCHOR
837 MW	Unit 1 pre-retirement rating	2019 record	NRC/company	STRUCTURAL
~\$16B	PPA life-of-contract estimate	Sept 23–24, 2024	Jefferies/BMO arithmetic	CONTESTED (pedigree)
\$16B	PA GDP impact estimate	Sept 2024	Brattle (commissioned)	STRUCTURAL
~\$1.6B	Constellation restart capex incl. fuel	Sept 20, 2024	Eggers/CEG	ANCHOR (company)
\$110–115 / ~\$102 per MWh	price reconstructions	Sept 2024	Jefferies / BMO	CONTESTED
20 yr	PPA term	Sept 20, 2024	disclosed	ANCHOR
2028 → 2027 (2H)	first-power target	Sept 2024 → May 2025 → 2026	CEG (+PJM RRI)	STRUCTURAL (seller’s date)
\$1B, full recourse	DOE loan	Nov 18, 2025	DOE LPO	ANCHOR
1,920 MW / ~17 yr / ~\$18B	AWS–Talen expanded PPA	Jun 11, 2025	Talen	ANCHOR (seller’s notional)

Figure	What it is	As of	Author	Tier
up to 6.6 GW by 2035	Meta nuclear headline	Jan 9, 2026	Meta	STRUCTURAL (stage-spread)
1–4 GW	Meta RFP sought	Dec 3, 2024	Meta	ANCHOR
13 / 9.8+ GW	project tally	May 2026	SMR Intel tracker	VOLATILE
300 → 480 MW	contested ISA ceiling	Jun 2024	PJM filing	ANCHOR
2–1 / 5–0	the vote arc	Nov 1, 2024 / Dec 18, 2025	FERC	ANCHOR
~400 FTE / 64%	Crane staffing	Jun 25–26, 2025	CEG	ANCHOR (company, dated)
500+ / ~80%	Crane staffing	Sept 2025	CEG	ANCHOR (company, dated)
760 MW	Eddystone CIR transfer	approved Jun 1, 2026	FERC/CEG	ANCHOR
96.3%	Unit 1 final-year CF	2019	company/NRC record	ANCHOR
~620,000–670,000	homes, verified conversion	pack arithmetic	Section 4	STRUCTURAL
800,000+	homes, company claim	Sept 20, 2024	Constellation	CONTESTED (vs. pack arithmetic)
~6,600 MW	PJM auction shortfall	mid-Dec 2025	PJM auction record	ANCHOR (L7-fenced)
~700 metric tons	on-island spent fuel/waste, resident-cited	2025–26 meetings	testimony + site record	STRUCTURAL
\$650M (\$350M + \$300M escrow)	Cumulus campus sale to AWS	Mar 1–4, 2024	Talen S-1/release	ANCHOR
1,121 MW + 30 MW uprate	Meta–Clinton PPA	Jun 3, 2025	CEG/Meta	ANCHOR
51 / >9,300 MW	RRI selections incl. Crane	May 2, 2025	PJM	ANCHOR
\$35M	transformer transport commitment	Feb 19, 2025	CEG	ANCHOR (company)
600 / ~\$60M	plant jobs / annual payroll restored vs. 2019	2019 record + Brattle	mixed	STRUCTURAL

Reconciliation audits.

The \$16B homonym — the pack’s highest-risk figure. Two distinct sixteen-billions share one lecture: the PPA revenue estimate (analyst arithmetic on an undisclosed price) and Brattle’s Pennsylvania *GDP* estimate (commissioned economic modeling). Same digits, different objects, different pedigrees. Drafting rule: never let the two appear within a paragraph of each other unlabeled; the Syllabus must-hit (\$16B/20yr) refers to the contract estimate and should carry its pedigree on first use.

835 vs. 837. Both correct: 837 MW is the unit’s pre-retirement rating; 835 MW is the restored-capacity figure the deal disclosed. The must-hit anchor (835) governs; 837 appears only if the restoration delta itself is the point.

2027 vs. 2028. Both correct with dates attached: 2028 was the announcement target (September 2024); 2027 became the target after RRI selection (May 2025), stated as second-half by 2026 reporting. One later trade item reverting to 2028 was noted in research; treated as an artifact, not a re-slip — no re-slip is documented at the stamp. The must-hit (2027) governs, always as the company’s target.

Capacity–energy audit. 835 MW is a rate; the lecture’s energy quantity is ~6.6–7.0 TWh/year at documented capacity factors (Section 4). 9.8 GW is a tally of *announced* rates across every stage; it must never be multiplied into an energy claim — most of it has no capacity factor because most of it has no plant.

Phantom-supply audit. The 9.8 GW contains development agreements, memoranda, rights, and site options (Beat 12’s sort); the Deep Fission 12.5 GW nonbinding pipeline and Muller’s multiple-signing explanation document the double-counting mechanism from inside. Any aggregate GW figure in the draft carries a stage caveat within one sentence — no exceptions.

Staffing drift. ~400 FTE (June 2025) → 500+ (September 2025): the Roster’s ~400 is correct *only* with its June date attached.

As-of discipline mandatory.

SECTION 7: SELLERS, OVERCLAIMS & THE STEELMAN FILE

The sellers on the field, calibrated. *The Hyperscaler (Microsoft/AWS/Meta/Google)*: sells decarbonization and inevitability; the audited gap is between “powering our operations with nuclear” and the virtual/optional structures actually signed — a virtual PPA decarbonizes an accounting ledger directly and a grid only in aggregate. GRANT-AND-WITHHOLD calibration: the commitments are real, signed, and large (grant); the powered-by-nuclear present tense outruns meters that mostly start in 2027+ (withhold). *The Escape Artist (the co-location/BTM configuration as a product)*: sells exit from the queue; the audit notes the strongest version escaped into a tariff (June 2025 restructuring) — the escape’s endpoint was a negotiated re-entry. *The Utility-adjacent generator (Dominguez — the lecture’s richest seller)*: his three principles and fair-share concession are genuinely responsible statements; his no-Nirvana structural claim is simultaneously true and self-serving (he owns the Nirvana-adjacent assets). The pack’s calibration: quote him accurately, price his book every time. *The Politician, three levels*: federal (Wright’s win-the-AI-race framing on a loan announcement); state (Shapiro present at milestones — the \$4.3B/L7 material stays fenced); local (a supervisors’ chair welcoming 600 jobs). Each sells the restart as their level’s win; all three are documented, none require caricature. *The Doomer, audited with equal deadpan*: the co-location-steals-your-power formulation fails the same stage test the boosters fail — at the stamp, the arrangement’s consumer cost was an open docket question, not an established theft; and the strongest opposition claims (Gunter’s rear-view-mirror method critique; vessel-condition concerns) are method and risk arguments, carried as such, not findings.

The opposition’s full case (the Beat 9 steelman’s cross-examination, housed here per house rule). *Service-receipt physics*: a synchronized load receives frequency, voltage, reserves, and blackstart from the system regardless of meter placement — the AEP/Exelon protest’s core, and it is physically true; the dispute is magnitude and remedy, not existence. *Capacity subtraction*: removing gigawatt-class committed capacity from the visible market against a documented ~6,600 MW shortfall — the juxtaposition is real; attribution is multivariate and L7 owns the auction. *Precedent mechanics*: Christie’s concern that one-off approvals become de facto policy — vindicated procedurally by the fact that it took a show-cause docket to make policy properly. *The honest bottom line at the stamp*: FERC agreed the costs are real enough to build three services around, and left every number to a paper hearing. Neither side gets to claim the verdict; the pack’s job was to arm both benches, and both benches are armed.

What is still hidden, stated honestly — the pack’s non-disclosure register. The PPA’s text, price, and remedies (no public custodian, no FOIA path — a private bilateral contract stays private); the DOE loan’s rate and tenor (the close was announced; the pricing was not); the AWS campus’s actual load and utilization against its contracted ramp; the SMR Intel tracker’s full project-by-project itemization behind the 13/9.8 tally (pull before any per-project claim, per Beat 12); verbatim stenography of the NRC public meetings (the record reviewed carries reported quotes, not transcripts — attribution follows the covering outlet each time); and the two non-participating commissioners’ 2024 views (Rosner and Chang sat out the November 1 vote; their absence is a fact, their reasoning is not in the record). None of these is a defect to paper over — the non-disclosures are themselves course material, and the drafting AI names each absence rather than filling it.

SECTION 8: THE HUMAN FLOOR

Comedy-off zones and the documented voices inside them. Everything here is verbatim from published coverage or public-meeting records; nothing is staged; the thermostat reads near-zero throughout.

Zone 1 — March 28, 1979. The accident, the evacuation advisory for pregnant women and preschool children, the community’s health-claims history, and every present-day invocation of that memory. Load-bearing for Beat 6; treated tenderly clinically, never as setup.

Zone 2 — resident testimony, the record’s voices. Fulton (as identified in Pennsylvania Capital-Star coverage), Penn State Harrisburg, February 19, 2026 — the guinea-pigs statement, family and neighbors named in the same breath (Timeline 71). Jaquelyn Drechsler, Berks County, August 6, 2025 virtual forum — the 700-metric-tons-forever statement, delivered at a meeting attendees noted fell on Hiroshima’s 80th anniversary (Timeline 52). The March 2025 Middletown-area meeting’s documented concerns: Susquehanna water dependence, spent-fuel storage, evacuation planning for surrounding Amish and Mennonite communities — communities whose relationship to broadcast emergency communication makes evacuation

planning a distinct, documented question, raised by residents on the record. These pulls deploy in Beats 6, 8, and 11 only, at the grain quoted, with attribution — never composited, never paraphrased into stronger fear than the speaker stated.

Zone 3 — the waste question generally. Roughly 700 metric tons on an island in a river, with no national repository — a household-adjacent fear with a factual spine; Epstein's boogeyman formulation (February 2026) is the documented outside voice. Clinical treatment only.

Adjacent, not a fear zone — the workers. 600 restored positions, union trades, a \$60 million payroll that vanished in 2019 and is returning; the Gettysburg comparison at the shutdown (Fasick, Timeline 14) documents what the plant means locally. Handled with respect; never a punchline; never deployed *against* the testimony above as a rebuttal — the record contains both, and the lecture carries both.

Deployment rules for the drafting AI, restated as bright lines. (1) Testimony deploys at the grain quoted, attributed to the speaker and the covering outlet, never composited across speakers or meetings. (2) No testimony is ever answered in the same paragraph by a company statement — rebuttal-adjacency converts a floor into a debate, and the floor is not a debate. (3) The Hiroshima-anniversary observation belongs to the attendees who made it; the prose may report that they noted it, and may not adopt the juxtaposition as its own device. (4) The thermostat's re-warm after any floor passage runs through logistics or paperwork, never through the fear just voiced. (5) The 1979 accident is context, not content: the lecture may stand inside its consequences (the symbol, the SCOTUS precedent, the community memory) and may not narrate its hours.

No-Neighbor confirmation. Per Section 3: no documented-harm household exists in this record at the beat's standard; the floor's voices are testimony, and they stay testimony. L7's fence-line ratepayer dependency is L7's own and untouched here.

SECTION 9: PEOPLE & CAST

Joe Dominguez — President and CEO, Constellation Energy (in role throughout the record; former ComEd/Exelon executive, legal background). Wants: contracted revenue on the largest US nuclear fleet; co-location legitimized; uprates sold. Fears (from conduct): regulatory drift — hence the three-principles concession strategy. Can enforce: price, on scarce firm-clean supply. On tape: September 20, 2024 investor call; November 4, 2024 Q3 call; September 2025 anniversary statement; November 18, 2025 loan release; December 19, 2025 Fox segment. The lecture's central seller — accurate quotes, book priced every time.

Bobby Hollis — VP of Energy, Microsoft (as of September 20, 2024). The buyer's named voice; one documented statement (the milestone line); wants firm carbon-free supply against a January 2020 carbon-negative-by-2030 commitment. Thin profile by design — the buyer's silence beyond the release is itself characterizing.

Dan Eggers — EVP & CFO, Constellation (as of the calls). The capex voice (\$1.6B including fuel); the stack's named accountant.

Mac McFarland — President & CEO, Talen Energy (as of March 2024 and June 2025). The Escape Artist's executive: sold the campus (\$650M), defended the ISA, then restructured around the rejection into \$18B of notional front-of-meter revenue. Documented statements at both deal dates.

Christopher M. Crane (1958–April 2024) — retired Exelon CEO; INPO-formed operator-executive; NEI and WANO boards. Died five months before his name entered a federal docket as a facility title. Profile handled with the respect the record supports; the Symbol Audit's procurement lens is aimed at the *rename mechanics*, never at the man.

Eric Epstein — Three Mile Island Alert (founded 1977); the record's most durable local watchdog. Three dated verbatims spanning the arc (market-decided, September 2024; Pep Boys, March 2025; boogeyman, February 2026). Wants: no restart; failing that, scrutiny. Can enforce: attention.

Willie Phillips / Mark Christie — the 2–1's two poles (then-Chairman convention mandatory for Phillips post-chairmanship). Phillips: the national-security dissent. Christie: the consumer-cost concurrence. Between them, the entire collision personified in two government-speech documents.

Chris Wright — Secretary of Energy (from February 2025; title convention: Secretary only from that date forward). The federal seller: the win-the-AI-race framing on the loan close; the Fox segment inside TMI. Documented at Timelines 60, 65.

Josh Shapiro — Governor of Pennsylvania; present at the announcement (statement) and the June 2025 celebration; his January 2025 PJM capacity settlement is L7's and stays fenced. The state-level politician of the three-level set, on the record at milestones only.

Scott Burnell — NRC public-affairs voice across the meeting record: the water-level limits statement (August 2025) and the transparency statement (February 2026) — the agency's documented register: procedural, unpromising, precise.

The three main power transformers — the lecture's L5-native object: contracted February 2025, \$35M transport line, 2026 delivery, American rigging crews specified in the company's own release. Bought, not queued — the distinction from L4's treatment.

Institutions with incentives on the record: Constellation (merchant fleet → contracted-revenue conversion); Talen (IPP, no captive ratepayers — the freedom that started the fight); PJM (returning, L4 lead — here as RRI fast-lane operator and ordered tariff-builder); the NRC (pacing authority; transparency statements via Burnell on the record); DOE's LPO under Wright (energy-dominance framing, first concurrent commit-and-close); AEP & Exelon (protesting utilities — free-ridership theory's authors); Meta's RFP apparatus (procurement-izing reactors); Holtec at Palisades (the template, growing a cautionary tail).

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

Inherits (from L4): the seven-year line. Fresh specifics for the inheritance, so the seam doesn't replay L4: Crane's RRI selection (May 2, 2025 — 51 projects, >9,300 MW) is the documented moment the workaround lecture's centerpiece *used* a queue mechanism L4 built; the inheritance is cashed in one clause, not re-derived. Queue anatomy, interconnection-agreement anatomy, transformer lead times generally, and the 49 GW figure: **not rebuilt** — L4's Section 5 pre-allocations referenced where needed (Beats 3, 9).

Binds at: the meter and the milestone. The lecture's two native grains, held throughout: billing topology (Beat 3) and restart pacing (Beat 11).

Who pays: contested — the docket is the fight. Held genuinely open at the stamp; the paper hearing is the live edge (Section 11).

Manufactures (→ L6): who financed the workaround. Handoff primary, per Syllabus 2.0: *cost left unassigned* — somebody owns all this compute and financed it with something (Beat 12 rider, drafted). Alternates for markup, both record-grounded: (a) the DOE loan's full-recourse chain — public credit priced on private balance sheets, walking into L6's leverage terrain; (b) Talen's contracted-margins language — a PPA functioning as a financing instrument, the exact device L6 anatomizes at neocloud scale. Rotation verified: L4 question · L5 cost-unassigned · L6 bill-walking — no adjacent repeats.

Returning-character grain check. The interconnection agreement returns at contract-term grain only (the ISA ceiling as a clause; Article 4 as a pointer) — never re-anatomized. PJM returns as two named mechanisms (RRI lane; ordered tariff-builder) — never re-introduced as an institution. The Roster's return-grade discipline is satisfied if the draft can delete every returning-character sentence and the lecture still stands; the pack was assembled to that test.

Handoff refresh-safety. The cost-left-unassigned rider survives every volatile figure in the lecture: it references no tally, no price, and no date — only the structural fact that the compute has owners and financiers, which is true in every edition. Verified refresh-safe.

Fences held (consistency ledger). Memphis/xAI: two fence-posts, one clause each (Timeline 63; Beat 3 rung one) — L8's. "Winning the Race": one dated line (Beat 8) — detonates L8. \$4.3B/Shapiro/Bowring, auction economics, IMM 40%: L7 seeds at one line each (Timeline 39, 62, 67). Neocloud finance, Oklo-as-company, founder terrain: L6/L9 — named only inside stage-label inventories. Orbital: untouched. Refresh-safe check: every volatile figure carries an as-of; the As-Of Stamp armors the closer; the 2027 target is always the company's.

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

Live proceedings at the stamp (July 21, 2026). EL25-49 paper hearing: briefs closed April 17, 2026; order pending — **the pack's most decay-exposed edge; any FERC rate decision partially rewrites Beats 8–10's open-question posture.** NRC Crane track: EA comments closed July 8 (thirteen days pre-stamp); final EA/FONSI pending; amendment action from March 2027 per agency schedule. PA DEP: NPDES comments closed May 18; §401 certification pending — a state-clock dependency on the federal critical path. Fifth Circuit: Talen petition pending, largely mooted.

Last-90-days items (highest volatility). Eddystone CIR approval (June 1); draft EA/FONSI (June 3–8); Walmart agreement (June 23); NY renewals (June 26). Verify all four for supersession at draft.

Unconfirmed at the stamp. Spring 2026 Susquehanna reconfiguration completion (front-of-meter transition mechanism) — expected, not confirmed; verify before any present-tense use. The ~March 2026 residual FERC affirmance date — single-source.

Watch items with dates. Palisades: refurbishment complete, fuel on site, no firm restart date — if it starts before the L5 draft records, the nearest-restart framing in Beat 12 updates. Meta-Vistra purchases: begin late 2026. Second ILT class: results land 2026–27. Tracker refresh: the 13/9.8 figures are monthly-volatile; the stamp construction absorbs this by design.

Verify-at-draft checklist (consolidated from flags above and throughout). (1) EL25-49 paper-hearing order — issued or pending. (2) Final Crane EA/FONSI — issued or pending. (3) §401 certification status. (4) Palisades — restarted or not. (5) Spring 2026 Susquehanna reconfiguration — confirmed complete or not. (6) The ~March 2026 residual affirmance date — second source. (7) Tracker refresh — restamp the tally. (8) Staffing figure — current with as-of date. (9) Cleveland-Cliffs-class supplier statuses: none carried in this pack; no action. (10) Any Fifth Circuit disposition.

Decay register (tier: Mid, confirmed). Refreshes on edition update: tallies, staffing, docket postures, loan disbursements. Doesn't refresh: the procurement frame, the billing-topology sort, the vote arc, the five-year snap, the stage-label method. The lecture's spine is decay-proof; its garnish is dated.

SECTION 12: SOURCE INVENTORY

Primary-first; seller documents flagged; secondary renderings noted. Numbered for draft-stage citation pulls.

1. Constellation–Microsoft joint announcement, Sept 20, 2024 (constellationenergy.com) — seller document.
2. Constellation investor call, Sept 20, 2024 (webcast/company IR) — Dominguez symbol quote; Eggers capex.
3. Constellation Q3 2024 earnings call, Nov 4, 2024 — primary: company webcast; secondary rendering: Motley Fool transcript.
4. Constellation Form 10-Q, Q3 2024 (SEC EDGAR) — the PPA's authorized public description.
5. Jefferies note, Sept 23, 2024 (via trade coverage) — price reconstruction; analyst-vantage flag.
6. BMO Capital note, Sept 24, 2024 (via trade coverage) — alternative reconstruction.
7. Brattle Group study for PA Building & Construction Trades Council, Sept 2024 — commissioned; flag every use.
8. FERC Docket ER24-2172: order rejecting amended ISA, Nov 1, 2024 (incl. Christie concurrence, Phillips dissent); Dec 2024 rehearing denial — public domain.
9. FERC Docket AD24-5: co-location technical conference record, Nov 2024.
10. FERC Docket EL25-49: Show Cause Order, Feb 20, 2025 (190 FERC ¶ 61,115); Order on Show Cause, Dec 18, 2025 (193 FERC ¶ 61,217) + fact sheet — public domain; the pack's verbatim well.
11. AEP/Exelon protest filings, ER24-2172, Jun–Jul 2024.
12. Talen–AWS campus sale materials, Mar 1–4, 2024: Talen release, investor deck, S-1 lineage — seller documents.
13. Talen–AWS expanded PPA release + deck, Jun 11, 2025 — seller; notional-revenue flag.
14. Talen v. FERC, Fifth Circuit petition, Jan 16, 2025 (docket record).
15. NRC Docket 50-289 (DPR-50): rename LAR Jan 13, 2025; fuel-receipt LAR Jun 27, 2025 (accepted Aug 7); DTF exemption rescission request Jul 31, 2025; Environmental Report Oct 31, 2025; RAI Nov 19, 2025 + response Jan 29, 2026; Federal Register notice Feb 23–24, 2026; draft EA/FONSI Jun 3–8, 2026 — public domain.
16. Steam generator inspection report (spring 2024), as filed with NRC — the Gesture's inch.
17. 10 CFR 50.82(a)(1)–(2); Exelon cessation certification Jun 20, 2017; fuel-removal certification Sept 26, 2019.
18. Metropolitan Edison Co. v. PANE, 460 U.S. 766 (Apr 19, 1983) — public domain.
19. Constellation progress releases: Feb 19, 2025 (transformers, \$35M, hiring); Jun 25–26, 2025 (64%/~400 FTE); Sept

- 2025 one-year (80%/500+) — seller documents, as-of dates mandatory.
20. DOE LPO: Crane \$1B loan close, Nov 18, 2025 (incl. Wright statement); Palisades \$1.52B guarantee (Sept 2024) and disbursement record through Sept 16, 2025.
 21. PJM: RRI approval Feb 11, 2025 (FERC order); RRI selections May 2, 2025 (51 projects/>9,300 MW); Eddystone CIR waiver filing Mar 31, 2026, FERC approval Jun 1, 2026; Dec 2025 auction result (L7-fenced).
 22. NRC/community meeting coverage: Pennsylvania Capital-Star (Feb 19, 2026 — Fulton, Epstein, Burnell); StateImpact PA / regional coverage (Mar 2025 — Epstein, Gunter, Amish/Mennonite concerns); NRC virtual forum record (Aug 6, 2025 — Drechsler, Burnell) — testimony verbatims.
 23. Epstein state-capitol event coverage, Sept 3, 2024 — the market-decided quote.
 24. 2019 shutdown coverage (regional press, Sept 20, 2019) — Fasick quote; tombstones description; workforce/payroll figures.
 25. Google-Kairos MPDA release, Oct 14, 2024 (Terrell, Laufer statements) — seller.
 26. Amazon triple announcement, Oct 16, 2024 (X-energy Series C-1; Energy Northwest; Dominion MOU) — seller.
 27. Meta nuclear RFP, Dec 3, 2024; Meta-Constellation Clinton PPA, Jun 3, 2025 (Parekh statement); Meta-Oklo/Vistra/TerraPower announcements, Jan 9, 2026 (Kaplan, Burke statements) — seller documents; stage labels from the releases' own nouns.
 28. Google-Elementl announcement, May 9, 2025 — seller.
 29. NextEra Duane Arnold FERC waiver, Aug 2025 (trade coverage; date-precision flag noted in research).
 30. Holtec Palisades record: NRC approvals Jul 2025; certification rescissions Aug 25, 2025; schedule updates through Jul 2026; SMR-300 permit Part 1 + \$400M DOE grant, Dec 31, 2025.
 31. SMR Intel tracker, May 2026 — the 13/9.8+ GW tally; trade-tally motive flag.
 32. Bloomberg TV, Oct 15, 2025 — Deep Fission 12.5 GW nonbinding; Muller quote.
 33. Fox News segment, Dec 19, 2025 — Dominguez/Wright at TMI.
 34. Constellation-GSA arrangement, Jan 2025; Constellation-Walmart agreement, Jun 23, 2026; NY license-renewal applications, Jun 26, 2026 — periphery.
 35. White House, *Winning the Race: America's AI Action Plan*, Jul 2025 — one-line L5 use; L8's document.
 36. Trade/technical press of record for dates and secondary renderings: World Nuclear News, ANS Nuclear Newswire, NucNet, Utility Dive, RTO Insider — each use secondary-flagged where it stands alone (notably the ~Mar 2026 affirmation date).

Access paths for draft-stage pulls. FERC items: eLibrary by docket number (ER24-2172, AD24-5, EL25-49). NRC items: ADAMS by docket 50-289 / license DPR-50. Securities items: SEC EDGAR, ticker CEG. Federal Register items: by publication date. Meeting-coverage verbatims: the covering outlet's archive, attribution to the outlet on use.

Inventory discipline note. Every verbatim in this pack traces to a numbered source above; government-speech items (8–10, 15, 17–18, 21, 35) are public domain and quotable at length at draft stage; corporate and analyst language stays inside the one-quote-per-source, under-fifteen-words discipline already applied throughout.

— *End of Research Pack 1.0, Lecture 5. RESEARCH AS OF 21 July 2026.*

Lecture 6 — The Neoclouds

Research Pack 1.0 · source file L6_Research_Pack_1_0_COMPLETE.md · research as of 21 July 2026

THE ASSEMBLED LECTURE IDENTITY

Title: Lecture 6 — The Neoclouds.

Frame & through-line (Syllabus 2.0, carried from 1.0): A power-arbitrage business wearing a cloud costume. The core insight stated early: this is a time-arbitrage on electricity.

Register: Ledger leads. High-decay lecture: every figure carries its date; the Handoffs into and out of this lecture hinge on the structural arbitrage, never the numbers. Cascade position: the financing answer to Lecture 5's cost-left-unassigned, manufacturing Lecture 7's who-pays.

Cascade edge (Syllabus 2.0 format): Inherits: the financed workaround. · Binds at: the depreciation schedule. · Who pays: the bondholder if the schedule is wrong — and, next hour, the ratepayer either way. · Manufactures: who actually pays for the shared grid → L7.

Strawman beat plan (12, running order, STRAWMAN FOR MARKUP — the count is fixed; selection and order are not):

1. **Cold Open on an Object [O]** — an H100 in a cage: a depreciating asset wearing a collateral costume. (Opener rotation verified: Cold Open opens 2, 4, and 6 — three distinct objects, and 2 and 4 are separated by 3's Bill Arrives; L5 opened Hearing Room, L7 opens Bill Arrives — no adjacent repeats.)
2. **The Founder Audit** — *Intrator* — the mythology told straight, audited against the March 2025 IPO; the gas-trader biography as the tell.
3. **The Paper Trail — class: securities filing** — the CoreWeave S-1 undressing the pitch deck. (Class rotation verified: state audit 1 · tech spec 2 · permit 3 · queue instrument 4 · contract 5 · **securities filing 6** · tariff docket 7 · executive doc 8 · regulatory application 9 · accounting policy 10.) *Note the strawman's own annotation: "Mechanism-free by design" — the Paper Trail sits where a Mechanism Autopsy would; the arbitrage mechanics live in Beats 4 and 9.*
4. **Follow the Money** — the reference capital structure: 4.8x D/E, GPU-collateralized debt, \$34B off-balance-sheet through 2028.
5. **Taxonomy by Business Model** — the landscape by arbitrage type, not logo: Nebius, Crusoe, Lambda, Voltage Park. (Cap verified: Taxonomy casting 2 of 3 — L3 cooling vendors · **L6 neoclouds** · L9 orbital players.)
6. **The Deal** — Microsoft's \$60B+ committed to nominal competitors; Nadella and Hood's "capacity constrained" as the buyer's motive on tape.
7. **The Hearing Room** — the earnings-call record where the constraint was admitted — transcript only. (Only scene beat; max-1-scene satisfied by construction.)
8. **The Forecast Problem** — GPU spot-price curves and ABS rating assumptions as forecasts with owners.
9. **The Bottleneck** — energized capacity as the moat: 3–5 years for a hyperscaler campus vs. 6–18 months for a neocloud that locked power early.
10. **The Perverse Incentive** — the circularity: NVIDIA investing in customers who buy NVIDIA GPUs with debt collateralized by NVIDIA GPUs.
11. **The Steelman** — *defendant: the neocloud CFO's depreciation schedule*. (Rotation verified: L1 county · L4 PJM's queue · L5 BTM customer · **L6 neocloud CFO** · L7 Dominion · L8 White House · L9 orbital case · L10 hyperscaler capex — no party twice.)
12. **The Externality Swap [C]** — own-and-wait vs. rent-now: 3–5 years and you own it, 6–18 months and you rent it — both sides priced, which is why the \$60B exists. Carries the As-Of, the Kicker, and the Handoff rider.

Handoff (rides outside the count): *the bill walking* — the money is private, but the grid is shared; the bill leaves the boardroom for a mailbox in Manassas. (Rotation verified: L5 cost unassigned · **L6 the bill walking** · L7 question — no identical adjacent mechanisms. **Pack flag on the Manassas mailbox, Section 10:** the City of Manassas is served by a

municipal electric utility, not Dominion — verify service territory before the rider names the town, or move the mailbox one jurisdiction over.)

Negative space (strawman leaves out — Section 3 scans each): The Bill Arrives · The Wrong Map · Mechanism Autopsy · Hearing Room as opener · The Physics Audit · The Regulatory Collision · The County · The Neighbor · The Symbol Audit · Operator Reality. (Irreversibility Ledger: zero mid-course by plan.)

Cast (Roster 1.0, verified):

- *Human (anchor):* **Michael Intrator** — co-founder, Chairman, Chief Executive Officer and President of CoreWeave since September 2017 (title verified in role as of research date, company governance page and February 2026 Form 4). Before CoreWeave: co-founder and CEO of Hudson Ridge Asset Management LLC, a natural gas hedge fund, January 2013–January 2018; before and overlapping that, Natsource Asset Management, September 1998–July 2014, rising to Principal Portfolio Manager over global environmental markets and Kyoto-era carbon transactions. The man traded power before he traded compute. Lead: 6.
- *Document (anchor):* **The CoreWeave S-1** — filed publicly March 3, 2025 (SEC, CIK 1769628); the securities filing that undressed the pitch deck. **Pack finding flagged up front:** the depreciation policy note’s exact filed sentence was not independently retrieved verbatim in this run (EDGAR page pull flagged for draft stage, Section 4); the policy’s *content* — straight-line, six years, extended from five effective January 1, 2023 — is multiply confirmed, and a verified verbatim alternative from the filed risk-factor language is supplied.
- *Object (anchor):* **The H100 (as collateral)** — carried as confirmed per Syllabus 2.0 Open Item 7. The unit of the pricing spread and the asset that depreciates faster than the liabilities it secures amortize. Full object dossier in Section 2, Beat 1; chain of custody starts at the loading dock (boundary discipline — fabrication is behind the silicon door).
- *Secondaries:* **NVIDIA in its circularity costume** — vendor, investor (5.96% pre-IPO), customer (\$320M paid to CoreWeave through December 31, 2024, per the prospectus), IPO anchor (\$250M at \$40), backstop buyer (\$6.3B order form, September 9, 2025), and collateral (the chips themselves) — including DGX Cloud and the Lambda leaseback · **Satya Nadella and Amy Hood** — “capacity constrained” on tape across five quarters of transcripts (Section 8’s Hearing Room corpus) · **Jed McCaleb’s Voltage Park** — the Founder Audit contrast case · **the rating agencies’ data-center ABS criteria** — Moody’s (February 6, 2025), S&P (April 23, 2025), Fitch (exposure draft July 24, 2025), KBRA (January 9, 2026) · **Nitin Agrawal**, Chief Financial Officer, CoreWeave (title verified at February 26, 2026 earnings release) — the Steelman’s defendant made flesh · **Jim Chanos** — the documented public critic *available to this lecture* (his August 12, 2025 arithmetic), which keeps Burry entirely in Lecture 10 per Open Item 4.
- *Returning characters (return-grade only, no re-introduction):* **NVIDIA’s rack roadmap** (lead L2 — returns here only as the cadence that compresses the collateral’s economic life; L2’s pack pre-planted the circularity line: NVIDIA’s \$18.6B of single-quarter private-company investments, filed May 20, 2026, “owned by Lecture 6”) · **the interconnection agreement** (lead L4 — one-line presence only: the thing the neocloud’s early power position routed around) · **CoreWeave itself is the lead treatment here;** Lecture 10 takes the return (the \$311M interest-expense payoff is L10’s must-hit anchor — see boundary discipline, Section 10).

Must-hit anchors (Syllabus 1.0 values, verbatim, governing): 3–5 yr vs. 6–18 month standup; Microsoft \$60B+; CoreWeave 4.8x D/E, GPU-collateralized debt, \$34B OBS leases through 2028; \$2.95–3.99 vs. \$6.88–11.01/GPU-hr; depreciation as thesis risk; March 2025 IPO.

Moves plan (as assigned, all seven, with pack-verification flags):

- *Step Function:* the pricing spread — the number that breaks “the hyperscalers are the efficient ones.” **Verified with one mandatory caveat (Section 4): CoreWeave’s own on-demand list price is the sector’s exception.**
- *Unit Conversion:* \$34B off-balance-sheet → candidate held for packs — **hard gate per Open Item 11. Arithmetic shown in Section 4; verdict: PASS on the recommended candidate (\$34B $\approx$ 1.5 $\times$ CoreWeave’s own \$23B fully diluted IPO valuation — the obligations exceeded the company).**
- *Timeline Snap:* March 2025 — the IPO that put the structure on the public record. **Verified; two candidate days supplied (March 3 disclosure vs. March 28 listing), with the incentive states on each side documented.**
- *Verbatim:* the S-1’s depreciation policy note. **Existence gate: PARTIAL — exact policy-note sentence not retrieved verbatim this run; flat status and the verified alternative (filed risk-factor language) supplied in Section 4 per the L5 convention.**
- *As-Of Stamp:* the GPU-hour pricing (2026). **Verified with current readings and index citations.**

- *Kicker*: the collateral depreciates faster than the liabilities amortize. **Verified and armed — and the record has sharpened it: as of H1 2026 the company's average debt tenor (~5.9 years) sits just inside its own six-year equipment life. Section 4.**
- *Gesture*: candidate for the training-run door (what the collateral is actually computing) — **pending the third-door call (Open Item 9). One-inch material supplied in Section 4, deployable only if Nick opens the door; nothing researched beyond it.**

Overclaim & narrator move assignments: Seller on the field: **the Neocloud Founder** — the pitch deck vs. the S-1; the gap is where this course's deadpan lives. Governing move: **GRANT-AND-WITHHOLD** — the arbitrage is real; the mythology is doing investor-relations work — with the circularity critique given its full steelman rather than a sneer. Section 7 pressure-tests the calibration and covers the rest of the field (the Hyperscaler as buyer, the vendor, the Doomer/short-seller direction).

Decay tier: High — refresh priority 1 with Lectures 9 and 10. Every figure below carries its date. The Handoffs into and out of this lecture hinge on the structural arbitrage (compute has owners and financiers; the grid is shared), never on a number.

Human-floor flags: This lecture's strawman carries no Neighbor, no County, no Operator Reality — the machine touches households only at the Handoff seam, where the bill walks toward a residential mailbox. **Comedy drops to near-zero in the rider's final sentences.** One additional standing flag: the 881 employees (end-2024, prospectus) and the data-center technicians surged between sites (Intrator, February 26, 2026) are workers inside a leverage structure being publicly audited; if the drafting touches them, the thermostat drops there too.

Pack dependencies (the debts, each resolved or failed below):

1. **Open Item 7** — Object slot confirmed as the H100-as-collateral → full object dossier delivered (Section 2, Beat 1). **RESOLVED.**
2. **Open Item 11** — the \$34B Unit Conversion must clear arithmetically at pack stage → arithmetic shown, PASS with recommended candidate (Section 4). **RESOLVED.**
3. **Open Item 9** — three training-run-door Gesture candidates ride on Nick's third-door call (L1, L6, L8) → one-inch material supplied, deployment held pending the call (Section 4). **RESOLVED-CONDITIONAL.**
4. **Open Item 4** — Burry cast in L10 so Intrator stays uncrowded → this pack keeps Burry to a single dated line and supplies **Chanos** as L6's documented critic instead (Sections 2, 7). **RESOLVED.**
5. **Roster debts** — Intrator verbatim with context; the S-1's policy language; Nadella and Hood "capacity constrained" on tape with dates; as-of titles → delivered in Sections 2, 4, 8, 9; one honest **PARTIAL** on the policy-note sentence (Section 4). **RESOLVED / 1 PARTIAL.**
6. **New pack finding, flagged for markup:** the Handoff's "mailbox in Manassas" has a service-territory problem (municipal utility, not Dominion) — Section 10. **DELIVERED AS FINDING.**

RESEARCH AS OF 21 July 2026

SECTION 1: TIMELINE OF THE CONSTRAINT

The constraint machine this lecture assembles: cheap-money-plus-locked-power meeting expensive-chips-plus-short-lives. Entries carry day/month/year where the record supplies it. Stage labels per the cardinal rule.

1. **September 1998** — Michael Intrator joins Natsource Asset Management, where he will rise to Principal Portfolio Manager over global environmental markets and energy products; the firm's peak AUM and commitments exceed \$1.2 billion (company bio; The Org). Why it matters: the thesis's biography begins in traded power and traded paper.
2. **May 2007** — Brian Venturo joins Natsource as Portfolio Manager — Energy and Emissions (governance disclosures via secondary compilation). The founding trio's common room is a commodities desk.
3. **January 2013** — Intrator co-founds **Hudson Ridge Asset Management LLC**, a fundamental, systematic natural gas hedge fund, as CEO; Venturo is a partner (CoreWeave governance bio — the company's own words: "a natural gas hedge fund"). Runs to January 2018 — overlapping CoreWeave's founding by four months.
4. **2016** — Intrator, Venturo, and Brannin McBee become interested in Bitcoin "after using the token to bet on sports" (Bloomberg Billionaires profile — paraphrase of Bloomberg's account, single-narrative origin detail, mythology-adjacent).

5. **September 2017** — **Atlantic Crypto Corporation** founded; Intrator is Chairman, CEO, and President from inception (governance bio). Business: Ethereum mining on NVIDIA GPUs. Location: New Jersey.
6. **October 2017** — Venturo becomes CTO (serves to March 2024, then Chief Strategy Officer).
7. **2018** — **Crusoe Energy Systems** founded in Denver by Chase Lochmiller and Cully Cavness: flared oil-field gas → electricity → co-located modular data centers (“Digital Flare Mitigation”). A second power-first origin story, filed for Beat 5.
8. **2012 (context entry)** — **Lambda** founded by twin brothers Stephen and Michael Balaban; begins in ML software, sells GPU workstations, later pivots to GPU cloud (TSG Invest profile). The one taxonomy specimen that predates both crypto and the boom.
9. **2019** — Crypto markets crash; Atlantic Crypto renames to **CoreWeave** and buys GPUs from struggling competitors (Bloomberg profile). The first documented buy-the-distressed-asset move — a commodities-desk reflex executed in silicon.
10. **14 May 2020** — (Return, owned by L2:) A100 announced. Matters here only as the fleet vintage Intrator will cite in his 2025–26 depreciation defense.
11. **15 September 2022** — The Ethereum Merge ends proof-of-work Ethereum, stranding GPU-mining economics industry-wide. CoreWeave has already pivoted toward GPU cloud; the Merge converts the pivot from choice to survivorship. [Date ANCHOR; CoreWeave-specific consequences STRUCTURAL, via company history compilations.]
12. **2022 (FY)** — CoreWeave revenue: **\$15.8–16M** (S-1 via CNBC/procurement analyses). The base of the 12,000% two-year climb.
13. **November 2022** — ChatGPT launches, built on A100s (Cheah/Latent Space). Demand arrives before the H100 does.
14. **1 January 2023** — **CoreWeave extends the estimated useful life of its technology equipment from five years to six**, effective this date (S-1 disclosure, multiply reported: Motley Fool 11 Nov 2025; Cape Fear Advisors, July 2026). The single most load-bearing accounting date in this lecture. Two years pre-IPO.
15. **February 2023** — **Microsoft–CoreWeave Master Services Agreement signed** (per CoreWeave filings via later 10-K annotation) — the contract that will still carry pre-IPO pricing into 2026, when Microsoft is 67% of revenue.
16. **March 2023** — H100s reach the market in volume (Cheah); CoreWeave’s HGX H100 clusters go live, announced at GTC, serving clients including Anlatan/NovelAI (Series B release).
17. **10 April 2023** — **NVIDIA and CoreWeave sign their Master Services Agreement** — the MSA under which the 2025 backstop order form will later be written. [Date from CoreWeave’s own 8-K of 15 September 2025 — a 2023 date disclosed in 2025.]
18. **20 April 2023** — **Series B: \$221M** led by Magnetar Capital (\$111M), with NVIDIA, Nat Friedman, and Daniel Gross splitting the remainder; ~\$2B pre-money; total raised to date \$371M (TechCrunch; company release). NVIDIA’s investor costume goes on.
19. **April 2023** — A separate **\$420M primary led by Magnetar** (referenced in the May 2024 Series C release); the “Series B” is later described in company materials as \$421M total.
20. **June 2023** — CoreWeave and NVIDIA post the MLPerf GPT-3 175B training record: under 11 minutes, 29x faster than the next competitor (company release). Marketing artifact and capability proof in one.
21. **July 2023** — **Plano, Texas data center announced: \$1.6B**, 450,000+ sq ft, ~30 MW (company release; IndexBox). The reference facility later cited in the debt coverage.
22. **July 2023** — CoreWeave Compute Acquisition Co. structure appears in the financing record (10-K annotation via MTS) — the SPV scaffolding of GPU-secured lending.
23. **3 August 2023** — **DDTL 1.0: \$2.3 billion** delayed-draw term loan led by Magnetar and Blackstone Tactical Opportunities, with Coatue, DigitalBridge Credit, BlackRock, PIMCO, Carlyle (company/Blackstone releases). Collateral: GPUs and customer contracts. Widely described as the first GPU-collateralized facility at scale. **Effective annual interest rate: 14.12% (2023), 14.11% (2024)** (S-1 figures via Where’s Your Ed At analysis). Fully drawn by S-1 date.
24. **October 2023** — **Voltage Park launches**: 501(c)(3)-owned GPU cloud funded by Jed McCaleb’s Navigation Fund; ~24,000 H100 SXM5s, ~\$500M (Reuters via TechCrunch/DCD; Forbes later says a \$900M grant — conflict noted, Section 9). The anti-capital-structure specimen.
25. **2023 (FY)** — CoreWeave revenue **\$228.9M**; capex **~\$3.1B** (S-1). Data centers: 3 → 14 in one year. Microsoft: \$81M, 35% of revenue (S-1 via Lockwood compilation).
26. **December 2023** — **\$642M secondary** closes (Series C release reference). Early liquidity for early money.

27. **February 2024** — Yandex N.V. agrees to sell its Russian assets; deal closes **July 2024** at ~\$5.4B; the remainder — Finnish data center, cloud platform, international teams — becomes **Nebius Group** (TechTimes profile). A neocloud created by geopolitical amputation.
28. **March 2024** — Venturo moves from CTO to Chief Strategy Officer.
29. **1 May 2024** — **Series C: \$1.1B** led by Coatue, with Magnetar, Altimeter, Fidelity, Lykos; valuation **\$19B** (PRNewswire; widely reported valuation). Philippe Laffont on the record for Coatue.
30. **17 May 2024** — **DDTL 2.0: \$7.5 billion** led by Blackstone with Magnetar co-lead and Coatue — “one of the largest private financings in history” per the release; secured by GPUs and customer contracts; investment-grade and speculative-grade tranches; **variable rate averaging ~11%; repayments begin January 2026** (Blackstone release; Quinn Emanuel client alert, March 2026). The moment private credit fully arrives.
31. **June 2024** — CoreWeave makes an unsolicited ~\$1B (\$5.75/share) offer for **Core Scientific** — a bitcoin miner that entered Chapter 11 in December 2022 and emerged January 2024; rejected. Core Scientific instead signs 12-year AI hosting contracts with CoreWeave (contract series later totaling ~\$10.2B — Diligence Stack, April 2026). [The 2001-rhyme adjacency — a bankruptcy estate becoming AI real estate — is noted and **left for L10.**]
32. **October 2024** — **\$650M secondary** at ~\$23B valuation; buyers include Jane Street, JPMorgan Asset Management, G42-affiliated capital (matrixbcg compilation; widely reported).
33. **October 2024** — SemiAnalysis publishes its **AI Neocloud Playbook and Anatomy** — the analyst document that consolidates the category’s name and economics (SemiAnalysis; the term “neocloud” is attributed in later trade coverage to SemiAnalysis and McKinsey research).
34. **11 October 2024** — Eugene Cheah publishes “**\$2 H100s: How the GPU Rental Bubble Burst**” (Latent Space): 2023 prices above \$4.70 (peak ~\$8); early 2024 ~\$2.85 across providers; break-even math — below **\$1.65/hr** the hardware never recoups; above **\$2.85/hr** to beat stock-market IRR. The Forecast Problem’s founding text.
35. **17–18 November 2024** — (Return, owned by L2:) first GB200 NVL72 racks ship, Dell → CoreWeave.
36. **December 2024** — **Crusoe Series D: \$600M at \$2.8B**, led by Founders Fund, NVIDIA participating, at \$29.17184/share (Sacra). NVIDIA’s investor costume, second fitting.
37. **December 2024** — **Nebius \$700M private placement** — Accel, Orbis, and NVIDIA (AI Business/Ren compilation). Third fitting.
38. **31 December 2024** — CoreWeave year-end: revenue **\$1.92B (+737%)**; net loss **\$863.4M**; Q4 revenue \$747.4M at ~76% gross margin, operating income \$112.7M, Q4 net loss \$51.4M “due to interest expenses”; debt approaching **\$8B**; **32 data centers, 250,000+ GPUs; 881 employees**; NVIDIA has paid CoreWeave **\$320M** as a customer; RPO **\$15.1B** (S-1 via CNBC, 3 March 2025; prospectus details via CNBC IPO coverage).
39. **21 January 2025** — **Stargate announced at the White House** (\$100B initial / up to \$500B, OpenAI–Oracle–SoftBank). Same day, Microsoft discloses the partnership change: exclusivity ends; **Microsoft moves to a right of first refusal** on new OpenAI capacity (Microsoft blog via CNBC/DCD). The date the buyer’s leash lengthened. [Stargate itself is **L8’s Symbol Audit** — this timeline carries only the ROFR consequence.]
40. **February 2025** — TD Cowen analyst notes report Microsoft canceling data-center leases; Microsoft strongly refutes; markets convulse (Semafor; Computer Weekly). Nadella on CNBC: “We’re good for our \$80 billion.” [7 words, verbatim, CNBC via Semafor, Feb–Mar 2025.]
41. **February 2025** — **Lambda Series D: \$480M** at ~\$2.5B, NVIDIA among investors (TSG Invest; Fahey compilation).
42. **6 February 2025** — **Moody’s publishes its Data Center Securitizations rating methodology** — Monte Carlo tenant-default simulation; five asset-quality groups (CRA/CREFC primers). The paper that decides what GPU cash flow is worth.
43. **3 March 2025** — **The S-1 goes public**. Nasdaq ticker CRWV; initial aim: raise \$3B+ at a valuation above \$35B (procurement analyses; CNBC). The structure enters the record: 77% of revenue from two customers; Microsoft 62%; “Customer C” unnamed; six-year useful life; the DDTLs; the leases.
44. **5–6 March 2025** — **The Financial Times** (Kinder, Morris, Uddin, Gara) reports Microsoft has “walked away from some of its commitments” with CoreWeave over delivery issues and missed deadlines; **CoreWeave disputes the characterization** (FT via TipRanks/The Fly; Semafor). Conflict stated, not smoothed — Section 2, Beat 6.
45. **10 March 2025** — **OpenAI–CoreWeave: up to \$11.9B over five years**, with OpenAI taking a **\$350M** equity position via private placement at the IPO (company release; Benzinga; Stanford CodeX). Semafor (20 March): Microsoft held a ~\$12B option on that capacity and deferred; OpenAI took it.
46. **20 March 2025** — S-1/A prices the range: **\$47–\$55**, ~49M shares, ~\$2.5B target (CNBC).
47. **25 March 2025** — **Crusoe sells its entire bitcoin-mining and Digital Flare Mitigation business to NYDIG:**

- 425+ modular data centers, ~250–270 MW across seven states and Argentina, ~135 employees transfer; Crusoe becomes a major equity holder in the combined entity and rebrands around AI (“the AI factory company”) (CNBC; Architect Partners; Contrary). The origin story sold to fund the pivot.
48. **27 March 2025 — IPO priced at \$40** — below range; offering cut to 37.5M shares (36.59M primary + 910k secondary); ~\$1.5B raised; ~\$23B fully diluted (Reuters calc); **NVIDIA anchors with a \$250M order at \$40** (CNBC; Reuters; company release). Pre-IPO: NVIDIA holds 17.9M shares, **5.96%**; Intrator controls **38% of voting power** (CNBC; Forbes-family reporting).
 49. **28 March 2025** — First trade: opens \$39, closes \$40 flat. Biggest US tech IPO since 2021; first pure-play AI IPO (CNBC). Intrator to CNBC after the bell: calls the NVIDIA relationship “symbiotic.” [1 word quoted; CNBC via iTiger.]
 50. **23 April 2025** — S&P Global publishes “**How We Rate Data Centers Across Public and Private Markets**” (CRA primer citation).
 51. **14 May 2025 — Q1 2025 earnings:** revenue **\$981.6M (+420%)**; adjusted EPS **−\$0.61**; total liabilities ~\$18.8B, debt \$8.7B; **interest expense ~\$264M**, guided \$260–300M next quarter (Seeking Alpha; Zacks via Finviz). Stock reaches \$65.77 within the week; NVIDIA’s stake now 24.2M shares (~\$900M at 31 March) (Forbes via iTiger).
 52. **May 2025** — OpenAI agreement **expanded by up to \$4B** (Intrator to CNBC, per the September release’s own recap).
 53. **May 2025 — High-yield debut: ~\$2B senior notes** (upsized from \$1.5B), coupon in the 9%s, due 2030–31 (Zacks/Finviz; later coverage cites a 9.25% print and a subsequent ~9.0% unsecured print). The public credit market prices the structure for the first time.
 54. **May 2025 — Silicon Data launches the H100 Rental Price Index (SDH100RT)** — the first standardized daily benchmark for the commodity this lecture’s collateral produces (Silicon Data/Carmen Li).
 55. **June 2025 — AWS cuts H100 pricing ~44–45%** (Introl; IntuitionLabs). The hyperscaler tail of the spread compresses.
 56. **19 June 2025** — SDH100RT reads **\$2.36**, down from a \$3.06 high on 1 September 2024 — **−23%** in under a year (Silicon Data).
 57. **30 June 2025** — CoreWeave total debt **\$11.17B** (up from ~\$8B at year-end), plus ~\$3.5B lease liabilities; refinancing wall: \$986M due 2025, \$4.2B due 2026; technology-equipment assets just over **\$13B** (10-Q figures via Level-Headed Investing; Motley Fool). Q2 customer concentration: Customer A (Microsoft) **71%** of revenue.
 58. **3 July 2025** — (Return, owned by L2:) first GB300 NVL72 ships, Dell → CoreWeave, 142 kW rack.
 59. **7 July 2025 — CoreWeave offers ~\$9B all-stock for Core Scientific at \$20.40/share** — a fixed exchange ratio, which becomes the deal’s undoing (deal releases; Two Seas materials).
 60. **24 July 2025 — Fitch publishes its data-center securitization exposure draft;** Fitch has viewed AI-training data centers less favorably than cloud data centers (CRA primer). The rating world’s own stage-label discipline.
 61. **12 August 2025 — Q2 2025 earnings:** revenue **\$1.21B (+207%)**; adjusted EBITDA \$753.2M; backlog **\$30.1B**; FY2025 guidance raised to **\$5.15–5.35B**; capex guided **\$20–23B**; >900 MW active power targeted by year-end (Barchart; Fortune). Same day, **Jim Chanos posts his arithmetic on X:** capital employed averaging \$19.2B in Q2 against \$637M of quarterly D&A-plus-lease-amortization — an implied **7.5-year life** “for predominantly GPU’s” (Chanos, @RealJimChanos, 12 Aug 2025, verbatim in Section 2 Beat 11 bank).
 62. **August 2025** — Lambda establishes a \$275M credit facility (Businesswire, later upsize reference).
 63. **1 September 2024 → mid-2025 (series entry)** — the H100 spot curve’s full arc now on the record: ~\$8 (2023 peak) → \$2.85 (early 2024) → \$3.06 index high (Sept 2024) → \$2.36 (June 2025) → **\$2.00 (9 December 2025)** (Silicon Data series).
 64. **8 September 2025 — Nebius–Microsoft: \$17.4B, expandable to \$19.4B**, five years through 2031 — dedicated GPU capacity from a new ~300 MW data center in **Vineland, New Jersey** (AI Business; TechTimes). Nebius’s first hyperscaler contract.
 65. **9 September 2025 — CoreWeave–NVIDIA order form, initial value \$6.3B**, under the 10 April 2023 MSA: NVIDIA obligated to purchase **residual unsold cloud capacity through 13 April 2032** (CoreWeave 8-K, filed 15 September; SEC Archives). Shares +~8% on disclosure (CNBC).
 66. **25 September 2025 — OpenAI expansion: up to \$6.5B → total ~\$22.4B** (company release; CNBC).
 67. **30 September–1 October 2025 — Meta–CoreWeave: \$14.2B through 14 December 2031**, with an option to expand through 2032 (8-K via Zacks/RCR; stock +11.7% to \$136.85 on 1 October).
 68. **October 2025 — Crusoe Series E: \$1.375B at \$10B+**, co-led by Valor Equity Partners and Mubadala Capital; NVIDIA, Fidelity, T. Rowe Price, Tiger Global, Salesforce Ventures, Founders Fund participate (TSG Invest; Rain-

- maker). Power pipeline >45 GW claimed; Cloud bookings ~5x YoY through three quarters (Sagra).
69. **13–15 October 2025** — (Return, owned by L2:) OCP Summit; CoreWeave, Lambda, Nebius named designing for 800 VDC.
 70. **15 October 2025** — **Microsoft–Nscale: ~\$23B** for ~200,000 GB300 GPUs across the UK, Norway, Portugal, and Texas (SiliconANGLE via Introl) — the largest single neocloud commitment on record.
 71. **17–28 October 2025** — **Two Seas Capital’s campaign** against the Core Scientific sale: SEC-filed presentation (10 October — the exchange ratio “manifestly inadequate” [2-word fragment, Two Seas filing via Stock Titan]); letters citing the drifted deal value (~\$16.40–17.50/share as CRWV fell ~15% while peers tripled); CORZ trading ~12% above deal value for 44 straight days (Stock Titan; Finviz).
 72. **20–21 October 2025** — **ISS recommends AGAINST** (PR Newswire). Intrator to CNBC: the acquisition is a “nice to have, not a need to have” [8 words, CNBC via Coinspeaker]; CoreWeave will not raise its bid.
 73. **29 October 2025** — **Microsoft FY2026 Q1 earnings call**. Amy Hood: “We now expect to be capacity constrained through at least the end of our fiscal year” [14 words, Motley Fool transcript]. Also disclosed: the new OpenAI definitive agreement — OpenAI has contracted an **incremental \$250B of Azure**; quarterly capex \$34.9B, roughly half on short-lived assets (GPUs/CPUs) (transcripts via Motley Fool/AOL). The Hearing Room’s primary candidate.
 74. **30 October 2025** — **Core Scientific shareholders vote the merger down** at the special meeting (SEC; Coinspeaker). Intrator, in the press release: “CoreWeave’s strategy remains unchanged” [5 words]. The hosting relationship survives the failed marriage: ~\$10.2B over 12 years (Diligence Stack, April 2026).
 75. **31 October–1 November 2025** — **BG2 Pod “Halloween special”** (Brad Gerstner, Bill Gurley, with Nadella and Altman). Nadella: “It’s not a supply issue of chips” [7 words] — the fuller passage, paraphrased: the biggest issue is power, not a compute glut; chips are sitting in inventory with no “warm shells” to plug into (DCD; Tom’s Hardware; TechSpot — full locator set in Section 8). Altman’s **\$1.4 trillion** compute-commitment figure circulates from the same conversation (TheStreet).
 76. **3 November 2025** — A single day, three deals: **Microsoft–IREN \$9.7B** (US News via Introl); **Microsoft–Lambda multibillion** (GB300 NVL72s; relationship since 2018 — Balaban on CNBC: “We’re in the middle of probably the largest technology buildout that we’ve ever seen” [13 words]); **OpenAI–Amazon \$38B over seven years** (TechCrunch). The buyer’s-market fiction dies in one news cycle.
 77. **November 2025** — **Bloomberg: Microsoft’s neocloud commitments cross \$60 billion** — roughly doubling from ~\$33B in October; counterparties include Nscale, Nebius, CoreWeave, IREN, Lambda; Microsoft executives describe “land-grab mode” [3 words, Bloomberg via Introl] (Bloomberg via Introl, Cryptopolitan, DCD). **The must-hit anchor’s vintage: November 2025.**
 78. **November 2025** — Michael Burry’s public attack on hyperscaler depreciation — cumulative ~\$176B understatement estimated across the five largest hyperscalers, 2026–28 (Motley Fool recap). **[One line only; owned by Lecture 10.]**
 79. **10 November 2025** — **Q3 2025 earnings**: backlog **\$55.6B** (from \$30.1B); revenue guidance *cut* on construction delays at a third-party data-center developer; **interest expense \$311M vs. \$104M a year earlier** [figure stated here once for the record; **the \$311M moment is L10’s must-hit anchor and its payoff belongs there**]; the **\$34B** in scheduled lease payments commencing through 2028, many on 10+ year terms, re-reported from the August 10-Q (Fortune, 8 and 10 November). Stock –30%+ from mid-August highs.
 80. **14 November 2025** — **Intrator on CNBC**, post-earnings: CoreWeave is being “data driven” [2 words] about GPU shelf life; the 2020-vintage A100 fleet is fully booked; an H100 tranche freed by an expiring contract was immediately re-booked **at 95% of its original price** (CNBC, 14 Nov 2025). The steelman’s evidentiary core.
 81. **November 2025** — **Nebius Q3**: revenue \$146.1M (+355%); net loss \$119.6M; **Meta deal confirmed at \$3B / five years**; ARR target \$7–9B by end-2026 (AI Business).
 82. **November 2025** — **Lambda Series E: \$1.5B+** led by TWG Global with the US Innovative Technology Fund; secondary marks up to ~\$6B; total funding ~\$2.3B; capital earmarked for owned “AI factories” (Fahey; TSG Invest). Kansas City AI factory (24 MW → 100+ MW) announced in October.
 83. **Late November–December 2025** — **\$2B convertible senior notes due 1 December 2031** announced; stock –2.3% to \$86.24 on announcement; **five-year CDS spreads: 368 (6 October) → 643 (mid-November)** (Bloomberg data via MEXC recap); total debt ~\$14B at 30 September; most recent unsecured notes at 9%.
 84. **December 2025** — Lambda reported to have filed confidentially for an IPO (trade reporting; single-sourced — marked as reported).
 85. **9 December 2025 → 6 January 2026** — SDH100RT jumps **\$2.00 → \$2.20 (+10% in four weeks)** — the largest short-term increase since mid-2025, isolated to the H100 (Silicon Data).

86. **Early January 2026 — Intrator and Venturo on the Big Technology Podcast** rebut the depreciation bear case; CRWV +11.9% in a session, lifting Nebius and Oracle (Yahoo Finance; Seeking Alpha, 13 Jan 2026, notes contract-renewal price durability claims and the counterargument on older fleets).
87. **9 January 2026 — KBRA publishes its Data Center ABS Global Rating Methodology** (CREFC primer).
88. **14 January 2026 — Ohio Carpenters' Pension Plan v. Oracle** filed (N.Y. Sup. Ct.): bondholders sue over AI-buildout losses (Reuters via Quinn Emanuel). The financing model meets the courtroom — adjacency noted, not this lecture's story.
89. **January 2026 — Voltage Park merges with Lightning AI** in a ~\$2.5B deal; combined entity claims third-largest neocloud by chips deployed (Forbes, 21 Jan 2026); DDTL 2.0's **repayments begin this month** per its 2024 terms (Quinn Emanuel).
90. **29 January 2026 — Microsoft FY2026 Q2 call:** capex ~\$37.5B (H1 total \$72.4B); Azure +39%; Hood: "demand continues to exceed available supply" [6 words, transcript via AOL]; Morgan Stanley's Keith Weiss puts the ROI question on tape (AOL/Yahoo recaps). Second Hearing Room candidate.
91. **February 2026 — NVIDIA announces a \$2B equity investment in CoreWeave** (earnings-preview reporting, MEXC, 26 Feb 2026 — **single-sourced in this run; verify against the 8-K/13F record at draft stage**). Intrator's economic stake: ~12% per a February 2026 Form 4 (Bloomberg profile).
92. **26 February 2026 — Q4/FY2025 earnings (8-K, SEC):** FY revenue **\$5.13B (+168%)**; Q4 revenue \$1.6B (+110%); FY net loss **\$1.17B**; Q4 net loss \$452M; Q4 adjusted EBITDA \$898M (57%); backlog **\$66.8B** — up \$11.2B sequentially, >4x over the year; **>850 MW active power; 43 data centers; >3.1 GW contracted**; 2026 guidance: revenue \$12–13B, capex **\$30–35B, 1.7 GW active by year-end 2026**, +5 GW beyond contracted by 2030; D&A \$843M (2024) → **\$2.3B (2025)**; Microsoft **67% of 2025 revenue** on the February 2023 MSA; margins to trough in Q1 (SEC 8-K; CNBC; Yahoo call recap; MTS 10-K annotations). Intrator, from the release: "the fastest cloud in history to reach \$5 billion in annual revenue" [11 words].
93. **March 2026 — \$8.5B non-recourse GPU-backed facility — rated A3 (Moody's) / A-low (DBRS)** — reported as the first investment-grade-rated GPU-collateralized deal (AI Consulting Network compilation; Cape Fear's H1-2026 financing inventory). The collateral class gets a credit rating.
94. **16 March 2026 — Nebius–Meta expands to up to ~\$27B / five years** (Nebius 6-K, SEC): **\$12B of dedicated GPU clusters (Vera Rubin platform), deployments in tranches from early 2027**, plus a further order under which **Meta is obligated to purchase unsold capacity** for five years from deployment (6-K text). The NVIDIA-backstop structure, replicated by a hyperscaler. Nebius +14% (CNBC). Meta's 2026 capex guidance in the same coverage: \$115–135B.
95. **March–April 2026 — SemiAnalysis H100 1-Year Rental Price Index: \$1.70 (October 2025) → \$2.35 (March 2026), +~40%**; on-demand capacity described as sold out across GPU types ("The Great GPU Shortage — Rental Capacity," SemiAnalysis, April 2026). The spot curve reverses.
96. **9 April 2026 — Meta–CoreWeave expansion: additional \$21B through December 2032** (8-K), lifting Meta's total to **\$35.2B** and the backlog toward **\$87.8B**, with Meta at **40.1%** of the extended backlog (Next Platform, 9 April 2026).
97. **29 April 2026 — Microsoft FY2026 Q3 call:** quarterly capex to exceed **\$40B**; **~\$190B** total investment this fiscal year; Nadella attributes ~\$25B to component-price inflation; **capacity constrained through 2026** (Fortune, 29–30 April).
98. **May–June 2026 — CoreWeave's H1-2026 financing run completes:** converts and senior notes (April), a syndicated facility (May), dollar and euro senior notes (June); **every instrument matures by October 2032; average tenor ~5.9 years against a stated six-year equipment life**; Q1 technology equipment on the six-year schedule: **\$26.6B**; Q1 capex **\$7.695B** (Cape Fear Advisors, July 2026, from the filings).
99. **7 May 2026 — Q1 2026 earnings:** revenue **\$2.08B (+112%)**; net loss **\$740M** (vs. \$315M); adjusted EPS **–\$1.12**; adjusted EBITDA **~\$1.2B (56%)**; **backlog \$99.4B (+~50% QoQ)** — "strongest bookings quarter in CoreWeave's history" [6 words, company release]; **surpassed 1 GW active power; ~3.5 GW total contracted**; capex guidance raised to **\$31–35B** on component pricing; 2026 exit run-rate **\$18–19B**; 2027 exit ARR **>\$30B, >75% already contracted; \$8.5B of new debt raised in the quarter**; new customers include Cline and Perplexity; **10 clients at ≥\$1B commitments**; stock **–6.6% to –17%** post-print, ~\$132 (SEC/company release; CNBC; Investing.com; call transcript PDF).
100. **18 June 2026 — Nebius touches a record \$298.85** ahead of 22 June Nasdaq-100 inclusion, from a 52-week low near \$44 (TechTimes; Ren).
101. **1 July 2026 — Bloomberg reports Meta is exploring "Meta Compute"** — selling excess AI capacity; **Nebius**

and CoreWeave fall ~15% intraday, IREN ~6% (Trending Topics; 24/7 Wall St.). The customer's costume slips toward competitor. The lecture's thesis-stress event of record as of the stamp.

102. **21 July 2026 (stamp)** — SDH100RT: **\$2.53/GPU-hour** current (Silicon Data index page, checked within a week of the stamp); B200 on-demand ~\$5.18; B300 ~\$9.16 (Apex36/Spheron compilations, mid-2026). Next scheduled event: CoreWeave Q2 2026 earnings, **18 August 2026** (Investing.com).

SECTION 2: STRAWMAN BEAT DOSSIER

Beat 1 — Cold Open on an Object [O] (the H100 in a cage)

Syllabus 2.0 assignment: An H100 in a cage: a depreciating asset wearing a collateral costume. Opens the lecture; must end on a sentence that clearly continues.

Beat Menu definition: *Atoms · opener only.* A physical thing before any framing; sustained by manufacture, cost, lead time, tolerances, failure modes, chain of custody. Comedy engine: hyper-specificity. Small enough to hold in the mind, expensive enough to hurt.

Facts, dates, names, numbers. The object: the NVIDIA H100 Tensor Core GPU, Hopper generation — announced 22 March 2022 (GTC), in market volume by March 2023 (Cheah). Form factors: SXM5 module (~700 W TDP, 80 GB HBM3) and PCIe (~350 W) [vendor specs, STRUCTURAL]. Purchase price: **\$30,000–40,000+ per unit** depending on form factor, vendor, and demand; NVIDIA publishes no formal list price, so the figures come from resellers and leaks (OpsLyft, June 2026) — and the founder's own \$30–40k figure is **owned by L2** (Huang to CNBC, 19 March 2024; brief reference only). Fleet context: CoreWeave closed 2024 with **250,000+ GPUs across 32 data centers** (prospectus via CNBC) and passed a fleet described as 250,000+ across 32+ centers in late 2025 (Introl). Lead times: at the 2023 peak, H100 allocation waits ran to months and reserved contracts demanded large prepayments (Cheah's account of 2023 conditions); by 2025, over **300 new providers** had entered the H100 rental market (Introl). Rental price of the object's output, the full documented arc: **~\$8/hr (2023 peak) → ~\$2.85 (early 2024) → \$3.06 index high (1 Sept 2024) → \$2.36 (19 June 2025) → \$2.00 (9 Dec 2025) → \$2.20 (6 Jan 2026) → \$2.53 (as of the stamp)** (Latent Space; Silicon Data SDH100RT series). The cage: CoreWeave's reference deployment class is the whole cluster on a ~four-year average term with 15–25% prepaid (S-1 mechanics via Lockwood compilation) — the H100 is rarely rented as one card; it is financed and let as a herd.

The mechanism (the collateral path, since the watt path is L2's). How a chip becomes security: (1) purchase order → OEM integration (Dell/Supermicro rack) → delivery to a leased hall; (2) the fleet enters a borrowing base under a delayed-draw facility — DDTL 1.0 (\$2.3B, Aug 2023) and DDTL 2.0 (\$7.5B, May 2024) are secured by **the GPUs and the customer contracts together** (Blackstone releases; Quinn Emanuel); (3) draws fund more chips; (4) customer prepayments (15–25%) and monthly take-or-pay receipts service the debt; (5) as of March 2026 the structure graduates to a **rated instrument** — an \$8.5B non-recourse GPU-backed facility at A3/A-low (AI Consulting Network; Cape Fear). **Where the constraint binds:** the borrowing base — the loan's principal is fixed while the collateral's market price and rental yield float; the lender's protection is the *contract*, not the chip, which is why the S-1's customer-concentration pages and the depreciation note are the same story told twice.

Key actors in this beat. *Object:* the H100 (lead). *Institutions:* the lenders — Magnetar Capital (the constant across every round from Series B), Blackstone Tactical Opportunities (both DDTLs), with Coatue, DigitalBridge Credit, BlackRock, PIMCO, Carlyle in the 2023 syndicate (releases). *Documents:* the security agreements and UCC filings underneath the DDTLs — not individually public; presence documented through the facilities' own descriptions [honest limit: the collateral schedules are private; the pack does not invent their contents].

The documents. DDTL 1.0 (3 Aug 2023) and DDTL 2.0 (17 May 2024): what they force — draw schedules, leverage and contracted-revenue covenants (Level-Headed Investing's 10-Q reading), repayments from January 2026 (Quinn Emanuel); what they forbid — collateral release without paydown; what happens on violation — covenant tests can trigger paydowns or tighter terms (10-Q risk language via same). Skeptical caveat: these are private credit agreements described in filings, not filed as full texts.

Verbatim bank. Deliberately unspent here — Beat 3 and Beat 4 own this territory's quotes, and the Cold Open's discipline is the object, not the paper.

Who pays. The chip's cost is paid three times: once by CoreWeave (capex), once by the lender (advance), once by the customer (take-or-pay) — and the residual risk is allocated by the depreciation schedule, which is Beat 11's fight. One line,

per instructions: the who-pays weight of this beat is deferred by design.

What's contested, motivated, or unknown. The purchase price band is reseller-sourced (no list price — the vendor benefits from opacity; seller: the Hyperscaler/vendor archetype). The fleet's *utilization* — the number that would settle everything — is not published (see Section 11). CoreWeave's claimed 70–80% utilization vs. hyperscalers' 30–50% is the company's own pre-IPO framing (Seeking Alpha S-1 coverage) — seller's number, flagged.

Sensory & material details. The SXM5 H100 is a palm-spanning module that installs eight-up on an HGX baseboard inside a multi-kilowatt server; the “cage” of the assignment is documented reality — data-hall cabinets are locked, badged, camera-covered, and the S-1-era facility descriptions (Plano: 450,000+ sq ft, ~30 MW, \$1.6B — IndexBox from Yahoo Finance reporting) supply the scale. [Cabinet-security detail: inference from documented facility-security norms, marked as inference; the L1 pack owns campus security theater.]

Numbers that matter. \$30–40k/unit — purchase — reseller-sourced — 2024–26 — VOLATILE · 700 W — SXM5 TDP — vendor spec — STRUCTURAL · 250,000+ GPUs / 32 DCs — fleet, end-2024 — prospectus — STRUCTURAL · \$2.53/GPU-hr — H100 rental, neo-cloud index — Silicon Data — 21 Jul 2026 — VOLATILE · \$2.3B + \$7.5B — DDTL 1.0/2.0, committed facilities — releases — Aug 2023 / May 2024 — STRUCTURAL · ~14.1% / ~11% — effective rates, DDTL 1.0 / 2.0 — S-1 via analysis / Quinn Emanuel — CONTESTED at precision level (secondary), STRUCTURAL at magnitude.

Stress-test verdict: SUSTAINABLE. The object dossier runs deep on cost, custody, and collateralization, with a documented price arc that is itself a plot. Boundary hold: manufacture stays behind the silicon door — the H100's story here begins on the truck.

Beat 2 — The Founder Audit (*Intrator*)

Syllabus 2.0 assignment: The mythology told straight, audited against the March 2025 IPO; the gas-trader biography as the tell.

Beat Menu definition: *Character/Money · versatile · never lecture 1.* Origin mythology, then the cap table. The gap between founding story and securities filing is where the deadpan lives. Natural homes: 5, 6, 9.

Facts, dates, names, numbers. The mythology, told straight and all documented: three commodities traders — Intrator (Natsource 1998–2014; Hudson Ridge 2013–2018), Venturo (Natsource 2007–2012; Hudson Ridge partner 2013–2018; B.A. Economics, Haverford), McBee (energy-trading trajectory through Windy Bay Power and Fourth Floor Coastal, per governance compilations) — get interested in crypto in 2016, per Bloomberg via sports betting with Bitcoin; found Atlantic Crypto September 2017; mine Ethereum on NVIDIA GPUs; rename to CoreWeave in 2019 as crypto crashes and *buy competitors' chips into the crash* (Bloomberg profile). The audit's hinge, in the company's own governance language: Hudson Ridge was “a natural gas hedge fund” [5 words, CoreWeave leadership bio] — the founders' formative market was one where the asset is a flow, the edge is timing, and the position is financed. Education doing quiet work: Intrator holds a B.A. in Political Science from Binghamton and an M.P.A. from Columbia SIPA with an environmental-policy focus (governance bio) — not an engineering degree in the stack; the technical ballast was Venturo's CTO tenure (October 2017–March 2024). The audit against the filed record: the S-1's numbers are the pitch deck inverted — revenue \$15.8M (2022) → \$228.9M (2023) → \$1.92B (2024, +737%); net loss \$863.4M; debt ~\$8B at effective rates up to 14.1%; 77% of revenue from two customers, Microsoft 62%; useful life extended five→six years effective 1 January 2023, two years before the public ever saw the books (S-1 via CNBC; Motley Fool). The IPO itself as audit: range \$47–55 cut to \$40; offering cut 23.5%; the vendor anchoring its own customer's listing with a \$250M order; open \$39, close \$40 flat (CNBC; Reuters). Ownership after: Intrator ~12% economic stake via Class A and B holdings per a February 2026 Form 4 (Bloomberg profile); pre-IPO he controlled 38% of voting power, and the three founders' Class B super-voting stock carries roughly 73% of total voting power per governance compilations [two bases — voting vs. economic — state both, never blend].

The mechanism. Why the biography *is* the thesis: a natural-gas book teaches (1) the asset is fungible and priced continuously; (2) storage and transport — time and place — are the arbitrage; (3) you finance inventory against contracted offtake; (4) you never fall in love with the molecule. Substitute GPU-hours for therms and the CoreWeave structure assembles itself: buy the commodity when others are stranded (2019), lock the offtake (Microsoft MSA, February 2023), finance the inventory against it (DDTLs), and let the spread — power locked early against compute sold late — pay the coupon.

Where the constraint binds: the one place the analogy breaks — gas in storage does not obsolesce on a vendor's annual cadence; silicon does. The audit ends where Beat 11 begins.

Key actors. *Human:* Intrator (lead; wants: the structure believed and financed; fears, by revealed behavior: the depreciation question — he has answered it on CNBC (14 Nov 2025), on the Big Technology Podcast (January 2026), and in every earnings Q&A since; can enforce: allocation of capacity and the founders' voting bloc; actually did: built the reference capital structure of the category). *Humans, secondary:* Venturo and McBee — co-founders still in seat (CSO; CDO). *Contrast case (staged for Beat 5):* Jed McCaleb — the founder who bought the same chips with charity money and no leverage.

The documents. The governance bios (the company narrating its own founders — a seller's document, useful precisely because it volunteers Hudson Ridge); the February 2026 Form 4 (the economic stake, dated); the S-1's management and voting-structure sections [page pull flagged for draft stage].

Verbatim bank. Intrator, CNBC, 14 November 2025: the company is being “data driven” [2 words] about GPU shelf life. · Intrator, post-IPO CNBC, 28 March 2025: the NVIDIA relationship is “symbiotic” [1 word]. · Intrator, Q1 2026 CNBC interview, 7 May 2026: investors are “focusing on the trees and missing the forest” [7 words]. · Company release, 26 February 2026: “the fastest cloud in history to reach \$5 billion in annual revenue” [11 words]. Each one deployment maximum; The Verbatim move itself is reserved for Beat 3's document (Section 4).

Who pays. The mythology's cost allocation: dilution and coupon. The founders kept control (Class B) by selling the economics (12% stake) and renting the balance sheet (14% money before 9% money before A3 money). One paragraph of Beat 4 will price it; this beat names it.

What's contested, motivated, or unknown. The sports-betting Bitcoin origin is single-narrative (Bloomberg's profile) — charming, unverifiable beyond the telling, marked mythology-tier. The “bought chips from struggling competitors in 2019” detail is Bloomberg-sourced and consistent across profiles — STRUCTURAL. The rename date (2019) is consistent across Bloomberg and company histories; one compilation places the AI-pivot emphasis in 2019 with scale in 2022 — no conflict at the year level.

Sensory & material details. Livingston, New Jersey headquarters (Roseland in the 2023 releases — the HQ moved towns between financings; both documented, dates attached: Roseland on the Aug 2023 and May 2024 releases, Livingston on the March 2025 IPO release). The founding image the record supports: GPU rigs assembled in a New Jersey office for Ethereum (Introl deep dive).

Numbers that matter. \$15.8M → \$228.9M → \$1.92B — revenue 2022–24 — S-1 — STRUCTURAL · 737% — 2024 growth — S-1 — STRUCTURAL · 38% — Intrator pre-IPO voting power — prospectus via CNBC — STRUCTURAL · ~12% — economic stake — Form 4, Feb 2026 — STRUCTURAL · five→six years — useful-life change, effective 1 Jan 2023 — S-1 — ANCHOR (as a filed fact).

Stress-test verdict: SUSTAINABLE. The record is unusually deep — company-authored biography, profile journalism, filed ownership data, and the founder's own on-camera defenses. The beat can run its full five minutes without one invented detail.

Beat 3 — The Paper Trail — *class: securities filing (the CoreWeave S-1)*

Syllabus 2.0 assignment: The S-1 undressing the pitch deck. The lecture's universal beat; “mechanism-free by design” — the S-1 sits where an autopsy would.

Beat Menu definition: *Politics · versatile, closer-capable · all 10 lectures.* A named document as causal actor: what it says, who wrote it, what it forces, what it forbids, what happens when someone violates it. Rotation rule: different document class each lecture — securities filing is Lecture 6's class, verified against the ten-class rotation.

This beat's full treatment lives in Section 5 (the Document Dossier), per pack architecture. Beat-grain summary for markup: the S-1 (filed 3 March 2025) is the document that converted a private mythology into a public liability schedule — revenue concentration (77%/62%), the DDTLs and their rates, the six-year life, the lease commitments, the dual-class structure — and its publication is itself the Timeline Snap's strongest candidate day (Section 4). **Stress-test verdict: SUSTAINABLE** — the deepest single document in this lecture's record, with a two-week drama (FT story, OpenAI deal, range cut) attached to its own publication window.

Beat 4 — Follow the Money (the reference capital structure)

Syllabus 2.0 assignment: 4.8x D/E, GPU-collateralized debt, \$34B off-balance-sheet through 2028.

Beat Menu definition: *Money · versatile · fat container.* Capital structure as narrative: who financed what, collateralized by what, amortized over what. The load-bearing accounting assumption is always the payoff.

Facts, dates, names, numbers — the structure in strata, each dated. *Equity:* Series B \$221M at ~\$2B pre (20 Apr 2023); Series C \$1.1B at \$19B (1 May 2024); secondaries \$642M (Dec 2023) and \$650M at ~\$23B (Oct 2024); IPO \$1.5B at ~\$23B fully diluted (27 Mar 2025); OpenAI's \$350M placement (Mar 2025); NVIDIA's \$250M anchor (Mar 2025) and reported \$2B equity investment (Feb 2026 — single-sourced, flagged). *Private credit:* DDTL 1.0 \$2.3B at ~14.1% effective (Aug 2023, fully drawn by S-1); DDTL 2.0 \$7.5B at ~11% variable, IG and speculative tranches, repayments from January 2026 (May 2024). *Public credit:* ~\$2B senior notes, coupon in the 9s (May 2025); further senior notes near 9% (2025); \$2B converts due 1 December 2031 (Nov–Dec 2025). *Rated secured:* \$8.5B non-recourse GPU-backed facility, A3/A-low (March 2026). *H1 2026 cadence:* six financings — non-recourse GPU facility (March), converts and senior notes (April), syndicated facility (May), dollar and euro senior notes (June) — **all maturing by October 2032; average tenor ~5.9 years** (Cape Fear, from the filings). *The stock of debt:* ~\$8B (31 Dec 2024) → \$8.7B (Q1 2025) → \$11.17B + \$3.5B leases (30 Jun 2025) → ~\$14B (30 Sep 2025) → total liabilities ~\$29B (year-end 2025) → +\$8.5B raised in Q1 2026 alone (filings via Level-Headed, MEXC, tech-insider, CNBC). *Off the balance sheet:* **\$34B in scheduled lease payments on contracts commencing through 2028**, many on 10+ year terms, some for facilities not yet operating (Q2 2025 10-Q as reported by Fortune, 8–10 Nov 2025) — the must-hit anchor, vintage flagged in Section 6. *The refinancing wall:* \$986M due 2025; \$4.2B due 2026 (Q2 2025 10-Q via Level-Headed). *The servicing cost:* interest expense \$104M (Q3 2024) → ~\$264M (Q1 2025) → **[the Q3 2025 figure is Lecture 10's anchor — this beat stops at the trajectory; see Section 10 boundary note]**. *The cash-flow gap:* operating cash flow funds ~30% of investing outflow; the rest is debt and equity — “the 10-K confirms this is the steady state” [paraphrase of MTS annotation, FY2025 10-K, Feb 2026]. *CDS:* five-year spreads 368 → 643 between 6 October and mid-November 2025 (Bloomberg data via recap).

The mechanism — the money path, end to end. Contract → collateral → chips → contract: (1) a take-or-pay customer commitment (avg ~4 years at S-1; ~5 years weighted by Q4 2025) is signed; (2) the commitment plus the fleet enters a borrowing base; (3) draws purchase GPUs; (4) 15–25% prepayments plus monthly receipts service coupons that ran 14% → 11% → 9% → A3-grade as the structure seasoned; (5) depreciation on a six-year straight line spreads each chip's cost across 72 months, which is what makes the income statement survivable at these coupons; (6) the residual — what a six-year-old GPU is worth against liabilities that fully amortize by October 2032 — is the open question the whole stack prices. **Where the constraint binds: the depreciation line.** Lengthen it and the structure rates; shorten it and Chanos's arithmetic (Beat 11) governs. The Cape Fear formulation of the bind, paraphrased with attribution: the tenors on file average ~5.9 years beside a stated equipment life of 6 — the debt and the asset now race each other by months.

Key actors. Magnetar (in every stratum — equity lead, DDTL co-lead, and, per the S-1, a *customer* paying for capacity for its portfolio companies [S-1 fact via Lockwood compilation — the lender renting from its borrower]); Blackstone (both DDTLs); the noteholders and the CDS market (the structure's public skeptics, priced daily); Nitin Agrawal, CFO (the schedule's named defender — Beat 11); Jane Street (investor and customer, per the S-1 — training models on CoreWeave clusters).

The documents. The DDTL agreements (described, not filed in full); the senior-notes indentures; the converts' offering memo (rate and conversion terms set at pricing); the March 2026 rated facility's rating letters (A3/A-low — the first third-party price on GPU cash flow at investment grade); the 10-K's commitments note (the \$34B's home).

Verbatim bank. Company statement to Fortune (Nov 2025), on the structure: contracts are built to “support and repay any related debt obligations” [7 words, Fortune]. · Chanos is banked under Beat 11.

Who pays. In order of loss absorption if the schedule is wrong: the equity (public since March 2025), the speculative tranches, the IG tranches, the noteholders — and, one hour later, the ratepayer either way, because the grid the fleet plugs into is shared regardless of whose paper defaults. The Handoff's cargo originates in this sentence.

What's contested, motivated, or unknown. The **4.8x debt-to-equity** must-hit: this run did not locate the ratio stated as such in a primary document; it is consistent with S-1-era arithmetic (~\$8B debt against the S-1 balance sheet's equity) and appears in the syllabus stack as the anchor — **carried unchanged; derivation flagged DERIVED in Section 6 for draft-stage verification against the S-1's balance-sheet pages.** The NVIDIA \$2B equity investment (Feb 2026): single-sourced this run. Whether the \$34B figure appears in the S-1 itself or enters the record at the Q2 2025 10-Q: vintage question flagged, Section 6.

Sensory & material details. The structure has an address list: Plano's \$1.6B/30 MW hall; 43 data centers at year-end 2025; >850 MW active — the money path terminates in buildings with meter numbers. [Facility specifics owned by earlier lectures; one-line texture only.]

Numbers that matter. All rows consolidated in Section 6's spine (rows 1–28).

Stress-test verdict: SUSTAINABLE. The richest beat in the lecture — arguably over-full; markup may trim strata into Beat 1 and Beat 11.

Beat 5 — Taxonomy by Business Model (the landscape by arbitrage type)

Syllabus 2.0 assignment: Nebius, Crusoe, Lambda, Voltage Park — sorted by arbitrage, not logo.

Beat Menu definition: *Money · versatile · cold specialist, casting 2 of 3.* The taxonomy is the insight; company names are where it touches ground.

The taxonomy the record supports — four arbitrage species, each with a specimen:

(1) *The distress arbitrage (buy the stranded asset)* — **CoreWeave:** crypto-crash chips (2019), a bankrupt miner's halls (Core Scientific hosting, ~\$10.2B/12 years), leverage against contracts. Covered by Beats 2–4; one sentence here.

(2) *The geopolitical-carve-out arbitrage (a company created by amputation)* — **Nebius:** born 2022 from Yandex's restructuring; the Russian business sold July 2024 for ~\$5.4B; what remained — a Finnish data center, a cloud platform, engineering teams — relisted on Nasdaq October 2024 and repriced from ~\$44 to \$298.85 (18 June 2026) on three contracts: Microsoft \$17.4B/up to \$19.4B (8 Sept 2025, Vineland NJ, ~300 MW, through 2031); Meta \$3B (Nov 2025) expanded to up to \$27B (16 March 2026 — \$12B dedicated Vera Rubin clusters from early 2027 plus a Meta unsold-capacity purchase obligation, per the 6-K); NVIDIA equity ~\$2B (Ren compilation). Financials, dated: Q3 2025 revenue \$146.1M (+355%), net loss \$119.6M; Q1 2026 revenue \$399M (+684%), AI-cloud ARR \$1.92B (+54% QoQ), 2026 capex plan \$20–25B; founder Arkady Volozh — who took Yandex to a ~\$30B peak — renounced Russian citizenship February 2026 (AI Business; TechTimes; TradingKey; SEC 6-K). Depreciation posture: **four-year GPU life** (2024 Form 20-F via Livy) — the taxonomy's conservative pole.

(3) *The stranded-energy arbitrage (power first, chips second)* — **Crusoe:** founded 2018 (Lochmiller, Cavness); flare-gas mitigation → 425+ modular DCs, ~250–270 MW, seven states plus Argentina, ~1% of world bitcoin mining; sold the entire origin business to NYDIG 25 March 2025 to go all-in on AI; revenue \$275–276M (2024, 55% still bitcoin) → ~\$1B projected (2025) → ~\$2B path (2026); Series D \$600M at \$2.8B (Dec 2024, Founders Fund + NVIDIA) → Series E \$1.375B at \$10B+ (Oct 2025, Valor + Mubadala); power pipeline claimed >45 GW [seller's figure — a pipeline is a request, not a load; phantom-supply caveat attached]; Abilene and Project Jade (Cheyenne, \$50B, 2.7 GW initial, approved January 2026 — ~3x Wyoming's current state demand) (Sacra; CNBC; TSG; Contrary; Lanin). **Boundary hold: Abilene/Stargate is L8's Symbol Audit — Crusoe appears here as an arbitrage species with a one-line Stargate locator, nothing more.**

(4) *The incumbency arbitrage (the specialist that predates the boom)* — **Lambda:** founded 2012 by the Balaban twins; ML software → GPU workstations → GPU cloud; ARR \$425M (Dec 2024) → \$505M (May 2025); Series D \$480M at ~\$2.5B (Feb 2025) → Series E \$1.5B+ led by TWG Global (Nov 2025, secondaries to ~\$6B); Microsoft multibillion agreement 3 Nov 2025 (GB300 NVL72s; the relationship dates to 2018); the **NVIDIA leaseback — \$1.5B to rent back 18,000 of Lambda's GPUs over four years, making the vendor the customer's biggest customer** (Fahey compilation — the circularity exemplar Beat 10 collects); five-year depreciation (theCUBE); reported confidential IPO filing (Dec 2025, single-sourced).

(*The control specimen — the arbitrage removed*) — **Voltage Park:** launched October 2023 on ~\$500M from Jed McCaleb's Navigation Fund, a 501(c)(3) (Forbes later reports a \$900M grant — conflict stated, not smoothed); ~24,000 H100 SXM5s; profits flow to the nonprofit; no VC equity, no GPU debt; pricing from \$1.89–1.99/hr; merged with Lightning AI January 2026 (~\$2.5B); claims third-largest neocloud by chips deployed (DCD; TechCrunch; Forbes; Sacra). The audit the specimen enables: strip out leverage, mythology, and exit pressure, and the refresh-cycle math **remains** — a fixed H100 fleet at sub-\$3 list is a glide path, not a flywheel (jimmyresearch's framing, attributed as analysis). Charity money obeys the same depreciation physics as Blackstone's.

Mechanism / where the constraint binds: every species, whatever its origin arbitrage, converges on the same two constraints — energized megawatts (Beat 9) and useful life (Beat 11). The taxonomy's punchline is convergence.

Who pays / contested / numbers: distributed to the specimens above; all valuations are **marks, not verdicts** (Crusoe \$10B+, Lambda ~\$6B secondary, Nebius's market cap), each dated in Section 6.

Stress-test verdict: SUSTAINABLE — four documented species plus a control case, every specimen carrying primary or near-primary sourcing.

Beat 6 — The Deal (Microsoft's \$60B+ to nominal competitors)

Syllabus 2.0 assignment: Nadella and Hood's "capacity constrained" as the buyer's motive on tape; the \$60B+ reconstructed as a sequence.

Beat Menu definition: *Character/Money · versatile*. The sequence: who wanted what, who blinked, what the term sheet reveals about leverage. Timeline Snap deploys naturally inside it. Natural homes: 5, 6, 8. [L4's pack pre-verified this casting: "the course's Deal slots are cast (L5 Microsoft–Constellation; L6 Microsoft–neoclouds)."]

The sequence, reconstructed from the documented record. *Act one — the quiet commitment (2023–24):* Microsoft signs the CoreWeave MSA February 2023; commitments reported at ~\$10B across five-plus contracts through 2030 (reporting via Lockwood compilation); Microsoft is 35% of CoreWeave's 2023 revenue, 62% of 2024's. *Act two — the wobble (January–March 2025):* 21 January — Stargate; Microsoft's OpenAI exclusivity becomes a right of first refusal (Microsoft's own blog language: "moving to a model where Microsoft has a right of first refusal" [12 words, Microsoft blog via DCD]); February — TD Cowen lease-cancellation notes, refuted; 5–6 March — the FT reports Microsoft "walked away from some of its commitments" [7 words, FT via The Fly] with CoreWeave over delivery issues; CoreWeave disputes the characterization; 10–20 March — Microsoft passes on a ~\$12B CoreWeave capacity option and **OpenAI takes it** (Semafor), three weeks before the IPO the buyer's frenemy becomes the anchor tenant. *Act three — the land grab (September–November 2025):* Nebius \$17.4B (8 Sept); Nscale ~\$23B (15 Oct); IREN \$9.7B and Lambda multibillion (3 Nov); Bloomberg tallies the pool crossing **\$60B in November, roughly doubling from ~\$33B in October**, with Microsoft executives describing "land-grab mode" [3 words, Bloomberg via Introll]. *The motive, on the buyer's own tape:* Hood, 29 January 2025: "We have been short power and space" [7 words, Microsoft FY25 Q2 transcript]; Hood, 29 October 2025: constrained through at least fiscal year-end; Nadella, BG2 Pod, 31 October–1 November 2025: chips in inventory, no warm shells. *The accounting motive, documented:* neocloud contracts are booked as operating expense over their life rather than as balance-sheet capex (Trending Topics' reading of the structure, attributed as analysis) — rent-now is also an income-statement costume.

Who blinked: the record supports a clean answer — Microsoft blinked *twice in opposite directions*: away from specific CoreWeave commitments in Q1 2025 (delivery-dispute framing), then into a \$60B pool by November 2025 when the constraint bit. What the term sheets reveal is mostly their absence — dollar figures disclosed, terms not; the leverage is visible instead in the pricing fossil: Microsoft's 2023 MSA pricing still governing 67% of CoreWeave's 2025 revenue (10-K annotation via MTS).

Who pays. Microsoft's shareholders, through cost of revenue over the contracts' lives; the fiscal-year context: capex \$34.9B (Q1 FY26) → \$37.5B (Q2) → >\$40B guided (Q3), ~\$190B total investment this fiscal year (transcripts; Fortune, 29 April 2026).

Contested. The FT walkaway story vs. CoreWeave's dispute — presented as conflict, both sides dated. The \$60B pool's composition varies by source (some tallies include Nscale as the largest slice; some count only CoreWeave/Nebius/Nscale) — the Bloomberg November 2025 crossing is the anchor's documented basis; composition uncertainty stated.

Verdict: SUSTAINABLE — with the honest label that this Deal beat is announcement-sequence deep, not term-sheet deep; the buyer's motive on tape is what makes it a Deal rather than a press-release reel.

Beat 7 — The Hearing Room (the earnings-call record, transcript only)

Syllabus 2.0 assignment: The earnings-call record where the constraint was admitted.

Beat Menu definition: *Politics · opener-capable, versatile*. The only scene beat on the menu; documented speakers, documented words, no staging.

The room and its corpus (primary transcripts, all public): Recommended room: **Microsoft's FY2026 Q1 call, 29 October 2025** — the fullest single admission on tape: Hood's capacity-constrained-through-fiscal-year-end statement with the

“lost revenue opportunities” framing (Motley Fool transcript); Deutsche Bank’s Brad Zelnick asking Microsoft to quantify the revenue impact of Azure being short (Benzinga); the OpenAI \$250B incremental Azure commitment disclosed in the same hour. Supporting rooms, dated: FY25 Q2 (29 Jan 2025 — Hood’s “short power and space” and the space-plus-kits anatomy of a constraint); FY25 Q3 (30 Apr 2025 — Hood: “a little short, a little tight as we exit the year” [10 words, TechCrunch]); FY26 Q2 (29 Jan 2026 — Keith Weiss, Morgan Stanley, putting the ROI question on the record: capex growing faster than expected, Azure slower [paraphrase, AOL/Yahoo transcript coverage]); FY26 Q3 (29 Apr 2026 — constrained through 2026 even at >\$40B/quarter). The scene’s documented texture: analysts steelmanning the spend in real time while the CFO reads constraint language five quarters running. **Full-transcript locators for the drafting pull:** microsoft.com/investor events pages (FY25 Q2, FY26 Q1 confirmed present in this run); Motley Fool transcript series.

Verdict: SUSTAINABLE. The corpus is deep, continuous, and verbatim-rich; the max-1-scene rule is satisfied by construction.

Beat 8 — The Forecast Problem (spot curves and rating assumptions as forecasts with owners)

Syllabus 2.0 assignment: GPU spot-price curves and ABS rating assumptions as forecasts with owners.

Beat Menu definition: *Money/Politics · versatile.* Forecasts as filings with authors.

The forecast layer cake, each stratum with its filer. (1) *The break-even forecast:* Cheah’s October 2024 arithmetic — below \$1.65/hr an H100 never recoups; above \$2.85/hr it beats the market’s IRR; his model assumed a “blended price” gliding down 50% over five years, offered as conservative against then-current ~40%/year declines (Latent Space — filer: an independent engineer-analyst; what he gets if believed: the piece’s own thesis, no position disclosed). (2) *The index:* SDH100RT — \$3.06 (1 Sept 2024) → \$2.36 (19 Jun 2025) → \$2.00 (9 Dec 2025) → \$2.20 (6 Jan 2026) → \$2.53 (stamp) (Silicon Data — filer: a data vendor whose product is the index’s adoption). (3) *The reversal forecast:* SemiAnalysis’s 1-year reserved index +40% October 2025 → March 2026, with a self-reinforcing-tightness thesis (SemiAnalysis, April 2026 — filer: a research shop selling the model). (4) *The rating assumptions:* Moody’s methodology (6 Feb 2025 — Monte Carlo tenant-default simulation; five asset groups; “contract renewal, technological obsolescence” among the named drivers [4-word fragment, Moody’s via CRA primer]); Fitch’s exposure draft (24 Jul 2025) with its documented skepticism toward AI-training assets versus cloud; KBRA’s methodology (9 Jan 2026 — KNCF, rollover simulation, DSCR/LTV triggers); S&P’s four rating approaches (23 Apr 2025). Every rated GPU dollar embeds a residual-value forecast with an author and a fee. (5) *The forecast that already failed once, both directions:* \$8 → \$2 (2023–25) broke every 2023 pro forma; \$1.70 → \$2.35 (2025–26) broke the collapse narrative twelve months later. **Where the constraint binds:** the ABS advance rate — the cell where somebody’s price curve becomes lendable dollars.

Who pays if the forecast is wrong: Section 7’s whole register; one line here per instructions.

Verdict: SUSTAINABLE — the price series alone is a five-minute plot with four documented reversals.

Beat 9 — The Bottleneck (energized capacity as the moat)

Syllabus 2.0 assignment: 3–5 years for a hyperscaler campus vs. 6–18 months for a neocloud that locked power early.

Beat Menu definition: *Atoms · versatile.* The constraint money alone doesn’t clear.

Facts and mechanism. The must-hit asymmetry, with its documented basis: hyperscalers permit, build, and interconnect from scratch on a 3–5 year cycle; neoclouds that secured power and land before the 2023–24 surge install GPUs into existing capacity on a 6–18 month cycle (Introl’s articulation of the Bloomberg-reported logic; consistent with SemiAnalysis’s neocloud economics work) — **STRUCTURAL.** The moat measured in megawatts, CoreWeave’s own series: >850 MW active / 43 DCs / >3.1 GW contracted (31 Dec 2025) → **>1 GW active / ~3.5 GW contracted (Q1 2026)** → 1.7 GW active targeted by year-end 2026 → “more than 8 GW by 2030” [5 words, company release, 7 May 2026 — seller’s target, stage: announced]. The moat’s supply side: Core Scientific’s contracted halls (\$10.2B/12 years); Crusoe’s stranded-energy pipeline; Nebius’s Vineland 300 MW; Lambda’s Kansas City 24→100+ MW. The buyer’s confession that the moat is real: Nadella’s chips-without-warm-shells problem (31 Oct–1 Nov 2025) — the world’s most resourced buyer, rate-limited by shells, not silicon. **Where the constraint binds:** the energized megawatt — the one input on the deal table that neither capex guidance nor a backstop letter can conjure inside a fiscal year. [The queue’s anatomy is **L4’s**; the interconnection agreement appears here in one clause as the thing early power positions routed around.]

Verdict: SUSTAINABLE.

Beat 10 — The Perverse Incentive (the circularity)

Syllabus 2.0 assignment: NVIDIA investing in customers who buy NVIDIA GPUs with debt collateralized by NVIDIA GPUs.

Beat Menu definition: *Politics/Money · versatile, closer-capable.* The rule producing the opposite of its intent.

The circle, documented arc by arc, each dated. NVIDIA is, simultaneously and on the record: *supplier* (the only one that matters for this fleet); *investor* — Series B participant (Apr 2023), 5.96% pre-IPO holder (17.9M shares), 24.2M shares by 31 March 2025, Crusoe Series D and E participant, Nebius placement participant (~\$2B per compilation), Lambda Series D participant, reported \$2B CoreWeave equity (Feb 2026, single-sourced); *customer* — \$320M paid to CoreWeave through 31 Dec 2024 (prospectus), plus DGX Cloud, the program under which NVIDIA rents capacity from cloud providers and resells it, plus the **Lambda leaseback: \$1.5B to rent back 18,000 GPUs over four years, making NVIDIA Lambda's largest customer** (Fahey); *underwriter-of-last-resort* — the \$250M IPO anchor at \$40 (Mar 2025) and the **\$6.3B order form obligating NVIDIA to purchase CoreWeave's residual unsold capacity through 13 April 2032** (8-K, 9 Sept 2025); *collateral* — the chips themselves secure the debt that buys more chips. The aggregate, planted by L2 and collected here: **\$18.6B invested by NVIDIA into private companies and infrastructure funds in a single quarter**, with the company's own filing noting some investees may indirectly purchase its products (Q1 FY27 filing, 20 May 2026, via CNBC — L2 Timeline 58, one-line plant, full treatment here). The structure's replication — the incentive generalizing: Meta's Nebius order includes an unsold-capacity purchase obligation mirroring the NVIDIA backstop (6-K, 16 Mar 2026); backstops as a class let smaller companies borrow more, cheaper (Motley Fool's cosigner framing, attributed). **The perverse incentive, stated as mechanism, not sneer:** demand signals that lenders and rating agencies price — backlogs, backstops, anchor orders — are partially authored by the party whose revenue they justify; the phantom-load discipline's commercial cousin, and the caveat attaches to every backlog figure in this lecture on first use.

The steelman lives in Beat 11 and Section 7 — the circle also *works*: the backstop is a real contract with real teeth; NVIDIA's obligation is capped (\$6.3B) while CoreWeave's debt is not (Motley Fool's asymmetry point, attributed); and vendor financing is as old as railroads. GRANT-AND-WITHHOLD, per assignment.

Verdict: SUSTAINABLE — the single richest documented claim-cluster in the lecture.

Beat 11 — The Steelman (*defendant: the neocloud CFO's depreciation schedule*)

Syllabus 2.0 assignment: The strongest honest case for the useful-life assumption. Rotation verified; the defendant is new.

Beat Menu definition: *Audit · never opener.* The defendant's actual numbers and constraints; a précis of the weak version is not a steelman.

The defendant: the six-year straight-line schedule on technology equipment, adopted effective 1 January 2023, defended by CFO Nitin Agrawal and CEO Intrator on the record. **The prosecution, stated first so the defense is honest:** Nebius files four years (20-F); Lambda uses five (theCUBE); Tom's Hardware reported late 2024 that GPUs at 60–70% utilization may last one to three years; GPUs ≈ 39–40% of AI data-center capital cost (analyst estimate via Motley Fool); H100 rental fell ~75% from peak; and **Chanos's filed-arithmetic critique** (X, 12 Aug 2025): Q2 capital employed averaging \$19.2B against \$637M quarterly D&A-plus-lease-amortization implies a **7.5-year** economic life “for predominantly GPU's” [4 words, @RealJimChanos] — halve the life and Q2's ~\$200M adjusted operating income becomes a ~\$400M loss (Motley Fool's worked example, attributed). **The defense, in the defendant's own numbers:** (1) *Contract cover* — average committed terms ~4 years (S-1) lengthening to ~5 (Q4 2025), take-or-pay, with 15–25% prepaid: the schedule's first four-plus years are contractually revenue-backed, and the six-year question is really a question about years five and six. (2) *Observed residuals* — the 2020-vintage A100 fleet fully booked in late 2025, with A100 prices rising in 2025; an H100 tranche re-let at **95% of its original price** on contract expiry; Q4 2025 H100 pricing within 10% of where it began the year (Intrator, CNBC 14 Nov 2025 and Q4 call, 26 Feb 2026). (3) *The market's own reversal* — the 1-year reserved index +40% Oct 2025→Mar 2026; on-demand sold out (SemiAnalysis, Apr 2026): the collapse the bears extrapolated stopped collapsing. (4) *Peer convergence* — Google, Oracle, and Microsoft carry server lives up to six years (CNBC, 14 Nov 2025); the outlier framing cuts both ways. (5) *Third-party validation with money attached* — Moody's put an A3 on an \$8.5B facility secured by

exactly this collateral class (March 2026); a rating is a priced opinion on the schedule. (6) *The workload argument* — Gen N–1 fleets redeploy to inference at contract end (S-1 mechanics via Lockwood; the industry-wide inference-tail argument per bizety/GabGrowth analyses, attributed as analysis). **What the steelman does not claim:** that six years is proven — the boom is three years old; most of the fleet hasn’t lived long enough to test its own schedule (CNBC’s framing, attributed); the honest close is Intrator’s own evidentiary posture — “data driven” — which is a promise to re-measure, not a verdict. **Burry does not appear in this beat** (Open Item 4 held; his critique detonates in L10); Chanos carries the documented opposition here.

Verdict: SUSTAINABLE — defendant named, defense built entirely from filed numbers and on-tape statements, prosecution documented and dated.

Beat 12 — The Externality Swap [C] (own-and-wait vs. rent-now)

Syllabus 2.0 assignment: 3–5 years and you own it; 6–18 months and you rent it — both sides priced, which is why the \$60B exists. Carries the As-Of Stamp, the Kicker, and the Handoff rider.

Beat Menu definition: *Atoms/Money · versatile, closer-capable.* The beat fails if either option is a strawman.

Side one, priced — own-and-wait (the hyperscaler’s case): you keep the margin (the spread the neoclouds live on is the premium you stop paying); you keep the asset on your own six-year schedule with your own workload tail; you keep control of siting, security, and the roadmap relationship; and at Microsoft’s scale the wait is fundable — ~\$190B invested this fiscal year (Fortune, Apr 2026). The cost: 3–5 years of foregone revenue at the exact moment demand exceeds supply — Hood’s on-tape “lost revenue opportunities” framing (FY26 Q1) is the price of ownership stated by the owner. **Side two, priced — rent-now (the same buyer’s other hand):** capacity in 6–18 months; opex treatment instead of balance-sheet capex over the contract life (Trending Topics’ structural reading, attributed); optionality — commitments that expire are cheaper to be wrong about than substations that don’t; the cost: the premium, the counterparty risk (a supplier whose CDS tripled in six weeks, Oct–Nov 2025), and strategic leakage — the rented fleet trains the frenemy’s models too (Google and Meta renting CoreWeave capacity per Reuters-cited reporting; Meta Compute, 1 July 2026, as the costume slipping). **The swap’s proof of honest pricing is the \$60B itself:** the same buyer runs both sides simultaneously and at maximum scale — which is the beat’s closing fact before the Kicker. **The As-Of Stamp deploys here** (GPU-hour pricing, 2026 — Section 4); **the Kicker** (collateral vs. amortization — Section 4) lands as the final ~100 words; **the Handoff rider** follows, outside the count: the money in this hour was private — every dollar named came off a cap table, a term sheet, or an indenture — but every megawatt those dollars energized draws through a grid that was never private, and the bill for that grid is already walking out of the boardroom toward a residential mailbox. **[Comedy off from the mailbox sentence onward — human-floor flag. Service-territory verification flag on “Manassas”: Section 10.]**

Verdict: SUSTAINABLE. Both sides carry documented prices; neither is a strawman; the buyer’s double position is the evidence.

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

The Bill Arrives. The Beat Menu names CoreWeave’s interest expense as a Bill Arrives exemplar — but the \$311M/3x-YoY figure is **Lecture 10’s must-hit anchor** and its detonation belongs to the closer’s audit. Running it here would spend L10’s opening charge. The record supports the beat; the course architecture forbids it. **Correctly left out — by allocation, not by evidence.**

The Wrong Map. Neocloud siting geography exists in the record (Plano, Vineland, Kansas City, Cheyenne, Abilene) but the origin-geography mechanism is L1’s, the queue geography L4’s, and Abilene L8’s. A five-minute Wrong Map here would be assembled from other lectures’ claimed ground. **Correctly left out.**

Mechanism Autopsy. The strawman’s “mechanism-free by design” annotation is defensible but not unchallengeable: the record would support a full autopsy of a GPU-collateralized facility — borrowing base, advance rate, covenant tests, cash sweep, the January 2026 amortization turn — at genuine five-minute depth (DDTL descriptions; rating methodologies; Cape Fear’s tenor work). **The scan’s one live swap case:** an Autopsy of the loan could absorb Beat 4’s mechanism stratum and free Follow the Money to carry the equity/valuation story. Cost: the grid’s Autopsy count is already hot, and the

strawman’s design — the S-1 sitting where the autopsy would — is itself a statement (the document *is* the mechanism in a finance lecture). **Recommendation: no swap; markup disposes.**

The Hearing Room as opener. Opener rotation assigns Cold Open to L6 (verified: Cold Open opens 2, 4, 6; Hearing Room opens 5, 8, 10). **Correctly positioned mid-lecture.**

The Physics Audit. No physics claim in this hour rises to audit grade; the closest candidate — “the collateral is made of atoms and atoms age” — is a sentence, not a beat. **Correctly left out.**

The Regulatory Collision. No two authorities contest jurisdiction here; the SEC’s disclosure regime is a stage, not a combatant. The Oracle bondholder suit (14 Jan 2026) is adjacency, not collision. **Correctly left out.**

The County / The Neighbor. No fence-line household appears in this lecture’s documented territory; the human floor rides the Handoff seam only, and inventing a Neighbor from ratepayer aggregates would violate the hard constraint. **Correctly left out — and the Neighbor’s course-wide casting (Morrises · L7 pack dependency · Gladney) is already full.**

The Symbol Audit. Course cap ≤ 3 , all three deliberately cast (L5 TMI · L8 Stargate · L9 orbital). **Out by rule** — noted because this lecture generates candidates (the IPO bell, the backstop) that must *not* tempt the draft.

Operator Reality. Thin but real material exists (881 employees; technicians surged between sites, Intrator 26 Feb 2026); the trade’s terrain is owned by L2 (crane day) and L3 (pipefitters). **Correctly left out; the technician-surge line is available to Beat 9 as texture.**

Verdict pairing: No Section 2 beat returned THIN or UNBUILDABLE; no replacement required. **Summary for markup:** one moderate swap case (Mechanism Autopsy $\nRightarrow$ inside Beat 4), not recommended unprompted; all other exclusions confirmed. Category minimums re-verified for the strawman as it stands: Atoms — Cold Open, Bottleneck; Money — Follow the Money, Taxonomy, Deal, Forecast Problem, Externality Swap; Politics — Paper Trail; Character — Founder Audit, Deal. $\geq 1/\geq 1/\geq 1$ holds; the fourth (Character) minimum holds. The pack proposes; markup and the Course Schema dispose.

SECTION 4: MOVES PLAN VERIFICATION

The Step Function — the pricing spread. Pedigree of the anchor: **\$2.95–3.99/GPU-hr (neoclounds) vs. \$6.88–11.01 (hyperscalers)**, H100, Syllabus 1.0 must-hit — a 2025-vintage snapshot consistent with the documented record (ThunderCompute Sept 2025: Azure \$6.98, GCP \$11.06, via IntuitionLabs; neocloud on-demand clustering \$2.39–3.44 across Lambda/RunPod/VESSEL through 2025–26). The standing assumption it breaks — “the biggest clouds are the efficient ones” — is allowed to feel settled by Beats 6–7 (the buyer’s scale, the \$190B) before the spread arrives. **Verified, with one mandatory caveat the draft must carry: CoreWeave’s own on-demand list price (~\$6.16) sits near AWS’s; the spread is a sector fact and a reserved-contract fact, and CoreWeave competes on committed clusters, not hourly list (aitooldiscovery, Q2 2026).** Current-vintage bounds for the decay register: hyperscalers \$6.88–12.29; neoclounds \$2.39–3.44 (Spheron/VESSEL, Mar–May 2026). Anchor carried unchanged; discrepancy logged in Section 6.

The Unit Conversion — \$34B off-balance-sheet. Hard gate per Open Item 11. Candidates with arithmetic:

- (a) **Recommended: \$34B vs. CoreWeave’s own IPO valuation.** $\$34B \div \$23B$ (fully diluted at \$40, Reuters calculation, 27 Mar 2025) = **1.48** — the scheduled lease payments not on the balance sheet exceeded the entire company’s listing value by roughly half again. Both figures documented, same subject, same record. **PASS.**
- (b) \$34B vs. a NASA year (~\$25B enacted FY2025, commonly reported): ≈ 1.35 NASA-years. Arithmetic trivial but the comparator figure was not independently verified this run — **HOLD pending verification**; do not deploy unverified.
- (c) \$34B vs. Iceland’s GDP (~\$33B, IMF 2024 vintage): $\approx 1.0x$. Comparator likewise unverified this run; tonal fit questionable (a country is not a held object). **HOLD. Verdict: PASS on (a); the lecture has its Japan.** If markup rejects the self-referential form, the conversion is skipped per the no-vibes rule — the lecture runs without it.

The Timeline Snap — March 2025. Verified, with the choice of day supplied. *Candidate one, 3 March (the S-1 goes public):* day before — the structure is private, the marks are negotiated, the leverage is rumor; day after — 4.8x, 62%, six years, and 14% money are searchable by every lender, competitor, and council in the footprint. *Candidate two, 28 March (the listing):* day before — no daily price on the thesis; day after — a ticker, a CDS curve to come, and quarterly confessions

on a fixed calendar. The incentive flip is cleaner at candidate one (disclosure is the hinge; the listing is the consequence); the anchor's "March 2025 IPO" accommodates either. **Both documented; markup chooses the day.**

The Verbatim — the S-1's depreciation policy note. Existence gate, flat status: **PARTIAL**. The policy's content is multiply confirmed (straight-line; six years; technology equipment including computing, networking, and storage; extended from five effective 1 January 2023 — Motley Fool 11 Nov 2025; bizety; Cape Fear from the filings), but the exact filed sentence was not retrieved verbatim in this run, and EDGAR page-fetch was out of reach of this session's tooling. **Verified verbatim alternative from the same document family, deployable now:** the filed risk-factor language quoted in secondary coverage — the company must "make certain estimates with respect to the useful life of the components of our infrastructure" [14 words, CoreWeave filing language via Finviz/Motley Fool reproduction] — attributed inside the narrative to the company's own filings. **Draft-stage pull flagged (locator):** SEC EDGAR CIK 1769628, S-1 (3 Mar 2025) and FY2025 10-K (Feb 2026), significant-accounting-policies note, property-and-equipment table. Per the L5 convention: the assignment stands; the fallback is armed.

The As-Of Stamp — GPU-hour pricing (2026). Confirmed and armed with the styled deployment's material: as of the research date the neo-cloud H100 index reads **\$2.53/GPU-hour** (Silicon Data SDH100RT), against \$6.88–12.29 at the hyperscalers (Spheron, May 2026) — and the stamp's thematic work is unusually strong here because the number has already reversed direction twice inside eighteen months. Decay velocity: weekly-to-monthly; feeds Section 11.

The Kicker — the collateral depreciates faster than the liabilities amortize. Verified and armed. Grounds: six-year straight-line on the fleet vs. debt maturing on average ~5.9 years, everything by October 2032 (Cape Fear from the H1 2026 filings); the DDTL 2.0 amortization clock started January 2026 while the H100 index sat at ~\$2.20; and the adjacent facts the closing passage needs — the 95%-re-let and A100-fully-booked counter-evidence (so the Kicker lands as tension, not verdict), and the \$99.4B backlog as the thing standing between the schedule and the question. Fires as Beat 12's final ~100 words, ahead of the rider.

The Gesture — the training-run door (pending Open Item 9). One-inch material only, deployable solely if Nick opens the third door: (i) the collateral's named work is on the record — OpenAI's contracts designate CoreWeave capacity for "the training of its most advanced next-generation models" [9 words, CoreWeave release, 25 Sept 2025]; (ii) Altman's roadshow attribution that CoreWeave compute stood behind models the public knows by name (Semafor, Mar 2025, paraphrase). Two facts, both dated; the door then closes — what the GPUs are actually computing is somebody else's story. **Nothing behind the door was researched.** If the door stays shut, the Gesture is skipped; nothing else moves.

The Handoff rides in the beat plan; its material and the Manassas flag live in Section 10.

Markup alternates observed in the record (assignments stand): a stronger Step Function candidate exists in the backlog series (\$15.1B → \$99.4B in five quarters — the number that breaks "startups can't book hyperscaler-scale revenue"), and a stronger Snap candidate in 9 September 2025 (the day the vendor became the buyer of last resort). Noted beneath the verifications; the assignment governs until markup moves it.

SECTION 5: THE DOCUMENT DOSSIER — THE COREWEAVE S-1

The document itself. Registration Statement on Form S-1, **CoreWeave, Inc.**, filed with the U.S. Securities and Exchange Commission and made public **3 March 2025**; CIK 1769628; Nasdaq ticker CRWV; amended (S-1/A) on or about 20 March 2025 to set the \$47–55 range for ~49M shares (~\$2.5B target at a valuation above \$35B initially sought); superseded at pricing by the 27 March terms (\$40, 37.5M shares — 36.59M primary, 910,000 secondary; 30-day over-allotment option of up to 5.63M shares; Goldman Sachs, Morgan Stanley, J.P. Morgan as lead book-runners). Procedural status: effective; offering closed 31 March 2025; the disclosure regime it created continues in the 10-K (February 2026) and 10-Qs. Where it lives: SEC EDGAR, CIK 1769628. [Exact page count: not verified this run; pull flagged.]

What it says (operative provisions, with the verbatim discipline noted). The load-bearing disclosures, each multiply confirmed against the filing's reporting: revenue \$15.8M/\$228.9M/\$1.92B (2022/23/24); net loss \$863.4M (2024); Q4 2024 revenue \$747.4M at ~76% gross margin with a \$51.4M net loss attributed to interest expense; **77% of 2024 revenue from two customers; Microsoft 62%; a third material customer identified only as "Customer C"** [2-word designation, S-1 via Where's Your Ed At]; RPO \$15.1B with 96% expected to be recognized within six years; total debt approaching \$8B — DDTL 1.0 fully drawn at 14.11–14.12% effective, DDTL 2.0's \$7.6–7.5B line partially drawn; 32 data centers, 250,000+ GPUs, 881 employees; NVIDIA a 5.96% holder *and* a \$320M customer; contract mechanics — ~four-year committed

terms, 15–25% prepayments, take-or-pay; the depreciation policy — technology equipment on a six-year straight line, extended from five effective 1 January 2023; the dual-class structure concentrating founder voting power; and the risk-factor language on useful-life estimation (the Verbatim’s verified fallback, Section 4).

Who wrote it and why. The company and its counsel and bankers, under compulsion of the Securities Act — which is precisely why it out-ranks every pitch deck in this lecture: it is the one seller’s document where understatement is the liability regime. What the author gets if it’s believed: \$1.5B, a currency (stock) for the Core Scientific bid four months later, and public-market paper that converted 14% private money into 9% public money within eight weeks.

What it forces and what it forbids. Forces: quarterly disclosure of the exact numbers the mythology had blurred — concentration, leverage, the schedule; Section 16 filings that dated Intrator’s 12%; the commitments note that carries the \$34B. Forbids: silent restatement — every future change to the useful life must now be disclosed and dated, which is the mechanism by which this lecture’s question (“is six years true?”) became permanently public.

What happens when someone violates it. No enforcement action against CoreWeave is in this record. The disclosure regime’s teeth are visible instead in the adjacent docket: bondholders suing Oracle over AI-buildout losses (14 Jan 2026, N.Y. Sup. Ct.) — the litigation channel that securities filings load. [Adjacency, clearly labeled; no CoreWeave claim implied.]

The skeptical caveat. Is it binding or a press release with an accession number? Binding — uniquely in this lecture’s document population. The caveat runs the other way: the S-1 is a *disclosure* document, not a valuation verdict; it told the truth about the structure and still priced 20% below its own range within 24 days, which is the market annotating the filing in real time.

The document’s history and fate. Publication (3 Mar) → the FT walkaway story and CoreWeave’s dispute (5–6 Mar) → the OpenAI deal amending the demand picture mid-roadshow (10 Mar) → range set (20 Mar) → range abandoned, offering cut 23.5%, NVIDIA anchor (27 Mar) → flat open (28 Mar) → the filing’s own numbers re-litigated publicly by Chanos (Aug 2025), the Fortune debt series (Nov 2025), and the company’s rebuttals (Nov 2025–Jan 2026). The S-1 did not end an argument; it armed both sides of one.

Returning documents (return-grade only). *NVIDIA’s rack roadmap* (lead L2): returns here in exactly one capacity — the published cadence that compresses the collateral’s economic life; the new consequence this lecture adds is the accounting question the cadence forces (L2 planted it; Beat 11 answers for the defense). *The interconnection agreement* (lead L4): one clause — the paper the neocloud’s early-power position routed around. *The depreciation schedule as a document class* is **Lecture 10’s Paper Trail (accounting policy)** — this lecture reads CoreWeave’s instance inside the S-1 and leaves the cross-instance read (hyperscaler extensions, Amazon’s February 2025 reversal, Burry) untouched for the closer.

SECTION 6: THE NUMBER SPINE

(Research document — tables permitted here, banned in published prose.)

#	figure	unit	stage	as-of	author/filer	source	tier	notes
1	3–5 yr vs 6–18 mo	build/standup time	n/a (structural)	2025–26	analyst consensus (SemiAnalysis- lineage; Introl)	trade/analysis	STRUCTURAL	must-hit anchor
2	\$60B+	Microsoft neocloud commit- ments	committed (contracts, multi-year)	Nov 2025	Bloomberg reporting	Introl/Cryptopolis	WOL/NOTICE	anchor; ~\$33B Oct → \$60B Nov
3	4.8x	debt-to- equity	S-1 vintage	Mar 2025	syllabus anchor; derivation not located verbatim	—	DERIVED — verify vs. S-1 balance sheet at draft	do not substitute

#	figure	unit	stage	as-of	author/filer	source	tier	notes
4	\$34B	scheduled lease payments, off-balance-sheet, commencing through 2028	committed	Aug 2025 10-Q (reported Nov 2025)	CoreWeave filing via Fortune	Fortune 8–10 Nov 2025	STRUCTURAL	anchor; vintage flag: anchor attributes to S-1; cleanest verification is Q2-25 10-Q
5	\$2.95–3.99 vs \$6.88–11.01	\$/GPU-hr, H100	list/on-demand snapshot	2025 vintage	multi-provider surveys	anchor + IntuitionLabs	VOLATILE	anchor; 2026 bounds: \$2.39–3.44 vs \$6.88–12.29 — flag, don't substitute
6	Mar 2025	IPO	occurred	27–28 Mar 2025	SEC/company	CNBC/Reuters	ANCHOR (date)	
7	6 yrs (from 5)	useful life, technology equipment	filed policy, effective 1 Jan 2023	S-1/10-K	CoreWeave	filings via Fool/Cape Fear	ANCHOR (as filed fact)	thesis-risk anchor
8	\$1.92B / +737%	FY2024 revenue	reported	31 Dec 2024	CoreWeave S-1	CNBC	STRUCTURAL	
9	\$5.13B / +168%	FY2025 revenue	reported	31 Dec 2025	CoreWeave 8-K	SEC	STRUCTURAL	
10	\$2.08B / +112%	Q1 2026 revenue	reported	31 Mar 2026	CoreWeave	SEC/CNBC	STRUCTURAL	
11	62% → 71% → 67%	Microsoft share of revenue	reported	FY24 / Q2-25 / FY25	CoreWeave filings	CNBC/analyses	STRUCTURAL	Feb 2023 MSA pricing
12	\$8B → \$11.17B → ~\$14B → ~\$29B total liabilities	debt / liabilities	drawn/reported	12/24 · 6/25 · 9/25 · 12/25	CoreWeave filings	multiple	VOLATILE	
13	14.11% / ~11%	effective rate DDTL 1.0 / 2.0	contracted	2024 / May 2024	S-1 / facility terms	WYEA / Quinn Emanuel	STRUCTURAL	
14	\$986M / \$4.2B	maturities 2025 / 2026	scheduled	30 Jun 2025	10-Q	Level-Headed	STRUCTURAL	
15	\$15.1B → \$30.1B → \$55.6B → \$66.8B → \$99.4B	revenue back-log/RPO	contracted (incl. RPO + other)	12/24 → 3/26	CoreWeave	filings/releases	VOLATILE	phantom caveat row 29
16	\$22.4B	OpenAI total contract value	contracted, “up to”	25 Sep 2025	CoreWeave release	company	STRUCTURAL	1.9+4+6.5

#	figure	unit	stage	as-of	author/filer	source	tier	notes
17	\$14.2B → \$35.2B	Meta commitments	contracted, “up to,” through 2031/2032	9/25 → 9 Apr 2026	8-Ks	Next Platform	VOLATILE	Meta = 40.1% of \$87.8B extended backlog
18	\$6.3B / 13 Apr 2032	NVIDIA order form, residual-capacity obligation	contracted	9 Sep 2025	CoreWeave 8-K	SEC	ANCHOR (filed)	MSA dated 10 Apr 2023
19	\$250M / 5.96% / \$320M / \$2B	NVIDIA anchor / stake / customer payments / equity (rep.)	committed/held	8/25/3/25 12/24 · 2/26	SEC/filings/reporting	CNBC/Benzinga/MEXX	single-sourced	circularity spine
20	>850 MW → >1 GW / 43 DCs / 3.1→3.5 GW	active power / contracted power	energized / contracted	12/25 → 3/26	CoreWeave	releases	VOLATILE	1.7 GW target = announced
21	\$30–35B → \$31–35B	2026 capex guidance	announced	2/26 → 5/26	CoreWeave	releases	VOLATILE	vs. \$20–23B FY25
22	\$2.3B → \$7.5B → ~\$2B → \$2B → \$8.5B	major facilities/notes	committed	8/23–3/26	releases/filings	multiple	STRUCTURAL	A3/A-low on the \$8.5B
23	~5.9 yrs vs 6 yrs	avg debt tenor vs equipment life	filed	H1 2026	filings via Cape Fear	Cape Fear	STRUCTURAL	Kicker’s grounds
24	\$17.4B–19.4B / \$27B / \$9.7B / \$23B / multibillion	Nebius-MSFT / Nebius-Meta / IREN-MSFT / Nscale-MSFT / Lambda-MSFT	contracted “up to”	9/25–3/26	releases/6-K/Bloomberg	SEC/CNBC/Intell	VOLATILE	
25	\$8 → \$2.85 → \$3.06 → \$2.36 → \$2.00 → \$2.20 → \$2.53	H100 \$/GPU-hr series	spot/index	2023 → 21 Jul 2026	Latent Space / Silicon Data	cited	VOLATILE	
26	\$1.70 → \$2.35 (+40%)	H100 1-yr reserved	contracted	Oct 2025 → Mar 2026	SemiAnalysis index	SemiAnalysis	VOLATILE	
27	\$19.2B / \$637M / 7.5 yr	Chanos arithmetic	derived from Q2-25 filings	12 Aug 2025	Chanos	X post	CONTESTED (interpretation), STRUCTURAL (inputs)	

#	figure	unit	stage	as-of	author/filer	source	tier	notes
28	~\$176B	hyperscaler depreciation understate-ment 2026–28	estimate	Nov 2025	Burry	Fool recap	CONTESTED — L10's; one line max here	
29	\$99.4B etc.	all backlog aggregates	see note	—	—	—	—	Phantom-caveat row: see audit below

Reconciliation against the must-hit anchors. All six anchors carried at Syllabus 1.0 values, zero substitutions. Three flags for Nick: (i) the pricing-spread anchor's bounds vs. 2026 readings (row 5) — the spread survives; its endpoints have moved; (ii) the \$34B's vintage (row 4) — the anchor's syllabus attachment to “the S-1” vs. this run's cleanest verification at the Q2 2025 10-Q; recommend the drafting formulation attribute to “the company's filings” pending the S-1 page pull; (iii) the 4.8x (row 3) — DERIVED status; verify the arithmetic against the S-1 balance sheet before it anchors a paragraph. Additional non-anchor drift for awareness only: Microsoft's neocloud pool and Meta's commitments have both grown past the syllabus vintage (rows 2, 17); handled by as-of dating, not substitution.

Capacity/energy audit. Power figures in this spine are rates (MW/GW of active or contracted power — rows 20, 24-adjacent) and are labeled; no TWh quantities appear natively in this lecture; no source-level blur detected in the rows carried. One blur risk flagged for prose: “capacity” in this lecture means *compute* capacity (GPU-hours) in the commercial documents and *electrical* capacity (MW) in the buildout figures — the draft must never let the two share a sentence unlabeled.

Phantom-load audit (commercial cousin). Aggregate demand figures in this spine — the backlogs (row 15), the Microsoft pool (row 2), the “up to” contract values (rows 16–17, 24) — carry duplicate-and-option inflation risk by construction: “up to” values include unexercised options; the same end-demand (OpenAI's, Meta's) appears across multiple suppliers' backlogs; and some backlog dollars are backstopped by the vendor whose chips they buy (row 18). The caveat attaches on each figure's first appearance in prose, per the figures disciplines.

SECTION 7: THE SELLERS & THE OVERCLAIMS

The assigned seller — the Neocloud Founder (fullest treatment). *The claim as sold:* the category self-descriptions, dated — “the AI Hyperscaler™” (CoreWeave releases, 2024–25) → “The Essential Cloud for AI™” (by Feb 2026); “the Superintelligence Cloud” (Lambda, Nov 2025); “the AI factory company” (Crusoe, 2025); the fastest-cloud-to-\$5B framing (Intrator, 26 Feb 2026). Venue: releases, roadshow video, CNBC hits, podcasts. *What the seller gets if believed:* the next facility's debt priced at 9% instead of 14%; the rating; the multiple; the IPO window (Lambda's reported filing; Nscale's considered listing). *What's real underneath, granted precisely:* the arbitrage is real — energized-power lead times are physics and paper, the 6–18 month standup is documented, the spread existed and persists at sector level, the take-or-pay backlog is contracted, and the biggest skeptic-proof fact is the buyer: Microsoft put \$60B where the pitch was. *What's oversold, named exactly:* “hyperscaler” (a term of scale worn before the scale — CoreWeave's active power crossed 1 GW in Q1 2026, against fleets an order larger); backlog-as-destiny (“up to” values, options, and vendor-backstopped dollars inside the aggregate); utilization claims without published utilization; and the origin mythology doing investor-relations work — the pivot-genius narrative omits that the S-1's own risk language prices the possibility the schedule is wrong. *Narrator-move check:* **GRANT-AND-WITHHOLD confirmed as calibrated** — the record supports granting more than a skeptic would expect (the 95% re-let; the A3) and withholding more than a bull would like (the tenor race; the CDS tape). No re-calibration proposed.

The Hyperscaler (as buyer, this lecture's second seller). Claim as sold: “capacity constrained” — which is simultaneously true, a demand signal to markets, and a justification for \$190B of spend. Real: five quarters of consistent constraint language plus chips-in-inventory. Oversold: constraint framing treats the buyer's own forecast as exogenous — the same institution files the demand curve it then cannot meet. Move: GRANT-AND-WITHHOLD, executed inside Beats 6–7.

The vendor (NVIDIA, in costume). Claim: the ecosystem's health as disinterested fact. Real: the checks cleared — \$250M, \$6.3B, \$18.6B/quarter are filed. Oversold: demand statistics partially authored by the demand's financier; the company's own filing concedes investees “may indirectly purchase or use our products” [8 words, NVIDIA filing via CNBC, 20 May 2026]. Move: the Perverse Incentive beat *is* the move — mechanism stated, villainy withheld.

The steelman file (assigned defendant: the neocloud CFO's depreciation schedule). Delivered in full at Beat 11 — the defendant's own numbers (contract cover, observed residuals, peer schedules, the rated facility), his best documents (the S-1's policy and risk language; the Q4 2025 call; the Big Technology appearance), and his best on-tape line (“data driven”). Rotation intact: the neocloud CFO has not been and will not be steelmanned elsewhere.

The skepticism, cut both ways (the Doomer direction, same audit). *The claims:* it's WeWork (Jeffrey Emanuel, Mar 2025, via Semafor — long-term obligations against short-term demand); it's a debt time bomb (Where's Your Ed At, and the Fortune bear framing, Nov 2025); the chips die in 1–3 years (Tom's Hardware-derived claims); the CDS tape as verdict. *What's real:* the maturity wall is filed; the concentration is filed; the lease obligations are filed; the collateral's spot price did fall 75% peak-to-trough; the guidance cut of 10 Nov 2025 happened. *What's oversold:* the 1–3 year GPU-death claim generalizes mining-era utilization patterns to fleets whose observed residuals (95% re-let; A100s booked; A100 prices rising in 2025) contradict it so far; the WeWork analogy prices the liabilities and ignores that the assets here are take-or-pay contracted where WeWork's desks were month-to-month; and the CDS spread is a price of insurance in a thin market, not a default probability stamped by an oracle (the recap's own thin-trading caveat carried). *What would settle it:* published utilization and realized residual values at scale — which nobody publishes (Section 11), so **HOLD OPEN** is the honest terminal posture on the schedule question, exactly as the L10 hand-off expects. Burry's conclusion: refused here and cast there, per the architecture.

SECTION 8: THE HUMAN FLOOR

This lecture's machine touches households at one documented seam and individuals at none of the beat-grade intensity the Neighbor requires — stated plainly rather than stretched, per the never-promote rule.

The seam (comedy off): the Handoff's residential mailbox. The pack supplies the seam's grounds without colonizing L7: the megawatts this lecture's money energized draw from shared systems whose cost-allocation fights, bill deltas, and named ratepayers are Lecture 7's documented territory (the 267%, the \$4.3B, Warrenton's record). The rider must gesture at the mailbox with **zero recycled L7 specifics** — the walking bill is a direction, not a data point, until the next hour. Thermostat: near-zero from the mailbox sentence.

Workers inside the structure (flag, not a beat): 881 employees at end-2024 (prospectus); data-center technicians pulled “from across our entire portfolio” to recover the November delays [6 words, Intrator via CNBC, 26 Feb 2026]. If drafted, these are people whose workplaces are collateral — handled factually, comedy off.

Hearing-transcript pulls (the corpus this lecture's scene is built from): Microsoft FY2025 Q2 (29 Jan 2025) and FY2026 Q1 (29 Oct 2025) transcripts — microsoft.com investor-events pages, both confirmed live this run; Motley Fool transcript series for FY26 Q1/Q2; CoreWeave Q4 2025 and Q1 2026 call transcripts — investors.coreweave.com quarterly-results page (PDFs confirmed present, including the 7 May 2026 call). Speakers identified in this pack: Hood, Nadella, Zelnick (Deutsche Bank), Weiss (Morgan Stanley), Intrator, Agrawal. Continuous-material status: the transcripts are public and paginated; the drafting pull takes extended excerpts directly from those primary pages under the Verbatim rules. **Pack-dependency resolution:** the Roster's on-tape debts (Nadella/Hood constraint language; Intrator's defenses; as-of titles) — **RESOLVED** with dated locators throughout; no Neighbor-grade named-household dependency was assigned to this lecture, and none is manufactured.

SECTION 9: THE PEOPLE & THE CAST

The Humans.

Michael Intrator — full treatment delivered at Beat 2 and Section 1; consolidated status: co-founder, Chairman, CEO, President since September 2017; verified in role as of the research date; ~12% economic stake (Form 4, Feb 2026); Bloomberg Billionaires-tracked; on-record defenses dated 14 Nov 2025, Jan 2026 (Big Technology, with Venturo), 26 Feb 2026, 7

May 2026. Wants: the schedule believed and the next \$30B financed. Fears (revealed): the depreciation question and the delivery calendar (the Nov 2025 guidance cut was construction, not demand — his framing). Can enforce: capacity allocation; the founder voting bloc. Did: built the category's reference structure and put it on the public record.

Brian Ventura — co-founder; CTO Oct 2017–Mar 2024, then Chief Strategy Officer; Haverford economics; Nat-source/Hudson Ridge lineage; co-defender on the January 2026 podcast. *Brannin McBee* — co-founder, Chief Development Officer; energy-trading background. Founders jointly ~73% of voting power via Class B (governance compilation; verify precise figure against the proxy at draft stage — flagged).

Nitin Agrawal — Chief Financial Officer, CoreWeave (verified at 26 Feb 2026 release; also on the 7 May 2026 call). The Steelman's named defendant; his on-record framing: backlog visibility and a capital structure “positioned... to scale” [paraphrase-adjacent; exact line in the Q1 2026 release — pull at draft].

Jim Chanos — Kynikos-lineage short seller; the documented L6-available critic; the 12 Aug 2025 X arithmetic (verbatim banked, Beat 11); characterizations of CoreWeave as “a financial company” [3 words] with “short-lived assets that truly depreciate” [5 words] (via Finviz/Motley Fool coverage). Status: commentary ongoing as of late 2025; position disclosure not verified — treat as critic-with-incentive, symmetrical to sellers.

Stephen Balaban — co-founder and CEO, Lambda (as-of Nov 2025; a January 2026 Businesswire release describes him moving to lead technology strategy and product full-time under an expanded leadership structure — title drift flagged; use “then-CEO” convention for the November quote if the drift confirms). The 3 Nov 2025 CNBC line banked (Beat 5/Section 1). *Michael Balaban* — co-founder, CTO.

Arkady Volozh — founder and CEO, Nebius; Yandex founder (took it to a ~\$30B peak); renounced Russian citizenship February 2026; quote banked: “We will continue to deliver.” [5 words, Nebius release/6-K, 16 Mar 2026].

Chase Lochmiller (co-founder/CEO) and *Cully Cavness* (co-founder/COO), Crusoe — the flare-gas founders who sold the origin business (25 Mar 2025) to fund the pivot.

Jed McCaleb — Mt. Gox, Ripple, and Stellar co-founder; funds Voltage Park through the Navigation Fund; documented as *not* operationally involved in either entity — the founder-audit contrast is precisely his absence. *Eric Park* (CEO at 2023 launch) → *Ozan Kaya* (CEO by Jan 2026, per Forbes) — as-of convention applies.

Satya Nadella (Chairman and CEO, Microsoft) and *Amy Hood* (EVP and CFO) — the buyer's voices; verified in role throughout the window; quote inventory dated across Sections 1, 2, 8.

The Institutions. *CoreWeave* — lead treatment this lecture (L10 takes the return); motive/exposure fully documented above; treatment-completeness check: origin (Beat 2), document (Beat 3/Section 5), structure (Beat 4), market position (Beats 5–6, 9), defense (Beat 11), present tense (Section 11) — complete; **left deliberately unspent for L10:** the \$311M moment, the useful-life fight across instances, the audit's verdict-refusal. *Microsoft* — buyer-seller hybrid; incentives: constraint relief, opex optics, optionality; exposure: \$60B+ of commitments to structures it does not control. *NVIDIA* — the circularity's hub; Section 7's audit applies; never villainy — the backstop is also simply a vendor financing demand it believes in, at a capped \$6.3B against its own ~\$18.6B/quarter investing cadence. *Magnetar / Blackstone* — the private-credit architects; incentive: yield on secured paper; exposure: the borrowing base. *The rating agencies* — Moody's, S&P, Fitch, KBRA; incentive: fees on a new asset class; exposure: methodology risk in public. *Nebius*, *Crusoe*, *Lambda*, *Voltage Park* — specimen-grade treatments at Beat 5; lead lectures: none elsewhere (L6 owns the taxonomy; L9's taxonomy is orbital).

The Objects. *The H100-as-collateral* — full dossier, Beat 1; current disposition: ~\$2.53/hr on the index at the stamp, one generation behind Blackwell, two behind Rubin, still sold out on-demand per SemiAnalysis (Apr 2026). *The GB200/GB300 racks* — **L2's objects**; brief-reference only (first units shipped to CoreWeave — the fact rides in one clause).

The Documents — Section 5; cross-referenced, not duplicated.

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

The cascade edge, restated: Inherits: the financed workaround. · Binds at: the depreciation schedule. · Who pays: the bondholder if the schedule is wrong — and, next hour, the ratepayer either way. · Manufactures: who actually pays for the shared grid → L7.

The inherited problem, re-established with fresh specifics. L5 handed forward *cost left unassigned* — somebody owns all this compute and financed it with something. This pack supplies the re-establishment material the sampler needs without

recapping for the completist: the ownership answer arrives as a cap table (Magnetar to Mubadala), a coupon history (14% → A3), and a customer ledger (\$22.4B OpenAI, \$35.2B Meta, \$60B+ Microsoft-wide) — none of which appears in L5's pack. **Specifics L5 already owns (do not duplicate):** the PPA-as-financing-instrument framing (Talen's contracted margins — L5's alternate Handoff), the DOE full-recourse chain, and all procurement-of-power material. L6 answers L5's question with balance sheets, not with megawatt deals.

The manufactured problem and the Handoff. Primary, per Syllabus 2.0: *the bill walking* — drafted in Beat 12's rider. **Pack finding, flagged for markup:** the rider's named destination — “a mailbox in Manassas” — carries a service-territory risk: the **City of Manassas operates a municipal electric utility**, which would put the wrong utility's rider on the walking bill [municipal-utility status: high confidence from general public-record knowledge; **verify the exact service-territory boundary at draft stage** — locator: City of Manassas Utilities; Virginia municipal-electric membership rolls]. Remedies, either of which preserves the sentence's music: (a) move the mailbox one jurisdiction (Ashburn, Leesburg, Woodbridge — Dominion territory, all L7-adjacent); (b) drop the proper noun (“a mailbox in Northern Virginia”). **Alternates from the record, for rotation if the seam needs it:** (i) *a question left hanging* — the fleet's meters are private; whose meter carries the upgrades? (colliding with L7's opener mechanics — check rotation: L7's Handoff is a question, so this alternate would break the no-adjacent-repeat rule *forward*; flagged); (ii) *a cost left unassigned* — the CDS market has priced the bondholder's risk daily since October 2025; nobody has yet priced the ratepayer's (rotation-legal check: L5 used cost-unassigned; L5/L6 would repeat adjacently — **illegal, discard**); (iii) *a character walking* — the CFO leaves the earnings call for a rate-case docket (legal: L3 used character-walking, non-adjacent). Net: primary stands; alternate (iii) is the legal fallback.

Refresh-safe handoffs (binds hardest on this lecture). Verified: the rider as drafted references no valuation, no backlog figure, no price — only the structural facts that the money is private and the grid is shared, true in every edition. The inbound seam (L5→L6) likewise hinges on ownership-as-question, not on the 9.8 GW tally. **Refresh-safe: PASS**, contingent on the Manassas fix.

The boundary doors. *Silicon:* held — the H100's story begins on the truck; no fabrication, no CoWoS, no HBM supply detail beyond the one Silicon Data sentence noting packaging bottlenecks eased (carried as market context, not opened). *Reactor:* untouched. *Training-run internals:* one-inch material staged in Section 4, deployment pending Nick's call; nothing further researched. **Unassigned-door pressure detected and flagged:** this lecture's material presses on a *fourth* door the course has not assigned — **securitization mechanics as a discipline** (tranche math, Monte Carlo methodologies). The pack stops at what the rating documents say and who benefits; the fence runs at the methodology's front page.

Cross-lecture consistency ledger. L6 claims (later packs take brief-reference only): the Intrator/founder dossier; the S-1 treatment entire; the capital-structure strata and the H1-2026 tenor finding; the neocloud taxonomy and its four specimens; the Microsoft-neocloud Deal sequence including the ROFR consequence and the FT dispute; the circularity treatment entire (collecting L2's plant); the Chanos critique; the GPU price-cycle series and its indices; the pricing-spread deployment. L6 must not claim: the rack, crane day, Huang's quotes, the roadmap document treatment (L2); cooling, water, the Morris (L3); the queue's anatomy, the transformer, Order 2023 (L4); TMI, the PPA, co-location (L5); the \$4.3B, the 267%, Warrenton, tariff dockets, Martin & Peskoe (L7 — seed nothing beyond the rider's direction); Memphis, Stargate-as-symbol, Abilene's politics, jobs math (L8); orbital anything (L9); **the \$311M moment, Amazon's February 2025 reversal, hyperscaler useful-life extensions, Burry, the 2001 rhyme, Loudoun's Moody's exposure (L10)**. Verified line-by-line against the L1–L5 packs' own ledgers; one collection recorded: L2's circularity plant (NVIDIA \$18.6B line) is hereby collected by L6 — the Course Schema should log the debt as retired.

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

Live status of every deal, docket, and project (as of 21 July 2026). *CoreWeave:* Q1 2026 reported 7 May (revenue \$2.08B; backlog \$99.4B; >1 GW active; ~3.5 GW contracted); FY26 guidance \$12–13B revenue, \$31–35B capex; next milestone **Q2 2026 earnings, 18 August 2026** (company/Investing.com); stock last documented ~\$132 post-print (7 May), —~15% intraday on the 1 July Meta Compute report — no verified quote nearer the stamp; the drafting stamp should re-price. *Meta–CoreWeave:* \$35.2B through 2032, ramp undisclosed (Next Platform's caution carried). *OpenAI–CoreWeave:* \$22.4B, five-year base from March 2025. *NVIDIA order form:* in force to 13 April 2032; the full agreement was to be filed with Q3 2025 reporting (CNBC) — **exhibit pull flagged**. *Core Scientific:* independent; hosting contracts ~\$10.2B/12 years in force. *Nebius:* Nasdaq-100 constituent since 22 June; Meta \$27B structure with early-2027 tranche starts; Vineland ramp

through 2026. *Lambda*: Microsoft agreement ramping; IPO posture unconfirmed publicly. *Crusoe*: Project Jade approved (Jan 2026), \$50B/2.7 GW initial — **construction milestones unverified past approval**. *Voltage Park/Lightning*: merged entity operating. *Microsoft*: capacity constrained “through 2026” per the 29 April call; FY26 Q4 earnings expected late July 2026 — **inside the drafting window; re-check before Draft 1**.

Pending events with dates (announcing party attached; all expected): 18 Aug 2026 — CRWV Q2 earnings (company) · late Jul 2026 — Microsoft FY26 Q4 call (company; date not captured this run — pull) · Jan 2026-series amortization continues on DDTL 2.0 (facility terms) · through 2026 — Nebius Vineland capacity deliveries (company) · early 2027 — Nebius–Meta dedicated-cluster tranches begin (6-K) · 2027 — CoreWeave >\$30B exit ARR target, >75% contracted (company, 7 May 2026) · by Oct 2032 — every CoreWeave debt instrument matures (filings via Cape Fear).

The decay register (direction and velocity, for the 2027 refresh). GPU-hour pricing — weekly; direction contested (index \$2.53 and rising on SemiAnalysis’s model; falling on the correction thesis) · backlog figures — quarterly, upward-biased by “up to” accounting · Microsoft neocloud pool — monthly during land-grab conditions · debt stock and ratings — quarterly; watch the A3 · valuations (Crusoe \$10B+, Lambda ~\$6B secondary, Nebius market cap) — reprice continuously; marks, not verdicts · the pricing-spread anchor — re-snapshot at refresh; the anchor range is already vintage · the \$60B+ and \$35.2B — will be wrong by 2027 in the upward direction absent a break · Meta Compute — the single development most capable of inverting this lecture’s customer table; watch weekly.

What just changed (last ~90 days — the facts most likely to blindside a draft built on the anchors alone): the Meta \$21B expansion and the \$87.8B→\$99.4B backlog step (April–May); the capex raise to \$31–35B on component pricing (May); the H1-2026 financing run completing with the ~5.9-year tenor finding (June reporting); Nebius’s Nasdaq-100 entry and ~\$300 print (June); **Meta Compute (1 July)** — the customers-as-competitors risk moving from risk-factor boilerplate to a 15% single-day repricing; Microsoft’s ~\$190B fiscal-year investment figure (April).

What is still hidden (the refusal is course material). Fleet utilization — no neocloud publishes it; the number that would settle the schedule fight does not exist in public. Realized residual values at scale — only anecdotes (the 95% re-let) are on the record. The DDTL collateral schedules, the Microsoft MSA’s pricing, the Meta and OpenAI ramp curves, the NVIDIA order form’s full terms (exhibit promised, pull pending), Lambda’s confidential filing — all private or redacted. “Customer C” — named only by letter in the S-1. The honest terminal marker: the load-bearing assumption of this lecture is tested quarterly in public against evidence that remains almost entirely private.

SECTION 12: SOURCE INVENTORY

[1] CoreWeave, Inc. — Form S-1 — 3 Mar 2025 — SEC EDGAR, CIK 1769628 — PRIMARY; the lecture’s document; policy note and balance-sheet page pulls flagged. [2] CoreWeave — Form 8-K (NVIDIA Order Form) — 15 Sep 2025 — SEC (crwv-20250909) — PRIMARY; MSA date 10 Apr 2023; backstop terms verbatim. [3] CoreWeave — Q4/FY2025 earnings release (8-K) — 26 Feb 2026 — SEC — PRIMARY; Intrator/Agrawal quotes; FY figures. [4] CoreWeave — Q1 2026 release, presentation, and call transcript — 7 May 2026 — investors.coreweave.com — PRIMARY; \$99.4B; 1 GW; 8 GW target. [5] CoreWeave — OpenAI expansion release — 25 Sep 2025 — company — PRIMARY (seller’s own); \$22.4B arithmetic. [6] CoreWeave — IPO pricing release — 27 Mar 2025 — company — PRIMARY. [7] CoreWeave — Series B / DDTL 1.0 / Series C / leadership-bio pages — 2023–24 — company/PRNewswire — PRIMARY (seller’s own); Hudson Ridge language. [8] Blackstone — DDTL 1.0 and 2.0 releases — 3 Aug 2023 / 17 May 2024 — blackstone.com — PRIMARY (lender’s own). [9] Nebius Group — Form 6-K (Meta agreement) + release — 16 Mar 2026 — SEC — PRIMARY; unsold-capacity obligation text. [10] Microsoft — FY25 Q2 and FY26 Q1 earnings webcast/transcript pages — 29 Jan 2025 / 29 Oct 2025 — microsoft.com/investor — PRIMARY; Hood verbatim. [11] Motley Fool transcript series — MSFT FY26 Q1/Q2 — Oct 2025/Jan 2026 — fool.com — transcript secondary of primary calls. [12] CNBC — S-1 filing; IPO pricing/day; NVIDIA anchor; Q4-25; Q1-26; Crusoe–NYDIG; Lambda–Microsoft; OpenAI \$6.5B; ROFR — Mar 2025–May 2026 — cnbc.com — reported secondary, reporter-by-lined. [13] Reuters — IPO downsizing; \$6.3B order — Mar/Sep 2025 — wire primary-adjacent. [14] Fortune — CoreWeave debt series — 8–11 Nov 2025 — fortune.com — the \$34B/current-liabilities record with company statement. [15] Semafor — Microsoft’s \$12B option deferred to OpenAI — 20 Mar 2025 — semafor.com — the Deal’s hinge report; Altman roadshow quote. [16] Financial Times (Kinder, Morris, Uddin, Gara) via The Fly/TipRanks — Microsoft walkaway — 5–6 Mar 2025 — contested-claim record. [17] Bloomberg (via Introl/Cryptopolitan/DCD) — \$60B neocloud pool; \$33B October — Oct–Nov 2025 — the anchor’s basis. [18] Bloomberg Billionaires — Intrator profile — May 2026 vintage — biography + Form 4 stake. [19] Stanford CodeX —

OpenAI–Microsoft partnership analysis — 21 Mar 2025 — ROFR mechanics. [20] DCD — Nadella BG2/warm shells; Microsoft \$60B; Lambda deal; Voltage Park — Nov 2025–Jun 2026 — trade secondary. [21] Tom’s Hardware / TechSpot / Yahoo–TheStreet — BG2 Pod verbatim corroboration set — 2–6 Nov 2025. [22] Eugene Cheah — “\$2 H100s: How the GPU Rental Bubble Burst” — 11 Oct 2024 — Latent Space — the Forecast Problem’s founding text; break-even math. [23] Silicon Data — SDH100RT index page + price-history and spike posts — May 2025–Jul 2026 — index primary (vendor incentive noted). [24] SemiAnalysis — “The Great GPU Shortage – Rental Capacity” + 1-yr index — Apr 2026 — analyst primary (model-seller incentive noted); also the Neocloud Playbook lineage (Oct 2024). [25] Quinn Emanuel — client alerts on AI data-center financing/litigation — Nov 2025–Mar 2026 — law-firm synthesis of facility terms; DDTL 2.0 rate/amortization; Oracle suit citation. [26] CRA (Charles River Associates) / CREFC — data-center ABS primers — Dec 2025 / Feb 2026 — methodology synthesis with docketed citations (Moody’s 6 Feb 2025; S&P 23 Apr 2025; Fitch 24 Jul 2025; KBRA 9 Jan 2026). [27] Moody’s — data-center securitization blog — 2025 — rating-agency primary. [28] Jim Chanos — @RealJimChanos X post — 12 Aug 2025 — critic primary; arithmetic verbatim. [29] Motley Fool / AOL — Burry–CoreWeave depreciation explainers — 11 Nov 2025 — the five→six change; \$13B asset base; \$176B (L10). [30] Cape Fear Advisors — “CoreWeave, Twenty-Seven Years” — Jul 2026 — filings-derived analysis; tenor vs. life; H1-2026 financing inventory; \$26.6B equipment base. [31] Level-Headed Investing — Q2-2025 debt analysis — Oct 2025 — 10-Q synthesis; maturity wall. [32] MTS (datacenters.mts.now) — CoreWeave filings annotated — 2026 — 10-K synthesis; 67%; D&A series; cash-flow gap. [33] Next Platform — Meta \$21B expansion analysis — 9 Apr 2026 — 8-K synthesis; \$87.8B; 40.1%. [34] Two Seas Capital / ISS — proxy materials and recommendations — Oct 2025 — PRIMARY (contestant’s own, SEC-filed); Core Scientific fight. [35] Coinspeaker/Yahoo — merger-vote outcome; Intrator statements — 30–31 Oct 2025. [36] AI Business / TechTimes / TradingKey / Ren — Nebius record set — Nov 2025–Jul 2026 — deal terms, financials, Volozh biography (company-release-derived; incentives noted). [37] Sacra / Contrary / TSG Invest / Rainmaker — Crusoe and Lambda company profiles — 2025–26 — funding/revenue compilations (secondary; verify load-bearing figures against releases). [38] TechCrunch — Voltage Park launch; Lambda–Microsoft — Oct 2023 / Nov 2025. [39] Forbes (Iain Martin) — Voltage Park–Lightning merger — 21 Jan 2026 — the \$900M-grant variant; Kaya title. [40] Businesswire — Lambda releases (Microsoft agreement; credit facility; leadership) — Nov 2025–Jan 2026 — PRIMARY (seller’s own). [41] Spheron / VESSL / IntuitionLabs / aitooldiscovery / OpsLyft / Apex36 — 2026 GPU pricing surveys — Mar–Jul 2026 — pricing secondaries; CoreWeave \$6.16 exception; current bounds. [42] Introl — Microsoft–\$60B, CoreWeave deep-dive, price-collapse briefs — Dec 2025–Mar 2026 — synthesis with citations (an infrastructure-services vendor; incentive noted). [43] Trending Topics / 24-7 Wall St. — neocloud landscape + Meta Compute repricing — Jul 2026 — the 1 July event record. [44] io-fund — circular-financing analysis — 12 Jun 2026 — \$35.2B/\$62.2B/\$122.2B aggregations (analyst synthesis; verify before load-bearing use). [45] IndexBox / Yahoo — Plano facility specifics — Nov 2025. [46] Where’s Your Ed At (Zitron) — S-1 bear reading — 2025 — DDTL rates; Customer C (advocacy-flavored; used for filed-figure extraction only). [47] Benzinga — IPO structure; OpenAI \$350M placement; NVIDIA 5.96% — Mar 2025. [48] MEXC/Coinspeaker recaps — converts, CDS series, Q4 preview incl. NVIDIA \$2B — Nov 2025–Feb 2026 — **single-source risk on the \$2B; upgrade before use.** [49] CoreWeave leadership/governance pages + Equilar/The Org/PitchBook — Intrator/Venturo bios — current — Natsource AUM figures (variant \$1.2B/\$1.4B — state as range). [50] NVIDIA Q1 FY27 filing via CNBC — 20 May 2026 — the \$18.6B circularity line (collected from L2).

Prioritization note per instructions: the SEC-filed set ([1]–[9], [34]) and the transcript set ([10]–[11], [4]) outrank everything above them; every company release is flagged as the seller’s own; every analyst source carries its named incentive.

Pack status: All twelve sections delivered. Verdicts: 12/12 beats SUSTAINABLE (one with an allocation caveat); moves — five VERIFIED, one PASS-with-recommendation (Unit Conversion), one PARTIAL with armed fallback (Verbatim); dependencies — five RESOLVED, one RESOLVED-CONDITIONAL (Gesture/third door), one PARTIAL (policy-note verbatim), plus one new finding delivered for markup (the Manassas meter). Flagged draft-stage pulls, consolidated: S-1 policy-note and balance-sheet pages (EDGAR); the NVIDIA order-form exhibit; the founders’ voting-power figure against the proxy; the NVIDIA–CoreWeave \$2B second source; Balaban’s as-of title for the November quote; Microsoft FY26 Q4 call date; a fresh CRWV price at drafting. The pack proposes; markup and the Course Schema dispose.

L6 Research Pack 1.0 · Research as of 21 July 2026 · How AI Data Centers Work (An Unteachable Briefing) · Unteachable Courses. Built against Syllabus 2.0 (primary key), Syllabus 1.0 (locked base), Beat Menu 1.0, Moves List 1.0, Main Character Roster 1.0, and Master Style Guide §5. Strawman verdicts, negative-space scan, and moves verifications feed markup; the Course Schema locks the running order; must-hit anchors govern all figures until the Figures & Claims Ledger exists.

Lecture 7 — Who Pays

Research Pack 1.0 · source file L7_Research_Pack_1_0.md · research as of 21 JULY 2026

LECTURE IDENTITY (assembled from Syllabus 2.0, Syllabus 1.0, Beat Menu 1.0, Moves List 1.0, Roster 1.0, Style Guide §5)

Title: Lecture 7 — Who Pays

Frame & through-line: The local fight, framed as a bill rather than a protest. The rate case is the true battlefield, and the line that runs the lecture: *“It is the customer’s extension cord.”*

Register: Ledger leads. The Hearing Room and Neighbor beats carry the human floor, comedy off.

Cascade edge (Syllabus 2.0 format): Inherits: the socialized bill (from L6’s financed workaround and depreciation schedule) · Binds at: the rate case · Who pays: the lecture’s whole subject — named, dated, dollared · Manufactures: the three-altitude collision → L8.

THE STRAWMAN BEAT PLAN (12) — strawman for markup; the Course Schema locks running order

#	Beat	Family	Assignment per Syllabus 2.0
1	The Bill Arrives [O]	Money	The transmission rider on a Dominion residential bill, traced upstream
2	Mechanism Autopsy	Atoms	Cost-allocation doctrine made legible: how “system benefits” reasoning socializes a private customer’s extension cord
3	The Paper Trail — <i>class: tariff docket</i>	Politics	The AEP Ohio data center tariff filing as counter-move template; the interconnection agreement returns carrying its line
4	Follow the Money	Money	\$4.3B across seven PJM states in 2024, approved solely to connect data centers; residential bills near hubs up as much as 267% in five years
5	The Perverse Incentive	Politics/Money	“System benefits” doctrine producing the opposite of its intent
6	The Physics Audit	Atoms/Audit	The “data centers pay their share” claim run as arithmetic
7	The Steelman	Audit	<i>Defendant: Dominion</i> — the utility’s strongest case, in its own filed numbers

#	Beat	Family	Assignment per Syllabus 2.0
8	The Regulatory Collision	Politics	The moratorium wave: at least 11 states with active bills, against commissions' and legislatures' competing authority
9	The Hearing Room	Politics	Warrenton, February 15, 2023, ~2:30 a.m., hundreds packed in — transcript and minutes only; Miller's testimony, comedy off
10	The Neighbor	Character	One fence-line ratepayer from the hearing record — pack dependency flagged
11	The Externality Swap	Atoms/Money	Large-load tariffs: fence the costs in vs. deter the investment — both sides priced
12	The County [C]	Politics/Character	The sweep: Francis defeats Sutphin, Nov 5, 2024; every yes-vote gone; democracy as a rate-payer revolt with land-use paperwork

Paper Trail document class: tariff docket (rotation position 7 of 10 distinct classes). **Named document:** *In re Application of Ohio Power Company for New Tariffs Related to Data Centers*, Public Utilities Commission of Ohio Case No. **24-508-EL-ATA** → **Schedule DCT**, effective 23 July 2025.

Handoff mechanism (assigned): *a question left hanging* — the bill fight is one altitude; what happens when three stack over the same cornfield? (Rotation-verified against Syllabus 2.0: L4 ran *question*, L5 *cost unassigned*, L6 *the bill walking*; L7 *question* is non-adjacent to L4. Next mechanism is L8's *door not opened*.)

Negative space (beats left out): Cold Open on an Object · The Wrong Map · The Forecast Problem · The Founder Audit · The Symbol Audit · Taxonomy by Business Model · The Deal · Operator Reality · The Bottleneck.

THE CAST

Anchors (4 — carried as confirmed per Syllabus 2.0 Open Item 8):

Slot	Anchor	Status
Document	The interconnection agreement	RETURN — lead treatment owned by L4 (Section 5 of the L4 pack carries the full anatomy: feasibility → system impact → facilities studies, the FERC pro forma LGIA, the funding/true-up terms). L7 takes brief-reference only , and cashes the line the roster pre-assigned it: “ <i>It is the customer’s extension cord.</i> ” Do not rebuild.
Humans	Eliza Martin & Ari Peskoe, Harvard Law School	LEAD. Cast as a unit. <i>Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech’s Power</i> (March 2025) is the lecture’s intellectual spine. Author-crossover rule applies (the document is the plot event).

Slot	Anchor	Status
Human/County	Roy Francis, Warrenton Town Council, Ward 1	LEAD. Defeated Heather Sutphin 5 November 2024, 61.11% to 38.19%. The on-record verdict runs the closer.

Secondaries (documented): McKenzie Miller (Fauquier County resident, Feb 2023 testimony — **comedy off**) · Peggy DiVincenzo (Warrenton resident, Feb 2023 hearing) · Larry Kovalik, Michele O'Halloran, William Semple, Eric Gagnon (the five incoming members' joint statement) · Heather Sutphin, Brett Hamby, James Hartman, Jay Heroux (the four yes-votes) · David McGuire, Paul Mooney, William Semple (the three no-votes) · Brandie Schaeffer (then-Town Manager; 3,142 emails; departed to Amazon) · Kevin Ramundo (president, Citizens for Fauquier County) · Governor **Josh Shapiro** (PA) — the January 2025 PJM settlement · **Joseph Bowring** / Monitoring Analytics — ~12,000 MW “almost entirely” data centers; \$6.3B of \$16.4B · **Dominion Energy** — **return, and this lecture's steelman defendant** (exhibit intro L1; pipeline exhibit L4; **full steelman treatment is L7's**) · **PJM** — **return** (lead L4; returns here with the \$4.3B/seven-state arithmetic and the capacity-auction fight; returns again L10) · Andrew Major (SCC staff attorney) · Louise White (Deputy Chief Energy Officer, Commonwealth of Virginia) · Mike Jacobs (UCS) · Governor **Abigail Spanberger** (VA) · Sen. **L. Louise Lucas** (VA) · Sen. **Elizabeth Warren** (MA).

Recurring-cast status: *Returns into L7:* the interconnection agreement (L4 owns), PJM (L4 owns), Loudoun County (L1 owns), Dominion (steelman is L7's own — this is Dominion's **lead** hour). *Exports from L7:* Dominion's steelman is spent here and must not be rebuilt; the moratorium wave hands to L8's federal-preemption collision.

MUST-HIT ANCHORS (verbatim from Syllabus 1.0 / 2.0)

267% bill increases; \$4.3B / seven states / 2024 PJM; 11+ state moratorium bills; Warrenton council sweep (Nov 5, 2024); the 2:30 a.m. Feb 15, 2023 vote; large-load tariff cases; the interconnection agreement as artifact; Extracting Profits from the Public (March 2025).

△ **One must-hit anchor fails verification as worded.** See Section 6, **Discrepancy A** (the 267% figure is a *wholesale nodal price* series, not a residential bill series). This is a finding, not a substitution; the anchor value stands until Nick resolves it.

MOVES PLAN (as assigned) — with pack-verification results

Move	Assignment	Pack verdict
Step Function	267% in five years	VERIFIED AS A NUMBER / MISLABELED AS A CLAIM — see §4 and §6 Discrepancy A
Unit Conversion	\$4.3B → per-household arithmetic (<i>pack-verify before deploying</i>)	PASS — arithmetic shown in §4
Timeline Snap	5 November 2024 — the night the incentives flipped	VERIFIED , with a documented rival date presented (§4)
Verbatim	The tariff's definition of a “Large Load Customer”	FAIL as assigned — Schedule DCT contains no such defined term. Three verified substitutes supplied (§4)
As-Of Stamp	The 11+ state moratorium tally	VERIFIED and already decayed — current range 11–14 depending on counter; one state now enacted (§4)
Kicker	Every member who voted yes at 2:30 in the morning is gone	VERIFIED , with a precision note: three left voluntarily, one was defeated (§4)
Gesture	<i>skip proposed</i>	Skip confirmed. No boundary door is pressed by this lecture's material (§10)

Move	Assignment	Pack verdict
Handoff	Question left hanging	Material in §10

OVERCLAIM & NARRATOR MOVE (as assigned)

Sellers on the field: the **Utility** and the **Politician**. **Governing §5 moves:** **GRANT-AND-WITHHOLD** on “data centers fund your schools” (the revenue is real; the allocation doctrine is the fight) · **HOLD OPEN** on socialization vs. fencing — the tariff cases are live and the course says so. **Steelman defendant (rotation-locked):** **Dominion**. No party steelmanned twice course-wide; Dominion appears at L1 and L4 as exhibit only.

Decay tier: **Mid**. Tallies and tariff cases refresh; the doctrine fight persists.

HUMAN-FLOOR FLAGS — comedy drops to near-zero inside every zone below

1. **Beat 1 (The Bill Arrives)** — the entire beat sits on a household’s bill line. Thermostat near-zero from the first sentence through the upstream trace’s arrival at the substation.
2. **Beat 9 (The Hearing Room)** — McKenzie Miller testified in tears about affordable housing. Comedy off for the full duration of her material. Absurdity may attach to *procedure* (the 2:30 a.m. clock, the 3,142 withheld emails) but never to speakers.
3. **Beat 10 (The Neighbor)** — John Steinbach’s \$281 January 2026 bill against a ~\$100 December 2025 bill, in a house he has lived in for nearly forty years. Comedy off, entire beat.
4. **Any deployment of the \$14–\$37/month JLARC range, the \$2.90→\$0.94 Rider T-1 estimate, or the DC/Maryland/Maine residential price series** — these are household money. Precision, not levity.
5. **Winter-bill material** (February 2026 Dominion bill-shock coverage; Prince George’s County, Maryland) — flagged, cold-snap bills are a hardship record.
6. **Workers:** none in this lecture’s documented territory. If a lineman or study engineer surfaces, punch-up-only per the L3/L4 precedent.

PACK DEPENDENCIES (restated as a checklist; each resolved or honestly failed below)

#	Dependency	Source	Status
D1	A named fence-line ratepayer must surface from the hearing record for the Neighbor beat; fallback is a second Hearing Room-sourced treatment of Miller	Syllabus 2.0 Open Item 8	PARTIAL — resolved with a caveat. §8 supplies John Steinbach (Manassas, VA), a named Dominion residential ratepayer with a dated bill delta and verbatim words — but from published reporting , not a hearing transcript, and he is not documented as living at a fence line. Fallback (Miller) also fully built in §8. Markup call required.
D2	Unit Conversion arithmetic must clear at pack stage (\$4.3B → per-household)	Syllabus 2.0 Open Item 11	PASS — §4
D3	The Verbatim must exist verbatim (tariff definition of “Large Load Customer”)	Moves List §8 evidence discipline	FAIL as assigned; three verified substitutes supplied — §4

#	Dependency	Source	Status
D4	Roster debt: Francis’s election-night line, with full context	Roster 1.0, “What the Research Packs still owe the roster”	RESOLVED — §2 Beat 12, §8, §9
D5	Roster debt: McKenzie Miller’s Feb 2023 testimony, verbatim	Roster 1.0	RESOLVED — §8
D6	Roster debt: as-of titles at dated moments	Roster 1.0	RESOLVED — §9, using the “then-” convention throughout
D7	Roster debt: Warrenton hearing-transcript pulls	Roster 1.0	PARTIAL — §8 supplies contemporaneous reported quotations plus the location of the primary corpus (CFFC’s eight unedited video segments of the 14 Feb 2023 hearing; Town of Warrenton minutes, Municode). No certified stenographic transcript is public. Flagged.
D8	The four named anchors confirmed (agreement, Martin & Peskoe as a unit, Francis)	Syllabus 2.0 Open Item 8	SUPPORTED — all four carry pack-grade material; §9

RESEARCH AS OF 21 JULY 2026

(Every volatile figure inside this pack carries its own as-of date in addition to this pack-level stamp. This is the contract with the 2027 refresh: Section 11 lists exactly what to re-research.)

SECTION 1: TIMELINE OF THE CONSTRAINT

A cost-allocation machine assembling itself. Entries are dated to the day where the record supports it, to the month or year where it does not.

The doctrine, before there was anything to fight over

1. **1945** — *Colorado Interstate Gas Co. v. Federal Power Commission*, 324 U.S. 581, 590: the Supreme Court states that ratemaking is not an exact science. Quoted by Martin & Peskoe eighty years later as the load-bearing admission underneath every cost-allocation fight in this lecture. (*Why it matters: the imprecision is the mechanism.*)
2. **1961** — James C. Bonbright publishes *Principles of Public Utility Rates* (Columbia University Press). Page 338 contains the sentence about “notorious disagreements among the experts as to the choice of the most rational method of cost allocation.” Both Martin & Peskoe (2025) and the Union of Concerned Scientists (2025) cite Bonbright by name. The cost-causation principle this lecture audits has a 1961 hardcover as its founding document.
3. **1982** — *Alabama Electric Cooperative, Inc. v. FERC*, 684 F.2d 20, 27 (D.C. Cir.): rates should “produce revenues from each class of customers which match, as closely as practicable, the costs to serve each class or individual customer.” The standard the whole lecture measures against.
4. **24 April 1996** — FERC Order No. 888 (Dockets RM95-8-000, TM94-7-001): open-access transmission. The federal/state jurisdictional line that the connection-cost loophole later falls through.
5. **16 February 2007** — FERC Order No. 890: local vs. regional transmission planning formalized. Local plans are presumed to serve wholesale purposes — the presumption that breaks when a single retail customer needs a 500 kV line.
6. **21 July 2011** — FERC Order No. 1000: transmission planning and cost allocation by public utilities. Regional cost allocation “roughly in proportion to benefits.”

7. **2019** — Nevada Power files a Long Term Energy Supply Agreement with Google (Nev. PUC Docket 19-12017, application filed 19 December 2019). The white paper argues the blended rate gives Google cost certainty. An early specimen of the special contract.
8. **2022** — Exelon and Constellation separate into distinct companies. Generation and delivery now have opposed financial interests — the structural precondition for the co-location fight that arrives in 2024.
9. **2023** — Aneil Kovvali and Joshua C. Macey publish *Hidden Value Transfers in Public Utilities*, 171 U. Penn. L. Rev. 2129. Coins the term Martin & Peskoe build their argument on.
10. **4 February 2022** — FERC issues its audit report on FirstEnergy Corp. (Docket FA19-1-000). The audit finds lobbying expenses mislabeled such that internal controls were “possibly obfuscated or circumvented.” Rate cases did not detect it; a federal sting operation did. (*Why it matters: the pack’s cleanest evidence that PUC review of utility accounting is not adversarial-proof.*)

The demand arrives

11. **November 2022** — ChatGPT’s public release. Martin & Peskoe date the current surge to it explicitly.
12. **March 2023** — AEP Ohio institutes a **moratorium on new data center connections** in central Ohio. It will run 28 months. (*The utility’s own pause is the predicate for the tariff it files fourteen months later.*)
13. **20 November 2023** — Data Center Frontier reports Skybox planning a 300 MW campus south of Dallas; Martin & Peskoe use the City of Cleveland’s ~300 MW municipal system as the comparison. The “as much as a city” era begins.
14. **December 2023** — PJM approves roughly **\$5 billion** of regional transmission projects, citing generation retirement and “unprecedented data center load growth,” primarily in Virginia. Roughly half the cost lands on Virginia utilities, ~10% on Maryland utilities, remainder across the footprint.
15. **January 2024** — Newmark’s *2023 U.S. Data Center Market Overview* projects 35 GW of data center demand by 2030 (up from 19 GW actual in 2023 per FERC’s May 2024 summer assessment). By December 2024 Grid Strategies will be at 65 GW. (*The forecast doubles inside twelve months — the DISCOUNT move’s home exhibit.*)
16. **1 May 2024** — Then-interim AEP CEO Ben Fowke tells the market AEP faces 15 GW of new load by 2030, driven by Amazon, Google and other data centers, against a multi-state system that peaks at 35 GW.
17. **13 May 2024** — Direct testimony of **Matthew S. McKenzie** on behalf of Ohio Power Company, PUCO Case No. 24-508-EL-ATA, at 2: AEP Ohio has “limited ability to distinguish customers who are merely speculating on potential data center investments from customers who are willing to make long-term financial commitments.” (*The phantom-load problem, stated by the utility itself, under oath, in the docket this lecture’s Paper Trail lives in.*)
18. **May 2024** — **AEP Ohio files Case No. 24-508-EL-ATA**, seeking a new tariff structure for data centers >25 MW and crypto/mobile data centers >1 MW. The original ask: a **10-year commitment to pay for a minimum of 90%** of subscribed load.
19. **24 May 2024** — The Data Center Coalition moves to intervene in 24-508, warning AEP Ohio’s proposals “may have a significant impact on existing and planned data centers in AEP Ohio’s service territory.”
20. **10 June 2024** — Sidecat LLC, a Meta affiliate, intervenes in 24-508: applicable electricity rates “will be a significant consideration for Meta when evaluating possible sites.”
21. **July 2024** — Virginia’s largest utility applies to the SCC to build infrastructure serving a new large data center. SCC staff find the project “likely, if not certainly, would not be needed at this time” but for the data center’s request. The utility tells regulators the **\$23 million** project will be recovered through its FERC-approved transmission tariff — under which about half of assigned costs are billed to residential ratepayers.
22. **30 July 2024** — PJM posts the 2025/2026 Base Residual Auction results: **\$269.92/MW-day** RTO-wide, a record, with BGE at \$466.35 and Dominion at \$444.26. Up from **\$28.92/MW-day** for 2024/25.
23. **30 July 2024** — The Virginia Court of Appeals reverses the Fauquier Circuit Court in *Citizens for Fauquier County v. Town of Warrenton*, holding the circuit court erred in letting Warrenton claim the FOIA “working papers” exemption for both mayor and town manager, and erred in reviewing a 10-email sample chosen by the town’s own counsel. **3,100+ emails** remain at issue.
24. **August 2024** — FERC rejects a utility’s proposed new ratepayer class for crypto operations, finding insufficient evidence that crypto poses “a greater stranded asset risk than other loads of similar size.” (*The evidentiary bar the AEP Ohio class will have to clear.*)
25. **13 August 2024** — Warrenton Town Council votes **4–3** to appeal the FOIA ruling to the Virginia Supreme Court.
26. **18 October 2024** — Direct testimony of Kevin C. Higgins for the Data Center Coalition in 24-508, at 7: the tariff “will adversely impact planned data center development in the Company’s service territory”; at 11, a caution against

- “unjust and discriminatory terms.”
27. **23 October 2024** — **The utility-side stipulation is filed** in 24-508 by AEP Ohio, PUCO Staff, the Ohio Consumers’ Counsel, the Ohio Energy Group, Walmart, and Ohio Partners for Affordable Energy: minimum **85%** of subscribed load, financial assurances, cancellation penalties, and a path to lifting the March 2023 moratorium.
 28. **8 November 2024** — Direct testimony of Brendon J. Baatz opposing the second joint stipulation, 24-508, at 4: Schedule DCT’s terms are “far more restrictive and burdensome than those imposed by investor-owned utilities in other states.” Same day, Amazon witness Michael Fradette’s second supplemental testimony, at 18, asks the Commission to reject “a stipulation that unfairly discriminates against data centers.”
 29. **5 NOVEMBER 2024** — **THE TIMELINE SNAP**. Warrenton, Virginia. **Roy Francis defeats incumbent Heather Sutphin in Ward 1, 61.11% to 38.19%** — the town’s only contested council race. Kovalik (Ward 3) and O’Halloran (Ward 4) win open seats; Semple and Gagnon are re-elected. Every candidate elected had campaigned against data center construction in town. Fauquier County turnout exceeds 75%. (*By this date the other three yes-votes had already left: Heroux declined to seek re-election in September 2023; Hartman and Hamby in June 2024.*)
 30. **13 November 2024** — Tate Hewitt’s story runs in the *Fauquier Times / Prince William Times*. **Francis, on the record: “All of the people who voted for Amazon are gone... This election was a referendum on Amazon.”** Sutphin, in the same piece: “They’re going to find out that, no matter what you decide, they’re going to find something wrong with it.”
 31. **20 November 2024** — *The Impact of Data Centers on Energy Demand and Market Prices* posted to SSRN (abstract 5017484): unaddressed data center demand growth could raise Virginia electricity rates by as much as **70% within a decade**.
 32. **21 November 2024** — FERC’s 2024 Report on Enforcement (Docket AD07-13-018) at 51: most audits find non-operating expenses booked into administrative and general accounts, “leading to inappropriate inclusion of such costs in revenue requirements produced by their formula rates.”
 33. **December 2024** — FERC approves a contract governing transmission facilities for a new data center: the data center pays immediately for interconnection facilities but not for upgrades to existing transmission, which AES pledges to place in transmission rates paid by all ratepayers pending a state tariff. The Ohio ratepayer advocate protests the protective language as “unacceptably ambiguous” and asks FERC for “specific language to preclude shifting data center costs.” FERC approves anyway as premature. **Commissioner Mark Christie concurs separately, questioning the stranded-cost treatment.**
 34. **9 DECEMBER 2024** — **JLARC delivers Report 598, Data Centers in Virginia, to the General Assembly.** Findings: Northern Virginia is the world’s largest data center market, ahead of Beijing and London; the industry generates roughly **\$9.1 billion** in annual economic activity; unconstrained demand could **triple** by 2040; meeting it could cost up to **\$18 billion**; a typical Dominion residential customer could see generation- and transmission-related costs rise **\$14 to \$37 per month in constant 2040 dollars**. Chief legislative analyst **Mark Gribbin** frames the tax-exemption options: extend, expire, or modify. A JLARC representative tells lawmakers that modern data centers “are large industrial facilities and are largely incompatible with residential use.”
 35. **16 December 2024** — Virginia SCC technical conference on the share of upgrade costs borne by the data center industry. Same day, the JLARC report summary circulates to localities including Prince William County.
 36. **16 December 2024** — Ohio Governor Mike DeWine announces a **\$10 billion** AWS investment plan in greater Ohio.
 37. **December 2024** — **Governor Josh Shapiro files a complaint at FERC against PJM**, attacking the capacity auction design as flawed and warning of historic price increases across the 13-state footprint.
 38. **5 December 2024** — Meta announces a 4-million-square-foot, **2 GW** Louisiana campus. Palo Verde, the largest U.S. nuclear station, is ~3.3 GW across three reactors.
 39. **3 January 2025** — PUCO holds a local public hearing in Columbus on the AEP Ohio data center tariff. The Ohio Consumers’ Counsel frames the choice publicly as protecting Ohio customers versus catering to “multi-billion dollar corporations.”
 40. **3 January 2025** — Microsoft discloses it expects to spend **\$80 billion** on AI-enabled data centers in fiscal 2025, more than \$40 billion in the U.S.
 41. **January 2025** — Initial DeepSeek reports on low energy consumption trigger the first serious public question about whether the demand curve is real. Guggenheim analysts describe “panic among investors.”
 42. **21 January 2025** — At a White House press conference, OpenAI headlines **\$100 billion** in data center investment with the possibility of **\$400 billion more** over four years. (*Announced, not spent — \$5 discipline.*)
 43. **28 JANUARY 2025** — **Shapiro and PJM reach agreement.** PJM will set a **\$325/MW-day cap and \$175/MW-**

- day floor** for the 2026/27 and 2027/28 auctions — down from a cap over \$500/MW-day. Shapiro's office estimates **\$21 billion** in avoided costs over two years.
44. **January 2025** — Georgia Power files its Budget 2025 load and energy forecast (Ga. PSC Docket 56002); executives attribute ~80% of forecast demand growth to data centers.
 45. **January 2025** — A bill is introduced in Virginia requiring regulators to determine whether cost allocation methods “unreasonably subsidize” data centers and to minimize or eliminate any such subsidies.
 46. **February 2025** — Nevada Energy agrees with intervenors to modify its Clean Transition Tariff proposal and defer some cost-allocation questions, after PUC staff conclude the tariff would not in fact firewall generation costs — including a proposal to charge other ratepayers a portion of “lost” revenue.
 47. **26 February 2025** — FirstEnergy reports its data center pipeline nearly doubled to almost **3 GW by 2029** and raises its five-year capital plan 8% to **\$28 billion**, implying ~9% compound rate-base growth.
 48. **5–6 MARCH 2025** — **Martin & Peskoe publish *Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power*** (Harvard Law School Environmental and Energy Law Program). Peskoe posts it at 8:56 a.m. on 6 March 2025. Based on review of **nearly 50 regulatory proceedings**, including **40 state PUC special-contract proceedings**.
 49. **March 2025** — Pennsylvania's PUC opens **Docket M-2025-3054271**, “concerning interconnection and tariffs for large load customers,” schedules an en banc hearing, and directs staff to develop a model large-load tariff. (*Note the phrase the docket uses. See §4, Verbatim.*)
 50. **17 March 2023 → April 2025** — The Warrenton merits litigation grinds: *Citizens for Fauquier County and 10 individual plaintiffs v. Town of Warrenton*, filed in Fauquier County Circuit Court **17 March 2023**; Amazon Data Services petitions to join in April 2023; the town approves the site plan in April 2024; CFFC and ten residents file a Board of Zoning Appeals challenge 16 May 2024; the town sues to stop the BZA from hearing it; CFFC files a writ of mandamus.
 51. **7 April 2025** — Martin and Peskoe publish the plain-language companion, *How you subsidize Big Tech with your electricity bill*, through the Salata Institute.
 52. **April 2025** — Oregon PUC approves Portland General Electric's changes to new-load connection cost policies (Docket UE 430).
 53. **22 April 2025** — **FERC approves the Shapiro–PJM settlement.**
 54. **5 May 2025** — Virginia Governor Glenn Youngkin vetoes HB 1601, which would have required environmental and community impact assessments for proposed data centers.
 55. **2 May 2025** — PJM announces 51 Reliability Resource Initiative selections.
 56. **June 2025** — Oregon enacts **HB 3546, the POWER Act** (16 June 2025), requiring the PUC to establish a separate large-load class.
 57. **3 June 2025** — Monitoring Analytics publishes *Analysis of the 2025/2026 RPM Base Residual Auction — Part G (Revised)*: current and projected data center demand **increased capacity costs by \$9.3 billion, or 174%**, for the 2025/26 delivery year against a no-data-center counterfactual.
 58. **4 June 2025** — Joseph Bowring speaks at a FERC conference on resource adequacy.
 59. **9 JULY 2025** — **PUCO issues its Opinion and Order in Case No. 24-508-EL-ATA**, adopting the utility-side stipulation. PUCO Chair **Jenifer French**: the order “represents a well-balanced package that safeguards non-data center customers on an industrial and residential level while establishing a dependable and reasonable environment for data centers to continue to thrive within Ohio.” Regulators find the framework ensures expansion costs are “appropriately” borne by those who incur them.
 60. **11 July 2025** — AEP Ohio files its compliance tariff.
 61. **July 2025** — **Warrenton Town Council amends the zoning ordinance to remove data centers as a permitted use in industrial districts.** The amendment does not disturb the February 2023 permit; it forecloses the next one.
 62. **22 July 2025** — PJM posts 2026/2027 BRA results: **134,311 MW UCAP** procured plus 11,933 MW FRR = 146,244 MW; clearing price **\$329.17/MW-day (UCAP)** at the FERC-approved cap, RTO-wide. Cleared volume exceeds the reliability requirement by just **139 MW**. Shapiro's office scores the settlement at **\$8.3 billion** in avoided cost, ~\$1.6 billion and ~\$116 per household in Pennsylvania.
 63. **23 JULY 2025** — **Schedule DCT becomes effective.** AEP Ohio's data center tariff is live: >25,000 kW new or expanded facilities, mobile/crypto >1 MW.
 64. **Sept 2025** — **The Union of Concerned Scientists publishes *Connection Costs Loophole Costs Customers Over \$4 Billion to Connect Data Centers to Power Grid*** (author: **Mike Jacobs**, senior manager, energy, UCS Climate and Energy Program).

65. **29 SEPTEMBER 2025** — Bloomberg publishes *How AI Data Centers Are Sending Your Power Bill Soaring*, analyzing wholesale prices at roughly 25,000 nodes across seven regional grids (price data from Grid Status; data center locations from DC Byte). Finding: **wholesale prices at some nodes near significant data center activity cost as much as 267% more for a single month than five years earlier** (April 2020 → April 2025); more than 70% of nodes with price increases sit within 50 miles of significant data center activity, against 20% of nodes with decreases.
66. **7 November 2025** — AEP Ohio issues its DCT Load Study Letter.
67. **13 November 2025** — The Ohio Manufacturers' Association challenges the new billing structure. AEP had told PUCO it had **more than 50 data centers in the queue representing more than 30,000 MW** of demand.
68. **17 November 2025** — Peskoe presents the paper at a Harvard Energy Policy Seminar.
69. **November 2025** — A coalition tells the Montana PSC that NorthWestern has “short-circuited” the public’s right to know on data center deals.
70. **November 2025** — Consumer Reports fields a nationally representative survey of 2,146 U.S. adults: **78%** are somewhat or very concerned that new data centers will raise their energy bills.
71. **5 December 2025** — Incoming Virginia Lieutenant Governor Ghazala Hashmi and Governor-elect Abigail Spanberger press the “fair share” framing publicly.
72. **15 DECEMBER 2025** — **Senator Elizabeth Warren and colleagues send letters to data center companies** opening an investigation into their effect on utility costs. The letters cite the September 2025 Bloomberg analysis. (*This is where the 267% figure begins its migration from wholesale nodes to household bills.*)
73. **17 December 2025** — PJM posts 2027/2028 BRA results: **134,479 MW UCAP** plus 11,299 FRR = 145,777 MW. **The first auction in which the entire RTO, including FRR areas, fell short of the reliability requirement** — short by **6,516.6 MW** on a UCAP basis, against 208.7 MW short in 2026/27. Price at the cap, **~\$333/MW-day**. Total cost **~\$16.4 billion**, against \$2.2 billion two delivery-years earlier. Shapiro’s office scores this auction at **\$9.9 billion** avoided.
74. **17 December 2025** — Shapiro’s office publicly calls for PJM reform “before the next uncapped auction in June 2026.”
75. **5–7 January 2026** — Monitoring Analytics’ report on the December auction: data center load accounted for **40%** of that auction’s costs; data center *forecasts* beyond existing facilities made up **45% of the \$47.2 billion** in capacity costs across PJM’s last three auctions. The market monitor: **“Data center load growth is the primary reason for recent and expected capacity market conditions, including total forecast load growth, the tight supply and demand balance, the significant shortfall in cleared capacity, and high prices.”**
76. **January 2026** — PJM issues a new load forecast reflecting stricter vetting of potential large loads.
77. **January 2026** — Global Strategy Group / Chesapeake Climate Action Network Action Fund survey: **nearly three-quarters of Virginia voters** blame data centers for rising electricity costs.
78. **January 2026** — A Christopher Newport University Wason Center poll finds **63%** of Virginians support site assessments for data centers.
79. **JANUARY 2026** — **John Steinbach, Manassas, Virginia, receives a \$281 electricity bill**, against roughly \$100 the previous month. He has lived in the house nearly forty years. (*Human floor. Comedy off. \$8.*)
80. **16 January 2026** — Shapiro announces federal support for extending the PJM price cap.
81. **February 2026** — AEP Ohio files a February 2026 update in the DCT docket.
82. **5 February 2026** — Stateline reports states weighing new data center laws against the Bloomberg 267% finding. **Lucas Fykes**, senior director of energy policy and regulatory counsel at the Data Center Coalition: “It’s inaccurate to draw a clear line between large load customers like data centers coming online and increases in prices. It’s just not that simple.”
83. **21 February 2026** — WAVY reports Dominion customers receiving unusually high bills: “This is extreme.”
84. **24 February 2026** — A Prince George’s County, Maryland leader calls for an investigation into the utility bill surge and offers senior assistance.
85. **24 February 2026** — House Science Committee Investigations & Oversight Subcommittee hearing, *Powering America’s AI Future*, 2318 Rayburn. Witnesses include Google’s head of energy and sustainability policy.
86. **February–March 2026** — Kentucky Utilities and Louisville Gas & Electric receive approval for a new Extremely High Load Factor Service tariff (Cases 2025-00113 / 2025-00114).
87. **March 2026** — **Google, Amazon, Microsoft and Meta sign a ratepayer protection pledge at the White House.** (*Retained: in July 2026 an SCC staff attorney will note on the record that none of them mentioned it in testimony.*)
88. **March 2026** — NorthWestern Energy files a Large New Load Tariff application with the Montana PSC

- (2026.04.023).
89. **14 March 2026** — Utility Dive: PJM wholesale power costs jump **54%** in one year — “clear warning signs.”
 90. **16 March 2026** — The Buckeye Institute publishes *Undermining Ohio’s Competitive Edge*, attacking Schedule DCT’s 85% take-or-pay and 12-year term as an inversion of the Ramsey rule: it charges the most elastic customers the highest markups. (*The best-argued opposition case on the record; see §7.*)
 91. **20 March 2026** — Consumer Reports publishes *AI Data Centers: Big Tech’s Impact on Electric Bills, Water, and More*, carrying Steinbach’s account and quotes.
 92. **April 2026** — Lawrence Berkeley National Laboratory publishes *Retail Electricity Price Trends and Drivers* (2026 edition): equipment costs, an aging grid, and clean energy requirements are also drivers. (*The pack’s honest counterweight to single-cause attribution.*)
 93. **2 April 2026** — Xcel’s Colorado subsidiary proposes a large-load tariff; PSCo projects large-load customers will be two-thirds of new demand and 950 MW of new generation over five years. Per the Smart Electric Power Alliance tariff database: **29 large-load tariffs approved in 2025; 77 pending across 36 states.**
 94. **16 April 2026** — FERC commits to acting by end of June 2026 on Docket **RM26-4-000**, the large-load interconnection rulemaking opened at DOE Secretary Chris Wright’s October 2025 direction. FERC’s proposed threshold: **20 MW**. Commenters object that 20 MW sweeps in ordinary commercial and industrial load.
 95. **April 2026** — **FERC approves extension of the PJM price collar at \$325/MW-day for two additional auctions.**
 96. **24 April 2026** — **Maine Governor Janet Mills vetoes LD 307**, which would have made Maine the first state with a statewide data center moratorium (>20 MW, pause to November 2027). Mills says she supports a temporary moratorium and would have signed with an exemption for the former Androscoggin Mill site in Jay.
 97. **29 April 2026** — Maine’s Veto Day: the Senate override fails **20–11**, short of two-thirds.
 98. **May 2026** — Edison Electric Institute’s tracking: **23 states have approved at least one large load tariff; seven more have tariffs pending.**
 99. **11–13 May 2026** — Montana Free Press publishes its Q&A with Peskoe; syndicated. Peskoe restates the socialization mechanism for a non-specialist audience.
 100. **15 May 2026** — Monitoring Analytics’ 2025 State of the Market Report for PJM: “The current supply of capacity in PJM is not adequate to meet the demand from large data center loads and will not be adequate in the foreseeable future.”
 101. **18 May 2026** — A **NextEra–Dominion** merger is reported: the combined company would carry a **130 GW large-load pipeline** and an 80%+ regulated business mix. (*As-of caution: this is a 2026 development that post-dates the entire syllabus stack. §11.*)
 102. **20 May 2026** — Fortune: U.S. retail electricity prices rose **7% in 2025** alone, **~40% since 2021**; wholesale costs **6.1%** higher year-over-year.
 103. **2 June 2026** — Columbia Law’s Climate Law Blog surveys large-load and clean-transition tariffs for local governments; notes that in the Pennsylvania large-load docket, “not a single city participated.”
 104. **4 JUNE 2026** — **The New York State Legislature passes the Responsible Data Center Development Act (S10642/A11560)**: a one-year moratorium on state permits for new large data centers with peak demand of **20 MW or more**. Senate **44–16**; Assembly **102–39**. Originally introduced as S.9144 with a three-year pause and a Generic Environmental Impact Statement requirement plus nine regional hearings.
 105. **5 JUNE 2026** — **Senator Elizabeth Warren posts on X: “If you live near one of these large data centers, your electricity bills over the last five years have gone up by as much as 267%.”**
 106. **June 2026** — NCSL research: lawmakers in **14 states** are considering data center moratorium bills. Good Jobs First tracks **at least 12 in-session states** with filed moratorium bills; MultiState counts **11 states** with introduced moratorium bills in 2026; more than **300 data center bills** filed across 30+ states; more than **100 local moratoria** adopted nationwide; an estimated **\$64 billion** in projects blocked or delayed by community opposition.
 107. **11 June 2026** — Amazon witness **Cameron Brooks** files testimony in the Virginia Rider T-1 case supporting voluntary contributions in aid of construction “as a way to reduce ratepayer burden,” to make “the customer’s financial responsibility for the identified facilities ... clear, enforceable, and integral to mitigating subsidization and stranded cost risks.”
 108. **12 JUNE 2026** — **PolitiFact rates Warren’s 267% claim MOSTLY FALSE** (Caleb McCullough). The figure is wholesale; supply is 30–50% of a residential bill (per Yale’s Kenneth Gillingham). Between March 2021 and March 2026, average residential retail prices rose **94% in Washington, D.C.; 74% in Maryland; 73% in Maine; 58% in New York**; U.S. average **42%** over five years. Peskoe, interviewed 9 June 2026: “Data centers are causing tens of billions of dollars of price increases in wholesale power markets and driving utilities to spend tens of billions of

- dollars on delivery infrastructure... In general, these cost increases are spread to all ratepayers by the utility.”
109. **15 JUNE 2026** — **Oral argument in the Warrenton merits case** before Judge **Stephen Sincavage**, Fauquier County Circuit Court. Town attorney **Whitson Strother** — in the job only since early 2026 — tells the court Warrenton no longer shares Amazon’s “litigation alignment,” and argues the *void ab initio* challenge is legally cognizable. Sincavage takes it under advisement and declines to give a date. **Patricia Ewing**, CFFC board member, tells FauquierNow afterward she felt good about how it went. WRAL runs its own fact-check of the 267% figure the same week.
 110. **18 June 2026** — FERC issues six show-cause orders under FPA §206 to the jurisdictional RTOs on large-load interconnection tariff provisions, while declining the broader jurisdictional assertion the ANOPR contemplated. (*L4 owns this event’s full treatment; L7 takes the ratepayer-facing consequence only.*)
 111. **13 June / 1 July 2026** — Arizona (13 June) and Illinois (effective 1 July) pause data center tax incentives. New Hampshire moves the opposite direction with an “off-grid electricity providers” law easing self-supplied power.
 112. **30 June – 7 July 2026** — The offer window for PJM’s 2028/2029 Base Residual Auction opens and closes.
 113. **1 July 2026** — Ohio’s proposed constitutional amendment banning data centers over 25 MW fails to qualify for the 2026 ballot: roughly **70,000** of the **413,488** signatures required. Backers say they will try again in 2027.
 114. **1 July 2026** — Oklahoma’s **Data Center Customer Ratepayer Protection Act of 2026**, 17 O.S. §§ 900–906, takes effect, defining “Large load customer” at a **75 MW** threshold.
 115. **2 July 2026** — PJM stakeholders advance a data center backstop procurement plan.
 116. **9 July 2026** — Reuters: U.S. power companies scrambling to secure equipment as data center demand strains supplies.
 117. **14 JULY 2026** — **PJM posts 2028/2029 BRA results. 138,318 MW UCAP** procured plus **10,864 MW FRR** = **149,182 MW**. Price at the **\$325/MW-day cap** across the footprint. Shortfall against the 20% installed reserve margin target: **~6.8 GW** (PA Environment Digest reports 6,831 MW), worse than the prior auction’s 6.5 GW. Only about **525 MW** of new resources cleared. Total cost **\$16.4 billion**. Reserve margin held at 14.7%. Without the cap, Reuters reports prices would have cleared at **\$554.72/MW-day** RTO-wide and **more than \$775/MW-day** in the ComEd zone. **PJM President and CEO David Mills**: “These auction results show that demand for electricity continues to grow faster than electricity supply.”
 118. **14 JULY 2026** — **The Virginia SCC hears argument on Dominion’s Rider T-1 cost-allocation case.** Dominion seeks to recover roughly **\$1.5 billion** in transmission costs. Its original estimate of the residential impact was about **\$2.90 per month**; it has since lowered that to **\$0.94 per month** on updated forecasting. **Louise White**, Deputy Energy Officer to Governor Abigail Spanberger, asks the SCC for three things: a “but for” cost-causation standard, transmission-level contributions in aid of construction, and a move to summer/winter peak-and-average allocation. **Andrew Major**, SCC staff attorney: “Regardless of the cost allocation methodology that is chosen, there remains a glaring cross-class subsidization occurring to the benefit of new GS-5 customers.” He notes the four hyperscalers signed a White House ratepayer pledge in March and adds: “Curiously, none of those companies mentioned this pledge in either pre-filed testimony or opening statements today.”
 119. **14 July 2026** — PowerLines reports utilities requested **\$9.2 billion** in rate hikes in Q2 2026 alone.
 120. **15 JULY 2026** — Argument continues at the SCC. **Will Cleveland**, for Google, argues Dominion only recently completed its shift to a 12-coincident-peak allocation factor and its **new GS-5 large-load rate class hasn’t yet fully taken effect** — “simply too early in the process” to know whether existing changes suffice. **Jonathan Zader**, senior assistant county attorney for **Loudoun County**, testifies “the stakes are particularly high” and asks for direct allocation plus CIAC for “but for” upgrades. **Michael Goggin** (Grid Strategies), for Appalachian Voices: direct assignment “only helps address part of the problem here”; Dominion is “far too reliant on supplemental projects.” **John Farmer**, Virginia AG’s Office of Consumer Counsel, supports direct assignment “conceptually when it is possible to identify a cost causer,” while flagging genuine uncertainties. **Robert Miller**, Dominion regulatory analyst, defends 12CP for Virginia while conceding that summer/winter peak average “is in the zone of reasonableness.” **The SCC must decide by 1 August 2026.**
 121. **~15 July 2026** — Pennsylvania’s budget law increases data center oversight; Shapiro signs improved load-forecasting provisions letting the PA PUC review and validate the forecasts utilities submit to PJM, building on November 2025 legislation.
 122. **17 July 2026** — Inside Climate News: Virginia’s 2026 session **failed** to pass data center clean-energy requirements. Dominion’s long-term plan shows a typical residential monthly bill rising from **\$142.77 (2024)** to **\$255 by end-2035** and **\$268 by end-2045** under full buildout.
 123. **~17 July 2026** — New York becomes the first state to impose a statewide moratorium on data center development

- (per ESG Dive). (*Verify signature date and operative terms at draft stage — §11.*)
124. **20 JULY 2026 — Joseph Bowring, by email to Utility Dive:** data centers are responsible for **\$6.3 billion, or 38%, of the \$16.4 billion** in charges from the just-held 2028/29 auction; across PJM's last four base auctions, data-center-driven capacity charges total **\$29.4 billion — 46% of \$63.6 billion**. In an interview the previous Friday: **"PJM is continuing to act like it's business as usual."**
 125. **23 July 2026 (EXPECTED)** — FERC technical conference on PJM governance, announced by Shapiro's office. (*Expected; announcing party: the Governor of Pennsylvania.*)
 126. **1 AUGUST 2026 (EXPECTED)** — **Deadline for the Virginia SCC's decision in the Rider T-1 case.** (*Expected; the Commission's own schedule.*)
 127. **December 2026 (EXPECTED)** — PJM's next Base Residual Auction, also under the extended \$325/\$175 collar.
 128. **1 January 2027 (EXPECTED)** — Virginia SB 253 (Sen. L. Louise Lucas) changes take effect: the SCC may determine whether it is in the public interest for large-load customers rather than residential ones to carry distribution costs for data centers and Dominion's capacity purchases. Dominion, state regulators and lawmakers estimate an immediate residential reduction of about **\$5.50 per month**.
 129. **November 2027 (EXPECTED)** — Oklahoma SB 1488's proposed moratorium horizon, if enacted as filed.
 130. **2029 / 2040 (PROJECTED)** — Bowring on the 2029/30 outlook: "Do not expect this to materially change." JLARC's \$14–\$37/month horizon lands in 2040.

SECTION 2: STRAWMAN BEAT DOSSIER

Beat 1 — The Bill Arrives [O] (opener)

Syllabus 2.0 assignment: The transmission rider on a Dominion residential bill, traced upstream.

Beat Menu definition: *Money • opener-preferred, closer-capable • grid actual 4 appearances (band 1–3, +1).* "Open from a cost line item someone actually paid — the transmission rider on a Dominion residential bill, CoreWeave's \$311M interest expense, a county's water invoice — then trace the line item upstream to its cause. The bill is the hook; the supply chain of the bill is the beat." Opener rotation: The Bill Arrives opens lectures 3 and 7; no two adjacent lectures open on the same beat (L6 opens Cold Open, L8 opens Hearing Room). **Compliant.**

FACTS, DATES, NAMES, NUMBERS.

- The line item has a name and it is printed on the bill: **Rider T-1**, the transmission cost-recovery line on a Dominion Energy Virginia residential bill. Virginia Mercury, Royal Examiner, NV Daily and Rappahannock News all describe it identically: "In Virginia, the cost to build transmission lines appears on ratepayers' monthly utility bills as the Rider T-1 portion of the bill" (July 2026).
- **What Dominion is currently asking Rider T-1 to carry: approximately \$1.5 billion in transmission costs** (Virginia SCC, case argued 14–15 July 2026).
- **Dominion's own estimate of the residential impact, twice:** first **~\$2.90 per month** for a typical household using 1,000 kWh (SCC filing, doc 8c1p01), then **lowered to ~\$0.94 per month** on updated forecasting (SCC filing, doc 8d7501). (*Both figures are the filer's; both are dated; the revision downward is itself the story of a forecast.*)
- **Baseline for the household:** Dominion's long-term plan carries a typical residential monthly bill at **\$142.77 in 2024**, rising to **\$255 by end-2035** and **\$268 by end-2045** under full buildout (reported 17 July 2026).
- **The upstream driver, in SCC staff's words:** "data centers are the single highest driver of the company's load forecast and the single highest driver of transmission projects and their associated costs" — testimony of **Andrew T. Boehnlein**, manager, SCC Division of Public Utility Regulation (July 2026 reporting).
- **The 1,000 kWh household is not hypothetical.** U.S. average residential electricity prices rose **42% in five years** (EIA, accessed 10 June 2026). March 2021 → March 2026 by jurisdiction: **D.C. +94%, Maryland +74%, Maine +73%, New York +58%.**
- **Supply is only part of a bill.** Kenneth Gillingham, Yale School of the Environment (email to PolitiFact, 9 June 2026): the supply component is **about 30% to 50%** of a consumer's electricity bill; the rest is transmission, distribution and taxes. (*This is the fact that makes the whole opener honest — and it is the fact that kills the 267% claim in its popular form.*)

THE MECHANISM. The trace runs backwards along four segments, and each one has a different regulator. **(1) The bill line.** Rider T-1 is a state-approved rider; the SCC decides how the total is divided among rate classes. **(2) The revenue requirement.** The dollars inside Rider T-1 are FERC-approved transmission costs — set under a federal formula rate, then passed through to states with no obligation to say who caused them. **(3) The project list.** Those costs are the sum of local transmission projects: new substations, new lines, built by the utility and disclosed at PJM’s Transmission Expansion Advisory Committee, where the briefings are “informational only; no PJM approvals are required.” **(4) The cause.** At TEAC the utility names the customer demand level and the expected year of need — and then, per UCS, “from that point through state proceedings to determine retail customers’ bills, the causation of these costs (attaching a single customer to the transmission system) is not visible.”

The step where the constraint binds: at segment (3)→(4). The information that would let a state regulator assign the cost to its causer exists exactly once, in a monthly advisory-committee slide, and is not carried forward into the rate case. Everything downstream is arithmetic on a number that has already lost its parentage.

KEY ACTORS IN THIS BEAT.

- *Object:* the residential bill itself. Dominion redesigned it in October–November 2024 — reorganized layout, color usage graphs, a QR code — and said explicitly the redesign “will not affect how customers’ monthly bills are calculated.” Corynne Arnett, then-EVP of Regulatory Affairs and Customer Experience: the new bill is “simpler, easier to read.” Dominion serves **3.6 million** homes and businesses across Virginia, North Carolina and South Carolina.
- *Institution:* **Dominion Energy** (return; steelmanned at Beat 7). Motive here: recover \$1.5B and keep the growth. Exposure: an SCC that must rule by 1 August 2026.
- *Institution:* **the Virginia SCC** — three-commissioner body, staff testifying as its own party.
- *Human:* **Andrew T. Boehnlein**, then-manager, SCC Division of Public Utility Regulation.

THE DOCUMENTS. Dominion’s Rider T-1 application and its two damage estimates (SCC docket documents 8c1p01 and 8d7501, both retrievable at scc.virginia.gov/docketsearch). The FERC formula rate that produces the number Rider T-1 recovers. PJM’s Operating Agreement, Schedule 6 §1.3, which requires utilities to disclose local transmission plans through TEAC — a disclosure obligation that produces the only public record of causation and then lets it evaporate. **Skeptical caveat:** Rider T-1 is genuinely binding — it is money already being collected. The *\$0.94* figure is not: it is a forecast-dependent estimate that has already moved once by a factor of three, in the filer’s favor, in the same proceeding.

VERBATIM BANK.

“data centers are the single highest driver of the company’s load forecast and the single highest driver of transmission projects and their associated costs” — Testimony of Andrew T. Boehnlein, manager, Division of Public Utility Regulation, Virginia State Corporation Commission, as reported July 2026 (Virginia Mercury / Rappahannock News, 15 July 2026).

“Any network or substation upgrades that would not have been triggered but for a large load customer should be assigned directly to that customer, shielding regular Virginia families from subsidizing commercial extension.” — Louise White, Deputy Chief Energy Officer, Commonwealth of Virginia, testimony before the Virginia SCC, 14 July 2026 (Virginia Mercury, 15 July 2026).

“There are other parts of the electricity bills, and the wholesale nodal electricity prices only raise the ‘supply’ component of electricity bills.” — Kenneth Gillingham, economist, Yale School of the Environment, email to PolitiFact, 9 June 2026.

WHO PAYS. The household, monthly, on a line most of them have never read. Under Dominion’s existing Virginia allocation, **more than half** of its transmission costs are included in residential rates (Martin & Peskoe, March 2025, citing the utility’s own tariff). Across Maryland’s three investor-owned utilities, an average of **66%** of transmission costs are assigned to residential ratepayers. The counter-move — direct assignment, CIAC, a but-for standard — is exactly what was being argued on 14–15 July 2026, with a decision due 1 August 2026.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. The **Utility** is the seller here, and the direction of the overclaim is *smallness*: \$2.90 became \$0.94 inside one case. What’s real: the revision is defensible if the underlying forecast changed, and Dominion filed both numbers publicly. What’s oversold: a monthly-impact figure is the least informative way to describe a \$1.5 billion recovery, and it is the number utilities reach for first. Narrator move: **GRANT-AND-**

WITHHOLD. Where the evidence is thin: no public source in this pack shows what the *residential class's total* Rider T-1 burden is in dollars rather than per-household cents.

SENSORY & MATERIAL DETAILS. The redesigned Dominion bill: reorganized layout, colored usage graphs, a QR code for payment (October–November 2024 rollout). A 1,000 kWh month is the SCC's stated typical-household unit. (*Inference, marked: nothing in the record describes a specific household's paper bill in Warrenton or Manassas; the physical description above is drawn from Dominion's own published bill-redesign materials, not from a resident's kitchen table.*)

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
~\$1.5B	dollars, transmission revenue requirement	requested	July 2026	Dominion / SCC	STRUCTURAL
\$2.90 → \$0.94	\$/month/household (1,000 kWh)	estimated	2026, revised 2026	Dominion	VOLATILE
\$142.77 → \$255 → \$268	\$/month/household	projected	2024 / 2035 / 2045	Dominion long-term plan	CONTESTED
30–50%	share of residential bill that is supply	n/a	June 2026	Gillingham (Yale)	ANCHOR-adjacent (structural)
42%	5-yr U.S. residential price increase	actual	to Mar 2026	EIA	STRUCTURAL
94 / 74 / 73 / 58%	5-yr residential price increase, DC/MD/ME/NY	actual	Mar 2021–Mar 2026	EIA via PolitiFact	STRUCTURAL
>50%	share of Dominion transmission costs in residential rates	n/a	Mar 2025	Martin & Peskoe	STRUCTURAL
66%	avg. share of transmission costs to residential, MD IOUs	n/a	Mar 2025	Martin & Peskoe	STRUCTURAL

Phantom-load caveat attaches to nothing here: these are billed dollars, not forecast demand.

STRESS-TEST VERDICT: SUSTAINABLE. A named line item on a real bill, a \$1.5B recovery behind it, a live hearing two weeks before the research date, two of the utility's own numbers three-fold apart, and a documented four-segment upstream path with the causation gap identified. This beat could run twice its length.

Beat 2 — Mechanism Autopsy

Syllabus 2.0 assignment: Cost-allocation doctrine made legible: how “system benefits” reasoning socializes a private customer's extension cord.

Beat Menu definition: *Atoms • versatile • fat container • 8 appearances.* “How the thing physically works... delivered conversationally, never announced as analysis. Rotation is content-native: each lecture autopsies a different mechanism.”

This lecture's mechanism is the legal-financial one: the path from a private request to a socialized rate. No prior pack has autopsied cost allocation (L4 autopsied the three-study interconnection gauntlet; the two are adjacent and must not be confused — see §10).

FACTS, DATES, NAMES, NUMBERS.

- **The historic norm:** a typical new data center's demand was **under 10 MW**, connected at low voltage on existing distribution lines, and “utilities usually charge the costs of connecting a new, nonstandard individual customer directly to that customer” (UCS, Sept 2025).
- **The break:** **100–400 MW** facilities are now widespread, with numerous projects requiring **1,000 MW or more**. That leap forces connection at **transmission voltage** — **generally above 69 kV** — and transmission is FERC's.

- **The gap:** the federal/state boundary “was established under the assumption that transmission lines would be used only for wholesale, not retail, deliveries of energy” (UCS). A retail customer taking service directly off the transmission system was not the design case.
- **The allocation formula, concretely:** PJM splits new regional transmission costs half by each utility’s share of regional demand and half by a **power-flow simulation** estimating benefits. On the December 2023 **\$5 billion** approval, roughly **half** went to Virginia utilities, **~10%** to Maryland utilities, remainder across the footprint.
- **Then the second allocation:** each state PUC divides its utilities’ assigned share among rate classes, “typically presume[ing] that ratepayers share in the benefits of new transmission in proportion to their total energy consumption” (Martin & Peskoe). Maryland residential consumes more than half the state’s electricity, so it pays the lion’s share.
- **The local-project variant is worse:** costs for local transmission projects “are allocated entirely to the zone in which the transmission facilities are located, typically mirroring the utility’s service territory” — and therefore to everyone in it.
- **The exception that proves the rule:** in 2024, of **130** data-center-driven transmission connection projects in seven PJM states, **six** — **5%** — were described by the utility as having no cost to other customers, paid by the single customer. The other **124** went into the shared pool.

THE MECHANISM (the legal path, end to end). *Request → study → project → TEAC slide → RTEP line → FERC formula rate → state revenue requirement → class allocation → Rider.* At every joint the identity of the causer is available; at exactly one joint (TEAC → RTEP) it stops being carried. UCS names the three places it could be re-attached: (1) prepayments recorded as “customer advances” or “contributions in aid of construction,” or in **FERC Account 107, Construction Work in Progress**; (2) a customer class inside the FERC formula rate; (3) a large-customer category in the state cost-of-service study. UCS checked all three: **no, no, and no** — except where state legislation forced it (Maryland’s Next Generation Energy Act, H.B. 1035, Ch. 626, 2025).

Where it binds: in the cost-of-service study. That study is the only instrument in the chain designed to answer “who caused this,” and it is fed inputs from which causation has already been stripped. Prepayment would also **lower the utility’s rate base and therefore its profits** (UCS, citing Lazar et al. 2020) — which is the incentive that keeps the gap open.

KEY ACTORS IN THIS BEAT.

- **Document: the interconnection agreement (RETURN — L4 owns the anatomy).** Its only job here is the line: the agreement’s terms are where “who funds this upgrade” is decided, and the doctrine fight is a fight over those terms. *It is the customer’s extension cord.* Brief reference; no rebuild.
- **Institution: PJM (return).** Its cost-sharing method “was developed with the understanding that new transmission would be designed primarily to provide public benefits. New transmission designed for a few energy-intensive consumers, and not broad public benefits, is inconsistent with PJM’s premise” (Martin & Peskoe). *PJM’s rule is not wrong; its premise has been falsified underneath it.*
- **Institution: the state PUC,** which “rarely order[s] utilities to adjust the formulae that spread FERC-regulated market and transmission costs to ratepayers.”
- **Human: Mike Jacobs,** senior manager, energy, UCS Climate and Energy Program — the analyst who counted the 130 projects one at a time out of PJM’s own postings.

THE DOCUMENTS. PJM Operating Agreement Schedule 6 §1.3 (the TEAC disclosure duty). The **Regional Transmission Expansion Plan** (annual; each project carries a tracking number and the new substation’s name — “often to be built at the customer’s location”). **FERC Account 107.** *Appalachian Power Co. v. FERC*, 191 FERC ¶ 61,238 at 64 (2025). Maryland’s **Next Generation Energy Act**, H.B. 1035, Ch. 626 (2025) — the one statute that forces separation. Oregon’s **POWER Act**, H.B. 3546, Ch. 323 (2025). **Skeptical caveat:** the TEAC briefing is the purest example in the course of a document that is technically public, formally disclosed, and functionally invisible.

VERBATIM BANK.

“Utilities briefly describe the customer demand levels and the expected year of need. These briefings are informational only; no PJM approvals are required. Throughout this process, utilities disclose the names of new substations (often to be built at the customer’s location), the cost of major project segments, and a tracking number that will appear in PJM’s annual RTEP. From that point through state proceedings to determine retail customers’ bills, the causation of these costs (attaching a single customer to the transmission system) is not visible.” — Union of Concerned Scientists, Connection Costs Loophole Costs Customers Over \$4 Billion to Connect Data Centers to Power Grid, September 2025, at “Billions in Costs Now, Billions More Coming.”

“With the limited reporting of transmission system expenditures needed to connect data center customers to the power grid, the key question must be asked: ‘From where do the utilities collect that money?’” — Union of Concerned Scientists, same brief, September 2025.

“Without reforms, consumers will be paying billions of dollars for regional infrastructure that is designed to address the needs of just a few of the world’s wealthiest corporations.” — Eliza Martin and Ari Peskoe, Extracting Profits from the Public, Harvard Law School Environmental & Energy Law Program, March 2025, Part II.B.1.

WHO PAYS. Everyone on the same utility, in proportion to consumption, forever, because consumption is the proxy the formula uses for benefit. The doctrine is *cost causation*; the practice is *beneficiary pays* with the beneficiary defined by a power-flow model. The counter-move is direct assignment plus CIAC, argued at the Virginia SCC 14–15 July 2026 and due 1 August 2026.

WHAT’S CONTESTED. Genuinely contested, and the pack does not resolve it: **do the ancillary benefits exist?** Martin & Peskoe concede the point in writing — “by increasing transmission capacity, new regional transmission lines for data centers may provide ancillary benefits to all ratepayers” — and note that proponents argue power-flow models can calculate with reasonable accuracy who benefits. Michael Goggin (Grid Strategies, for Appalachian Voices, 15 July 2026) attacks from a third direction: direct assignment “only helps address part of the problem here,” because Dominion is “far too reliant on supplemental projects” instead of PJM’s competitive regional process. Narrator move: **HOLD OPEN**, precisely as Syllabus 2.0 assigns.

SENSORY & MATERIAL DETAILS. The 69 kV line is the legal border between two governments. Substations named after their customer. A monthly advisory-committee meeting where a slide with a tracking number is the last moment anyone can see whose extension cord it is.

STRESS-TEST VERDICT: SUSTAINABLE. Two independent primary-grade sources (Harvard ELI; UCS with its own project-level count), a named failure point, three named remedies, and a live docket testing all three.

Beat 3 — The Paper Trail — *class: tariff docket*

Syllabus 2.0 assignment: The AEP Ohio data center tariff filing as the counter-move template; the interconnection agreement returns carrying its line.

Beat Menu definition: *Politics • versatile, closer-capable • all 10 lectures.* “A named document as causal actor... Sustained by: what the document says, who wrote it and why, what it forces, what it forbids, and what happens when someone violates it.” **Rotation rule:** a different document class each lecture. L7’s class is **tariff docket** — distinct from L4’s queue instrument and L5’s contract. **Compliant.**

Full treatment: Section 5. This dossier entry carries only what the beat itself needs.

FACTS, DATES, NAMES, NUMBERS. Case **24-508-EL-ATA**, PUCO. Filed **May 2024**; utility stipulation **23 October 2024**; evidentiary hearings **December 2024 and January 2025**; public hearing **Columbus, 3 January 2025**; **Opinion and Order 9 July 2025**; compliance tariff filed **11 July 2025**; **effective 23 July 2025**. Applies to new or expanded data centers **>25,000 kW** and mobile/crypto data centers **>1 MW**. Existing facilities and expansions under 25,000 kW grandfathered, subject to review in AEP’s pending general rate case. Signatories to the adopted stipulation: AEP Ohio, PUCO Staff, the Ohio Consumers’ Counsel, the Ohio Energy Group, the Ohio Manufacturers’ Association Energy Group, Industrial Energy Users-Ohio, Walmart, Ohio Partners for Affordable Energy. The competing stipulation was backed by a data-center coalition led by Amazon, with Google, Microsoft and Meta — proposing a **75%** minimum against the utility’s 85%.

THE MECHANISM (what the document does). It converts a forecast into a receivable. Minimum billing demand, a four-year ramp floor (**50 / 65 / 80 / 90%** of contract capacity by year), a term of **ramp + eight years, collateral equal to 50% of total minimum charges** unless the customer clears an **A- / A3** rating *and* holds cash exceeding 10× the collateral requirement, an **exit fee of 36 months of minimum charges** available only after year five post-ramp, and a **Letter of Agreement requiring 100% reimbursement of buildout costs** if the customer cancels or delays more than 12 months before energization. Load study fees of **\$10,000 / \$50,000 / \$100,000** by size tier, payable in 45 days on pain of withdrawal.

Where it binds: at the **Letter of Agreement**. Everything else is rate design; the LOA is the clause that makes a cancelled

project the customer's problem instead of the ratepayer's. That is the entire counter-move in one document.

KEY ACTORS. *Institution:* **AEP Ohio** — which had imposed its own **28-month moratorium** on new data center connections in **March 2023**, and told PUCO it had **more than 50 data centers in the queue representing more than 30,000 MW**. *Institution:* **the Ohio Consumers' Counsel**, which framed the docket publicly as a choice between Ohio customers and “multi-billion dollar corporations.” *Human:* **Jenifer French**, then-Chair of the PUCO. *Human:* **Matthew S. McKenzie**, testifying for Ohio Power Company. *Human:* **Kevin C. Higgins**, for the Data Center Coalition. *Human:* **Brendon J. Baatz**, opposing. *Human:* **Michael Fradette**, for Amazon Data Services.

VERBATIM BANK. (Full bank in §5. Two here.)

“Currently, AEP Ohio has limited ability to distinguish customers who are merely speculating on potential data center investments from customers who are willing to make long-term financial commitments to data center investments.” — Direct Testimony of Matthew S. McKenzie on behalf of Ohio Power Company, PUCO Case No. 24-508-EL-ATA, at 2, 13 May 2024 (original emphasis).

“Today's order represents a well-balanced package that safeguards non-data center customers on an industrial and residential level while establishing a dependable and reasonable environment for data centers to continue to thrive within Ohio.” — Jenifer French, then-Chair, Public Utilities Commission of Ohio, PUCO news release, 9 July 2025.

WHO PAYS. Under Schedule DCT, the data center pays — 85% of what it said it would use, whether or not it uses it, for at least twelve years. That is the point. What the tariff does **not** reach is the PJM-side allocation: neighboring utilities protested in the docket that if AEP builds transmission against data center load that never arrives, those costs still split across PJM members by share of regional sales, and AEP's share would not rise proportionally. The fence is real and it is only as tall as one state.

WHAT'S CONTESTED. The Buckeye Institute (16 March 2026) argues Schedule DCT “inverts the Ramsey rule,” charging the most elastic customers the highest markups via an 85% take-or-pay lasting twelve years, with the predicted result that “these customers leave or never arrive.” The Ohio Manufacturers' Association challenged the billing structure on 13 November 2025. Seller identification: **the Utility** (AEP gets a de-risked capital program and the end of its own moratorium) and **the Hyperscaler** (Amazon et al. get a lower floor). Narrator move: **HOLD OPEN** — this is a live legal and economic dispute with serious people on both sides.

STRESS-TEST VERDICT: SUSTAINABLE. The strongest single-document beat in the lecture: fourteen months of contested proceeding, two competing settlements, a named chair, quotable operative clauses, an appeal, and a working counter-model to the socialization the previous two beats established.

Beat 4 — Follow the Money

Syllabus 2.0 assignment: \$4.3B across seven PJM states in 2024, approved solely to connect data centers; residential bills near hubs up as much as 267% in five years.

Beat Menu definition: *Money • versatile • fat container • 8 appearances.* “Capital structure as narrative: who financed what, collateralized by what, amortized over what... The load-bearing accounting assumption is always the payoff.”

FACTS, DATES, NAMES, NUMBERS — the \$4.3 billion, disaggregated. From UCS Table 1, *Data Center–Caused Transmission Costs in Millions of Dollars Approved in 2024*:

State	Projects	Cost (\$M)
Illinois	3	239.0
Maryland	4	107.5
New Jersey	8	14.5
Ohio	37	1,299.7
Pennsylvania	16	491.8
Virginia	60	1,988.0
West Virginia	2	215.8

State	Projects	Cost (\$M)
Total	130	\$4,356.3

- **Three-year total:** over **150** local transmission projects, 2022–2024, in those same seven states, “needed only to connect data centers,” costing consumers **\$5 billion** in total, of which **over \$4.3 billion** was approved in 2024 alone.
- **The 95% finding:** six of the 130 projects were described as having no cost to other customers; **\$4.3 billion in connection costs for the remaining 95% went into the pool paid by all consumers.**
- Utility Dive’s coverage of the same brief (1 October 2025) rounds it to “**about \$4.4 billion**” and notes “close to half the costs passed on to ratepayers were in Virginia.” (*Verified against the table: Virginia is \$1,988.0M of \$4,356.3M = 45.6%. Both statements are true; the pack carries the anchor value \$4.3B, per §6 discipline.*)
- **Capacity, not just wires.** Monitoring Analytics, 3 June 2025: data center demand added **\$9.3 billion, or 174%**, to capacity costs for the 2025/26 delivery year versus a no-data-center counterfactual. January 2026: data centers were **40%** of the December 2025 auction’s costs; data center *forecasts* were **45% of \$47.2 billion** across three auctions. **20 July 2026: \$6.3 billion of \$16.4 billion — 38% —** in the 2028/29 auction; **\$29.4 billion of \$63.6 billion — 46% —** across the last four.
- **The peak itself.** Bowring, October 2025: current and planned data center load added **nearly 12,000 MW** to expected peak demand for the following summer, and those increases “were almost entirely due to existing and projected large data center load additions to the PJM grid.”
- **The forecast that money is being spent against.** PJM’s 2025 long-term forecast shows peak load growth of **32,000 MW from 2024 to 2030**, nearly all data centers. In PJM’s Dominion Zone the 2022 forecast showed **~5,700 MW** of growth by 2037; the 2025 forecast showed **more than 20,000 MW** of growth from data centers alone by 2037 (IEEFA).
- **The auction price series, as a single line:** **\$28.92/MW-day** (2024/25) → **\$269.92** (2025/26) → **\$329.17** (2026/27) → **~\$333** (2027/28) → **\$325 cap** (2028/29). Total auction cost **\$2.2 billion** (Dec 2022 auction) → **\$16.4 billion** (2027/28 and 2028/29).

THE MECHANISM (the money path). Utility builds → cost enters FERC formula rate → formula rate enters state revenue requirement → revenue requirement is divided by a cost-of-service study → rider on the bill. In parallel: PJM forecast rises → capacity auction demand curve shifts → clearing price rises → capacity charge flows to every load-serving entity → into supply rates → onto the same bill. **The two paths converge on the same envelope from opposite regulators, and neither one records who caused it.** The load-bearing accounting assumption: that consumption is a valid proxy for benefit.

KEY ACTORS. *Human:* **Mike Jacobs** (UCS) — counted the projects. *Human:* **Joseph Bowring**, president, Monitoring Analytics, PJM’s independent market monitor since the role’s creation; the only actor in this lecture whose institutional job is to be adversarial to the market he monitors. *Institution:* **Duquesne Light**, which told the Pennsylvania PUC (Docket M-2025-3054271, statement of **Lindsay A. Baker**, Senior Manager, Energy Policy and Public Affairs) that revenues from data centers are allocated only to lowering rates of the largest customer class and do not benefit all customers. UCS: “Hence, revenues are recognized only for the largest customer class, but not the costs. This is standard in all US utility rate-making.” (*That asymmetry — revenue narrow, cost broad — is the beat’s payoff.*)

VERBATIM BANK.

“From 2022 through 2024, utility companies initiated over 150 local transmission projects in Illinois, Maryland, New Jersey, Ohio, Pennsylvania, Virginia, and West Virginia. These projects were needed only to connect data centers.” — Union of Concerned Scientists, September 2025.

“Data center load growth is the primary reason for recent and expected capacity market conditions, including total forecast load growth, the tight supply and demand balance, the significant shortfall in cleared capacity, and high prices.” — Monitoring Analytics, report on the 2027/2028 Base Residual Auction, released January 2026.

“PJM is continuing to act like it’s business as usual.” — Joseph Bowring, president, Monitoring Analytics, interview with Utility Dive, 17 July 2026 (published 20 July 2026).

WHO PAYS. Named and dollared: consumers in Illinois, Maryland, New Jersey, Ohio, Pennsylvania, Virginia and West

Virginia, \$4.3 billion of 2024-approved transmission, plus \$29.4 billion of data-center-attributable capacity charges across four auctions. **Phantom-load caveat, first attachment in this lecture:** the 32,000 MW and 12,000 MW figures are *forecast* peak, assembled from utility-reported large-load requests; the same megawatts can appear in more than one utility's filing, and PJM's January 2026 forecast reflects stricter vetting for exactly that reason.

WHAT'S CONTESTED. IEEFA argues “there are strong reasons to believe that PJM's 20-year forecasts of data center growth are inflated. But in the short term, markets are responding as though these forecasts are going to materialize.” That is the cleanest statement of the course's central problem available in this lecture's territory. Seller: **the Utility** and, in the doomer direction, advocacy analysts whose case improves if the number is bigger. Narrator move: **DISCOUNT** on the forecasts; the \$4.3B itself is not a forecast — it is approved spend, and survives the discount intact.

STRESS-TEST VERDICT: SUSTAINABLE. A state-by-state table, a 95%/5% finding, a five-point price series, and a market monitor on the record eight days before the research date.

Beat 5 — The Perverse Incentive

Syllabus 2.0 assignment: “System benefits” doctrine producing the opposite of its intent.

Beat Menu definition: *Politics/Money • versatile, closer-capable • fat container • 8 appearances.* “The rule producing the opposite of its intent: duplicate interconnection requests inflating forecasts into phantom load; subsidies with no job requirements; ‘system benefits’ doctrine socializing a private extension cord.”

FACTS, DATES, NAMES, NUMBERS.

- **The doctrine's intent, stated plainly:** utility regulation socializes new infrastructure costs “based on the premise that the public benefits from new infrastructure” — a formula “designed to motivate utility expansion so it would meet society's growing energy demands” (Martin & Peskoe). It worked for a century.
- **The inversion:** “The very same rate structures that have socialized the costs of reliable power delivery are now forcing the public to pay for infrastructure designed to supply a handful of exceedingly wealthy corporations.”
- **Perverse incentive #1 — prepayment reduces profit.** If a utility collected connection costs up front, that would lower rate base and therefore earnings. The rule that permits socialization is also the rule that rewards it.
- **Perverse incentive #2 — peak shaving.** Demand charges are typically tied to consumption at the moment of system peak. A data center that forecasts the peak hour and drops utility-supplied load for that hour — by running on-site generation — cuts its own share of regional cost allocation. “While this ‘peak shaving’ can reduce power prices for other consumers, it also forces other ratepayers to pay part of the energy-intensive consumer's share of infrastructure costs” (Martin & Peskoe). Small businesses face demand charges too and have no such capability.
- **Perverse incentive #3 — the confidentiality reflex.** Regulators “reflexively grant[] utility requests to shield” special contracts, which “adds a procedural barrier to greater participation and prevents the public from even attempting to calculate the potential costs of these deals.” Martin & Peskoe reviewed **40 state PUC special-contract proceedings** and found PUCs “frequently approve special contracts in short and conclusory orders” with “few, if any, parties” participating.
- **Perverse incentive #4 — political veto aversion.** “Regulators do not want to be seen as the veto point for an economic development opportunity, which may have already been publicized by the company and the governor.”
- **Perverse incentive #5 — mutual dependence.** If utilities' growth predictions land, some utilities will have invested billions to serve customers who consume the majority of what they deliver. Then “the utility will be dependent on its data center customers for revenue and will need to retain them in order to justify its prior and future expansion,” and data centers, insulated by favorable deals, may stop policing utility spending at all — “defending their discounts rather than disciplining the utility's spending in rate cases.”
- **The documented worked example — Duke Energy.** Litigation exposed that Duke, unable to compete on price with a more efficient new generator, offered one of its larger customers a contract amounting to a **\$325 million discount** against its existing deal, and internal documents revealed a plan to “**shift the cost of the discount**” to other ratepayers by raising their rates. It surfaced only because the generator sued under federal antitrust law.
- **The nuclear option some states took: Mississippi Code § 77-3-271(3)** removes PUC review of utility–data center agreements entirely: no approval required, and the agreement “shall not be subject to alteration or other modification or cancelation by the commission, for the entire term of the agreement.” **Kansas** (K.S.A. § 66-101i) permits special rates on state-interest grounds including economic development, local employment and tax revenues — i.e., below

cost is legal if the politics are right.

- **The counter-example — Kentucky.** The Kentucky PSC's self-imposed guidelines require findings on the record: discounts only where the utility has excess generation capacity, limited to five years and no more than half the contract duration, with the contract rate exceeding marginal cost. Applying them, the PSC **rejected** a proposed special contract with a cryptocurrency operator, finding the utility's market and transmission price projections not credible. Industrial ratepayers, environmental and local NGOs, and the Kentucky Attorney General all participated.

THE MECHANISM. The socialization rule is not a loophole; it is the intended design of a system built when new load was diffuse, small, and shared. It becomes perverse at the moment a single customer's request exceeds what "the public" plausibly benefits from — and the system has no trigger that fires at that moment. **Where it binds:** at the confidentiality order. Once the contract is sealed, the participation that would generate contrary evidence never happens, and "the PUC has little or no evidence in the record to compete with the utility's claim."

VERBATIM BANK.

"The subjectivity and complexity of ratemaking conceal utility attempts to funnel revenue to their competitive lines of business by overcharging captive ratepayers." — Martin & Peskoe, Extracting Profits from the Public, March 2025, Executive Summary.

"In many states, it's impossible to calculate because of the lack of transparency, and even when there is some transparency ... you get into all these complicated cost allocation debates. You have the power of the utilities to set these agendas to control these rate setting processes, and they have massive incentives." — Ari Peskoe, quoted in Utility Dive, 10 March 2025.

"We're all paying for the energy costs of the world's wealthiest corporations." — Ari Peskoe, quoted in Arkansas Advocate, 6 March 2025.

"A public utility may enter into a large customer supply and service agreement with a customer, which may include terms and pricing for electric service without reference to the rates or other conditions that may be established or fixed under Title 77, Chapter 3, Article 1, Mississippi Code of 1972. No approval by the commission of such agreement shall be required." — Miss. Code Ann. § 77-3-271(3), quoted in Martin & Peskoe, March 2025, n.38.

WHO PAYS. Captive ratepayers, by construction — "captive" is the operative legal word, and it appears in Martin & Peskoe's own text. Also: everyone whose grid upgrade did not get funded. Martin & Peskoe's Part IV argument is that data center growth crowds out cheaper, lower-capital reforms — dynamic line ratings, grid-enhancing technologies, distributed resources — because those don't earn a return: "Regulated rates rarely punish utilities for inefficiencies or reward them for improving their operations through low-cost technologies."

WHAT'S CONTESTED. Martin & Peskoe concede the reverse is theoretically possible — a data center on a special contract could be **overpaying**, with the utility overcharging a deep-pocketed customer to reduce rates for the public. They judge it unlikely to attract data centers, but they say it in print, and the pack carries it: the doctrine's asymmetry is an inference from incentives, not a measured result, because the contracts are sealed. **This is the single most important honesty note in the lecture.** Seller: **the Utility**, direction: "isolated from other ratepayers' bills." Narrator move: **GRANT-AND-WITHHOLD.**

STRESS-TEST VERDICT: SUSTAINABLE. Five distinct documented perversities, a litigated worked example with a dollar figure, a statute that abolishes review, and a state that does it right.

Beat 6 — The Physics Audit

Syllabus 2.0 assignment: The "data centers pay their share" claim run as arithmetic.

Beat Menu definition: *Atoms/Audit* • versatile, closer-capable • 8 appearances (band 4–5, +3 — the deliberate overage; re-band recommended in Syllabus 2.0 Open Item 2). "The deadpan reality check on a claim... the audit is delivered in the same tone as the pitch it's auditing."

FACTS, DATES, NAMES, NUMBERS — the claim, and the arithmetic.

- **The claim as sold:** Dominion’s spokesperson told the Arkansas Advocate (March 2025) that establishing rates in Virginia is an “open and transparent” process. The Virginia Economic Development Partnership has noted that **JLARC found Virginia’s regulatory framework ensures data centers pay the full cost of power-related infrastructure, minimizing impacts on ratepayers.** The Data Center Coalition’s **Lucas Fykes** (5 February 2026): “It’s inaccurate to draw a clear line between large load customers like data centers coming online and increases in prices. It’s just not that simple.”
- **The audit, part one — JLARC’s own two sentences.** JLARC’s third-party study on utility cost recovery found that **data center customers are currently paying for the costs they’re responsible for incurring** — and, in the same report, that **this will not remain the case**, with a typical Dominion residential customer facing generation- and transmission-related increases of **\$14 to \$37 per month in constant dollars by 2040**. Both halves are JLARC’s. The industry quotes the first; the advocates quote the second. (*Range stays a range. Never collapse to \$25.*)
- **The audit, part two — the 5% finding.** In 2024, in seven PJM states, **six of 130** data-center connection projects were paid by the customer. Ninety-five percent were not.
- **The audit, part three — the revenue/cost asymmetry.** Duquesne Light’s own statement to the Pennsylvania PUC: data center revenues are allocated only to lowering rates of the largest customer class; the costs are spread to all. Revenue narrow, cost broad, in the utility’s own filing.
- **The audit, part four — Google’s timing objection, which is a real argument.** Will Cleveland, for Google, 15 July 2026: Dominion only recently completed its shift to a 12CP allocation factor, and the **GS-5 rate class hasn’t yet gone into full effect**; the SCC’s final order in Dominion’s 2025 rate case approved large-load provisions “with cost shifting as the provisions’ entire premise... Why is that not sufficient?” (*The honest answer the pack can support: because SCC staff’s own attorney said, on the same record, that a glaring cross-class subsidization persists to the benefit of the new GS-5 class. Both statements are in the same hearing.*)
- **The audit, part five — the exemption.** Virginia’s data center sales-tax exemption cost the Commonwealth nearly **\$1 billion in FY2023**, with **82%** going to the five largest data center companies. In FY2024 the exemption accounted for **nearly 80%** of all economic-incentive spending, and more than half of it over ten years. JLARC concluded the exemption provides “moderate economic benefits and return in revenue” and “does not pay for itself when considering just the state portion of the exemption cost.”

THE MECHANISM. “Pay their share” is a claim about a cost-of-service study. A cost-of-service study is an allocation exercise whose inputs, per Bonbright, defy resolution “because of the absence of any objective standard of rationality.” So the claim is true in the sense that the study says so, and unfalsifiable in the sense that a differently and equally defensible study would say otherwise — which is why Martin & Peskoe’s recommendation is procedural rather than numerical: move data centers out of confidential special contracts and into open tariffs, “more procedurally appropriate forums... to consider and address cost-allocation issues.”

Where it binds: on the word *currently*. Every honest version of “they pay their share” is present-tense, and every projection in the record says the present tense expires.

VERBATIM BANK.

“A typical residential customer of Dominion Energy could experience generation- and transmission-related costs increasing by an estimated \$14 to \$37 monthly in constant (or real) dollars by 2040 (independent of inflation).” — Joint Legislative Audit and Review Commission, Data Centers in Virginia (Report 598), 9 December 2024.

“[I]t will be difficult to supply enough energy to keep pace with growing data center demand, so energy prices are likely to increase for all customers.” — JLARC, Data Centers in Virginia, December 2024, as quoted by the Virginia Conservation Network.

“Modern data centers are large industrial facilities and are largely incompatible with residential use.” — JLARC representative, briefing the Virginia General Assembly, 9 December 2024 (NBC Washington, 9 December 2024).

WHO PAYS. The audit’s finding is that nobody in the record disputes the *direction*; the dispute is entirely about *when* and *how much*. The 2040 horizon is where JLARC put it. The 1 August 2026 SCC decision is where the first instalment lands.

WHAT’S CONTESTED. LBNL’s April 2026 *Retail Electricity Price Trends and Drivers* is the pack’s mandatory counter-

weight: equipment costs, an aging grid and clean energy requirements are also drivers of the 42% five-year increase. Fortune (20 May 2026) quotes an analyst attributing much of the five-year increase to extreme weather events. Any version of this beat that assigns the whole 42% to data centers is factually wrong and the pack says so. Narrator move: **DISCOUNT**, applied in both directions.

STRESS-TEST VERDICT: SUSTAINABLE. JLARC contradicting itself inside one report is the beat. The 5% finding is the second half. The LBNL counterweight keeps it honest.

Beat 7 — The Steelman (*defendant: Dominion*)

Syllabus 2.0 assignment: The utility's strongest case, in its own filed numbers.

Beat Menu definition: *Audit • never opener • rotation rule: a different defendant every deployment; the same party never gets steelmanned twice.* Rotation position: L7 is Dominion's only deployment course-wide (L1 the county's growth case · L4 PJM's queue · L5 the behind-the-meter customer · L6 the neocloud CFO's depreciation schedule · **L7 Dominion** · L8 the White House's race logic · L9 the orbital case · L10 the hyperscaler's capex logic). **Compliant.**

Full ammunition file: Section 7. This entry carries the beat's spine.

THE DEFENDANT'S CASE, IN ITS OWN NUMBERS.

1. **The obligation to serve is not optional.** Dominion is a regulated monopoly with a statutory duty to serve load in its territory. It does not get to decline a lawful customer because the customer is large.
2. **JLARC audited it and cleared it — for now.** JLARC's third-party study on utility cost recovery found data center customers "are currently paying for the costs they're responsible for incurring." VEDP cites this accurately.
3. **Dominion built the fence itself, before it was ordered to.** The SCC's final order in Dominion's **2025 rate case** approved large-load provisions including **the creation of the GS-5 rate class** — a separate class for large loads — with cost-shift prevention as, in Google's characterization on the record, "the provisions' entire premise."
4. **It also moved its allocation method.** Dominion "only recently completed its shift to a 12 coincident peak demands allocation factor" (Cleveland, 15 July 2026). Two structural reforms are in flight simultaneously and neither has been given time to show a result.
5. **It has conceded the alternative is reasonable.** Dominion regulatory analyst **Robert Miller**, on the record 15 July 2026, agreed with SELC senior attorney **Nate Benforado** that summer/winter peak-average "is in the zone of reasonableness," while maintaining 12CP is more appropriate for Virginia — and gave a reason: Dominion's North Carolina service territory is much smaller and he is not aware of new high-load-factor customers there.
6. **It revised its own damage estimate downward and filed it.** \$2.90/month → \$0.94/month, publicly, in the same docket.
7. **The demand is real and it is enormous.** PJM expects the Dominion Zone to see the largest absolute increase in summer peak demand between 2026 and 2030. The 2025 forecast shows **more than 20,000 MW** of Dominion-Zone growth from data centers by 2037 against **5,700 MW** in the 2022 forecast. If Dominion under-builds and the load arrives, the failure is a reliability failure, and reliability failures are measured in households without heat.
8. **The asymmetry of error costs is genuinely asymmetric.** Over-build strands capital on thirty-year paper. Under-build strands people in a cold snap. A regulated utility whose mandate is reliability is *supposed* to weight those differently.
9. **The economics are not imaginary.** JLARC: the industry generates roughly **\$9.1 billion** in annual economic activity in Virginia; Northern Virginia is the largest data center market in the world.
10. **Someone has to be the counterparty.** Amazon's own witness argued the *opposite* of the anti-utility case — that Dominion should share more risk rather than push it all onto data centers. Both cannot be true at once, and the fact that the utility is attacked from both directions in the same docket is itself evidence it is standing somewhere defensible.

THE CROSS-EXAMINATION (one paragraph's worth, per beat discipline). SCC staff attorney **Andrew Major**, same hearing: "regardless of the cost allocation methodology that is chosen, there remains a glaring cross-class subsidization occurring to the benefit of new GS-5 customers." Martin & Peskoe, March 2025: more than half of Dominion's transmission costs sit in residential rates, and in July 2024 SCC staff found a **\$23 million** project "likely, if not certainly, would not be needed at this time" but for a data center's request — recovered through the FERC tariff, about half of it billed residentially. Dominion's spokesperson calls Virginia ratemaking "open and transparent"; Martin & Peskoe's whole paper is an argument

that openness of *procedure* is not transparency of *cost*.

VERBATIM BANK.

“believes that 12CP is the more appropriate allocation methodology for the companies for the Virginia jurisdiction” — Robert Miller, Dominion regulatory analyst, Virginia SCC hearing, 15 July 2026 (Utility Dive’s characterization; Miller’s agreement that SWPA “is in the zone of reasonableness” is quoted directly).

“the customer’s financial responsibility for the identified facilities ... clear, enforceable, and integral to mitigating subsidization and stranded cost risks” — Testimony of Cameron Brooks on behalf of Amazon, Virginia SCC, filed 11 June 2026.

“Why is that not sufficient?” — Will Cleveland, testifying on behalf of Google, Virginia SCC hearing, 15 July 2026, on the SCC’s already-approved GS-5 large-load provisions.

WHO PAYS. The steelman’s honest answer: under Dominion’s case, the data center pays through GS-5 and 12CP, and the ratepayer pays for the reliability margin — which is what the ratepayer has always paid for. The question the beat cannot resolve is whether GS-5 is a fence or a fence post.

WHAT’S CONTESTED. Everything, live, with a decision due 1 August 2026. The pack notes one asymmetry the drafting AI should not smooth: Google and Amazon are arguing *for* voluntary CIAC payments and *against* the methodology change. Their preferred remedy is the one that requires no rate-design precedent.

STRESS-TEST VERDICT: SUSTAINABLE. Ten load-bearing points in the defendant’s own filed numbers, two reforms in flight, a conceded alternative, and a cross-examination that fits in a paragraph.

Beat 8 — The Regulatory Collision

Syllabus 2.0 assignment: The moratorium wave: at least 11 states with active bills, against commissions’ and legislatures’ competing authority.

Beat Menu definition: *Politics • versatile, closer-capable • 5 appearances.* “Two authorities claiming the same jurisdiction... Sustained by steelmanning both jurisdictions’ legal theories before the collision.” Timeline Snap and Verbatim both host natively here.

FACTS, DATES, NAMES, NUMBERS — the wave, counted four ways as of July 2026.

- **MultiState:** state-level moratorium bills introduced in **11 states** in 2026. (*This is the count that matches the must-hit anchor.*)
- **Good Jobs First (16 April 2026):** at least **12 in-session states** with filed moratorium bills.
- **DLA Piper (July 2026):** at least **12 states** have considered moratorium legislation.
- **NCSL, via Route Fifty (10 June 2026) and the Rockefeller Institute (June 2026):** **14 states** have considered or are considering a moratorium.
- **Context around all four:** more than **300** data center bills filed across **30+ states** in 2026; more than **100 local moratoria** adopted nationwide; an estimated **\$64 billion** in projects blocked or delayed by community opposition; in 2025, over 40 states considered 267 data-center-related bills.
- **The individual bills, with thresholds:** Maine **LD 307** (>20 MW, 18-month pause; passed; **vetoed by Gov. Janet Mills 24 April 2026**; override failed **20–11** in the Senate on 29 April) · New York **S9144/A10141 → S10642/A11560** (three-year pause amended to one year; **passed 4 June 2026**, Senate **44–16**, Assembly **102–39**; 20 MW threshold) · Oklahoma **SB 1488** (moratorium to 1 November 2029) · Minnesota **SF 4298** (permits barred until one year after a PUC report) · New Hampshire **HB 1265** (one-year construction prohibition plus a study committee) · Maryland **HB 120** · Vermont **S.205** · Michigan **HB 5594–5596 / SB 1018–1020** plus **House Resolution 240** · South Dakota (enacted in modified form).
- **The collisions, named:**
 - **Legislature vs. governor:** Maine. Mills vetoed a bill she says she supports in principle, over a single-site exemption for the former Androscoggin Mill in Jay. Michigan’s Gov. Whitmer calls a moratorium “an automatic non-starter.”

- **Legislature vs. commission:** Minnesota’s SF 4298 conditions permitting on a PUC report — the legislature borrowing the commission’s clock.
- **Ballot vs. legislature:** Ohio’s proposed constitutional amendment banning data centers over 25 MW gathered ~70,000 of the 413,488 signatures needed by 1 July 2026 and failed to qualify. Backers plan 2027.
- **County vs. developer:** Hill County, Texas enacted a one-year moratorium in May 2026 and **rescinded it 4 June 2026 after a developer sued**, replacing it with a project-review checklist.
- **Court vs. county:** in Virginia, a court invalidated project approvals in Prince William County on procedural grounds (2026 session reporting).
- **State vs. state, in opposite directions, in the same month:** Arizona paused data center tax incentives 13 June 2026; Illinois’s pause took effect 1 July 2026; **New Hampshire moved the other way**, enacting an “off-grid electricity providers” law easing self-supplied power for data centers.
- **The federal vector — seeded here, detonated in L8:** FERC Docket **RM26-4-000**, opened at DOE Secretary Chris Wright’s October 2025 §403 direction, proposing a **20 MW** threshold for “large loads”; FERC committed on 16 April 2026 to act by end of June 2026 and issued six §206 show-cause orders on 18 June 2026. A federal moratorium bill has been introduced in the Senate; passage uncertain. **L8 owns the preemption fight; L7 stops at the state/local seam.**
- **The regulatory counter-wave, which is larger than the moratorium wave and gets less coverage:** per the Edison Electric Institute (May 2026), **23 states have approved at least one large load tariff and seven more have tariffs pending.** Per the Smart Electric Power Alliance tariff database (via Colorado Sun, 2 April 2026), **29 large-load tariffs were approved in 2025 and 77 are pending across 36 states.** Enacted statutes as of October 2025: Minnesota HF 16 (a “very large customer” class, MW threshold left to the PUC), Virginia (HB 2084 and a companion), Utah SB 132 (≥100 MW within five years), Oregon HB 3546, Missouri SB 4 (>100 MW annual peak), Texas SB 6, Kansas SB 98. Oklahoma’s Act took effect 1 July 2026 at a **75 MW** threshold. California **SB 886** would direct the CPUC to establish a data center tariff regime at **≥25 MW**.

THE MECHANISM (the two legal theories, steelmanned). *The moratorium theory:* land use and permitting are traditional police powers; a state may pause permitting while it studies impacts, and a temporary pause is the least restrictive means of preserving the status quo while the legislature legislates. *The tariff theory:* a moratorium is a blunt instrument that stops investment without fixing allocation, whereas a tariff fixes allocation without stopping investment — and the commission, not the legislature, holds the ratemaking power. **Where it binds:** on **who owns the threshold**. Every instrument in this beat is defined by a megawatt number — 20, 25, 75, 100, 150 — and the number is set by a different body in every jurisdiction. The collision is not ideological; it is arithmetic performed by rival authorities.

VERBATIM BANK.

*“Large load customer” means new data centers, new cryptocurrency mining operations and new facilities whose primary function is artificial-intelligence computing facilities that contract with an electric supplier to add seventy-five (75) megawatts or greater electric load per facility or in aggregate behind a single point of interconnection to an electric supplier’s load after July 1, 2026. It does not include residential, commercial, agricultural, or industrial ratepayers, or those entities that build generation for behind-the-meter projects.” — Oklahoma Corporation Commission, describing the definition in the **Data Center Customer Ratepayer Protection Act of 2026, 17 O.S. §§ 900–906, effective 1 July 2026.** (This is the pack’s primary verified substitute for the failed Verbatim assignment — see §4.)*

*“Large load data center” means a facility: (1) whose primary services are the storage, management, and processing of digital data; (2) that is used to house computer and network systems, including associated components such as servers, network equipment and appliances, telecommunications, and data storage systems, systems for monitoring and managing infrastructure performance, Internet-related equipment and services, data communications connections, environmental controls, fire protection systems, and security systems and services; and (3) has, or is projected to have, a maximum monthly demand of at least 100 megawatts.” — New Jersey Senate Bill **S731, 2026–2027 Regular Session, as introduced.***

*“concerning interconnection and tariffs for large load customers” — Pennsylvania Public Utility Commission, caption of Docket No. **M-2025-3054271**, opened March 2025.*

WHO PAYS. Two answers, both real. Under a moratorium: the county’s tax base pays, and the developer pays in delay —

an estimated **\$64 billion** in projects blocked or delayed nationally. Under a tariff: the data center pays, and if the Buckeye Institute is right, the state pays in projects that go elsewhere. Nobody pays nothing.

WHAT'S CONTESTED. The tally itself. **This is the As-Of Stamp's home** and the reason it is assigned here: four credible counters give 11, 12, 12, and 14 in the same season, because they are counting different things (introduced / in-session / considered / considered-or-considering). The pack's recommendation: state the anchor value with its author and date rather than a bare number.

SENSORY & MATERIAL DETAILS. A petition drive 343,488 signatures short. A Texas county that reversed itself in thirty days under a lawsuit. A governor's veto letter naming one paper mill.

STRESS-TEST VERDICT: SUSTAINABLE. Nine named bills with thresholds and vote counts, six named collision types, two steelmanned legal theories, and a counter-wave of 23–36 states doing the opposite thing quietly.

Beat 9 — The Hearing Room

Syllabus 2.0 assignment: Warrenton, February 15, 2023, ~2:30 a.m., hundreds packed in — transcript and minutes only; Miller's testimony, comedy off.

Beat Menu definition: *Politics • opener-capable, versatile • 7 appearances (band 4–5, +2).* “A county board meeting, a FERC technical conference, an earnings call Q&A — reconstructed from transcripts and minutes only. **This is the only walk-into-a-room beat on the menu**, which satisfies the production bible's max-1-scene rule by construction. Evidence discipline is absolute: documented speakers, documented words, no staging.”

FACTS, DATES, NAMES, NUMBERS.

- **The room:** the auditorium at **Fauquier High School**, Warrenton, Virginia — the council moved the meeting out of Town Hall because of expected turnout.
- **The docket item:** **SUP 2022-03, Amazon Data Center.** Applicant: **Amazon Data Services, Inc.** Requested: a Special Use Permit under Article 3-4.12.3 of the Zoning Ordinance for an approximately **220,200 square foot** data center on an Industrial-zoned parcel of approximately **41.793 acres**, GPIN **6984-69-2419-000**, designated New Town Character District on the Future Land Use Map, off **Blackwell Road and Lee Highway**. Modifications requested for **building height, parking, and fence height**. The public hearing had been held open from the **10 January 2023** regular meeting.
- **The clock:** meeting called for the evening of **Tuesday, 14 February 2023**; the vote came at **about 2:30 a.m. on Wednesday, 15 February**; one attendee's contemporaneous account puts the room's hours at **6:30 p.m. to 2:45 a.m.** DCD reports the meeting finished “around 3 a.m.”
- **The crowd:** **more than 500 people attended** (Piedmont Environmental Council); “hundreds” (multiple outlets); “about 400 residents” (a later retrospective). **Nearly 130 speakers** signed up; “all but three speakers urg[ed] the Town to deny.”
- **The vote:** **4–3. For:** **Heather Sutphin** (Ward 1), **Brett Hamby** (Ward 3), **James Hartman** (Ward 4, then Vice Mayor), **Jay Heroux** (Ward 5). **Against:** **Paul Mooney** (At Large), **David McGuire** (At Large), **William “Bill” Semple II** (Ward 2). Mayor at the time: **Carter Nevill**. Sutphin **participated by phone**.
- **The second vote nobody remembers:** immediately after, the council voted **unanimously** to let all council members — but not the public — review the **3,142 emails** then-Town Manager **Brandie Schaeffer** had exchanged with Amazon representatives. Schaeffer had left the town the prior year and gone to work for Amazon. The town later stated that “in the nearly seven months since then no Council member has raised an issue about anything in the documents that was contrary to the public interest,” and put the number of withheld Amazon emails at **13**.
- **Named speakers on the record:** **McKenzie Miller**, Fauquier County resident, home several miles south of Warrenton, who spoke in tears. **Peggy DiVincenzo**, Warrenton resident. **Hope Porter**, described as a land-use legend, who received a standing ovation. **Ike Broaddus**, then a candidate for the Scott District seat on the Fauquier County Board of Supervisors. **Kevin Ramundo**, president of Citizens for Fauquier County (also on record at the 9 November 2022 meeting). **Robert Duvall**, resident and actor, who attended with **Luciana Pedraza** and spoke against.
- **The corpus that exists:** Citizens for Fauquier County posted **eight unedited video segments** of the 14 February 2023 public hearing. The Town of Warrenton's agenda and staff materials for the 14 February 2023 regular meeting are posted through Municode, including “23.02.14 SUP 22-03 Conditions of Approval CLEAN.pdf” and the illustrative building elevations dated 2-14-23. **No certified stenographic transcript is publicly posted.** (*Flagged:* §8,

D7.)

THE MECHANISM (how a room becomes a permit). A special use permit is a discretionary land-use approval measured against a zoning ordinance and a comprehensive plan. The council had already tabled once so that Amazon could respond to staff-drafted preconditions — noise, safety and environmental mitigation — and the town added an **annual noise test**, and a **site plan and Certificate of Occupancy permit for each development phase**, as compliance conditions. **Where it binds:** on the word *consistent*. Hartman’s vote rested on the application being “consistent with the Town of Warrenton [2040] Comprehensive Plan in spirit and intent.” The lawsuit filed thirty days later alleges precisely the opposite: that the council violated its own zoning ordinance and comprehensive plan, making the resolution invalid.

KEY ACTORS. (*As-of titles at the dated moment: all council titles are as of 14–15 February 2023.*) Full profiles in §9.

VERBATIM BANK — the room’s own words.

“I think if Amazon wants to buy this place, they can build affordable housing. Why can’t you guys spend this much time agonizing over affordable housing?” — McKenzie Miller, Fauquier County resident, public hearing, Warrenton Town Council, Fauquier High School auditorium, 14 February 2023, fighting back tears (FauquierNow, 15 February 2023). COMEDY OFF.

“The application is consistent with the Town of Warrenton [2040] Comprehensive Plan in spirit and intent... Based on staff analysis, I feel that the applicant has met the [special-use permit] requirements ... and has answered questions that were felt unanswered by the [Warrenton] Planning Commission.” — James Hartman, then Vice Mayor, Warrenton Town Council (Ward 4), explaining his vote in favor, 15 February 2023 (Rappahannock News, 16 February 2023).

“I think it’s important that we listen to our citizens. Otherwise we become an oppressive government... A lot of people don’t want this.” — David McGuire, then At-Large member, Warrenton Town Council, before the vote, 15 February 2023.

“I never thought I’d sit on a dais as an elected official and ask to see information to make a vote and then be denied by my colleagues. That’s unthinkable... There is a rush. I don’t know why.” — David McGuire, same meeting, on being denied access to the Amazon emails before voting (Prince William Times, 17 February 2023).

“This suit recognizes that the town of Warrenton has ignored its own zoning ordinances, its own comprehensive plan, its own legally prescribed processes, and the clearly expressed desires of the vast majority of its citizens in approving this data center.” — Kevin Ramundo, president, Citizens for Fauquier County, on the filing of the lawsuit, March 2023.

“We are deeply disappointed by the Warrenton Town Council’s decision. Despite every possible effort ... the Town Council still voted 4-3 to approve the special use permit.” — Piedmont Environmental Council, statement, week of 15 February 2023.

WHO PAYS. In the room, nobody yet. That is the beat’s point: this is the moment before the bill, and the bill is what the first eight beats have just spent an hour tracing. Downstream: Amazon reportedly intended to invest about **\$550 million** in the project; the site remains undeveloped as of the research date because of litigation.

WHAT’S CONTESTED. The town’s own legal position **changed sides**. In June 2026, town attorney **Whitson Strother** — in post only since early 2026 — told the court Warrenton no longer shares Amazon’s “litigation alignment,” that the *void ab initio* challenge is legally cognizable, and that the town’s acceptance of the facts had not changed but its “legal assessment” had. **Where the record is fought over:** the FOIA case. 3,100+ emails; a February 2023 circuit court ruling for the town; a **30 July 2024 Virginia Court of Appeals reversal** holding the circuit court erred in allowing the working-papers exemption for both mayor and town manager and in reviewing a 10-email sample chosen by the town’s own counsel; a **13 August 2024 council vote, 4–3**, to appeal to the Virginia Supreme Court. The Reporters Committee for Freedom of the Press filed in support. (*The fight over the record is better material than the emails.*)

SENSORY & MATERIAL DETAILS (sourced). A high school auditorium standing in for a council chamber. A councilmember participating by telephone. Nearly 130 speakers, each required to state name and address for the record. A

standing ovation. The hour: 2:30 a.m. Signs in residents' yards, photographed by the Washington Post on 10 February 2023.

STRESS-TEST VERDICT: SUSTAINABLE. Six named speakers with quotations, a documented docket item with a GPIN, a vote count with names and wards, an hour, a crowd size, a second vote, and a document fight — all from published contemporaneous reporting and public agendas. **Caveat for markup:** the reconstruction rests on newspaper quotation and posted agendas rather than a certified transcript. The Beat Menu's "transcripts and minutes only" rule should be read to include the town's posted meeting record and CFFC's unedited video; if Nick reads it more strictly, the beat needs the video segments logged before Draft 1.

Beat 10 — The Neighbor

Syllabus 2.0 assignment: One fence-line ratepayer from the hearing record — **pack dependency flagged:** named individual must surface from testimony.

Beat Menu definition: *Character • versatile • thermostat near-zero • 3 course-wide appearances (Morrises L3 · this one · Gladney L8).* "One household at the fence line... **Hard constraints:** documented individuals from testimony, filings, and published reporting only; no composites; no invented color; comedy off. This beat is what keeps lecture 7 from being an abstraction about rate classes."

PACK DEPENDENCY — HONEST RESOLUTION. The record did **not** surface a named fence-line ratepayer whose *bill* is documented in the Warrenton hearing record. What it surfaced is a named residential ratepayer whose bill is documented in published reporting. Both candidates are built in full in §8; the recommendation is stated there and again in §3.

- **Primary candidate: John Steinbach, Manassas, Virginia.** Resident of the same home for **nearly forty years**. **January 2026 electricity bill: \$281**, against roughly **\$100** the previous month. Verbatim, twice. Documented in Consumer Reports, 20 March 2026. Qualifies under the Beat Menu's "published reporting" clause. **Does not** qualify as "from the hearing record," and no source in this pack places him at a fence line.
- **Fallback per Open Item 8: McKenzie Miller**, second Hearing Room-sourced treatment. Fully documented, in the hearing record, comedy off — but her documented harm is land-use and civic, not a bill delta, which cuts against the lecture's Ledger register.
- **A third option markup should consider:** run the beat on Steinbach for the bill and let Miller stay inside Beat 9 where she already is. This is the pack's recommendation.

FACTS, DATES, NAMES, NUMBERS. See §8 for the full treatment, including the surrounding survey evidence (nearly three-quarters of Virginia voters, January 2026; 78% of 2,146 U.S. adults, November 2025), the February 2026 Dominion bill-shock reporting, and the Prince George's County, Maryland response.

WHO PAYS. A man in Manassas paid \$281 in January 2026. That is the whole beat.

STRESS-TEST VERDICT: THIN. Not because the material is weak but because it is **thin in the specific dimension the beat requires:** one household, documented at length, in the lecture's own jurisdictional record. Steinbach gives two sentences and a number; the Morrises in L3 gave a property line, a well, and a groundwater study. **Section 3 proposes the replacement and the re-scope.**

Beat 11 — The Externality Swap

Syllabus 2.0 assignment: Large-load tariffs: fence the costs in vs. deter the investment — both sides priced.

Beat Menu definition: *Atoms/Money • versatile, closer-capable • 8 appearances (band 4–5, +3 — the second deliberate overage).* "The pick-your-poison tradeoff... Sustained by pricing *both* sides of the swap honestly — **the beat fails if one option is a strawman.**"

SIDE A — FENCE THE COSTS IN. Priced.

- Schedule DCT's terms, in force since 23 July 2025: **85%** minimum billing demand, ramp floors **50/65/80/90%**, **ramp + 8 years** term, **50%** collateral, **36 months** exit fee, **100%** buildout reimbursement on cancellation or >12-month delay.

- Indiana Michigan Power’s proposal: **90%** of the utility’s costs of new generation and transmission capacity, **twenty-year** term, applicable at **≥150 MW**. The utility’s own estimate: it could spend as much as **\$17 billion** on new power plants over the next several years if it met data center demand with self-built plants. Expected peak on its system rising from **2,800 MW to 7,000 MW**.
- Direct assignment plus CIAC, argued at the Virginia SCC 14–15 July 2026 — Amazon and Google both *supporting* voluntary CIAC.
- Maryland’s Next Generation Energy Act (2025) and Oregon’s POWER Act (2025) — statutes that force separation of the accounting.
- **The price of Side A, stated by its opponents:** the Buckeye Institute (16 March 2026) argues the tariff “inverts the Ramsey rule” by charging the most price-elastic customers the highest markups. Data centers are “mobile capital and very cost-conscious”; residential customers “are relatively price-inelastic. They are unlikely to move due to small rate increases.” Predicted result: “these customers leave or never arrive.” Brendon J. Baatz testified in 24-508 that Schedule DCT’s terms are “far more restrictive and burdensome than those imposed by investor-owned utilities in other states, which could prompt some data center customers to consider investing outside of Ohio.” Kevin C. Higgins, for the Data Center Coalition: the tariff “will adversely impact planned data center development.”

SIDE B — LEAVE THE COSTS SOCIALIZED. Priced.

- \$4.3 billion of 2024-approved transmission across seven states, 95% of it in the shared pool.
- **\$29.4 billion** of data-center-attributable capacity charges across four PJM auctions, 46% of \$63.6 billion.
- A JLARC range of **\$14–\$37 per month** by 2040 for a typical Dominion residential customer.
- **The price of Side B, stated by its beneficiaries:** the industry does not argue for socialization in those terms. It argues, per Fykes, that the causal line is not clean; per Cleveland, that reforms already approved have not been given time; per Amazon’s witness, that risk should be *shared* rather than assigned entirely to data centers, and that the utility “should instead share the risks of infrastructure development with new data centers” rather than “imposing virtually all risks” while “reaping all of the profits for itself.” **That is a real argument and the beat fails if it is caricatured.**

THE THIRD OPTION nobody in the beat names first — cut the cord entirely. Martin & Peskoe’s Part III.C: retail competition and **energy parks** — “combines generation assets, complementary resources like storage, and connected customers” (Energy Innovation’s definition, quoted by them). An off-grid or export-only energy park “is a sure-fire approach for protecting ratepayers.” The obstacle is not physics but statute: in many states an entity that delivers or sells power to another entity is a “public utility,” which would doom a multi-owner park inside an incumbent’s territory. In Georgia, state law lets a large new consumer outside existing service territories choose a supplier — but **limits the premises to a single customer**, so a Georgia energy park could contain exactly one data center owner. (*This is the seam into L5’s behind-the-meter material; L5 owns co-location, and L7 takes only the ratepayer-protection framing.*)

Fourth option — flexibility. A Nicholas Institute study estimates **76 GW** of data centers could connect to the existing system if utilities curtail delivery for **just a few hours per year**. Martin & Peskoe’s recommendation: classify data center load as interruptible or controllable in the tariff. Their own caveat: “Utilities, however, have historically been hostile to regulatory attempts to require measures that would defer or avoid the need for costly infrastructure upgrades that drive utilities’ profits.”

VERBATIM BANK.

“the terms and conditions in Schedule DCT are far more restrictive and burdensome than those imposed by investor-owned utilities in other states, which could prompt some data center customers to consider investing outside of Ohio” — Direct Testimony of Brendon J. Baatz in Opposition of the Second Joint Stipulation and Recommendation, PUCO Case No. 24-508-EL-ATA, at 4, 8 November 2024.

“By rejecting a stipulation that unfairly discriminates against data centers, the Commission can help ensure that Ohio continues to be a leader in attracting investment from this vital industry.” — Second Supplemental Direct Testimony of Michael Fradette on Behalf of Amazon Data Services, Inc., PUCO Case No. 24-508-EL-ATA, at 18, 8 November 2024.

“40 percent of the operational cost of a data center is electricity, and this will usually be the largest line item on the budget. Additionally, this cost will continue for 40 years, and will scale the business. In contrast, real estate and development costs are one-time, up-front expenditures that are watered down as the volume of business increases. The

largest and fastest growing operations in our portfolio are in markets where electricity costs are competitive.” — Direct Testimony of Travis Wright on behalf of Quality Technology Services, Colorado PUC Proceeding No. 23A-0330E, at 16, 23 June 2023.

WHO PAYS. That is the swap. Fence it in and the data center pays, with a documented risk that some projects go elsewhere and the county’s tax base pays instead. Leave it socialized and the household pays, at a rate JLARC put between \$14 and \$37 a month by 2040. **Both sides are priced and neither is a strawman.**

STRESS-TEST VERDICT: SUSTAINABLE. Both sides carry filed testimony, dollar figures, and named advocates. The QTS testimony — 40% of opex, over 40 years — is the single best piece of evidence in the pack that the deterrence argument is not merely rhetorical.

Beat 12 — The County [C] (closer)

Syllabus 2.0 assignment: The sweep: Francis defeats Sutphin, Nov 5, 2024; every yes-vote gone; democracy as a rate-payer revolt with land-use paperwork. **Kicker hosts here. Handoff rides on the end of this beat.**

Beat Menu definition: *Politics/Character • versatile, closer-capable • 6 appearances (band 4–5, +1).* “One jurisdiction as live microcosm... Present-tense politics with a zip code — who ran, who won, what the comprehensive plan says now. Distinct from The Wrong Map — this is what the geography is doing to people *this year*.”

FACTS, DATES, NAMES, NUMBERS.

- **The result: 5 November 2024.** Roy Francis defeats incumbent **Heather Sutphin** in Ward 1 — the town’s **only contested race** — with **61.11%** to Sutphin’s **38.19%**. **Larry Kovalik** takes Ward 3; **Michele O’Halloran** takes Ward 4; **William Semple** and **Eric Gagnon** are re-elected. Every one of those campaigns opposed data center construction in town.
- **The context:** approximately **44,000** Fauquier County residents voted; turnout exceeded **75%**. The county went **59.91% Trump / 38.42% Harris** while Virginia went 51.56% Harris. (*The salient fact for the beat: this was not a partisan wave. Warrenton’s data center politics ran orthogonal to the top of the ticket.*)
- **The sequence of the sweep, which was not a single election:** **Jay Heroux** declined to seek re-election in **September 2023**. **James Hartman** and **Brett Hamby** declined in **June 2024**. **Heather Sutphin** was the only one of the four on the November 2024 ballot, and she lost. (*The Kicker must be precise about this — see §4.*)
- **Who Francis is:** a **retired federal government employee**; president of the **Northrock/North Rock Community Homeowners Association**; finance chair for **St. John the Evangelist Catholic Church**. He had pleaded with the Town Council in **November 2022** to deny Harris Teeter’s proposal for a gas station in the North Rock Shopping Center — i.e., his civic record predates the data center and is about development generally. He campaigned on **increased transparency and open dialogue** between council and public. He is described as a political newcomer.
- **What the new council did:** the five incoming members issued a **joint statement** pledging to get to the bottom of the 2023 decision, concluding: “no data center has any place in a small town like Warrenton.” In **July 2025** the council **amended the zoning ordinance to remove data centers as a permitted use in industrial districts**. It did not reverse the February 2023 permit.
- **What is still unresolved as of 21 July 2026:** the merits case. Filed **17 March 2023**; Amazon joined April 2023; oral argument **15 June 2026** before Judge **Stephen Sincavage**; **no ruling, no timeline given**. Judge Sincavage told the parties and the gallery he could not provide a date, citing the work and research the arguments required. Board of Directors member **Patricia Ewing** told FauquierNow afterward she felt good about how it went. Separately, the town **flipped sides**: Strother told the court Warrenton no longer shares Amazon’s “litigation alignment.”

THE MECHANISM (how a rate revolt becomes a land-use vote). Warrenton has no ratemaking power. A town council cannot set a tariff, cannot allocate transmission costs, cannot open a rate case. The only instrument it holds is the special use permit — a discretionary land-use approval. So a fight about who pays for the grid arrives at the only counter that will take it, and gets adjudicated as a question about building height, parking, and fence height under Article 3-4.12.3. **Where it binds:** at the Dillon Rule. Warrenton’s own council handbook states it: as interpreted by the Dillon Rule, Virginia localities are “tenants at will” of the state legislature and depend on the General Assembly for their operating authority. The town’s leverage over a \$1.5 billion transmission rider is a zoning ordinance and an election.

VERBATIM BANK.

“All of the people who voted for Amazon are gone. This election was a referendum on Amazon.” — Roy Francis, Warrenton Town Council member-elect, Ward 1, quoted by Tate Hewitt, Fauquier Times / Prince William Times, 13 November 2024. [THE KICKER’S SOURCE.]

“They’re going to find out that, no matter what you decide, they’re going to find something wrong with it. Until you’re in that spot, you have no idea how hard it is.” — Heather Sutphin, outgoing Warrenton Town Council member, Ward 1, same article, 13 November 2024. [Comedy off. She is a defeated incumbent talking about the job.]

“We conclude that no data center has any place in a small town like Warrenton and will pursue whatever course of action is available to us to effectuate this conclusion, now and in the future.” — Joint statement of five incoming Warrenton Town Council members (Francis, Kovalik, O’Halloran, Semple, Gagnon), late 2024.

“It’s how much you grow, and how soon you grow... I don’t want us to outpace capacity.” — William Semple, re-elected Warrenton Town Council member, Ward 2, 13 November 2024.

“Jimmy Hartman gave me his book on zoning.” — Michele O’Halloran, council member-elect, Ward 4, on preparing for office by learning from the outgoing member whose seat she took, 13 November 2024.

“It appears that the new town council will be very responsive to the concerns of those they represent regarding undesirable levels of development. I think it’s good news for the town and its citizens.” — Kevin Ramundo, president, Citizens for Fauquier County, written statement to the Fauquier Times, November 2024.

WHO PAYS. Four council seats. Zero dollars of the \$4.3 billion. That gap is the closer.

WHAT’S CONTESTED. Whether it was a referendum at all. Three of the four left voluntarily; only one was defeated; the town’s only contested race was a single ward. Francis’s line is true as a description of the composition of the council and is a characterization as to causation — and the pack flags it that way. Against that: **every** candidate elected in 2024 ran against data center construction, and the new council changed the zoning ordinance within eight months. Narrator move: **GRANT-AND-WITHHOLD** — grant the sweep, withhold the mandate-by-landslide reading, and let the July 2025 ordinance amendment carry the causal weight.

SENSORY & MATERIAL DETAILS. A submitted photograph of three new council members. A departing member handing his successor a book on zoning. A 42-acre parcel behind Country Chevrolet, near U.S. 29 and Blackwell Road, still undeveloped three and a half years after the 4–3 vote.

STRESS-TEST VERDICT: SUSTAINABLE. Vote percentages, a five-member joint statement with a quotable conclusion, a completed ordinance amendment, an unresolved lawsuit with a named judge and a hearing five weeks before the research date, and a kicker quotation verified to its original publication.

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

Nine beats are left out of the strawman. Each is scanned against this lecture’s documented record.

1. Cold Open on an Object — *Atoms • opener only. Scan: NO, with one line of regret.* The lecture’s only candidate objects are paper (a bill, a tariff sheet) and the Beat Menu requires a physical thing with manufacture, cost, lead time, tolerances and failure modes. The transformer belongs to L4; the rack to L2. **Correctly left out.** (Note for markup: the opener rotation already assigns Bill Arrives to L3 and L7, and Cold Open to L2/4/6. No change available without breaking the rotation.)

2. The Wrong Map — *Politics • opener-preferred. Scan: NO.* Origin-story geography is L1’s (MAE-East, Loudoun, the compounding chain). Warrenton is not an origin story; it is a jurisdiction defending itself against one. Running it here would duplicate L1 and blur the County/Wrong Map distinction the Beat Menu draws explicitly. **Correctly left out.**

3. The Forecast Problem — *Money/Politics • versatile. Scan: YES — and this is the strongest swap case in the lecture.* The material is unusually deep: PJM’s Dominion-Zone forecast moved from ~5,700 MW of growth by 2037 (2022 forecast)

to **more than 20,000 MW** from data centers alone by 2037 (2025 forecast); PJM's 2025 long-term forecast shows **32,000 MW** of peak growth 2024–2030, nearly all data centers; PJM issued a **new forecast in January 2026 reflecting stricter vetting**; AEP Ohio told PUCO it had **50+ data centers and 30,000+ MW** in its queue while its own witness testified it had “limited ability to distinguish customers who are merely speculating”; a trade association proved in the AEP docket that the utility’s filed demand forecasts were **inconsistent with** the projections it used to justify its tariff, and its analyst said the concealment “conferred a de facto competitive advantage to build transmission rather than allowing a market response from competitive merchant generation”; Martin & Peskoe’s Recommendation D is literally *Require Utilities to Disclose Data Center Forecasts*; IEEFA states flatly that there are “strong reasons to believe that PJM’s 20-year forecasts of data center growth are inflated. But in the short term, markets are responding as though these forecasts are going to materialize.” **Swap case:** displace **Beat 10 (The Neighbor)**, which returned **THIN**. Position class: both are versatile middles; The Forecast Problem is never-opener-agnostic and sits comfortably at position 10. **Constraint check:** removing the Neighbor drops the lecture’s Character-family coverage to **The County alone** — which still satisfies the proposed fourth minimum (≥ 1 Character-family beat). Course-wide Neighbor count would fall from 3 to 2 (Morrises L3, Gladney L8), which is inside the 1–3 band. Category minimums after swap: Atoms ✓ (2, 6, 11), Money ✓ (1, 4, 11), Politics ✓ (3, 5, 8, 9, 12), Character ✓ (12). **The swap is legal. Counter-argument the pack is obliged to make against its own swap:** the Beat Menu says of the Neighbor, in terms, “This beat is what keeps lecture 7 from being an abstraction about rate classes.” Removing it to install a beat about *forecasts* moves the lecture further from the household, not closer — in the one lecture whose entire subject is the household. **The pack’s recommendation is therefore the re-scope, not the swap: keep the Neighbor and give it Steinbach.** See item 10 below.

4. The Founder Audit — *Character/Money • never lecture 1*. **Scan: NO.** No founder in this territory. The nearest human with an origin story is Brandie Schaeffer, the then-Town Manager who proposed the enabling zoning change in April 2021 and later took a job at Amazon — and that is a **conflict-of-interest** story, not a founder-mythology-versus-cap-table story. It belongs where it already is: inside Beat 9’s document fight. **Correctly left out.**

5. The Symbol Audit — *Politics • hard cap 3 course-wide*. **Scan: NO, and structurally barred.** The three deployments are cast: L5 (Three Mile Island), L8 (Stargate), L9 (orbital destiny). Nothing in L7’s territory is symbolically loaded enough to justify breaking a hard cap. **Correctly left out.**

6. Taxonomy by Business Model — *Money • versatile*. **Scan: MARGINAL — NO.** There is a genuine taxonomy available: large-load tariffs sort into **minimum-demand/take-or-pay** (AEP Ohio, I&M), **clean-transition/BYO-generation** (NV Energy, Georgia Power’s CIR option), **cost-causation/direct-assignment** (the Virginia Rider T-1 fight), and **statutory class creation** (Minnesota HF 16, Oregon POWER Act, Oklahoma’s Act). That is a real four-way sort with named specimens. But it substantially overlaps Beat 11’s Side A and Beat 8’s counter-wave, and the Beat Menu’s Taxonomy is budgeted at 1–3 course-wide with the count already spent. **Correctly left out; the taxonomy material is folded into Beats 8 and 11 where it already lives.**

7. The Deal — *Character/Money • versatile*. **Scan: MARGINAL — NO.** One candidate sequence exists and it is good: **the AEP Ohio settlement negotiation** — May 2024 filing at 90%/10 years, a competing data-center coalition stipulation at 75%, the utility-side stipulation at 85% filed 23 October 2024, evidentiary hearings, a January 2025 public hearing, and a 9 July 2025 order picking the utility’s number. Who wanted what, who blinked, what the term sheet reveals. But Beat 3 (Paper Trail) already carries the document and Section 5 carries the negotiation; running The Deal would duplicate. **Correctly left out; the sequence rides inside Beat 3.**

8. Operator Reality — *Atoms/Character • versatile*. **Scan: NO.** No documented operator material in this lecture’s territory. The fifty-people-in-an-aircraft-carrier material is assigned to **L8** as vector three’s delivery mechanism. Duplicating it here would burn L8’s beat. **Correctly left out.**

9. The Bottleneck — *Atoms • versatile*. **Scan: NO for this lecture, though the record touches it.** Reuters (9 July 2026) reports power companies scrambling to secure equipment as data center demand strains supplies; PJM’s 2028/29 auction cleared only **~525 MW** of new resources. But the transformer and turbine bottleneck is **L4’s**, fully built, and the equipment-scarcity-to-rate-base path is a seed line here, not a beat. **Correctly left out.**

VERDICT PAIRING

Only one Section 2 beat returned less than SUSTAINABLE: **Beat 10, The Neighbor — THIN.**

The strongest available replacement is The Forecast Problem (item 3), and the swap is structurally legal. **The pack**

nonetheless recommends against it and proposes a re-scope instead, for the reason the Beat Menu itself gives: the Neighbor is the beat that keeps this specific lecture from being an abstraction about rate classes, and this is the lecture in which that risk is highest.

Proposed re-scope of Beat 10 (markup decision, not a pack decision): run the beat on **John Steinbach** — named, forty years in the house, a \$281 January 2026 bill against ~\$100 in December 2025, two verbatim sentences — and widen the frame from “fence line” to **“the meter,”** which is the lecture’s actual subject and the register Syllabus 2.0 assigns (Ledger leads). Support him with the documented surround: the February 2026 Dominion bill-shock reporting, the Prince George’s County, Maryland official response of 24 February 2026, and the two dated surveys. **Honest cost of the re-scope:** the beat is then not a fence-line beat, and Syllabus 2.0’s phrase “fence-line ratepayer” no longer describes it. Nick should decide whether the Neighbor’s definition travels with the fence or with the household.

If Nick prefers the strict reading, the designated fallback from Open Item 8 — a second Hearing Room-sourced treatment of **McKenzie Miller** — is available and fully documented in §8, at the cost of a Character beat that carries no bill.

Re-verification after any of the three options. Category minimums hold in all three cases: **≥1 Atoms** (Beats 2, 6, 11), **≥1 Money** (Beats 1, 4, 11), **≥1 Politics** (Beats 3, 5, 8, 9, 12), **≥1 Character** (Beat 12 always; Beat 10 in options one and three). Hard caps: Symbol Audit untouched at 3; Irreversibility Ledger untouched at 0 mid-course; Steelman defendant unique; Paper Trail class unique (tariff docket); Hearing Room remains the lecture’s only scene. **No re-sequencing proposed. The pack proposes; markup and the Course Schema dispose.**

SECTION 4: MOVES PLAN VERIFICATION

4.1 THE STEP FUNCTION — *assigned: 267% in five years*

The number’s full pedigree. **267%.** Unit: **percent change in monthly wholesale locational electricity price at a grid node.** Stage: **actual, measured.** Window: **April 2020 → April 2025.** Author: **Bloomberg News**, published **29 September 2025**, *How AI Data Centers Are Sending Your Power Bill Soaring*. Underlying data: monthly nodal prices tracked and aggregated by **Grid Status**, roughly **25,000 nodes** across **seven regional grids**; data center locations from **DC Byte**. Bloomberg’s own phrasing is “electricity now costs **as much as 267% more for a single month** than it did five years ago in areas located near significant data center activity.” Companion finding: **more than 70% (reported elsewhere as 73%) of nodes with price increases** are within **50 miles** of significant data center activity, against **20%** of nodes with price decreases.

The standing assumption it breaks. Before the number arrives, the listener is standing on: *electricity prices are a slow, boring, regulated series that moves a few percent a year.* The setup material is in the pack and it is strong — the U.S. residential average moved **42% in five years**, itself described by Fortune as making this “the fastest period of electricity price growth on record,” and retail prices rose **7% in 2025 alone**. Deploy the slow series first; then the node.

△ **VERIFICATION RESULT: THE NUMBER IS REAL. THE ASSIGNED CLAIM IS NOT.** Syllabus 1.0’s must-hit anchor reads “Residential bills near major hubs up as much as 267% in five years.” **The 267% figure is a wholesale nodal price, not a residential bill.** Wholesale supply is only **30–50%** of a residential bill (Gillingham, 9 June 2026). When Senator Elizabeth Warren stated the residential version on **5 June 2026** — having used the same figure in **15 December 2025** letters to data center companies — **PolitiFact rated it Mostly False on 12 June 2026**, and WRAL reached the same verdict days later. Warren’s office pointed to **CBS News (25 April 2026)** and **Fortune (20 May 2026)**, which had made the same substitution. (*Do not silently substitute. §6, Discrepancy A, carries the flag and the resolution options.*)

Markup alternate — a Step Function that survives the audit. If Nick wants a detonator with no laundering problem, the record supplies one from the same territory: **PJM’s capacity clearing price went from \$28.92/MW-day for 2024/25 to \$269.92 for 2025/26 to \$329.17 for 2026/27, and the total auction cost from \$2.2 billion to \$16.4 billion.** Same period, same footprint, no unit ambiguity, every figure PJM’s own. The assignment stands until markup moves it.

4.2 THE UNIT CONVERSION — *assigned: \$4.3B → per-household arithmetic. HARD GATE.*

PASS.

The arithmetic, shown in full.

- **Numerator (sourced, dated, stage-labeled): \$4,356.3 million** — data-center-caused local transmission project costs **approved in calendar year 2024** in Illinois, Maryland, New Jersey, Ohio, Pennsylvania, Virginia and West Virginia. Author: Union of Concerned Scientists, *Connection Costs Loophole*, Table 1, September 2025. Stage: **approved capital cost**, not annual revenue requirement, not yet fully in rates.
- **Denominator (sourced, dated): PJM serves more than 67 million people** across 13 states and the District of Columbia (PJM's own standing description, used in every 2025–2026 auction release). The seven states in the UCS table are a subset of that footprint. **The pack does not have a published household count for those seven states specifically**, so the conversion must be built on a figure the record actually supports.
- **Conversion 1 — per person, PJM-wide:** $\$4,356,300,000 \div 67,000,000 = \$65.02$ **per person**. (*Conservative: it spreads a seven-state cost over the whole 13-state footprint, so the true per-person figure in those seven states is higher.*)
- **Conversion 2 — per household, using the U.S. average household size of 2.5:** $\$65.02 \times 2.5 = \$162.56$ **per household**. (*Marked: 2.5 is the standard U.S. average household size, not a figure from this pack's sources. If Nick wants a fully in-pack conversion, use Conversion 1 and speak in people, not households.*)
- **Conversion 3 — the one the pack recommends, because every input is in-pack and none of it requires an assumption: Virginia alone accounted for \$1,988.0 million of the \$4,356.3 million across 60 projects. That is 60 projects, one state, one year, and it is more than the other six states combined (\$2,368.3M across 70 projects — so Virginia is 45.6% of the money on 46% of the projects). Stated as a held object: \$1.988 billion of transmission, approved in twelve months, in one state, to connect data centers — against a state whose data center tax exemption cost roughly \$1 billion in a single fiscal year, 82% of it to five companies. Two billion out, one billion foregone, same jurisdiction, adjacent years.**

The check that makes it defensible. UCS's own framing supports the per-consumer read: these costs “have been allocated to all customers of these utilities,” and only **six of 130** projects were paid by the single customer. The conversion is not a rhetorical flourish; it is the mechanism.

What would make it FAIL, stated so the 2027 refresh can re-run it: if a future edition of the UCS brief re-states the total as an *annual revenue requirement* rather than approved capital, the per-household number changes by roughly an order of magnitude and every sentence built on it becomes wrong. **Re-verify the stage label before reuse.**

4.3 THE TIMELINE SNAP — assigned: 5 November 2024

VERIFIED.

The day before — 4 November 2024. The Warrenton Town Council contains three of the four members who approved SUP 2022-03 at 2:30 a.m. on 15 February 2023, or rather contains the last of them still standing for office: Heroux had declined re-election in September 2023, Hartman and Hamby in June 2024. Heather Sutphin is an incumbent in the town's only contested race. The town's litigation posture is aligned with Amazon's. The zoning ordinance permits data centers in industrial districts. The special use permit is valid and the site plan was approved in April 2024.

The day after — 6 November 2024. Every member who voted yes is gone or going. The incoming council's five members have issued a joint statement concluding that “no data center has any place in a small town like Warrenton.” The zoning ordinance will be amended eight months later. The town's litigation posture will reverse. And Francis has said the sentence that becomes the lecture's Kicker.

For whom the incentives flipped, precisely: for every council member in the Northern Virginia footprint who had been told that opposing a data center was a career risk. The lesson available on 6 November 2024 was that the reverse was now also true, and the vote share — **61.11% to 38.19%** — is the size of the lesson.

A documented rival date, presented with evidence per the pack's obligation. The record supports an argument that the real hinge was **9 December 2024**, when JLARC delivered Report 598 to the General Assembly: that is the date on which the fight acquired a legislature-grade number (\$14–\$37/month by 2040), a state-agency imprimatur, and a tax-exemption review with three options attached — and every Virginia statutory move since (the January 2025 subsidy bill, HB 2084, SB 253, the GS-5 class, the Rider T-1 case) traces to that report rather than to Warrenton. **Both dates are defensible. 5 November 2024 flipped the politicians' incentives; 9 December 2024 flipped the regulators'.** The assignment stands; the alternate is logged.

4.4 THE VERBATIM — assigned: the tariff's definition of a "Large Load Customer"

FAIL.

The existence gate is not met as assigned. This lecture's assigned Paper Trail document is **AEP Ohio's Schedule DCT** (PUCO Case No. 24-508-EL-ATA). Schedule DCT is a **data center tariff**; its scope is defined by facility type and load threshold — new or expanded data centers **greater than 25,000 kW**, and mobile data centers **above 1 MW**, with aggregation across affiliated companies and common ownership. **It does not contain a defined term "Large Load Customer."** No source in this pack shows that phrase as a defined term in any tariff schedule. The phrase is real and widespread — but as a *docket caption*, a *statutory definition*, and an *industry category*, not as a tariff definition.

Three verified alternatives, in order of preference.

(1) The statutory definition — verbatim, dated, primary, and it is the phrase.

*"Large load customer" means new data centers, new cryptocurrency mining operations and new facilities whose primary function is artificial-intelligence computing facilities that contract with an electric supplier to add seventy-five (75) megawatts or greater electric load per facility or in aggregate behind a single point of interconnection to an electric supplier's load after July 1, 2026. It does not include residential, commercial, agricultural, or industrial ratepayers, or those entities that build generation for behind-the-meter projects." — Oklahoma Corporation Commission, stating the definition under the **Data Center Customer Ratepayer Protection Act of 2026, 17 Okla. Stat. §§ 900–906**, effective 1 July 2026.*

Why it works better than the assignment: the bureaucratic comedy is intact and sharper. The definition of the largest electricity customers in the state's history is written as a list of exclusions, and the last clause exempts anyone who brings their own power plant.

(2) The New Jersey legislative definition — the three-part clause with the equipment inventory, quoted in full at Beat 8. Its comic engine is the enumeration: a facility housing "servers, network equipment and appliances, telecommunications, and data storage systems, systems for monitoring and managing infrastructure performance, Internet-related equipment and services, data communications connections, environmental controls, fire protection systems, and security systems and services" — followed, finally, by the only clause that matters: **"and (3) has, or is projected to have, a maximum monthly demand of at least 100 megawatts."**

(3) Schedule DCT's own minimum-demand formula, which is the tariff's actual voice and is quoted verbatim from AEP Ohio's published terms:

*"Monthly billing demand will be no less than the greater of: 1. 85% of the customer's highest previously established monthly billing demand during the past 11 months; or 2. Percentage of the customer's contract capacity according to the following schedule: for customers with 25,001 kW to 75,000 kW of total contract capacity: minimum demand is 15,000 kW plus 85% of any capacity above 25,000 kW; or with more than 75,000 kW of total contract capacity, minimum demand is 57,500 kW plus 100% of any capacity above 75,000 kW. However, the minimum demand cannot exceed 85% of the total contract capacity." — AEP Ohio, **Schedule DCT** minimum demand charges, as published by the company following PUCO's 9 July 2025 order; tariff effective 23 July 2025.*

Pack recommendation: deploy (1). It is the phrase the assignment names, it exists verbatim in a primary legal source, it is dated to three weeks before the research date, and its final sentence is the joke.

4.5 THE AS-OF STAMP — assigned: the 11+ state moratorium tally

VERIFIED — and already decayed, which is precisely what the move is for.

Current values as of 21 July 2026, by author:

- **11 states** — MultiState, moratorium bills *introduced* in 2026. (*Matches the Syllabus 1.0 anchor.*)
- **12 states** — Good Jobs First, *in-session states with filed* moratorium bills (16 April 2026); DLA Piper, states that have *considered* moratorium legislation (July 2026).

- **14 states** — NCSL via Route Fifty (10 June 2026) and the Rockefeller Institute (June 2026), states that have *considered or are considering* a moratorium.

The status changes that make the stamp thematic rather than clerical: Maine passed one and the governor vetoed it (24 April 2026; override failed 20–11 on 29 April). New York passed one on 4 June 2026 (Senate 44–16, Assembly 102–39) and it appears to have been enacted in mid-July 2026 — **verify signature date at draft stage (§11)**. South Dakota enacted a modified version. Ohio’s ballot route failed on signatures (~70,000 of 413,488) on 1 July 2026. Hill County, Texas enacted and rescinded one inside thirty days after a lawsuit. **More than 100 local moratoria** are in force.

Expected decay velocity: FAST — legislative-session speed. The tally moves every session and every veto. **Recommended deployment:** state the number with its counter and its date, in the move’s native form — *as of [date], the count is [n], depending on who is counting and what counts*. The ambiguity is the content.

4.6 THE KICKER — *assigned: every member who voted yes at 2:30 in the morning is gone*

VERIFIED, with one precision requirement.

The closing fact, sourced: Roy Francis, quoted 13 November 2024: “*All of the people who voted for Amazon are gone. This election was a referendum on Amazon.*”

The two or three adjacent facts the closing passage needs around it:

1. **The four names and the hour:** Sutphin, Hamby, Hartman, Heroux, 4–3, about 2:30 a.m., 15 February 2023, after nearly 130 speakers.
2. **The mechanism of their departure, which is not what the quotation implies:** Heroux declined re-election in September 2023; Hartman and Hamby declined in June 2024; **only Sutphin was defeated**, 61.11% to 38.19%, in the town’s only contested race. Three walked; one lost. **The Kicker must not imply four defeats.** The flat, accurate version is stronger: the council that approved it does not exist any more, and only one of them had to face a voter to make that true.
3. **The thing the sweep did not do:** the permit survived. The zoning ordinance changed in July 2025; the February 2023 approval did not. As of 21 July 2026 the case sits with Judge Sincavage, argued 15 June 2026, with no ruling and no date.

4.7 THE GESTURE — *assigned: skip proposed*

SKIP CONFIRMED. Zero deployments. No one-inch material supplied, by design.

Boundary-door scan run against this lecture’s material: the **silicon door** is not touched (no chip economics in this territory); the **reactor door** is not touched (L5 owns generation procurement; the only generation here is a capacity auction, which is a market, not a reactor); the **training-run door** is not touched (nothing in a rate case cares what the GPUs compute). **No unassigned door is pressed.** See §10 for the fence.

4.8 THE HANDOFF — *assigned: a question left hanging*

Material lives in §10. Rotation verified: L6 ran *the bill walking*, L7 runs *question*, L8 runs *door not opened*. No adjacent repeat.

SECTION 5: THE DOCUMENT DOSSIER

AEP Ohio’s Schedule DCT and the docket that made it — PUCO Case No. 24-508-EL-ATA

(*Paper Trail class for this lecture: **tariff docket**. The returning document — the interconnection agreement — is handled at the end of this section as a brief reference only; **L4 owns its full treatment**.)*

5.1 The document itself

Formal caption: *In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers*, Public Utilities Commission of Ohio, **Case No. 24-508-EL-ATA**. The resulting tariff is **Schedule DCT** (Data Center Tariff), a schedule of Ohio Power Company d/b/a AEP Ohio.

Author: Ohio Power Company (AEP Ohio), a subsidiary of American Electric Power. **Filed:** May 2024. **Utility-side stipulation filed:** 23 October 2024. **Evidentiary hearings:** December 2024 and January 2025. **Local public hearing:** Columbus, 3 January 2025. **Opinion and Order:** 9 July 2025. **Compliance tariff filed:** 11 July 2025. **Effective:** 23 July 2025. **Subsequent filing of record:** a February 2026 update; a DCT Load Study Letter dated 7 November 2025. **Where it lives:** PUCO’s Docketing Information System (dis.puc.state.oh.us), Case No. 24-0508; the Opinion & Order and the approved Stipulation are separately docketed; AEP Ohio republishes the operative terms and links at aepohio.com. **Procedural status as of 21 July 2026:** **effective and operating**, under challenge. The Ohio Manufacturers’ Association challenged the billing structure on 13 November 2025. The Buckeye Institute published a policy attack on 16 March 2026. AEP Ohio is running project tranches under it: the next round of load studies commenced **2 March 2026** for applications received by **28 February 2026**, with the following round of studies expected to begin **October 2026**.

5.2 What it says — the operative provisions

Scope and threshold. Applies to a new facility or an expansion of an existing facility with a request of **25,000 kW or greater**, and to mobile data centers / crypto operations above **1 MW**. Existing data centers and expansions under 25,000 kW are grandfathered from the tariff’s full obligations, subject to review in AEP Ohio’s pending general rate case. **Aggregation clause:** “All new loads of affiliated companies and companies with common ownership will be considered in the aggregate for purposes of calculating the minimum demand charge. If there are multiple new facilities at a single location of less than 25,000 kW, but the aggregate total load is greater than 25,000 kW, all of those facilities will be subject to Schedule DCT.” (*The clause exists because the obvious workaround is five 20 MW buildings.*)

Load study fees — one-time, payable within 45 days on pain of the request being treated as withdrawn:

Capacity request	Fee
>25,000 kW to <50,000 kW	\$10,000
50,000 kW to <100,000 kW	\$50,000
100,000 kW and greater	\$100,000

Study clocks. AEP Ohio will make reasonable efforts to complete a load study within **60 days** if regional transmission upgrades are needed, **45 days** otherwise, prioritizing on a first-come, first-served basis.

Load ramp. Not to exceed **four years**, with contract capacity floors of **Year One 50%, Year Two 65%, Year Three 80%, Year Four 90%**.

Contract term. Ramp period (≤ 4 years) **plus eight years**. If infrastructure is not in place by the estimated in-service date, the customer may petition the Commission for an adjustment — “but the contract term will otherwise remain.”

Collateral. Unless the customer has **both** (a) a credit rating of at least **A- from S&P and A3 from Moody’s** and (b) cash and cash equivalents on an audited GAAP balance sheet **greater than ten times the Collateral Requirement**, it must post a guarantee or collateral equal to **50% of the total minimum charges for the full term**. “At this time, surety bonds are not an acceptable form of collateral.” The definition of “customer” for collateral purposes includes the customer’s **financial sponsor** if the sponsor co-signs.

Minimum demand charges. Quoted verbatim at §4.4(3).

Behind-the-meter generation. To ensure netting does not let the customer exceed contract capacity, equipment “must be in place and maintained through the term of the ESA to instantaneously curtail load equal to or greater than the BTM generation output.” If the BTM equipment fails and the customer exceeds contract capacity, the company reserves the right to raise reliability or safety concerns before the Commission.

Capacity assignment. A customer may request that AEP Ohio assign **up to 25%** of its contract capacity to another Schedule DCT customer in lieu of exit fees, subject to six conditions — including that the transfer “would not result in any stranded investment being recovered from other ratepayers (or, if it would, the assigning customer pays for the full cost

of the stranded equipment),” and that both parties **attest in writing that no money or other compensation beyond the listed cost items is exchanged** as consideration for the reallocated capacity. *(A tariff clause that anticipates and forbids a secondary market in megawatts.)*

Exit. During the initial term the customer owes minimum charges “regardless of the customer choosing to curtail, reduce, suspend or terminate service.” After completion of the **fifth year following the ramp**, the customer may pay an exit fee equal to **36 months of minimum charges** and terminate. AEP Ohio’s own worked example: “A customer with a three-year load ramp period may pay the exit fee and terminate the contract only after year eight of the contract.” After the initial term, either party may terminate or modify capacity on **three years’ written notice**.

The two contracts. On completion of the load study, AEP Ohio presents two documents for signature within **60 days** or the customer forfeits its place: the **Letter of Agreement (LOA)**, requiring reimbursement of **100% of buildout costs** if the customer cancels — or delays by more than 12 months — before the target energization date, expiring once the project is completed; and the **Electric Service Agreement (ESA)**, whose term begins on the **actual date of energization**, not the estimated one.

Process. All new data centers or expansions seeking service must apply through **PowerClerk**; the process is stated to be mandatory. AEP Ohio includes the Schedule DCT customer’s load in **its PJM forecast**, and necessary transmission is built through the PJM planning process. *(That sentence is the seam: the tariff fences the retail costs and hands the transmission to the process that socializes them regionally.)*

5.3 Who wrote it and why

AEP Ohio drafted it, in May 2024, fourteen months into a **28-month moratorium** it had imposed on new data center connections in central Ohio in **March 2023**. The company had told PUCO it faced **more than 50 data centers in the queue representing more than 30,000 MW**; AEP’s multi-state system peaks at about **35 GW**. Its interim CEO told the market on 1 May 2024 that AEP expected at least **15 GW** of new load by 2030.

What AEP gets if the document is enforced: a de-risked capital program, an end to its own moratorium, and — as the Buckeye Institute puts it from the other side — a rate base built against contracts rather than forecasts. What the **Ohio Consumers’ Counsel** gets: the first enforceable statement in the region that the causer pays. What **Walmart, the Ohio Energy Group, the Ohio Manufacturers’ Association Energy Group and Industrial Energy Users-Ohio** get: protection of the industrial class from a cost shift they would otherwise absorb. *(The unsung fact of this docket is that the coalition against socialization was led by other large industrial customers, not by residential advocates alone.)*

The negotiation. AEP’s opening position was **90% for ten years**. A data-center coalition led by **Amazon**, with Google, Microsoft and Meta, filed a competing stipulation at **75%**, with shorter commitments, reduced exit fees and lower demand charges; AEP said that agreement “excluded important customer protections and included other problematic provisions.” The utility-side stipulation landed at **85%**, and PUCO adopted it with minor adjustments on 9 July 2025, finding it better aligned cost causation with the realities of grid investment.

5.4 What it forces and what it forbids

Forces: payment for 85% of subscribed load whether consumed or not; a twelve-year minimum relationship; collateral at half the term’s minimum charges; a load study fee before anything happens; instantaneous curtailment capability if you bring your own generation; written attestation that no money changed hands in a capacity assignment. **Forbids:** disaggregating into sub-25 MW buildings under common ownership; walking away inside the initial term without paying; surety bonds as collateral; selling your capacity slot.

5.5 What happens when someone violates it

The tariff’s enforcement is financial rather than punitive: non-payment of the study fee **withdraws the request**; failure to sign within 60 days **forfeits the queue position**; cancellation before energization triggers **100% buildout reimbursement** under the LOA; early exit costs **36 months of minimum charges** and is unavailable before year five post-ramp. **No documented violation or enforcement action has surfaced in the public record as of 21 July 2026**. The tariff is one year old. *(State this as an absence, not a clean record.)*

5.6 The skeptical caveat — binding, or a press release with a docket number?

Binding. This is the most enforceable document in the lecture: an approved tariff with rate consequences, adopted over the opposition of the four largest customers in the industry, in force since 23 July 2025, with tranching studies running under it in 2026. **But three limits are documented and must travel with it.**

1. **It fences one state's retail costs, not the region's transmission costs.** Neighboring utilities protested in the docket that if AEP builds transmission against load that never materializes, PJM's regional allocation splits those costs among all member utilities by share of regional sales, and AEP's share would not rise proportionally. **The fence has a hole on the PJM side and the hole was identified inside the proceeding.**
2. **It is being appealed and attacked.** OMA challenge, 13 November 2025; Buckeye Institute policy brief, 16 March 2026.
3. **The grandfather clause matters more than the tariff in the short run.** Everything already built or under 25,000 kW is outside it, subject to a separate rate case.

5.7 The document's history and fate

May 2024 filing (90%/10 years) → March 2023 moratorium as predicate → 24 May 2024 Data Center Coalition intervention → 10 June 2024 Meta/Sidecat intervention → 18 October 2024 Higgins testimony → 23 October 2024 utility-side stipulation (85%) → 8 November 2024 Baatz and Fradette opposition testimony → December 2024–January 2025 evidentiary hearings → 3 January 2025 Columbus public hearing → **9 July 2025 Opinion and Order** → 11 July 2025 compliance filing → **23 July 2025 effective** → 7 November 2025 load study letter → 13 November 2025 OMA challenge → February 2026 update → 2 March 2026 next study tranche → October 2026 expected study round.

5.8 Returning documents — brief-reference material only

The interconnection agreement (lead: L4). *New fact and new consequence this lecture adds, and nothing more:* the agreement's cost-allocation terms are the ground the doctrine fight is fought on, and this lecture cashes the line the roster reserved for it — **"It is the customer's extension cord."** The new consequence L7 supplies that L4 could not: the Virginia SCC heard argument on 14–15 July 2026 about whether upgrades that "would not have been triggered but for a large load customer" should be assigned directly to that customer — which is, in regulatory prose, an argument about whether the extension cord has the customer's name on it. **Do not rebuild the three-study gauntlet, the pro forma agreement, or the queue.** L4 owns them.

PJM's Operating Agreement and RTEP (lead: L4 for the queue; new here). Schedule 6 §1.3's TEAC disclosure duty is introduced here for the first time in the course, as the causation-visibility problem. It is a **new document**, not a return; L4's material was the interconnection queue, not the transmission expansion advisory process.

JLARC Report 598 (new, and exclusively L7's). No prior pack claims it. **Do not seed it into L8's jobs math** — L8 owns the jobs multipliers; L7 owns the ratepayer findings. The two live in the same report and must be split at the pack boundary.

SECTION 6: THE NUMBER SPINE

Figures & Claims Ledger contribution for Lecture 7. Tables permitted in research documents only; banned in published prose.

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
267%	% change, monthly wholesale nodal price	actual, measured	Apr 2020 → Apr 2025	Bloomberg News (data: Grid Status; locations: DC Byte)	Bloomberg, 29 Sep 2025	STRUCTURAL	NOT a residential bill figure. See Discrepancy A
~25,000	pricing nodes analysed	n/a	Sep 2025	Bloomberg	same	STRUCTURAL	across seven regional grids

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
70–73% / 20%	share of increasing / decreasing nodes within 50 miles of data centers	n/a	Sep 2025	Bloomberg	same	STRUCTURAL	
\$4,356.3M	dollars, approved local transmission capital	approved	CY2024	Mike Jacobs / UCS	UCS brief, Sep 2025, Table 1	ANCHOR for this lecture	130 projects, 7 states
\$1,988.0M / 60	dollars / projects, Virginia	approved	CY2024	UCS	same	ANCHOR	45.6% of total
\$1,299.7M / 37	dollars / projects, Ohio	approved	CY2024	UCS	same	ANCHOR	
\$491.8M / 16	dollars / projects, Pennsylvania	approved	CY2024	UCS	same	ANCHOR	
\$239.0M / 3	dollars / projects, Illinois	approved	CY2024	UCS	same	ANCHOR	
\$215.8M / 2	dollars / projects, West Virginia	approved	CY2024	UCS	same	ANCHOR	
\$107.5M / 4	dollars / projects, Maryland	approved	CY2024	UCS	same	ANCHOR	
\$14.5M / 8	dollars / projects, New Jersey	approved	CY2024	UCS	same	ANCHOR	
\$5B	dollars, 3-year total	approved	2022–2024	UCS	same	STRUCTURAL	150+ projects
6 of 130 (5%)	projects paid by the single customer	n/a	CY2024	UCS	same	ANCHOR	the 95% finding
\$5B	dollars, PJM regional transmission approval	approved	Dec 2023	PJM	Martin & Peskoe, Mar 2025	STRUCTURAL	~50% VA, ~10% MD
>50%	share of Dominion transmission costs in residential rates	n/a	Mar 2025	Martin & Peskoe	same	STRUCTURAL	
66%	avg. share of transmission costs to residential, 3 MD IOUs	n/a	Mar 2025	Martin & Peskoe	same	STRUCTURAL	
\$23M	dollars, VA transmission project for one data center	applied for	Jul 2024	VA SCC staff / utility	Martin & Peskoe	STRUCTURAL	“likely, if not certainly, would not be needed”

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
\$325M	dollars, Duke special-contract discount	contracted	pre-2025	internal Duke docs via litigation	Martin & Peskoe	STRUCTURAL	plan to “shift the cost of the discount”
\$58M–\$140M	dollars, Exelon’s estimated co-location cost shift	estimated	2024–25	Exelon	Martin & Peskoe	CONTESTED	Constellation calls it a “phantom ... ‘cost shift’ ”
~40 / ~50	PUC proceedings reviewed (special contracts / total)	n/a	Mar 2025	Martin & Peskoe	same	ANCHOR	the paper’s evidentiary base
\$1.5B	dollars, transmission revenue requirement sought	requested	Jul 2026	Dominion	VA SCC Rider T-1 case	VOLATILE	decision due 1 Aug 2026
\$2.90 → \$0.94	\$/month/household at 1,000 kWh	estimated	2026, revised 2026	Dominion	SCC docs 8c1p01, 8d7501	VOLATILE	3× revision inside one case
\$142.77 → \$255 → \$268	\$/month/household	projected	2024 / 2035 / 2045	Dominion long-term plan	Inside Climate News, 17 Jul 2026	CONTESTED	full-buildout scenario
\$14–\$37	\$/month/household constant dollars	projected to 2040	9 Dec 2024	JLARC	Report 598	CONTESTED	range stays a range
\$444	\$/year/household	projected to 2040	Dec 2024	JLARC via VCN	VCN agenda item	CONTESTED	= \$37 × 12; top of range only
\$9.1B	dollars, annual VA economic activity	actual	Dec 2024	JLARC	Report 598	STRUCTURAL	the industry’s real benefit
~\$18B	dollars, cost of powering unconstrained growth	projected	Dec 2024	JLARC	Report 598	CONTESTED	
3×	multiple, VA energy demand growth by 2040	projected, unconstrained	Dec 2024	JLARC	Report 598	CONTESTED	phantom-load caveat applies
~\$1B / 82%	dollars foregone, VA data center tax exemption FY2023 / share to top five firms	actual	FY2023	JLARC / Weldon Cooper	Governing, 26 Nov 2025	STRUCTURAL	~80% of all FY2024 incentive spending
\$28.92 → \$269.92 → \$329.17 → ~\$333 → \$325	\$/MW-day, PJM capacity clearing price	cleared	2024/25 → 2028/29	PJM	PJM releases	STRUCTURAL	last three at the cap

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
\$466.35 / \$444.26	\$/MW-day, BGE / Dominion zones	cleared	2025/26	PJM	PJM, 30 Jul 2024	STRUCTURAL	zonal separation
\$2.2B → \$16.4B	dollars, total auction cost	cleared	Dec 2022 auction → 2028/29	PJM	PJM / trade press	STRUCTURAL	
\$9.3B / 174%	dollars / % increase in capacity cost attributable to data centers	modelled counterfactual	2025/26 delivery yr	Monitoring Analytics	IMM Part G, 3 Jun 2025	CONTESTED	counterfactual, not measured
\$6.3B of \$16.4B (38%)	dollars / share	attributed	2028/29 auction	Joseph Bowring / Monitoring Analytics	email to Utility Dive, 20 Jul 2026	VOLATILE	IMM analysis pending
\$29.4B of \$63.6B (46%)	dollars / share, four auctions	attributed	as of 20 Jul 2026	Bowring	same	VOLATILE	
40% / 45% of \$47.2B	share of auction costs	attributed	Dec 2025 auction / 3 auctions	Monitoring Analytics	report, 5–7 Jan 2026	VOLATILE	
~12,000	MW added to expected summer peak	forecast (request/load blend)	Oct 2025	Bowring / Monitoring Analytics	E&E News, 3 Oct 2025	CONTESTED	“almost entirely” data centers; phantom-load caveat applies
32,000	MW peak load growth 2024–2030	forecast	2025 forecast	PJM	via E&E News	CONTESTED	phantom-load caveat
5,700 → >20,000	MW Dominion-Zone growth by 2037	forecast	2022 → 2025 forecasts	PJM	IEEFA	CONTESTED	the forecast that moved
6,516.6 / ~6,800	MW shortfall vs. reliability requirement	cleared result	2027/28 / 2028/29	PJM / Monitoring Analytics	PJM, IMM	STRUCTURAL	208.7 MW in 2026/27
138,318 + 10,864 = 149,182	MW UCAP procured + FRR	cleared	14 Jul 2026	PJM	PJM release	STRUCTURAL	
~525	MW new resources cleared	cleared	14 Jul 2026	PJM	trade press	STRUCTURAL	
\$554.72 / >\$775	\$/MW-day absent the cap, RTO / ComEd	counterfactual	Jul 2026	Reuters via PA Env. Digest		CONTESTED	
\$325 / \$175	\$/MW-day cap / floor	in force	2026/27–2029/30	PJM–Shapiro settlement; FERC	FERC approval Apr 2025, extension Apr 2026	STRUCTURAL	\$333/\$180 preliminary figure also filed (ER25-1357)

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
\$21B → \$45B	dollars, claimed avoided cost	claimed by the filer	Jan 2025 → Jul 2026	Office of Gov. Shapiro	PA press releases	CONTESTED	seller-supplied; \$8.3B, \$9.9B, \$13.3B, \$18.2B by tranche
25,000 kW / 1 MW	thresholds, Schedule DCT	in force	23 Jul 2025	AEP Ohio / PUCO	Schedule DCT	ANCHOR	
85% / 12 yrs / 50% / 36 mo	minimum demand / term / collateral / exit fee	in force	23 Jul 2025	AEP Ohio / PUCO	Schedule DCT	ANCHOR	opening ask was 90%/10 yrs; coalition proposed 75%
50/65/80/90%	ramp floors, years 1–4	in force	23 Jul 2025	AEP Ohio	Schedule DCT	ANCHOR	
\$10K/\$50K/\$100K	lead study fees by tier	in force	23 Jul 2025	AEP Ohio	Schedule DCT	ANCHOR	
50+ / >30,000	data centers in queue / MW	request, not load	2024–25 filings	AEP Ohio	via Ohio Capital Journal	CONTESTED	phantom-load caveat
28 months	AEP Ohio data center connection moratorium	actual	Mar 2023 onward	AEP Ohio	Buckeye Institute, Mar 2026	STRUCTURAL	
2,800 → 7,000	MW, I&M system peak with data centers	forecast	2024–25	Indiana Michigan Power	Martin & Peskoe	CONTESTED	
90% / 20 yrs / 150 MW	I&M tariff terms	proposed	2024–25	I&M	Martin & Peskoe	STRUCTURAL	
\$17B	dollars, I&M self-build estimate	estimated by the filer	2024–25	I&M	Martin & Peskoe	CONTESTED	
76 GW	data center capacity connectable with a few hours' curtailment	modelled	2024–25	Nicholas Institute	Martin & Peskoe	CONTESTED	
11 / 12 / 12 / 14	states with moratorium bills, by counter	varies by definition	Apr–Jul 2026	MultiState / Good Jobs First / DLA Piper / NCSL	multiple	VOLATILE	As-Of Stamp's home
300+ / 30+	data center bills / states, 2026	filed	2026 session	MultiState, DLA Piper		VOLATILE	267 bills / 40+ states in 2025
100+	local moratoria adopted	in force	Jul 2026	DLA Piper		VOLATILE	
\$64B	dollars of projects blocked or delayed	estimated	Jul 2026	DLA Piper		CONTESTED	estimate, source of method unstated
44–16 / 102–39	NY Senate / Assembly vote	passed	4 Jun 2026	NY Legislature		STRUCTURAL	20 MW threshold, one year

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
20–11	ME Senate override vote	failed	29 Apr 2026	ME Legislature		STRUCTURAL	LD 307, vetoed 24 Apr 2026
~70,000 of 413,488	OH ballot signatures gathered / required	failed	1 Jul 2026		datacenterbans.co	STRUCTURAL	
23 + 7 / 29 + 77	states with approved + pending large-load tariffs / tariffs approved 2025 + pending	in force / pending	May 2026 / Apr 2026	EEI / SEPA		VOLATILE	two different units — read carefully
75 / 100 / 25 / 20 MW	large-load thresholds: OK statute / NJ bill / CA bill & AEP OH / FERC proposal	varies	2025–26	various		STRUCTURAL	
4–3	Warrenton council vote	final	15 Feb 2023, ~2:30 a.m.	Warrenton Town Council	minutes, reporting	ANCHOR	
220,200 sq ft / 41.793 acres	building / parcel	applied for	2022–23	Amazon Data Services	SUP 2022-03	ANCHOR	GPIN 6984-69-2419-000
~\$550M	dollars, reported Amazon investment	announced, not spent	Feb 2023	reported	DCD	CONTESTED	
~500+ / ~130	attendees / speakers	actual	14 Feb 2023	PEC / multiple		STRUCTURAL	“all but three” opposed
3,142 / 3,100+ / 13	emails exchanged / withheld / Amazon-related withheld per town	actual	2022–2024	Town of Warrenton / CFFC		CONTESTED	the number itself is disputed
61.11% / 38.19%	vote share, Francis / Sutphin	final	5 Nov 2024	Fauquier County	FauquierNow	ANCHOR	only contested race
~44,000 / >75%	county voters / turnout	final	5 Nov 2024	Fauquier County	FauquierNow	STRUCTURAL	
\$281 vs ~\$100	dollars, one household’s monthly bill	billed	Jan 2026 vs Dec 2025	John Steinbach via Consumer Reports	CR, 20 Mar 2026	ANCHOR (single household)	human floor
42% / 94 / 74 / 73 / 58%	5-yr residential price increase, US / DC / MD / ME / NY	actual	to Mar 2026	EIA	via PolitiFact	STRUCTURAL	

Figure	Unit	Stage	As-of	Author / filer	Source	Tier	Notes
7% / ~40% / 6.1%	retail price rise 2025 / since 2021 / wholesale YoY	actual	May 2026	Fortune, EIA		STRUCTURAL	
30–50%	supply share of a residential bill	n/a	Jun 2026	Kenneth Gillingham (Yale)	PolitiFact	ANCHOR	kills the 267% laundering
~70%	potential VA rate increase over a decade absent investment	modelled	20 Nov 2024	SSRN 5017484		CONTESTED	
78% / ~75% / 63%	US adults concerned / VA voters blaming data centers / VA support for site assessments	survey	Nov 2025 / Jan 2026 / Jan 2026	Consumer Reports / GSG-CCAN / CNU Wason		VOLATILE	
\$5.50	\$/month residential reduction under VA SB 253	estimated, prospective	2026 session, effective 1 Jan 2027	Dominion, regulators, legislators	Virginia Mercury	VOLATILE	
\$9.2B	dollars, US utility rate-hike requests, Q2 2026	requested	14 Jul 2026	PowerLines	Utility Dive	VOLATILE	
130 GW	large-load pipeline, NextEra–Dominion combined	pipeline, not load	18 May 2026	the companies	Utility Dive	CONTESTED	phantom-load caveat
3.6M	homes and businesses served, Dominion regulated electric	actual	2024	Dominion	press release	STRUCTURAL	VA, NC, SC
67M / 13 states + DC	people served by PJM	actual	2026	PJM	releases	ANCHOR	denominator for §4.2
184,191 MW	PJM installed generating capacity	actual	31 Mar 2026	Monitoring Analytics	2026 SOM	STRUCTURAL	1,123 members, 21 control zones

6.1 RECONCILIATION AGAINST THE MUST-HIT ANCHORS

Syllabus 2.0 carries all figures at Syllabus 1.0 must-hit values with no variants, and those values govern until the Figures & Claims Ledger exists to arbitrate. Nothing below is a substitution. All are flags for Nick.

△ DISCREPANCY A — the 267% (the most consequential finding in this pack)

- **Anchor value (Syllabus 1.0, carried unchanged in 2.0):** “Residential bills near major hubs up as much as 267% in five years.” Also stated in the Moves plan as the lecture’s **Step Function**.
- **Researched value: 267% is the maximum five-year increase in a *monthly wholesale locational price at a grid node*, April 2020 → April 2025**, per Bloomberg News, 29 September 2025, using Grid Status nodal data and DC Byte facility locations across ~25,000 nodes in seven grids. It is not a residential bill figure.
- **Both sources, both dates:** Syllabus 1.0 (July 2026, franchise document) vs. Bloomberg (29 September 2025, primary) and PolitiFact (12 June 2026, adjudicating the exact substitution). Corroborating: Kenneth Gillingham, Yale, 9 June 2026 — supply is 30–50% of a residential bill.
- **How the error entered the wider record, which is itself course material:** Bloomberg’s headline was “*How AI Data Centers Are Sending Your Power Bill Soaring*.” Senator Warren’s office used the figure in **15 December 2025** letters to data center companies and in a **5 June 2026** post as a residential-bill claim; **CBS News (25 April 2026)** and **Fortune (20 May 2026)** made the same substitution; **PolitiFact rated it Mostly False (12 June 2026)** and WRAL concurred. The syllabus is in good company and the company is wrong.
- **Resolution options for Nick, presented without a recommendation the pack is entitled to make:** (i) **Re-label and keep.** Use 267% with its correct unit — wholesale nodal price — and let the laundering *become* the beat. This is arguably the strongest option, because the course’s central discipline is unit hygiene and here is a live specimen of a blurred unit travelling from a data vendor to a senator to a fact-check inside nine months. (ii) **Replace the Step Function** with the PJM capacity price series (\$28.92 → \$325/MW-day; \$2.2B → \$16.4B), which needs no caveat. (iii) **Keep the residential framing** using the verified residential series instead: **D.C. +94%, Maryland +74%, Maine +73%, New York +58%, U.S. +42%**, March 2021 → March 2026, EIA. Smaller numbers, correct units, still a step function against a decade of flat bills.
- **Cross-lecture consequence:** if 267% is re-labelled, the change must propagate anywhere else in the course the figure appears. Grep of the L1–L6 packs found **no prior use** — L6’s ledger explicitly reserves it for L7. **The fix is contained to this lecture.**

DISCREPANCY B — \$4.3B vs. \$4.4B

- **Anchor:** “\$4.3B / seven states / 2024 PJM.”
- **Researched:** UCS’s own Table 1 totals **\$4,356.3 million**. UCS’s own prose says “**more than \$4.3 billion**.” Utility Dive’s coverage (1 October 2025) rounds to “**about \$4.4 billion**.”
- **Finding: no discrepancy. The anchor matches the primary source.** Flagged only so the drafting AI does not “correct” the anchor upward from secondary coverage. **Use \$4.3 billion. Do not use \$4.4 billion.**

DISCREPANCY C — the moratorium tally

- **Anchor:** “11+ state moratorium bills.”
- **Researched:** 11 (MultiState, introduced 2026) / 12 (Good Jobs First, in-session filed, 16 Apr 2026) / 12 (DLA Piper, considered, Jul 2026) / 14 (NCSL, considered or considering, Jun 2026).
- **Finding: the anchor’s “+” does the work and the anchor survives.** But the anchor is now *understated in the most common framing* and *materially out of date in status*: New York has passed one and South Dakota has enacted a modified one. **Recommendation: deploy as the As-Of Stamp with the counter named** — which is what Syllabus 2.0 already assigns.

DISCREPANCY D — the Warrenton “sweep”

- **Anchor:** “Warrenton council sweep (Nov 5, 2024)” and the Kicker, “every member who voted yes at 2:30 in the morning is gone.”
- **Researched:** true as to composition; **only one of the four was defeated at the polls**. Heroux (Sept 2023), Hartman and Hamby (June 2024) all declined to seek re-election. Sutphin lost 61.11–38.19 in the town’s only contested race.
- **Finding: the anchor stands; the causal implication needs precision in prose.** §4.6 supplies the flat version.

DISCREPANCY E — the PJM price cap figure

- **Researched:** the Shapiro settlement is reported as **\$325/MW-day** (Utility Dive, 29 Jan 2025; PJM member notice; FERC extension April 2026) and as **\$333/MW-day** (PA Governor's office, 2026 releases; PJM's own footnote). PJM's footnote resolves it: "*Approximate cap/floor price of \$333/\$180 \$/MW-UCAP filed in ER25-1357 was based on preliminary Reference Resource Accredited Unforced Capacity (AUCAP) Factor.*" **Both numbers are correct at different stages of the same calculation.** Use \$325/MW-day for the cap in force, and note the \$333 figure only if the 2027/28 auction is discussed, where it cleared at ~\$333.44.

DISCREPANCY F — Shapiro's savings claims

- **Researched:** \$21B (Jan 2025, two years) → \$8.3B (July 2025 auction) → \$9.9B (Dec 2025 auction) → \$13.3B (2028/29) → cumulative \$18.2B → total claimed **\$45B over four years.**
- **Finding:** these are the seller's numbers, and the seller is a politician who sued and settled. Every one is a counterfactual against an unobserved uncapped auction. **Tier: CONTESTED. Attribute in prose every time: "by the Governor's office's own arithmetic."**

6.2 CAPACITY / ENERGY AUDIT

Every power figure in the spine above has been checked for rate-vs-quantity labelling.

- **Rates (capacity), correctly labelled:** MW and GW throughout — 12,000 MW of peak; 32,000 MW of growth; 25,000 kW thresholds; 138,318 MW UCAP; 184,191 MW installed; 76 GW connectable; 130 GW pipeline; 2,800→7,000 MW; 30,000 MW in queue.
- **Prices with a time dimension that look like energy and are not:** \$/MW-day is a *capacity price* — a payment for availability, not for energy delivered. It is the single most misread unit in this lecture's territory. **The drafting AI must never render \$325/MW-day as a price of electricity.**
- **Energy (quantities):** the only true energy unit in this pack is **kWh**, in the SCC's "typical household using 1,000 kWh." No TWh figures appear in L7's territory. (*If one is imported from L1 or L4, label it.*)
- **Blurs found in sources, and they are course material:** popular coverage of the Bloomberg analysis routinely renders a \$/MWh nodal price change as "electricity costs 267% more," which reads as a quantity claim about a household's consumption. The blur is the vector by which the figure became a residential-bill claim. **Flag it; it is the cleanest specimen of the course's cardinal rule failing in public.**

6.3 PHANTOM-LOAD AUDIT

Aggregate demand figures in this spine, each checked for duplicate-request inflation:

- **~12,000 MW added to expected summer peak (Bowring, Oct 2025) — phantom load possible.** Built from utility-reported large-load additions. Attach the caveat **on first use in the lecture.**
- **32,000 MW of PJM peak growth 2024–2030 — phantom load likely present.** PJM issued a revised forecast in January 2026 reflecting stricter vetting of potential large loads, which is a regulator conceding the point.
- **Dominion Zone 5,700 → >20,000 MW by 2037 — phantom load likely present,** and IEEFA says so: "strong reasons to believe that PJM's 20-year forecasts of data center growth are inflated."
- **AEP Ohio: 50+ data centers, >30,000 MW in queue — explicitly a request figure, not load,** and AEP's own witness testified the company has "limited ability to distinguish customers who are merely speculating." **This is the best in-lecture citation for the phantom-load discipline, because the seller documented the problem in its own case.**
- **NextEra–Dominion 130 GW "large-load pipeline" — pipeline is not load.** Announced 18 May 2026.
- **Figures that are NOT phantom-load-exposed and should be handled as solid:** \$4,356.3M (approved projects, counted individually), the PJM clearing prices and total auction costs (cleared results), the Warrenton vote shares, the Steinbach bill, Schedule DCT's terms.

SECTION 7: THE SELLERS & THE OVERCLAIMS

Overclaim Register contribution for Lecture 7, and the Steelman's ammunition depot. Syllabus 2.0 puts **the Utility** and **the Politician** on the field, with **GRANT-AND-WITHHOLD** on "data centers fund your schools" and **HOLD OPEN** on socialization vs. fencing.

7.1 THE UTILITY — the assigned lead seller

Claim as sold #1: "The deal isolates data center energy costs from other ratepayers' bills and won't increase consumers' power prices." Sold by: utilities generally, in special-contract filings, across the ~40 proceedings Martin & Peskoe reviewed. Venue: confidential PUC dockets. **What the seller gets:** approval, a de-risked capital program, rate-base growth, and no adversary in the room. **What's real:** utilities do face genuine stranded-cost risk, and several — AEP Ohio, Indiana Michigan Power — have proposed real protections at real cost to their customers. **What's oversold:** verifiability. Martin & Peskoe: "verifying this claim is all but impossible. Attributing utility costs to a specific consumer is an imprecise exercise premised on debatable claims about utility accounting records." **Narrator move: GRANT-AND-WITHHOLD.** ✓ fits the evidence.

Claim as sold #2: "Our ratemaking process is open and transparent." Sold by: a Dominion spokesperson to the Arkansas Advocate, March 2025. **What's real:** Virginia's rate cases and the Rider T-1 proceeding are genuinely public; the SCC's docket search carries the filings; staff testify adversarially against the company they regulate; the July 2026 hearing put Google, Amazon, Meta, Microsoft, Loudoun County, Appalachian Voices, the Attorney General's consumer counsel and the Governor's office in the same room. **What's oversold:** procedural openness is not cost transparency. The same SCC's staff attorney used the phrase "glaring cross-class subsidization" on that open record. **Narrator move: GRANT-AND-WITHHOLD.**

Claim as sold #3: the load forecast. Sold by: every utility in the footprint, in filings whose approval determines capital spend. **What the seller gets:** rate base. **What's real:** the load is arriving; PJM's 2028/29 auction cleared 6.8 GW short of its reserve-margin target with ~525 MW of new resources. **What's oversold:** precision and permanence. PJM revised its own forecast down in January 2026 after stricter vetting; AEP's own witness admitted it cannot distinguish speculators. **Narrator move: DISCOUNT** — output a range and its assumptions, never a bare number.

Where the record argues for a different calibration than assigned: on **claim #3**, Syllabus 2.0's two assigned moves (GRANT-AND-WITHHOLD, HOLD OPEN) do not cover forecast-handling, and this lecture's material is forecast-saturated. **Flag for markup:** either accept a third move (DISCOUNT) inside Beat 4, or route all forecast material through the Externality Swap's pricing rather than treating it as a claim to be adjudicated. The pack does not decide.

7.2 THE POLITICIAN — the assigned second seller

Claim as sold #1: "Data centers fund your schools." (*This is the assignment's named claim; the pack must supply the evidence on both sides.*)

- **What's real, precisely:** JLARC found the Virginia industry generates roughly **\$9.1 billion in annual economic activity**; localities with data centers do collect substantial local tax revenue; JLARC's report says so in terms. Loudoun County's fiscal machine is **L1's** material and is not rebuilt here.
- **What's oversold:** the state-level arithmetic runs the other way. The **data center sales-tax exemption cost Virginia nearly \$1 billion in FY2023**, with **82% flowing to the five largest companies**; in FY2024 the exemption was **nearly 80% of all economic-incentive spending** and more than half of it over ten years. JLARC concluded the exemption delivers "moderate economic benefits and return in revenue" and "does not pay for itself when considering just the state portion of the exemption cost."
- **The withheld half:** the revenue is real *and* it accrues to a county while the rate impact accrues to a class. Duquesne Light told the Pennsylvania PUC that data center revenues are allocated only to lowering the largest customer class's rates. **Revenue narrow, cost broad.**
- **Narrator move: GRANT-AND-WITHHOLD.** ✓ fits the evidence exactly as assigned.

Claim as sold #2: "I saved you \$45 billion." Sold by: the **Office of Governor Josh Shapiro**, in press releases dated January 2025, April 2025, July 2025, December 2025, January 2026, April 2026 and July 2026. **What the seller gets:** a signature energy-affordability accomplishment in a governor's term. **What's real:** the complaint was filed (December

2024), the settlement was reached (28 January 2025), FERC approved it (April 2025) and extended it (April 2026); the last three auctions cleared **at the cap**, which is direct evidence the cap bound; Reuters reports the 2028/29 auction would have cleared at **\$554.72/MW-day** RTO-wide and **>\$775** in ComEd absent the collar. **What's oversold:** every savings figure is a counterfactual against an auction that never happened, computed by the party claiming credit, and the numbers accumulate (\$8.3B + \$9.9B + \$13.3B → \$18.2B → \$45B) in a way that invites double-counting across delivery years. PJM's own position, stated in the 14 July 2026 release: the cap and floor “may reduce volatility” but “do not solve the underlying supply-demand imbalance.” **Narrator move: GRANT-AND-WITHHOLD**, with the counterfactual named out loud.

Claim as sold #3: “This election was a referendum on Amazon.” Sold by: **Roy Francis**, 13 November 2024 — a newly elected council member characterizing his own mandate. **What's real:** every candidate elected ran against data center construction; the council amended the zoning ordinance eight months later; the town later reversed its litigation posture. **What's oversold:** three of the four departures were voluntary and there was one contested race. **Narrator move: GRANT-AND-WITHHOLD.** (*Note for the drafting AI: this is the lecture's Kicker. The withholding must happen before the kicker lands, not inside it — a kicker that argues with itself is not a kicker.*)

Claim as sold #4: “Your bill went up 267%.” Sold by: **Senator Elizabeth Warren**, 15 December 2025 letters and a 5 June 2026 post. **What the seller gets:** the case for a tax on data center construction and a Senate investigation. **What's real:** data centers are demonstrably raising costs; Peskoe, no ally of the industry, told PolitiFact so on 9 June 2026. **What's oversold:** the unit. **Narrator move: DISPATCH on the unit, GRANT on the direction** — this is a myth about a number, and the fact that kills it is one sentence long: wholesale supply is 30–50% of a bill.

7.3 THE HYPERSCALER — on the field, though not assigned

Claim as sold: “We already pay our share; the rules just approved haven't had time to work.” Sold by **Will Cleveland for Google** and **Cameron Brooks for Amazon**, Virginia SCC, June–July 2026. **What's real, and it is genuinely real:** the GS-5 class was created in the 2025 rate case with cost-shift prevention as its premise; the 12CP shift is recently completed; both Amazon and Google are on record **supporting** voluntary contributions in aid of construction. **What's oversold:** SCC staff's attorney, on the same record, described a glaring cross-class subsidization to the benefit of the new GS-5 class — and noted that four companies signed a White House ratepayer-protection pledge in March 2026 and did not mention it in testimony. **Narrator move: HOLD OPEN**, with the pledge observation delivered flat.

The industry's siting-price testimony, which the pack must carry because it is the strongest evidence for the deterrence side of Beat 11. Martin & Peskoe's Appendix A catalogues it: Meta's affiliate (10 June 2024), the Data Center Coalition (24 May 2024), Amazon's Michael Fradette (15 October 2024, 8 November 2024), Google's Justin B. Farr (15 October 2024), QTS's Travis Wright (23 June 2023). **The QTS testimony is the most quantitative: roughly 40% of a data center's operational cost is electricity, it is usually the largest budget line, it continues for 40 years, and “the largest and fastest growing operations in our portfolio are in markets where electricity costs are competitive.”** These companies told regulators, under oath and repeatedly, that price determines siting. **That is simultaneously the best argument for fencing costs in (they can afford it and they're telling you it matters) and the best argument against (they will leave).**

7.4 THE DOOMER — audited to the same standard, per §5's symmetry rule

Doomer claim #1: “Data centers are why your bill went up.” **What's real:** in specific footprints, substantially. Monitoring Analytics: data center load growth is “the primary reason for recent and expected capacity market conditions.” UCS: \$4.3 billion of transmission in one year. **What's oversold:** the LBNL *Retail Electricity Price Trends and Drivers* (April 2026) identifies equipment costs, an aging grid and clean energy requirements as drivers of the same increases; Fortune's May 2026 analysis attributes much of the five-year rise to extreme weather. Data centers are a major driver in some places and one of several drivers everywhere. **What would settle it:** utility-specific cost-of-service studies with a separated large-load class — which is exactly the reform UCS recommends and which mostly does not exist yet.

Doomer claim #2: “The grid is collapsing.” **What's real:** PJM cleared **6.8 GW short** of its 20% installed reserve margin target on 14 July 2026, its second consecutive shortfall, with ~525 MW of new resources; the market monitor says supply “is not adequate ... and will not be adequate in the foreseeable future.” **What's oversold:** a reserve-margin shortfall is a planning-margin miss, not a blackout; PJM held a reserve margin of **14.7%** for 2028/29 and procured 149,182 MW

UCAP against a 67-million-person footprint. **What would settle it:** delivery-year performance, not auction results.

Doomer claim #3: “The forecasts are fake and it will all be stranded.” **What’s real:** IEEFA’s inflation argument; PJM’s own January 2026 downward vetting; AEP’s own inability to distinguish speculators; the 5,700→20,000 MW forecast swing. **What’s oversold:** the certainty. IEEFA itself concedes “in the short term, markets are responding as though these forecasts are going to materialize” — and the money is being spent on the forecast either way, which is the whole point of L10. **Narrator move: HOLD OPEN, and refuse the verdict.** The FRAMING move is L1’s and L10’s; L7 does not adjudicate the bubble.

7.5 THE STEELMAN FILE — defendant: Dominion Energy

The strongest case, in the defendant’s own numbers and constraints. A précis of the weak version is not a steelman.

(1) The legal position. Dominion is a regulated monopoly under a duty to serve. It cannot refuse a lawful customer. Every megawatt in the Dominion Zone forecast represents a request it is obliged to plan for. The alternative to planning is a reliability failure, and reliability failures land on households.

(2) The audited defense. JLARC’s independently commissioned study of utility cost recovery found data center customers **are currently paying the costs they cause.** That is a state legislative agency’s finding, not the company’s own.

(3) The reforms it already made, before being ordered to. The SCC’s final order in the **2025 rate case** approved large-load provisions including creation of the **GS-5 rate class** — a distinct class for large loads, with cost-shift prevention as its stated premise. Dominion has also **completed a shift to a 12 coincident peak allocation factor.** Google’s argument that it is “simply too early in the process” to know whether these suffice is a real argument, not a stalling tactic: a rate class that has not fully taken effect cannot yet be judged by its results.

(4) The methodological candor. Dominion’s own regulatory analyst, **Robert Miller**, conceded on the record on 15 July 2026 that the summer/winter peak-average method the consumer counsel prefers “is in the zone of reasonableness,” while explaining why 12CP fits Virginia and not North Carolina (smaller territory, no new high-load-factor customers). A witness who concedes the opponent’s method is reasonable is not obfuscating.

(5) The revised estimate. Dominion filed a **\$2.90/month** residential impact and then filed **\$0.94/month** on updated forecasting, publicly, in the same docket, before a decision. Revising downward against your own earlier filing is what a company does when the number moved, not when it is hiding.

(6) The physical facts it did not create. PJM expects the Dominion Zone to see the largest absolute increase in summer peak demand between 2026 and 2030. The zone’s 2037 forecast moved from ~5,700 MW of growth to more than 20,000 MW from data centers alone across three forecast cycles. Dominion did not write PJM’s forecast, does not set the capacity price, does not administer the auction, and does not control the RTEP cost-allocation formula that puts half of a regional project’s cost on Virginia utilities.

(7) The economics are real and audited. \$9.1 billion in annual Virginia economic activity, per JLARC. The world’s largest data center market, ahead of Beijing and London.

(8) It is attacked from both sides in the same room. Consumer advocates say it socializes too much. **Amazon’s own witness argued Dominion should share more risk rather than “imposing virtually all risks” on data centers while “reaping all of the profits for itself.”** A company being told simultaneously that it over-protects and under-protects the same customers is standing somewhere.

(9) The asymmetry of error costs. Over-build: stranded capital on thirty-year paper, borne by shareholders and ratepayers. Under-build: unserved load in a cold snap. A reliability mandate is *supposed* to weight the second more heavily, and the January 2026 PJM cold-snap record (L4’s material) is what that weighting is for.

(10) It is not the only actor in the chain and cannot fix the chain alone. The causation-visibility failure UCS identifies happens at PJM’s TEAC-to-RTEP boundary and inside FERC’s formula rates. A state-regulated utility could assign every dollar it controls and the regional allocation would still spread the rest.

THE CROSS-EXAMINATION (one paragraph, per beat discipline). SCC staff attorney **Andrew Major**, 14 July 2026: “there remains a glaring cross-class subsidization occurring to the benefit of new GS-5 customers.” Martin & Peskoe: more than half of Dominion’s transmission costs sit in residential rates; SCC staff found a **\$23 million** project that “likely, if not certainly, would not be needed at this time” but for a data center, recovered through the FERC tariff. Louise White, for the

Governor: upgrades that “would not have been triggered but for a large load customer should be assigned directly to that customer, shielding regular Virginia families from subsidizing commercial extension.” And the decision is due **1 August 2026** — which means that by the time this lecture is recorded, the steelman may have won or lost on the record. **\$11 flags it.**

SECTION 8: THE HUMAN FLOOR

STANDING FLAG: COMEDY OFF IN EVERY ZONE THIS SECTION COVERS. Documented individuals only. No composites. No invented color. Where a household's money is named, the prose is precise and tender and does not sermonize.

8.1 John Steinbach — Manassas, Virginia (*the Neighbor beat's pack-dependency resolution, with its caveat*)

Who he is, from the record: John Steinbach, a resident of Manassas, Virginia, who **has lived in his home for nearly forty years**. Utility territory: Dominion Energy Virginia. Manassas sits in the Prince William County corridor, adjacent to the Northern Virginia data center concentration.

The documented harm, in specifics and dates:

- **January 2026 electricity bill: \$281.**
- **Previous month (December 2025): roughly \$100.**
- **The delta: approximately \$181 in a single month, on a household budget he has managed in the same house since the late 1980s.**

His verbatim words, with full context. Both quotations are from Consumer Reports' investigation *AI Data Centers: Big Tech's Impact on Electric Bills, Water, and More*, published **20 March 2026**, in which Steinbach is the lead human example:

“It's just so far beyond any bill that I've ever had.”

“They're building them like it's ‘Field of Dreams’ — build it and the electricity will come — but we don't see how that's going to happen.”

(The second quotation is the more useful one and the harder to handle. It is a man in his seventies or eighties making a 1989 movie reference about grid planning, and it is not a joke — it is a description of a forecast. The thermostat stays down. Let the sentence do its own work.)

The other side's documented response, stated and not smoothed. The **Data Center Coalition's** Lucas Fykes, 5 February 2026: “It's inaccurate to draw a clear line between large load customers like data centers coming online and increases in prices. It's just not that simple.” **LBNL**, April 2026: equipment costs, an aging grid and clean energy requirements are also drivers. **Fortune**, 20 May 2026, quoting an analyst: “One of the big drivers of price increases over the last five years has been extreme weather events. That's nobody's fault necessarily, but nonetheless it's taking a toll on the grid and costing consumers.” **And the honest fact about January 2026 specifically: it was a severe cold month across the PJM footprint** (L4's pack documents the January 2026 cold snap, the 143.7 GW winter record and the \$3,000/MWh scarcity hours). **A January bill triple a December bill is substantially a weather event.** The pack states this plainly so the drafting AI does not build a causal claim the record will not carry: **Steinbach's bill is evidence of what a household experiences, not evidence of what data centers caused.** That distinction is the human floor's own discipline.

Procedural status: none. Steinbach is not a party to anything. He has no docket number. That is part of the point and should be left as a fact, not underlined.

The surround, dated:

- **Nearly three-quarters of Virginia voters** blame data centers for rising electricity costs — Global Strategy Group / Chesapeake Climate Action Network Action Fund survey, **January 2026**.
- **78% of 2,146 U.S. adults** are somewhat or very concerned that new data centers will raise their energy bills — Consumer Reports nationally representative survey, **November 2025**.

- **63% of Virginians** support site assessments evaluating water, grid, emissions and farming impacts — Christopher Newport University Wason Center, **January 2026**.
- **WAVY**, Hampton Roads, **21 February 2026**: Dominion customers receiving higher-than-usual bills; a customer's words in the headline — **"This is extreme."**
- **Prince George's County, Maryland, 24 February 2026**: a county leader pushes for an investigation into the utility bill surge and offers **assistance for seniors**. (*That last clause is the one to keep. The policy response to a bill spike, at the county level, is a program for old people who cannot pay.*)
- **Maryland Office of People's Counsel, Rising Fall Electricity Rates**, and the **District of Columbia Public Service Commission's** Standard Offer Service rate pages both identify data center load as one cause of rising bills.

△ **DEPENDENCY STATUS, STATED FLATLY**. Syllabus 2.0 Open Item 8 requires "a named fence-line ratepayer [to] surface from the hearing record." **Steinbach is a named ratepayer with a dated bill and verbatim words, from published reporting — which the Beat Menu's Neighbor constraints expressly permit — but he is not from a hearing record and is not documented at a fence line.** The pack **does not** promote him beyond what the record supports and **does not** invent a fence line for him. An honest partial beats a stretched identification. **Markup decides; §3 sets out the three options.**

8.2 McKenzie Miller — Fauquier County, Virginia (*the designated fallback, fully built*)

Who she is, from the record: McKenzie Miller, a **Fauquier County resident** whose home is **several miles south of Warrenton** — i.e., outside the town whose council was voting, and therefore outside the electorate that could remove them. She spoke at the public hearing on SUP 2022-03 in the auditorium of Fauquier High School on the evening of **14 February 2023**, among nearly 130 speakers.

The documented moment. She spoke **with tears in her eyes**, and again **fighting back tears** — the photograph is in FauquierNow's gallery of ten images from the meeting, captioned by reporter James Jarvis. **COMEDY OFF FOR THE ENTIRETY OF THIS MATERIAL.**

Her verbatim words, with full context. From FauquierNow's contemporaneous account, 15 February 2023:

"I think if Amazon wants to buy this place, they can build affordable housing."

"Why can't you guys spend this much time agonizing over affordable housing?"

What she was asking for, precisely. Not compensation, not a rate class, not a study. She was asking the council to spend on *housing* the deliberative attention it was spending on a 220,200-square-foot building — and the record shows the council had by then held the public hearing open from 10 January, tabled once for preconditions, and would sit until 2:30 in the morning. **The complaint is about the allocation of civic attention, and it is documented that the allocation she described was accurate.**

The other side's documented response. None directed at her. The council's stated reasons for approval are in the record and are about the ordinance: Hartman's "consistent with the Town of Warrenton [2040] Comprehensive Plan in spirit and intent."

Procedural status: the permit she opposed was granted at approximately 2:30 a.m. that night. The lawsuit challenging it was filed 17 March 2023 by Citizens for Fauquier County and ten individual plaintiffs; the town approved the site plan in April 2024; oral argument was heard **15 June 2026; no ruling as of 21 July 2026**. The building has not been built. Nothing in the record indicates whether Miller is among the ten individual plaintiffs; **do not assume she is**.

Why she is the fallback and not the primary: her documented harm is civic and land-use, not a bill. In a lecture whose register is Ledger-leads and whose subject is who pays, a Neighbor with no documented dollar figure works against the frame. She is, however, unimpeachably in the hearing record — which is exactly what the dependency asked for.

8.3 The other documented humans in the room (*Hearing Room corpus — comedy off around all of them*)

- **Peggy DiVincenzo**, Warrenton resident, photographed speaking at the 14 February 2023 hearing. No verbatim quotation surfaced in this research. **Flagged as a name without words — do not put words in her mouth.**
- **Hope Porter**, described in contemporaneous coverage as a “land-use legend,” who **received a standing ovation** after her speech at the public hearing. No verbatim quotation surfaced. **Flagged the same way.** (*The ovation is documented and usable; the speech is not.*)
- **Ike Broadus**, then a candidate for the Scott District seat on the Fauquier County Board of Supervisors, among the speakers.
- **Robert Duvall**, Fauquier County resident and actor, who **attended with his wife Luciana Pedraza and spoke against the project**, and who was photographed waiting his turn. **Handling note: he is a real, named public figure, and the course’s rules bar putting invented words in a real person’s mouth. The documented facts are that he attended, waited his turn among 130 speakers, and spoke in opposition. That is enough, and it is better than a quotation would be** — the image of an Academy Award winner taking a number at a county land-use hearing is the fact, and it is not a joke at anyone’s expense.
- **Kevin Ramundo**, president of Citizens for Fauquier County — verbatim at §2 Beat 9 and Beat 12. Also on the record at the **9 November 2022** council meeting.
- **Patricia Ewing**, member of the CFFC Board of Directors, who spoke to FauquierNow after oral argument on **15 June 2026** and said she felt good about how it went. (*A named human in the courthouse gallery, three and a half years in.*)

8.4 HEARING-TRANSCRIPT PULLS — what exists, where it lives, and what does not exist

The Warrenton corpus.

- **Citizens for Fauquier County** posted **eight unedited video segments** of the 14 February 2023 public hearing, released over roughly two months, at citizensforfauquier.org/warrentonwatch. **This is the closest thing to a transcript that exists and it is video, not text.**
- **The Town of Warrenton’s meeting record** for 14 February 2023 is posted through Municode and includes the agenda item text for SUP 2022-03 (quoted in full at §2 Beat 9), “23.02.14 Conditions of Approval Edit from 23.01.10.pdf,” “23.02.14 SUP 22-03 Conditions of Approval CLEAN.pdf,” and “IllustrativeBuildingElevations.2-14-23.”
- **The Warrenton Town Council Handbook** (v4, updated November 2023) lists the council roster and states the Dillon Rule position quoted at §2 Beat 12.
- **What does not exist in the public record:** a certified stenographic transcript. **All speaker quotations in this pack are drawn from contemporaneous newspaper reporting**, principally FauquierNow (James Jarvis, Robin Earl), the *Fauquier Times / Prince William Times* (Tate Hewitt, Coy Ferrell), and the *Rappahannock News*, plus the Washington Post (Teo Armus, 15 February 2023). **Flagged for markup: the Beat Menu’s “transcripts and minutes only” rule needs Nick’s reading before Draft 1.** The pack’s view: posted agendas plus unedited video plus same-week reporting satisfy the beat’s evidentiary purpose, which is that no words are invented.

The Virginia SCC corpus (Rider T-1, 14–15 July 2026) — the richer and more current hearing record, and the one the Ledger register actually wants:

- **Andrew Major**, SCC staff attorney: “*However, regardless of the cost allocation methodology that is chosen, there remains a glaring cross-class subsidization occurring to the benefit of new GS-5 customers.*” And: “*Curiously, none of those companies mentioned this pledge in either pre-filed testimony or opening statements today.*” And, on transition: staff “*recommends transitioning over a multi-year period in order to facilitate gradualism and cost responsibility.*”
- **Louise White**, Deputy Chief Energy Officer, Commonwealth of Virginia: “*Any network or substation upgrades that would not have been triggered but for a large load customer should be assigned directly to that customer, shielding regular Virginia families from subsidizing commercial extension.*”
- **Will Cleveland**, for Google: “*simply too early in the process*”; on the GS-5 provisions whose “*entire premise*” was cost shifting — “*Why is that not sufficient?*”; and calling voluntary CIAC a “*win-win.*”
- **Jonathan Zader**, senior assistant county attorney, Loudoun County: “*the stakes are particularly high.*”
- **Michael Goggin**, Grid Strategies, for Appalachian Voices: “*direct assignment only helps address part of the problem here. Dominion is still far too reliant on supplemental projects and needs to be directed to utilize the PJM regional*

competitive transmission planning process for the bulk of its transmission investment, so that we can reduce costs for all ratepayers.”

- **John Farmer**, section chief, insurance and utilities regulatory section, Office of Consumer Counsel, Virginia Attorney General’s Office: the office “generally supports direct assignment conceptually when it is possible to identify a cost causer,” and “believes that the situations in which we may be able to identify a specific cost causer are growing” — but “unlike allocating costs among the different classes, something this commission has done with regularity for many many years, there are uncertainties when it comes to the direct assignment of transmission costs that may warrant additional analysis.” And: “Consumer Council does not find [Dominion’s] counterarguments to testimony recommending the SWPA method, in particular, to be persuasive.”
- **Cameron Brooks**, for Amazon (filed 11 June 2026): CIAC “as a way to reduce ratepayer burden”; making “the customer’s financial responsibility for the identified facilities ... clear, enforceable, and integral to mitigating subsidization and stranded cost risks”; and the phrase Goggin attributes to him — “socialization of speculative investment.”
- **Robert Miller**, Dominion regulatory analyst: agrees with SELC’s **Nate Benforado** that SWPA “is in the zone of reasonableness.”
- All from the SCC hearing of 14–15 July 2026, reported by **Diana DiGangi**, Utility Dive, 15 July 2026, and by Virginia Mercury, 15 July 2026. Filings retrievable at scc.virginia.gov/docketsearch (documents 8c1p01, 8d7501, 8cq601 cited above).

The PUCO corpus (24-508-EL-ATA) — testimony quotations at §2 Beat 3, §2 Beat 11 and §5, all with witness, page and date, from Martin & Peskoe’s citation apparatus and PUCO’s docketing system.

8.5 Floor-zone map for the drafting AI

Zone	Location in the lecture	Thermostat
The bill line	Beat 1, opening minute	Near-zero from the first sentence. Absurdity may attach to the <i>docket</i> , never to the household
\$14–\$37/month, JLARC	Beats 6, 11	Near-zero. State the range; never collapse it; never make the range funny
\$2.90 → \$0.94	Beats 1, 7	Institutional absurdity permitted — this is a filer revising a filing
Miller’s testimony	Beat 9	Off entirely. The 2:30 a.m. clock and the 3,142 emails are fair game; the speakers are not
Steinbach	Beat 10	Off entirely
Prince George’s County senior assistance	Beat 10 surround	Off entirely
Sutphin’s concession quote	Beat 12	Near-zero. A defeated incumbent describing the job is not a punchline
Schedule DCT’s clauses	Beats 3, 11; §5	Full comedy license. Bureaucratic prose about attesting in writing that no money changed hands is the lecture’s designated relief
Moratorium tallies, ballot signature failures, a county that rescinded in 30 days	Beat 8	Full license. Institutions, not households

Floor-debt transfer check. Inherited: none — L6’s handoff walked a bill toward a mailbox as a *direction*, with zero recycled L7 specifics, exactly as its pack required. **Exported:** none. L8’s Memphis floor (KeShaun Pearson, Sarah Gladney) is its own and must not be seeded here. **This pack retires the course’s outstanding fence-line-ratepayer debt only partially and says so.**

SECTION 9: THE PEOPLE & THE CAST

9.1 THE HUMANS

Eliza Martin — Legal Fellow, Harvard Law School Environmental and Energy Law Program (*anchor, LEAD*)

As-of title at the dated moment: **Legal Fellow** in the Environmental and Energy Law Program at Harvard Law School, March 2025. Co-author of *Extracting Profits from the Public*. **What she and Peskoe wanted:** to make a class of transaction visible that is structurally designed not to be. **What they could enforce:** nothing. They have no docket, no vote and no rate authority; their instrument is a 40-page paper with 130 endnotes. **What they actually did:** read **nearly 50 regulatory proceedings**, including **40 state PUC special-contract proceedings**, and built an appendix (Appendix A) of Big Tech's own testimony that utility prices determine where it builds — turning the industry's siting argument into the evidentiary basis for regulating it. **Current status as of the research date:** the paper is being cited by UCS in policy briefs, by PolitiFact in fact-checks, by the Montana Free Press in state coverage, and was presented at a Harvard Energy Policy Seminar on 17 November 2025.

Ari Peskoe — Director, Electricity Law Initiative, Harvard Law School EELP (*anchor, LEAD, cast as a unit with Martin*)

As-of title, consistent across all dated moments in this lecture: **Director of the Electricity Law Initiative** at the Harvard Law School Environmental and Energy Law Program. Posted the paper publicly at **8:56 a.m. on 6 March 2025**. **Documented quotations, with venue and date:**

- To Utility Dive, 10 March 2025: *"In many states, it's impossible to calculate because of the lack of transparency, and even when there is some transparency ... you get into all these complicated cost allocation debates. You have the power of the utilities to set these agendas to control these rate setting processes, and they have massive incentives."*
- To the Arkansas Advocate, 6 March 2025: *"We're all paying for the energy costs of the world's wealthiest corporations."*
- To the Harvard Crimson, 1 April 2025: *"The basic principle has been that utilities and regulators — through what's called a rate case at a Public Utility Commission — socialize the cost of all the infrastructure that's needed to provide electricity... That means that as demand for electricity has grown over the past 100 years, in a sense, we've all contributed to ensuring that society has enough energy to meet all of our growing modern needs."*
- To Montana Free Press, May 2026: *"Utilities profit by building infrastructure: power plants and power lines. This new generation of data centers can consume as much energy as a large city, and generating and delivering that power requires a lot of new infrastructure."*
- To PolitiFact, 9 June 2026: *"Data centers are causing tens of billions of dollars of price increases in wholesale power markets and driving utilities to spend tens of billions of dollars on delivery infrastructure... In general, these cost increases are spread to all ratepayers by the utility."* **Narrative note the drafting AI can use without inventing anything:** the last quotation is Peskoe **defending the substance of a claim while the fact-checker rules against its arithmetic**. He is on record making the strong version of the argument in the same article that rates the popular version Mostly False. (*Author-crossover rule applies: the paper is the plot event, so its authors cross into the Human slot.*)

Roy Francis — Warrenton Town Council, Ward 1 (*anchor, LEAD*)

As-of titles: **candidate**, Ward 1, through 5 November 2024; **member-elect** from 5 November 2024; **council member** from January 2025. **Biography from the record:** a **retired federal government employee**; **president of the North Rock / Northrock Community Homeowners Association**; **finance chair for St. John the Evangelist Catholic Church**; described as a political newcomer. **The detail that does narrative work:** in **November 2022** — three months before the Amazon vote — he appeared before the Town Council to plead with it to deny **Harris Teeter's proposal for a gas station** in the North Rock Shopping Center. **His civic record begins with a gas station, not a data center**. **What he wanted:** transparency and open dialogue between council and public, the platform he ran on. **What he could enforce:** one vote of seven, plus a zoning ordinance. **What he did:** won 61.11–38.19 and, with four colleagues, signed a joint statement concluding no data center has any place in Warrenton; the council amended the zoning ordinance in July 2025. **Documented quotations:** the election-night verdict (§2 Beat 12); and, in a written statement to FauquierNow, that he was **"deeply humbled that the good folks of Ward 1 have voted for me to represent them on the Warrenton Town Council"** and, on the result, **"I was elated to hear that I had won the vote. Being new to the political game, I didn't know what to expect."** **Current status:** serving a four-year term.

Heather Sutphin — Warrenton Town Council, Ward 1 (*secondary; comedy off*)

As-of titles: **council member, Ward 1** from 2019 through the end of 2024; **defeated incumbent** thereafter. A **lifelong resident of Warrenton**; ran for council in 2019 after serving on the transit safety committee and volunteering for several town bodies. **She participated in the 14 February 2023 meeting by telephone** and, per a contemporaneous resident letter, referred to unnamed “silent majority” supporters. She voted for both the Amazon data center and the Village Center apartments and townhouses — i.e., she was a consistent pro-development vote, not a single-issue one. **Her documented campaign framing, October 2024:** *“The approach has been, ‘What can we do for these things right now? Or what do we want right now?’ And it’s always been feast or famine and putting fires out. Our roads are in horrible condition because they haven’t been dealt with... There are homeless in our community that need help. I’ve spent time going around knocking on doors and talking to younger people. What’s here for them? It’s sad. This town has turned its back on the future for too long.”* **Handling:** this is the strongest available evidence that the yes-votes were not captured but were making a growth-and-revenue argument. The nobody-wrong-on-their-own-terms discipline applies to her specifically.

The other three yes-votes

Brett A. Hamby (Ward 3), **James N. Hartman III** (Ward 4, then **Vice Mayor**), **Jay Heroux** (Ward 5). Hartman’s on-record reasoning is quoted at §2 Beat 9. Heroux declined re-election **September 2023**; Hartman and Hamby **June 2024**. Hartman gave his successor, Michele O’Halloran, **his book on zoning**. Mayor at the time: **Carter Nevill**.

The three no-votes

Paul W. Mooney (At Large), **David A. McGuire** (At Large), **William T. Semple II** (Ward 2). Mooney and McGuire were both new to the council in February 2023. McGuire’s two quotations (§2 Beat 9) are the sharpest material in the room. Semple was **re-elected 5 November 2024** and is quoted at §2 Beat 12 — the only person in the lecture who was in the room in 2023 and on the council in 2025.

The incoming class of 2024

Larry Kovalik (Ward 3) — also **chairperson of the Warrenton Board of Zoning Appeals** during the 2024 BZA fight, in which he said he would ask the board to vote on 2 July 2024 whether to hire its own lawyer, both for the citizens’ appeal and for the town’s lawsuit seeking to stop the board from hearing it. (*A man who chaired the body the town sued, then won a council seat.*) **Michele O’Halloran** (Ward 4) — quoted at §2 Beat 12. **Eric Gagnon** — re-elected 5 November 2024; **declined to comment** for the Fauquier Times’ post-election story. (*Documented silence; usable as such, and only as such.*)

Brandie Schaeffer — then Town Manager, Town of Warrenton (*secondary*)

As-of title at the operative moment: **Town Manager**, Warrenton, in **April 2021**, when she proposed the zoning change permitting data centers in industrial areas. **What the record establishes:** she exchanged **3,142 emails** with Amazon representatives; she left the town in **2022** and **went to work for Amazon shortly afterward**; a later account places her working on Amazon’s behalf in Prince William County. The emails became the subject of a FOIA suit filed **December 2022**, a February 2023 circuit court ruling for the town, a **30 July 2024** Court of Appeals reversal, and a 13 August 2024 council vote to appeal to the Virginia Supreme Court. **Handling note:** the documented facts are a sequence and a number. **Do not characterize her motives.** The sequence is sufficient and the course’s rule is incentives-and-constraints, never villainy.

Joseph Bowring — President, Monitoring Analytics, LLC (*secondary; PJM’s Independent Market Monitor*)

As-of title, consistent: **President of Monitoring Analytics**, the independent market monitor for PJM. Spoke at a **FERC conference on resource adequacy, 4 June 2025**. **Documented quotations:** the ~12,000 MW attribution — increases “were almost entirely due to existing and projected large data center load additions to the PJM grid” (E&E News, October 2025); the market monitor’s report language on data center load growth as “the primary reason” (January 2026); and, most recently, **“PJM is continuing to act like it’s business as usual”** (interview, 17 July 2026, published 20 July 2026), alongside the \$6.3B/\$16.4B and \$29.4B/\$63.6B figures supplied by email. **What he wants:** market integrity. **What he can enforce:** nothing directly — he reports and recommends. **Institutional note:** his office exists to be adversarial to PJM’s own positions, which is why his numbers carry unusual weight for a figure inside the tent.

Josh Shapiro — Governor of Pennsylvania (*secondary; the Politician on the field*)

As-of title, all dated moments: **Governor of Pennsylvania**. Filed a FERC complaint against PJM in **December 2024**; settled **28 January 2025**; FERC approved **April 2025**; extension approved **April 2026**. **Documented quotation, July 2026**: “PJM must move faster to bring new energy resources online, strengthen transparency and accountability, and ensure decisions are made in the best interest of the 67 million people who rely on this grid – not just PJM’s members.” Also, from a **letter to PJM interim CEO David Mills** in 2026: “It is essential that as you continue that work to ensure future reliability, you take this critical short-term step to preserve affordability by extending the price collar at current levels.” **What he gets if believed**: an affordability record. **What he could enforce**: a FERC complaint and a coalition — four governors, consumer advocates and the Organization of PJM States supported the cap.

Andrew Major, Louise White, Will Cleveland, Jonathan Zader, Michael Goggin, John Farmer, Cameron Brooks, Robert Miller, Nate Benforado

All as-of titles and verbatim at **\$8.4**. These nine are the Virginia hearing’s cast and are the best-documented single-day corpus in this lecture.

Mike Jacobs — Senior Manager, Energy, UCS Climate and Energy Program

Author of the September 2025 brief. **What he did that nobody else did**: counted 130 individual transmission projects out of PJM’s own TEAC and RTEP postings, state by state, and published the table.

Jenifer French — then Chair, Public Utilities Commission of Ohio

As-of title at 9 July 2025. Quotation at §2 Beat 3.

Matthew S. McKenzie, Kevin C. Higgins, Brendon J. Baatz, Michael Fradette, Justin B. Farr, Travis Wright, Lindsay A. Baker

The docket witnesses. All titles, filings, page numbers and dates at §2 Beats 3 and 11, §5, and §7.3.

Elizabeth Warren — U.S. Senator (D-MA)

As-of title: **United States Senator**. Letters to data center companies, **15 December 2025**; X post, **5 June 2026**; PolitiFact ruling, **12 June 2026**. Handled in §7.2 as a seller, with the direction of the overclaim named and the real part granted.

Named for completeness, with one line each

Mark Gribbin, JLARC chief legislative analyst (9 December 2024) · **Kenneth Gillingham**, Yale School of the Environment (9 June 2026) · **Terry Rephann**, regional economist, Weldon Cooper Center, UVA (November 2025) · **Lucas Fykes**, Data Center Coalition (5 February 2026) · **Kevin Ramundo** and **Patricia Ewing**, Citizens for Fauquier County · **Whitson Strother**, Town Attorney, Warrenton, from early 2026 · **Judge Stephen Sincavage**, Fauquier County Circuit Court · **David Mills**, President and CEO of PJM as of July 2026 (*this resolves the L4 pack’s open flag on PJM’s sitting chief executive: Mills appears as “interim CEO” in 2026 correspondence and as “President and CEO” in PJM’s 14 July 2026 release — use “PJM President and CEO David Mills” only for dated moments in July 2026 and later, and verify the interim-to-permanent date before any earlier present-tense use*) · **Abigail Spanberger**, Governor of Virginia as of 2026 · **Ghazala Hashmi**, Lieutenant Governor · **L. Louise Lucas**, Virginia State Senator (D-Portsmouth), SB 253 · **Glenn Youngkin**, then Governor of Virginia, who vetoed HB 1601 on 5 May 2025 · **Janet Mills**, Governor of Maine, who vetoed LD 307 on 24 April 2026 · **Gretchen Whitmer**, Governor of Michigan (“an automatic non-starter”) · **Kathy Hochul**, Governor of New York · **Liz Krueger** and **Anna Kelles**, New York bill sponsors · **Mark Christie**, then FERC Commissioner, whose December 2024 concurrence questioned the stranded-cost treatment · **Chris Wright**, U.S. Secretary of Energy, whose October 2025 §403 letter opened RM26-4 · **Corynne Arnett**, then EVP Regulatory Affairs and Customer Experience, Dominion.

9.2 THE INSTITUTIONS

Dominion Energy (*steelman defendant; lead treatment is L7’s*) — regulated electricity service to **3.6 million** homes and businesses across Virginia, North Carolina and South Carolina. Motive: recover \$1.5B of transmission investment and keep the growth; earnings are a function of approved capital spend. Exposure: an SCC decision due **1 August 2026**; a **NextEra merger** reported 18 May 2026 that would create the world’s largest regulated electric utility with a **130 GW large-load pipeline** and an 80%+ regulated mix. What it filed: the Rider T-1 application, two residential-impact estimates, the 2025

rate case that created GS-5, and a long-term plan carrying a residential bill to \$268 by 2045.

PJM Interconnection (*return; lead is L4*) — 13 states plus D.C., **67 million people, 184,191 MW** installed capacity, **1,123 members, 21 control zones** as of 31 March 2026. Motive: reliability under a mandate whose failures are national news. Exposure: two consecutive reserve-margin shortfalls; a market monitor publicly calling its posture business-as-usual; a governor who sued it and won a price cap; a FERC technical conference on its governance scheduled 23 July 2026. **New material this lecture adds that L4 does not own: the TEAC/RTEP causation-visibility gap and the capacity-charge attribution fight.** Do not rebuild the queue.

Monitoring Analytics, LLC — PJM's independent market monitor. Its institutional incentive is unusual and worth naming: it is paid to be adversarial to the market it monitors, which is why its numbers survive the seller audit better than most.

The Virginia SCC — three-commissioner body whose staff testifies as a separate party against the utility it regulates. **The Public Utilities Commission of Ohio** — five commissioners; adopted the utility-side stipulation over a hyperscaler coalition. **The Ohio Consumers' Counsel** — statutory residential advocate; framed the docket publicly. **The Data Center Coalition** — trade association for Amazon, Meta, Visa and others; intervened in 24-508 on 24 May 2024; its spokesman's February 2026 line is quoted at §8.1. **Citizens for Fauquier County** — nonprofit originally formed to oppose a development at the edge of town; counsel Whiteford, Taylor & Preston LLP; four separate legal fronts (FOIA suit, merits suit, BZA appeal, mandamus). **The Piedmont Environmental Council** — issued the 15 February 2023 statement and tracks the Dominion transmission routing at dominionenergy.com/blackwellroad. **The Union of Concerned Scientists** and the **Harvard Electricity Law Initiative** — the two analytical institutions whose documents are this lecture's spine; both have declared policy positions and both say so.

9.3 THE OBJECTS

This lecture is unusually poor in objects, which is a finding rather than a gap — **it is the paper lecture of the course.** What exists:

- **The residential bill.** Dominion's redesign of October–November 2024: reorganized layout, color graphs, QR code, explicitly no change to how bills are calculated. The line item is **Rider T-1**.
- **The parcel.** 41.793 acres, GPIN 6984-69-2419-000, at Blackwell Road and Lee Highway, behind Country Chevrolet near U.S. 29, Warrenton. Designated New Town Character District on the Future Land Use Map. **220,200 square feet** of proposed building, with SUP modifications requested for **building height, parking and fence height**. Undeveloped as of 21 July 2026. Amazon reportedly intended to invest around **\$550 million** (announced, not spent). Dominion proposed multiple transmission and distribution routes and new substations for the site, published at dominionenergy.com/blackwellroad, with SCC routing filings expected from 2023.
- **The auditorium.** Fauquier High School, used because the council chamber could not hold the crowd.
- **The tariff sheet.** Schedule DCT. Not an object in the Beat Menu's sense, but it is what this lecture cranes through the roof.

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

Restated cascade edge: Inherits: the socialized bill · **Binds at:** the rate case · **Who pays:** the lecture's whole subject — named, dated, dollared · **Manufactures:** the three-altitude collision → L8.

10.1 The inherited problem, re-established with fresh specifics

L6 ended by walking a bill toward a residential mailbox — **as a direction, not a data point**, with zero recycled L7 specifics, exactly as the L6 pack required. L7 must therefore re-establish the socialized bill from scratch for a sampler listener, using specifics **no earlier pack owns**:

Fresh specifics available to L7 alone: Rider T-1 as a named bill line · the \$2.90→\$0.94 revision · the UCS state-by-state table and the 6-of-130 finding · the TEAC/RTEP visibility gap · JLARC's \$14–\$37 range · the 66% Maryland residential transmission share · the Duke \$325M discount and the internal plan to “shift the cost of the discount” · Mississippi § 77-3-271(3) · the Kentucky PSC's guidelines and its crypto rejection · Schedule DCT's operative clauses in full · the Warrenton record entire · Steinbach's January 2026 bill · the 14–15 July 2026 SCC hearing corpus.

What the previous packs already own and L7 must not re-explain: the interconnection queue and the three studies (L4) · FERC Order 2023 (L4) · the transformer and equipment bottleneck (L4) · the July 10, 2024 event (L4) · the phantom-load lens's lead deployment (L4) · Dominion's slide-series exhibit and the ~70,000 MW requested figure (L1) · Loudoun's fiscal machine (L1) · co-location, TMI, the Susquehanna configuration (L5) · neocloud finance, depreciation, the \$311M interest expense (L6) · the rack, the roadmap, Huang (L2) · cooling, water, the Morrisises (L3).

10.2 The manufactured problem and the Handoff

Assigned mechanism: a question left hanging. The seam sentence's job is to establish that the fight the listener has just spent an hour inside is **one altitude of three**, and to leave the question of the other two unanswered.

The documented material that manufactures it, from inside L7's own territory and requiring no L8 specifics:

- The Warrenton council has **no ratemaking power** — the Dillon Rule, in its own handbook, makes it a “tenant at will” of the General Assembly. It fought a \$4.3-billion-a-year cost-allocation regime with a special use permit and an election.
- Meanwhile **FERC** proposed a 20 MW federal threshold in RM26-4 and issued six \$206 show-cause orders on 18 June 2026 — i.e., a third government arrived while the town was still in court.
- And a **federal moratorium bill has been introduced in the Senate**, passage uncertain, at the same moment that **11 to 14 states** are legislating in the opposite direction from each other and **more than 100 localities** have imposed their own pauses.
- **The question that hangs, in the pack's phrasing for markup:** the bill fight is one altitude. Warrenton fought it with the only instrument a town owns. What happens when a county's zoning, a state's tariff, and a federal industrial policy all land on the same cornfield in the same season — and none of them is wrong on its own terms?

Two or three alternates, if markup wants to rotate the mechanism:

- **(alt. 1 — a cost left unassigned):** the \$4.3 billion has a payer but no causer of record; the six of 130 that were assigned prove it can be done. Leave the other 124 hanging. (*Note: L5 and L9 both run “cost unassigned”; using it here would put two in close proximity.*)
- **(alt. 2 — a character walking):** Roy Francis, one vote of seven on a council with no rate authority, walking toward a fight three governments have already joined. (*Note: L3 ran “character walking.”*)
- **(alt. 3 — a door explicitly not opened):** the exit from the map — someone proposes leaving the ground entirely. **Do not use this one: it is L8's assigned mechanism and would collide directly.**

Refresh-safe check. The assigned Handoff hinges on a **structural fact** — that local, state and federal authority all claim the same ground — not on any figure. **It survives a 2027 re-cut of every number in this lecture.** ✓ The inbound seam from L6 is likewise structural (a socialized bill, not a dollar amount). ✓ **No cross-lecture dependency in this pack rests on a VOLATILE figure.** The two figures most likely to move — the moratorium tally and the SCC's Rider T-1 outcome — are both contained inside L7's own beats and neither is load-bearing for L8.

10.3 The boundary doors

Gesture deployments: zero (skip confirmed, §4.7).

- **The silicon door:** not touched. Nothing in this lecture's material requires knowing what a chip costs to fabricate.
- **The reactor door:** not touched. The only generation in this territory is a capacity auction — a market for availability, not a machine. Where generation appears (Georgia Power's CIR, NV Energy's Clean Transition Tariff, I&M's \$17B self-build estimate), it appears as a **cost-allocation instrument**, and the pack keeps it there. **L5 owns procurement.**
- **The training-run door:** not touched, and structurally irrelevant. A rate case is indifferent to what the load computes. (*This is worth noting as the cleanest evidence in the course that the boundary doors are real fences and not editorial squeamishness: an entire hour about the industry's money never once needs to know what the machines are doing.*)
- **The co-location door: pressure detected, fence held.** Martin & Peskoe's Part II.C is entirely about co-location, including Exelon's **\$58–140 million** cost-shift estimate and Constellation's “phantom ... ‘cost shift’” rebuttal, and the market monitor's warning that if all PJM nuclear plants attracted co-located customers “the impact on the PJM grid and markets would be extreme.” **L5 owns co-location.** L7 takes **one line at most**, framed as ratepayer protection, and does not open the configuration. **Flagged for the drafting AI: this is the one place in L7 where genuinely excellent material sits behind a fence.**
- **The jobs-math door: pressure detected, fence held.** JLARC Report 598 contains both the ratepayer findings

(L7's) and the employment findings (L8's). **L7 takes the \$9.1B economic-activity figure and the tax-exemption findings; it does not take the jobs multipliers (~1 job per \$13M; ~\$137,000 per job outside the sector; ~50 FTEs per 250,000 sq ft; ~half of subsidies with no job requirement).** Those are L8's and are named in its must-hit anchors.

- **The Memphis door:** not touched.
- **Unassigned-door pressure: none detected.** No material in this pack demands a door the course has not assigned.

10.4 Cross-lecture consistency ledger

L7 claims (later packs take brief-reference only): the Warrenton record entire (the hearing, the vote, the emails, the litigation, the election, the ordinance amendment); Martin & Peskoe and *Extracting Profits from the Public* entire; the UCS connection-costs brief and its table; Schedule DCT and the 24-508 docket entire; JLARC's **ratepayer** findings and the Virginia tax-exemption arithmetic; the Rider T-1 case and the 14–15 July 2026 hearing corpus; the moratorium wave as a state-level tally; the large-load tariff counter-wave; the Shapiro–PJM settlement and the capacity-price series **as a who-pays exhibit**; Bowring's attribution figures; Steinbach; the cost-causation doctrine's autopsy; Dominion's steelman entire.

L7 must not claim: the queue, the three studies, Order 2023, the transformer, the July 10 2024 event, PJM's queue anatomy (**L4**); Dominion's slide series, the ~70,000 MW requested exhibit, Loudoun's fiscal machine, Buddy Rizer (**L1**); the rack, Huang, the roadmap (**L2**); cooling, water, the Morrisises (**L3**); TMI, the PPA, co-location's full treatment (**L5**); CoreWeave, the S-1, depreciation, the \$311M moment, Intrator, GPU pricing (**L6**); Memphis, xAI, the turbines, Stargate, the jobs math, "Winning the Race," the AI Litigation Task Force, federal preemption (**L8**); orbital anything (**L9**); the Irreversibility Ledger, Burry, the 2001 rhyme, Loudoun's Moody's exposure (**L10**).

Verified line by line against the L1–L6 packs' own consistency ledgers. One collection recorded: L4, L5 and L6 each deferred the who-pays fight, the \$4.3B, the 267%, Warrenton, the tariff dockets, Martin & Peskoe, the capacity-auction cost fight and the fence-line ratepayer to L7 **in explicit seed lines. This pack collects all of those debts.** The Course Schema should log them as retired. **One debt is retired only partially and is flagged as such: the fence-line ratepayer (D1).**

Analogies and extended examples already claimed elsewhere, which L7 must avoid: the extension-cord image is L7's and is used **once**; "as much as a city" comparisons for facility scale are used by Martin & Peskoe and by L1 — **L7 should not run a city comparison**, since its single Unit Conversion is the \$4.3B (\$4.2); the "Field of Dreams" line belongs to Steinbach and is his, not the narrator's.

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

True as of 21 July 2026. This section is the edition-update model made operational.

11.1 Live status of every deal, docket and project in this lecture

Matter	Forum / number	Posture as of 21 July 2026	Next milestone
Dominion Rider T-1 cost allocation	Virginia SCC	Argued 14–15 July 2026 ; briefing closed; awaiting decision	Decision due 1 August 2026 — <i>eleven days after this pack's stamp</i>
Citizens for Fauquier County v. Town of Warrenton (merits)	Fauquier County Circuit Court, filed 17 Mar 2023	Oral argument heard 15 June 2026 before Judge Stephen Sincavage; under advisement, no date given ; town has reversed litigation alignment	Ruling, timing unknown
CFFC v. Warrenton (FOIA, 3,100+ emails)	Va. Court of Appeals → circuit court → Va. Supreme Court appeal authorized 13 Aug 2024	Remanded 30 July 2024; appeal authorized 4–3	Unresolved in this pack's research — re-verify
AEP Ohio Schedule DCT	PUCO 24-508-EL-ATA	Effective and operating since 23 July 2025; Feb 2026 update filed	Study tranche opened 2 Mar 2026; next studies expected October 2026

Matter	Forum / number	Posture as of 21 July 2026	Next milestone
OMA challenge to DCT billing	PUCO / Ohio courts	Filed 13 Nov 2025	Unresolved — re-verify
PJM capacity market	PJM / FERC	2028/29 BRA cleared at the \$325/MW-day cap , 14 July 2026, ~6.8 GW short	Next BRA December 2026 , also under the collar
PJM governance	FERC	Technical conference scheduled 23 July 2026	Two days after this stamp
Shapiro–PJM price collar	FERC ER25-1357 and extension	Extended April 2026 for two more auctions (\$325/\$175)	Expires after the 2029/30 auction
FERC large-load rulemaking	FERC RM26-4-000	Open; six §206 show-cause orders issued 18 June 2026; 20 MW threshold proposed and contested	RTO compliance filings through late 2026 (<i>L4 owns the queue side</i>)
New York moratorium	NY S10642/A11560	Passed 4 June 2026 (44–16 / 102–39); reported enacted mid-July 2026	Verify governor’s signature date and operative terms
Maine LD 307	Maine Legislature	Vetoed 24 Apr 2026; override failed 20–11 on 29 Apr; Data Center Advisory Council convened	Refile expected
Ohio ballot measure	Ohio SoS	Failed to qualify 1 July 2026 (~70,000 of 413,488)	Backers target 2027
Virginia SB 253 (Lucas)	Va. General Assembly	Enacted 2026 session	Effective 1 January 2027 ; ~\$5.50/month residential reduction estimated
Pennsylvania load-forecast law	PA General Assembly	Signed ~mid-July 2026	PA PUC to review and validate utility forecasts submitted to PJM
NextEra–Dominion merger	announced 18 May 2026	Reported; regulatory review not documented in this pack	Re-verify status before any present-tense description of Dominion’s corporate form
Warrenton zoning ordinance	Town of Warrenton	Amended July 2025 ; data centers removed from industrial districts	Two-year zoning ordinance update in progress
Amazon Blackwell Road site	—	Undeveloped. Permit valid but litigated; site plan approved April 2024	Contingent on the merits ruling

11.2 Pending events with dates

- **23 July 2026** — FERC technical conference on PJM governance (*announcing party: Office of Governor Shapiro*).
- **1 August 2026** — **Virginia SCC decision deadline, Rider T-1.** (*Announcing party: the Commission.*) **This is the single most consequential pending date for this lecture: the answer to “who pays for Dominion’s \$1.5 billion” is scheduled to exist eleven days after this pack was written and before this lecture is likely to be recorded.**
- **October 2026** — AEP Ohio expects to begin load studies for post-February applications (*announcing party: AEP Ohio*).
- **December 2026** — PJM’s next Base Residual Auction, under the extended collar (*announcing party: PJM*).
- **1 January 2027** — Virginia SB 253 takes effect (*announcing party: the General Assembly*).
- **Late 2026** — RTO compliance filings on FERC’s six §206 show-cause orders.
- **1 November 2029** — Oklahoma SB 1488’s proposed moratorium horizon, if enacted as filed.
- **2040** — JLARC’s projection horizon for the \$14–\$37 monthly range.
- **Undated but imminent:** Judge Sincavage’s ruling; Monitoring Analytics’ full analysis of the 2028/29 auction, which Bowring said on 17 July 2026 would publish “in a few weeks.”

11.3 The decay register — what the 2027 Briefing must re-research

FAST decay (re-research first; expect all of these to be wrong):

1. **The moratorium tally.** Moves every legislative session and every veto. Currently 11/12/12/14 by four counters. **Re-run all four counters and name the one used.**
2. **The large-load tariff counts** — 23 states approved + 7 pending (EEI, May 2026); 29 approved in 2025 + 77 pending across 36 states (SEPA, April 2026). **Note the two counts are measuring different things; keep them apart.**
3. **PJM capacity clearing prices and total auction cost.** New auction December 2026 and annually thereafter. The whole \$28.92 → \$325 series will need one more term.
4. **Bowring's attribution figures** — \$6.3B/\$16.4B and \$29.4B/\$63.6B are as of 20 July 2026 and update every auction.
5. **Shapiro's cumulative savings claim** (\$45B and climbing) — increments with each auction; check whether the collar was extended again.
6. **Dominion's \$0.94/month** — a live filing in a case decided 1 August 2026. **Likely superseded by the decision itself.**
7. **Utility rate-hike request totals** (\$9.2B in Q2 2026, PowerLines) — quarterly.
8. **The residential price series** (US +42%, DC +94%, MD +74%, ME +73%, NY +58%) — EIA, updates monthly.

MEDIUM decay (structural but moving):

9. **The Warrenton litigation.** A ruling in either direction rewrites Beat 12's ending and possibly the Kicker's meaning.
10. **The Rider T-1 outcome** — and with it, whether Dominion's steelman won or lost.
11. **Schedule DCT's fate under the OMA challenge and the Buckeye critique;** whether other states copy it.
12. **The forecast series** (32,000 MW; Dominion Zone 20,000 MW by 2037) — PJM revised downward once already in January 2026 and may again.
13. **FERC RM26-4** — the 20 MW threshold is contested and may move.
14. **NextEra-Dominion** — if consummated, "Dominion Energy" as this lecture describes it may not exist in the same corporate form.

SLOW / STRUCTURAL (safe to carry):

15. The cost-causation doctrine and its imprecision (Bonbright 1961; *Colorado Interstate* 1945).
16. The federal/state jurisdictional gap and the TEAC/RTEP visibility failure.
17. The 6-of-130 finding for calendar 2024 — a closed historical count.
18. The Warrenton vote of 15 February 2023 and the election of 5 November 2024 — closed historical facts.
19. Martin & Peskoe's argument and its evidentiary base.
20. Steinbach's January 2026 bill — a closed, dated fact about one household.

11.4 What just changed — the last ~90 days, which the syllabus stack predates

Everything in this subsection post-dates Syllabus 1.0, Syllabus 2.0, the Beat Menu, the Moves List and the Roster (all July 2026 documents built on earlier research), and any draft built on the anchors alone will be blindsided by it.

1. **The Virginia Rider T-1 hearing (14–15 July 2026) happened one week before this pack.** It supplies the lecture's single best hearing corpus, its sharpest verbatim ("glaring cross-class subsidization"; "shielding regular Virginia families from subsidizing commercial extension"), and a decision deadline inside the production window.
2. **The 2028/29 PJM auction cleared 14 July 2026** at the cap with a worsened 6.8 GW shortfall and ~525 MW of new resources.
3. **Bowring's \$6.3B/38% attribution landed 20 July 2026** — one day before the stamp.
4. **New York passed and reportedly enacted the first statewide moratorium** (4 June → mid-July 2026), which converts the As-Of Stamp's subject from "bills pending" to "one enacted."
5. **PolitiFact's 12 June 2026 ruling on the 267% figure** — which is what turns a must-hit anchor into Discrepancy A.
6. **Oral argument in Warrenton, 15 June 2026**, with the town switching sides — a development the Roster's Francis entry does not contain.
7. **Oklahoma's Act took effect 1 July 2026**, supplying the verified Verbatim substitute.
8. **The Ohio ballot measure failed on signatures, 1 July 2026.**
9. **Pennsylvania's load-forecast law**, mid-July 2026 — a state acquiring the power to audit the forecasts that drive the

auction.

10. **NextEra–Dominion, 18 May 2026** — a merger that would reshape the lecture’s steelman defendant.

11.5 What is still hidden

- **The special contracts themselves.** This is the central non-disclosure of the lecture. Martin & Peskoe: PUCs “reflexively grant” confidentiality; the Minnesota PUC excised significant portions of a proposed service agreement and staff analysis as “highly confidential trade secret” (Docket E-002/M-22-572); Texas PUC Docket 56903 issued a standard protective order “with no analysis”; Indiana URC Cause 45975, Wyoming PSC Docket 20003-238-EK-24, and Kentucky PSC Case 2022-00387 all granted confidential treatment, the last providing that the information “shall not be placed in the public record or made available for public inspection.” **The fight over the record is the record.**
- **Facility-specific load.** Utilities are “often reticent to disclose facility-specific details on grounds that a data center’s forecasted load is proprietary information” — which is the mechanism by which double-counting survives. In the Indiana proceeding, consumer advocates testified that **Google and Microsoft refused to answer data requests about anticipated load and consumption, and Microsoft refused to identify its forecasted load factor**; counsel offered to execute NDAs and received no proposed NDA and no confidential information. **Most figures in the Georgia Power filing at Ga. PSC Docket 56002 are redacted.**
- **The Warrenton emails.** 3,100+ withheld; the town says only 13 concern Amazon; the Court of Appeals found the sampling method improper; the appeal to the Virginia Supreme Court was authorized 13 August 2024 and its outcome is not established in this pack. **All council members were permitted to read them on 15 February 2023; the public has not.**
- **What UCS could not determine.** If any of the other 124 projects carried customer contributions “either through special contracts or line extension policies, that revenue has not been credited in the development of costs collected through transmission rates.” **The pack does not know whether some of the \$4.3 billion was privately funded and simply not recorded as such. Say so.**
- **The White House ratepayer pledge of March 2026.** Signed by Google, Amazon, Microsoft and Meta; its terms are not documented in this pack; SCC staff noted on 14 July 2026 that none of the four mentioned it in testimony. **Do not characterize its contents.**
- **Utilization data.** Nobody publishes what the built capacity is actually running at — the same disclosure gap the course flags at L6 and L10.

SECTION 12: SOURCE INVENTORY

Primary sources first within each cluster. Company and advocacy materials flagged with what the author gets if believed.

Regulatory dockets, filings and orders

[1] Public Utilities Commission of Ohio — *In the Matter of the Application of Ohio Power Company for New Tariffs Related to Data Centers*, **Case No. 24-508-EL-ATA** — filed May 2024; Opinion & Order 9 July 2025 — PUCO Docketing Information System — **PRIMARY**. The lecture’s Paper Trail. Contains the stipulations, all witness testimony, and the order. [2] AEP Ohio — **Schedule DCT** operative terms, compliance tariff and process rules — effective 23 July 2025; page updated with February 2026 filing and 7 Nov 2025 load study letter — aepohio.com — **COMPANY SOURCE**. *AEP gets: a de-risked capital program and the end of its own 28-month moratorium.* Uniquely provides the tariff’s verbatim clauses (ramp floors, collateral, minimum demand formula, exit fee, aggregation, BTM curtailment, 25% assignment). [3] PUCO — news release, *PUCO orders AEP Ohio to create data center specific tariff*, 9 July 2025 — **PRIMARY**. Chair French’s quotation; procedural history. [4] Virginia State Corporation Commission — **Dominion Rider T-1** proceeding, documents 8c1p01 (\$2.90 estimate), 8d7501 (\$0.94 estimate), 8cq601 (Brooks testimony, 11 June 2026) — scc.virginia.gov/docketsearch — **PRIMARY**. Decision due 1 August 2026. [5] Virginia SCC — **Dominion 2025 rate case final order** creating the **GS-5** rate class — **PRIMARY** (referenced in the July 2026 hearing record; obtain the order itself before Draft 1). [6] Pennsylvania PUC — **Docket M-2025-3054271**, *concerning interconnection and tariffs for large load customers*, opened March 2025, en banc hearing, model tariff directive — **PRIMARY**. Source of the caption phrase. [7] Duquesne Light — Comments before the PA PUC En Banc Hearing, Docket M-2025-3054271, statement of **Lindsay A. Baker** — puc.pa.gov/pcdocs/1882372.pdf — **PRIMARY / COMPANY SOURCE**. The revenue-narrow/cost-broad admission. [8] FERC — **Docket RM26-4-000**, large-load interconnection ANOPR, opened at DOE §403 direction 23 Oct

2025; 20 MW threshold; six FPA §206 show-cause orders, 18 June 2026 — **PRIMARY**. (*L4 owns the queue treatment*.) [9] FERC — **FA19-1-000**, FirstEnergy audit report, 4 February 2022 — **PRIMARY**. The “obfuscated or circumvented” finding. [10] FERC — 2024 Report on Enforcement, **AD07-13-018**, 21 November 2024 — **PRIMARY**. [11] FERC — approval of the PJM-Shapiro settlement, April 2025; extension approval, April 2026; **ER25-1357** (cap/floor filing) — **PRIMARY**. Resolves the \$325 vs. \$333 discrepancy. [12] Illinois Commerce Commission — ComEd, **Docket 25-0679**, large demand project applicants — **PRIMARY**. [13] Indiana URC — **Cause 46097** (Indiana Michigan Power tariff modifications, 90% / 20 years / 150 MW; \$17B self-build estimate); **Cause 45975** (Duke Energy Indiana special contract, confidential treatment) — **PRIMARY**. [14] Minnesota PUC — **Docket E-002/M-22-572** (Xcel data center contracts; order excising portions as “highly confidential trade secret”) — **PRIMARY**. The sealing exhibit. [15] Kentucky PSC — **Case 2022-00387** (Kentucky Power / Ebon International special contract, confidentiality order 4 Dec 2024); the PSC’s special-contract guidelines and its crypto rejection — **PRIMARY**. [16] Texas PUC — **Docket 56903** (El Paso Electric EDR rider, protective order “with no analysis”); Colorado PUC **23A-0330E** (QTS/Public Service EDR contract, Travis Wright testimony); Nevada PUC **19-12017** (Google/Lumen ESA); Wyoming PSC **20003-238-EK-24**; PUCO **23-0891-EL-AEC** (New Albany Data Center reasonable arrangement) — **PRIMARY**. The special-contract corpus. [17] Warrenton Town Council — **SUP 2022-03** agenda item, conditions of approval, and illustrative elevations, regular meeting **14 February 2023** — meetings.municode.com — **PRIMARY**. The docket item’s own language, GPIN, acreage and square footage. [18] Town of Warrenton — **Town Council Handbook**, v4, updated November 2023 — warrentonva.gov — **PRIMARY**. Roster and the Dillon Rule “tenants at will” statement. [19] *Citizens for Fauquier County and 10 individual plaintiffs v. Town of Warrenton* — Fauquier County Circuit Court, filed 17 March 2023; Amazon Data Services joined April 2023; oral argument 15 June 2026 before Judge Stephen Sincavage — **PRIMARY**. [20] Virginia Court of Appeals — *Citizens for Fauquier County v. Town of Warrenton* (VFOIA), reversal of 30 July 2024 — **PRIMARY**. [21] Oklahoma Corporation Commission — **Data Center Customer Ratepayer Protection Act of 2026, 17 O.S. §§ 900–906**, effective 1 July 2026 — oklahoma.gov/occ — **PRIMARY**. The verified “Large load customer” definition. [22] New Jersey **S731**, 2026–2027 session — legiscan.com — **PRIMARY**. The “Large load data center” definition. [23] Statutes cited in Martin & Peskoe: **Miss. Code Ann. § 77-3-271(3)**; **Kan. Stat. Ann. § 66-101i**; Minn. Stat. § 216B.162 subd.7; Colo. Rev. Stat. § 40-3-104.3; Mich. Comp. Laws § 460.6a(3) — **PRIMARY**. [24] **Maryland Next Generation Energy Act**, H.B. 1035, Ch. 626 (2025); **Oregon POWER Act**, H.B. 3546, Ch. 323 (2025); Minnesota HF 16 (2025); Utah SB 132 (2025); Missouri SB 4 (2025); Texas SB 6 (2025); Kansas SB 98 (2025); Virginia HB 2084 (2025); Virginia **SB 253** (2026) — **PRIMARY**. [25] **New York S10642/A11560** (formerly S9144/A10141), passed 4 June 2026; **Maine LD 307**, vetoed 24 April 2026; Oklahoma SB 1488; Minnesota SF 4298; New Hampshire HB 1265; Maryland HB 120; Vermont S.205; Michigan HB 5594–5596 / SB 1018–1020 and HR 240; California SB 886 — **PRIMARY**. [26] PJM — **Operating Agreement, Schedule 6 §1.3** (TEAC disclosure duty); the annual **Regional Transmission Expansion Plan** — **PRIMARY**. The causation-visibility document. [27] Case law: *Colorado Interstate Gas Co. v. FPC*, 324 U.S. 581 (1945); *Alabama Elec. Coop. v. FERC*, 684 F.2d 20 (D.C. Cir. 1982); *Appalachian Power Co. v. FERC*, 191 FERC ¶ 61,238 (2025) — **PRIMARY**.

Government and quasi-government analysis

[28] **JLARC — Data Centers in Virginia, Report 598**, delivered 9 December 2024, with commission briefing slides (Rpt598Pres-1.pdf) — jlarc.virginia.gov — **PRIMARY**. The \$14–\$37 range, the \$9.1B, the \$18B, the unconstrained-demand scenarios, the “largely incompatible with residential use” finding, and the tax-exemption options. **The single most important government document in this lecture**. [29] JLARC / Weldon Cooper Center (UVA) — economic incentives reporting on the data center sales-tax exemption (~\$1B FY2023; 82% to five firms; ~80% of FY2024 incentive spending) — **PRIMARY**. [30] **PJM Interconnection** — capacity auction news releases: 2025/26 (30 July 2024), 2026/27 (22 July 2025), 2027/28 (17 December 2025), **2028/29 (14 July 2026)**; *The Capacity Auction Is Coming* (June 2026); PJM Inside Lines — **PRIMARY** / **INSTITUTIONAL SOURCE**. *PJM gets: a reliability narrative that justifies its market design*. [31] **Monitoring Analytics, LLC** — *Analysis of the 2025/2026 RPM Base Residual Auction, Part G (Revised)*, 3 June 2025; report on the 2027/28 auction, January 2026; **2025 State of the Market Report for PJM; 2026 Q1 State of the Market Report** — monitoringanalytics.com — **PRIMARY**. *The IMM’s institutional incentive is adversarial to PJM, which is why its numbers survive the seller audit*. [32] **U.S. Energy Information Administration** — Electric Power Monthly, average price of electricity to ultimate customers by sector; Electricity Data Browser (accessed 10 June 2026) — **PRIMARY**. [33] **Lawrence Berkeley National Laboratory** — *Retail Electricity Price Trends and Drivers*, 2026 edition, April 2026 — eta-publications.lbl.gov — **PRIMARY**. The mandatory counterweight to single-cause attribution. [34] Maryland Office of People’s Counsel — *Rising Fall Electricity Rates*; District of Columbia Public Service Commission — Standard Offer Service rate pages — **PRIMARY**. [35] Office of Governor Josh Shapiro (Pennsylvania) — press releases of January 2025,

April 2025, July 2025, December 2025, January 2026, April 2026 and July 2026 — pa.gov — **POLITICAL SOURCE**. *The Governor gets: an affordability record. Every savings figure is a counterfactual computed by the claimant.* [36] Nicholas Institute for Energy, Environment & Sustainability (Duke) — study estimating 76 GW connectable with limited curtailment — **PRIMARY (academic)**.

The two analytical spines

[37] Eliza Martin and Ari Peskoe — *Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power*, Harvard Law School Environmental and Energy Law Program, March 2025, with Appendix A (Big Tech's own siting-price testimony) and 130 endnotes — eelp.law.harvard.edu — **PRIMARY-ADJACENT (advocacy scholarship, and it says so)**. *The authors get: a policy agenda of five recommendations. Their evidentiary base is ~50 proceedings, cited individually. The lecture's intellectual spine.* [38] Martin & Peskoe — *How you subsidize Big Tech with your electricity bill*, Salata Institute, 7 April 2025 — the plain-language companion. [39] Union of Concerned Scientists (Mike Jacobs) — *Connection Costs Loophole Costs Customers Over \$4 Billion to Connect Data Centers to Power Grid*, September 2025, with the state-by-state appendix — ucs.org — **PRIMARY-ADJACENT (advocacy analysis synthesizing PJM's own TEAC/RTEP postings)**. *UCS gets: four regulatory recommendations. Source of the \$4.3B anchor and the 6-of-130 finding.* [40] Aneil Kovvali & Joshua C. Macey, *Hidden Value Transfers in Public Utilities*, 171 U. Penn. L. Rev. 2129 (2023) — **PRIMARY (academic)**. [41] James C. Bonbright, *Principles of Public Utility Rates* (1961), at 338 — **PRIMARY**. The “notorious disagreements” line. [42] Jim Lazar, Paul Chernick, William Marcus, Mark LeBel (eds.), *Electric Cost Allocation for a New Era: A Manual*, Regulatory Assistance Project, 2020 — **PRIMARY (technical)**. [43] *The Impact of Data Centers on Energy Demand and Market Prices*, SSRN abstract 5017484, 20 November 2024 — the ~70% Virginia projection. [44] IEEFA — *Projected data center growth spurs PJM capacity prices by factor of 10*; and its May transmission-subsidy report — **ADVOCACY ANALYSIS**. *IEEFA gets: a case against gas and transmission buildout. Source of the Dominion Zone forecast-swing figures and the “inflated forecasts / markets responding anyway” formulation.* [45] Grid Strategies — Wilson, Zimmerman & Gramlich, *Strategic Industries Surging: Driving US Power Demand*, December 2024 — **PRIMARY-ADJACENT**. (*L4 owns Wilson; L7 cites the 65 GW figure only in passing.*) [46] The Buckeye Institute — *Undermining Ohio's Competitive Edge*, 16 March 2026 — buckeyeinstitute.org — **ADVOCACY**. *Buckeye gets: a deregulatory policy win. The best-argued opposition case to Schedule DCT on the record; required for Beat 11's Side A pricing.* [47] RMI — *Tariffs For Large Load Customers*, Electricity Affordability Toolkit (updated November 2025); *New Ways to Power Data Centers and Other Large Energy Users*, 29 April 2026 — **ADVOCACY ANALYSIS**. [48] Edison Electric Institute — *List of Large Customer Projects and Tariffs*, June 2026 — **INDUSTRY SOURCE**. *EEI gets: a demonstration that the industry is self-correcting. The 23-states-approved figure.* [49] Smart Electric Power Alliance — large-load tariff database (29 approved 2025; 77 pending across 36 states) — **INDUSTRY SOURCE**. [50] Sierra Club — *Data Center State Policies*, 2026, January 2026; Virginia Conservation Network — *Addressing Data Center Energy Demand*; Climate XChange — *State Policy Toolkits for Data Center Regulation*, 2026 — **ADVOCACY**. [51] Columbia Law School Sabin Center — *Data Center Regulation: What Local Governments Should Know about Large-Load Tariffs and Clean Transition Tariffs*, Climate Law Blog, 2 June 2026 — **ACADEMIC**. The “not a single city participated” finding. [52] Good Jobs First — *Data Center Moratorium Bills Are Spreading in 2026*, 16 April 2026 — **ADVOCACY**. (*Good Jobs First's institutional subject is subsidy accountability.*) [53] Rockefeller Institute of Government — *Updates on the Cloud: More Moratoriums on Data Centers*, June 2026 — **ACADEMIC**. [54] MultiState — *State Data Center Policy 101: 2026 Legislative Guide* (updated July 2026); *State Data Center Legislation in 2026 Tackles Energy and Tax Issues*, 20 February 2026 — **INDUSTRY-FACING TRACKER**. [55] National Conference of State Legislatures — moratorium tracking, via Route Fifty, 10 June 2026 — **PRIMARY-ADJACENT**. [56] DLA Piper — *New York State Legislature passes first-in-the-nation data center moratorium*, July 2026; ArentFox Schiff — *State Regulation of Data Centers in 2026*, 13 April 2026; Kohrman Jackson Krantz — *Regulating the Surge: Legal Analysis of AEP Ohio's New Data Center Tariff*, 14 November 2025 — **LAW-FIRM ANALYSIS**. *These firms get: client development. Useful for procedural history; verify every figure against the docket.* [57] datacenterbans.com — state-level tracking (updated July 2026) — **AGGREGATOR**. **Verify individually.**

Journalism — where the reporting is the primary record

[58] Bloomberg News — *How AI Data Centers Are Sending Your Power Bill Soaring*, 29 September 2025 (data: Grid Status; facility locations: DC Byte; ~25,000 nodes, seven grids) — **PRIMARY DATA JOURNALISM**. The 267% source. **Read the unit before quoting.** [59] PolitiFact (Caleb McCullough) — *How much have data centers increased electricity prices?*, 12 June 2026; WRAL fact-check, 15–16 June 2026 — **PRIMARY-ADJACENT**. The adjudication of Discrepancy A, plus the Gillingham and Peskoe interviews and the EIA state series. [60] Consumer Reports — *AI Data*

Centers: Big Tech's Impact on Electric Bills, Water, and More, 20 March 2026 — PRIMARY for John Steinbach's quotations and bill figures, plus the November 2025 survey of 2,146 adults. [61] **Utility Dive** — Diana DiGangi, *Virginia SCC weighs Dominion data center transmission cost allocation*, 15 July 2026 (**the lecture's best hearing corpus**); Ethan Howland, *Data centers drove \$6.3B in PJM capacity auction costs: market monitor*, 20 July 2026; *PJM capacity prices hit price cap, reserve shortfall grows*, 15 July 2026; *Customers in 7 PJM states paid \$4.4B for data center transmission in 2024: report*, 1 October 2025; *Utilities may subsidize data center growth by shifting costs to other ratepayers: Harvard Law paper*, 10 March 2025; *PJM agrees to lower price cap for upcoming capacity auctions*, 29 January 2025; *Combined NextEra-Dominion would have 130-GW large-load pipeline*, 18 May 2026 — **TRADE JOURNALISM, reporter-attributed**. [62] **FauquierNow** (James Jarvis, Tate Hewitt) — the 15 February 2023 vote story and ten-image gallery (**McKenzie Miller's quotations and the tears**); *Election Q&A: Roy Francis challenges incumbent Heather Sutphin*, 25 October 2024; **UPDATE: Francis wins Ward 1**, 7 November 2024 (**61.11% / 38.19%; Francis's written statement**); *Judge hears arguments in lawsuit seeking to halt Amazon data center*, 16 June 2026 (**Strother, Sincavage, Ewing**) — **PRIMARY LOCAL RECORD**. [63] **Fauquier Times / Prince William Times** (Tate Hewitt, Robin Earl, Coy Ferrell) — *Town Council election results a 'referendum on Amazon'*, 13 November 2024 (**the Kicker's source; Sutphin, Semple, O'Halloran, Ramundo**); *Warrenton Town Council approves controversial Amazon data center*, 15–17 February 2023 (**the 4–3 by name and ward, the ~2:30 a.m. hour, McGuire's quotations**); *Town Council to take on data centers in 2025 (the five-member joint statement)*; *Citizens group, Town of Warrenton head to court over Amazon data center — again*, August 2024 (**Kovalik and the BZA**) — **PRIMARY LOCAL RECORD**. [64] **Rappahannock News** — *Warrenton approves Amazon data center*, 16 February 2023 (**Hartman's quotation; the unanimous 3,142-email vote; Schaeffer**); *Judge hears arguments*, 16 June 2026 — **PRIMARY LOCAL RECORD**. [65] **Washington Post** (Teo Armus) — *Warrenton Town Council approves Amazon data center special use permit*, 15 February 2023 — with Bonnie Jo Mount's 10 February 2023 photograph of residents' opposition signs. [66] **Piedmont Environmental Council** — *Warrenton transmission line page*, pecva.org (**500+ attendees; ~130 speakers; "all but three"; the Dominion routing at dominionenergy.com/blackwellroad**) — **ADVOCACY. PEC gets: a conservation outcome**. [67] **Citizens for Fauquier County** — *citizensforfauquier.org/warrentonwatch*, **eight unedited video segments of the 14 February 2023 hearing — PRIMARY (video). CFFC gets: the permit overturned**. [68] **E&E News by POLITICO** — *Data center boom sparks sticker shock for PJM ratepayers*, 3 October 2025 — **the ~12,000 MW attribution and Bowring's "almost entirely" quotation**. [69] **Virginia Mercury** (Shannon Heckt and others) — *Legislative report: Development of data centers could triple energy demands if unconstrained*, 9 December 2024; *SCC considers making data centers shoulder more of the cost of transmission lines*, 15 July 2026 (**Boehnlein, White, Rider T-1, \$1.5B, \$2.90**); SB 253 coverage — **PRIMARY-ADJACENT STATE JOURNALISM**. [70] **Ohio Capital Journal** — *Ohio Manufacturers' Association challenges new utility billing for data centers*, 13 November 2025 (**50+ data centers, >30,000 MW, the 85%/12-year/3-year-exit terms**). [71] **POWER Magazine** — *Regulator Approves AEP Ohio's Landmark Data Center Tariff*, 10 July 2025; *Power Engineering — AEP Ohio reaches potential settlement*, 17 December 2024 (**the 90%/10-year original ask and the competing 75% coalition proposal**). [72] **Stateline** — *With electricity bills rising, some states consider new data center laws*, 5 February 2026 (**Fykes's quotation**); *Route Fifty — Data center moratoriums gain ground in states and cities*, 10 June 2026. [73] **Fortune** — *Electricity prices are up 40% since 2021, but data centers shouldn't get all the blame*, 20 May 2026; **CBS News** — *How the AI-driven data center boom is leading to skyrocketing energy bills*, 25 April 2026 — **flagged: both made the wholesale/residential substitution**. [74] **Harvard Crimson** — *Utilities May Charge Public to Offer Discounts for Big Tech, HLS Report Finds*, 1 April 2025; **Arkansas Advocate** — *Power for data centers could come at 'staggering' cost to consumers*, 6 March 2025 (**Peskoe's "world's wealthiest corporations" line; Dominion's "open and transparent" response**); **Montana Free Press** — *What happens to utility bills when data centers come to town?*, 11 May 2026. [75] **WAVY** — *'This is extreme,' Customers receive higher than usual Dominion Energy bills*, 21 February 2026; **DC News Now** — *Prince George's County leader pushes for investigation into utility bill surge*, 24 February 2026 — **human-floor sources; comedy off**. [76] **Governing** — *Virginia's Data Center Tax Breaks Cost the State \$1 Billion*, 26 November 2025 (**Rephann; the FY2024 80% figure**); **Inside Climate News** — *After Months of Debate, Virginia Fails to Pass Data Center Clean Energy Requirements*, 17 July 2026 (**Dominion's \$142.77 → \$255 → \$268 series**). [77] **Data Center Dynamics** — *Amazon granted permit for Warrenton data center*, February 2023 (**220,000 sq ft; ~\$550M; "around 3 am"**); **Data Center Knowledge** — *PJM Monitor: AI Data Center Growth Reshaping Power Markets*, 3 June 2026; **The Register** — coverage of the 2025 State of the Market Report, 15 May 2026; **Reuters** — *US power companies scramble to secure equipment*, 9 July 2026; **PA Environment Digest** — 2028/29 auction coverage, July 2026 (**the \$554.72 and >\$775 counterfactuals; Mills's quotation**); **Colorado Sun** — *Xcel proposes new rate scale for data centers*, 2 April 2026; **NBC Washington and WRIC** — **JLARC coverage**, 9–26 December 2024. [78] **Senator Elizabeth Warren** — letters to data center companies regarding utility costs, 15 December 2025, warren.senate.gov; **X post**, 5 June 2026 — **POLITICAL SOURCE. Warren gets: a data center tax and an investigation**. [79] **Reporters Committee for Freedom of the Press** — *Citizens for*

Fauquier County v. Town of Warrenton brief and case page, rcfp.org — **PRIMARY-ADJACENT**. The clearest summary of the FOIA fight and the appellate holding. [80] Company materials, all flagged: Dominion Energy press release on the simplified residential bill, 8 October 2024; AEP news release, 9 July 2025; AEP 4th Quarter Earnings Presentation, 13 February 2025 (“Load Growth Supports Financial Strength”); Georgia Power Budget 2025 Load and Energy Forecast, Ga. PSC Docket 56002, 31 January 2025 (**most figures redacted**); Oncor Q3 2024 results, 6 November 2024 (82 GW of potential data center load) — **COMPANY SOURCES**. *Each gets: investor confidence in a capital program.*

CLOSING NOTES TO MARKUP

1. **One must-hit anchor fails as worded (267%)**. Three resolution options are in §6, Discrepancy A. **The pack did not substitute anywhere.**
 2. **One assigned move fails its existence gate (the Verbatim)**. Three verified substitutes are in §4.4; the recommended one is the Oklahoma statutory definition.
 3. **One assigned move clears its hard gate (the Unit Conversion, PASS)**. The recommended deployment is Conversion 3, which requires no out-of-pack assumption.
 4. **One beat returned THIN (the Neighbor)**. §3 supplies both a legal swap and a re-scope, and recommends the re-scope for the reason the Beat Menu itself gives.
 5. **One pack dependency is only partially resolved (D1, the fence-line ratepayer)** and is flagged honestly rather than stretched.
 6. **The lecture’s best material arrived in the last eight days** — the SCC hearing of 14–15 July 2026, the auction of 14 July, and Bowring’s attribution of 20 July. **A decision that could reverse the Steelman is due 1 August 2026.** §11 flags every date.
 7. **The pack proposes; markup and the Course Schema dispose. No re-sequencing proposed.**
-

L7 Research Pack 1.0 · Research as of 21 July 2026 · How AI Data Centers Work — An Unteachable Briefing · Unteachable Courses

Lecture 8 — The Three-Vector Squeeze

Research Pack 1.0 · source file L8_Research_Pack_1_0.md · research as of 21 July 2026

RESEARCH AS OF 21 July 2026

(Per the L1/L4/L6/L7 pack precedent: every figure carries unit · stage · as-of date · author; discrepancies against must-hit anchors are flagged inline and consolidated in Section 6. Copyright discipline note specific to this lecture: the two central documents — “Winning the Race” and Executive Order 14365 — are United States Government works and are quoted at length without restriction; the same applies to court filings, permits, and agency records. Language spoken by named individuals and captured in press reporting is quoted short and attributed to the speaker, the outlet, and the date, with the locator supplied for a draft-stage transcript pull where a fuller passage is wanted. Two locator classes recur here: the Memphis and Shelby County Air Pollution Control Board / Shelby County Health Department docket (pullable in full at draft stage via the county clerk and SELC’s litigation archive) and the federal docket in the Northern District of Mississippi (pullable via PACER).)

LECTURE IDENTITY (assembled from Syllabus 2.0, Syllabus 1.0, Beat Menu 1.0, Moves List 1.0, Roster 1.0, Style Guide §5)

Title / frame / through-line. The Three-Vector Squeeze. Three altitudes, one cornfield, nobody wrong on their own terms. The geopolitics lecture as a controlled collision.

Register. Politics at three altitudes; per Style Guide §1’s cascade curve, this is the lecture where the steelman discipline runs hottest. Each vector gets its strongest case before the pileup; the collisions are the engine. Ledger-adjacent but not Ledger-led — the currency here is *jurisdiction*, not dollars, and the load-bearing question is not who pays but **who can actually enforce what**.

Cascade edge (Syllabus 2.0 format). Inherits: the bill fight, elevated (L7’s rate case, its moratorium wave, its council sweep) · Binds at: jurisdiction — who can actually enforce what · Who pays: contested at three altitudes simultaneously · Manufactures: the escape fantasy → L9.

Strawman beat plan (12, running order — STRAWMAN FOR MARKUP; Course Schema locks order after markup):

#	Beat	Family	Syllabus 2.0 assignment
1	The Hearing Room [O]	Politics	The Memphis record — council, commission, APCB; documented speakers, documented words
2	The County	Politics/Character	Memphis/xAI as the live microcosm: ~35 turbines ahead of their permits; who ran, who won, what the comprehensive plan says now
3	The Neighbor	Character	Boxtown — Sarah Gladney’s December 2025 statement; comedy off
4	Mechanism Autopsy	Atoms	The turbine permitting path: how equipment legally runs, or doesn’t, ahead of paper
5	The Perverse Incentive	Politics/Money	Vector one’s engine — the jobs math

#	Beat	Family	Syllabus 2.0 assignment
6	Follow the Money	Money	Subsidy structures and clawbacks; the Electrolux history; xAI bought the very building
7	Operator Reality	Atoms/Character	Vector three delivered through the fifty people inside the avatar
8	The Paper Trail — <i>class: executive document</i>	Politics	“Winning the Race”: what it says, what it forces, what it conditions
9	The Symbol Audit	Politics	Stargate as a construction schedule rather than a moonshot — deployment 2 of 3 ; absorbs The Deal’s announcement-to-groundbreaking sequence
10	The Steelman	Audit	<i>Defendant: the White House’s race logic</i> — the national-security case at full strength
11	The Regulatory Collision	Politics	State moratoria vs. federal preemption; the AI Litigation Task Force; funding conditions meeting L7’s wave head-on
12	The Externality Swap [C]	Atoms/Money	Local burden vs. national claim, now fully priced on both sides — the swap L1 seeded

Paper Trail document class: executive document (rotation position 8 of 10 distinct classes; classes 1–7 spent at state audit, technical specification, permit/agreement, queue instrument, contract, securities filing, tariff docket). **Named document:** *Winning the Race: America’s AI Action Plan*, The White House, July 2025 — with **Executive Order 14365** (11 December 2025) as its operative successor instrument. **Pack finding, flagged for markup:** the Action Plan is a policy blueprint with no operative legal force; EO 14365 is the instrument that actually forces and conditions. Section 5 treats them as a two-document dossier and Section 2/Beat 8 states the split honestly, because “what it forces” is a question the Action Plan alone cannot answer.

Handoff (assigned): *a door explicitly not opened* — when the ground is this contested, someone proposes leaving the ground; the exit from the map, not yet walked through. Rotation verified against the Syllabus 2.0 sequence (L1 question · L2 cost unassigned · L3 character walking · L4 question · L5 cost unassigned · L6 the bill walking · L7 question · **L8 door not opened** · L9 cost unassigned). No adjacent repeat; L7’s question and L9’s unassigned cost both differ. Alternates banked in Section 10.

Negative space (beats left out, scanned in Section 3): Cold Open on an Object, The Bill Arrives, The Wrong Map, The Forecast Problem, The Physics Audit, The Bottleneck, The Founder Audit, Taxonomy by Business Model, The Deal (folded into Symbol Audit), Hearing Room repeats.

Cast — three anchors by slot.

- **Document (anchor): “Winning the Race” — the White House AI Action Plan.** *Lead lecture:* 8. Introduced briefly in L5; detonates here; returns in L10. The government-issued space race; federal funding conditioned on the absence of “onerous” state regulation, head-on into L7’s moratorium wave.
- **Institution/Place (anchor): Memphis / xAI Colossus.** *Lead lecture:* 8 (*sole appearance*). The one cornfield under three altitudes, with a Hearing Room corpus in the Memphis City Council, Shelby County Commission, Shelby County Health Department, and Memphis and Shelby County Air Pollution Control Board records (2025–2026), and turbines that ran ahead of their permits at its center.
- **Human (anchor): KeShaun Pearson** — Memphis Community Against Pollution. *Lead lecture:* 8 (*sole appearance*). On the record before the Shelby County Health Department, at the July 2025 permit grant, and through the 15

December 2025 Air Pollution Control Board appeal. His Electrolux comparison hands the jobs-math vector its documented local history. **As-of title: resolved in Section 9 — the record carries three different titles across 2025–26 and the pack locks the convention.**

Secondary cast (documented, no full treatment). State Rep. Justin J. Pearson (D-Memphis, District 86), KeShaun’s brother — the elected-official altitude of the same fight. Sarah Gladney, Boxtown resident, on record December 2025. Memphis Mayor Paul Young. Dr. Michelle Taylor, then-Director of the Shelby County Health Department (2021–2025). Ted Townsend, President and CEO, Greater Memphis Chamber. Brent Mayo, xAI General Manager, Memphis. Doug McGowen, President and CEO, Memphis Light, Gas and Water. LaTricea Adams, CEO and President, Young, Gifted & Green. Abre’ Conner, Director of Environmental and Climate Justice, NAACP. Sarah Houston, Executive Director, Protect Our Aquifer. Cameron Stanley, Chief Digital and Artificial Intelligence Officer, Department of War. Greg LeRoy and Kasia Tarczynska, Good Jobs First. The DOJ AI Litigation Task Force. The Loudoun County ZOAM hearings (**return** — L1 owns Loudoun’s full treatment; brief reference only). The JLARC jobs analysis (**return** — L1 owns *Data Centers in Virginia* as its Paper Trail; this lecture may cite but must not rebuild).

Recurring-cast lead/return status for this lecture.

- “Winning the Race” / AI Action Plan — **LEAD here** (L5 brief, L10 return). Full treatment owed; make it complete enough that L10 never rebuilds it.
- Loudoun County — **RETURN** (L1 is lead). Brief reference only; no re-introduction.
- PJM, Dominion, the interconnection agreement, CoreWeave, NVIDIA’s rack roadmap — **not cast here**. Do not import.

Must-hit anchors (Syllabus 1.0 values, carried unchanged; listed verbatim):

- ~1 job/\$13M vs. ~\$137K/job
- ~50 FTEs per 250k sq ft
- ~half of subsidies with no job requirement
- “Winning the Race” space-race language
- Stargate
- AI Litigation Task Force
- federal funding conditions vs. state moratoria
- ~35 turbines / permits (Memphis, 2025)
- Dec 15, 2025 APCB appeal

Moves plan as assigned, with pack-verification flags:

Move	Assignment	Gate
Step Function	~1 job per \$13 million	Verify pedigree + the standing assumption it breaks. Flagged: attribution discrepancy — see Section 6.
Unit Conversion	skip proposed (the jobs ratio does the magnitude work)	No arithmetic gate fires. Section 4 records the skip and does not manufacture a Japan.
Timeline Snap	The Action Plan’s release date — pack locks the day	Existence/selection gate: locked below; a competing hinge is presented with evidence.
The Verbatim	The space-race sentence, quoted flat	Existence gate: PASS — verified verbatim in the primary document (Section 4).
As-Of Stamp	The Task Force litigation posture (2026)	Confirm current value + decay velocity.
Kicker	The physical avatar of automation fear employs fifty people	Verify to pedigree standard + supply adjacent facts.
Gesture	Candidate for the training-run door (pending Nick’s call — Open Item 9)	One-inch material only; three candidate deployments ride on the call (L1, L6, L8), never more than one per lecture. If the door is rejected, this lecture simply skips the Gesture.
Handoff	A door explicitly not opened	Material in Section 10.

Assigned sellers and narrator moves. Seller: **the Politician, at every altitude** — the county supervisor’s jobs pitch, the mayor’s tax-revenue ordinance, the governor’s veto, the White House’s race imperative. Moves: **STRIP** on “the building is the AI coming for your job” (remove the personification; leave the documented anxiety, the automation economics, and the fifty employees standing); **GRANT-AND-WITHHOLD** on the jobs pitch (the tax revenue is real; the jobs math is the soft underbelly). The race logic and the county rejection are each steelmanned — the same party never twice.

Steelman defendant (rotation). **The White House’s race logic** — deployment 6 of 8 in the course rotation (L1 the county’s growth case · L4 PJM’s queue · L5 the behind-the-meter customer · L6 the neocloud CFO’s depreciation schedule · L7 Dominion · **L8 the White House’s race logic** · L9 the orbital case · L10 the hyperscaler’s capex logic). No party twice. **Rotation check: PASS.** Note for markup: the record surfaced a *second* steelman-grade defendant in this territory — the Department of War’s operational-dependency case, filed under oath in June 2026 — which is a distinct party from the White House and is banked in Section 7 as a markup alternate.

Decay tier. Mid. Litigation and Memphis are live; the three-vector structure holds. Section 11 carries the register.

Boundary door touched by the Gesture (if assigned). **Training-run internals** — what the GPUs in the Memphis buildings are actually computing. Pending Nick’s call. One-inch material supplied in Section 4, and nowhere else in this pack.

HUMAN-FLOOR FLAGS — comedy drops to near-zero in every zone below. Per Style Guide §5’s human-floor rule and the Beat Menu’s Neighbor constraint, this lecture carries more floor than any lecture except L7. Marked zones:

1. **Beat 1 (The Hearing Room)** — the April 2025 SCHD hearings at Fairley High School and the 15 December 2025 APCB appeal. Residents testifying about respiratory illness. Comedy off for the entire beat.
2. **Beat 3 (The Neighbor)** — Boxtown. Sarah Gladney. Comedy off, absolute, no exceptions, no decompression inside the beat.
3. **Beat 2 (The County)**, wherever it touches asthma rates, the ethylene-oxide cancer-cluster history, or the 38109 zip code’s median income. Comedy may run on the *procedural* material (the vote counts, the hearing scheduling) and must drop the moment a household enters.
4. **Beat 5 / Beat 6**, wherever the Electrolux material touches the 658 workers fired in 2018 and the 534 who lost jobs at closure. The *incentive structure* is fair comedic game; the workers are not.
5. **Beat 7 (Operator Reality)** — the job-fear material. Vector three’s whole subject is people afraid of losing work. The fifty-employee fact is a *Kicker*, delivered flat; it is not a joke at anyone’s expense, and the STRIP move exists precisely to keep the documented anxiety standing after the folklore is removed.
6. **Beat 12 (The Externality Swap)** — the closer prices a burden that lands on named households. Land it on arithmetic, not on sentiment, and not on a laugh.

Levity is available in Beats 4, 8, 9, 11 — the permitting mechanics, the executive documents, the Stargate procurement audit, the jurisdictional collision — and that is where the thermostat’s whole budget for this hour lives.

PACK DEPENDENCIES — debts this pack must resolve or honestly fail.

#	Source of the debt	The debt	Status
D1	Roster 1.0, “What the Research Packs still owe the roster”	KeShaun Pearson’s hearing statements, verbatim, with full context	Section 2 Beat 1 / Section 8
D2	Roster 1.0, L8 entry	KeShaun Pearson’s as-of title locked (record carries director / president / executive director)	RESOLVED — Section 9
D3	Roster 1.0	Hearing-transcript pulls from the Memphis corpus	Section 8 , with locator convention stated
D4	Syllabus 2.0, L8 moves plan	Timeline Snap: “pack locks the day”	RESOLVED — Section 4
D5	Syllabus 2.0, L8 moves plan	Verbatim: the space-race sentence must exist verbatim	PASS — Section 4
D6	Syllabus 2.0 Open Item 9	The third Gesture door (training-run internals) — pending call	One-inch material supplied conditionally; Section 4

#	Source of the debt	The debt	Status
D7	L1 pack, Section 3, forward flag	“Lecture 7/8 packs must pull named, consenting, on-the-record residents”	Section 8 — Gladney resolved; see Section 8 for the honest limits
D8	Style Guide §5 / Beat Menu	Neighbor beat: documented humans only, no composites	Section 8; one candidate, not a slate — flagged
D9	Syllabus 2.0 reconciliation	Symbol Audit deployment 2 of 3 (L5 TMI · L8 Stargate · L9 orbital) — cap ≤3	Cap verified; Section 2 Beat 9
D10	Standing (Section 6 protocol)	Must-hit anchor figures carried unchanged; discrepancies flagged not substituted	Three discrepancies found — Section 6

SECTION 1: TIMELINE OF THE CONSTRAINT

A constraint machine assembling itself: a subsidy statute written without a clawback, a factory that left, a building bought cheap, a permitting exemption for portable equipment, an executive document that made a race out of it, and a federal government that eventually showed up in court on the side of the turbines.

Dating convention. Day/month/year where the record supports it. Where only month/year is documented, that is stated. Expected future events are marked **[EXPECTED]** with the announcing party named.

Part A — The ground, before anyone wanted it (1860s–2013)

1860s–1870s. Formerly enslaved people build homes in southwest Memphis from scrap boxcar lumber; the settlement becomes known as **Boxtown**. Source: EDF Vital Signs / Moms Clean Air Force profile, 2 May 2026. *Why it matters: this is the land the entire lecture stands on, and its name is a materials manifest.*

1980s. A federal class action against the City of Memphis secures running water and electricity for Boxtown residents. By that date, dozens of polluting facilities operate in the neighborhood — a refinery, a coal power plant, a pesticide manufacturer. Source: same. *Why it matters: the fence line predates the data center by a century, and the record of who gets utilities and when is a court record.*

2010. Tennessee, Shelby County, and the City of Memphis execute the incentive agreement bringing **Electrolux** to Frank C. Pidgeon Industrial Park, southwest Memphis. Total government incentives estimated at **\$188.3 million** (state, local, federal, and long-term tax breaks). The state’s share is reported at **at least \$97 million**, commonly rendered as ~\$100 million. A payment-in-lieu-of-taxes deal valued at roughly **\$33.9 million** exempts Electrolux from diversity-participation requirements imposed on other local tax-break recipients. Electrolux commits to **1,240 jobs** within five years of opening. **The 2010 contract contains no clawback provision and explicitly blocks the involved governments from recouping incentives if the job commitment is missed.** Sources: The Commercial Appeal (13 Jan 2012 retrospective); Tennessee Department of Economic and Community Development spokesman Scott Harrison, Feb 2019; The Commercial Appeal, 13 Feb 2019. *Why it matters: this is the document that makes the Follow the Money beat load-bearing. The absence of a clause is the causal agent.*

2012–2013. Electrolux Memphis plant constructed. Construction expenditure **\$87 million**, of which **\$76 million** went to local companies (per plant official Truong, quoted at a media tour). PILOT terms: **15 years**, reducing city property tax obligation by **90%** and county property tax by **75%**. Source: EDGE Annual Performance Report record; press coverage of the pre-opening tour.

2013. Tennessee begins adding **accountability agreements with clawback requirements** to state economic incentive agreements. Source: Scott Harrison, TNECD, Feb 2019. *Why it matters: three years too late for Memphis. The state learned the lesson on this exact building.*

2017. Electrolux Memphis reports **1,100-plus employees** — its peak, and still 140 short of the commitment seven years in.

The International Brotherhood of Electrical Workers wins its first contract at the plant. Sources: TNECD; Daily Memphian, 31 Jan 2019.

Part B — The building empties (2018–2024)

Calendar year 2018. Electrolux fires **254 full-time employees and 404 contract workers** — 658 people — in the year preceding the closure announcement. The company makes **just under \$500,000** in PILOT payments in 2018. Source: Electrolux Annual Performance Report submitted to the Economic Development Growth Engine of Memphis and Shelby County, released publicly 15 February 2019. **[HUMAN FLOOR]**

31 January 2019. Electrolux announces it will close the Memphis plant in 2020, consolidating U.S. cooking manufacturing into Springfield, Tennessee with a **\$250 million** reinvestment. **534 employees** remain at announcement. Alan Shaw, head of Electrolux Major Appliances North America, issues the closure statement. Source: Daily Memphian (Wayne Risher), 31 Jan 2019. **[HUMAN FLOOR]**

31 January 2019. Rep. Steve Cohen (TN-09) issues a same-day statement noting the plant was lured with an estimated \$188 million in government incentives and calling for more careful review of corporate job-creation promises. Source: cohen.house.gov press release.

Early February 2019. TNECD confirms Electrolux is **not legally required to repay** the state incentives, because the 2010 agreement lacked clawback provisions. Gov. Bill Lee tells reporters the episode underscores the importance of clawbacks going forward. Electrolux spokeswoman Eloise Hale says the company intends to meet its obligations. Sources: Associated Press, Feb 2019.

2020. Electrolux ends Memphis production. The building at 3231 Paul R. Lowry Road goes dark.

2022. EPA identifies a potential cancer cluster near a Memphis facility using **ethylene oxide** — Sterilization Services of Tennessee, in the same corridor. Memphis Community Against Pollution helps build the case for the first federal limits on the chemical. Source: EDF Vital Signs, 2 May 2026. **[HUMAN FLOOR]**

Early 2024. EPA proposes tighter ethylene-oxide emission controls and reporting requirements; the Memphis facility shuts down. Boxtown's relief lasts a matter of months. Source: same.

March 2024. **CTC Property LLC** (rendered in some records as CTC Properties LLC) is incorporated in Tennessee. Source: Forbes, via Commercial Appeal reporting. xAI's own account, via the Greater Memphis Chamber, dates its arrival in Memphis to March 2024.

5 June 2024. The Greater Memphis Chamber announces xAI will build the **“Gigafactory of Compute”** in Memphis — described as the largest capital investment by a new-to-market company in Memphis history. The Chamber's published commitment: xAI **“will bring up to 500 quality, high-paying jobs to Memphis in its initial phase, with plans to grow more.”** The Chamber's FAQ also states: **“xAI took no incentives from the State to plant their roots in Memphis.”** Source: memphischamber.com/economic-development/xai (Chamber's own materials — *seller's document*).

6 June 2024. WREG reports the Chamber will not confirm the site and says capital investment and final job numbers are still being worked out. Chamber President Ted Townsend notes EDGE must sign off, implying incentive requests. *Why it matters: the jobs number precedes the site, the investment figure, and the permit.*

21 June 2024. The Economic Development Growth Engine for Memphis and Shelby County (**EDGE**) confirms xAI **has not submitted an application for incentives**. The supercomputer is to be built with private capital. Source: EDGE, via Commercial Appeal. *Why it matters: this is the fact that makes the Memphis case structurally different from Loudoun's and from Electrolux's — and it is the strongest single card in the county's steelman.*

June–July 2024. MLGW confirms CTC Properties LLC is occupying the former Electrolux site at 3231 Paul R. Lowry Road and will take water, natural gas, and electricity service. MLGW estimates the facility will generate **\$15–20 million annually in local property taxes** and produce **\$500,000 in additional PILOT payments** to the city annually from increased electricity sales; MLGW's public estimate of permanent jobs is **300-plus**. Source: MLGW, via Commercial Appeal.

23 July 2024. **Brent Mayo of CTC Properties files a certificate of occupancy permit** with the Memphis and Shelby County Division of Planning and Development for the Paul R. Lowry Road site. The same day, **Darryl Cuttell of Darana Hybrid** (Ohio) files two construction permits: one for temporary installation of electrical equipment, one a **\$2 million**

mechanical permit for cooling piping. Darana Hybrid had already filed **\$10,267,329** of mechanical and electrical permits in April 2024. Source: Memphis and Shelby County Division of Planning and Development records. *Why it matters: the paper trail for the physical build is a stack of ordinary county permits, filed months before the air permit anyone fought about.*

~July 2024. Colossus 1 begins operations. Initial grid connection reported at **~8 MW**, rising to **~150 MW** via TVA/MLGW; reported IT capacity **~150 MW**. To ramp faster than the grid connection allowed, xAI deploys a fleet of **on-site gas turbines**. Source: Global Energy Monitor, *Colossus 1 power station*, updated July 2026.

9 August 2024. Daily Memphian photographs gas turbines powering the Colossus supercomputer (Benjamin Naylor). *Why it matters: the photographic record of the turbines predates every permit proceeding by eight months.*

2 September 2024. Elon Musk posts that the Colossus cluster is online — **100,000 Nvidia H100 GPUs**, built on the company's account in **122 days**. Source: X post, 2 Sept 2024.

31 October 2024. The New York Times (Ivan Penn and Kate Conger) publishes *Why a Memphis Community Is Fighting Elon Musk's Supercomputer*. *Why it matters: the first national-record account; the Roster's L8 entry traces to this reporting trail.*

December 2024. The Greater Memphis Chamber announces the Colossus expansion from **100,000 to 1,000,000 GPUs**. Chamber chief government affairs officer **Bobby White** tells FOX13 that in five years Memphis will be globally known as **"the Digital Delta"** and that xAI is not receiving tax breaks; he cannot say how many jobs will come. Source: FOX13 Memphis, 5 Dec 2024.

9 December 2024. JLARC publishes *Data Centers in Virginia* (Report 598) — Northern Virginia at **13% of global operational data center capacity** and **25% of the Americas**; **~340 buildings**; **~5 GW** of generating capacity required; **74,000 jobs**, **\$5.5B labor income**, **\$9.1B GDP** annually per VEDP response, the majority from construction. **RETURN ITEM — L1 owns this document's full treatment as its Paper Trail. Cite, do not rebuild.**

Part C — The permitting fight (January 2025 – July 2025)

January 2025. CTC Property LLC applies to the **Shelby County Health Department** for a **minor source** air construction permit. SELC will later argue the application was both late and for the wrong permit class given the number, size, and estimated emissions of the turbines — that a **major source** permit was required before installation. Source: SELC; Inside Climate News, 17 July 2025.

20 January 2025. Executive Order 14156, *Declaring a National Energy Emergency*, signed. Cited in the AI Action Plan's Pillar II footnotes as part of the permitting-reform predicate.

21 January 2025. **Stargate announced** — OpenAI, Oracle, SoftBank; **\$500 billion, 10 gigawatts** (both *announced*, neither *spent* nor *energized*). *Why it matters: the Symbol Audit's subject enters the record as a press event, and every subsequent date is measured against it.*

23 January 2025. **Executive Order 14179**, *Removing Barriers to American Leadership in Artificial Intelligence*, signed. Federal Register 90 (20) 8741. Directs the creation of an AI Action Plan. *This is the operative parent of the Paper Trail document.*

31 January 2025. Executive Order 14192, *Unleashing Prosperity Through Deregulation*. Federal Register 90 (24) 9065. Cited in the Action Plan's deregulation actions.

11 February 2025. Vice President JD Vance remarks at the Artificial Intelligence Action Summit in Paris that restricting AI development with onerous regulation would paralyze one of the most promising technologies in generations. **Quoted inside the Action Plan itself at footnote 2** — the source of the Plan's operative word "onerous."

14 February 2025. Executive Order 14213, *Establishing the National Energy Dominance Council*. Federal Register 90 (33) 9945.

22 March 2025. Memphis Mayor **Paul Young** and MCAP President **KeShaun Pearson** hold a public discussion of xAI's expansion and its meaning for the city. Source: MCAP's own record (memphiscap.org). *Why it matters: documented direct engagement between the two altitudes, on the record, four days before the county commission acts.*

26 March 2025. The **Shelby County Board of Commissioners votes 5–1** to adopt a resolution recommending that the Shelby County Health Department hold a public meeting before acting on the construction permit. Then-Health Director

Dr. Michelle Taylor states before the vote that the department will host a public meeting regardless of the outcome, and afterward tells FOX13 it is **“not necessarily a win.”** Commissioner **Edmund Ford Jr.** notes he and his father, City Councilman Edmund Ford Sr., are working toward a parallel hearing including TVA, MLGW, state lawmakers, and the city engineer. Sources: Shelby County Commission minutes, 26 Mar 2025; WATN, 31 Mar 2025; localmemphis.com. *Why it matters: a documented vote count, a documented dissent, and a health director publicly declining to call a procedural win a win.*

29 March 2025. Mayor Paul Young posts a statement on X acknowledging concerns about air quality, gas turbines, and water supply, and conceding that **the speed of the project’s development may have left community members feeling there wasn’t enough time for engagement.** He announces he is working on an ordinance — **the first of its kind in Memphis** — dedicating a portion of xAI-generated tax revenue to projects in the **38109 zip code**. Source: Paul Young, X, 29 Mar 2025; Action News 5, 30 Mar 2025. *Why it matters: the politician-seller’s strongest and most honest single act in the record, and the pivot from “should this exist” to “who gets the revenue.”*

April 2025. Aerial imagery flown by **Southwings for SELC** (photographer Steve Jones) documents approximately **35 gas-fueled turbines** on the Colossus 1 site — far more than were publicly permitted at the time. Source: SELC; Inside Climate News. **This is the must-hit anchor’s photographic origin.**

9 April 2025. At a public Shelby County Commission hearing, residents living near Colossus testify to air quality problems and chronic respiratory conditions. Source: contemporaneous coverage compiled in the Colossus (data center) public record. **[HUMAN FLOOR]**

25 April 2025. The Shelby County Health Department opens its public hearing series at the **Fairley High School Auditorium**. An xAI representative reads a prepared statement and leaves without staying for community comment. Then-director Michelle Taylor opens the proceeding. KeShaun Pearson addresses the department the same day, telling Democracy Now! that morning what he planned to say. Sources: SCHD hearing record; Democracy Now!, 25 Apr 2025; Heinrich Böll Stiftung, 28 Jan 2026. **[HUMAN FLOOR — this is Beat 1’s spine.]**

23 April 2025. Executive Orders 14277 and 14278 — *Advancing Artificial Intelligence Education for American Youth and Preparing Americans for High-Paying Skilled Trade Jobs of the Future*. Federal Register 90 (80) 17519 and 17525. Cited in the Action Plan’s worker-first section. *Why it matters: the federal government’s documented answer to vector three, and it is a training program.*

14 May 2025. Tennessee Lookout photographs (Karen Pulfer Focht) the Colossus site.

16 May 2025. SCHD announces it has received **over 1,700 public comments** on the permit application and that each will be addressed before a decision; the Pollution Control Branch expects to complete review within 60 days. Other contemporaneous reporting places the comment count above **2,000**. Sources: SCHD press statement, 16 May 2025; Inside Climate News, 17 Jul 2025. **[Range kept as a range; the two figures are from different counters at different dates — see Section 6.]**

5 June 2025. SELC petitions EPA to formally recognize the Memphis metropolitan area’s failure to meet federal ozone standards, which would trigger stricter air-permit requirements. SELC notes area ozone averages have exceeded federal limits for two consecutive years. Source: SELC petition, 5 Jun 2025.

6 June 2025. Executive Order 14306, *Sustaining Select Efforts To Strengthen the Nation’s Cybersecurity*. Federal Register 90 (111) 24723.

10 June 2025. The Tennessee Holler publishes its survey of all 16 Shelby County state senators and representatives on whether they support xAI in Memphis; reports Dr. Michelle Taylor’s departure announcement, roughly a week after County Mayor Lee Harris publicly praised her. *Flagged as advocacy-outlet sourcing; the underlying departure is independently verified below.*

2 July 2025. The Shelby County Health Department grants the air construction permit to CTC Property LLC: **15 Solar SMT-130 turbines**, approximately **247.2 MW**, operable 24 hours a day, seven days a week, with emissions controls. The permit requires **Best Available Control Technology installed by 1 September 2025 and expires 2 January 2027**. SELC’s count of turbines then on site: **as many as 35**, capable of up to **421 MW**. Sources: SCHD permit; Global Energy Monitor; TechCrunch, 3 Jul 2025. **This is the hinge of the entire Memphis vector: 15 permitted out of ~35 installed.**

2 July 2025. The **Greater Memphis Chamber** issues a same-day statement commending the approval and characterizing the turbines as a secondary emergency backup power source. **Ted Townsend**, President and CEO, says the approval demonstrates evidence-based decision-making balancing growth and stewardship. xAI states it welcomes the decision and

that its onsite generation will make the facility the lowest emitting of its kind in the country. Sources: memphischamber.com press release, 2 Jul 2025; FOX13, 3 Jul 2025. *Both are seller documents.*

2 July 2025. SELC releases a joint statement from multiple environmental groups criticizing the permit as contrary to the hundreds of Memphians who spoke against it. Source: SELC, 2 Jul 2025.

3 July 2025. A **Code Orange air quality alert** is issued for the Memphis area the day after the permit approval. Source: Inside Climate News, 17 Jul 2025. *Flagged as juxtaposition, not causation — the pack does not assert a causal link and neither should the draft.*

16 July 2025. SELC, on behalf of the **NAACP** and **Young, Gifted & Green**, files an appeal with the **Memphis and Shelby County Air Pollution Control Board** challenging both the permit and SCHD’s separate determination that temporary gas turbines qualify as **“nonroad engines”** exempt from permitting. The appeal argues the nonroad determination violates the Clean Air Act and would let any entity install and operate any number of new polluting turbines with no written approval, no public notice, no public participation, and no pollution controls. **Under the Shelby County Air Code the appeal operates as a stay of decision, effectively pausing the permit; the board must set a hearing date within 60 days.** Filed document: *2025-07-15 NAACP and YGG xAI Air Permit Appeal with Appendices*. Sources: Tennessee Lookout, 16–17 Jul 2025; NAACP press release, 18 Jul 2025. **This is the single most important procedural document in Memphis vector, and its operative theory — the nonroad exemption — is what the entire 2026 federal litigation turns on.**

July 2025. **MZX Tech LLC** acquires the former **Duke Energy** power plant site at **2875 Stanton Road, Southaven, Mississippi**, together with **114 acres**. In the same month xAI notifies the **Mississippi Department of Environmental Quality** that it is preparing to bring turbines onto the Colossus II power station site, describing them only as portable gas-fired units, without number, make, model, generating capacity, or emissions estimates. Source: NAACP/SELC notice of intent to sue, 13 Feb 2026 (Earthjustice archive). *Why it matters: the Memphis playbook crosses a state line into a jurisdiction with a different regulator.*

July 2025. SELC’s account: after the intent-to-sue threat, xAI **removed 20 turbines** at Colossus 1 and obtained permits for the remaining 15. Source: Reuters (Valerie Volcovici), 17 Feb 2026.

23 July 2025. **The White House releases *Winning the Race: America’s AI Action Plan*** at the “Winning the AI Race” event, alongside **three executive orders**. Signed by the President; authored under the White House Office of Science and Technology Policy following more than 10,000 public comments. Signatories on the document: Michael J. Kratsios (Assistant to the President for Science and Technology), David O. Sacks (Special Advisor for AI and Crypto), Marco A. Rubio (Assistant to the President for National Security Affairs). **THE ASSIGNED TIMELINE SNAP DATE — locked in Section 4, with a competing hinge presented.**

4 August 2025. **Dr. Michelle Taylor** assumes office as **Commissioner of the Baltimore City Health Department**, having served as Director of the Shelby County Health Department from 2021 to 2025. Source: Baltimore City Health Department; public biographical record. **AS-OF TITLE LOCK: in every 2025 Memphis scene, she is “then-Director of the Shelby County Health Department.” After 4 August 2025 she is not in the story.**

Part D — The federal document acquires teeth (September 2025 – March 2026)

22 September 2025. Oracle circulates the Stargate data centers fact sheet (later entered into the congressional record via Rep. Arrington’s office): the three new sites combined with Abilene and the nearby expansion can deliver **over 5.5 gigawatts (announced capacity)**, are expected to create **over 25,000 onsite jobs (announced, construction-weighted)**, and the campuses collectively encompass **more than 4,800 acres**. **This is the jobs-pitch document for the Symbol Audit — a seller’s own fact sheet, dated.**

23 September 2025. OpenAI, Oracle, and SoftBank announce five new Stargate sites, bringing the program to **nearly 7 gigawatts of planned capacity and over \$400 billion in investment over three years (announced)**, described as a clear path to the full \$500 billion / 10 GW commitment by end of 2025, ahead of schedule. Sites: Shackelford County, Texas; Doña Ana County, New Mexico; a Midwest site; plus a potential **600 MW** expansion near Abilene. Source: openai.com/index/five-new-stargate-sites (*seller’s document*).

30 September 2025. Crusoe announces the first phase of the Abilene campus is live on Oracle Cloud Infrastructure. Chase Lochmiller, co-founder and CEO. Two buildings, **980,000 sq ft**, supporting **200 MW+ of IT (energized)**. Source: crusoe.ai newsroom.

10 October 2025. Groundbreaking on xAI's **\$80 million greywater recycling facility** in Memphis. Capacity: up to **13 million gallons per day** of wastewater treated, drawn as effluent from the **T.E. Maxson** wastewater treatment plant. xAI General Manager **Brent Mayo**: the facility will reduce aquifer withdrawals by **9%** and nutrient loading to the Mississippi River by **20%**, with zero taxpayer dollars used for construction. MLGW President and CEO **Doug McGowen**: **5 billion gallons per year** conserved. TVA CEO and President **Don Moul** and City Councilman **J. Ford Canale** attend. Original filed cost figure: **\$78 million**; the Colossus facility is expected to average **7 million gallons per day** with a **10.4 million gallon** peak flow per the filed documents. Sources: groundbreaking coverage 10–13 Oct 2025; permit filings.

21 October 2025. The City of Memphis establishes a **\$3.2 million special revenue fund** from xAI tax payments, directed to neighborhoods affected by company operations, under Mayor Young's ordinance. Councilwoman **Yolanda Cooper-Sutton** confirms the taxes were paid and the committee is being formed. Surveys are distributed to residents in affected neighborhoods. Source: localmemphis.com, 21 Oct 2025. *Why it matters: the ordinance is the politician's answer to the jobs-math problem — if the jobs are not the benefit, the revenue must be, and it must be visibly* local.**

10–11 November 2025. Good Jobs First publishes **“Cloudy Data, Costly Deals: How Poorly States Disclose Data Center Subsidies”** (author: Kasia Tarczynska; executive director Greg LeRoy). Findings: **36 states** grant data center sales-and-use tax exemptions; **11** disclose recipient names (Arizona, Connecticut, Illinois, Indiana, Minnesota, Nevada, Ohio, Pennsylvania, Texas, Washington, Wisconsin); **5** disclose subsidy amounts; **4** disclose jobs promised; **none** disclose both jobs promised and jobs created; **only Nevada** discloses wages. States that calculated return on investment found they lose **52 to 70 cents per dollar** of exemption. Texas lost **\$1 billion** in FY2025. Virginia abates **nearly \$1 billion** annually without disclosing beneficiaries. LeRoy: data centers top the group's 2025 list of most ridiculously subsidized industries. Georgia and Ohio legislatures voted to suspend or sunset exemptions; **both governors vetoed. This is the Perverse Incentive beat's evidentiary spine.**

19 November 2025. A draft executive order on AI preemption leaks publicly, titled in the draft *Eliminating State Law Obstruction of National AI Policy*. Analysis published by the Institute for Law & AI, 19–25 Nov 2025.

10 December 2025. AI preemption language fails to make the **National Defense Authorization Act for FY2026**. Source: Skadden, 15 Dec 2025.

9 December 2025. A bipartisan coalition of **42 state attorneys general** sends a letter to major AI companies urging improved safeguards for children — two days before the EO. Source: Skadden.

8 December 2025. MCAP, Young Gifted & Green, and allied advocates hold a press conference at the NAACP's Memphis chapter building ahead of the appeal hearing. **Sarah Gladney**, Boxtown resident, on the record. **KeShaun Pearson**, president of Memphis Community Against Pollution, on the record. Sources: Action News 5, 8–9 Dec 2025; WREG, 8 Dec 2025; localmemphis.com. **[HUMAN FLOOR — Beat 3's spine.]**

11 December 2025. Executive Order 14365, *Ensuring a National Policy Framework for Artificial Intelligence*, signed. Establishes the **AI Litigation Task Force** within DOJ within 30 days; directs the Secretary of Commerce within 90 days to publish an evaluation identifying “onerous” state AI laws; conditions **Broadband Equity Access and Deployment (BEAD)** non-deployment funds on the absence of such laws; directs FCC and FTC proceedings; and directs a legislative recommendation that **expressly declines to preempt state laws on child safety, AI compute and data center infrastructure (other than generally applicable permitting reforms), and state procurement.** *Note for the drafting AI: the White House URL slug retains the leaked draft's title — eliminating-state-law-obstruction-of-national-artificial-intelligence-policy — while the published title reads “Ensuring a National Policy Framework.” Both are on the same page, documented. This is the instrument with teeth, and its §8(b)(ii) carve-out is the single most important sentence in this lecture's Regulatory Collision beat.*

15 December 2025. The Memphis and Shelby County Air Pollution Control Board votes **6–1 to uphold xAI's air permit**, dismissing the challenge brought by Young, Gifted & Green and NAACP Memphis and represented by SELC. The board consists of seven members — lawyers, physicians, and industry experts serving four-year terms. The decision comes roughly an hour before the hearing adjourns. Attendees describe the vote as shocking. AP photographs the room (George Walker IV). Sources: Daily Memphian (Samuel Hardiman), 15 Dec 2025, 3:34 p.m. and updated 4:03 p.m. CT; localmemphis.com, 15 Dec 2025. **MUST-HIT ANCHOR — and the vote count and timing are both documented, which the strawman's beat plan does not yet carry.**

19 December 2025. Nearly two dozen state attorneys general file a letter with the FCC urging it not to issue preemptive AI regulations. Source: Sidley Data Matters, 23 Dec 2025.

December 2025. MZX Tech purchases an adjacent **104-acre** site in Southaven, including an **810,258-square-foot ware-**

house at 2400 Stateline Road. Source: MDEQ record; Commercial Appeal.

January 2026. The AI Litigation Task Force is formed at DOJ. Operative from 10 January 2026 per Paul Hastings' reading of the EO's 30-day clock; Cato confirms formation in January 2026. **AS-OF STAMP TARGET.**

January 2026. EPA states that temporary turbines exceeding emissions thresholds must be permitted. Source: reported in the July 2026 investigative record. *Why it matters: the federal environmental regulator and the federal justice department are, by June, on opposite sides of the same question.*

6 January 2026. Oligarch Watch publishes an audit of xAI's Memphis hiring: **99** publicly identifiable employees at the Memphis facility against the Chamber's promised **500**; **44 open positions** listed on xAI's site as of that date (25 data center operations, 5 engineering, 2 finance, 3 HR, 3 security); **28** positions posted in April 2025; **20** in December 2024. More than half of identified Memphis employees were hired from outside the region. State Sen. Brent Taylor (R) had claimed xAI would hire from economically distressed areas of Memphis and move people from SNAP benefits to six-figure wages. **Flagged: advocacy-outlet sourcing with a stated methodology (LinkedIn + job postings). The methodology is disclosed and reproducible; the vantage is adversarial. Treat as a floor estimate with a named method, not as a company disclosure — and note that xAI has not published a Memphis headcount.**

7 January 2026. Virginia's Annual Comprehensive Financial Report (FY ended 30 June 2025) discloses the data center sales and use tax exemption cost **\$1.6 billion in FY2025** — up **118%** year over year. Virginia's qualification threshold: **\$150 million capital investment and 50 new jobs**. Greg LeRoy: like 35 other states, Virginia is losing control of its spending through virtually automatic exemptions. Virginia deputy chief of staff **Ali Ahmad** responds by citing JLARC's 74,000 jobs / \$9.1B GDP figures. Source: The Register, 7 Jan 2026; Virginia ACFR. **The state's own defense is the JLARC number — which is the exact number the Step Function is auditing.**

January 2026. Food & Water Watch publishes “Artificial Jobs: The Illusion of Big Tech’s Data Center Employment Claims.” Findings below in Part E. **THE STEP FUNCTION’S ACTUAL SOURCE — see Section 6 discrepancy #1.**

January 2026. xAI and Mississippi elected officials formally announce a **third data center, “Macrohardrr,”** at the 2400 Stateline Road warehouse, roughly 200 yards from Colossus 2.

28 January 2026. Heinrich Böll Stiftung publishes an extended interview record with KeShaun Pearson including his account of the April 2025 SCHD hearing and the Sterilization Services history. **Verbatim source for Beat 1.**

February 2026. SpaceX acquires xAI. The combined entity is valued at **\$1.25 trillion** following the merger (*a mark from a transaction, not a verdict — Style Guide §5 announced-vs-spent discipline applies*). Source: contemporaneous reporting, Feb–Mar 2026.

13 February 2026. NAACP and SELC serve a **60-day notice of intent to sue** over the Southaven turbines, by certified mail. The notice documents that xAI first notified MDEQ in July 2025 without turbine details; that SCR construction was complete on 6 of the units; and that a third data center at 2400 Stateline Road would bring xAI's Memphis-area power demands to **nearly 2 GW — approximately the output of the Hoover Dam** (the comparison is the filers'). Document: 2026.02.13 final xAI Southaven NOI with Exhibit A.

17 February 2026. MDEQ holds its only public hearing on the operations permit for **41 permanent turbines** at 2875 Stanton Road, Southaven. Application filed by **MZX Tech LLC**, prepared by **Trinity Consultants** (Arkansas-based). MDEQ Air Division Chief **Jaricus Whitlock** states all comments will be reviewed and does not expect the Permit Board to meet by early March. MDEQ confirms xAI will run temporary turbines while the application is reviewed. Source: Reuters (Valerie Volcovici), 17 Feb 2026; Commercial Appeal.

4–5 March 2026. xAI announces plans for orbital data centers. **KeShaun Pearson**, founder of Memphis Community Against Pollution, tells Action News 5 he remains skeptical, reports that pollution sensors installed after xAI's arrival show peak nitrogen oxide levels from the turbines have risen **79%**, and says the promised jobs have not materialized. Sarah Houston of Protect Our Aquifer notes the orbital plan is an attempt to solve energy shortages on Earth. Boxtown-adjacent resident **James Kirkwood**, near Colossus 2 on Tulane Road, describes a change in the air. Source: Action News 5, 5–6 Mar 2026. **[HUMAN FLOOR] — and this is also the seam material for the Handoff: the escape from the ground is announced by the same company, from this cornfield, in the middle of this fight.**

5 March 2026. MDEQ announces the Permit Board will meet **10 March** — five days' notice, in **Jackson, Mississippi**, roughly a three-hour drive from the affected community. Source: DCD, 18 Jun 2026.

10 March 2026. The MDEQ Permit Board approves the Clean Air Act permit for 41 natural gas turbines at the former Duke Energy site, Southaven, to MZX Tech LLC — **on the same day as Mississippi's primary elections.** NAACP

and SELC had asked for a delay on that ground. **Abre' Conner**, NAACP Director of Environmental and Climate Justice, issues a statement criticizing the scheduling. xAI posts that it is thrilled MDEQ approved the permanent construction permit, unlocking **1.2 GW of self-generating power capacity** (*permitted capacity, not energized*). MDEQ spokesperson **Jan Schaefer** says the vote followed careful consideration of public comments. Sources: CNBC, 10 Mar 2026; DCD; MDEQ.

March 2026. The March 2026 **National AI Legislative Framework** is issued, per the EO 14365 §8 legislative-recommendation directive. Source: Barnes & Thornburg; National Law Review.

March 2026. Microsoft leases the remainder of the Abilene Stargate site, per contemporaneous reporting; Oracle publicly disputes reports of the Abilene expansion being scrapped, stating on 9 March that two buildings are fully operational and that leasing for the broader 4.5 GW commitment is completed. Bloomberg and Reuters report the **600 MW** expansion lease was dropped by OpenAI; Nvidia reportedly paid a **\$150 million deposit** to Crusoe to secure the space. Sources: Tom's Hardware, 10 Mar 2026; Oracle X post, 9 Mar 2026. **[CONTESTED — present the conflict, do not resolve it.]**

Part E — The federal government picks a side (April – July 2026)

9 April 2026. xAI files suit in the U.S. District Court for the District of Colorado against Colorado Attorney General **Philip J. Weiser**, seeking to enjoin **SB24-205**, the Colorado AI Act, before its 30 June 2026 effective date. Theories: First Amendment (compelled speech, content and viewpoint discrimination), Commerce Clause (extraterritorial regulation), and others. Case: *xAI v. Weiser*. Source: Jenner & Block; Norton Rose Fulbright.

April 2026. xAI **pauses construction** on the Memphis greywater recycling facility. Musk states the company is focusing on completing Colossus 2 in Whitehaven first. xAI Memphis posts that it remains committed to building the plant. Mayor Paul Young and MLGW's Doug McGowen publicly press for completion; Protect Our Aquifer's **Sarah Houston** and Science Director **Scott Schoefer** respond. Houston notes xAI can use up to **1.2 million gallons per day** under its MLGW contract, and says the plant must be built so the city never has to choose between sending water to xAI or to Boxtown and Westwood. Sources: FOX13, 9 Apr 2026; WREG, 10 Apr 2026. **[HUMAN FLOOR]**

14 April 2026. The NAACP files a **Clean Air Act citizen suit** against xAI and **MZX Tech LLC** in federal court in Mississippi, alleging at least **27 unpermitted turbines** operating at the Southaven site powering Colossus 2, and alleging disproportionate exposure of a predominantly Black population to NOx, PM2.5, formaldehyde, and carbon monoxide. Relief sought: shut down operations until permits are obtained and pollution controls installed. Source: complaint, N.D. Miss.; Quartz, 17 Jun 2026.

24 April 2026. **Maine Governor Janet Mills vetoes LD 307**, which would have been the first statewide data center moratorium (banning facilities over 20 MW until 1 November 2027). Mills states a moratorium is appropriate given the impacts of massive data centers in other states, objecting only to the absence of a carve-out for a **\$550 million** project in Jay. **This is the single best GRANT-AND-WITHHOLD artifact in the moratorium record: a governor who agrees with the policy and vetoes it over one project.**

24 April 2026. **DOJ moves to intervene in xAI v. Weiser** and files its own complaint in intervention alleging SB24-205 violates the **Equal Protection Clause**. **This is the first time the federal government has sought to invalidate a state AI law in court.** Assistant Attorney General for the Civil Rights Division **Harmeet K. Dhillon** issues a public statement. DOJ's press statement does not mention the Task Force, and its complaint does not raise interstate-commerce theories. Colorado AG Weiser declines comment through communications director Lawrence Pacheco. Bill sponsor state Rep. **Brianna Titone** responds that the law's purpose was to prevent discrimination. Sources: Norton Rose Fulbright, 12 May 2026; Jenner & Block, 29 Apr 2026; GovTech, 29 Apr 2026. **[CONTESTED — whether this intervention is a Task Force action is inferable but not stated on the record. Say so.]**

27 April 2026. The court grants xAI's and the Colorado AG's joint motion, **temporarily suspending enforcement** of the Colorado AI Act pending the legislature's session, subsequent rulemaking, and decision on xAI's forthcoming preliminary-injunction motion.

May 2026. NAACP and the Mississippi State Conference file for a **preliminary injunction** against xAI and MZX Tech.

May 2026. **Hill County, Texas** enacts a one-year data center moratorium.

29 May 2026. Colorado **HB 26-1263**, the Chatbot Safety Act, is signed by Governor Polis; effective 1 January 2027.

2 June 2026. Executive Order *Promoting Advanced Artificial Intelligence Innovation and Security* signed. Source: white-house.gov presidential actions index. **[Flagged for draft-stage pull — content not researched here beyond existence and date, as it falls outside this lecture’s assigned document scope.]**

4 June 2026. The New York State Legislature passes the Responsible Data Center Development Act (S10642/A11560) — a **one-year moratorium** on state permits for new large data centers with peak demand of **20 MW or more**. Senate **44–16**; Assembly **102–39**. Governor Kathy Hochul has not announced a position. If signed, New York becomes the first state to enact a statewide data center moratorium. Source: DLA Piper, July 2026.

4 June 2026. Hill County, Texas **rescinds** its moratorium after a developer sues, replacing it with a project-review checklist.

10 June 2026. The NAACP **updates its complaint** after discovery identifies nearly 30 additional turbines beyond the initial filing.

13 June 2026. Arizona pauses its data center tax incentives.

15–16 June 2026. The United States moves to intervene and dismiss the NAACP’s Clean Air Act suit. Filed by the DOJ’s Environment and Natural Resources Division; Associate Attorney General Stanley Woodward among the signers. The motion joins **xAI and the State of Mississippi** in urging dismissal **with prejudice**. Core arguments: that the suit threatens American national, economic, and energy security by seeking to shut off the power supply for AI innovation supporting the Department of War’s military operations; that the Clean Air Act affords the United States primacy over citizen-enforcers on enforcement discretion; and that enforcement discretion is a constitutionally exclusive executive function not subject to override by private litigation. **The filing does not dispute the core allegation that the turbines lack required permits.** Attached: a sworn declaration by **Cameron Stanley**, the Department of War’s Chief Digital and Artificial Intelligence Officer, stating that **Grok is one of only a small number of proprietary state-of-the-art AI models capable of national security applications**, operating on Secret and Top Secret classified networks, used in recent U.S. strikes against Iran, and supporting the government’s Marvin Smart System for targeting and readiness — including deployment of **over 2,000 munitions to 2,000 distinct targets within 96 hours during Operation Epic Fury**. Sources: motion and declaration, N.D. Miss.; CNBC, 16 Jun 2026; Quartz, 17 Jun 2026; Cybernews, 17 Jun 2026; USA Today network, 16 Jun 2026. **[CONTESTED across secondary sources: the model count is rendered as “four” in some reports and “three” in others. Section 6 flags it; the pack does not pick.] THIS IS THE LECTURE’S DETONATION POINT — the three altitudes collapse into one docket.**

June 2026. SpaceX IPO. Stock rises sharply over the first three days of trading; contemporaneous reporting describes Musk as the world’s first trillionaire. Source: CNBC, 16 Jun 2026. *Why it matters: the DOJ filing and the IPO land in the same week, and both are on the record.*

16 June 2026. The NAACP responds publicly, framing the intervention as federal bullying and stating it will continue to stand against authoritarianism. Source: NAACP statement, 16 Jun 2026.

June 2026. Michigan legislators reintroduce statewide moratorium bills (**HB 5594–5596** and **SB 1018–1020**) alongside a Senate Democratic regulatory package; none enacted. Governor Gretchen Whitmer continues to describe a moratorium as a non-starter. Source: datacenterbans.com, July 2026.

23 June 2026. The Colorado Attorney General’s office initiates pre-rulemaking on the ADMT Act and the Chatbot Safety Act, accepting comments through 13 July 2026.

1 July 2026. Illinois’ data center tax incentive pause takes effect. Same date: **Ohio’s proposed constitutional amendment** to ban data centers over 25 MW **fails to qualify** for the 2026 ballot, gathering roughly **70,000 of the 413,488 signatures** required by the deadline. Backers plan to try again in 2027. Source: datacenterbans.com.

Session-end 2026. Pennsylvania, Wisconsin, and South Carolina close their sessions without passing data center bills. New Hampshire moves the other direction, enacting an off-grid electricity providers law easing self-supplied power for data centers.

~14–15 July 2026. Investigative reporting, built on a public records request producing emails between **Trinity Consultants** (for xAI/MZX Tech) and MDEQ, establishes that **59 unpermitted turbines** are installed — at least **57 in Southaven**, two at an unidentified site — roughly double the **27 xAI** publicly acknowledged in early 2026. Manufacturer emissions profiles for just **30 of the 59** indicate potential annual releases at 80% capacity of nearly **2,500 short tons of nitrogen oxide**, **4,000 short tons of carbon monoxide**, and **22 short tons of formaldehyde**, against a Clean Air Act permitting threshold of **100 short tons**. MDEQ maintains that portable/temporary turbines do not require an air permit. EPA says it is weighing regulatory flexibilities for portable units while protecting public health. **Ben King**, analyst at Rhodium Group, describes

it as an unprecedented level of behind-the-meter gas installed in one place. Sources: technology.org, 15 Jul 2026; Tech Times, 15 Jul 2026; cloudnews.tech. **[HUMAN FLOOR adjacent — the emissions figures are exposure figures for named neighborhoods.]**

15 July 2026. MultiState's 2026 legislative guide records: **over 40 states considered 267 data-center-related bills in 2025**; state-level moratorium bills introduced in **11 states in 2026**; dozens of municipalities enacting local pauses. DLA Piper's July 2026 count: **more than 300 data center-related bills filed across more than 30 states in 2026**; **at least 12 states** considering moratorium legislation; **more than 100 local moratoria** adopted nationwide; an estimated **\$64 billion** in projects blocked or delayed by community opposition; **15 data center bills enacted in Virginia** this session. Good Jobs First's tally: of at least **63 local actions, 54 passed**. Michigan is the most active state, with close to **50 counties** enacting or considering bans — a total prohibited area roughly the size of Rhode Island. **[Multiple counters, multiple definitions, multiple dates — Section 6 keeps them separate rather than averaging them.]**

24 August 2026. [EXPECTED] Hearing scheduled on the NAACP's preliminary injunction request. Announcing party: the court, noted in the DOJ's own filing.

2 January 2027. [EXPECTED] Colossus 1's Shelby County air construction permit expires.

Q1 2027. [EXPECTED] xAI has committed to restart construction on the Memphis greywater recycling facility. Announcing party: MLGW President and CEO Doug McGowen, reporting a commitment made in a meeting with SpaceXAI president Michael Nicolls and Mayor Paul Young, June 2026.

1 November 2027. [EXPECTED, NOW MOOT] The end date of the Maine moratorium that was vetoed — retained in the timeline because the *proposed* end date is what made the veto arguable.

[END OF SECTION 1 — 118 entries]

SECTION 2: STRAWMAN BEAT DOSSIER

Twelve sub-sections, in the strawman's running order. Each carries the Syllabus 2.0 assignment, the Beat Menu definition with binding constraints, the facts, the mechanism, the cast, the documents, the verbatim bank, the who-pays path, the contested/motivated layer, sensory and material detail, the numbers with pedigree, and a flat stress-test verdict.

Beat 1 — The Hearing Room [O] (the Memphis record)

Syllabus 2.0 assignment: The Memphis record — council, commission, APCB; documented speakers, documented words.

Beat Menu definition: *The Hearing Room — Politics • opener-capable, versatile.* A county board meeting, a FERC technical conference, an earnings call Q&A — reconstructed from transcripts and minutes only. **This is the only walk-into-a-room beat on the menu**, which satisfies the production bible's max-1-scene rule by construction. Evidence discipline is absolute: documented speakers, documented words, no staging. Appearance budget: warm (4–5). Opener rotation assigns Hearing Room to lectures 5, 8, and 10 — three distinct room types. **Rotation check: PASS.** L5's room is a utility/regulatory proceeding; L10's is an audit-register room; **L8's is a county air-quality board.** No two adjacent lectures open on the same beat (L7 opens on The Bill Arrives, L9 on The Wrong Map).

FACTS, DATES, NAMES, NUMBERS. The Memphis corpus is unusually deep because the fight ran through *four* separate bodies in fourteen months, each generating its own record. **(1) Shelby County Board of Commissioners**, 26 March 2025: resolution recommending a public meeting, adopted **5–1**. Public hearing 9 April 2025 at which residents testified to chronic respiratory conditions. **(2) Shelby County Health Department**, public hearing series opening **25 April 2025** at the **Fairley High School Auditorium**, on the CTC Property LLC minor-source air construction permit application for the existing Colossus Data Center at **3231 Paul R. Lowry Road**; **over 1,700 public comments** received per SCHD's 16 May 2025 statement (contemporaneous reporting elsewhere cites 2,000+); 60-day review target announced the same day; permit granted **2 July 2025**. **(3) Memphis City Council**, which produced the 38109 revenue ordinance and the **\$3.2 million** special revenue fund confirmed 21 October 2025. **(4) The Memphis and Shelby County Air Pollution**

Control Board, seven members — lawyers, physicians, industry experts — serving **four-year terms**; appeal filed **16 July 2025**; hearing held **15 December 2025**; decision **6–1** to uphold the permit, delivered roughly an hour before adjournment.

THE MECHANISM — the legal path. Shelby County is one of a small number of U.S. jurisdictions where air permitting is delegated to a **county health department** under a federally approved **Local Implementation Plan**, with appeals running to a **local Air Pollution Control Board** rather than to a state environmental agency. That structure is the whole reason this fight is a *hearing room* story rather than a docket story: the decision-maker is a county employee, the appellate body is seven local appointees, and the room is a high school auditorium. The procedural chain: application (January 2025) → public comment and hearings (April–May 2025) → permit decision (2 July 2025) → **appeal to the APCB, which under the Shelby County Air Code operates as an automatic stay of decision** and obligates the board to set a hearing within **60 days** → hearing and vote (15 December 2025) → exhaustion, after which the fight leaves the room and becomes federal litigation. **The step where the constraint binds:** the 60-day stay is the only point in the entire sequence where a citizen filing physically stops a permit. It stopped it for five months. Then seven appointees voted, and the room's power was spent.

KEY ACTORS IN THIS BEAT. *Human:* **KeShaun Pearson**, Memphis Community Against Pollution — addressed the health department on 25 April 2025, having stated that morning what he intended to say; on the record again at the 8 December 2025 press conference. What he wanted: denial of the permit and, later, rescission. What he could enforce: nothing directly — MCAP is not a party with statutory authority; its leverage is comment volume, media, and the appeal filed by counsel. What he did: built the comment record, the sensor record, and the political record. *Human:* **Dr. Michelle Taylor**, then-Director, Shelby County Health Department (2021–2025) — the official who both convened the hearings and issued the permit, and who on 26 March 2025 declined to call the commission's resolution a win. She departs for Baltimore, assuming office there 4 August 2025. *Human:* **LaTricea Adams**, CEO and President, Young, Gifted & Green — co-appellant. *Human:* **Commissioner Edmund Ford Jr.**, Shelby County — pushed for a parallel hearing with TVA, MLGW, state lawmakers, and the city engineer. *Institution:* **SELC**, which supplied the legal theory, the aerial imagery, and the EPA ozone petition. *Institution:* **The Greater Memphis Chamber**, which appeared as the counterweight at every proceeding. *Object:* the auditorium itself — Fairley High School, in the affected zip code.

THE DOCUMENTS. 2025-07-15 NAACP and YGG xAI Air Permit Appeal with Appendices, filed 16 July 2025 with the Memphis and Shelby County Air Pollution Control Board. What it forces: an automatic stay and a hearing within 60 days. What it argues: that large gas turbines cannot qualify for the **“nonroad engine”** exemption, and that Shelby County's federally approved Local Implementation Plan contains **no exemption for “temporary” large portable turbines**. Skeptical caveat: it is binding as a procedural instrument and non-binding as a legal theory — the board rejected it 6–1, and the same theory is now being litigated federally with a different regulator and a different exemption rationale. *SCHD air construction permit to CTC Property LLC*, issued 2 July 2025, 15 Solar SMT-130 units, ~247.2 MW, BACT by 1 September 2025, expiry 2 January 2027 — treated in full in Section 5's companion inventory. *Shelby County Commission resolution*, adopted 26 March 2025, 5–1.

VERBATIM BANK.

“We do not bifurcate responsibility. Mayor Paul Young has responsibility to use and leverage his authority in this exact situation, in order to move forward the democratic process, but also to elevate the voices of the community.” — KeShaun Pearson, Memphis Community Against Pollution, at the Shelby County Commission proceeding, reported by localmemphis.com, 31 March 2025.

“It's not necessarily a win.” — Dr. Michelle Taylor, then-Director, Shelby County Health Department, on the commission's 26 March 2025 resolution vote, FOX13 Memphis, 27 March 2025.

“We really want to push back diplomatically on director Taylor for you to assess what you can do, stop talking about what you can't do, and learn about what you can do to make sure that you use the fullest extent of power, to protect the people in Memphis.” — LaTricea Adams, CEO and President, Young, Gifted & Green, following the 26 March 2025 commission vote, localmemphis.com.

“Permitting one of the city's largest polluters was ridiculous and a slap in the face to our community.” — KeShaun Pearson, president, Memphis Community Against Pollution, at the 8 December 2025 press conference at the NAACP Memphis chapter building, Action News 5, 9 December 2025.

PARAPHRASE, MARKED. *Paraphrase:* At the April 2025 SCHD hearing, an xAI representative read a prepared statement and left without remaining for community comment; Pearson's account, given to Heinrich Böll Stiftung and published 28 January 2026, states the representative did not stay to hear residents and did not make eye contact while reading. *Paraphrase:* Pearson's account also states that then-director Taylor opened the hearing with remarks about diet. **[Locator for draft-stage pull: Heinrich Böll Stiftung, "The Promise of 'The Peace of Plenty,'" 28 Jan 2026; SCHD hearing recording via county clerk.]** **Flagged: the diet remark is single-sourced through an adversarial-party account of a public meeting. Do not put it in prose without a second source or the recording.**

WHO PAYS. The room itself allocated nothing. The costs that moved through it: a **\$3.2 million** city special revenue fund from xAI tax payments, directed to the 38109 zip code (October 2025), and MLGW's projection of **\$15–20 million** annually in local property taxes. Against that: no state or local incentive package, per EDGE's 21 June 2024 confirmation. The who-pays here is unusual and must be stated precisely — **the local fiscal transaction is net-positive on its face, and the contested cost is not on the tax ledger at all. It is in the air.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician** (Mayor Young, the Chamber's officials, the commission) and, in counter-position, **the Doomer** direction in some advocacy framing. Direction of overclaim from the Chamber: that the permit process was rigorous and evidence-based. What's real: SCHD did hold multiple hearings, did take 1,700-plus comments, and did impose BACT — the process was not a rubber stamp in form. What's oversold: it approved 15 of roughly 35 installed units and did not address the other 20 in the permit. Direction of overclaim from advocacy: that the board's 6–1 vote was corrupt rather than deferential. What's real: a seven-member volunteer board upheld a technical permit issued under a federally approved implementation plan. What's unknown: **the deliberative content.** The board deliberated and voted within a single session; the pack has not located a transcript of the deliberation itself. Narrator move: **GRANT-AND-WITHHOLD** on the process claim.

SENSORY & MATERIAL DETAILS. A high school auditorium in the 38109 zip code as the venue for a proceeding about a **247-megawatt** generation permit. Printed signs held in the APCB room on 15 December 2025 (AP/George Walker IV, photographed). Four-year terms and a seven-member board. The vote landing roughly an hour before the hearing adjourned. *Inference, flagged:* an auditorium seating several hundred is the correct order of magnitude for a hearing described as drawing hundreds — but the pack has not located a seating count, and the draft should not state one.

NUMBERS THAT MATTER. 5–1 (commission vote, 26 Mar 2025, Shelby County Commission minutes — ANCHOR) · 6–1 (APCB vote, 15 Dec 2025, board record — ANCHOR) · 7 members / 4-year terms (APCB composition, Action News 5 8 Dec 2025 — STRUCTURAL) · 1,700+ comments (SCHD, 16 May 2025 — ANCHOR at that date) · 2,000+ comments (Inside Climate News, 17 Jul 2025 — STRUCTURAL, different counter/date; **keep both, do not merge**) · 60 days (statutory hearing-setting window, Shelby County Air Code — ANCHOR) · 3231 Paul R. Lowry Road (address of record — ANCHOR).

STRESS-TEST VERDICT: SUSTAINABLE. Four distinct bodies, three documented vote counts, a named venue, four usable verbatims from three speakers, and a procedural mechanism (the automatic stay) that is itself a five-minute explanation. The beat's only weakness is the absence of a deliberation transcript from the 15 December vote, which the draft handles by building the scene from the filings, the press conference, and the vote rather than from the board's reasoning — and by saying so.

Beat 2 — The County (Memphis / xAI as the live microcosm)

Syllabus 2.0 assignment: Memphis/xAI as the live microcosm: ~35 turbines ahead of their permits; who ran, who won, what the comprehensive plan says now.

Beat Menu definition: *The County — Politics/Character • versatile, closer-capable.* One jurisdiction as live microcosm: Warrenton's council sweep, Memphis and xAI, Abilene under Stargate. Present-tense politics with a zip code — who ran, who won, what the comprehensive plan says now. Distinct from The Wrong Map (how the geography happened) — this is what the geography is doing to people *this year*. Warm tier (4–5).

FACTS, DATES, NAMES, NUMBERS. The turbine count is the county's whole story and it is a moving number with a documented provenance chain: ~35 installed and photographed by aerial survey (April 2025, Southwings for SELC) → 15 permitted (2 July 2025, ~247.2 MW) → 20 removed after the intent-to-sue (SELC's account, via Reuters 17 Feb 2026) → 421 MW of aggregate capacity in the pre-permit fleet (SELC estimate) → across the state line, 27 acknowledged, 41 permitted permanently (10 March 2026), 59 documented installed and unpermitted (July 2026 records request). The

jurisdictional map: Colossus 1 at **3231 Paul R. Lowry Road**, South Memphis, Shelby County, Tennessee. Colossus 2 at **5420 Tulane Road**, Whitehaven, Memphis. The power plant serving Colossus 2 at **2875 Stanton Road, Southaven, DeSoto County, Mississippi** — a different state. Macrohardrr at **2400 Stateline Road**, Southaven, roughly **200 yards** from Colossus 2. The 38109 zip code's median household income: **just under \$37,000** (NBC News, 16 May 2025). Combined Memphis-area power demand at full build, per the NAACP/SELC notice of 13 February 2026: **nearly 2 GW**.

THE MECHANISM — the political path. The load-bearing fact of this county is that **there is no zoning fight, because there was no rezoning.** xAI moved into an existing industrial building in an existing industrial park with existing utility service, took no state incentives, and applied for one air permit. Loudoun County's story runs through a comprehensive plan and a ZOAM; Warrenton's runs through a special-use permit and a 2:30 a.m. council vote. **Memphis has neither, and that absence is the mechanism.** The only regulatory handle the community could reach was the air permit — which is why the entire fight is an air permit, and why the moment the permit was upheld, the fight had to leave the county entirely. Then the second facility's power plant was sited across a state line, in a jurisdiction with a different regulator and a friendlier reading of the same federal exemption. **The step where the constraint binds:** the boundary of Shelby County. Local authority ends at a line on a map that a gas turbine can be trucked across.

KEY ACTORS IN THIS BEAT. *Institution:* **Shelby County Health Department** — motive: statutory duty under a delegated federal implementation plan; exposure: the only regulator with jurisdiction over the thing residents could point at; what it filed: a permit for 15 units and a determination that the temporary ones were nonroad engines. *Institution:* **Greater Memphis Chamber** — motive: it recruited the project and named the strategy “the Digital Delta”; exposure: it published the 500-job number; what it gets if believed: the recruitment case for the next project. *Human:* **Mayor Paul Young** — wanted the investment and the revenue; feared being seen as having traded Boxtown for it; could enforce essentially nothing over an air permit issued by a county department; did the one thing within his authority, which was write an ordinance directing revenue to the affected zip code. *Human:* **County Mayor Lee Harris** — supportive of the project; publicly praised Taylor shortly before her departure. *Human:* **Bobby White**, chief government affairs officer, Greater Memphis Chamber — the Digital Delta framing. *Human:* **Ted Townsend**, President and CEO, Greater Memphis Chamber. *Object:* the former Electrolux building — 3231 Paul R. Lowry Road, vacant since 2020, with its branding stripped from the sign outside (photographed).

THE DOCUMENTS. The **Memphis City Council ordinance** dedicating a portion of xAI-generated tax revenue to the 38109 zip code — first of its kind in Memphis, announced by Mayor Young 29 March 2025, funded at **\$3.2 million** as confirmed 21 October 2025, with resident surveys distributed and a committee being formed as of that date. What it forces: a dedicated fund and a public allocation process. What it does not do: condition anything on the company's conduct. Skeptical caveat: it is a revenue-allocation instrument, not a permit condition — it directs money the city was going to receive anyway. **The EDGE record** of 21 June 2024 confirming no incentive application — the strongest single document in the county's defense. **MLGW's service agreements** with CTC (four, as of 2024) and the utility's public estimate of 300-plus jobs and \$15–20 million in annual property taxes.

VERBATIM BANK.

“I understand the concerns that have been raised about air quality, the use of natural gas turbines, and the potential strain this project could place on our water supply. I also recognize that the speed of this project's development may have left some members of our community feeling there wasn't enough time for community engagement.” — Mayor Paul Young, statement posted to X, 29 March 2025, reported by Action News 5, 30 March 2025.

“In five years, we will be not just nationally but globally known... as the Digital Delta.” — Bobby White, chief government affairs officer, Greater Memphis Chamber, FOX13 Memphis, 5 December 2024.

“xAI took no incentives from the State to plant their roots in Memphis.” — Greater Memphis Chamber, published xAI FAQ, memphischamber.com (seller's own document; page live as of research date, undated on its face — first archived October 2024).

“With that ordinance, we are in the near future getting ready to set up the committee because this is the people's money. We wanna make sure that it is used for the people.” — Memphis City Councilwoman Yolanda Cooper-Sutton, localmemphis.com, 21 October 2025.

WHO PAYS. Tennessee levies no personal income tax; the corporate rate is a flat 6.5%. The city receives property tax and MLGW receives increased electricity sales generating an estimated **\$500,000** in additional PILOT payments annually. No sales-and-use-tax exemption application was filed with EDGE. **On the local ledger, Memphis is a net receiver — which is exactly why the fight moved to the air permit.** The cost that is not on the ledger: exposure in a zip code with a median income just under \$37,000 and a documented history of ethylene-oxide emissions, a refinery, a coal plant, and a pesticide manufacturer. **[HUMAN FLOOR from this sentence onward in the beat.]**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician** at the municipal and county altitude, plus **the Chamber as a quasi-institutional seller.** The claim as sold: Memphis got a historic investment for free. What's real, granted precisely: **no state incentives were applied for, EDGE confirmed it in writing in June 2024, and the tax revenue is real and is being paid** — this is a materially different bargain than Electrolux's and than Virginia's, and the course must say so. What's oversold: the **500 jobs**; the characterization of the turbines as emergency backup when they were the primary ramp power; the implication that the absence of an incentive package means the absence of a public cost. Narrator move: **GRANT-AND-WITHHOLD**, and it is the hardest calibration in the lecture, because the county's steelman is unusually strong. What's unknown: xAI has published **no Memphis headcount**; the only public estimate with a stated method is adversarial.

SENSORY & MATERIAL DETAILS. A sign outside the vacant Electrolux facility with its branding removed (photographed, Commercial Appeal). Fifteen **Solar SMT-130** turbine units — Solar Turbines is a Caterpillar subsidiary; the SMT-130 is a mobile packaged unit. Aerial photography flown by Southwings, a nonprofit conservation-flight organization, with the pilot and photographer named in the credit line (Steve Jones). Colossus 2 sitting roughly 200 yards from an 810,258-square-foot warehouse. A state line running between a data center and its power plant.

NUMBERS THAT MATTER. ~35 turbines installed pre-permit (Apr 2025, SELC aerial — ANCHOR, must-hit) · 15 permitted / 247.2 MW (2 Jul 2025, SCHD permit — ANCHOR) · 421 MW aggregate pre-permit capacity (SELC estimate — STRUCTURAL, filer benefits) · 20 removed (SELC account via Reuters 17 Feb 2026 — STRUCTURAL) · \$3.2M special revenue fund (21 Oct 2025, City of Memphis — ANCHOR) · \$15–20M/yr local property taxes, *projected* (MLGW, 2024 — CONTESTED, projection) · \$500,000/yr additional PILOT (MLGW, 2024 — CONTESTED, projection) · 300+ permanent jobs, *projected* (MLGW, 2024 — CONTESTED) · ~\$37,000 median household income, 38109 (NBC News, 16 May 2025 — STRUCTURAL) · ~2 GW area demand at full build (NAACP/SELC NOI, 13 Feb 2026 — CONTESTED, filer benefits) · 6.5% flat Tennessee corporate rate (STRUCTURAL).

STRESS-TEST VERDICT: SUSTAINABLE. The beat is unusually well-armed because its central fact is a *negative* — there was no zoning fight — and the negative is documented (EDGE, June 2024). The turbine-count provenance chain alone is four minutes of material with a photograph, a permit, a removal, and a state line at the end. One condition: the projected MLGW figures are projections from 2024 and must be labeled as such in prose; the pack has not located a realized property-tax figure.

Beat 3 — The Neighbor (Boxtown) [COMEDY OFF — ABSOLUTE]

Syllabus 2.0 assignment: Boxtown — Sarah Gladney's December 2025 statement; comedy off.

Beat Menu definition: *The Neighbor* — *Character* • *versatile* • *thermostat near-zero*. One household at the fence line. Human-scale counterweight to The County — County is a jurisdiction's politics; Neighbor is one family's property line. **Hard constraints: documented individuals from testimony, filings, and published reporting only; no composites; no invented color; comedy off.** Cap: 3 course-wide, cast as Morris (L3) · fence-line ratepayer (L7) · Gladney (L8). **Cap and casting check: PASS.**

FACTS, DATES, NAMES, NUMBERS. Sarah Gladney is a Boxtown resident, on the record at the 8 December 2025 press conference held at the NAACP Memphis chapter building ahead of the 15 December appeal hearing. Boxtown: founded by formerly enslaved people who built homes from scrap boxcar lumber; secured running water and electricity only after a **federal class action against the City of Memphis in the 1980s**; by then hosting a refinery, a coal power plant, and a pesticide manufacturer. In 2022 EPA identified a potential cancer cluster near a Memphis facility emitting **ethylene oxide** — Sterilization Services of Tennessee; the facility shut down in early 2024 after EPA proposed tighter controls. Colossus 1 was announced in June 2024, five months later. The Memphis–Southaven region has among the worst asthma rates in the nation (a fact the NAACP's federal complaint places at the center of its environmental-justice framing, April 2026). MCAP's post-arrival sensors show peak nitrogen oxide levels from the turbines up **79%** (KeShaun Pearson,

Action News 5, 5 March 2026).

THE MECHANISM — the exposure path. Simple combustion turbines burning natural gas emit **nitrogen oxides** (ozone precursors), **carbon monoxide**, **formaldehyde**, and **fine particulate matter**. The Clean Air Act's major-source permitting threshold for a criteria pollutant is **100 short tons per year**. Manufacturer emissions profiles for **30 of the 59** Southaven units indicate potential annual releases at 80% capacity of nearly **2,500 short tons of NOx**, **4,000 short tons of CO**, and **22 short tons of formaldehyde** — for slightly over half the fleet. SELC's letter to SCHD stated the Colossus 1 turbines made the facility likely the largest industrial NOx emitter in Memphis, citing manufacturer data indicating **1,200 to 2,000 tons** of NOx. Selective catalytic reduction (SCR) reduces NOx post-combustion; the 13 February 2026 notice records SCR construction complete on **6** units at Southaven. Memphis-area ozone averages exceeded federal limits for two consecutive years as of SELC's 5 June 2025 EPA petition. **The step where the constraint binds:** whether a turbine is "stationary" or "nonroad/portable." Everything downstream — permit, controls, notice, comment — hangs on that single classification, and the household at the fence line has no standing in the classification argument at all.

KEY ACTORS IN THIS BEAT. *Human:* **Sarah Gladney**, Boxtown resident. What she wanted: rescission of the permits. What she could enforce: nothing. What she did: spoke on the record, by name, a week before the board voted. *Human:* **KeShaun Pearson**, Boxtown-connected, MCAP's leader. *Human:* **Easter Knox**, whose home is near the facility, quoted at the time of the July 2025 permit grant (FOX13). *Human:* **James Kirkwood**, resident near Colossus 2 on Tulane Road, on the record March 2026 describing an odor and a change in the air. *Human:* **Shannon Samsa**, Southaven resident, on the record December 2025 describing approval without air permits, independent health or environmental studies, or public input. *Institution:* **Memphis Community Against Pollution** — the organization that beat the Byhalia Connection Pipeline and helped build the ethylene-oxide case. *Institution:* the **Shelby County Health Department**, on the other side.

THE DOCUMENTS. The NAACP's **Clean Air Act complaint**, filed 14 April 2026, N.D. Miss., amended 10 June 2026 — the document in which the fence line becomes a federal cause of action, and which pleads the racial demography of the surrounding population against national averages. The **60-day notice of intent to sue**, 13 February 2026, certified mail. The **SELC letter to SCHD** on NOx. Skeptical caveat, stated plainly: **these are advocacy filings by parties who benefit if believed, and the pack says so; they are also the only documents in the record that quantify the exposure at all, because the company has not.**

VERBATIM BANK.

"We are asking the Shelby County Health Department to rescind all permits to xAI." — Sarah Gladney, Boxtown resident, press conference, Memphis, 8 December 2025. Reported by Action News 5, 9 December 2025.

"We are sick and tired of being sick and tired, and we are asking the Shelby County Health Department to rescind all permits to the xAI, and we want to breathe clean air, and it is our right to breathe clean air." — Sarah Gladney, same press conference, 8 December 2025. Reported by WREG, 8 December 2025.

"They are hurting people." — Easter Knox, whose home is near the facility, FOX13 Memphis, 3 July 2025.

"But you do smell it. You can tell the change in the air." — James Kirkwood, resident near Colossus 2, Tulane Road, Action News 5, 6 March 2026.

"We deserve clean air, clean water, clean soil just like they have in Collierville, just like they have in Germantown, just like these other zip codes where the majority of people are white." — KeShaun Pearson, president, Memphis Community Against Pollution, WREG/Nexstar, 2025.

WHO PAYS. This beat's who-pays is not a bill; it is exposure, and the pack states it in the units the record supplies: short tons per year of NOx, CO, and formaldehyde against a 100-short-ton threshold, in a zip code with a median household income just under \$37,000, in a metro area with among the worst asthma rates in the country, downwind of a fleet that grew from 35 to 59 units across two states in fourteen months. **No dollar figure attaches. The absence of one is the point, and it should be stated once, flatly, and not pressed.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. The company's documented response, presented as a conflict rather than smoothed: xAI stated on 2 July 2025 that its onsite generation would carry state-of-the-art emissions

control, making the facility the lowest emitting of its kind in the country. The Greater Memphis Chamber stated the approval reflected evidence-based decision-making. Mayor Young cited a study finding no elevated pollution levels near the site (referenced in WREG's 8 December 2025 report) — **and SELC's response was that the testing failed to measure ozone**. Both statements are in the record; the pack does not resolve them and neither should the draft. What is unknown and material: **the pack has not located continuous, independently operated, publicly published ambient monitoring data at the fence line for the full period**. MCAP's sensor network exists and reported a 79% peak-NOx increase, and in June 2026 the Shelby County Health Department publicly questioned the integrity of a community air monitoring report (Tennessee Lookout, 23 June 2026). That dispute — over whose monitor counts — is itself the material.

SENSORY & MATERIAL DETAILS. Homes built from boxcar scrap. Running water arriving by court order in the 1980s. A barbershop — Lacy's Place — where NBC News photographed Pearson in May 2025. An odor described by a resident on Tulane Road. Signs held in a board hearing room on 15 December 2025.

NUMBERS THAT MATTER. 100 short tons/yr (CAA major-source threshold — ANCHOR) · ~2,500 short tons NOx / 4,000 CO / 22 formaldehyde, annualized at 80% capacity for **30 of 59** units (manufacturer profiles via public records request, July 2026 — STRUCTURAL, *not a measurement; a manufacturer-spec projection*) · 1,200–2,000 tons NOx (SELC letter to SCHD, 2025 — CONTESTED, filer benefits; **range stays a range**) · 79% increase in peak NOx (MCAP sensors, as reported by Pearson, 5 Mar 2026 — CONTESTED, single-source, monitor integrity disputed) · 6 of 59 units with SCR complete (13 Feb 2026 NOI — STRUCTURAL) · 1980s (federal class action securing Boxtown utilities — ANCHOR).

STRESS-TEST VERDICT: SUSTAINABLE. Two direct verbatims from the assigned neighbor, three additional named residents on the record, a documented neighborhood history running to the 1860s, a quantified exposure estimate with a named method and a named threshold, and a documented dispute over the monitoring itself. **This is the strongest Neighbor beat in the course.** The one honest limit, stated for markup: Gladney is documented in *statements at a press conference*, not in a household portrait — the record supplies her words and her neighborhood but not her bill, her well, or her family. Section 8 records what could and could not be surfaced.

Beat 4 — Mechanism Autopsy (the turbine permitting path)

Syllabus 2.0 assignment: The turbine permitting path: how equipment legally runs, or doesn't, ahead of paper.

Beat Menu definition: *Mechanism Autopsy* — *Atoms • versatile • fat container*. How the thing physically works, delivered conversationally, never announced as analysis. Rotation is content-native: each lecture autopsies a different mechanism. Hot tier (6–8). **Content check:** L4 autopsied the three-study interconnection gauntlet; L3 the cooling loop; L7 cost-allocation doctrine. **L8 autopsies an exemption.** No overlap.

FACTS, DATES, NAMES, NUMBERS. The mechanism is a **classification**, and it has a name: the **nonroad engine exemption**. Under the Clean Air Act, stationary sources require preconstruction permits; nonroad engines — engines that are mobile, or portable, and not permanently affixed — are regulated federally at the manufacturer level and are not subject to local preconstruction permitting. Shelby County's position, stated publicly: permits are **not required for temporary turbines that operate for less than a year**. Mississippi's position, stated by MDEQ: **portable/temporary turbines do not require an air permit**. xAI's position, in its own court filings: the turbines are **mobile** rather than **stationary** pollution sources, and are meant to operate on a given site for **less than a year**. The appellants' position, filed 16 July 2025: Shelby County's **federally approved Local Implementation Plan contains no exemption for "temporary" large portable turbines**, and the determination would let any entity install any number of new polluting turbines with no written approval, no public notice, no public participation, and no pollution controls. **EPA's position, stated January 2026: temporary turbines exceeding emissions thresholds must be permitted** — and, as of mid-2026, EPA says it is weighing regulatory flexibilities for portable units. **Three regulators, two states, one federal agency, and no agreement.**

THE MECHANISM — end to end. The watt path first, because it is what makes the exemption load-bearing. Colossus 1's grid connection began at approximately **8 MW** and rose to roughly **150 MW** through TVA and MLGW. The IT load was ~150 MW at start and heading toward a million GPUs. **The gap between the interconnection timeline and the compute timeline is the entire reason the turbines exist** — this is L4's seven-year queue and L5's behind-the-meter workaround, arriving in a county that has neither a rate case nor a zoning hearing to slow it down. The turbines are **Solar SMT-130** packaged units: skid- or trailer-mounted simple-cycle gas turbines in the ~13 MW class, designed to be trucked in, set on a pad, connected to a gas header and a switchgear tie, and run. Fifteen of them at ~247.2 MW works out to roughly 16.5 MW apiece as permitted. Because they arrive on wheels and can leave on wheels, they present as *equipment*

rather than as *a power plant* — and the regulatory category they land in depends entirely on how a county or state reads the word “portable.” The legal path: install → operate → (if challenged) apply → public notice → comment → permit or denial → local appeal with automatic stay → board vote → federal citizen suit under the Clean Air Act’s citizen-suit provision → **and then, in June 2026, a motion by the United States to dismiss that citizen suit on enforcement-discretion and national-security grounds. The step where the constraint binds:** the word “temporary.” Nothing else in the chain is negotiable once that word is granted, and everything in the chain is available once it is refused.

KEY ACTORS IN THIS BEAT. *Object:* the **Solar SMT-130** — manufactured by Solar Turbines, a Caterpillar company; mobile packaged configuration; the physical fact of wheels is doing legal work. *Object:* **selective catalytic reduction units** — the BACT that the Shelby County permit required by **1 September 2025**, and which the February 2026 notice records as complete on **6** of the Southaven units. *Institution:* **Shelby County Health Department** (delegated authority under a federally approved Local Implementation Plan). *Institution:* **Mississippi Department of Environmental Quality** — Air Division Chief **Jaricus Whitlock**; spokesperson **Jan Schaefer**; the Permit Board. *Institution:* **EPA**, which is the author of the exemption and, since January 2026, the agency saying it does not apply at these volumes. *Institution:* **Trinity Consultants** (Arkansas-based), the permitting consultancy that prepared MZX Tech’s application and corresponded with MDEQ — the emails later produced under a public records request.

THE DOCUMENTS. The **SCHD air construction permit** (2 July 2025): 15 Solar SMT-130 units, ~247.2 MW, 24/7 operation authorized, **BACT required by 1 September 2025**, expiry **2 January 2027**. What it forces: emissions controls on 15 units. What it forbids: nothing about the other 20. What happens when violated: the permit is the *only* enforceable instrument, which is why appellants attacked the *exemption* rather than the permit. The **MDEQ operations permit** (10 March 2026): **41 permanent turbines**, MZX Tech LLC, at the former Duke Energy site; issued three weeks after the only public hearing; xAI describes the result as unlocking **1.2 GW of self-generating capacity**. The **Trinity Consultants–MDEQ correspondence**, obtained by public records request and reported July 2026, including *Request for Additional Information — Portable Turbines* (November 2025). Skeptical caveat: the March 2026 permit is binding and real; **it does not cover the 59 units already running**, which is the distinction the entire federal case turns on.

VERBATIM BANK.

“install and operate any number of new polluting turbines at any time without any written approval from the Health Department, without any public notice or public participation, and without pollution controls.” — NAACP and Young, Gifted & Green, Air Permit Appeal, filed with the Memphis and Shelby County Air Pollution Control Board, 16 July 2025, characterizing the consequence of the nonroad determination. Quoted in Tennessee Lookout, 16 July 2025.

“MDEQ has determined that portable/temporary turbines do not require an air permit.” — Mississippi Department of Environmental Quality, statement to reporters, July 2026.

“This looks to be an unprecedented level of behind-the-meter gas being installed in one place.” — Ben King, analyst, Rhodium Group, on the 59-turbine emissions analysis, July 2026.

“xAI welcomes today’s decision by the Shelby County Health Department. Our onsite power generation will be equipped with state-of-the-art emissions control technology, making this facility the lowest emitting of its kind in the country.” — xAI, statement, 2 July 2025, FOX13 Memphis.

WHO PAYS. Nobody, on this beat’s ledger — and that is the finding. Behind-the-meter generation of this kind bypasses the interconnection queue, the rate case, the cost-allocation doctrine of L7, and the socialization fight entirely. **The company pays for its own gas and its own turbines; no ratepayer is billed for a network upgrade; and the cost that does move is the one that does not appear on any utility bill.** State it in one clean line: this is the externality swap in its purest form, and the closer (Beat 12) prices it.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Utility-adjacent regulator and the company**, in a rare alignment. The claim as sold: the units are portable, therefore exempt, therefore lawful. What’s real: the exemption exists, is federal, is genuinely intended for mobile equipment, and two state-level regulators have applied it. What’s oversold: 59 units on pads, 6 of them fitted with permanent post-combustion emissions control, supplying primary power to a fixed data center, described as portable equipment operating for less than a year. Narrator move: **HOLD OPEN** — this is a live legal question with EPA on one side, two state regulators on the other, and a federal court hearing scheduled for 24 August

2026 that will settle part of it. **Do not pre-judge it.** What is unknown: whether the individual units have in fact been on their pads for less than a year each; the record does not establish per-unit tenure.

SENSORY & MATERIAL DETAILS. Turbines on pads, photographed from the air in April 2025 and from the ground on Riverport Road on 25 April 2025 (Brandon Dill for The Washington Post / Getty). Selective catalytic reduction skids completed on six units out of fifty-nine. A gas header. A permit that expires on 2 January 2027. Emails between a consultancy and a state agency, released because someone filed a records request.

NUMBERS THAT MATTER. 15 units / ~247.2 MW *permitted capacity* (SCHD, 2 Jul 2025 — ANCHOR) · 41 units *permitted capacity*, 1.2 GW claimed (MDEQ, 10 Mar 2026 — ANCHOR for the permit; the 1.2 GW figure is xAI's own characterization, VOLATILE) · 59 units *installed, unpermitted* (public records request, Jul 2026 — STRUCTURAL, method disclosed) · 27 units *acknowledged by company*, early 2026 (CONTESTED) · 100 short tons/yr threshold (CAA — ANCHOR) · ~8 MW → ~150 MW grid connection (Global Energy Monitor, 2024–25 — STRUCTURAL) · BACT deadline 1 Sept 2025 (SCHD permit — ANCHOR) · permit expiry 2 Jan 2027 (SCHD permit — ANCHOR).

STRESS-TEST VERDICT: SUSTAINABLE. A five-minute autopsy of a single word (“temporary”) with four institutional positions, one federal agency reversing course, a hardware object whose wheels are doing legal work, and a scheduled court date. This is the beat where the lecture's comedy budget lives, and it is entirely deadpan-procedural — no household is in it.

Beat 5 — The Perverse Incentive (vector one's engine: the jobs math)

Syllabus 2.0 assignment: Vector one's engine — the jobs math: ~1 permanent job per \$13M invested vs. ~\$137,000 per job outside the sector; ~50 FTEs per 250,000 sq ft; nearly half of state subsidies requiring no jobs at all.

Beat Menu definition: *The Perverse Incentive* — Politics/Money • versatile, closer-capable. The rule producing the opposite of its intent. “The jobs math (~1 job per \$13M; ~50 FTEs per 250k sq ft) lives here, not as its own beat.” Hot tier (6–8). This beat is where the Step Function detonates.

FACTS, DATES, NAMES, NUMBERS — with the attribution corrected. The must-hit anchor pair — ~1 permanent job per \$13 million invested in Virginia data centers, against ~\$137,000 to create one job outside the sector — is published in Food & Water Watch, “Artificial Jobs: The Illusion of Big Tech's Data Center Employment Claims,” January 2026, and is FWW's own analysis of Virginia Economic Development Partnership announcement data dating back to 1990. It is not a JLARC figure. Syllabus 2.0's cast list and must-hit anchors attribute “the JLARC jobs math (~1 job per \$13M)”; the pack flags this as **Discrepancy #1** in Section 6 and does not substitute. JLARC's December 2024 report supplies a *different* set of figures — 74,000 jobs, \$5.5B labor income, \$9.1B GDP annually, majority construction-phase — sourced to a VEDP response.

The rest of the FWW findings, all January 2026, all FWW analysis of VEDP and BLS data: data centers in Virginia employed approximately **7,600 people in 2024** (FWW's BLS-adjusted estimate; VEDP data alone yields **5,400**); as few as **23,000 people nationally** held a permanent data center job in 2024, being **0.01% of total U.S. jobs** against **4.4% of U.S. electricity usage** (the electricity figure sourced to LBNL's 2024 *United States Data Center Energy Usage Report*, LBNL-2001637, December 2024); including secondary jobs from VEDP data, investment per permanent job 1998–2025 was **\$7.8 million**; and — **the hardest number in the record** — from **2020 through late 2025**, Virginia's data centers created **1 direct permanent job for every \$54 million invested**, against **\$322,000** per permanent non-data-center job, a ratio of **168 to 1**. Virginia's tax exemption cost the state **\$673 million in 2022 alone**, which FWW renders as the median income of nearly **8,000 Virginian households** against an estimated 7,600 data center jobs. Virginia added **2,148 jobs** in the entire NAICS 518210 sector while Dominion connected **933 MW** (2023) and **977 MW** (2024) of data center capacity — **1.12 jobs per MW**.

On the industry side: PwC, for the **Data Center Coalition**, February 2025, reported data centers directly employed **603,000** people nationally in 2023 and supported **4.7 million** jobs — a figure FWW attacks on the ground that it uses the entirety of NAICS 518210 and counts part-time positions without full-time-equivalent conversion. NVTC (sponsored by Amazon and Dominion, among others) estimated data centers in Virginia cumulatively cost **\$203 billion** to build through 2023 and employed **12,140** — which, taken at face value, is **\$16.7 million** per job. NetChoice, lobbying Minnesota in 2024–25 on the 2022 Mangum Economics Wisconsin study, told legislators a new large-scale data center generates **300 full-time operations jobs**, **1,800 construction jobs**, and **\$23 million** in average pay and benefits.

On subsidy design: Good Jobs First, November 2025 — **36 states** with data center sales-and-use tax exemptions; **11** disclose recipients; **5** disclose amounts; **4** disclose jobs promised; **none** disclose both promised and delivered; **only Nevada** discloses wages. States that computed ROI found they lose **52 to 70 cents on the dollar**. Virginia’s qualification threshold is **\$150 million in capital investment and 50 new jobs** — for facilities now routinely costing billions. Georgia and Ohio legislatures voted to suspend or sunset their exemptions; **both governors vetoed**. Greg LeRoy’s earlier work found developers pocketing well over **\$1 million in state subsidies per permanent job created**.

THE MECHANISM — **how the rule produces the opposite of its intent**. A sales-and-use tax exemption is written to attract capital investment. Data centers are the most capital-intensive and least labor-intensive large facility in the modern economy. The exemption is therefore **maximally efficient at attracting exactly the industry that delivers the least of the thing the exemption was justified by**. Then the design compounds it: the qualification threshold is written in dollars (easy to clear) and jobs (a floor set a decade ago at 50, which a single facility clears with its permanent operations staff). Then the disclosure regime compounds it again: because no state reports both jobs promised and jobs created, **the exemption cannot be audited against its own justification by anyone, including the legislature that passed it**. Then the exemption becomes automatic — LeRoy’s word is that states have enacted “virtually automatic” exemptions — which removes the annual appropriation moment at which a legislature would have to look at the number. **The step where the constraint binds**: the moment the exemption became by-right rather than discretionary. After that, no one has to defend it again, and the cost grows without a vote — Virginia’s went from roughly \$733 million to **\$1.6 billion in FY2025, up 118% year over year**.

KEY ACTORS IN THIS BEAT. *Institution: Food & Water Watch* — motive: it explicitly calls for a **national moratorium on data center development**; what it gets if believed: the moratorium. **Name this every time the \$13M figure appears**. *Institution: Good Jobs First* — a nonpartisan corporate-accountability watchdog tracking data center subsidies since 2016; authors Kasia Tarczynska (senior research analyst) and Greg LeRoy (executive director). *Institution: Northern Virginia Technology Council* — a pro-data-center advocacy group sponsored by Amazon and Dominion Energy; publishes the biennial impact report. *Institution: Data Center Coalition / PwC* — the industry’s commissioned economic-impact analysis. *Institution: NetChoice* — the trade association that carried the Mangum numbers into Minnesota’s Senate Taxes Committee. *Human: Ali Ahmad*, Virginia deputy chief of staff, who answered the \$1.6 billion disclosure by citing JLARC’s 74,000 jobs. *Human: State Sen. Brent Taylor* (R-Tennessee), who told the public xAI would move Memphians from SNAP benefits to six-figure wages.

THE DOCUMENTS. *Artificial Jobs: The Illusion of Big Tech’s Data Center Employment Claims*, Food & Water Watch, January 2026 — 4 pages, 28 endnotes, method disclosed (VEDP announcement database filtered to NAICS 518210 with “data center” in the description; BLS QCEW cross-check; 95% confidence interval stated on the 7,600 figure). *Cloudy Data, Costly Deals*, Good Jobs First, November 2025. *Economic Contributions of Data Centers in the United States 2017–2023*, PwC for the Data Center Coalition, February 2025. *The Impact of Data Centers on Virginia’s State and Local Economies, 5th Biennial Report*, NVTC, April 2024. *Virginia Annual Comprehensive Financial Report*, FY ended 30 June 2025. **Every one of these is a seller’s document or a counter-seller’s document, and the beat’s authority comes from saying so about all five**.

VERBATIM BANK.

“Virginia data centers generate just 1 permanent job for every \$13 million invested, based on Virginia Economic Development Partnership (VEDP) data dating back to 1990. In contrast, it cost a mere \$137,000 to create 1 job outside of the data center sector — nearly 100 times less investment.” — Food & Water Watch, Artificial Jobs, January 2026, page 1.

“From 2020 through late 2025, Virginia’s data centers have only created 1 direct, permanent job for every \$54 million invested — 168 times more than what it cost to create 1 permanent non-data center job (\$322,000).” — Food & Water Watch, Artificial Jobs, January 2026, page 2. [This is the markup alternate for the Step Function — see Section 4.]

“Like 35 other states, Virginia is losing control of its spending by enacting virtually automatic sales and use tax exemptions, and sometimes other subsidies, for datacenter building materials and equipment.” — Greg LeRoy, executive director, Good Jobs First, statement to The Register, 7 January 2026.

“Data centers top our 2025 list of most ridiculously subsidized industries.” — Greg LeRoy, Good Jobs First press release, 10 November 2025.

“This is \$1 billion less for food assistance, public health care, roads, schools — public services that everyday Virginians rely on.” — Kasia Tarczynska, senior research analyst, Good Jobs First, to The Center Square, November 2025.

“According to analysis published by Virginia’s nonpartisan Joint Legislative Audit and Review Commission, data centers support 74,000 jobs, bring in \$9.1 billion in Virginia GDP, and generate billions of dollars in local revenue that fund education, public safety, and critical local services.” — Ali Ahmad, Virginia deputy chief of staff, statement to The Register, January 2026. [The state’s defense, in the state’s words — required for the GRANT-AND-WITHHOLD.]

WHO PAYS. Directly and datedly: Virginia forwent **\$1.6 billion** in FY2025 (Virginia ACFR, FY ended 30 June 2025) and **\$673 million** in 2022 (NVTC’s own figure). Texas lost **\$1 billion** in FY2025. Arizona’s program cost grew by more than 1,000% in recent years. States computing ROI found losses of **52–70 cents per dollar**. The bill lands on the state general fund, which is to say on everything a general fund pays for.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician** and, on the other side, an advocacy organization openly campaigning for a moratorium. The FWW numbers are *ratios of announced capital investment to announced permanent jobs* — they are not wrong, and they are also not the same claim as “data centers destroy jobs.” The honest reading, which the beat must carry: **data centers are extraordinarily capital-intensive and that is not a scandal; the scandal, if there is one, is that a subsidy justified by employment was designed for capital.** JLARC’s 74,000 figure is not a competing count of the same thing — it is a modeled figure including construction and indirect employment, and the majority of it is construction-phase, which JLARC itself says. **The two numbers are not in conflict; they are answers to different questions, and a draft that treats them as a contradiction will be wrong.** Narrator move: **GRANT-AND-WITHHOLD**, exactly as assigned. What’s unknown: no state publishes both jobs promised and jobs delivered, so the *actual* delivery rate against *promises* is, by construction, unknowable from public data — which is itself the Perverse Incentive’s punchline.

FLAGGED — the “~half of subsidies with no job requirement” anchor. The pack did **not** locate a source stating that nearly half of state data center subsidies require no job creation at all. The nearest documented statements are Good Jobs First’s finding that only 4 of 36 states disclose jobs promised and none disclose jobs created, and its observation that many sales tax exemptions do not require much permanent-job creation because data centers are extremely capital-intensive. **This is a sourcing gap, not a contradiction. Section 6 records it as Discrepancy #3 and flags it for resolution before the figure enters prose.**

SENSORY & MATERIAL DETAILS. A four-page PDF with 28 endnotes. A statutory threshold of \$150 million and 50 jobs, written for a different decade. Two governors’ vetoes of their own legislatures’ sunset bills. A lobbying handout to a Minnesota Senate committee with a map of neighboring states.

NUMBERS THAT MATTER. ~1 job / \$13M and ~\$137K/job (FWW, Jan 2026, VEDP 1990– — **must-hit anchor; attribution flagged**) · 1 job / \$54M and \$322K/job, 2020–late 2025 (FWW, Jan 2026 — STRUCTURAL, markup alternate) · \$7.8M/job incl. secondary, 1998–2025 (FWW — STRUCTURAL) · 7,600 VA data center employees 2024 (FWW/BLS — CONTESTED) · 5,400 (VEDP alone — CONTESTED) · ~23,000 national, 2024 (FWW — CONTESTED) · 0.01% of U.S. jobs / 4.4% of U.S. electricity (FWW + LBNL-2001637 — STRUCTURAL) · 603,000 direct / 4.7M supported (PwC for Data Center Coalition, Feb 2025 — CONTESTED, seller’s document) · \$203B / 12,140 = \$16.7M per job (NVTC, Apr 2024 — CONTESTED, seller’s own arithmetic turned against it) · 36 / 11 / 5 / 4 / 1 states (Good Jobs First, Nov 2025 — ANCHOR) · 52–70 cents lost per dollar (Good Jobs First — STRUCTURAL, range stays a range) · \$1.6B VA FY2025, +118% (Virginia ACFR — ANCHOR) · \$150M + 50 jobs (Virginia statutory threshold — ANCHOR) · 1.12 jobs/MW (FWW from BLS + Dominion IRPs — STRUCTURAL).

STRESS-TEST VERDICT: SUSTAINABLE — the richest beat in the lecture. Six named institutions with disclosed incentives, three competing methodologies, one seller’s own arithmetic (\$203B / 12,140) that indicts the seller, a statutory threshold that is itself a joke told by a legislature, and two governors vetoing their own legislatures. The Step Function detonates here. One condition: the “~half of subsidies” anchor must be sourced or dropped before Draft 1.

Beat 6 — Follow the Money (subsidies, clawbacks, and the Electrolux building)

Syllabus 2.0 assignment: Subsidy structures and clawbacks; the Electrolux history — subsidized arrival, hyperbolic promises, early exit; xAI bought the very building.

Beat Menu definition: *Follow the Money — Money • versatile • fat container.* Capital structure as narrative: who financed what, collateralized by what, amortized over what. The load-bearing accounting assumption is always the payoff. Hot tier (6–8). **Content check:** L1 followed Loudoun's tax base; L6 followed neocloud capital structure; L7 followed the \$4.3B transmission allocation. **L8 follows a clawback clause that wasn't there.** No overlap.

FACTS, DATES, NAMES, NUMBERS. In **2010**, Tennessee, Shelby County, and Memphis brought Electrolux to Frank C. Pidgeon Industrial Park in southwest Memphis with an estimated **\$188.3 million** in total government incentives — state, local, and federal, including long-term tax breaks. The state's direct share is reported at **at least \$97 million**, commonly rendered as **\$100 million**. A **payment-in-lieu-of-taxes agreement valued at roughly \$33.9 million** reduced the company's **city property tax by 90% and county property tax by 75% for 15 years** — and **exempted Electrolux from the diversity-participation requirements attached to other local tax breaks**. Electrolux committed to **1,240 jobs** within five years of opening. **The 2010 contract contained no clawback provision, and explicitly blocked the participating governments from recouping incentives if the job commitment was missed.** Tennessee began attaching accountability agreements with clawback requirements to state incentive deals **in 2013** — three years later. Construction cost **\$87 million**, of which **\$76 million** went to local firms. Peak employment: **1,100-plus in 2017**, the year the IBEW won its first contract. In **calendar 2018** the company fired **254 full-time and 404 contract workers — 658 people** — and made **just under \$500,000** in PILOT payments. On **31 January 2019** Electrolux announced closure by 2020, with **534 employees** remaining, and a **\$250 million** reinvestment in Springfield, Tennessee. In February 2019 TNECD confirmed **no repayment was required**. Production ended in **2020**.

xAI bought the building. CTC Property LLC took occupancy of **3231 Paul R. Lowry Road** — the former Electrolux plant — in 2024, filing a certificate of occupancy on **23 July 2024**. Elon Musk's stated reason for choosing an abandoned building over a new one was speed: getting AI applications running within **122 days**. And the second half of the arc: on **21 June 2024**, EDGE confirmed **xAI had submitted no application for incentives**. **The company that took nothing moved into the building that took \$188 million.**

THE MECHANISM — the money path. Follow it in the order the money moved. *Electrolux:* public capital in (grants, infrastructure, a 15-year PILOT), private capital in (\$87M construction), jobs promised (1,240), jobs delivered (peak 1,100-plus), jobs at exit (534), public capital recovered (**zero**, because the recovery clause was negotiated out). *The lesson the state drew:* clawbacks, starting 2013 — a policy change that cannot reach backward. *xAI:* private capital in (unstated; the Chamber calls it the largest new-to-market capital investment in Memphis history), public incentives requested (**none, per EDGE**), jobs promised (**up to 500**, per the Chamber), jobs identified by the only public method (**99**, Oligarch Watch, 6 January 2026), tax revenue paid (tens of millions per the Chamber's own account, with the Chamber projecting it to exceed **\$100 million** on current expansion plans), tax revenue ring-fenced for the affected zip code (**\$3.2 million**). *The greywater facility:* **\$80 million** pledged (filed at **\$78 million**), groundbreaking 10 October 2025, construction **paused April 2026**, commitment to restart **Q1 2027**. **The step where the constraint binds:** the clawback. A subsidy without a recapture clause is not an investment; it is a transfer, and the only enforcement mechanism is the next election. A project without a subsidy has no clawback to write — which means the community's leverage is not weaker than Electrolux's, it is *categorically different*, and it lives entirely in the permit.

KEY ACTORS IN THIS BEAT. *Institution:* **EDGE** (Economic Development Growth Engine for Memphis and Shelby County) — administers PILOTs, received Electrolux's annual performance reports, confirmed xAI filed nothing. *Institution:* **TNECD** — spokesman **Scott Harrison**, who delivered the no-clawback finding. *Human:* **Gov. Bill Lee**, who in February 2019 told reporters the episode underscored the importance of clawbacks. *Human:* **Rep. Steve Cohen** (TN-09), whose same-day statement is the congressional record's entry. *Human:* **Alan Shaw**, head of Electrolux Major Appliances North America, who issued the closure statement. *Human:* **Eloise Hale**, Electrolux spokeswoman. *Human:* **Brent Mayo**, xAI General Manager, Memphis — filed the occupancy permit in July 2024; delivered the greywater commitments in October 2025. *Object:* the building — the sign outside with its branding removed.

THE DOCUMENTS. The **2010 Electrolux incentive agreement** — the document whose *missing clause* is the character. What it forces: nothing. What it forbids: recoupment. The **Electrolux Annual Performance Report** filed with EDGE and released publicly **15 February 2019**, disclosing the 254 and 404 terminations and the sub-\$500,000 PILOT payment for 2018. The **EDGE confirmation of 21 June 2024**. The **Memphis City Council ordinance** creating the 38109 fund. The **greywater facility permit filings** (\$78M as filed). Skeptical caveat on the greywater documents: the groundbreaking

was a ceremony with a mayor, a utility CEO, a TVA CEO, and a councilman in attendance; the construction pause came six months later; a restart commitment for Q1 2027 was reported by MLGW's CEO as having been made in a meeting. **A commitment relayed from a meeting is not a permit condition, and the pack says so.**

VERBATIM BANK.

"Electrolux was a company that scammed the city of Memphis. Electrolux came to our city and promised jobs, promised prosperity, similar to what xAI is doing, and then they left. They left without fulfilling the promise of jobs." — KeShaun Pearson, executive director, Memphis Community Against Pollution, Democracy Now!, 25 April 2025. [This is the Roster's assigned Electrolux comparison, verbatim, with attribution and date. Debt DI partially discharged here.]

"The process now for incentives is that if a company does not deliver on what is promised, then there is an ability to retrieve those funds, and I want to make sure that we do that going forward." — Gov. Bill Lee, to reporters, February 2019, Associated Press.

"I'm very disappointed that the employees of Electrolux learned today that Memphis' economic development investment in one company's future apparently won't pay off." — Rep. Steve Cohen (TN-09), press release, 31 January 2019.

"Promises continue to be made, but those promises continue not to come true." — KeShaun Pearson, founder, Memphis Community Against Pollution, Action News 5, 5 March 2026.

"xAI will bring up to 500 quality, high-paying jobs to Memphis in its initial phase, with plans to grow more." — Greater Memphis Chamber, published xAI FAQ (seller's own document).

WHO PAYS. The Electrolux ledger is closed and the answer is: Tennessee, Shelby County, and Memphis paid an estimated \$188.3 million and recovered nothing, and 534 people lost jobs in 2020 after 658 lost them in 2018. **[HUMAN FLOOR — this sentence and the two around it.]** The xAI ledger is open and reads differently: no incentives applied for, tens of millions in local tax paid per the Chamber, \$3.2 million ring-fenced, and a contested exposure with no dollar figure. The honest framing for the draft: **these are two different transactions, and the second one is better on the tax ledger and worse on the air ledger, and the community's position is that it was never offered a choice between them.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician** (state and local, 2010 vintage) and **the Chamber** (2024 vintage). The claim as sold in 2010: 1,240 jobs and a supplier ripple estimated at 3,600 more. What was real: over 1,100 jobs for several years, an IBEW contract, \$76 million to local contractors. What was oversold: everything after 2017, and the assumption that a company would stay. The claim as sold in 2024: up to 500 jobs. What's real: xAI is hiring in Memphis, has paid substantial local tax, and took no state money. What's oversold: 500. Narrator move: **GRANT-AND-WITHHOLD.** Unknown: xAI's actual Memphis headcount. Contested: whether the greywater facility gets built — the pack has a groundbreaking, a pause, and a relayed commitment, and nothing enforceable.

SENSORY & MATERIAL DETAILS. A sign with the branding taken off it. A 15-year PILOT that cut city taxes 90% and county taxes 75%. A performance report submitted to a development agency and released on a Friday afternoon. A 122-day build inside somebody else's oven factory. **[Inference flagged: the pack has not verified the internal reuse of Electrolux's plant structure beyond the address and Musk's own speed rationale. Do not describe the interior.]**

NUMBERS THAT MATTER. \$188.3M total incentives / ≥\$97M state / ~\$33.9M PILOT (2010 agreement, Commercial Appeal + TNECD — ANCHOR) · 1,240 jobs committed (2010 agreement — ANCHOR) · 90% city / 75% county / 15 years (PILOT terms, EDGE — ANCHOR) · 1,100+ peak 2017 (TNECD — STRUCTURAL) · 254 + 404 = 658 terminations, 2018 (EDGE Annual Performance Report — ANCHOR) · <\$500,000 PILOT payment 2018 (same — ANCHOR) · 534 at closure announcement (TNECD, 31 Jan 2019 — ANCHOR) · \$250M Springfield reinvestment (Electrolux, 31 Jan 2019 — ANCHOR) · \$0 recovered (TNECD, Feb 2019 — ANCHOR) · 2013 (clawbacks begin — ANCHOR) · \$87M construction / \$76M local (pre-opening tour record — STRUCTURAL) · 122 days (Musk, 2024 — STRUCTURAL, self-reported) · no incentive application (EDGE, 21 Jun 2024 — ANCHOR) · up to 500 jobs promised (Chamber — ANCHOR as a promise) · 99 identified employees (Oligarch Watch, 6 Jan 2026 — CONTESTED, method disclosed, adversarial vantage) · 44 open positions (same date — CONTESTED) · \$80M / \$78M greywater (pledge vs. filing — STRUCTURAL) · \$3.2M fund (21 Oct 2025 — ANCHOR).

STRESS-TEST VERDICT: SUSTAINABLE. A missing contract clause as the causal agent; a state that learned the lesson three years too late; a performance report with the termination counts in it; a governor on the record about clawbacks; and the same building, bought again, by a company that asked for nothing. The arc is complete, dated at every joint, and the rhyme (subsidized arrival → hyperbolic promise → exit) is *documented*, not asserted — because the second company’s promise is on the Chamber’s own website with a number in it.

Beat 7 — Operator Reality (vector three, delivered through the fifty people inside the avatar) [HUMAN FLOOR]

Syllabus 2.0 assignment: Vector three delivered through the fifty people inside the avatar — the one place you can drive to and point at the thing that might take your job, staffed by fifty.

Beat Menu definition: *Operator Reality* — *Atoms/Character* • *versatile*. The ~50 people running a building the size of an aircraft carrier: shift structure, maintenance treadmill, the plumbing trades suddenly load-bearing in an industry that thought it was software. Sourced from job postings, staffing disclosures, and trade-press interviews — humanizes without inventing anyone. Cold specialist (1–3). **Cap check:** the L7 pack recorded that “the fifty-people-in-an-aircraft-carrier material is assigned to **L8** as vector three’s delivery mechanism” and declined the beat there to avoid burning it. **This is its assigned home. PASS.**

FACTS, DATES, NAMES, NUMBERS. The staffing ratios, with their bases stated. Uptime Institute’s published operations figures: **8 to 12 full-time operations staff per megawatt** at smaller facilities, and **1 to 2 staff per megawatt** at large hyperscale campuses benefiting from automation and scale. At the top of the scale the ratio compresses further: hyperscale facilities above **100 MW** report staffing ratios as low as **0.2–0.3 staff per MW**, and the most automated campuses above 100 MW operate with **20–30 permanent staff per 100 MW**. Applied: a **50 MW** hyperscale campus runs **50 to 80 permanent staff**. A colocation facility of **20 MW** — which supports many customers’ hands — might run **80 to 150**. An edge site of 1–5 MW runs **5 to 15**. Construction is the mirror image: **0.7–2.0 workers per MW**, and CBRE’s 2024 North America Data Center Trends report estimates a typical **50 MW** build requires **400 to 600 construction workers at peak**, with campuses above 100 MW employing **800 to 1,200 simultaneously**. Crusoe’s own count for Abilene: **7,000 electricians, construction professionals, and skilled tradespeople** coming to the site every day during the build (Crusoe statement, June 2026 — *seller’s own figure, and it is a construction figure*). Uptime’s global staffing forecast: from roughly **2.0 million full-time-equivalent roles in 2019 to about 2.3 million by 2025**. Uptime’s 2024 survey: **42% of operators** lost key staff to competitors offering **15% to 25%** salary increases, concentrated in Northern Virginia and Phoenix. Uptime’s 2025 annual survey finds the labor shortfall has not worsened.

At Memphis specifically: MLGW’s 2024 public estimate was **300-plus** permanent jobs; the Chamber promised **up to 500**; the only public headcount attempt with a stated method found **99** identifiable employees and **44** open positions as of 6 January 2026, with more than half of identified employees hired from outside the region.

The vector-three demand side, dated and attributed: **Pew Research Center**, survey conducted 7–13 October 2024 among 5,273 employed U.S. adults — **52%** of workers worried about the future impact of AI in the workplace; **32%** think it will lead to fewer job opportunities for them in the long run; **36%** hopeful; **33%** overwhelmed. **Pew**, June 2025 survey of 5,023 U.S. adults — **50%** of U.S. adults more concerned than excited about AI in daily life, against **37%** in 2021; **10%** more excited than concerned. **Pew**, September 2025 — **21%** of workers say some of their work is done with AI, up from 16% in 2024; **65%** of American workers say they don’t use AI much or at all in their job. **Reuters/Ipsos**, 2025 — **71%** feared AI could lead to permanent job losses; **June 2026** — **53%** feared AI could put them or someone in their household out of work. **Gallup**, 2026 — **18%** of employees think AI or automation is likely to eliminate their own job within five years. **Anthropic Public Record**, first wave, fielded November–December 2025 with **51,993** U.S. adults through YouGov, weighted to Census benchmarks — **AI-induced job loss is the most common AI fear in every single state, held by 64% of Americans.**

THE MECHANISM. The staffing curve and the fear curve run in opposite directions, and the beat is the place they cross. Physically: a hyperscale AI building runs on shifts — critical facilities technicians, electrical and mechanical maintenance, network operations, physical security, facility management, 24 hours a day. AI clusters running bare-metal GPUs need *more* hands per rack than virtualized cloud, not fewer: GPU swaps, liquid-cooling maintenance, and higher power-density management are hands-on work, which is why the industry’s fastest-growing operations salaries — **40% to 120% above traditional operations roles** — are in GPU clusters and liquid cooling, and why entry-level engineering hiring fell **25%–60%** from 2024 to 2025 as AI tools absorbed junior work. **The same industry that is compressing entry-level knowledge**

work is bidding up pipefitters. The projected U.S. shortfall in data center roles is on the order of **340,000 jobs by end of 2026.** **The step where the constraint binds:** the building cannot be pointed at as an employer, because at 100+ MW it employs on the order of a few dozen people — and it cannot be pointed at as an automation machine either, because what it is doing to employment is happening in offices four states away. **The avatar is load-bearing precisely because it is the only physical object in a distributed phenomenon.**

KEY ACTORS IN THIS BEAT. *Institution:* **Uptime Institute** — the industry’s standards body and survey house; vantage: it sells research and certification to operators, so its staffing figures are operator-reported. *Institution:* **CBRE** — commercial real estate services; vantage: it brokers the buildings. *Institution:* **Pew Research Center, Reuters/Ipsos, Gallup, Anthropic** — four survey houses with four different question wordings producing four different numbers, all correct for what they asked. *Human:* **Melody Freemon**, executive director, Greater Memphis Workforce Development Board, on the record October 2025 about the pipeline into xAI. *Human:* **State Sen. Brent Taylor** (R-TN), on the SNAP-to-six-figures claim. *Object:* the rack, the cold plate, the GPU that has to be physically swapped by a person on a shift.

THE DOCUMENTS. *Uptime Institute Global Data Center Staffing Forecast 2021–2025* (announced 26 January 2020) and the *Uptime Institute Global Data Center Survey 2025*. *CBRE North America Data Center Trends*, 2024 and 2025 editions. *U.S. Workers Are More Worried Than Hopeful About Future AI Use in the Workplace*, Pew Research Center, published 25 February 2025 on an October 2024 field. The **AI Action Plan’s own workforce sections** — “Empower American Workers in the Age of AI” and “Train a Skilled Workforce for AI Infrastructure” — which name the occupations the federal government expects the buildout to create: **electricians, advanced HVAC technicians**, and other high-paying trades, delivered through Registered Apprenticeships, CTE, and a proposed **AI Workforce Research Hub under DOL.** **That is the federal government answering vector three, in writing, and its answer is a trades pipeline.**

VERBATIM BANK.

“AI will improve the lives of Americans by complementing their work—not replacing it.” — Winning the Race: America’s AI Action Plan, *The White House*, July 2025, Introduction, page 2.

“To build the infrastructure needed to power America’s AI future, we must also invest in the workforce that will build, operate, and maintain it—including roles such as electricians, advanced HVAC technicians, and a host of other high-paying occupations.” — Winning the Race: America’s AI Action Plan, July 2025, Pillar II, “Train a Skilled Workforce for AI Infrastructure,” page 17.

“Led by DOL, leverage available discretionary funding, where appropriate, to fund rapid retraining for individuals impacted by AI-related job displacement.” — Winning the Race: America’s AI Action Plan, July 2025, Pillar I, “Empower American Workers in the Age of AI,” page 7.

“A huge thank you to our partners and investors for supporting our vision — and to the 7,000 electricians, construction pros, and skilled tradespeople who come to Abilene every day to build the future of AI infrastructure.” — Crusoe, statement on topping out the final Abilene building, June 2026 (seller’s own document; a construction figure, not an operations figure).

“We know that jobs are coming. We know that talent is here. We wanna make sure we’re not just putting people in any ole jobs. We wanna put people on a pathway to self-sustainability.” — Melody Freemon, executive director, Greater Memphis Workforce Development Board, *localmemphis.com*, 21 October 2025.

WHO PAYS. No cost allocation runs through this beat. State it in one line: **the labor cost of an AI data center is small, front-loaded into construction, and the permanent payroll is the smallest line on the operating statement — which is exactly why the jobs pitch had to be made in the first place, and exactly why it could not be kept.**

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician** (SNAP to six figures; the Digital Delta; 25,000 onsite jobs), plus **the Doomer** direction in the automation discourse. The folklore to be **STRIPPed**, exactly as assigned: *“the building down the road is the AI coming for your job.”* Strip the personification. What is left standing, all documented: 64% of Americans in every state naming job loss as their top AI fear (Anthropic, Nov–Dec 2025, n=51,993); 52% of workers worried and 32% expecting fewer opportunities (Pew, Oct 2024, n=5,273); a real automation economics literature; **and a building that employs on the order of a few dozen people.** The narrator does not mock anyone who

believes the folklore, because the folklore is a reasonable inference from the only visible object. What's oversold in the other direction: that the fear is irrational. It is not — the surveys are consistent across four houses and four question wordings. What's oversold by the industry: construction jobs presented as permanent jobs. **Every large jobs number in this territory is a construction number, and the beat's job is to say so once, clearly, with the Crusoe 7,000 and the Oracle 25,000 as the exhibits — both from the sellers' own documents.**

SENSORY & MATERIAL DETAILS. Shift handoffs at a facility running 24/7. A GPU swap performed by hand. Liquid-cooling maintenance in a building that thought it was software. Salaries 40%–120% above traditional operations roles for people who can tune a two-phase loop. Seven thousand tradespeople arriving in Abilene, Texas every morning to build a thing that will be run by a fraction of a percent of them. A hiring event in Memphis running noon to 2 p.m. and 6 to 8 p.m.

NUMBERS THAT MATTER. 8–12 staff/MW small facilities; 1–2 staff/MW hyperscale (Uptime — STRUCTURAL, ranges stay ranges) · 0.2–0.3 staff/MW at 100+ MW (industry compilation, 2026 — STRUCTURAL) · 20–30 permanent staff per 100 MW (Nov 2025 workforce analysis — STRUCTURAL) · 50–80 permanent staff at 50 MW (STRUCTURAL) · ~50 FTEs per 250,000 sq ft (Syllabus 1.0 must-hit anchor — carried; see Section 6, Discrepancy #2, on its basis) · 400–600 construction workers at peak for 50 MW; 800–1,200 for 100+ MW (CBRE 2024 — STRUCTURAL) · 7,000 daily tradespeople, Abilene (Crusoe, Jun 2026 — seller-reported, VOLATILE) · 25,000+ onsite jobs across five Stargate sites (Oracle/OpenAI, Sept 2025 — announced, CONTESTED) · 2.0M → 2.3M global FTE roles 2019→2025 (Uptime — STRUCTURAL) · 42% of operators losing staff to 15–25% raises (Uptime 2024 — STRUCTURAL) · 340,000 projected U.S. shortfall by end 2026 (industry estimate — CONTESTED) · 52% / 32% / 36% / 33% (Pew, field 7–13 Oct 2024, n=5,273 — ANCHOR at that date) · 50% concerned vs. 10% excited; 37% in 2021 (Pew, June 2025, n=5,023 — ANCHOR at that date) · 71% (Reuters/Ipsos 2025) and 53% (Reuters/Ipsos June 2026) — CONTESTED, different questions · 18% (Gallup 2026) — STRUCTURAL · **64% in every state (Anthropic Public Record, Nov–Dec 2025, n=51,993 — ANCHOR at that date; note the surveying party's interest).**

STRESS-TEST VERDICT: SUSTAINABLE. Four independent survey houses with four question wordings and four numbers, a staffing curve with published ratios at four facility scales, the federal government's own written answer to the fear (a trades pipeline), and the Kicker's number sitting at the end. The beat's honest limit: **the pack found no named, on-the-record data center operator in Memphis** — no shift technician interview, no staffing disclosure, no trade-press profile of a named worker at Colossus. The beat therefore builds on ratios, postings, and surveys rather than on a person, and the draft must not invent one.

Beat 8 — The Paper Trail (class: executive document — “Winning the Race”)

Syllabus 2.0 assignment: “Winning the Race”: what it says, what it forces, what it conditions.

Beat Menu definition: *The Paper Trail* — Politics • versatile, closer-capable • all 10 lectures. A named document as causal actor. Sustained by: what the document says, who wrote it and why, what it forces, what it forbids, and what happens when someone violates it. **Rotation rule:** a different document class each lecture. **Class here:** executive document, position 8 of 10. PASS.

FACTS, DATES, NAMES, NUMBERS. *Winning the Race: America's AI Action Plan*, The White House, July 2025, released 23 July 2025 at the “Winning the AI Race” event alongside **three executive orders**. Roughly **25 pages** including front matter and a deliberately blank page 24. **Over 90 federal policy actions** across **three pillars** — Accelerate AI Innovation; Build American AI Infrastructure; Lead in International AI Diplomacy and Security. Drafted by the **White House Office of Science and Technology Policy** following a request for information that drew **more than 10,000 comments**. Signed on its face by **Michael J. Kratsios** (Assistant to the President for Science and Technology), **David O. Sacks** (Special Advisor for AI and Crypto), and **Marco A. Rubio** (Assistant to the President for National Security Affairs). Issued pursuant to **Executive Order 14179** of 23 January 2025, Federal Register 90 (20) 8741. It opens with a quoted epigraph from the President.

THE MECHANISM — what an executive document actually does. This is the beat's load-bearing distinction and the pack's central finding on the assigned document. **The Action Plan forces nothing.** It is a policy blueprint: it “identifies,” it “recommends,” its operative verbs are *led by, explore, establish, convene, prioritize*. It creates no cause of action, binds no state, appropriates no money. Its own closing line describes it as a roadmap. What it *does* is set a policy predicate that later instruments cite — and the instrument that cites it, and that carries teeth, is **Executive Order 14365** of 11 December 2025, *Ensuring a National Policy Framework for Artificial Intelligence*. That order creates an **AI Litigation Task Force** at

DOJ within 30 days whose *sole responsibility* is to challenge state AI laws; directs Commerce within 90 days to publish an evaluation identifying “onerous” state AI laws; directs that **BEAD non-deployment funds** be made unavailable to states with such laws, to the maximum extent allowed by federal law; directs agencies to assess whether their **discretionary grant programs** may be conditioned on states not enacting, or agreeing not to enforce, conflicting AI laws; directs FCC and FTC proceedings; and directs a legislative recommendation. **The step where the constraint binds:** §5. Not the litigation, which must survive a court; not the Commerce evaluation, which is a list. **The money.** A grant condition operates before anyone gets to court.

And then the sentence that changes this lecture. EO 14365 §8(b) instructs that the legislative recommendation **shall not propose preempting** otherwise lawful state AI laws relating to (i) child safety protections; (ii) **AI compute and data center infrastructure, other than generally applicable permitting reforms**; (iii) state government procurement and use of AI; and (iv) other topics to be determined. **The federal preemption campaign expressly carves out data center regulation.** A draft that lets the listener believe the moratorium wave and the preemption push are the same collision will be factually wrong, and the Regulatory Collision beat (11) exists to run that distinction properly.

KEY ACTORS IN THIS BEAT. *Document:* the Action Plan. *Document:* EO 14365 — its operative successor. *Human:* **Michael J. Kratsios** — Assistant to the President for Science and Technology; OSTP is the drafting shop. *Human:* **David O. Sacks** — Special Advisor for AI and Crypto; EO 14365 requires the Task Force to consult him “from time to time,” and requires agencies assessing grant conditions to consult him. **A special advisor named as a consultation node in four separate sections of an executive order is a fact worth stating flatly.** *Human:* **Marco A. Rubio** — Assistant to the President for National Security Affairs; his signature is what makes the document a national-security instrument rather than an industrial-policy one. *Human:* **Vice President JD Vance**, whose Paris remarks of 11 February 2025 supply the word “onerous” at footnote 2. *Institution:* **OMB**, directed to work with agencies so they consider a state’s AI regulatory climate in funding decisions. *Institution:* **FCC**, directed to evaluate whether state AI regulations interfere with its Communications Act obligations, and later to open a preemption proceeding. *Institution:* **NTIA/Commerce**, under 47 U.S.C. 902(b), which is where BEAD lives.

THE DOCUMENTS. Treated exhaustively in Section 5. Here, the operative pairing: the Action Plan says what the government wants; EO 14365 says what the government will do to states that want otherwise; and the **BEAD Policy Notice** required within 90 days of 11 December 2025 is the instrument that actually moves money.

VERBATIM BANK. (*All U.S. Government works; quoted at length without restriction.*)

*“The United States is in a race to achieve global dominance in artificial intelligence (AI). Whoever has the largest AI ecosystem will set global AI standards and reap broad economic and military benefits. **Just like we won the space race, it is imperative that the United States and its allies win this race.**” — Winning the Race: America’s AI Action Plan, The White House, July 2025, Introduction, page 1. **THE ASSIGNED VERBATIM. Existence gate: PASS.***

“AI is far too important to smother in bureaucracy at this early stage, whether at the state or Federal level. The Federal government should not allow AI-related Federal funding to be directed toward states with burdensome AI regulations that waste these funds, but should also not interfere with states’ rights to pass prudent laws that are not unduly restrictive to innovation.” — Same, Pillar I, “Remove Red Tape and Onerous Regulation,” page 3.

*“Led by OMB, work with Federal agencies that have AI-related discretionary funding programs to ensure, consistent with applicable law, that they consider a state’s AI regulatory climate when making funding decisions and limit funding if the state’s AI regulatory regimes may hinder the effectiveness of that funding or award.” — Same, page 3. **This is the “funding conditioned on the absence of onerous state regulation” anchor, in the document’s own words.***

“Simply put, we need to ‘Build, Baby, Build!’” — Same, Introduction, page 1.

“Establish new Categorical Exclusions under NEPA to cover data center-related actions that normally do not have a significant effect on the environment.” — Same, Pillar II, page 14.

“Explore the need for a nationwide Clean Water Act Section 404 permit for data centers, and, if adopted, ensure that this permit does not require a Pre-Construction Notification and covers development sites consistent with the size

of a modern AI data center.” — Same, Pillar II, page 14. [Read this one flat next to Memphis. The document proposing a nationwide permit that requires no pre-construction notification was published three weeks after a county granted a permit for 15 turbines out of roughly 35 already running.]

“Expedite environmental permitting by streamlining or reducing regulations promulgated under the Clean Air Act, the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and other relevant related laws.” — Same, Pillar II, pages 14–15.

“Within 30 days of the date of this order, the Attorney General shall establish an AI Litigation Task Force (Task Force) whose sole responsibility shall be to challenge State AI laws inconsistent with the policy set forth in section 2 of this order...” — Executive Order 14365, Ensuring a National Policy Framework for Artificial Intelligence, 11 December 2025, §3.

“That Policy Notice must provide that States with onerous AI laws identified pursuant to section 4 of this order are ineligible for non-deployment funds, to the maximum extent allowed by Federal law.” — EO 14365, §5(a).

*“(b) The legislative recommendation called for in subsection (a) of this section shall not propose preempting otherwise lawful State AI laws relating to: (i) child safety protections; (ii) AI compute and data center infrastructure, other than generally applicable permitting reforms; (iii) State government procurement and use of AI; and (iv) other topics as shall be determined.” — EO 14365, §8(b). **The carve-out.***

WHO PAYS. The Action Plan allocates nothing. EO 14365 allocates **BEAD non-deployment funds** — a subset of a program established by the 2021 Bipartisan Infrastructure Law to extend high-speed internet to underserved communities, and reduced by the administration’s own “Benefit of the Bargain” reforms. **The money at risk in the federal-state standoff over AI regulation is broadband money for rural and underserved households.** That is the who-pays of this beat, and it is one sentence long and should be delivered without emphasis.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician at the national altitude** — the strongest and most explicit deployment of the seller in the course. What it gets if believed: a deregulatory mandate, a preemption predicate, a budget line, and an argument that ends other arguments. What’s real, granted precisely: the permitting system genuinely is slow; the grid genuinely does need to be built; a 50-state regulatory patchwork genuinely does impose real compliance costs on startups; and the competition with China is a real strategic fact that serious people on both sides of American politics take seriously. What’s oversold: the space-race analogy itself. **The space race was a federally funded program executed by a federal agency toward a defined public objective. This is a privately financed capital buildout in which the federal role is to remove obstacles.** The analogy does real work as motivation and none as description, and naming that is the beat’s sharpest available move — delivered flat, without sneering, because the analogy is also *sincere*. Narrator move as assigned: **the Politician, at every altitude**, with the calibration held identical to the county’s. What’s unknown: whether the Commerce evaluation of “onerous” state laws has been published and what it contains; the pack has not located it. **Flag for draft-stage pull.**

SENSORY & MATERIAL DETAILS. Twenty-five pages, three signatures, one deliberately blank page. An epigraph from a president on page i. Over 10,000 public comments condensed into 90 policy actions. Footnote 2 quoting a vice president quoting himself in Paris. A White House URL that still carries the leaked draft’s more combative title while the page it loads carries the milder published one.

NUMBERS THAT MATTER. 23 July 2025 (release — ANCHOR) · 90+ policy actions / 3 pillars (ANCHOR) · 10,000+ RFI comments (ANCHOR) · EO 14179, 23 Jan 2025, FR 90(20)8741 (ANCHOR) · EO 14365, 11 Dec 2025 (ANCHOR) · 30 days / 90 days (EO 14365 clocks — ANCHOR) · 47 U.S.C. 902(b) and 1702(e)-(f) (BEAD authorities — ANCHOR).

STRESS-TEST VERDICT: SUSTAINABLE. Two documents, one of which is famous and forces nothing and one of which is obscure and forces everything; a space-race sentence that is the Verbatim; a NEPA categorical exclusion and a Clean Water Act §404 proposal that read very differently after Beat 4; and a carve-out in §8(b) that quietly concedes the entire subject of this course. **Markup note:** the beat is assigned to “Winning the Race” alone. The pack recommends the assignment be read as *the executive-document class*, covering both instruments, because the assigned questions — what it forces, what it conditions — are answerable only from EO 14365. This is a scoping note, not a swap.

Beat 9 — The Symbol Audit (Stargate as a construction schedule) — deployment 2 of 3

Syllabus 2.0 assignment: Stargate as a construction schedule rather than a moonshot — deployment 2 of 3; **absorbs The Deal's announcement-to-groundbreaking sequence.**

Beat Menu definition: *The Symbol Audit — Politics • versatile, closer-capable • hard cap: 3 deployments.* A symbolically loaded object treated strictly as procurement. “Comedy-native and very this-course — which is exactly why it's capped.”

Cap check: L5 (Three Mile Island / Crane) · L8 (Stargate) · L9 (orbital). Three deliberate castings, cap ≤3. PASS — and this is the second.

FACTS, DATES, NAMES, NUMBERS — the schedule, in order. **21 January 2025:** Stargate announced — OpenAI, Oracle, SoftBank; **\$500 billion, 10 gigawatts** (*announced*). **July 2024, six months before the announcement:** construction had already begun at the Lancium Clean Campus in Abilene, Texas. **Five months before the announcement:** OpenAI's development partner **Crusoe** filed a permit in Texas to build a **360.5 MW** simple-cycle gas power plant on what would become the Stargate site. **It was approved six days later.** **December 2024:** Crusoe ordered **10 GE Vernova turbines**. **June 2025:** Crusoe bought **19 more**, collectively capable of over a gigawatt. **Crusoe did not buy combined-cycle turbines** — the backbone of the U.S. grid — because lead times for those had grown to as long as **seven years**; it bought **aeroderivative** units, which is to say jet engines. **March 2025:** construction begins on buildings three and four; building permits show a planned completion of **March 2026**. **July 2025:** OpenAI and Oracle enter an agreement to develop up to **4.5 GW** of additional Stargate capacity, described as a partnership exceeding **\$300 billion** over five years. **22 September 2025:** Oracle's fact sheet — over **5.5 GW**, over **25,000 onsite jobs**, more than **4,800 acres**. **23 September 2025:** five new sites announced; **nearly 7 GW planned, over \$400 billion** over three years; “ahead of schedule.” **30 September 2025:** Crusoe announces phase one live — two buildings, **980,000 sq ft, 200 MW+ of IT** (*energized*). **22 October 2025:** the Midwest site is confirmed as Wisconsin, developed by Oracle with Vantage. **9 March 2026:** Oracle publicly calls reports about Abilene false and incorrect, states two buildings are fully operational and that leasing for the 4.5 GW commitment is completed. **March 2026:** Bloomberg and Reuters report OpenAI walked away from the **600 MW** Abilene expansion; Nvidia reportedly paid Crusoe a **\$150 million deposit** to hold the space and approached Meta about the lease; no Meta deal confirmed. **March 2026:** Microsoft reported to have leased the remainder of the site. **24 March 2026:** satellite imagery (Airbus DS) captured for Epoch AI's site survey. **17 April 2026:** Epoch AI's assessment — Abilene at **0.3 GW operational** (~250,000 H100-equivalents) against **1.2 GW projected; four of eight buildings** estimated operational; seven sites total, **over 9 GW planned**, projected to exceed 9 GW by 2029. **June 2026:** Crusoe tops out the final Abilene building; buildings three and four, permitted for March 2026 completion, are **still not online**. Oracle is reported to carry **more than \$100 billion in debt** funding Stargate commitments with negative free cash flow, and shareholders have sued over disclosure.

THE MECHANISM — what a construction schedule actually is. Strip the name and Stargate is a sequence of ordinary procurement decisions under an extraordinary clock. The binding constraint was never capital; it was **turbine lead time**, and the workaround was a substitution: aeroderivative jet-engine turbines instead of combined-cycle plants, trading roughly ten points of thermal efficiency and higher fuel cost for delivery inside a year instead of inside seven. The second binding constraint was **permitting**, and the workaround was a Texas jurisdiction that approved a 360.5 MW power plant in **six days**. The third was **building schedule**, and there the workaround failed: buildings three and four missed by a quarter or more. **The step where the constraint binds:** the turbine order date. Everything upstream of December 2024 is a press release; everything downstream is a delivery schedule that money cannot compress. **And the announcement-to-groundbreaking sequence — the Deal material this beat absorbs — runs the wrong way: ground was broken in July 2024, the plant was permitted in the autumn of 2024, and the \$500 billion announcement happened in January 2025. The symbol was applied to a construction site that was already six months old.**

KEY ACTORS IN THIS BEAT. *Institution:* **Crusoe** — vertically integrated AI infrastructure provider; CEO and co-founder **Chase Lochmiller**; the party that actually filed the permits and ordered the turbines. *Institution:* **Lancium**, owner of the ~1,000-acre Clean Campus the buildings sit on. *Institution:* **Oracle** — the tenant of record on the Abilene buildings for OpenAI; the party carrying the debt. *Institution:* **OpenAI** — the announcing party and the walker-away from 600 MW. *Institution:* **SoftBank** — named in the announcement, largely absent from the construction record the pack surfaced. *Institution:* **GE Vernova** — the turbine supplier; 29 aeroderivative units across two orders. *Institution:* **Nvidia** — the \$150 million deposit. *Object:* the **aeroderivative turbine** — a jet engine on a skid, bought because the real power plant had a seven-year queue.

THE DOCUMENTS. *Oracle Fact Sheet: Stargate Data Centers*, 22 September 2025, entered into the congressional record via Rep. Arrington's office — a document marked confidential and internal on its face that is now a public exhibit. Crusoe's **Texas air permit application** for a 360.5 MW simple-cycle plant, filed ~August 2024, approved six days later. **Building permits** for Abilene buildings three and four showing March 2026 completion. Oracle's **X post of 9 March 2026** disputing press reports. The **shareholder suit** against Oracle over buildout disclosure (14 January 2026 per the L6 pack's record of the Oracle bondholder action; the disclosure suit is separately reported in March 2026 — **flagged: two distinct actions, do not merge**).

VERBATIM BANK.

"New data centers put Stargate ahead of schedule to secure full \$500 billion, 10-gigawatt commitment by end of 2025." — OpenAI, "OpenAI, Oracle, and SoftBank expand Stargate with five new AI data center sites," 23 September 2025 (seller's own document).

"The three new sites, combined with Abilene and the nearby expansion, can deliver over 5.5 gigawatts of capacity, and are expected to create over 25,000 onsite jobs, and tens of thousands of additional jobs across the U.S. ... These campuses collectively encompass more than 4,800 acres." — Oracle, Oracle Fact Sheet: Stargate Data Centers, 22 September 2025.

"One of the defining challenges of our generation is to energize AI infrastructure at the scale needed to power the ambitions of our world's greatest innovators." — Chase Lochmiller, co-founder and CEO, Crusoe, 30 September 2025.

WHO PAYS. Privately, and that is the finding — Abilene is behind-the-meter gas on a private campus, which means the Stargate build is *not* a socialized-cost story the way L7's transmission fight was. What moved publicly: a Texas permitting process that cleared a 360.5 MW plant in six days, and a county tax base. What moved onto a balance sheet: Oracle's reported **\$100 billion-plus** in debt against negative free cash flow, and a shareholder suit. **The bill on this beat is a corporate one, and the beat should say so plainly — because the contrast with Memphis, where the bill is in the air, and with Loudoun, where it is on a residential rate, is the whole point of running all three in one course.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Hyperscaler and the Politician**, jointly — Stargate was announced from the White House. What's real: four of eight buildings operational, 0.3 GW energized, 980,000 sq ft, GB200 racks running training and inference, 7,000 tradespeople on site during the build. **This is a genuinely enormous real thing and the audit must grant it in full before it discounts anything.** What's oversold: "ahead of schedule," against buildings permitted for March 2026 that were not online in June 2026; 10 GW and \$500 billion as *announced* figures against 0.3 GW *energized*; and 25,000 onsite jobs presented without the word "construction." Narrator move: **GRANT-AND-WITHHOLD**, with the **committed/contracted/energized** discipline doing the work. **CONTESTED, presented as conflict:** Bloomberg and Reuters report the 600 MW expansion was dropped; Oracle publicly calls such reporting false and says leasing is completed. Both statements are on the record, dated, and attributed. The pack does not resolve them.

SENSORY & MATERIAL DETAILS. Jet engines on skids in a West Texas field, bought because the real power plants had a seven-year queue. A thousand acres called a Clean Campus. A permit approved in six days. Four thousand eight hundred acres across seven sites. A satellite photograph taken on 24 March 2026. A \$150 million deposit paid to hold 600 megawatts of empty space.

NUMBERS THAT MATTER. \$500B / 10 GW *announced* (21 Jan 2025 — ANCHOR as an announcement, must-hit) · 0.3 GW *energized*, 4 of 8 buildings (Epoch AI, 17 Apr 2026 — VOLATILE) · 1.2 GW *projected* (VOLATILE) · 200 MW+ IT / 980,000 sq ft, two buildings (Crusoe, 30 Sept 2025 — STRUCTURAL) · 360.5 MW plant permitted in 6 days (Texas filing, 2024 — ANCHOR) · 10 + 19 = 29 GE Vernova aeroderivative turbines (Dec 2024, Jun 2025 — STRUCTURAL) · 7-year combined-cycle lead time (STRUCTURAL; **cross-check: L4 owns turbine lead times — cite, do not rebuild**) · 4.5 GW / \$300B+ Oracle-OpenAI (Jul 2025 — announced, CONTESTED) · 7 GW / \$400B+ (Sept 2025 — announced, CONTESTED) · 5.5 GW / 25,000 onsite jobs / 4,800 acres (Oracle fact sheet, 22 Sept 2025 — announced, CONTESTED) · 9+ GW by 2029 *projected* (Epoch AI — CONTESTED) · 600 MW expansion / \$150M Nvidia deposit (Mar 2026 — CONTESTED, disputed) · \$100B+ Oracle debt (Mar 2026 reporting — VOLATILE).

STRESS-TEST VERDICT: SUSTAINABLE. The beat has a documented six-day permit, a documented turbine substitution driven by a seven-year lead time, a documented missed completion date visible in building permits, a satellite

photograph, a confidential fact sheet that became a congressional exhibit, and a \$150 million deposit on empty space. The Deal material it absorbs is intact — and the sequence's punchline is that the announcement came *after* the groundbreaking. Comedy-native, comedy-safe, no household in it.

Beat 10 — The Steelman (*defendant: the White House's race logic*)

Syllabus 2.0 assignment: The national-security case at full strength.

Beat Menu definition: *The Steelman* — Audit • never opener • strongly encouraged, not universal. The full-throated strongest case for whoever's about to look worst. Sustained by the defendant's actual numbers and constraints — **a précis of the weak version is not a steelman**. Rotation rule: a different defendant every deployment; the same party never twice. Target 6–8 lectures. **Rotation check: deployment 6 of 8; defendant not previously used. PASS.**

THE DEFENDANT'S CASE, IN THE DEFENDANT'S OWN DOCUMENTS AND NUMBERS. The strongest version of the race logic does not rest on rhetoric. It rests on four things the record actually supports.

One: the grid premise is empirically correct. The Action Plan's Pillar II opens by stating that AI is the first digital service in modern life that challenges America to build vastly greater energy generation than it has today, that American energy capacity has stagnated since the 1970s while China has rapidly built out its grid, and that America's path to AI dominance depends on changing that trend. **This is not a contested claim.** It is the same fact L4 built a lecture on: twenty years of flat U.S. demand ending at once, against a competitor adding generation at a rate the U.S. has not matched in half a century. The document's diagnosis is right.

Two: the permitting premise is empirically correct. The Plan states that America's environmental permitting system makes it almost impossible to build this infrastructure at the required speed. The course has already documented, in L4, an interconnection queue running past seven years. The steelman's version: **a country that takes seven years to connect a load and four years to permit a transmission line does not get to describe itself as competitive**, and every categorical exclusion, FAST-41 expansion, and §404 nationwide permit in Pillar II is a direct response to a measured, documented failure.

Three: the patchwork premise is stated with specifics. EO 14365 does not merely assert a patchwork; it names the mechanism — fifty regulatory regimes making compliance disproportionately hard for startups — and it names a specific law and a specific theory: Colorado's ban on algorithmic discrimination, which the order argues may force models to produce false results in order to avoid a differential impact on protected groups. **Whatever one thinks of that reading, it is a legal argument with a named statute attached, and the DOJ then filed it in court under the Equal Protection Clause and won a temporary suspension.** A theory that produces an enforceable court order within four months is not a talking point.

Four — and this is the strongest and most uncomfortable part — the national-security premise is now sworn testimony. On 15–16 June 2026 the United States filed a declaration by **Cameron Stanley**, the Department of War's Chief Digital and Artificial Intelligence Officer, stating under oath that Grok is one of a small number of proprietary state-of-the-art models capable of national-security applications; that it operates on Secret and Top Secret classified networks; that it supported recent U.S. strikes against Iran; and that it supports the Marvin Smart System, which the declaration says enabled the deployment of over 2,000 munitions to 2,000 distinct targets within 96 hours during Operation Epic Fury. **The steelman's argument is not that pollution does not matter. It is that a district court weighing a citizen suit does not have, and cannot acquire, the information needed to trade off an air-permitting violation against the availability of a system in that role — and that the Clean Air Act itself gives the United States primacy over citizen-enforcers on enforcement discretion, precisely so that the executive can make that call.** The government's brief also raises the constitutional version: that the decision whether to pursue or forgo enforcement of federal law is an executive function that private litigation cannot override.

THE MECHANISM. The race logic is a *sequencing argument*, and stating it that way is what makes it a steelman rather than a slogan. It does not claim the local costs are zero. It claims they are **recoverable and the strategic position is not** — that a turbine can be retrofitted, a permit can be issued retroactively, a neighborhood can be compensated, and a lead in frontier AI, once lost, cannot be re-acquired on any schedule the country controls. **The step where the constraint binds:** the asymmetry claim. The whole argument stands or falls on whether the strategic loss is genuinely irreversible while the local harms are genuinely reversible — and the honest counter, which belongs in Beat 12, not here, is that some of the local costs are also irreversible, and that irreversibility is the closer's whole subject in L10.

THE DEFENDANT’S BEST DOCUMENTS. *Winning the Race*, Pillar II opening and permitting sections. EO 14365 §§1–2 and §8(b) — **note that §8(b)(ii) is itself part of the steelman: the administration’s own legislative recommendation declines to preempt state data center regulation, which is evidence that the preemption campaign is narrower and more targeted than its critics describe.** The DOJ memorandum in support of intervention, June 2026. The Stanley declaration.

VERBATIM BANK.

“AI is the first digital service in modern life that challenges America to build vastly greater energy generation than we have today. American energy capacity has stagnated since the 1970s while China has rapidly built out their grid. America’s path to AI dominance depends on changing this troubling trend.” — Winning the Race, Pillar II opening, page 14.

“Like most general-purpose technologies of the past, AI will require new infrastructure—factories to produce chips, data centers to run those chips, and new sources of energy to power it all. America’s environmental permitting system and other regulations make it almost impossible to build this infrastructure in the United States with the speed that is required.” — Same, page 14.

“But we remain in the earliest days of this technological revolution and are in a race with adversaries for supremacy within it.” — Executive Order 14365, §1, 11 December 2025.

“the Clean Air Act affords the United States primacy over citizen-enforcers when it comes to enforcement discretion.” — United States motion to intervene and dismiss, N.D. Miss., filed 15–16 June 2026.

“In doing so, the NAACP threatens American national, economic, and energy security by seeking to shut off the power supply for artificial-intelligence innovation that supports the Department of War’s military operations.” — Same motion.

“Grok represents one of only four proprietary state-of-the-art AI models currently capable of national security applications.” — Declaration of Cameron Stanley, Department of War, attached to the United States’ motion, June 2026. [CONTESTED RENDERING: secondary sources render the count as both “four” and “three.” Section 6 flags it. The draft must not state a number it cannot verify from the declaration itself — pull the filing at draft stage.]

WHO PAYS. On the steelman’s own terms: the nation pays if the race is lost, and the payment is denominated in something the defendant argues cannot be priced — military capability and standard-setting authority. The pack notes, without adjudicating, that this is the one who-pays claim in the entire course that **refuses to be denominated**, and that a course whose mantra is *power in, heat out, who pays* should say that out loud rather than pretend the argument is made in bad faith.

WHAT’S CONTESTED. The steelman’s weakest joint, named honestly so the pileup in Beats 11–12 has something to hit: **the filing did not dispute that the turbines lack required permits.** It argued that the enforcement question belongs to the executive. That is a jurisdictional argument, not a factual one, and it concedes the underlying fact. Second weak joint: the Action Plan’s own worker-first language — AI will complement work, not replace it — sits in the same document as the Plan’s directive to fund **rapid retraining for individuals impacted by AI-related job displacement.** Both sentences are in the document. **State the tension; do not editorialize it.**

MARKUP ALTERNATE. The Department of War’s operational-dependency case is a **distinct party** from the White House and would satisfy the never-twice rule independently. If markup wants the harder steelman, the Stanley declaration is a stronger single artifact than the Action Plan, because it is sworn. Recorded as an alternate; **the assignment stands.**

STRESS-TEST VERDICT: SUSTAINABLE. Four independent load-bearing premises, three of which are empirically supported by facts this course has already established in earlier lectures, plus a sworn declaration. This is the strongest steelman in the course by evidentiary weight, and it is the one most likely to make a listener uncomfortable — which is what the beat is for.

Beat 11 — The Regulatory Collision (state moratoria vs. federal preemption)

Syllabus 2.0 assignment: State moratoria vs. federal preemption; the AI Litigation Task Force; funding conditions meeting Lecture 7's wave head-on.

Beat Menu definition: *The Regulatory Collision — Politics • versatile, closer-capable.* Two authorities claiming the same jurisdiction. **Sustained by steelmanning both jurisdictions' legal theories before the collision.** Warm tier (4–5).

FACTS, DATES, NAMES, NUMBERS. *The federal side.* EO 14365, 11 December 2025. Task Force established at DOJ, operative from **10 January 2026**; Cato confirms formation that month. Commerce evaluation due within **90 days**. BEAD Policy Notice due within **90 days**, conditioning **non-deployment funds**. FCC proceeding due within 90 days of the Commerce identification. FTC policy statement due within 90 days. **March 2026:** the National AI Legislative Framework issued. **9 April 2026:** xAI sues Colorado AG Philip J. Weiser in D. Colo. over SB24-205. **24 April 2026:** DOJ moves to intervene and files a complaint in intervention on Equal Protection grounds — **the first time the federal government has sought to invalidate a state AI law in court.** AAG Harmeet K. Dhillon issues a public statement. **27 April 2026:** the court grants a joint motion suspending enforcement of the Colorado AI Act. **May 2026:** Colorado replaces SB 24-205 with SB 26-189 and enacts HB 26-1263, the Chatbot Safety Act (signed 29 May 2026, effective 1 January 2027); the enforcement stay explicitly covers legislation replacing or amending SB 24-205; AG Weiser states he will not enforce SB 26-189 until rulemaking concludes, by 1 January 2027; xAI signals a new preliminary-injunction motion against the replacement law. **19 December 2025:** nearly two dozen state AGs write to the FCC opposing preemptive AI regulation. **9 December 2025:** 42 state AGs write to AI companies on child safety.

The state and local side — the L7 wave, updated. **267** data-center-related bills across 40-plus states in 2025. In 2026: **more than 300** bills across **more than 30 states** (DLA Piper, July 2026); moratorium bills introduced in **11 states** (MultiState) or considered in **at least 12** (DLA Piper) or **14** (Bisnow) — **three counters, three definitions, three numbers; keep them separate.** **More than 100 local moratoria** adopted nationwide (Columbia/Sabin tally); Good Jobs First counts **54 passed of at least 63 local actions**. Michigan is the most active state, with close to **50 counties** enacting or considering bans, covering an area roughly the size of Rhode Island. An estimated **\$64 billion** in projects blocked or delayed by community opposition; a separate compilation puts it at **more than \$60 billion** blocked or delayed by **140+ local groups**. **24 April 2026:** Maine Gov. Janet Mills vetoes **LD 307** (>20 MW, until 1 November 2027). **4 June 2026:** New York passes the **Responsible Data Center Development Act** (S10642/A11560), one-year moratorium on state permits for ≥20 MW facilities, Senate **44–16**, Assembly **102–39**; Gov. Hochul has taken no position. **May–4 June 2026:** Hill County, Texas enacts and then rescinds a moratorium after a developer sues, replacing it with a checklist. **13 June 2026:** Arizona pauses its data center tax incentive. **1 July 2026:** Illinois' pause takes effect; Ohio's 25 MW constitutional-amendment ballot measure fails to qualify with roughly **70,000 of 413,488** required signatures. **Virginia:** 15 data center bills enacted this session; Del. Irene Shin's 1 MW moratorium bill (to July 2028 or until interconnection requests are fulfilled) held in committee; a court invalidated project approvals in **Prince William County** on procedural grounds. **Federal counter-move: S.4214**, introduced by Sen. Bernie Sanders (I-VT) **25 March 2026**, with House companion **H.R.9442** introduced by Rep. Alexandria Ocasio-Cortez (D-NY-14) **24 June 2026** with nine cosponsors — halting construction or upgrading of covered AI data centers until Congress passes safeguards and expressly terminates the moratorium. New Hampshire moves the opposite way, enacting an off-grid electricity providers law easing self-supplied power.

THE MECHANISM — and the distinction that makes this beat honest. These are two different collisions, and the lecture must not merge them.

Collision A — AI model regulation vs. federal preemption. The federal instruments (EO 14365, the Task Force, the Commerce evaluation, the FCC and FTC proceedings, BEAD conditioning) target state laws regulating **AI models**: transparency, disclosure, algorithmic-discrimination duties, chatbot safety. That is where the litigation is, and it has produced one enforcement stay in one state.

Collision B — data center siting vs. everything. The moratorium wave targets **buildings**: megawatt thresholds, permits, zoning, water, tax incentives. **EO 14365 §8(b)(ii) expressly excludes this territory from the recommended preemption framework** — AI compute and data center infrastructure, other than generally applicable permitting reforms. The Action Plan's own data-center actions are *permitting reforms* (NEPA categorical exclusions, FAST-41 expansion, a possible §404 nationwide permit, federal land) — federal levers applied to federal processes, not preemption of state land use.

So where do they actually collide? In three places, and only three, and each is documented. **(1) The funding condition.** §5(b) directs agencies to assess whether discretionary grants may be conditioned on states not enacting *or agreeing not to enforce* conflicting AI laws. If a state's data center law is characterized as an AI law, the condition reaches it. Nothing in

the record establishes that any agency has done so. **(2) The permitting-reform clause.** “Other than generally applicable permitting reforms” is an exception whose width has not been tested; a nationwide §404 permit requiring no pre-construction notification would, in practice, remove a review step that state and local objectors currently use. **(3) The enforcement-discretion theory.** The June 2026 Mississippi filing is the collision made physical: a federal executive telling a federal court that a citizen’s enforcement of a federal environmental statute against a data center’s power plant should be dismissed because the executive has decided otherwise. **That is not preemption of a state law. It is preemption of a citizen. The step where the constraint binds:** enforcement discretion. Every other lever in this beat has to survive a court; that one *is* the court argument.

BOTH JURISDICTIONS’ THEORIES, STEELMANNED — as the Beat Menu requires. *The federal theory:* interstate commerce genuinely is federal; a fifty-state patchwork genuinely does impose asymmetric costs on smaller developers; the Spending Clause genuinely does permit conditions on discretionary grants within limits; and enforcement discretion genuinely is an executive function with substantial constitutional support. *The state and local theory:* land use, zoning, water allocation, utility ratemaking, and public health permitting are the **paradigm** state and local powers, older than the Commerce Clause jurisprudence being invoked against them; the Clean Air Act’s citizen-suit provision was written by Congress precisely because Congress did not trust executives to always enforce; and a grant condition that reaches beyond the purpose of the grant is coercion, which is the argument the states will make. **Neither theory is a strawman and the beat fails if either is played as one.**

KEY ACTORS. *Institution:* the **AI Litigation Task Force**, DOJ. *Human:* **Harmeet K. Dhillon**, AAG for Civil Rights. *Human:* **Philip J. Weiser**, Colorado Attorney General — a defendant who has himself expressed reservations about the law he is defending, along with Gov. **Jared Polis**, both noting that a state-by-state patchwork poses challenges. *Human:* **State Rep. Brianna Titone**, a sponsor of SB24-205. *Human:* **Gov. Janet Mills** (Maine), who agreed with a moratorium and vetoed it. *Human:* **Gov. Gretchen Whitmer** (Michigan), who calls a moratorium a non-starter while ~50 of her counties consider them. *Human:* **Gov. Kathy Hochul** (New York), who has taken no position on the first statewide moratorium to reach a governor’s desk. *Human:* **Sen. Bernie Sanders** and **Rep. Alexandria Ocasio-Cortez**. *Institution:* **xAI** — simultaneously the plaintiff attacking a state AI law and the defendant in a federal environmental suit where the United States has intervened on its side. **That single fact is the beat’s spine.**

VERBATIM BANK.

“State-by-State regulation by definition creates a patchwork of 50 different regulatory regimes that makes compliance more challenging, particularly for start-ups.” — Executive Order 14365, §1, 11 December 2025.

“Executive departments and agencies (agencies) shall assess their discretionary grant programs... and determine whether agencies may condition such grants on States either not enacting an AI law that conflicts with the policy of this order... or, for those States that have enacted such laws, on those States entering into a binding agreement with the relevant agency not to enforce any such laws during the performance period in which it receives the discretionary funding.” — EO 14365, §5(b).

“a moratorium is appropriate given the impacts of massive data centers in other states” — Gov. Janet Mills of Maine, veto message on LD 307, 24 April 2026 — objecting only to the absence of a carve-out for a \$550 million project in Jay.

“The whole point of the law that we put in place was to prevent discrimination.” — State Rep. Brianna Titone, sponsor of Colorado SB24-205, GovTech, April 2026.

WHO PAYS. The BEAD non-deployment funds — broadband money for underserved households — are the explicit chip in §5(a). Beyond that: the **\$60–64 billion** in projects blocked or delayed by local opposition is a cost borne by developers and, arguably, by the counties that would have collected the tax; and the moratorium wave’s costs land on whichever side of the ledger the reader is standing on, which is why the beat prices both.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. Seller: **the Politician at every altitude**, in both directions. Narrator move: **HOLD OPEN** — this is a live constitutional question being litigated in at least two federal courts, with a hearing on 24 August 2026 and a Colorado rulemaking deadline of 1 January 2027. Style Guide §5 names it explicitly: federal preemption vs. state moratoria is settled in court. What is genuinely unknown: whether the Commerce evaluation

has been published; whether any agency has actually conditioned a grant; whether the DOJ's Colorado intervention was a Task Force action (DOJ's own press statement did not say so, and its complaint raised no commerce theory).

NUMBERS THAT MATTER. 267 bills / 40+ states, 2025 (MultiState — ANCHOR at that date) · 300+ bills / 30+ states, 2026 (DLA Piper, Jul 2026 — VOLATILE) · 11 / 12 / 14 states considering moratoria (three counters — **CONTESTED; keep all three, name each counter**) · 100+ local moratoria (Columbia/Sabin — VOLATILE) · 54 of 63 local actions passed (Good Jobs First — VOLATILE) · ~50 Michigan counties (VOLATILE) · \$64B blocked or delayed (DLA Piper — CONTESTED) · \$60B+ / 140+ groups (alternate compilation — CONTESTED) · 44–16 and 102–39 (New York, 4 Jun 2026 — ANCHOR) · 20 MW threshold (NY and Maine — ANCHOR) · 70,000 of 413,488 signatures (Ohio, 1 Jul 2026 — ANCHOR) · 15 Virginia bills enacted (2026 session — STRUCTURAL) · 10 Jan 2026 (Task Force operative — ANCHOR) · **11+ states with active moratorium bills (Syllabus 1.0/L7 must-hit anchor — carried; see Section 6, Discrepancy #4).**

STRESS-TEST VERDICT: SUSTAINABLE. Two collisions properly separated, both jurisdictions' theories genuinely steelmannable, one company appearing on opposite sides of two federal cases in the same quarter, a governor vetoing a bill she agrees with, and a carve-out clause that quietly concedes the course's entire subject matter. The one hazard is arithmetic: four separate counters publish four different moratorium tallies and a careless draft will average them.

Beat 12 — The Externality Swap [C] (local burden vs. national claim, both sides priced) [HUMAN FLOOR]

Syllabus 2.0 assignment: Local burden vs. national claim, now fully priced on both sides — the swap Lecture 1 seeded.

Beat Menu definition: *The Externality Swap — Atoms/Money • versatile, closer-capable.* The pick-your-poison tradeoff. **Sustained by pricing both sides of the swap honestly — the beat fails if one option is a strawman.** Warm tier, proposed for re-band to hot (Open Item 2). **Scope discipline:** L1 stated the swap for the first time under an explicit first-statement discipline; **this lecture prices it fully.** The L1 pack recorded that its Beat 11 “holds only under its first-statement scope discipline” — meaning the full pricing was deferred to here. **Debt discharged.**

FACTS ON THE LOCAL SIDE, PRICED. Exposure, in the units the record supplies: 59 unpermitted turbines across two states; manufacturer profiles for 30 of them projecting nearly **2,500 short tons of NO_x**, **4,000 short tons of CO**, and **22 short tons of formaldehyde** annually at 80% capacity against a **100 short ton** Clean Air Act threshold; SELC's estimate of **1,200–2,000 tons** of NO_x from Colossus 1 alone; MCAP sensors reporting peak NO_x up **79%**; a metro area with among the worst asthma rates in the nation; a zip code with a median household income just under **\$37,000**; two consecutive years of ozone averages exceeding federal limits; a permit for 15 units out of ~35 installed; an appeal denied 6–1; a federal suit the United States has moved to dismiss. Water: Colossus 1's requirement estimated at over **1 million gallons per day** — about **1%** of MLGW's daily aquifer draw — with the company requesting up to **3.7 million gallons per day** across both Memphis sites and contractually capped at **1.2 million gallons per day** under its MLGW agreement; an **\$80 million** greywater plant pledged, ground broken **10 October 2025**, paused **April 2026**, restart committed for **Q1 2027**. And on the other side of the local ledger: **no state incentive application** (EDGE, 21 June 2024), **\$15–20 million** projected annual local property taxes, **\$500,000** in additional annual MLGW PILOT payments, a **\$3.2 million** dedicated fund for the 38109 zip code, and hiring that is real if smaller than promised.

FACTS ON THE NATIONAL SIDE, PRICED. A sworn declaration that a model running on this compute supports operations on classified networks and was used in strikes on Iran. A documented flat-demand-to-surge grid inflection and a permitting system the government's own document says makes building nearly impossible at the required speed. A capital program — Stargate alone — of **\$500 billion announced** and **0.3 GW energized**, employing **7,000 tradespeople daily** at one site during construction. A federal workforce program answering the displacement fear with Registered Apprenticeships and a DOL research hub. And, on the other side of the national ledger: **64% of Americans in every state naming AI job loss as their top fear** (Anthropic, n=51,993, Nov–Dec 2025); **52% of workers worried, 32% expecting fewer opportunities** (Pew, Oct 2024, n=5,273); a subsidy architecture that costs states **52 to 70 cents on the dollar** and cost Virginia **\$1.6 billion in FY2025**; and a jobs ratio of roughly **1 permanent job per \$13 million invested** — or **1 per \$54 million** on the most recent five-year window.

THE MECHANISM — the swap, stated as a swap. Both sides are real and neither is free, and the beat's job is to make the exchange rate visible. *Choose the local option* — permit slowly, litigate the exemption, honor the moratorium — and you get: a slower buildout, load served by a grid that took seven years to connect it, socialized transmission costs of the kind L7 documented at **\$4.3 billion across seven PJM states in 2024**, and a strategic position the government argues cannot

be recovered. *Choose the national option* — behind-the-meter gas, categorical exclusions, nationwide permits, enforcement discretion — and you get: speed, private capital bearing the grid cost instead of ratepayers, **and the entire cost relocating from a rate base to a fence line.** That relocation is the swap. **It is not a swap between cost and no cost. It is a swap between a cost that is billed and a cost that is breathed** — and the reason it is politically durable is that the billed cost has a constituency with a statutory forum (the rate case) and the breathed one has a county health department, a seven-member volunteer board, and a citizen suit the executive is moving to dismiss. **The step where the constraint binds:** the forum. Whichever cost has a docket gets contested; whichever cost does not, gets paid.

KEY ACTORS. Every actor already introduced, arriving at the register. No new cast in the closer.

THE DOCUMENTS. No new documents in the closer. The closer's authority is arithmetic performed on documents already in evidence.

VERBATIM BANK — the closing inventory.

“Just like we won the space race, it is imperative that the United States and its allies win this race.” — Winning the Race, page 1. [If the Verbatim is deployed in Beat 8, it cannot be redeployed here — one per lecture. Available as an echo in paraphrase only.]

“We deserve clean air, clean water, clean soil just like they have in Collierville, just like they have in Germantown, just like these other zip codes where the majority of people are white.” — KeShaun Pearson, Memphis Community Against Pollution, WREG/Nexstar, 2025.

WHO PAYS — the beat's entire content. Locally: households in 38109 and in Southaven, in short tons and in asthma rates, with no dollar denomination available because none has been published. Nationally: the general funds of 36 states, at 52–70 cents on the dollar; BEAD non-deployment funds; and, on the defendant's own account, a strategic position that refuses to be denominated at all. **The closer's honest landing is that two of the three currencies in this trade have no exchange rate, and the one that does — the tax expenditure — is the smallest.**

THE KICKER'S MATERIAL. Assigned: *the physical avatar of automation fear employs fifty people.* Verified in Beat 7 and Section 4. The adjacent facts the closing passage needs, all in evidence: 64% of Americans in every state name job loss as their top AI fear; a hyperscale campus above 100 MW runs at 0.2–0.3 staff per megawatt; 7,000 tradespeople built one Texas site and a fraction of a percent of them will run it; and the federal government's written answer to the fear is an apprenticeship program.

THE HANDOFF — a door explicitly not opened. Material in Section 10. The seam is documented and it is *native*: on **4–5 March 2026**, in the middle of this fight, from this cornfield, the same company announced it would put data centers in orbit — and the response on the record came from KeShaun Pearson and from Sarah Houston of Protect Our Aquifer, both saying the same thing in different words: finish the one on the ground first.

WHAT'S CONTESTED. Everything, which is the point. Narrator move: **HOLD OPEN**, resolving nothing, per the assignment — the FRAMING verdict stays sealed until L10's Irreversibility Ledger. What the closer must *not* do: pick a vector. The frame is “nobody wrong on their own terms,” and the beat fails the moment one altitude becomes the villain.

SENSORY & MATERIAL DETAILS. A fence line with a distance. A permit with an expiry date of 2 January 2027. A greywater plant with a groundbreaking photograph and no construction on it. A seven-member board. A state line. A docket number. **[Inference flag: the pack has *not* located published fence-line distances in feet or decibel readings at either Memphis site. Do not state them. Residents' documented complaints about noise and odor are available; measurements are not.]**

STRESS-TEST VERDICT: SUSTAINABLE. Both sides genuinely priced from documents already in evidence, no new cast, no summary, an arithmetic landing rather than a sentimental one, and a Handoff seam that is *in the record* rather than manufactured. The closer's one discipline, stated for the drafter: it must resist the pull toward a verdict, because the verdict belongs to Lecture 10.

SECTION 2 SUMMARY VERDICT LINE (for markup): 12/12 beats SUSTAINABLE as assigned. No THIN or UNBUILDABLE verdicts. Four assignments survive on explicit conditions, each of which is a draft-stage gate rather than a beat-level failure:

1. **Beat 5** — the “~half of subsidies with no job requirement” anchor is **unsourced in this pack**. Section 6 Discrepancy #3. Must be sourced or dropped before it enters prose.
2. **Beat 5** — the ~1 job/\$13M and ~\$137K/job figures are **Food & Water Watch, not JLARC**. Section 6 Discrepancy #1. The figures are solid; the attribution in Syllabus 2.0 is not.
3. **Beat 8** — the assigned document (“Winning the Race”) **forces nothing**; the operative instrument is EO 14365. The pack recommends the beat be read as covering the executive-document *class*. Scoping note, not a swap.
4. **Beat 7** — the beat builds on ratios, job postings, and surveys because **no named, on-the-record data center operator surfaced in the Memphis record**. The draft must not invent one.

Two further notes for the Schema. **First**, the strawman’s running order buries the lecture’s single most detonating fact — the United States moving to dismiss a Clean Air Act citizen suit against the turbines on national-security grounds, June 2026 — inside Beats 10 and 11, arriving at minute 50 of a 60-minute hour. The material is powerful enough that markup should consider whether the Steelman/Collision pair sits too late. **The pack proposes nothing and re-sequences nothing**; it flags the weight distribution and stops. **Second**, the Hearing Room opener is legal and strong, but note that this lecture’s opener and L10’s are both Hearing Room deployments and L5’s is the third — the rotation holds, and the three room *types* are genuinely distinct (utility proceeding, county air board, audit register), which is the condition the rotation was written to protect.

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

Ten beats sit unused in the strawman. For each: what the record actually contains, whether a swap case exists, and a verdict. Rule of engagement, carried from the L1 and L6 packs: a swap is recommended only if the unused beat’s documented material is *stronger than an assigned beat’s* and the swap breaks no cascade edge, cap, or rotation. **Two near-misses surfaced; zero swaps recommended; both near-misses go to Nick with the cases stated.**

1. Cold Open on an Object — *Atoms • opener only*. **Scan: MARGINAL — NO.** The record holds a genuinely strong object: the **Solar SMT-130**, a Caterpillar/Solar Turbines packaged gas turbine, trailer-mounted, roughly 16.5 MW as permitted, delivered by truck, set on a pad, tied into a gas header, and — decisively for this lecture — **legally classified by its wheels**. Manufacture, cost, lead time, and tolerances are partially documented; chain of custody is documented through the permit. *Swap case*: Cold Open displacing The Hearing Room as opener. *Case against, three ways*. First, the opener rotation assigns Cold Open to lectures **2, 4, and 6** — three distinct objects, and the budget is spent. Second, L4 already opened on a 400,000-pound transformer on a Schnabel railcar; a second gas-turbine-on-a-trailer open inside the same course is exactly the calcification the rotation exists to prevent. Third, and most important, the SMT-130’s power in *this* lecture is not that it is a machine but that it is a **classification** — and a classification is a Mechanism Autopsy, which is where the strawman correctly put it (Beat 4). **Verdict: correctly left out; the object rides inside Beat 4 as the autopsy’s specimen.**

2. The Bill Arrives — *Money • opener-preferred, closer-capable*. **Scan: NO.** The defining fiscal fact of Memphis is that **no bill arrived** — EDGE confirmed on 21 June 2024 that xAI filed no incentive application, and MLGW projects the utility relationship as net-positive. The one genuine bill in this territory is the state general fund’s, and it is Virginia’s, and it is L7’s and L1’s material. Opener rotation assigns Bill Arrives to **3 and 7**; the budget is spent. **Verdict: correctly left out — and the absence is itself a finding the County beat carries.**

3. The Wrong Map — *Politics • opener-preferred*. **Scan: NO, with a real temptation named so the draft resists it.** There *is* an origin-geography story here — a 1980s federal class action, a refinery, a coal plant, a pesticide manufacturer, an ethylene-oxide emitter, and then a vacant appliance factory with 150 MW of industrial service already sitting on it. That is a compounding chain, and it is genuinely Wrong Map-shaped. But opener rotation assigns Wrong Map to **1 and 9**, the budget is spent, and — the substantive objection — **this lecture’s geography is not an accident of the 1990s internet; it is a deliberate, documented, century-long pattern of industrial siting**. Calling that a “wrong map” would soften it into a coincidence, which the human-floor rule forbids. **Verdict: correctly left out; the neighborhood history rides inside Beat 3 where it belongs, told straight.**

4. The Forecast Problem — *Money/Politics • versatile*. **Scan: NO.** This lecture’s numbers are *announcements* and *permits*, not load forecasts. The nearest candidates — Stargate’s 10 GW and the Chamber’s 500 jobs — are promises, not filed forecasts with a rate case attached, and the Symbol Audit and the Perverse Incentive already run them under the announced-vs-spent discipline. The forecast-as-fiction material is L4’s (Wilson’s inflection call, phantom load) and L1’s

(IEA/EPRI/LBNL as authored documents). **Verdict: correctly left out; running it here would rebuild L4's beat with weaker evidence.**

5. The Physics Audit — *Atoms/Audit • versatile, closer-capable*. **Scan: MARGINAL — NO, but the closest call in the scan.** *What the record holds:* a genuinely audit-grade physics claim. Simple-cycle aeroderivative turbines run roughly ten points below combined-cycle thermal efficiency; Crusoe bought jet engines instead of power plants **because combined-cycle lead times had reached seven years**; and the resulting emissions arithmetic is quantified — manufacturer profiles for 30 of 59 Southaven units projecting nearly 2,500 short tons of NOx annually at 80% capacity against a **100 short ton** statutory threshold. That is a claim (“this is backup power”) audited against a number, which is the beat’s exact mechanism. *Swap case:* Physics Audit displacing **Beat 4, Mechanism Autopsy**, on the grounds that the autopsy is really an audit. *Case against:* the two would be the same five minutes. The autopsy’s subject is the *legal* path — how equipment runs ahead of paper — and its punchline is a word, not a number. Converting it to a Physics Audit would trade a jurisdictional mechanism the lecture needs for an efficiency argument the lecture can deliver in two sentences inside the autopsy. Appearance budget also counts against: Physics Audit is warm (4–5), proposed for re-band to hot (Open Item 2), and its strongest deployments are in the Atoms-led lectures. **Verdict: no swap; the efficiency arithmetic and the 100-ton threshold are folded into Beat 4 and Beat 12, where they already sit. Banked for markup: if Draft 1 shows Beat 4 running short, the aeroderivative-efficiency material is the pre-approved thickening agent.**

6. The Bottleneck — *Atoms • versatile*. **Scan: NO.** The turbine-lead-time bottleneck is real and it is *load-bearing in this territory* — the seven-year combined-cycle queue is the reason Abilene runs on jet engines and, indirectly, the reason Memphis runs on trailers. **But the transformer-and-turbine bottleneck is L4's, fully built, and the Beat Menu's rotation discipline makes rebuilding it here a duplication.** Beat 9 cites it in one clause and moves on. **Verdict: correctly left out; cite L4's installation, never rebuild it.**

7. The Founder Audit — *Character/Money • versatile • never lecture 1*. **Scan: MARGINAL — NO. This is the scan's most unusual near-miss and it needs to be stated carefully.** *What the record holds:* the founder is present in this territory at extraordinary density — the 122-day build claim, the September 2024 online post, the orbital announcement of 4–5 March 2026, the February 2026 SpaceX–xAI merger at a **\$1.25 trillion** combined valuation, the June 2026 IPO, and the fact that the same person's company is simultaneously the plaintiff attacking a state AI law and the defendant the United States intervened to protect. That is a complete founder-audit arc: mythology (122 days, the fastest build in history) versus the filed record (permits filed after installation; a merger; a valuation mark). *Swap case:* Founder Audit displacing **Beat 7, Operator Reality**, on the grounds that Operator Reality is the weakest-sourced beat in the lecture. *Case against, and it is decisive on three grounds.* **(a) The cap and the casting.** Founder Audit's natural homes per the Beat Menu are lectures **5, 6, and 9**; the Roster casts **Michael Intrator** in 6 and **Philip Johnston** in 9, and L2's Huang deployment is an open call (Open Item 10). Adding a fourth deployment here, on the highest-profile founder in the world, is exactly the celebrity-audit the Roster's “not celebrity” note warns against. **(b) The register.** This lecture's frame is *nobody wrong on their own terms* at three institutional altitudes. A founder audit collapses an institutional collision into a personality, which is the single fastest way to lose the frame. **(c) Operator Reality is not replaceable.** It is the assigned delivery mechanism for **vector three** — one of the three vectors the lecture is named for — and it carries the Kicker. Cutting it would cut a third of the lecture's architecture to gain a character study. **Verdict: no swap; material banked. Note for the Schema: the founder material is available as texture inside Beats 2, 9, and 12 — the 122 days, the merger, the orbital announcement — but never as an audit of a person.**

8. Taxonomy by Business Model — *Money • versatile*. **Scan: NO.** A real four-way sort exists in this territory — behind-the-meter self-generation (xAI/MZX), private-campus gas (Crusoe/Lancium), grid-connected hyperscale (the Virginia model), and orbital (L9's) — but it is a *siting-and-power* taxonomy, not a business-model taxonomy, and the Beat Menu budgets Taxonomy at 1–3 course-wide with the count already spent per the L6 and L7 pack records. **Verdict: correctly left out.**

9. The Deal — *Character/Money • versatile*. **Scan: NO — because Syllabus 2.0 already absorbed it.** The beat plan states that the Symbol Audit “absorbs The Deal's announcement-to-groundbreaking sequence,” and Section 2 Beat 9 confirms the absorption is complete: the July 2024 groundbreaking, the ~August 2024 permit approved in six days, the December 2024 and June 2025 turbine orders, the 21 January 2025 announcement, the July 2025 4.5 GW agreement, the September 2025 expansion, and the March 2026 walk-away with a \$150 million deposit are all inside Beat 9. Running The Deal separately would either duplicate that sequence or force a second negotiation into the hour — and the only other Deal-shaped sequence in this territory (MZX Tech's July 2025 purchase of the Duke Energy site and its December 2025 adjacent acquisition) is a real-estate transaction whose terms are not public. **Verdict: correctly left out by construction; the absorption is**

working.

10. Hearing Room repeats — Scan: NO, by hard rule. The Moves List and Beat Menu permit one Hearing Room per lecture; the Memphis corpus could sustain three (the March 2025 commission, the April 2025 SCHD hearings, the December 2025 APCB appeal, the February 2026 MDEQ hearing in Jackson). **The lecture must pick one room and reference the others as procedural facts rather than as scenes** — this is also the franchise max-1-scene rule, satisfied by menu design. **Verdict: correctly excluded; Section 8 supplies the material for all four so the drafter can choose the room and use the rest as dates.**

VERDICT PAIRING

No Section 2 beat returned THIN or UNBUILDABLE. No replacement is required, and this scan therefore proposes no swaps.

Two beats returned **SUSTAINABLE on conditions**, and the scan names their pre-approved thickening agents so markup does not have to go looking if Draft 1 runs short:

- **Beat 4 (Mechanism Autopsy)**, if thin: the **Physics Audit** material — aeroderivative efficiency, the seven-year combined-cycle lead time, and the 30-of-59 emissions arithmetic against the 100-ton threshold. Already in the pack, already in the beat's territory, no cap or rotation implicated.
 - **Beat 7 (Operator Reality)**, if thin: the **staffing-ratio ladder** at four facility scales plus the Action Plan's own workforce sections, which are quoted in full in Section 2. If it is *still* thin, the honest remedy is to shorten the beat and lengthen Beat 5, not to import the Founder Audit.
-

SUMMARY FOR MARKUP

Ten of ten absences justified. Three near-misses documented (Cold Open, Physics Audit, Founder Audit), all three declined with the cases stated. Zero swaps recommended. Two forward flags lodged: the Physics Audit and staffing-ladder materials are pre-approved as thickening agents for Beats 4 and 7 respectively; and the founder material is banked as texture, never as an audit.

Category minimums re-verified for the strawman as it stands. Atoms: Mechanism Autopsy (4), Operator Reality (7), Externality Swap (12). **Money:** Perverse Incentive (5), Follow the Money (6), Externality Swap (12). **Politics:** Hearing Room (1), The County (2), Paper Trail (8), Symbol Audit (9), Regulatory Collision (11). **Character:** The Neighbor (3), The County (2), Operator Reality (7). **Audit:** The Steelman (10). ≥ 1 Atoms / ≥ 1 Money / ≥ 1 Politics holds with room to spare; the proposed fourth minimum (≥ 1 Character-family beat, Open Item 3) holds three times over. **All course-wide caps verified:** Symbol Audit at deployment 2 of ≤ 3 ; Steelman with a new defendant (6 of 8); Neighbor at deployment 3 of 3, documented human, comedy off; Paper Trail class 8 of 10 distinct; Hearing Room within its warm-tier budget and its three distinct room types; Irreversibility Ledger unspent, reserved for L10.

The pack proposes; markup and the Course Schema dispose. No re-sequencing is proposed here — though Section 2's summary flags, for markup's attention only, that the strawman's running order places the lecture's heaviest documented material (the June 2026 federal intervention) at Beats 10–11.

SECTION 4: MOVES PLAN VERIFICATION

Seven deployments are assigned; one (Unit Conversion) is assigned as a **skip**; one (the Gesture) is **conditional** on Open Item 9. Each verifies below under the Moves List 1.0 deployment disciplines. The Moves List cap — one deployment per move per lecture — is satisfied by construction.

Move 1 — The Step Function: ~1 permanent job per \$13 million invested

Gate: the number must break something the listener was standing on, not merely be large; the standing assumption must be allowed to feel settled before the number arrives; the pedigree must be complete.

Pedigree. Value: **1 permanent job per \$13,000,000 of capital investment**, against **\$137,000 per job created outside the data center sector**. Unit: jobs per dollar of announced capital investment. Stage: **announced investment against announced permanent jobs** — this is not a payroll audit, it is a ratio of two announcement figures, and the draft must not present it as a headcount. As-of: **January 2026**, on a data window running **from 1990**. Filer/author: **Food & Water Watch**, *Artificial Jobs: The Illusion of Big Tech's Data Center Employment Claims*, analyzing **Virginia Economic Development Partnership** announcement data (NAICS 518210, description containing “data center”), accessed 4 November 2025. Confidence tier: **STRUCTURAL** — the ratio is stable across a 35-year window and is not a fast-decay figure.

The seller. Food & Water Watch **explicitly calls for a national moratorium on data center development** in the same document's conclusion. Per Style Guide §5 and Research Instruction 16, the filer must be named every time the figure appears. What FWW gets if you believe it: the moratorium.

The standing assumption it breaks, and the evidence that lets it feel settled first. The assumption is not “data centers employ a lot of people” — a sophisticated listener does not hold that. The assumption is subtler and much more widely held: **that a large capital investment is a large economic development event, and that jobs are the unit in which that event is measured**. The material that lets it feel settled before the number lands is all in Beats 2, 5, and 6 and is all in the sellers' own words: the Greater Memphis Chamber's *up to 500 quality, high-paying jobs*; MLGW's *300-plus*; Oracle's *over 25,000 onsite jobs*; NetChoice's *300 full-time operations jobs* handout to a Minnesota Senate committee; Virginia's statutory qualification threshold of *\$150 million and 50 new jobs*; and Virginia's deputy chief of staff answering a \$1.6 billion disclosure by citing *74,000 jobs*. Every institution in the lecture measures the event in jobs. **Then the ratio arrives and the unit itself turns out to be wrong.** That is a Step Function, not merely a large number.

Verified — with two mandatory carries. (1) **The attribution.** The figure is **Food & Water Watch's**, not JLARC's. Syllabus 2.0's cast and anchor lists render it as “the JLARC jobs math (~1 job per \$13M).” **Section 6, Discrepancy #1. Do not attribute this figure to JLARC in prose.** (2) **The non-contradiction.** JLARC's 74,000 jobs is not a competing count; it is a modeled figure dominated by construction employment, and JLARC says so. A draft that stages the two as a contradiction will be wrong on the arithmetic and will hand the steelman a free point.

MARKUP ALTERNATE — a harder deployment, from the same document, same page-2 paragraph. From **2020 through late 2025**, Virginia's data centers created **1 direct permanent job for every \$54 million invested, against \$322,000 per permanent non-data-center job — a ratio of 168 to 1**. Same filer, same method, same interest, narrower and more recent window, and it breaks the assumption substantially harder because it is the *AI-era* number rather than the 35-year average. **The assignment stands until markup moves it.** The pack's note: if markup takes the alternate, the ~\$13M/\$137K pair must still appear somewhere in the course, because it is a Syllabus 1.0 must-hit anchor.

Adjacent pedigree, for whichever version deploys. FWW's Virginia employment estimate: **~7,600** in 2024 (BLS-adjusted; VEDP data alone yields **5,400**), stated within a 95% confidence interval by least-squares against Dominion-reported data center load. National estimate: **as few as 23,000** permanent data center jobs in 2024 — **0.01% of U.S. jobs** against **4.4% of U.S. electricity usage** (electricity figure: LBNL-2001637, December 2024). Including secondary jobs from VEDP data, **\$7.8 million** per permanent job, 1998–2025. And the seller's-own-arithmetic version, which is the deadpan one: **NVTC** — a pro-data-center group sponsored by Amazon and Dominion — reports **\$203 billion** in cumulative Virginia data center construction through 2023 employing **12,140** people, which is **\$16.7 million per job** by the advocacy group's own numbers.

Move 2 — The Unit Conversion: SKIP (assigned)

Gate: the conversion must be arithmetically defensible; no vibes conversions; a failed check means the lecture runs without its Japan.

Syllabus 2.0 proposes a skip, on the reasoning that the jobs ratio does the magnitude work. **The pack concurs and records the skip formally. No arithmetic gate fires and no Japan is manufactured.**

The reasoning, stated for the record because Open Item 11 tracks four conversions that deploy only if their arithmetic clears: **this lecture's alien magnitudes are already denominated in human units**. A job is a human unit. A short ton of NOx

against a 100-ton threshold is a regulatory unit that needs no translation. A vote of 6–1 needs no translation. **\$13 million per job is itself a conversion** — it translates capital into people — and deploying a second one in the same hour would put two translations inside the beat that is supposed to carry one. The Moves List’s own note applies exactly: this course generates alien magnitudes constantly, and the single-conversion budget means the rest stand on their own.

Three candidate conversions were tested and all three are recorded as declined, so markup can see the work rather than take the skip on faith:

- *Candidate A — the 2 GW comparison.* The NAACP/SELC notice of 13 February 2026 states that a third Southaven data center would bring xAI’s Memphis-area power demands to **nearly 2 GW — approximately the output of the Hoover Dam. Arithmetically defensible** (Hoover’s nameplate is ~2,080 MW), and the comparison is **already in the filing**, which makes it quotable rather than constructed. **Declined** because it is a *filer’s* comparison from an adversarial party and would import the filer’s rhetoric as the narrator’s, and because L5 and L9 own the generation-comparison register.
- *Candidate B — the water conversion.* Colossus 1’s documented draw of **over 1 million gallons per day** is about **1%** of MLGW’s daily aquifer pumping (McGowen, 2024). **Arithmetically defensible and already stated as a percentage by the utility.** **Declined** because it lands in a human-floor zone, and a Japan inside a comedy-off zone is a tonal violation regardless of its arithmetic.
- *Candidate C — the subsidy-to-households conversion.* FWW renders Virginia’s **\$673 million** 2022 exemption as the median income of **nearly 8,000 Virginian households**, against an estimated 7,600 data center jobs. **Arithmetically defensible and, in fact, the sharpest available.** **Declined only on the one-per-lecture cap** — it would compete with the Step Function inside the same beat. **Banked as the strongest alternate if markup ever moves the Step Function elsewhere.**

Verdict: SKIP, deliberately, with three cleared alternates banked. The lecture runs without its Japan by choice, not by failure.

Move 3 — The Timeline Snap: the Action Plan’s release date — pack locks the day

Gate: the absolute date the incentives flipped, in one paragraph; the choice of which date actually mattered is the move.

LOCKED: 23 July 2025 — the release of *Winning the Race: America’s AI Action Plan* at the “Winning the AI Race” event, alongside three executive orders. Announcing party: The White House. Pack dependency **D4 discharged**.

The incentive state on each side of it.

The day before, 22 July 2025. A state legislature considering an AI bill faced ordinary politics: industry lobbying, constituent pressure, a governor’s signature. A county weighing a data center permit faced ordinary land-use and environmental review. There was a January executive order stating a policy of AI dominance, and the One Big Beautiful Bill Act — signed 4 July 2025 — had **passed without the ten-year state AI moratorium the House version contained**, which the Senate stripped by a near-unanimous vote. **On 22 July 2025 the federal government had asserted a policy and Congress had just declined to enforce it.** State AI regulation carried no federal cost.

The day after, 24 July 2025. A published federal document instructed OMB to work with agencies so that **AI-related discretionary funding decisions consider a state’s AI regulatory climate, and limit funding where a state’s regime may hinder that funding’s effectiveness.** It instructed the FCC to evaluate whether state AI regulations interfere with its Communications Act authority. It proposed **NEPA categorical exclusions for data center actions, FAST-41 expansion,** and a possible **nationwide Clean Water Act §404 permit for data centers that would not require pre-construction notification.** **Nothing in the document was legally operative. Everything in it was a stated intention to attach a price to state regulation** — and a legislator weighing a data center bill after that date was weighing it against a federal funding posture rather than against industry lobbying alone.

THE COMPETING HINGE, PRESENTED WITH EVIDENCE, as the gate requires. A serious case exists that the incentives actually flipped on **11 December 2025**, when Executive Order 14365 converted the posture into instruments: a Task Force at DOJ with a 30-day clock and a sole responsibility; a Commerce evaluation with a 90-day clock; and a **BEAD Policy Notice required to make states with “onerous” AI laws ineligible for non-deployment funds to the maximum extent allowed by federal law.** The evidence for the December date: the first federal court intervention against a state AI law came on **24 April 2026**, four months after the EO and nine months after the Plan; and the EO, not the Plan, is what

every subsequent legal analysis cites as the operative instrument.

The pack’s reading, offered and not imposed: July 2025 is the correct snap for this lecture and December 2025 is the correct snap for a lecture about litigation. The Timeline Snap’s discipline is that it marks the date the *incentives* flipped, not the date the *machinery* arrived — and the incentives flipped when a state legislator first had to price federal displeasure into a vote. That is July. **December 2025 is banked as the markup alternate and belongs in Beat 11 as a date regardless, since the Snap is one per lecture and Beat 11 needs the EO’s clocks anyway.**

Move 4 — The Verbatim: the space-race sentence, quoted flat

Gate — existence: the exact words must be verifiable in a primary record. Attribution must be inside the narrative.

PASS. Verified verbatim in the primary document. Pack dependency **D5 discharged.**

*“The United States is in a race to achieve global dominance in artificial intelligence (AI). Whoever has the largest AI ecosystem will set global AI standards and reap broad economic and military benefits. **Just like we won the space race, it is imperative that the United States and its allies win this race.**”*

— Winning the Race: America’s AI Action Plan, *The White House*, July 2025, Introduction, page 1. Released 23 July 2025. Signatories on the document: Michael J. Kratsios, Assistant to the President for Science and Technology; David O. Sacks, Special Advisor for AI and Crypto; Marco A. Rubio, Assistant to the President for National Security Affairs. Issued pursuant to Executive Order 14179 of 23 January 2025. **United States Government work.**

Surrounding context sufficient to use it honestly. The sentence sits in the third position of the Introduction’s opening paragraph, immediately before the sentence describing EO 14179 as the President’s decisive first step. The paragraph’s argument is a network-effects argument, not a moral one: whoever has the largest ecosystem sets the standards and reaps the benefits. **The space-race analogy is doing work in a paragraph about standard-setting, which is the sharpest available reading of it and the one the draft should honor** — the Plan is not claiming AI is a moon landing; it is claiming the winner writes the rules. Two paragraphs later the document reaches its own summary of Pillar II with the line **“Simply put, we need to ‘Build, Baby, Build!’”** — available as an adjacent quote but **not** as a second Verbatim deployment, since the cap is one per lecture.

Attribution requirement inside the narrative, per the Moves List and Style Guide §5: who wrote it (the White House Office of Science and Technology Policy, under three named signatories), in what document (*Winning the Race: America’s AI Action Plan*), when (July 2025). All three must be spoken in the prose.

Markup alternates, if the Verbatim is ever reassigned within this lecture — each verified verbatim and each a U.S. Government work:

- EO 14365 §8(b)(ii) — the data-center carve-out. **Flatter, funnier, and more consequential**, and it is the sentence that concedes the course’s subject. If markup wants the driest possible Verbatim, this is it.
- The Action Plan’s Pillar II §404 line — a nationwide permit that “does not require a Pre-Construction Notification.”
- The DOJ’s Mississippi motion: “the Clean Air Act affords the United States primacy over citizen-enforcers when it comes to enforcement discretion.”

Move 5 — The As-Of Stamp: the Task Force litigation posture (2026)

Gate: confirm the assigned claim’s current value and date; note expected decay velocity.

Current value, as of 21 July 2026. The **AI Litigation Task Force** was established at the Department of Justice pursuant to EO 14365 §3 within the order’s 30-day window; commentary places it operative from **10 January 2026** and Cato confirms formation in **January 2026**. Its stated sole responsibility is to challenge state AI laws inconsistent with the order’s policy.

What it has actually done, on the record. The federal government’s one documented courtroom action against a state AI law is the **24 April 2026 motion to intervene** in *xAI v. Weiser*, D. Colo., in which DOJ filed a complaint in intervention alleging Colorado SB24-205 violates the **Equal Protection Clause**. The court granted intervention. On **27 April 2026** the court granted a joint motion by xAI and the Colorado Attorney General temporarily **suspending enforcement** of the

Act. **Two honest caveats the stamp must carry.** First: **DOJ’s press statement announcing the intervention did not mention the Task Force**, and its complaint raised no interstate-commerce theory — the connection is inferable from timing and policy, not stated on the record. Second: **the federal government was not the plaintiff.** xAI filed on 9 April 2026; the United States joined a private suit already under way. The most defensible formulation, and the one the draft should use: *as of mid-2026, the Task Force’s public litigation record consists of one intervention in a case a company brought first.*

Decay velocity: FAST — this is the fastest-decaying claim in the lecture and the reason the As-Of Stamp is assigned to it. Drivers: the Colorado enforcement stay expressly covers legislation replacing or amending SB 24-205, and Colorado has already replaced it (**SB 26-189**) and enacted a companion (**HB 26-1263**, the Chatbot Safety Act, signed 29 May 2026, effective 1 January 2027); AG Weiser has stated he will not enforce SB 26-189 until rulemaking concludes, with a deadline of **1 January 2027**; the AG’s office opened pre-rulemaking on **23 June 2026** with comments through **13 July 2026**; xAI signaled a new preliminary-injunction motion against the replacement law around **11 June 2026**, and whether it was filed is not established in the pack’s sources. **Any of those five clocks can move the posture within a quarter.** Feeds Section 11’s decay register at the top of the list.

Also unresolved and flagged: the **Commerce evaluation of “onerous” state AI laws**, required by EO 14365 §4 within 90 days (due ~11 March 2026), and the **BEAD Policy Notice** required by §5(a) on the same clock. **The pack did not locate either document.** Whether they were published, and what they name, is a draft-stage pull and a genuine hole — because §4’s list is the input to §3’s litigation and §5’s funding condition, and without it the entire enforcement chain is a set of clocks with nothing published on the other end.

Move 6 — The Kicker: the physical avatar of automation fear employs fifty people

Gate: verify the closing fact to full pedigree; supply the two or three adjacent facts the closing passage needs around it; never telegraph.

Verified, with the pedigree the number requires and one correction to how it must be stated.

The must-hit anchor is **~50 FTEs per 250,000 square feet** (Syllabus 1.0). The pack’s finding: **the ratio the industry actually publishes is per megawatt, not per square foot**, and the square-foot version is a derived convenience. **Section 6, Discrepancy #2.** The underlying figures, all verified:

- Uptime Institute, operations staffing: **8–12 full-time operations staff per MW** at smaller facilities; **1–2 per MW** at large hyperscale campuses. (STRUCTURAL; ranges stay ranges.)
- At 100+ MW: **0.2–0.3 staff per MW**, and **20–30 permanent staff per 100 MW** at the most automated campuses. (STRUCTURAL, 2025–26 compilations of operator-reported data.)
- Worked: **a 50 MW hyperscale campus runs 50 to 80 permanent staff.** (STRUCTURAL.)
- Construction, the mirror: **0.7–2.0 workers per MW**; CBRE’s 2024 estimate of **400–600** construction workers at peak for a 50 MW build and **800–1,200** for 100+ MW.

The Kicker’s safest and most defensible phrasing is therefore *a campus of this class runs on a few dozen permanent staff* — or, if the “fifty” is wanted verbatim as the anchor requires, **“about fifty people”** attached to a **facility scale**, not to a square footage the pack cannot source. The number survives; its denominator needs care.

The two adjacent facts the closing passage needs, both verified above:

1. **64% of Americans — in every single state — name AI-induced job loss as their most common AI fear.** Anthropic Public Record, first wave, fielded November–December 2025 through YouGov, **n = 51,993**, weighted to U.S. Census benchmarks. (The surveying party’s interest must be named: Anthropic is an AI developer.) Corroborated in direction by Pew (52% of workers worried; 32% expecting fewer opportunities; field 7–13 October 2024, n = 5,273), Reuters/Ipsos (53% household-level fear, June 2026), and Gallup (18% expecting their own job eliminated within five years, 2026).
2. **Crusoe’s own figure: 7,000 electricians, construction professionals, and skilled tradespeople came to Abilene every day to build the site** (June 2026, seller’s own statement) — against a permanent operations staff that, at the published ratios for a 1.2 GW campus, is a small fraction of one percent of that number.

Third adjacent fact, if the passage wants a fourth beat: the federal government’s own written answer to the fear is a **trades pipeline** — Registered Apprenticeships, CTE, an **AI Workforce Research Hub under DOL**, and named occupa-

tions: **electricians, advanced HVAC technicians.** *Winning the Race*, Pillar II, page 17.

Non-telegraph discipline, restated because this Kicker is unusually easy to telegraph: the fact is a *fact*, not a moral, and the reframe is the listener's job. No “and here's the thing.” No “fifty. Fifty people.” **[HUMAN FLOOR: the Kicker lands in a comedy-off zone. It is not a punchline at the expense of anyone who is afraid; the STRIP move exists precisely so the documented anxiety is still standing when the number arrives.]**

Move 7 — The Gesture: the training-run door (CONDITIONAL on Open Item 9)

Gate: open a boundary door exactly one inch; name two or three specific, verified, dated facts from just behind it; then close it by declaring the thing an input. Do not research further.

Status: the third boundary door — training-run internals — is pending Nick's call (Syllabus 2.0 Open Item 9). Three candidate deployments ride on it (L1, L6, L8), one each. If the door is rejected, this lecture simply skips the Gesture and nothing else moves.

The one-inch material, supplied conditionally and no further. Three verified, dated facts from immediately behind the door, chosen because each one presses on material this lecture already carries:

1. **Colossus 1 came online on 2 September 2024 with 100,000 Nvidia H100 GPUs**, per Elon Musk's own post that day, on a build the company dates at **122 days**. The thing the fifteen permitted turbines were burning gas to power was a training cluster of a specific, stated size, and the size is on the record from the operator.
2. **The Abilene Stargate buildings run Nvidia GB200 Blackwell racks and are executing both training and inference workloads**, per Crusoe and Oracle statements of September 2025 and March 2026. Epoch AI's April 2026 estimate translates Abilene's **0.3 GW energized** into roughly **250,000 H100-equivalents**, with the 1.2 GW projection at about **1.0 million**. **The unit in which this industry measures a building is a chip-equivalent — which means the building's own name for itself is a number of chips.**
3. **Grok's Gov model runs on Secret and Top Secret classified networks and supported U.S. strikes on Iran**, per the sworn declaration of Cameron Stanley, Department of War Chief Digital and AI Officer, filed with the United States' motion in the Northern District of Mississippi, June 2026. **This is the single most consequential fact about what the compute is for that exists anywhere in the public record, and it arrived in a Clean Air Act case.**

The closing move. Declare it an input and shut the door: what those GPUs are actually computing — how a training run is structured, what the loss curve does, why the cluster has to be that size — is somebody else's story. **The prose never references the catalog, other courses, or the course architecture. The appetite is manufactured by the closed door.**

Recommendation to markup, offered once and briefly. Of the three candidate deployments, **L8's case is the strongest of the three**, because fact 3 is *load-bearing here and nowhere else*: this is the lecture in which the question “what is it for?” stops being rhetorical and becomes a sworn answer in a federal filing. If the door opens anywhere, it should open here. **The call is Nick's; the pack does not spend it.**

Move 8 — The Handoff (rider): a door explicitly not opened

Assigned mechanism verified against the course rotation in the Lecture Identity. **Material lives in Section 10**, with the primary formulation, three banked alternates in the same rotation class, and the refresh-safety check.

SECTION 5: THE DOCUMENT DOSSIER

The Paper Trail's assigned class for this lecture is **executive document**, rotation position 8 of 10. The assigned document is *Winning the Race: America's AI Action Plan*. **The dossier treats it as a pair with Executive Order 14365**, because the questions the beat is assigned to answer — what it forces, what it forbids, what happens when someone violates it — are unanswerable from the Action Plan alone, and answering them from the wrong document would be the kind of error the course cannot afford.

5.1 — THE PRIMARY DOCUMENT

Full formal title. *Winning the Race: America's AI Action Plan*. **Author.** The White House Office of Science and Technology Policy, coordinating across the federal government. Signed on its face by **Michael J. Kratsios**, Assistant to the President for Science and Technology; **David O. Sacks**, Special Advisor for AI and Crypto; **Marco A. Rubio**, Assistant to the President for National Security Affairs. Opens with a quoted epigraph from **Donald J. Trump**, identified on the page as 45th and 47th President of the United States. **Date.** Dated **July 2025** on its cover; released **23 July 2025** at the “Winning the AI Race” event. **Length.** Roughly 25 pages including front matter, table of contents, and a page marked as intentionally left blank. **Where published.** [whitehouse.gov, /wp-content/uploads/2025/07/Americas-AI-Action-Plan.pdf](https://www.whitehouse.gov/wp-content/uploads/2025/07/Americas-AI-Action-Plan.pdf). No docket number; it is not a rulemaking. **United States Government work — public domain.** **Procedural status.** Published policy blueprint. **Not a rule, not an order, not a statute. It creates no cause of action, binds no state, and appropriates nothing.** It is issued in fulfillment of a directive in **Executive Order 14179** of 23 January 2025, Federal Register 90 (20) 8741, and it is cited as a policy predicate by later instruments. **Provenance.** OSTP issued a request for information asking what federal policies were needed to sustain American AI dominance and ensure that unnecessarily burdensome requirements do not hamper private-sector innovation. **More than 10,000 comments** were received. The Plan identifies **more than 90 federal policy actions** across **three pillars**.

WHAT IT SAYS — the operative provisions, and the ones this course lives on.

Structure. **Pillar I: Accelerate AI Innovation** (14 sections). **Pillar II: Build American AI Infrastructure** (8 sections). **Pillar III: Lead in International AI Diplomacy and Security** (8 sections).

The framing sentence. Quoted in full in Section 4. Its argument is network effects and standard-setting, not moral destiny.

The state-regulation posture, Pillar I. Quoted in full in Section 2 Beat 8. The load-bearing pair: **federal AI funding should not go to states with burdensome AI regulations**, and simultaneously the government **should not interfere with states' rights to pass prudent laws that are not unduly restrictive**. Both sentences are in the same paragraph. **That internal tension is the document's most honest feature and the draft should read it flat rather than treat it as hypocrisy** — it is a genuine attempt to state a limiting principle, and the limiting principle survives into EO 14365 §8(b).

The permitting actions, Pillar II — the ones that touch this course directly, quoted or precisely summarized:

- **NEPA:** establish new **Categorical Exclusions** covering data center-related actions that normally do not have a significant effect on the environment, adopting other agencies' exclusions where possible.
- **FAST-41:** expand the process to cover **all data center and data center energy projects** eligible under the Fixing America's Surface Transportation Act of 2015.
- **Clean Water Act:** “Explore the need for a nationwide Clean Water Act Section 404 permit for data centers, and, if adopted, ensure that this permit does not require a Pre-Construction Notification and covers development sites consistent with the size of a modern AI data center.”
- **Clean Air Act and CERCLA:** “Expedite environmental permitting by streamlining or reducing regulations promulgated under the Clean Air Act, the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and other relevant related laws.”
- **Federal lands:** direct agencies with significant land portfolios to identify sites suited to large-scale data center and generation development.
- **Grid:** a four-part sequence — stabilize today's grid and prevent premature decommissioning of critical generation; optimize existing resources including advanced grid management and reconductoring; prioritize interconnection of reliable dispatchable power and reform power markets to align incentives with stability; and create a strategic blueprint.

The workforce actions, quoted in Section 2 Beat 7. An **AI Workforce Research Hub under DOL**; BLS/Census/BEA study of AI's labor-market effects; Treasury guidance on Section 132 educational assistance; **DOL discretionary funding for rapid retraining of individuals impacted by AI-related job displacement**; and a named-occupation trades pipeline: **electricians, advanced HVAC technicians**, through Registered Apprenticeships and CTE.

The definitional comedy, per the dossier's standing instruction that the definitions section is frequently the comedy and always the substance. This document has no definitions section — which is itself the finding. **It uses “onerous,” “burdensome,” “unduly restrictive,” and “prudent” as operative discriminators without defining any of them, and then EO 14365 §4 instructs the Secretary of Commerce to publish an evaluation identifying which state laws are “onerous.”** The definitional work is deferred to a document the pack could not locate.

WHO WROTE IT AND WHY. OSTP, at the direction of EO 14179, with an explicit deliverable: articulate policy

recommendations the administration can deliver to achieve the President’s stated vision of global AI dominance. What the drafters get if the document is believed: a deregulatory mandate across a dozen agencies, a preemption predicate, an industrial-policy frame that converts a private capital buildout into a national project, and — per Style Guide §5’s seller taxonomy — a national-security argument that ends other arguments. The signature block is itself evidence: **a science advisor, a crypto-and-AI special advisor, and the national security advisor**. The third signature is what makes it a security instrument.

WHAT IT FORCES AND WHAT IT FORBIDS. Nothing and nothing. Its verbs are *led by, explore, establish, convene, prioritize, review, consider*. It has no term, no milestones, no penalties, no exit clauses, no conditions precedent. **This is the dossier’s central finding and Beat 8 is built on it.**

WHAT HAPPENS WHEN SOMEONE VIOLATES IT. Nothing, because it cannot be violated. **The correct question is what happens when someone acts against it, and the answer is EO 14365.**

THE SKEPTICAL CAVEAT — is it binding, or a press release with a docket number? It is neither. It is a **roadmap that acquired teeth five months later**. The honest formulation: the Action Plan is the most consequential non-binding document in this course, and its consequence is entirely downstream — it set the vocabulary (“onerous,” “the race,” “Build, Baby, Build”), it set the target list (state regulatory climates, NEPA, §404, the Clean Air Act), and it was cited by every subsequent instrument. **Treating it as toothless would be as wrong as treating it as binding.**

THE DOCUMENT’S HISTORY AND FATE. Foreshadowed by EO 14179 (23 January 2025). Preceded by the failed ten-year state AI moratorium in the House version of the One Big Beautiful Bill Act, stripped by the Senate by near-unanimous vote before the President signed the bill on **4 July 2025** — nineteen days before the Plan’s release. Operationalized by **EO 14365** (11 December 2025), itself issued the day after AI preemption language failed to make the **FY2026 NDAA** (10 December 2025) and two days after **42 state attorneys general** wrote to AI companies on child safety (9 December 2025). Followed by the **National AI Legislative Framework** (March 2026). **The document has not been amended, appealed, or withdrawn; it has been implemented in pieces, and the pieces are where the fights are.**

5.2 — THE OPERATIVE INSTRUMENT

Full formal title. *Ensuring a National Policy Framework for Artificial Intelligence*. **Instrument.** **Executive Order 14365.** **Date.** Signed **11 December 2025**. **Author.** The President. Consultation nodes named in the text: the Special Advisor for AI and Crypto; the Assistant to the President for Science and Technology; the Assistant to the President for Economic Policy; the Assistant to the President and Counsel to the President. **Where published.** whitehouse.gov Presidential Actions; PDF at /wp-content/uploads/2025/12/eo-14365.pdf. **A documented detail worth stating flat: the page’s URL slug reads eliminating-state-law-obstruction-of-national-artificial-intelligence-policy — the leaked draft’s title — while the published heading reads Ensuring a National Policy Framework for Artificial Intelligence. Both are on the same page. The draft leaked 19 November 2025. Procedural status.** Effective on signature. Nine sections.

WHAT IT SAYS — operative provisions, verbatim where the language matters.

§1, *Purpose — the diagnosis*. Three named defects in state regulation: a fifty-regime patchwork disproportionately burdening startups; state laws requiring entities to embed ideological bias (naming Colorado’s algorithmic-discrimination ban and arguing it may force models to produce false results to avoid differential impact); and extraterritorial regulation impinging on interstate commerce. Followed by: *“But we remain in the earliest days of this technological revolution and are in a race with adversaries for supremacy within it.”*

§2, *Policy*. To sustain and enhance global AI dominance through **a minimally burdensome national policy framework for AI**.

§3, *AI Litigation Task Force*. Quoted in Section 2. **30 days. Sole responsibility. Three named grounds** — unconstitutional regulation of interstate commerce, preemption by existing federal regulations, or otherwise unlawful in the Attorney General’s judgment.

§4, *Evaluation of State AI Laws*. **90 days**. Secretary of Commerce, under **47 U.S.C. 902(b)**, to publish an evaluation identifying **onerous** state laws conflicting with §2 and laws that should be referred to the Task Force. Minimum content: laws requiring AI models to alter truthful outputs, or compelling disclosure in a manner violating the First Amendment or any other constitutional provision. May also identify state laws that *promote* innovation.

§5, *Restrictions on State Funding — the money.* (a) Within 90 days, Commerce through NTIA to issue a **Policy Notice** specifying conditions for **BEAD** eligibility for remaining funds saved through the administration’s “Benefit of the Bargain” reforms, under **47 U.S.C. 1702(e)-(f)**. *“That Policy Notice must provide that States with onerous AI laws identified pursuant to section 4 of this order are ineligible for non-deployment funds, to the maximum extent allowed by Federal law.”* The Notice must also describe how a fragmented state landscape threatens BEAD-funded deployments and BEAD’s mission of universal high-speed connectivity. (b) All agencies to assess discretionary grant programs and determine whether grants may be conditioned on states not enacting a conflicting AI law, **or — for states that have — on entering a binding agreement not to enforce it during the funding performance period.**

§6, *FCC.* Within 90 days of the §4 identification, the FCC Chairman to initiate a proceeding on whether to adopt a federal reporting and disclosure standard for AI models **that preempts conflicting state laws.**

§7, *FTC.* Within 90 days, a policy statement on applying the FTC Act’s unfair-and-deceptive-practices prohibition (15 U.S.C. 45) to AI models, explaining when state laws requiring alterations to truthful outputs are preempted.

§8, *Legislation.* (a) A legislative recommendation for a uniform federal framework preempting conflicting state AI laws. (b) **The carve-out**, quoted in full in Section 2 Beat 8: the recommendation **shall not propose preempting** otherwise lawful state AI laws relating to child safety protections; **AI compute and data center infrastructure, other than generally applicable permitting reforms**; state procurement and use of AI; and other topics to be determined.

§9, *General Provisions.* Standard non-impairment, subject-to-appropriations, and — the standard clause that matters here — **“This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party.”** Plus: *“The costs for publication of this order shall be borne by the Department of Commerce.”*

WHO WROTE IT AND WHY. The White House, after two failures in Congress: the stripped OBBBA moratorium (July 2025) and the failed NDAA preemption language (10 December 2025). **The order is what an executive does when it cannot get a statute.** What it gets if enforced: a uniform national framework, achieved by litigation and money rather than legislation. What it gets even if unenforced: deterrence — a state legislature weighing an AI bill now weighs a grant condition.

WHAT IT FORCES AND WHAT IT FORBIDS. Forces four federal actions on 30- and 90-day clocks: a Task Force, an evaluation, a BEAD Policy Notice, and an agency-by-agency grant-condition assessment; plus two agency proceedings. Forbids nothing directly of anyone outside the executive branch — **its coercion runs entirely through money and litigation, both of which are contestable.**

WHAT HAPPENS WHEN SOMEONE VIOLATES IT — and here the record is thin, which is itself the story. States have not stopped legislating: **267 data-center-related bills across 40-plus states in 2025, more than 300 across more than 30 states in 2026**; Colorado enacted a replacement AI act and a Chatbot Safety Act after the order; New York passed a data center moratorium bill on 4 June 2026 and its governor imposed one by executive order on **14 July 2026**. **The pack could not locate the §4 Commerce evaluation or the §5(a) BEAD Policy Notice, and could not establish that any agency has actually conditioned a discretionary grant on a state’s AI regulatory posture.** The enforcement chain’s first link is a list nobody in the pack’s sources has seen. **Draft-stage pull required; state the gap rather than assume the documents exist.**

THE SKEPTICAL CAVEAT. EO 14365 is **binding on the executive branch and only on the executive branch.** Its §9(c) says so in terms. Its power over states is entirely derivative — a grant condition that must survive Spending Clause challenge, a litigation program that must win in court, and two agency proceedings that must survive the Administrative Procedure Act. **As of 21 July 2026 its documented courtroom output is one intervention in a suit a company filed first, which produced a temporary enforcement stay that the parties jointly requested.** That is a real result and a small one, and the draft should say both.

THE DOCUMENT’S HISTORY AND FATE. Draft leaked 19 November 2025 under a more combative title that survives in the URL. Issued 11 December 2025. Nearly two dozen state attorneys general wrote to the FCC opposing preemptive AI regulation on 19 December 2025. First operationalized in court 24 April 2026. **§8(b)(ii)’s data-center carve-out has not, so far as the pack can establish, been tested — and the width of its “other than generally applicable permitting reforms” exception is the open constitutional question this lecture leaves hanging.**

5.3 — RETURNING DOCUMENTS (brief-reference material only)

Per the roster’s cross-lecture table and the Style Guide’s cross-lecture consistency rule, the following appear in this lecture as **returns**. **Supply the new fact and the new consequence; name the owning lecture; do not rebuild.**

JLARC, *Data Centers in Virginia* (Report 598, 9 December 2024). **Owning lecture: L1** (its Paper Trail, class: state audit). *New fact this lecture adds:* the report has become the **state’s standard defense of the tax expenditure** — Virginia’s deputy chief of staff answered the January 2026 disclosure that the exemption cost **\$1.6 billion in FY2025, up 118% year over year**, by citing JLARC’s 74,000 jobs and \$9.1 billion GDP, and by characterizing Good Jobs First’s analysis as intentionally narrow and inaccurate. *New consequence:* the audit L1 introduced as the Commonwealth’s honest self-accounting is now, eighteen months later, the Commonwealth’s talking point. **One or two sentences maximum. Do not re-explain the report.**

“Winning the Race” itself. **Owning lecture: this one.** It was introduced briefly in **L5** and returns in **L10**. This is its full treatment; make it complete enough that L10 needs only the one line it wants.

Loudoun County ZOAM hearings (2023). **Owning lecture: L1** (Loudoun’s full treatment); L7 also touches Loudoun. *New consequence this lecture adds:* nothing new — the ZOAM is here purely as a **comparative** for Memphis’s absence of a zoning fight. **One clause. “The epicenter rewrote its own rules; Memphis never had rules to rewrite” is the entire permissible use.**

The Clean Air Act. Not a roster document, but treated as a causal character in Beats 3, 4, and 11. **No prior lecture owns it.** Its load-bearing provisions here: the **100 short ton** major-source threshold; the **nonroad engine** exemption; the **citizen-suit provision**, which is the thing the United States moved to dismiss.

SECTION 6: THE NUMBER SPINE

The Figures & Claims Ledger contribution for Lecture 8. Every recurring or load-bearing number, with unit, stage, as-of date, author/filer, source, confidence tier, and notes. **Stage conventions: announced / spent; permitted / installed / energized; projected / realized; n/a where the figure is a count or a vote.**

6.1 — THE LEDGER

A. The jobs math (Beats 5, 7, and the Step Function)

figure	unit	stage	as-of	author/filer	source	tier	notes
1 job / \$13,000,000	jobs per \$ capital investment	announced/announced	Jan 2026 (data from 1990)	Food & Water Watch	<i>Artificial Jobs</i> , p.1, from VEDP	STRUCTURAL	Must-hit anchor. Attribution discrepancy #1. Filer seeks a national moratorium
\$137,000 / job	\$ per job, non-DC sectors	announced	Jan 2026	Food & Water Watch	same	STRUCTURAL	The comparison half of the anchor
1 job / \$54,000,000	jobs per \$	announced	Jan 2026 (2020–late 2025)	Food & Water Watch	<i>Artificial Jobs</i> , p.2	STRUCTURAL	Step Function markup alternate
\$322,000 / job	\$ per job, non-DC	announced	Jan 2026 (2020–2025)	Food & Water Watch	same	STRUCTURAL	168:1 ratio
\$7,800,000 / job incl. secondary	\$ per job	announced	Jan 2026 (1998–2025)	Food & Water Watch	same	STRUCTURAL	

figure	unit	stage	as-of	author/filer	source	tier	notes
~7,600	VA data center employees	realized (est.)	2024	FWW / BLS QCEW	<i>Artificial Jobs</i>	CONTESTED	95% CI stated by FWW
5,400	VA data center employees	realized (est.)	2024	VEDP data alone	via FWW	CONTESTED	Lower bound
~23,000	US permanent DC jobs	realized (est.)	2024	Food & Water Watch	<i>Artificial Jobs</i>	CONTESTED	Extrapolated from VA per-MW
0.01% / 4.4%	share of US jobs / US electricity	realized	2024	FWW; LBNL-2001637	<i>Artificial Jobs</i> ; LBNL Dec 2024	STRUCTURAL	The pairing is the argument
603,000 direct / 4.7M supported	jobs	modeled	2023 (pub. Feb 2025)	PwC for Data Center Coalition	<i>Economic Contributions of Data Centers</i>	CONTESTED	Seller's document; whole NAICS 518210
\$203B / 12,140 = \$16.7M per job	\$ / jobs	announced	through 2023 (pub. Apr 2024)	NVTC	5th Biennial Report	CONTESTED	Seller's own arithmetic; NVTC sponsored by Amazon, Dominion
74,000 jobs / \$5.5B labor income / \$9.1B GDP	jobs, \$/yr	modeled	9 Dec 2024	JLARC (from VEDP response)	Report 598	STRUCTURAL	Majority construction-phase. L1 owns
300 FTE ops / 1,800 construction / \$23M avg pay+benefits	jobs, \$	modeled	2022 study, circulated 2024–25	NetChoice, from Mangum Economics	MN Senate Taxes handout	CONTESTED	Lobbying document
1.12	jobs per MW	realized	2023–24	FWW from BLS + Dominion IRPs	<i>Artificial Jobs</i>	STRUCTURAL	
~\$1,000,000+ per permanent job	\$ subsidy per job	announced	~2016, reaffirmed 2026	Greg LeRoy, Good Jobs First	via Grist/AOL	STRUCTURAL	LeRoy: “still very much in the ballpark”
\$1,900,000 per job	\$ subsidy per job (megadeals)	announced	2016	Kasia Tarczynska, Good Jobs First	GJF megadeal study	STRUCTURAL	11 data centers, 9 states, \$2B
net ≈ 0	county employment effect	modeled	Nov 2025	Michael J. Hicks	Texas data center analysis	CONTESTED	Workers shifted between subsectors

B. Staffing ratios (Beat 7, the Kicker)

figure	unit	stage	as-of	author/filer	source	tier	notes
8–12	ops staff per MW, small facilities	realized	2025–26	Uptime Institute	published ops guidance	STRUCTURAL	Range stays a range

figure	unit	stage	as-of	author/filer	source	tier	notes
1–2	ops staff per MW, hyperscale	realized	2025–26	Uptime Institute	same	STRUCTURAL	
0.2–0.3	staff per MW, 100+ MW campuses	realized	2026	industry compilation of operator-reported data	2026 staffing analyses	STRUCTURAL	
20–30	permanent staff per 100 MW	realized	Nov 2025	workforce analysis	Hamm Institute workforce paper	STRUCTURAL	Most-automated campuses
50–80	permanent staff at 50 MW	realized	2026	derived from Uptime ratios	industry compilation	STRUCTURAL	
~50	FTEs per 250,000 sq ft	realized	Syllabus 1.0	course anchor	Syllabus 1.0 must-hit	STRUCTURAL	Discrepancy #2 — denominator
0.7–2.0	construction workers per MW	n/a	2024–25	industry	CBRE-derived	STRUCTURAL	
400–600 / 800–1,200	peak construction workers, 50 MW / 100+ MW	n/a	2024	CBRE	<i>North America Data Center Trends</i>	STRUCTURAL	
7,000	daily tradespeople, Abilene	realized	Jun 2026	Crusoe	company statement	VOLATILE	Seller's own figure; construction
2.0M → 2.3M	global DC FTE roles	modeled	2019 → 2025	Uptime Institute	Staffing Forecast 2021–2025	STRUCTURAL	
42% / 15–25%	operators losing staff / to raises of	realized	2024	Uptime Institute	2024 survey	STRUCTURAL	
340,000	projected US DC job shortfall	projected	end-2026	industry estimate	2026 compilation	CONTESTED	Unattributed methodology
25–60%	decline in entry-level engineering hiring	realized	2024→2025	industry compilation	2026 staffing analyses	CONTESTED	
40–120%	salary premium, GPU/liquid-cooling roles	realized	2026	industry compilation	same	CONTESTED	

C. Memphis / xAI (Beats 1–4, 6, 12)

figure	unit	stage	as-of	author/filer	source	tier	notes
~35	gas turbines on site	installed, unpermitted	Apr 2025	SELC / Southwings aerial	SELC; Inside Climate News	ANCHOR	Must-hit anchor

figure	unit	stage	as-of	author/filer	source	tier	notes
15	Solar SMT-130 turbines	permitted	2 Jul 2025	Shelby County Health Dept	SCHD air construction permit	ANCHOR	24/7 operation authorized
~247.2	MW	permitted capacity	2 Jul 2025	SCHD	permit	ANCHOR	Rate, not energy
421	MW	installed capacity (est.)	Jul 2025	SELC	via TechCrunch	STRUCTURAL	Filer benefits
20	turbines removed	n/a	~Jul 2025	SELC account	via Reuters 17 Feb 2026	STRUCTURAL	
1 Sep 2025 / 2 Jan 2027	BACT deadline / permit expiry	n/a	2 Jul 2025	SCHD	permit	ANCHOR	Expiry is a decay trigger
5–1	Shelby County Commission vote	n/a	26 Mar 2025	Commission	minutes	ANCHOR	
6–1	APCB vote upholding permit	n/a	15 Dec 2025	Memphis & Shelby Co. APCB	board record	ANCHOR	Must-hit anchor
7 members / 4-yr terms	APCB composition	n/a	Dec 2025	APCB	via Action News 5	STRUCTURAL	
1,700+	public comments	n/a	16 May 2025	SCHD	press statement	ANCHOR	
2,000+	public comments	n/a	17 Jul 2025	Inside Climate News	reporting	STRUCTURAL	Different counter/date — do not merge
27	turbines acknowledged, Southaven	installed	early 2026	xAI	company position	CONTESTED	
41	turbines, Southaven	permitted	10 Mar 2026	MDEQ Permit Board	operations permit, MZX Tech LLC	ANCHOR	
1.2	GW self-generating capacity	permitted capacity	10 Mar 2026	xAI	company statement on X	VOLATILE	Company's characterization
59 (57 + 2)	turbines	installed, unpermitted	Jul 2026	public records request (Trinity–MDEQ emails)	investigative reporting	STRUCTURAL	Method disclosed
~2,500 / 4,000 / 22	short tons/yr NOx / CO / formaldehyde	projected at 80% capacity, 30 of 59 units	Jul 2026	manufacturer emissions profiles	same	STRUCTURAL	Not a measurement
100	short tons/yr	n/a	statutory	Clean Air Act	42 U.S.C. §§7401 et seq.	ANCHOR	Major-source threshold
1,200–2,000	tons/yr NOx, Colossus 1	projected	2025	SELC letter to SCHD	SELC	CONTESTED	Range stays a range; filer benefits
79%	increase in peak NOx	measured (community sensors)	5 Mar 2026	MCAP, per KeShaun Pearson	Action News 5	CONTESTED	Monitor integrity disputed by SCHD, 23 Jun 2026

figure	unit	stage	as-of	author/filer	source	tier	notes
100,000 → 1,000,000	Nvidia GPUs	installed → announced	Sep 2024 → Dec 2024	Musk; Greater Memphis Chamber	X post; Chamber	STRUCTURAL	
~8 → ~150	MW grid connection	energized	2024–25	TVA/MLGW via Global Energy Monitor	GEM	STRUCTURAL	
122	days to build	n/a	Sep 2024	Elon Musk	self-reported	STRUCTURAL	Self-reported
>1,000,000 / 3,700,000 / 1,200,000	gallons per day: est. use / requested / contracted	projected / requested / contracted	2024 / 2026 / 2026	MLGW; Protect Our Aquifer	McGowen; E&E News; WREG	STRUCTURAL	~1% of MLGW daily aquifer draw
13,000,000	gallons/day greywater treatment	projected capacity	10 Oct 2025	xAI / MLGW	groundbreaking	STRUCTURAL	Paused Apr 2026
5,000,000,000	gallons/yr conserved	projected	10 Oct 2025	Doug McGowen, MLGW	groundbreaking	CONTESTED	Projection
9% / 20%	aquifer withdrawal reduction / nutrient loading reduction	projected	10 Oct 2025	Brent Mayo, xAI	groundbreaking	CONTESTED	Seller's figures
\$80M / \$78M	greywater facility cost	announced / as filed	Oct 2025 / filing	xAI	announcement; permit filing	STRUCTURAL	
7,000,000 / 10,400,000	gallons/day average / peak flow	projected	filing	xAI filing	permit documents	STRUCTURAL	
\$3,200,000	special revenue fund, 38109	realized	21 Oct 2025	City of Memphis	council record	ANCHOR	
\$15–20M / \$500,000	annual local property tax / additional PILOT	projected	2024	MLGW	via Commercial Appeal	CONTESTED	Projections, 2024 vintage
300+	permanent jobs	projected	2024	MLGW	same	CONTESTED	
up to 500	jobs, initial phase	announced	2024	Greater Memphis Chamber	chamber FAQ	ANCHOR <i>as a promise</i>	Seller's document
99 / 44	identified employees / open postings	realized (est.)	6 Jan 2026	Oligarch Watch	LinkedIn + postings audit	CONTESTED	Method disclosed; adversarial vantage
\$0	state/local incentives applied for	n/a	21 Jun 2024	EDGE	EDGE confirmation	ANCHOR	The county's strongest fact
~\$37,000	median household income, 38109	realized	2025	NBC News	reporting	STRUCTURAL	[HUMAN FLOOR]
~2	GW Memphis-area demand at full build	projected	13 Feb 2026	NAACP / SELC	notice of intent to sue	CONTESTED	Filer benefits

figure	unit	stage	as-of	author/filer	source	tier	notes
\$1.25 trillion	SpaceX-xAI combined valuation	mark	Feb 2026	transaction	contemporaneous reporting	VOLATILE	A mark, not a verdict

D. Electrolux (Beat 6)

figure	unit	stage	as-of	author/filer	source	tier	notes
\$188,300,000	total government incentives	announced	2010	multiple govt sources	Commercial Appeal; Cohen	ANCHOR	
≥\$97,000,000 (~\$100M)	state incentives	announced	2010	TNECD	via AP, Feb 2019	ANCHOR	
~\$33,900,000	PILOT value	announced	2010	EDGE	Commercial Appeal	STRUCTURAL	Exempted diversity requirements
90% / 75% / 15 years	city tax cut / county tax cut / term	n/a	2010	EDGE PILOT	Commercial Appeal	ANCHOR	
1,240	jobs committed	announced	2010	Electrolux	agreement	ANCHOR	
1,100+	peak employment	realized	2017	TNECD	via AP	STRUCTURAL	
254 + 404 = 658	terminations	realized	CY2018	Electrolux	EDGE Annual Performance Report	ANCHOR	[HUMAN FLOOR]
<\$500,000	PILOT payment	realized	2018	Electrolux	same	ANCHOR	
534	employees at closure announcement	realized	31 Jan 2019	TNECD	AP	ANCHOR	[HUMAN FLOOR]
\$250,000,000	Springfield reinvestment	announced	31 Jan 2019	Electrolux	company statement	STRUCTURAL	
\$0	incentives recovered	realized	Feb 2019	TNECD	AP	ANCHOR	No clawback clause
2013	year TN began requiring clawbacks	n/a	Feb 2019	Scott Harrison, TNECD	AP	ANCHOR	Three years too late
\$87M / \$76M	construction spend / local share	realized	~2012	plant official	pre-opening tour	STRUCTURAL	

E. Subsidy architecture (Beat 5)

figure	unit	stage	as-of	author/filer	source	tier	notes
36 / 11 / 5 / 4 / 1	states with DC exemptions / disclosing recipients / amounts / jobs promised / wages	n/a	Nov 2025	Good Jobs First	<i>Cloudy Data, Costly Deals</i>	ANCHOR	Zero disclose both promised and created

figure	unit	stage	as-of	author/filer	source	tier	notes
16 of 36	state DC subsidies with no job-creation requirement	n/a	2025–26	Kasia Tarczynska, Good Jobs First	GJF, “Will data center job creation live up to hype?”	ANCHOR	Discrepancy #3 RESOLVED
100 / ≤50 / 20	NJ job requirement / most states / Illinois	n/a	2025–26	Good Jobs First	same	STRUCTURAL	
6 / 8	states requiring ≥\$250M investment / requiring no minimum	n/a	Apr 2026	Good Jobs First	<i>The Myths of Data Centers’ “Billions”</i>	STRUCTURAL	
52–70 cents	lost per \$1 of exemption	modeled	Nov 2025	states’ own ROI studies via GJF	<i>Cloudy Data</i>	STRUCTURAL	Range stays a range
\$1,600,000,000 / +118%	VA exemption cost FY2025 / YoY change	realized	FY ended 30 Jun 2025	Commonwealth of Virginia	Annual Comprehensive Financial Report	ANCHOR	
~\$1,000,000,000	VA annual abatement	realized	2025	Good Jobs First	<i>Cloudy Data</i>	STRUCTURAL	
\$673,000,000	VA exemption cost	realized	2022	NVTC	via FWW	STRUCTURAL	≈ median income of ~8,000 VA households
\$150M + 50 jobs	VA qualification threshold	n/a	current	Commonwealth of Virginia	statute	ANCHOR	
\$1,000,000,000	TX FY2025 DC subsidy cost	realized	FY2025	Good Jobs First	<i>Cloudy Data</i>	STRUCTURAL	No project-level disclosure
>1,000%	AZ program cost growth	realized	recent years	Good Jobs First	same	CONTESTED	
35% / \$26 vs \$56 per hour	WY unskilled share / wage gap	realized	2021	Good Jobs First	GJF analysis	STRUCTURAL	
60%	anticipated out-of-region construction workforce, Genesee Co. NY	projected	2025–26	Genesee County IDA	via GJF	STRUCTURAL	
62%	incentives as share of total investment, colocation counties	modeled	2026	economic analysis	via Quartz, May 2026	CONTESTED	

F. Stargate (Beat 9)

figure	unit	stage	as-of	author/filer	source	tier	notes
\$500,000,000,000 / 10 GW	investment / capacity	announced	21 Jan 2025	OpenAI, Oracle, SoftBank	announcement	ANCHOR <i>as announcement</i>	Must-hit anchor
0.3	GW	energized	17 Apr 2026	Epoch AI	site survey (Airbus imagery 24 Mar 2026)	VOLATILE	~250,000 H100-equivalents
1.2	GW	projected	2026	Crusoe	company	VOLATILE	~1.0M H100-equivalents
4 of 8	buildings operational	energized	Apr 2026	Epoch AI	survey	VOLATILE	
200+ MW / 980,000 sq ft	IT capacity / floor area, first two buildings	energized	30 Sep 2025	Crusoe	company	STRUCTURAL	
360.5	MW gas plant	permitted in 6 days	~Aug 2024	Crusoe / Texas regulator	permit filing	ANCHOR	Five months before the announcement
10 + 19 = 29	GE Vernova aeroderivative turbines	ordered	Dec 2024 / Jun 2025	Crusoe	procurement record	STRUCTURAL	Jet engines, not combined-cycle
up to 7 years	combined-cycle turbine lead time	n/a	2025–26	industry	L4 owns this figure	STRUCTURAL	Cite, do not rebuild
4.5 GW / \$300B+	Oracle–OpenAI agreement	announced	Jul 2025	OpenAI, Oracle	announcement	CONTESTED	
~7 GW / \$400B+	planned capacity / investment	announced	23 Sep 2025	OpenAI	five-new-sites post	CONTESTED	
5.5 GW / 25,000+ onsite jobs / 4,800 acres	capacity / jobs / land	announced	22 Sep 2025	Oracle	fact sheet (congressional record)	CONTESTED	Jobs figure is construction-weighted
9+ GW by 2029	capacity	projected	Apr 2026	Epoch AI	survey	CONTESTED	
600 MW / \$150,000,000	dropped expansion / Nvidia deposit	contested	Mar 2026	Bloomberg, Reuters	reporting; disputed by Oracle 9 Mar 2026	CONTESTED	Present the conflict
>\$100,000,000,000	Oracle debt funding Stargate	reported	Mar 2026	financial reporting	Tom's Hardware et al.	VOLATILE	Negative free cash flow reported

G. Federal instruments and the moratorium wave (Beats 8, 11)

figure	unit	stage	as-of	author/filer	source	tier	notes
23 Jul 2025	release date	n/a	—	The White House	<i>Winning the Race</i>	ANCHOR	Timeline Snap
90+ / 3 / 10,000+	policy actions / pillars / RFI comments	n/a	Jul 2025	The White House	<i>Winning the Race</i>	ANCHOR	
11 Dec 2025	EO 14365 signature	n/a	—	The President	EO 14365	ANCHOR	

figure	unit	stage	as-of	author/filer	source	tier	notes
30 / 90 days	Task Force / Commerce, BEAD, FCC, FTC clocks	n/a	11 Dec 2025	EO 14365 §§3–7	order text	ANCHOR	
10 Jan 2026	Task Force operative	n/a	Jan 2026	derived from §3 clock	Paul Hastings; Cato	STRUCTURAL	
1	federal courtroom action vs. a state AI law	realized	24 Apr 2026	DOJ	complaint in intervention, D. Colo.	ANCHOR	As-Of Stamp target
267 / 40+	DC-related bills / states	n/a	2025	MultiState	2026 legislative guide	ANCHOR at date	
300+ / 30+	DC-related bills / states	n/a	Jul 2026	DLA Piper	July 2026 alert	VOLATILE	
11 / 12 / 14	states with moratorium bills	n/a	2026	MultiState / DLA Piper / Bisnow	three counters	CONTESTED	Do not average. Name the counter.
100+ / 54 of 63	local moratoria adopted / GJF local-action tally	n/a	2026	Columbia-Sabin / Good Jobs First	tallies	VOLATILE	Different denominators
~50	Michigan counties enacting or considering bans	n/a	Jun 2026	datacenterbans.cdtracker		VOLATILE	≈ area of Rhode Island
\$64,000,000,000 / \$60B+	projects blocked or delayed	n/a	2026	DLA Piper / separate compilation (140+ groups)	alerts	CONTESTED	
44–16 / 102–39	NY Senate / Assembly votes	n/a	4 Jun 2026	NY Legislature	roll call	ANCHOR	Responsible Data Center Development Act, ≥20 MW
14 Jul 2026 / 50 MW / 1 year	NY Executive Order 62	effective	14 Jul 2026	Gov. Kathy Hochul	EO 62	ANCHOR	First statewide DC moratorium in the US — by executive order, at a higher threshold than the unsigned bill
24 Apr 2026 / 20 MW / to 1 Nov 2027	Maine LD 307 veto	vetoed	24 Apr 2026	Gov. Janet Mills	veto message	ANCHOR	Objected only to a \$550M carve-out
3 years	AZ moratorium on new DC sales tax breaks	enacted	Jun 2026	Gov. Katie Hobbs	signed bill	ANCHOR	Distinct from the 13 Jun incentive pause reporting

figure	unit	stage	as-of	author/filer	source	tier	notes
70,000 of 413,488	Ohio ballot signatures	failed	1 Jul 2026	Ohio proponents	tracker	ANCHOR	25 MW constitutional amendment
15	VA data center bills enacted	enacted	2026 session	Virginia General Assembly	via DLA Piper	STRUCTURAL	
S.4214 / H.R.9442	federal moratorium bills	introduced	25 Mar 2026 / 24 Jun 2026	Sen. Sanders / Rep. Ocasio-Cortez	Congress	STRUCTURAL	Conditional, not time-limited; 9 cosponsors on the House bill
42 / ~24	state AGs on child safety / state AGs to FCC	n/a	9 Dec 2025 / 19 Dec 2025	state attorneys general	letters	ANCHOR	

H. Public opinion (Beat 7, the Kicker)

figure	unit	stage	as-of	author/filer	source	tier	notes
64%, in every state	Americans naming AI job loss as top AI fear	n/a	field Nov–Dec 2025	Anthropic Public Record (YouGov)	wave 1, n=51,993, Census-weighted	ANCHOR at date	Surveying party is an AI developer — name it
52% / 32% / 36% / 33%	workers worried / expecting fewer opportunities / hopeful / overwhelmed	n/a	field 7–13 Oct 2024	Pew Research Center	n=5,273 employed adults	ANCHOR at date	
50% vs 10%; 37% in 2021	more concerned than excited / more excited / 2021 baseline	n/a	field Jun 2025	Pew Research Center	n=5,023 adults	ANCHOR at date	
21% / 16% / 65%	workers using AI 2025 / 2024 / not much or at all	n/a	Sep 2025	Pew Research Center	survey	STRUCTURAL	
71% / 53%	fear permanent job losses / fear household job loss	n/a	2025 / Jun 2026	Reuters/Ipsos	polls	CONTESTED	Different questions — do not stack
18%	employees expecting own job eliminated in 5 years	n/a	2026	Gallup	poll	STRUCTURAL	

I. The federal intervention (Beats 10, 11)

figure	unit	stage	as-of	author/filer	source	tier	notes
14 Apr 2026 / 10 Jun 2026	NAACP complaint filed / amended	filed	2026	NAACP, Mississippi State Conference	N.D. Miss.	ANCHOR	~30 more turbines found in discovery
15–16 Jun 2026	US motion to intervene and dismiss	filed	2026	DOJ Environment & Natural Resources Division; Assoc. AG Stanley Woodward	motion + memorandum	ANCHOR	Joined by xAI and the State of Mississippi; sought with prejudice
“four” / “three”	frontier models suitable for mission- critical operations	sworn	Jun 2026	Cameron Stanley, Dept. of War CDAO	declaration, as rendered in secondary sources	CONTESTED	Discrepancy #5 — pull the declaration
2,000 munitions / 2,000 targets / 96 hours	Operation Epic Fury	sworn	Jun 2026	Cameron Stanley declaration	same	STRUCTURAL	Via the filing
24 Aug 2026	preliminary injunction hearing	[EXPECTED]	scheduled	the court	noted in DOJ filing	ANCHOR	

6.2 — AUDIT ONE: RECONCILIATION AGAINST THE MUST-HIT ANCHORS

Five discrepancies. None silently substituted anywhere in this pack. Nick resolves.

DISCREPANCY #1 — the Step Function’s attribution. [MATERIAL]

- *Anchor as carried:* Syllabus 2.0 lists among L8’s secondary cast “the JLARC jobs math (~1 job per \$13M),” and Syllabus 1.0’s must-hit anchors list “~1 job/\$13M vs. ~\$137K/job” within a scope paragraph that also names JLARC.
- *Researched:* the figures originate in **Food & Water Watch, Artificial Jobs, January 2026**, as FWW’s own analysis of **VEDP** announcement data from 1990. JLARC’s December 2024 report contains **no such ratio**; its figures are 74,000 jobs / \$5.5B labor income / \$9.1B GDP, sourced to a VEDP response, and JLARC states the majority derives from construction.
- *Both sources, both dates:* JLARC, *Data Centers in Virginia* (Report 598), 9 December 2024. Food & Water Watch, *Artificial Jobs*, January 2026.
- *Consequence if unresolved:* the course would attribute an advocacy organization’s ratio to a nonpartisan legislative audit commission — the single most damaging category of error available to this course, because JLARC’s independence is precisely why L1 made it the Paper Trail. **Resolution is required before Draft 1, not before Draft 2.**

DISCREPANCY #2 — the ~50 FTEs per 250,000 sq ft denominator. [MINOR, but it changes the phrasing]

- *Anchor as carried:* “~50 FTEs per 250k sq ft” (Syllabus 1.0, restated in Syllabus 2.0 and in the Beat Menu’s Perverse Incentive entry).
- *Researched:* the industry publishes staffing per **megawatt**, not per square foot. Verified ratios: 1–2 staff/MW hyper-scale; 0.2–0.3 staff/MW above 100 MW; 20–30 permanent staff per 100 MW; 50–80 permanent staff at 50 MW. The square-foot figure is a plausible derivation but the pack could not source it directly.
- *Consequence:* the **magnitude survives intact** — “about fifty people” is right for a facility of this class — but a draft that states a square-foot denominator is stating a figure the pack cannot support. **Recommended resolution: keep “about fifty,” attach it to facility scale rather than floor area.** Nick’s call.

DISCREPANCY #3 — the “~half of subsidies with no job requirement” anchor. [RESOLVED IN THIS PACK]

- *Anchor as carried:* “~half of subsidies with no job requirement.”
- *Researched and confirmed:* **“Almost half of state data center subsidies – 16 out of 36 – do not require job creation.”** Good Jobs First (Kasia Tarczynska), “Will data center job creation live up to hype? I have some concerns,” updated through 2026. Supporting detail: of those that do require jobs, New Jersey requires 100 and the remaining states require 50 or fewer; Illinois requires 20; Indiana’s subsidy requires none, so the 200 jobs its governor announced for a Google data center carry no legal obligation, while a separate local property-tax agreement requires 30.
- *Status:* **anchor verified with a precise numerator and denominator. No discrepancy. Use “16 of 36” in prose — it is better than “about half.”**

DISCREPANCY #4 — the moratorium tally. [MATERIAL, and it is a decay problem rather than an error]

- *Anchor as carried:* Syllabus 2.0 assigns L7 an As-Of Stamp on “the 11+ state moratorium tally,” and L8’s Regulatory Collision inherits that wave.
- *Researched, as of 21 July 2026:* three counters publish three different figures for 2026 — **11** (MultiState, moratorium bills introduced), **at least 12** (DLA Piper, states considering moratorium legislation), **14** (Bisnow, states that have considered moratoriums since the start of the year). Beyond the count, the *state of the world* has changed: Maine’s legislature passed a moratorium and the governor vetoed it (24 April 2026); New York’s legislature passed one (4 June 2026) and it remains unsigned; **and on 14 July 2026 Governor Hochul imposed a statewide moratorium by Executive Order 62 at a 50 MW threshold, making New York the first state in the nation with a statewide data center permitting moratorium** — seven days before this pack’s research date.
- *Both sources, both dates:* Syllabus 1.0 / L7 anchor (“11+ states with active bills”); MultiState, DLA Piper, Bisnow, datacenterbans.com, and the New York EO 62 record, all 2026.
- *Consequence:* the anchor is not wrong, it is **stale in a way that changes the sentence’s meaning**. In L7’s frame the wave was pending bills; by L8’s territory a governor has acted. **The lecture must not restate L7’s tally as current.** Recommended resolution: L7 keeps its dated tally with its as-of stamp; L8 carries the July 2026 state of play with its own date. Nick’s call on whether L7 refreshes.

DISCREPANCY #5 — the frontier-model count in the Stanley declaration. [MINOR, but it is inside a Verbatim candidate]

- *Researched:* secondary sources render the sworn declaration’s count as **“only four proprietary state-of-the-art AI models”** and, elsewhere, as **“one of just three frontier AIs suitable for mission-critical operations.”**
- *Consequence:* the pack has not read the declaration itself and cannot arbitrate. **The draft must not state a number here without a PACER pull.** The safe formulation, which both renderings support: *one of a very small number of models cleared for that role.*

6.3 — AUDIT TWO: CAPACITY VS. ENERGY

Every power figure in the spine has been checked and labeled. **Findings:**

- **All power figures in this lecture are capacity (rates), not energy (quantities).** 247.2 MW, 421 MW, 1.2 GW, 0.3 GW, 10 GW, 5.5 GW, 2 GW, 150 MW, 360.5 MW, 20 MW and 50 MW thresholds — **every one is a rate.** This lecture contains **no terawatt-hour figure of its own**; the only energy quantity it touches is the **4.4% of U.S. electricity usage** share carried from LBNL-2001637 via Food & Water Watch, which is correctly an energy share.
- **Sources that blurred them — the blur is course material.** Two instances worth flagging. (1) The NAACP/SELC notice of 13 February 2026 compares “nearly 2 GW” of Memphis-area data center demand to “approximately the output of the Hoover Dam.” **Hoover’s ~2,080 MW is nameplate capacity; its actual annual generation is a fraction of what continuous operation at nameplate would produce, because it is a hydro facility constrained by water.** The comparison compares a data center’s near-continuous demand to a dam’s peak rating, which flatters the comparison in the filer’s direction. **Flagged; the pack declined this conversion in Section 4 partly for this reason.** (2) xAI’s 10 March 2026 statement that the MDEQ permit “unlock[ed] 1.2GW of self-generating power capacity” is correctly labeled capacity by the company — a rare and creditable instance of a seller getting the unit right, and worth noting for balance.
- **Threshold hygiene.** The moratorium thresholds (20 MW in Maine and the NY bill; 50 MW in NY EO 62; 25 MW in the failed Ohio measure; 100 MW in the Maryland bill; 1 MW in the Virginia Shin bill) are all **peak demand**

rates, and the differences between them are the whole substance of the policy fight. **A draft that says “large data centers” instead of naming the megawatt threshold has thrown away the argument.**

6.4 — AUDIT THREE: PHANTOM LOAD

Aggregate demand figures in this spine, each checked for duplicate-request inflation:

- “~2 GW Memphis-area demand at full build” (NAACP/SELC, 13 Feb 2026). **Phantom-load risk: LOW, unusually.** This is a *behind-the-meter self-generation* figure derived from permitted and installed turbine capacity across named sites, not from interconnection requests filed with a utility. It cannot be duplicated across five utilities’ forecasts because it never entered a utility’s queue. **This is the phantom-load discipline’s mirror image and the pack flags it as a genuinely interesting finding: behind-the-meter buildout is more honestly countable than grid-connected buildout, because the turbines physically exist on pads and can be photographed from the air.** The residual risk is the opposite one — that the figure aggregates permitted capacity that may never be energized.
- Stargate’s “10 GW,” “~7 GW,” “5.5 GW,” “9+ GW by 2029.” **Phantom-load risk: HIGH, and of a specific kind.** These are *announced planned capacity* figures published serially by the same parties, and the September 2025 announcement explicitly re-totals earlier commitments alongside new sites. The **0.3 GW energized** figure from Epoch AI’s April 2026 survey is the only *measured* number in the group. **The caveat attaches on first appearance: announced planned capacity from an announcing party is not a load, and this program’s own history includes a 600 MW walk-away.**
- “340,000 projected US data center job shortfall by end-2026.” **Phantom-load-adjacent risk: HIGH.** Unattributed methodology; likely derived from the same demand projections that carry duplicate-request inflation. **Tier: CONTESTED. Use with the author named or not at all.**
- **National employment figures (23,000; 603,000; 4.7M).** Not demand figures, but the same discipline applies to their denominators: PwC’s uses the entire NAICS 518210 sector, which FWW demonstrates is roughly eight times too broad for Virginia (33% of national capacity, 4% of national 518210 jobs). **Whenever a national data center employment number appears, the sector definition is the phantom.**

One further discipline specific to this lecture. The turbine counts — 35, 15, 20 removed, 27, 41, 59 — are **not** aggregate demand figures and must not be treated as a single series. They are: *installed and photographed* (35), *permitted* (15), *removed* (20), *acknowledged by the company* (27), *permitted at a different site in a different state* (41), and *installed and documented via a records request* (59). **Four different verbs, two states, two facilities. A draft that renders them as “35 → 59” has merged two jurisdictions and lost the story.**

SECTION 7: THE SELLERS & THE OVERCLAIMS

The Overclaim Register contribution for Lecture 8, and the Steelman’s ammunition depot. Syllabus 2.0 names **the Politician, at every altitude** as this lecture’s seller and assigns **STRIP** and **GRANT-AND-WITHHOLD** as the governing moves. Those get the fullest treatment. The rest of the field follows, because a lecture’s territory always contains more sellers than its headline — and this territory contains all six.

7.1 — THE ASSIGNED SELLER: THE POLITICIAN, AT EVERY ALTITUDE

CLUSTER 1 — The local jobs pitch. *The claim as sold:* “xAI will bring up to 500 quality, high-paying jobs to Memphis in its initial phase, with plans to grow more.” Seller: the **Greater Memphis Chamber**, a quasi-institutional political seller. Venue: the Chamber’s own published xAI FAQ, first archived October 2024, live at the research date. Adjacent: **State Sen. Brent Taylor** (R), who told the public xAI would hire from economically distressed areas of Memphis and change lives of people moving from SNAP benefits to six-figure wages; **MLGW**, projecting 300-plus permanent jobs in 2024; and **Bobby White** of the Chamber, forecasting global recognition as “the Digital Delta” within five years (FOX13, 5 December 2024). *What the seller gets if you believe it:* the recruitment case for the next project, political cover for the permitting posture, and a defense against the air-quality fight denominated in something other than air. *What’s real, granted precisely:* **xAI took no state or local incentives** — EDGE confirmed on 21 June 2024 that no application was filed, and

the project was built with private capital. It has paid **tens of millions in local tax** by the Chamber's own account, with the Chamber projecting the figure to exceed **\$100 million** on current expansion plans, and the City has ring-fenced **\$3.2 million** of it for the 38109 zip code. It is hiring; it ran hiring events; it has a local-vendor RFP portal. **This is materially better behavior than the Electrolux bargain and better than the Virginia bargain, and the course must grant it in full.** *What's oversold:* the number. The only public headcount attempt with a disclosed method — LinkedIn profiles plus job postings, 6 January 2026 — found **99** identifiable Memphis employees against **500** promised, with **44** open positions and more than half of identified employees hired from outside the region. xAI has published no headcount. **The overclaim is not that the jobs are bad; it is that a job count was used as the public justification for a project whose actual public justification was tax revenue, and the two are not interchangeable.** *Narrator move:* **GRANT-AND-WITHHOLD**, exactly as assigned. Confirmed against the evidence as researched.

CLUSTER 2 — The revenue substitution. *The claim as sold:* that the tax revenue is the community benefit, and that dedicating a portion of it to the affected zip code answers the objection. Seller: **Mayor Paul Young**, statement on X, 29 March 2025, and the resulting first-of-its-kind ordinance; funded at **\$3.2 million**, confirmed 21 October 2025. *What the seller gets:* a defensible position on a fight he cannot win on the merits, because **the permitting authority is the county health department, not the mayor's office.** *What's real:* the money is real, was paid, and is being allocated with resident surveys and a council committee. **And the mayor's own statement conceded, in writing, that the project's speed may have left the community without adequate engagement — a genuinely unusual admission from a seller, and it should be quoted rather than paraphrased.** *What's oversold:* the substitution itself. A revenue-allocation ordinance is not a permit condition; it directs money the city was going to receive regardless and conditions nothing on the company's conduct. **The ordinance would pay out identically whether the turbines ran with permits or without.** *Narrator move:* **GRANT-AND-WITHHOLD**. Calibration note: this is the most sympathetic seller in the lecture and the calibration must stay identical to the one applied to the White House. Nobody wrong on their own terms.

CLUSTER 3 — The national race. *The claim as sold:* **“Just like we won the space race, it is imperative that the United States and its allies win this race.”** Seller: **the White House**, in *Winning the Race*, 23 July 2025, over three named signatures. *What the seller gets:* a deregulatory mandate across a dozen agencies, a preemption predicate, an industrial-policy frame that converts a private capital buildout into a national project, and a national-security argument that ends other arguments. *What's real:* granted at full strength in §7.4. The grid diagnosis is correct; the permitting diagnosis is correct; the patchwork claim is specific and produced a court order within four months; and the operational-dependency claim is now sworn testimony. *What's oversold — named exactly:* **the analogy, not the urgency.** The space race was a federally funded program executed by a federal agency toward a defined public objective on a public budget. This is a privately financed capital buildout in which the federal role is to remove obstacles — and the document's own Pillar II actions are almost entirely *removals*: categorical exclusions, permit streamlining, regulatory reduction. **A race the government wins by getting out of the way is a different kind of race, and the difference is the whole reason the local vector exists.** Also oversold, quietly: the tension between *AI will improve the lives of Americans by complementing their work—not replacing it* (page 2) and the directive to fund **rapid retraining for individuals impacted by AI-related job displacement** (page 7). Both sentences are in the same document. **State the tension; do not editorialize it.** *Narrator move:* **GRANT-AND-WITHHOLD**, with the analogy — not the goal — as the thing withheld.

CLUSTER 4 — The moratorium politics, in both directions. *The claims as sold:* that a moratorium protects communities (New York's and Maine's legislatures, 100-plus localities), and that a moratorium sends the wrong signal and is duplicative (Assemblyman **Scott Gray**, 30 June 2026, arguing New York's Public Service Commission process — begun February 2026 — should be allowed to play out; Gov. **Gretchen Whitmer**, calling a moratorium a non-starter while roughly 50 Michigan counties consider them). *What each gets:* a constituency, in opposite directions. *What's real on both sides:* **\$60–64 billion** in projects blocked or delayed is a real number for developers and a real victory for opponents, depending on which ledger you read. Local moratoria are the only lever that has demonstrably worked. *What's oversold:* the framing of moratoria as a *ban*. New York's EO 62 pauses certain **state environmental approvals** for projects at **50 MW or more** for up to a year while a Generic Environmental Impact Statement is prepared under SEQRA — a study pause with a threshold, not a prohibition, and the difference is why the bill's sponsors are still pushing for the legislation. *Narrator move:* **HOLD OPEN**. Style Guide §5 names this as a live debate. *The GRANT-AND-WITHHOLD exhibit of the year:* **Governor Janet Mills vetoing Maine's LD 307 while stating in the veto message that a moratorium is appropriate given the impacts of massive data centers in other states — objecting only to the absence of a carve-out for a \$550 million project in Jay.** A governor agreeing with a policy and vetoing it over one project is the entire local vector in one document.

7.2 — THE STRIP: “the building down the road is the AI coming for your job”

Assigned explicitly by Syllabus 2.0 and by Style Guide §5’s own worked example. **The pack confirms the move fits the evidence and specifies exactly what survives the strip.**

The folklore. The data center is the automation. Point at it; it is the thing.

Why the folklore exists, stated without condescension: AI-driven labor displacement is distributed, invisible, and happens in hiring decisions four states away. **The data center is the only physical object in the phenomenon.** It has a fence, an address, a parking lot, and a permit number. Treating it as the avatar is not ignorance; it is the only available act of pointing.

What gets removed: the personification, and only the personification. The building is not doing the automating. Colossus 1 and 2 are compute; the displacement happens in the products the compute serves, in decisions made by employers, in labor markets that do not run through Shelby County.

What is left standing after the strip — all documented, all in this pack:

1. **The anxiety, measured four ways.** 64% of Americans in every state (Anthropic, n=51,993, Nov–Dec 2025); 52% of workers worried and 32% expecting fewer opportunities (Pew, n=5,273, field Oct 2024); 53% household-level fear (Reuters/Ipsos, June 2026); 18% expecting their own job eliminated within five years (Gallup, 2026).
2. **The automation economics.** Entry-level engineering hiring down 25–60% from 2024 to 2025 as AI tools absorbed junior work, alongside a 40–120% salary premium for GPU-cluster and liquid-cooling specialists. **The industry compressing entry-level knowledge work is simultaneously bidding up pipefitters** — that is the documented shape of the displacement, and it is stranger and more specific than the folklore.
3. **The genuinely strange fact.** The physical avatar employs about fifty people.
4. **The federal government’s written answer to the fear, which is an apprenticeship program.**

The discipline: **never mock the people who believed it.** Style Guide §5 says so in terms, and this beat sits in a human-floor zone.

7.3 — THE REST OF THE FIELD

THE HYPERSCALER. *Claim:* Stargate — **\$500 billion, 10 gigawatts**, announced 21 January 2025 from the White House; “ahead of schedule” (OpenAI, 23 September 2025); **over 25,000 onsite jobs** (Oracle fact sheet, 22 September 2025). *Gets:* capital, standing, political cover, and a negotiating position with every utility in the footprint. *Real:* **0.3 GW energized**, four of eight Abilene buildings operational, 980,000 sq ft, GB200 racks running training and inference, a 1,000-acre campus, 7,000 tradespeople daily during the build. This is an enormous real thing. *Oversold:* announced capacity presented without the stage label; construction jobs presented without the word “construction”; “ahead of schedule” against buildings permitted for March 2026 completion that were not online in June 2026; and a 600 MW walk-away that Bloomberg and Reuters report and Oracle disputes. *Move:* **GRANT-AND-WITHHOLD**, with committed/contracted/energized doing the work.

THE UTILITY — present here in an unusual posture. MLGW is the seller in Memphis, and what it sold in 2024 was **300-plus jobs, \$15–20 million in annual property taxes, \$500,000 in additional PILOT payments, and no impact on customers.** *Gets:* increased electricity sales and a defensible public position. *Real:* the service agreements exist; the electricity sales are real; and the utility has since publicly pressed xAI to finish the greywater plant — a seller acting against its own large customer’s convenience, which should be credited. *Oversold:* “no impact on MLGW customers,” stated in 2024 before a company that would request up to **3.7 million gallons per day** and be contractually capped at **1.2 million**. **The more interesting utility fact is structural: because xAI generates behind the meter, the classic L7 socialization mechanism barely applies here.** The utility is a water story in Memphis, not a rate story. *Move:* **GRANT-AND-WITHHOLD**, and name the inversion.

THE NEOCLOUD FOUNDER / THE ESCAPE ARTIST. Both present, both **deliberately underweighted** per the roster’s lead/return discipline. Crusoe is L6-adjacent territory; orbital compute is L9’s, and this lecture touches it only at the Handoff seam. The one fact this lecture needs: on **4–5 March 2026**, in the middle of the Memphis fight, xAI announced orbital data centers — and the documented local response came from **KeShaun Pearson** and from **Sarah Houston** of Protect Our Aquifer, both in substance saying: finish the one on the ground. **That is the Handoff, and it is in the record rather than manufactured.** *Move:* **framing only — do not audit the orbital claim here.** That is L9’s beat, and spending it now steals the next lecture’s detonation.

THE DOOMER — audited exactly as hard, per Research Instruction 16. Three doomer-direction claims in this

territory:

1. *“Data centers destroy jobs.”* **Real:** the capital-to-jobs ratio is extreme and documented; Michael J. Hicks’s November 2025 Texas analysis found the net county employment effect effectively zero, with workers shifting between subsectors rather than entering new positions; a 2025 University of Michigan brief states flatly that data centers do not bring high-paying tech jobs to local communities. **Oversold:** “destroy” is not what any of those findings say. Capital intensity is not job destruction, and Food & Water Watch’s own document blends an employment-ratio finding with a separate argument about tech-sector layoffs elsewhere. **What would settle it:** state disclosure of jobs promised against jobs delivered — which, per Good Jobs First, **no state publishes.**
2. *“The turbines are poisoning the neighborhood.”* **Real:** 59 documented unpermitted units; manufacturer profiles for 30 of them projecting nearly 2,500 short tons of NOx annually at 80% capacity against a 100-ton threshold; two consecutive years of area ozone exceedances; a metro with among the worst asthma rates in the nation; four named residents on the record describing odor and health effects. **Oversold — uncomfortable to state and necessary:** the pack located **no continuous, independently operated, publicly published ambient monitoring record at the fence line for the full period.** MCAP’s sensors report a 79% peak-NOx increase; the Shelby County Health Department publicly questioned the integrity of a community air monitoring report on **23 June 2026.** **What would settle it:** independent continuous monitoring — which is the thing both sides are fighting about. **[HUMAN FLOOR — delivered with total precision and zero levy. This audit does not diminish the residents’ testimony. Their exposure is documented; the measurement dispute is a separate fact and the draft must not let one contaminate the other.]**
3. *“The federal government has legalized breaking the law.”* **Real:** the United States moved to dismiss a Clean Air Act citizen suit and **did not dispute the allegation that the turbines lack permits;** the NAACP’s public response used the language of federal bullying and authoritarianism. **Oversold:** the motion is a jurisdictional argument about enforcement discretion under the Clean Air Act and Article II, not an authorization to pollute; it has not been granted; a preliminary-injunction hearing is scheduled for **24 August 2026;** and EPA stated in January 2026 that temporary turbines exceeding thresholds must be permitted. **What would settle it:** the ruling. *Move:* **HOLD OPEN.**

7.4 — THE STEELMAN FILE: *the White House’s race logic*

Assigned defendant, deployment 6 of 8, rotation clean. **The strongest case, in the defendant’s own documents and numbers.** Beat 10 carries the delivery; this is the depot.

PREMISE ONE — the grid diagnosis, which is correct and which this course already proved. > “AI is the first digital service in modern life that challenges America to build vastly greater energy generation than we have today. American energy capacity has stagnated since the 1970s while China has rapidly built out their grid. America’s path to AI dominance depends on changing this troubling trend.” > — *Winning the Race*, Pillar II opening, page 14.

Supporting evidence from inside the course: twenty years of flat U.S. demand ending at once; a projected generation shortfall; interconnection queues past seven years — all installed in **L4.** **The defendant’s diagnosis and the course’s diagnosis are the same diagnosis, and that is what makes this a steelman rather than a strawman.**

PREMISE TWO — the permitting diagnosis, also correct. > “Like most general-purpose technologies of the past, AI will require new infrastructure—factories to produce chips, data centers to run those chips, and new sources of energy to power it all. America’s environmental permitting system and other regulations make it almost impossible to build this infrastructure in the United States with the speed that is required.” > — Same, page 14.

Supporting evidence in the defendant’s favor: the Crusoe counterexample — a **360.5 MW** plant permitted in **six days** in Texas, against multi-year timelines elsewhere. *And the counter-evidence the steelman must absorb honestly:* the same speed produced 59 unpermitted turbines in Mississippi. **The strongest version of the case concedes this and argues the remedy is faster lawful permitting, not weaker enforcement — which is, in fact, what Pillar II proposes.**

PREMISE THREE — the patchwork claim, stated with specifics and tested in court. > “State-by-State regulation by definition creates a patchwork of 50 different regulatory regimes that makes compliance more challenging, particularly for start-ups.” > — EO 14365, §1.

Supporting evidence: **267 data-center-related bills across 40-plus states in 2025; more than 300 across more than 30 states in 2026.** The order names a specific law (Colorado SB24-205) and a specific theory (that an algorithmic-

discrimination duty may compel models to produce false results to avoid differential impact). **DOJ filed that theory as an Equal Protection claim on 24 April 2026 and a federal court suspended the Act's enforcement three days later.** A theory that produces an enforceable order in four months is not a talking point.

And the defendant's own limiting principle — the steelman's best card, and the one critics rarely quote: > “(b) The legislative recommendation called for in subsection (a) of this section shall not propose preempting otherwise lawful State AI laws relating to: (i) child safety protections; (ii) AI compute and data center infrastructure, other than generally applicable permitting reforms; (iii) State government procurement and use of AI; and (iv) other topics as shall be determined.” > — EO 14365, §8(b).

The administration's own instrument declines to preempt state data center regulation. A critic who says the federal government is trying to override local control over data centers has not read §8(b)(ii).

PREMISE FOUR — the operational-dependency claim, under oath. > “In doing so, the NAACP threatens American national, economic, and energy security by seeking to shut off the power supply for artificial-intelligence innovation that supports the Department of War's military operations.” > — United States motion to intervene and dismiss, N.D. Miss., 15–16 June 2026.

*“the Clean Air Act affords the United States primacy over citizen-enforcers when it comes to enforcement discretion.”
— Same motion.*

The declaration: **Cameron Stanley**, Chief Digital and Artificial Intelligence Officer, Department of War, sworn — Grok is one of a very small number of proprietary state-of-the-art models capable of national-security applications; it runs on Secret and Top Secret classified networks; it was used in recent U.S. strikes against Iran; it supports the Marvin Smart System for targeting and readiness, which the declaration says enabled deployment of **over 2,000 munitions to 2,000 distinct targets within 96 hours during Operation Epic Fury.** [Model count **CONTESTED** across secondary renderings — **Section 6.2, Discrepancy #5.**]

The argument at full strength: a district court adjudicating a citizen suit cannot acquire the information needed to weigh an air-permitting violation against the availability of a system in that role; Congress gave the executive primacy over citizen-enforcers on enforcement discretion precisely so the executive could make that call; and Article II makes the decision whether to pursue or forgo enforcement an executive function that private litigation cannot override.

THE SEQUENCING ARGUMENT — what makes this a steelman rather than a slogan. The race logic does not claim the local costs are zero. It claims they are **recoverable and the strategic position is not.** A turbine can be retrofitted with selective catalytic reduction; a permit can be issued; a neighborhood can be compensated through a revenue ordinance; **a lead in frontier AI, once lost, cannot be re-acquired on any schedule the country controls.** Everything stands or falls on that asymmetry.

THE STEELMAN'S WEAKEST JOINTS — named honestly, so the pileup has something to hit and so Beat 10 does not become advocacy.

1. **The motion did not dispute that the turbines lack required permits.** It argued the enforcement question belongs to the executive. That concedes the underlying fact.
2. **EPA, in January 2026, took the opposite position** on the same classification question the Justice Department is now defending. Two federal agencies, one exemption, opposite readings.
3. **The asymmetry claim is contestable on its own terms** — several of the local costs are not obviously reversible. That is Beat 12's material and L10's whole subject. **Do not spend it here.**
4. **The internal tension in the Plan's own worker language**, documented above.

MARKUP ALTERNATE, recorded and not taken. The **Department of War's operational-dependency case** is a distinct party from the White House and would satisfy the never-twice rule independently; the Stanley declaration is a stronger single artifact than the Action Plan because it is sworn. **The assignment stands until markup moves it.**

SECTION 8: THE HUMAN FLOOR

COMEDY OFF THROUGHOUT THIS SECTION AND IN EVERY BEAT IT FEEDS. Documented individuals only, from testimony, filings, and published reporting. No composites. No invented color.

8.1 — THE ASSIGNED NEIGHBOR: SARAH GLADNEY

Name and location. Sarah Gladney, resident of **Boxtown**, southwest Memphis, Shelby County, Tennessee — the neighborhood adjacent to the Colossus 1 site at 3231 Paul R. Lowry Road, in the **38109** zip code.

The documented moment. **8 December 2025**, a press conference at the **NAACP’s Memphis chapter building**, one week before the Memphis and Shelby County Air Pollution Control Board’s appeal hearing. Convened by Memphis Community Against Pollution and Young, Gifted & Green with allied advocates. She was addressing the Shelby County Health Department through the press.

Her verbatim words, with full context:

“We are asking the Shelby County Health Department to rescind all permits to xAI.” — Sarah Gladney, Boxtown resident, press conference, Memphis, 8 December 2025. Reported by Action News 5, 9 December 2025.

“We are sick and tired of being sick and tired, and we are asking the Shelby County Health Department to rescind all permits to the xAI, and we want to breathe clean air, and it is our right to breathe clean air.” — Sarah Gladney, same press conference, 8 December 2025. Reported by WREG, 8 December 2025.

What she was asking for: rescission of permits already granted — not denial of a pending application, which had been decided on 2 July 2025. **Procedural status of the ask:** the appeal she spoke in support of was **dismissed 6–1 on 15 December 2025**, seven days later. **The permits were not rescinded.**

The documented surround, which the draft uses instead of inventing detail. Boxtown: founded by formerly enslaved people building from scrap boxcar lumber; running water and electricity secured only through a **federal class action against the City of Memphis in the 1980s**; by then hosting a refinery, a coal power plant, and a pesticide manufacturer. In **2022** EPA identified a potential cancer cluster near a Memphis facility emitting **ethylene oxide**; MCAP helped build the case for the first federal limits on the chemical; **Sterilization Services of Tennessee** shut down in **early 2024** after EPA proposed tighter controls. In **June 2024** — **five months later** — **the Chamber announced Colossus**. The 38109 median household income is just under **\$37,000**. The Memphis–Southaven region has among the worst asthma rates in the nation, a fact at the center of the NAACP’s April 2026 federal complaint.

The other side’s documented response, stated as a conflict and not smoothed. xAI, 2 July 2025: its onsite generation would carry state-of-the-art emissions control, making the facility the lowest emitting of its kind in the country. The Greater Memphis Chamber, same day: the approval demonstrated evidence-based decision-making balancing growth and stewardship. Mayor Paul Young cited a study finding no elevated pollution levels near the site. **SELC’s response: the testing failed to measure ozone — and Memphis-area ozone averages had exceeded federal limits for two consecutive years, the basis of SELC’s 5 June 2025 EPA petition.** On **23 June 2026** the Shelby County Health Department publicly questioned the integrity of a community air monitoring report. **All of these are in the record. The pack does not resolve them and neither should the draft.**

PACK-DEPENDENCY RESOLUTION — D7 and D8, with the honest limits. The L1 pack lodged a forward flag: *“Lecture 7/8 packs must pull named, consenting, on-the-record residents.”* **For L8 the flag is discharged: Gladney is named, on the record, and quoted twice verbatim with date, venue, and audience.** The limit, stated for markup rather than papered over: **the record supplies her words and her neighborhood; it does not supply a household portrait.** The pack found no reported bill delta, no well cost, no appliance replacement, no retirement delayed, no age, no household composition — the material the Morris’ L3 treatment has and this one does not. **Do not manufacture it.** The Neighbor beat here is built on testimony and neighborhood history rather than on a household ledger, and that is a difference in the *record*, not a licence to fill the gap. **If markup wants a household-ledger Neighbor, this territory cannot supply one and the beat should be re-scoped rather than stretched.**

8.2 — THE OTHER DOCUMENTED RESIDENTS

Four additional named individuals, on the record, available as documented surround. **None is promoted to Neighbor grade; the cap is spent and Gladney holds the slot.**

Easter Knox — home near the Colossus 1 facility, on the record the day after the permit was granted. > “They are hurting people.” > — Easter Knox, FOX13 Memphis, 3 July 2025.

James Kirkwood — resident near Colossus 2, Tulane Road, Whitehaven, Memphis. > “But you do smell it. You can tell the change in the air.” > — James Kirkwood, Action News 5, 6 March 2026.

Shannon Samsa — resident of Southaven, DeSoto County, Mississippi, on the record the same week as the December 2025 appeal. > “This project was approved with no air permits, no independent health or environmental studies, and no public input from the communities being impacted. XAI is exploiting a regulatory exemption to run their turbines without a permit, just like they did in Memphis.” > — Shannon Samsa, WREG, 8 December 2025. **[The clearest lay articulation in the record of the cross-state pattern — and it was made three months before MDEQ granted the 41-turbine permit.]**

Orion Overstreet — a 20-year-old college sophomore who organized concerts and bake sales for the Boxtown Neighborhood Association. > “We want our futures to be here, and if our futures are going to be here, then we have to fight like hell against this, because this is going to affect all of us.” > — Orion Overstreet, WREG/Nexstar, 2025.

8.3 — HEARING-TRANSCRIPT PULLS AND THE CORPUS MAP

Four rooms exist in this territory; the lecture may stage only one. All four are mapped so the drafter can choose the room and use the other three as dated procedural facts.

ROOM 1 — Shelby County Board of Commissioners, 26 March 2025 (resolution, 5–1) and 9 April 2025 (public hearing). > “We do not bifurcate responsibility. Mayor Paul Young has responsibility to use and leverage his authority in this exact situation, in order to move forward the democratic process, but also to elevate the voices of the community.” > — KeShaun Pearson, Memphis Community Against Pollution, localmemphis.com, 31 March 2025.

“It’s not necessarily a win.” — Dr. Michelle Taylor, then-Director, Shelby County Health Department, FOX13 Memphis, 27 March 2025.

“We really want to push back diplomatically on director Taylor for you to assess what you can do, stop talking about what you can’t do, and learn about what you can do to make sure that you use the fullest extent of power, to protect the people in Memphis.” — LaTricea Adams, CEO and President, Young, Gifted & Green, localmemphis.com, 31 March 2025.

Also documented: Dr. Taylor’s statement before the vote that the department would host a public meeting regardless of the outcome, and her presentation of a map of polluted communities; Commissioner **Edmund Ford Jr.**’s effort with City Councilman **Edmund Ford Sr.** toward a parallel hearing including TVA, MLGW, state lawmakers, and the city engineer; residents testifying to chronic respiratory conditions at the 9 April hearing. *Locator for a full transcript pull at draft stage:* Shelby County Commission minutes and video archive.

ROOM 2 — Shelby County Health Department public hearings, opening 25 April 2025, Fairley High School Auditorium. *Documented:* an xAI representative read a prepared statement and left without remaining for community comment. **Over 1,700 public comments** (SCHD, 16 May 2025); contemporaneous reporting elsewhere cites **2,000+**. Pearson addressed the department that day, having stated that morning what he intended to say: > “What’s happening in Memphis is a human rights violation. Elon Musk and xAI are violating our human right to clean air and a clean, healthy environment.” > — KeShaun Pearson, executive director, Memphis Community Against Pollution, Democracy Now!, 25 April 2025, describing what he planned to tell the Shelby County Health Department that day.

Paraphrase, marked, single-sourced: Pearson’s later account (Heinrich Böll Stiftung, 28 January 2026) states the xAI representative did not look residents in the eyes while reading, and that then-director Taylor opened the hearing with remarks about diet. **Flagged: an adversarial party’s account of a public meeting. Do not put the diet remark in prose without the recording or a second source.** *Locator:* SCHD hearing recording via the county clerk.

ROOM 3 — Memphis and Shelby County Air Pollution Control Board, appeal hearing, 15 December 2025. *Documented:* a seven-member board on four-year terms — lawyers, physicians, industry experts. Petition brought by **Young, Gifted & Green** and **NAACP Memphis**, represented by **SELC**, arguing large combustion turbines tied to the project violated Clean Air Act requirements. **Decision: 6–1 to allow xAI to retain the permit**, delivered about an hour before

adjournment. Advocates in attendance described the vote as shocking and disappointing. AP photographed attendees holding signs (George Walker IV). Daily Memphian (Samuel Hardiman) filed at 3:34 p.m. CT, updated 4:03 p.m. CT, characterizing the hearing as a clash between environmental activism and the city’s business establishment.

The week-before record, which is where the usable verbatims are: > “Permitting one of the city’s largest polluters was ridiculous and a slap in the face to our community.” > — KeShaun Pearson, president, Memphis Communities Against Pollution, press conference, 8 December 2025, Action News 5, 9 December 2025.

“The Shelby County Health Department has a responsibility to care for our community. It’s time for them to step up.”
— statement from the same 8 December 2025 press conference, Action News 5.

Also documented: a Health Department spokesperson said the department was “not granting interviews about that topic at this time” when asked to make the interim director available. *Locator:* APCB hearing record; SELC litigation archive. **The pack did not locate a transcript of the board’s deliberation. The scene must be built from the filings, the press conference, the room, and the vote — and the draft must not narrate reasoning the record does not contain.**

ROOM 4 — Mississippi Department of Environmental Quality: public hearing 17 February 2026; Permit Board 10 March 2026, Jackson. *Documented:* the 17 February hearing was **the only public hearing on the project**. Air Division Chief **Jaricus Whitlock** said all comments would be reviewed and that he did not expect the Permit Board to meet by early March. The Permit Board meeting was announced **5 March for 10 March** — five days’ notice, in Jackson, roughly a **three-hour drive** from the affected community, **on the day of Mississippi’s primary elections**. NAACP and SELC asked for a delay on that ground. The permit for **41 turbines** was approved. > “We are outraged that, despite the community’s clear demand to move the Election Day hearing, MDEQ chose to bulldoze through a decision that silenced the very residents most harmed by it.” > — Abre’ Conner, Director of Environmental and Climate Justice, NAACP, joint statement with SELC, 10 March 2026.

The regulator’s stated position: MDEQ spokesperson **Jan Schaefer** said the board voted to approve after careful consideration of all public comments and community concerns. *Locator:* MDEQ Permit Board minutes.

8.4 — THE WORKER FLOOR

Vector three’s human floor is not a household; it is a labor market, and **the pack could not surface a named individual inside it in this territory**. Stated plainly rather than filled.

What the record supports: the surveys catalogued in §7.2 and Section 6H, all with sample sizes, field dates, and named houses. The 2018 Electrolux terminations — **254 full-time and 404 contract workers** — and the **534** who remained at the closure announcement, documented in a performance report filed with EDGE. **Melody Freeman**, executive director of the Greater Memphis Workforce Development Board, on the record 21 October 2025 about the pipeline into xAI hiring events running noon to 2 p.m. and 6 to 8 p.m.

What the record does not support: **no named data center operator, technician, or shift worker at Colossus 1 or 2 appears in the pack’s sources**. No staffing disclosure, no trade-press profile, no interview. **The Operator Reality beat therefore runs on ratios, postings, and surveys, and the draft must not invent a person to stand inside it**. Recorded as an honest failure per Research Instruction 5.

On the displaced-worker side: the Electrolux workforce is documented in aggregate (658 terminated in 2018; 534 at closure) but the pack surfaced **no named former Electrolux worker. Do not compose one**. The building can carry the weight without a face on it — and the absence of a face after a plant closure is itself a fact about how these events get covered.

SECTION 9: THE PEOPLE & THE CAST

Organized by the Style Guide §7 four-slot cast. Anchors marked; lead/return status stated for every recurring character.

9.1 — THE HUMANS

KeShaun Pearson — ANCHOR (Human slot). Lead lecture: 8 (sole appearance).

Role: leads **Memphis Community Against Pollution (MCAP)**, a southwest Memphis environmental justice organization.

AS-OF TITLE LOCK — pack dependency D2, resolved. The record carries three forms across 2025–26: **“executive director”** (Democracy Now!, 25 April 2025; Democracy Now!, 22 April 2026; Memphis Flyer, 15 April 2026), **“president”** (NBC News, 16 May 2025; WREG/Nexstar, 2025; Action News 5, 9 December 2025), and **“founder”** (Action News 5, 5 March 2026). **Recommended convention, for Nick’s confirmation:** use **“president of Memphis Community Against Pollution”** at the December 2025 moments and **“executive director”** at the April 2025 and April 2026 moments — because that is what the record says at each date — and, if a single stable form is wanted for audio, use the neutral and universally supported **“who leads Memphis Community Against Pollution.”** **The one form the pack recommends against is “founder,”** which appears once and is not corroborated: the Memphis Flyer’s April 2026 history describes MCAP as an organization Pearson leads and attributes its Byhalia-era success to it, without establishing founding.

Career, with the details that do narrative work: MCAP under Pearson’s leadership fought and defeated the **Byhalia Connection Pipeline**, a proposed high-pressure crude oil pipeline routed over Memphis’s water supply. His account of the developers’ own reasoning — that they chose the community as the path of least resistance — is on the record and is the sharpest single line in his corpus. MCAP then helped build the case for the **first federal limits on ethylene oxide** after EPA identified a potential cancer cluster in 2022; **Sterilization Services of Tennessee** shut down in early 2024. **Five months later the Chamber announced Colossus.** Pearson learned of the pending xAI announcement during conversations with local elected officials about environmental justice planning.

What he wants: denial, then rescission, of the permits; independent monitoring; the jobs and revenue promises kept. *What he fears, in his own framing:* that southwest Memphis is treated as the path of least resistance. *What he can enforce:* nothing directly. MCAP is not a party with statutory authority. His leverage is comment volume, sensor data, media, elected-official pressure, and counsel (SELC). *What he actually did, dated:* met publicly with Mayor Young 22 March 2025; spoke at the Shelby County Commission proceeding March 2025; addressed the Shelby County Health Department 25 April 2025; led the 8 December 2025 press conference; deployed a community sensor network reporting a 79% increase in peak NOx by March 2026; on the record again after the NAACP’s April 2026 federal filing. *Documented quotes:* block-quoted with attribution in Sections 2, 6, 7, and 8. **His Electrolux comparison — the roster’s assigned material — is at Section 2, Beat 6, verbatim, Democracy Now!, 25 April 2025. Pack dependency D1 discharged.** *Current status as of 21 July 2026:* leading MCAP; most recently on the record in the March 2026 orbital coverage and the April 2026 Democracy Now! appearance.

Justin J. Pearson — secondary. State Representative, Tennessee’s 86th House District (D-Memphis). KeShaun Pearson’s brother; the elected-official altitude of the same fight; on the record at hearings and press events. Documented framing: that the project perpetuates environmental racism by proceeding against residents’ wishes. **Naming-discipline hazard, flagged: two brothers with the same surname in an audio lecture.** If both appear, the recommended stable forms are **“KeShaun Pearson”** and **“State Representative Justin Pearson,”** never “Pearson” alone after both are introduced.

Sarah Gladney — Boxtown resident. Full treatment in Section 8.1.

Dr. Michelle Taylor — secondary. AS-OF TITLE LOCK, resolved. *Then-Director, Shelby County Health Department, 2021–2025.* Pediatrician; born c. 1976 in North Dakota; educated at Howard University, East Tennessee State University, and the University of Tennessee Health Science Center, with an M.P.H. from the Johns Hopkins Bloomberg School of Public Health (2015) and an M.P.A. from the Harvard Kennedy School (2018). Colonel and flight surgeon, Tennessee Air National Guard. **Assumed office as Commissioner of the Baltimore City Health Department on 4 August 2025.**

Convention: in every 2025 Memphis scene she is “then-Director of the Shelby County Health Department.” After 4 August 2025 she is not in the story. Documented acts: supporting a public hearing at the March 2025 commission proceeding; presenting a map of polluted communities; stating the department would hold a meeting regardless of the vote; declining to call the resolution a win. **The permit was issued 2 July 2025 under her department’s authority, one month before her departure.** *Flagged for calibration:* one advocacy outlet characterized her departure as fleeing a decision. **The pack does not adopt that framing.** The verified facts are the dates and the roles; the motive is not in the record, and the nobody-wrong-on-their-own-terms discipline forbids assigning one. A public health official taking a commissioner’s post in another city is an ordinary career event; the draft may state the timing and must not imply the motive.

Mayor Paul Young — secondary. Mayor of Memphis. Documented acts: the 29 March 2025 statement conceding that

the project's speed may have left the community feeling under-consulted; the first-of-its-kind ordinance dedicating xAI tax revenue to the 38109 zip code, funded at \$3.2 million by October 2025; the public meeting with KeShaun Pearson on 22 March 2025; publicly pressing xAI to complete the greywater facility (April 2026); the June 2026 meeting with SpaceXAI president **Michael Nicolls** and MLGW's Doug McGowen that produced the Q1 2027 restart commitment. *What he can enforce*: nothing over the air permit — the authority is the county health department's. **The gap between accountability and authority is the character.**

Ted Townsend — secondary. President and CEO, Greater Memphis Chamber. The recruiter; issued the same-day statement commending the 2 July 2025 permit as evidence-based decision-making. The Chamber was named 2025 Chamber of the Year by ACCE, citing its Digital Delta initiative. *What the institution gets if believed*: the case for the next recruitment.

Bobby White — secondary. Chief government affairs officer, Greater Memphis Chamber. The “Digital Delta” framing, FOX13, 5 December 2024; stated at the time that xAI was not receiving tax breaks and that he could not say how many jobs would come.

Brent Mayo — secondary. General Manager, xAI Memphis. Filed the certificate of occupancy for 3231 Paul R. Lowry Road on 23 July 2024 as an officer of CTC Properties. Delivered the greywater commitments at the 10 October 2025 groundbreaking: a 9% reduction in aquifer withdrawals, a 20% reduction in nutrient loading to the Mississippi, zero taxpayer dollars. **The single named xAI employee who appears repeatedly in the public record on both the permitting and the community-commitment sides.**

Doug McGowen — secondary. President and CEO, Memphis Light, Gas and Water. Stated in 2024 that Colossus would need over a million gallons of water a day, about 1% of MLGW's daily aquifer draw. Stated at the October 2025 groundbreaking that the plant would conserve 5 billion gallons a year. In June 2026 reported that xAI committed in a meeting to restart construction in Q1 2027. **A utility executive publicly pressuring his own large customer — credit it.**

LaTricea Adams — secondary. CEO and President, Young, Gifted & Green. Co-appellant; on the record at the March 2025 commission proceeding and in the NAACP's July 2025 appeal announcement, where she framed the challenge through her own experience as a Black woman born and raised in Memphis.

Abre' Conner — secondary. Director of Environmental and Climate Justice, NAACP. The 10 March 2026 statement on the Election Day permit board meeting.

Sarah Houston — secondary. Executive Director, Protect Our Aquifer. Documented April 2026 on the greywater pause; noted xAI's 1.2-million-gallon-per-day contractual cap and framed the stakes as never having to choose between sending water to xAI or to Boxtown and Westwood. **Her organization has pushed for water reclamation since around 2017, ramping up in 2022–23 — a decade before xAI, which is the fact that defeats any framing of the greywater plant as a gift.** On the record again in March 2026 on the orbital announcement. Science Director **Scott Schoefer** documented April 2026.

Cameron Stanley — secondary. Chief Digital and Artificial Intelligence Officer, Department of War. Author of the sworn declaration filed with the United States' motion, June 2026. **The most consequential named federal official in this lecture, and he appears only in a court filing.**

Stanley Woodward — secondary. Associate Attorney General of the United States. Among the signers of the motion to intervene and dismiss, filed by DOJ's Environment and Natural Resources Division.

Harmeet K. Dhillon — secondary. Assistant Attorney General, Civil Rights Division, DOJ. Issued the public statement accompanying the 24 April 2026 intervention in *xAI v. Weiser*.

Michael J. Kratsios, David O. Sacks, Marco A. Rubio — secondary. The three signatories of *Winning the Race*, in their as-of titles: Assistant to the President for Science and Technology; Special Advisor for AI and Crypto; Assistant to the President for National Security Affairs. **Sacks is named as a consultation node in four separate provisions of EO 14365.**

Greg LeRoy and Kasia Tarczynska — secondary. Good Jobs First. LeRoy: executive director; founded the organization; has tracked data center subsidies since 2016; his first major data center jobs study, roughly nine years before 2026, found developers pocketing well over a million dollars in state subsidies per permanent job — a figure he says remains very much in the ballpark. Tarczynska: senior research analyst; author of *Cloudy Data*, *Costly Deals* and of the job-requirement analysis. **Author-crossover rule applies: their published documents are the plot events, which is what admits them**

to the Human slot.

Gov. Janet Mills, Gov. Kathy Hochul, Gov. Gretchen Whitmer, Gov. Katie Hobbs — secondary, at the state altitude. Mills vetoed Maine's LD 307 on 24 April 2026 while agreeing with the policy. Hochul signed **Executive Order 62** on 14 July 2026 creating the first statewide data center permitting moratorium in the country, at a 50 MW threshold, while the legislature's 20 MW bill sits unsigned; her staff described the bill as complicated. Whitmer calls a moratorium a non-starter while roughly 50 Michigan counties consider them. Hobbs signed Arizona's three-year moratorium on new data center sales tax breaks in June 2026. **Four governors, four different answers, all within ninety days — and the draft should note that three of the four are from the same party.**

Assembly Speaker Carl Heastie and State Sen. Kristen Gonzalez — secondary, New York. Gonzalez sponsored the Responsible Data Center Development Act in the Senate; Heastie stated on 14 July 2026 that he remained hopeful the executive order did not signal a veto. **Assemblyman Scott Gray** (Watertown) urged a veto on economic and duplication grounds, citing the Public Service Commission's February 2026 transmission study.

9.2 — THE INSTITUTIONS

The White House / OSTP. *Motive:* stated in its own document — global AI dominance as a national security imperative. *Exposure:* two congressional failures (the OBBBA moratorium, the NDAA preemption language) preceding the executive route. *What it filed:* an Action Plan with no operative force and an executive order with clocks. *What it gets if believed:* a deregulatory mandate and an argument that ends arguments.

The Department of Justice. *Motive:* execute EO 14365. *Exposure:* its two documented 2026 actions in this territory both **join private parties rather than initiate** — an intervention in xAI's Colorado suit and an intervention in xAI's Mississippi defense. *What it gets:* precedent on preemption and on enforcement discretion, in both directions.

The Shelby County Health Department. *Motive:* statutory duty under a federally approved Local Implementation Plan. *Exposure:* the only regulator with a handle on the thing residents could point at, in a county where nothing else about the project required approval. *What it filed:* a permit for 15 units and a nonroad determination for the rest. *Constraint, stated fairly:* it operated under a delegated federal framework and an exemption it did not write. **Incentives plus constraints, never villainy.**

The Memphis and Shelby County Air Pollution Control Board. Seven appointees — lawyers, physicians, industry experts — on four-year terms, whose 6–1 vote on 15 December 2025 exhausted the local process.

The Mississippi Department of Environmental Quality. *Motive and constraint:* the same federal exemption, read the same way, in a state that has since joined the company's side in federal court. *What it filed:* a 41-turbine operations permit on 10 March 2026, three weeks after the only public hearing.

The Greater Memphis Chamber. *Motive:* recruitment. *Exposure:* it published the 500-job number. *What it gets:* the Digital Delta and the next project. *Balance:* named 2025 Chamber of the Year by ACCE.

Memphis Light, Gas and Water. Municipal utility; four service agreements with CTC as of 2024; projected \$15–20 million in annual local property taxes and \$500,000 in additional PILOT payments; publicly pressing its customer to finish the water plant.

EDGE. Administers PILOTs; received Electrolux's performance reports; **confirmed on 21 June 2024 that xAI filed no incentive application.**

The NAACP, Young, Gifted & Green, SELC, MCAP, Protect Our Aquifer. *Motives:* stated; all five are advocacy parties who benefit if believed, and the pack names that every time their figures are used. *What they supply that nobody else does:* the aerial imagery, the emissions arithmetic, the legal theory, the sensor data, and the named residents. **Without these five organizations there is no quantified record of this project's emissions at all — which is itself the finding, and the reason their interest does not disqualify their evidence.**

Food & Water Watch, Good Jobs First, NVTC, the Data Center Coalition / PwC, NetChoice, MultiState, Uptime Institute, CBRE, Epoch AI, Rhodium Group. Ten analytical institutions with ten different vantages, catalogued with their interests in Section 12.

OpenAI, Oracle, SoftBank, Crusoe, Lancium, GE Vernova, Nvidia. The Stargate cast, treated in Beat 9. **None is cast as an anchor and none receives a full treatment — Crusoe and the neocloud landscape belong to L6, and the**

boundary must hold.

xAI / CTC Property LLC / MZX Tech LLC / SpaceX — the corporate map, which the draft needs and must state once, cleanly. CTC Property LLC (also rendered CTC Properties LLC), incorporated in Tennessee in March 2024, is the entity on the Memphis permits and MLGW service agreements. **MZX Tech LLC** purchased 2875 Stanton Road, Southaven, in July 2025 and holds the Mississippi permits. **xAI** was acquired by **SpaceX** in February 2026; the combined entity was valued at **\$1.25 trillion** and completed an IPO in June 2026. **SpaceXAI president Michael Nicolls** met Memphis officials in June 2026. **Four names for one company across two states is not corporate housekeeping; it is the ordinary structure of project finance — and it is also why Good Jobs First reports that state subsidy disclosure captures LLC names rather than parent companies.**

9.3 — THE OBJECTS

The Solar SMT-130 gas turbine. *Manufacture:* Solar Turbines, a Caterpillar company. *Configuration:* packaged, skid- or trailer-mounted, simple-cycle. *Class:* roughly 16.5 MW apiece as permitted (15 units at ~247.2 MW). *Deployment:* trucked to site, set on a pad, tied to a gas header and switchgear. *Chain of custody:* documented through the Shelby County permit, the SELC aerial survey, and — for the Mississippi fleet — Trinity Consultants' correspondence with MDEQ released under a public records request. *Emissions and controls:* NOx, CO, formaldehyde, PM2.5; **selective catalytic reduction** required as BACT by 1 September 2025 on the permitted Memphis units, documented complete on **6 of 59** Southaven units as of February 2026. **The narratively load-bearing property is not thermodynamic. It is that the unit has wheels, and the wheels are doing legal work.**

The former Electrolux plant, 3231 Paul R. Lowry Road. Built in Frank C. Pidgeon Industrial Park after two years of construction, opened roughly 2013; \$87 million construction spend, \$76 million to local firms; vacant from 2020; branding stripped from the sign outside and photographed; occupied by CTC Property under a certificate of occupancy filed 23 July 2024; chosen, per Musk, for speed, enabling a 122-day build. **The only object in this lecture that appears in both halves of the arc.**

The aeroderivative turbine (Abilene). GE Vernova; 10 units ordered December 2024, 19 more in June 2025, collectively over a gigawatt. Chosen over combined-cycle units because combined-cycle lead times had reached as long as seven years. **A jet engine, bought because the power plant was sold out.** *Cross-lecture note: L4 owns turbine lead times. Cite, do not rebuild.*

The greywater recycling facility. \$80 million pledged, \$78 million as filed; capacity up to 13 million gallons per day of effluent from the T.E. Maxson wastewater treatment plant; average projected flow 7 million gallons per day, peak 10.4 million; groundbreaking 10 October 2025; paused April 2026; restart committed for Q1 2027. **An object that exists as a groundbreaking photograph, a permit filing, and a promise.**

The document as object. *Winning the Race:* roughly 25 pages, three signatures, an epigraph, and a page marked intentionally left blank. **EO 14365:** nine sections, four clocks, one carve-out, and a URL that still carries the leaked draft's title.

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

This lecture's cascade edge, restated: Inherits: the bill fight, elevated · Binds at: jurisdiction — who can actually enforce what · Who pays: contested at three altitudes simultaneously · Manufactures: the escape fantasy → L9.

10.1 — THE INHERITED PROBLEM, RESTATED WITH FRESH SPECIFICS

L7 ends on **The County:** Warrenton, 5 November 2024, Roy Francis defeating Heather Sutphin, every member who approved Amazon's special-use permit at roughly 2:30 a.m. on 15 February 2023 now gone — democracy as a ratepayer revolt with land-use paperwork — and a question left hanging. **L8 opens by answering that question in the least satisfying possible way: the revolt worked, and it changed nothing that mattered at a higher altitude.**

The inheritance is honored with entirely new material, per the sampler/completist discipline. The specifics L8 uses,

none of which L7 owns: a county where there was **no special-use permit to vote on**, because the building already existed and was already industrially zoned; a jurisdiction where the only regulatory handle was **an air permit issued by a county health department** rather than a rate case or a zoning board; a **6–1** vote by seven appointees rather than a council sweep by voters; and a company that **took no incentives at all**, which removes the Warrenton lever entirely. **L7's ratepayer had a docket. L8's neighbor had a health department and a stay that expired.**

Specifics L7's pack already owns — do not duplicate: the \$4.3 billion across seven PJM states in 2024; the 267% five-year residential increase near hubs; cost-allocation doctrine; the AEP Ohio tariff docket and its 90%/85%/75% negotiation; the Warrenton hearing at 2:30 a.m.; Francis's election-night verdict; John Steinbach's \$281 January 2026 bill; the Martin & Peskoe extension-cord line; the interconnection agreement's return; PJM's auction figures. **L8 may reference the fact of a socialized-bill fight in one clause and must not re-run any of its numbers.**

The one figure L8 legitimately re-uses, and how: L7's moratorium wave. **It must be re-dated, not restated** — see Section 6.2, Discrepancy #4. L7's stamp sits on a tally of pending bills; L8 carries the July 2026 state of play, in which a governor has acted.

10.2 — WHAT THIS LECTURE BINDS AT

Jurisdiction. Every other lecture in the cascade binds at something physical or financial: a transformer, a queue, a cold plate, a rate case, a depreciation schedule. **This one binds at the question of who is allowed to say no** — and the answer turns out to be layered and mostly hollow. A county health department can condition 15 turbines and not the other 20. A seven-member appointed board can uphold or vacate, and did the former. A state line can be crossed by a truck. A state legislature can pass a moratorium and a governor can veto it, or replace it with a narrower one of her own. A citizen can sue under a federal statute and the federal executive can move to dismiss the citizen. **The binding is not that nobody can enforce anything. It is that each altitude can enforce exactly the thing that does not settle the question.**

Who pays, on this hour's ledger: contested at three altitudes simultaneously and **denominated differently at each**, which is the finding. Locally, in short tons and asthma rates, with no dollar figure published. At the state level, in tax expenditures — \$1.6 billion in Virginia in FY2025, 52 to 70 cents lost per dollar. Nationally, in BEAD non-deployment funds and in a strategic position the defendant argues cannot be priced. **Three currencies, one of which has no exchange rate, and the lecture ends without converting them.**

10.3 — WHAT THIS LECTURE MANUFACTURES, AND THE HANDOFF

The manufactured problem. L8's final beats leave the listener holding a fight that has run out of forums: the county process exhausted 6–1, the state line crossed, the federal citizen suit met by the federal executive, and a governor's executive order in New York pausing permits at 50 MW while the legislature's 20 MW bill sits unsigned. **When every altitude has been tried and the ground is still contested, the next move is to leave the ground.** That is L9's subject, and this lecture manufactures the appetite for it without spending any of L9's material.

THE HANDOFF — assigned mechanism: a door explicitly not opened.

Primary formulation, riding Beat 12's final ~200 words. **The material is documented and native — it does not have to be manufactured, because it happened.** On 4–5 March 2026, in the middle of the Memphis fight, the same company announced it intended to put data centers in orbit within three years. The documented local response came from two named people: **KeShaun Pearson**, who said the promises made on the ground had not come true, and **Sarah Houston** of Protect Our Aquifer, who characterized the orbital plan as an attempt to solve energy shortages on Earth. **The door is named and left shut: there is a version of this problem where the building isn't on anyone's ground, and it is somebody else's hour.**

Refresh-safety check. **PASS.** The handoff hinges on a *structural* fact — that a contested-ground problem generates an escape proposal, and that the escape proposal was made from this specific cornfield during this specific fight — not on any VOLATILE figure. The March 2026 announcement date and the two named responses are fixed historical facts. **The 2027 refresh re-checks only that the orbital proposal still exists as a proposition, which is L9's problem, not this seam's.** The edition-update conventions bind hardest on handoffs into and out of lectures 6, 9, and 10; **this is a handoff into 9, and it is clean because it carries no valuation, no deal count, and no capacity figure.**

Three alternates banked for markup, same rotation class, all refresh-safe:

- **(a) The door of what the compute is for.** The Stanley declaration answered “what is it for?” under oath, in a Clean Air Act case, and the answer sits behind classification. *“There is a room in this story nobody in Memphis has clearance to enter.”* **Risk: it collides with the Gesture if the training-run door is approved (Open Item 9). Do not deploy both.**
- **(b) The door of the number nobody publishes.** No state discloses jobs promised against jobs delivered; xAI publishes no Memphis headcount; there is no continuous published fence-line monitoring. *“There is a set of numbers that would settle every argument in this hour, and nobody keeps them.”* **Risk: it points at L10’s audit rather than L9’s escape, and would mis-aim the cascade.**
- **(c) The door of the ground itself.** The most literal reading of the assignment: every fight in this hour has been about a piece of ground — a zip code, a county line, a state line, a jurisdiction. Name the exit and don’t walk through it. **Lowest risk, most on-assignment, least specific. Recommended fallback if the primary’s March 2026 material is wanted elsewhere in the lecture.**

FOR MARKUP: the primary is recommended because it is the only one of the four that is **in the documented record as an event** rather than as a rhetorical construction, and because it lets two named humans from this lecture’s own human floor speak the seam.

10.4 — THE BOUNDARY DOORS

Confirmed: nothing in this pack researches behind the boundary doors beyond Section 4’s one-inch Gesture facts.

Silicon fabrication (October’s course). Untouched. The GB200 racks in Abilene and the H100s in Memphis arrive as counts and as chip-equivalents. **No fab, no process node, no packaging, nothing upstream of the truck.**

Reactor engineering (January–February’s course). Untouched, and structurally easy to hold here because **there is no nuclear in this territory.** Memphis runs on gas turbines; Abilene runs on gas turbines. The only generation physics that appears is simple-cycle versus combined-cycle efficiency, which is a *procurement* fact, not a reactor fact.

Training-run internals (proposed third door, Open Item 9). Section 4 supplies exactly three one-inch facts and stops. **The pack researched no further and the draft must not.**

Territory where this lecture presses on an *unassigned* door — flagged so the drafter knows where the fence runs.

(1) Military AI applications. The Stanley declaration opens onto operational military use of frontier models — targeting systems, classified networks, munitions deployment rates. **This is not one of the three sanctioned doors, and it is not a door this franchise has opened anywhere.** Correct handling: the declaration is evidence about *this lecture’s* subject — why the federal government intervened — and the draft uses it for exactly that. **Quote the filing; do not analyze the weapon.** No assessment of the capability, no elaboration of the operation, no speculation about the classification.

(2) Air-quality health science. The emissions figures press toward dose-response epidemiology. **The pack has deliberately stopped at emissions inventories, statutory thresholds, and documented testimony, and has not researched health outcomes attributable to these specific facilities** — because the record does not support such an attribution and because the human-floor rule requires precision, not implication. The draft states what was emitted, what the threshold is, what residents testified, and what the disputes are. **It does not diagnose anyone.**

10.5 — CROSS-LECTURE CONSISTENCY NOTES

Claimed by prior lectures — do not repeat here:

- Loudoun County, MAE-East, the ~14% figure, Buddy Rizer, the JLARC report’s full treatment, farmland above \$1M an acre — **L1.**
- The rack-density step function, the GB200 crane day, Jensen Huang, the NVIDIA roadmap — **L2.**
- Direct-to-chip cooling, the Morrisres, the pipefitters, coolant chemistry — **L3.**
- The 400,000-pound transformer and Schnabel railcar, the three-study gauntlet, the interconnection agreement, John D. Wilson’s inflection call, transformer and turbine lead times, PJM’s queue — **L4.** (*L8 cites the seven-year combined-cycle lead time in one clause inside Beat 9 and rebuilds nothing.*)

- Three Mile Island / Crane, the Symbol Audit's first deployment, behind-the-meter co-location as a mechanism, Joe Dominguez — **L5**. (*L8's Memphis and Abilene material is behind-the-meter by construction; the draft invokes L5's installed concept and does not re-explain it.*)
- CoreWeave, Michael Intrator, GPU-collateralized debt, the depreciation schedule, the GPU-hour spread — **L6**.
- The \$4.3 billion, the 267%, cost-allocation doctrine, the AEP Ohio tariff, Martin & Peskoe, Warrenton, Roy Francis, McKenzie Miller, John Steinbach, Dominion's steelman — **L7**.

Claimed by this lecture, for later packs: the Memphis / xAI Colossus record in full (turbine counts, permits, the APCB vote, the federal litigation, the greywater plant, Boxtown, KeShaun Pearson, Sarah Gladney); *Winning the Race* and **EO 14365** in full (**L10 gets return-grade reference only**); the Electrolux arc and the no-clawback finding; the jobs math in all its versions and the subsidy-architecture figures; Stargate as a construction schedule, including the six-day permit and the aeroderivative substitution; and the moratorium wave's 2026 state of play, including New York EO 62.

Exports from L8: the executive-document pair (→ L10, brief reference); Loudoun's fourth appearance (→ L10, if Open Item 6 is confirmed); the March 2026 orbital announcement as a *seam* only (→ L9, which owns the substance); and the irreversibility candidates below.

PRE-LOADING L10'S IRREVERSIBILITY LEDGER. L10's closer inventories every documented irreversible expenditure across the course's territory. **This lecture generates six entries, banked here so L10's pack does not re-research them:**

1. **59 gas turbines installed** across two states, 41 of them permanently permitted on 10 March 2026 — capital committed to combustion generation with a decades-long asset life, on a site purchased for the purpose.
2. **\$188.3 million** in Electrolux incentives, **unrecoverable by contract**, 2010–2019 — the cleanest irreversibility entry in the course, because the irreversibility is written into the document as an absent clause.
3. **Land converted:** the former Duke Energy power plant site plus **114 acres** (July 2025) and an adjacent **104 acres** with an **810,258-square-foot** warehouse (December 2025).
4. **Political legitimacy spent:** a 6–1 board vote on 15 December 2025 that exhausted a local process, and a federal executive intervening against a citizen suit under a federal environmental statute. **Institutional trust is not refundable.**
5. **Virginia's \$1.6 billion FY2025 tax expenditure**, spent, against a statutory threshold written for a different decade.
6. **A greywater facility with a groundbreaking and no construction** — the inverse entry, and arguably the most interesting one for L10: **a promise that has already been made irreversibly even though the thing has not been built.**

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

Status as of 21 July 2026.

11.1 — LIVE STATUS OF EVERY DEAL, DOCKET, AND PROJECT

NAACP and Mississippi State Conference v. xAI Corp. and MZX Tech LLC (N.D. Miss.). Complaint filed **14 April 2026**; preliminary injunction sought **May 2026**; complaint amended **10 June 2026** after discovery identified nearly 30 additional turbines. **The United States moved to intervene and dismiss with prejudice on 15–16 June 2026**, joined by xAI and the State of Mississippi. **The case has not been dismissed.** Next milestone: **preliminary injunction hearing, 24 August 2026 [EXPECTED]**, scheduled by the court and noted in the government's own filing.

Colossus 1 air construction permit (Shelby County). Issued 2 July 2025; upheld **6–1** on 15 December 2025; **expires 2 January 2027 [EXPECTED]**. **Renewal or replacement falls inside the 2027 Briefing's window and should be treated as a refresh trigger.**

Colossus 2 / Southaven power plant (MDEQ). Operations permit for **41 permanent turbines** granted **10 March 2026** to MZX Tech LLC. **59 turbines documented as installed and unpermitted as of July 2026**, which the permit does not cover. MDEQ maintains portable turbines require no permit; **EPA stated in January 2026 that temporary turbines exceeding thresholds must be permitted** and, as of mid-2026, says it is weighing regulatory flexibilities for portable units. **Unresolved.**

Colossus 3 / “Macrohardrr,” 2400 Stateline Road, Southaven. Announced January 2026 by xAI and Mississippi elected officials; an 810,258-square-foot warehouse on 104 acres, with a further **\$659 million** reported for an adjacent building. Would bring Memphis-area demand to **nearly 2 GW** per the NAACP/SELC notice. **In development.**

The Memphis greywater recycling facility. Broke ground 10 October 2025; **paused April 2026; restart committed for Q1 2027 [EXPECTED]**, per MLGW President and CEO Doug McGowen reporting a commitment made in a June 2026 meeting with SpaceXAI president Michael Nicolls and Mayor Paul Young. **A commitment relayed from a meeting, not a permit condition.**

xAI v. Weiser (D. Colo.). Filed 9 April 2026. DOJ intervened 24 April 2026. Enforcement of the Colorado AI Act **suspended 27 April 2026** by joint motion. Colorado replaced SB 24-205 with **SB 26-189** and enacted **HB 26-1263** (Chatbot Safety Act, signed 29 May 2026, effective 1 January 2027). The stay expressly covers replacing or amending legislation. AG Weiser will not enforce SB 26-189 until rulemaking concludes, **deadline 1 January 2027 [EXPECTED]**. Pre-rulemaking opened **23 June 2026**, comments through **13 July 2026**. xAI signaled a further preliminary-injunction motion against the replacement law around **11 June 2026; whether it was filed is not established in this pack’s sources.**

The AI Litigation Task Force. Formed January 2026. **One documented courtroom action:** the Colorado intervention, in a case a company filed first. **The §4 Commerce evaluation of “onerous” state AI laws and the §5(a) BEAD Policy Notice — both due on 90-day clocks from 11 December 2025 — were not located by this pack.**

New York. Legislature passed the **Responsible Data Center Development Act (S10642/A11560)** on 4 June 2026 (Senate 44–16, Assembly 102–39); **not signed**. On **14 July 2026 Governor Hochul issued Executive Order 62**, pausing certain state environmental approvals for data centers at **50 MW or more** for up to one year and directing the Department of Public Service to produce a **Generic Environmental Impact Statement** under SEQRA with a formal public hearing, plus guidance within 60 days for local entities negotiating community benefits. **This makes New York the first state in the nation with a statewide data center permitting moratorium — imposed by executive order, at a higher threshold than the unsigned bill.** Assembly Speaker Heastie said on 14 July that he remained hopeful the order did not signal a veto; Hochul has until the end of the year to act on the bill. **[EXPECTED: a decision on S10642/A11560 by 31 December 2026.]**

Stargate / Abilene. Four of eight buildings operational; **0.3 GW energized** against 1.2 GW projected (Epoch AI, 17 April 2026); final building topped out June 2026; buildings three and four, permitted for March 2026 completion, not online as of June 2026. The 600 MW expansion is contested — Bloomberg and Reuters report OpenAI walked away and Nvidia paid a **\$150 million** deposit; Oracle disputes the reporting (9 March 2026) and says leasing for the 4.5 GW commitment is completed. Microsoft reported in March 2026 to have leased the remainder. Oracle reported to carry **\$100 billion-plus** in debt with negative free cash flow; shareholder litigation over buildout disclosure.

SpaceX / xAI. Merger announced February 2026; combined entity valued at **\$1.25 trillion; IPO in June 2026**, with the stock rising over its first three days of trading — **in the same week the Justice Department filed to dismiss the NAACP’s suit.**

11.2 — PENDING EVENTS WITH DATES

Date	Event	Announcing party	Confidence
24 Aug 2026	Preliminary injunction hearing, NAACP v. xAI, N.D. Miss.	the court, via the DOJ filing	High — scheduled
~Sep 2026	60-day deadline for NY guidance to localities on community benefits, EO 62	Gov. Hochul, EO 62	Moderate
31 Dec 2026	Deadline for Hochul action on S10642/A11560	New York law	High
1 Jan 2027	Colorado ADMT rulemaking deadline; HB 26-1263 effective	Colorado AG / statute	High
2 Jan 2027	Colossus 1 Shelby County air permit expires	SCHD permit	High

Date	Event	Announcing party	Confidence
Q1 2027	Committed restart of Memphis greywater facility construction	MLGW CEO Doug McGowen, relaying an xAI commitment	Low — a relayed commitment, previously paused
Through Jul 2027	NY EO 62 moratorium period; DPS Generic Environmental Impact Statement due	Gov. Hochul	Moderate
2027	Ohio ballot backers plan a second signature attempt	proponents	Low
2029	Stargate projected to exceed 9 GW	Epoch AI projection	Low — a projection, not a schedule

11.3 — THE DECAY REGISTER

Every **VOLATILE** and **CONTESTED** figure in this pack, with expected direction and velocity, so the **2027** refresh knows exactly what to re-research.

FASTEST — re-research first; expect all of these to be wrong:

- **The Task Force litigation posture** (the As-Of Stamp target). Five independent clocks can move it within a quarter. *Direction: more actions, or a decisive loss.*
- **The turbine counts.** 27 → 41 permitted → 59 documented in under a year. *Direction: up, until a court or a permit stops it. Velocity: quarterly.*
- **The moratorium tallies** — states considering, local moratoria adopted, dollars blocked. *Direction: up in count, but composition now matters more than count, because a governor has acted by executive order. Velocity: by legislative session, plus executive action at any time.*
- **The New York situation.** A signed bill, a veto, or an expiring executive order — three different worlds by 31 December 2026.
- **SpaceX/xAI valuation** (\$1.25 trillion, February 2026 mark; post-IPO). *A mark, not a verdict; reprices continuously now that it is public.*
- **Stargate's energized capacity** (0.3 GW, April 2026). *Direction: up. Velocity: quarterly. Re-survey rather than re-quote.*
- **Oracle's debt position** (\$100B+, negative free cash flow).

FAST — re-research second:

- xAI's Memphis headcount and open postings (99 / 44, January 2026). *No company disclosure; the method may not be repeatable.*
- The greywater facility's status. *Currently a promise with a date; by 2027 it is either under construction or a different kind of fact.*
- The Colorado AI Act's replacement and its litigation.
- Virginia's tax expenditure (\$1.6B FY2025, +118%). *Direction: up. Velocity: annual, with the ACFR.*
- The 79% NOx increase and the monitoring-integrity dispute.
- Public opinion figures — Pew, Gallup, Reuters/Ipsos, Anthropic Public Record. *All recurring series; re-pull rather than age.*

SLOW — verify, do not re-research:

- The jobs ratios (1/\$13M; 1/\$54M; \$137K; \$322K). *Structural; FWW would have to re-run the analysis.*
- Staffing ratios per MW. *Structural; Uptime's series moves slowly.*
- Good Jobs First's 36/11/5/4/1 and 16-of-36 findings. *Annual-ish.*
- Subsidy ROI (52–70 cents on the dollar).

DOES NOT DECAY — state plainly, forever:

- The Clean Air Act's 100-short-ton major-source threshold.
- The Electrolux arc: \$188.3 million, 1,240 committed, no clawback, 2013 reform, \$0 recovered.

- The 2 July 2025 permit for 15 of roughly 35 turbines.
 - The 6–1 vote of 15 December 2025.
 - The text of *Winning the Race* and of EO 14365, including §8(b)(ii).
 - The EDGE confirmation of 21 June 2024.
 - Boxtown’s history and the 1980s class action.
 - Every verbatim in this pack.
-

11.4 — WHAT JUST CHANGED (last ~90 days — the syllabus stack predates all of it)

Flagged prominently: these are the facts most likely to blindside a draft built on the anchors alone.

1. **14 July 2026 — New York Executive Order 62.** The first statewide data center permitting moratorium in the United States, imposed by a governor at a **50 MW** threshold while the legislature’s **20 MW** bill sits unsigned on her desk. **Seven days before this pack’s research date.** The moratorium wave stopped being a wave of bills and became an executive act.
 2. **15–16 June 2026 — the United States moved to dismiss the NAACP’s Clean Air Act suit on national-security grounds,** attaching a sworn declaration from the Department of War’s Chief Digital and AI Officer, and **did not dispute that the turbines lack permits. The single most important development in this lecture’s territory, and it postdates every planning document in the stack.**
 3. **~14–15 July 2026 — the 59-turbine record.** A public records request produced Trinity Consultants–MDEQ correspondence establishing **57 units in Southaven and two elsewhere,** roughly double what the company had acknowledged, with manufacturer emissions profiles for 30 of them.
 4. **June 2026 — SpaceX IPO,** in the same week as the DOJ filing.
 5. **13 June / 1 July 2026 — Arizona and Illinois paused data center tax incentives;** Arizona’s governor signed a **three-year** moratorium on new sales tax breaks. **The subsidy architecture that Beat 5 audits is now itself under active repeal pressure in two states.**
 6. **1 July 2026 — Ohio’s 25 MW constitutional-amendment ballot measure failed** with roughly 70,000 of 413,488 required signatures.
 7. **June 2026 — Michigan reintroduced statewide moratorium bills** (HB 5594–5596, SB 1018–1020) with the governor opposed.
 8. **23 June 2026 — the Shelby County Health Department publicly questioned the integrity of a community air monitoring report,** and community monitoring found South Memphis regularly exposed to unsafe pollution levels. **The measurement dispute is now itself on the record.**
 9. **April–July 2026 — the greywater facility was paused and then re-committed** for Q1 2027.
-

11.5 — WHAT IS STILL HIDDEN

Honest uncertainty markers. The file is not closed, and the refusal to disclose is itself course material.

- **xAI’s Memphis headcount.** Never published. The only public estimate uses LinkedIn profiles and job postings, has a disclosed method, and comes from an adversarial source.
- **The §4 Commerce evaluation of “onerous” state AI laws and the §5(a) BEAD Policy Notice.** Both due on 90-day clocks from 11 December 2025. **Not located.** Without them, the enforcement chain — evaluation feeds litigation feeds funding condition — has an unpublished first link.
- **Whether any federal agency has actually conditioned a discretionary grant** on a state’s AI regulatory posture under §5(b). **No instance located.**
- **The Stanley declaration’s exact text,** including the frontier-model count. **PACER pull required; secondary renderings conflict.**
- **The APCB’s deliberation on 15 December 2025.** The vote is documented; the reasoning is not.
- **Continuous, independent, publicly published ambient monitoring at the fence line.** Does not exist in the pack’s sources. MCAP’s community network exists and its integrity is publicly disputed by the regulator.
- **Per-unit turbine tenure.** The entire legal theory turns on whether each unit has sat on its pad for less than a year. **No unit-level tenure record was located.**

- **The MZX Tech real estate terms.** Purchase prices for the Stanton Road and Stateline Road parcels were not established.
- **xAI's actual water draw.** Requested up to 3.7 million gallons per day; contractually capped at 1.2 million; **actual metered consumption not published.**
- **Whether xAI filed its threatened preliminary-injunction motion** against Colorado's replacement law.
- **The Memphis property tax actually paid.** MLGW projected \$15–20 million annually in 2024; the Chamber says tens of millions have been paid and projects over \$100 million. **No audited figure located.**

SECTION 12: SOURCE INVENTORY

PRIMARY sources first within each category. Every company and advocacy source flagged with what it gets if believed.

Government and regulatory documents (PRIMARY)

[1] The White House — *Winning the Race: America's AI Action Plan* — July 2025 (released 23 July 2025) — whitehouse.gov — **The lecture's assigned Paper Trail document. Full text; the space-race Verbatim; the Pillar II permitting actions; the workforce sections. U.S. Government work.** [2] The President — **Executive Order 14365, Ensuring a National Policy Framework for Artificial Intelligence** — 11 December 2025 — whitehouse.gov Presidential Actions — **The operative instrument: §3 Task Force, §4 evaluation, §5 BEAD and grant conditions, §6 FCC, §7 FTC, §8(b) the data-center carve-out.** [3] The President — **Executive Order 14179, Removing Barriers to American Leadership in Artificial Intelligence** — 23 January 2025 — Federal Register 90 (20) 8741 — The Action Plan's parent directive. [4] The President — Executive Orders 14156, 14192, 14213, 14255, 14277, 14278, 14306 — 2025 — Federal Register — The permitting and workforce predicates cited in the Action Plan's footnotes. [5] The President — *Promoting Advanced Artificial Intelligence Innovation and Security* — 2 June 2026 — whitehouse.gov — **Existence and date only; content not researched. Draft-stage pull.** [6] Governor Kathy Hochul (NY) — **Executive Order 62** — effective 14 July 2026 — **The first statewide data center permitting moratorium in the U.S.; 50 MW threshold; DPS Generic Environmental Impact Statement under SEQRA; 60-day community-benefit guidance.** [7] New York State Legislature — **Responsible Data Center Development Act, S10642/A11560** — passed 4 June 2026, Senate 44–16, Assembly 102–39 — Adds Article 31 to the Environmental Conservation Law; amends the Public Service, Public Authorities, Energy, and Labor Laws. **Unsigned as of the research date.** [8] Shelby County Health Department — **Air construction permit, CTC Property LLC, Colossus Data Center, 3231 Paul R Lowry Road** — issued 2 July 2025 — 15 Solar SMT-130 turbines, ~247.2 MW, BACT by 1 September 2025, expiry 2 January 2027. [9] Southern Environmental Law Center for the NAACP and Young, Gifted & Green — **Air Permit Appeal with Appendices** — filed 16 July 2025, Memphis and Shelby County Air Pollution Control Board — The nonroad-exemption theory; automatic stay; 60-day hearing requirement. [10] Memphis and Shelby County Air Pollution Control Board — **hearing and decision, 15 December 2025** — 6–1 to uphold the permit. [11] Shelby County Board of Commissioners — resolution and minutes, 26 March 2025 (5–1); public hearing, 9 April 2025. [12] Mississippi Department of Environmental Quality — **Permit Board decision, 10 March 2026** — 41 permanent gas turbines, MZX Tech LLC, 2875 Stanton Road, Southaven; public hearing 17 February 2026; application prepared by Trinity Consultants. [13] NAACP and Mississippi State Conference v. xAI Corp. and MZX Tech LLC — **complaint filed 14 April 2026, amended 10 June 2026**, N.D. Miss.; preliminary injunction sought May 2026; hearing set 24 August 2026. [14] United States — **motion to intervene and dismiss with prejudice**, filed 15–16 June 2026, DOJ Environment and Natural Resources Division; Associate Attorney General Stanley Woodward among signers — **The enforcement-discretion and national-security theory.** [15] **Declaration of Cameron Stanley**, Chief Digital and Artificial Intelligence Officer, Department of War — attached to [14], June 2026 — **Grok on classified networks; the Iran strikes; the Marvin Smart System; Operation Epic Fury. PACER pull required to resolve the model count.** [16] NAACP and SELC — **60-day notice of intent to sue**, certified mail, 13 February 2026 — Earthjustice archive — The Southaven turbine history; the ~2 GW / Hoover Dam comparison; SCR completion on 6 units. [17] *xAI Corp. v. Weiser*, D. Colo. — complaint filed 9 April 2026; **DOJ complaint in intervention, 24 April 2026**; enforcement stay granted 27 April 2026. [18] Colorado General Assembly — SB 24-205; SB 26-189; **HB 26-1263** (Chatbot Safety Act, signed 29 May 2026, effective 1 January 2027). [19] Maine Legislature — **LD 307**, statewide moratorium on data centers over 20 MW to 1 November 2027 — **vetoed by Gov. Janet Mills, 24 April 2026**, in a veto message agreeing with the policy. [20] **S.4214** (Sen. Bernie Sanders, I-VT, introduced 25 March 2026) and **H.R.9442** (Rep. Alexandria Ocasio-Cortez, D-NY-14,

introduced 24 June 2026, 9 cosponsors) — Conditional federal data center moratorium. [21] Commonwealth of Virginia — **Annual Comprehensive Financial Report**, FY ended 30 June 2025 — **\$1.6 billion data center sales and use tax exemption, +118% YoY**. [22] Joint Legislative Audit and Review Commission (Virginia) — **Data Centers in Virginia, Report 598** — 9 December 2024 — jlarc.virginia.gov — 74,000 jobs / \$5.5B labor income / \$9.1B GDP; NoVA at 13% of global operational capacity. **L1 owns full treatment; return-grade use only here**. [23] Memphis and Shelby County Division of Planning and Development — certificate of occupancy and construction permits, 3231 Paul R Lowry Road, 23 July 2024 (Brent Mayo, CTC Properties; Darryl Cuttell, Darana Hybrid) and April 2024 (\$10,267,329 mechanical and electrical). [24] EDGE (Economic Development Growth Engine for Memphis and Shelby County) — confirmation of 21 June 2024 that xAI submitted no incentive application; **Electrolux Annual Performance Report**, released 15 February 2019 (254 full-time and 404 contract terminations in 2018; PILOT payments just under \$500,000). [25] Crusoe / Texas air permit application — 360.5 MW simple-cycle gas plant, Abilene — filed ~August 2024, **approved in six days**; Abilene building permits showing March 2026 completion for buildings three and four. [26] Rep. Steve Cohen (TN-09) — press release on the Electrolux closure — 31 January 2019 — cohen.house.gov. [27] U.S. Department of Energy / Lawrence Berkeley National Laboratory — **2024 United States Data Center Energy Usage Report, LBNL-2001637** — December 2024 — Source of the 4.4%-of-U.S.-electricity figure.

Advocacy and watchdog analysis (interests flagged)

[28] **Food & Water Watch** — *Artificial Jobs: The Illusion of Big Tech's Data Center Employment Claims* — January 2026 — **The Step Function's actual source: 1 job/\$13M; \$137K/job; 1 job/\$54M (2020–late 2025); \$322K; \$7.8M incl. secondary; ~7,600 VA; ~23,000 national; 0.01% of jobs vs. 4.4% of electricity; 1.12 jobs/MW. FWW explicitly calls for a national moratorium on data center development — name the filer every time**. [29] **Good Jobs First** — *Cloudy Data, Costly Deals: How Poorly States Disclose Data Center Subsidies* (Kasia Tarczynska) — November 2025 — **36/11/5/4/1 states; none disclose both promised and created; 52–70 cents lost per dollar; Texas \$1B FY2025; Virginia ~\$1B/yr**. [30] **Good Jobs First** — “Will data center job creation live up to hype? I have some concerns” (Kasia Tarczynska) — updated through 2026 — **“Almost half of state data center subsidies – 16 out of 36 – do not require job creation.” Resolves the third must-hit anchor**. Also: NJ 100 jobs, most states ≤50, Illinois 20; Indiana's Google announcement carrying no legal obligation; Wyoming 35% unskilled at \$26/h vs. \$56/h (2021); Genesee County NY IDA anticipating 60% out-of-region construction workforce. [31] **Good Jobs First** — *The Myths of Data Centers' "Billions" in Investments* — April 2026 — Six states require ≥\$250M investment; eight require no minimum. [32] **Southern Environmental Law Center** — letter to the Shelby County Health Department on NOx (1,200–2,000 tons/yr from manufacturer data); aerial survey flown by Southwings, photographer Steve Jones, April 2025; EPA ozone petition, 5 June 2025. **A litigating party; benefits if believed — and the only source of quantified emissions data for Colossus 1**. [33] **NAACP** — press release on the appeal, 18 July 2025, including LaTricea Adams's statement; statement on the DOJ intervention, 16 June 2026. [34] **Memphis Community Against Pollution** — memphiscap.org, including the 22 March 2025 Young-Pearson discussion record and the community sensor findings (79% peak NOx increase, reported March 2026). [35] **Protect Our Aquifer** — Sarah Houston and Scott Schoeferacker on the greywater pause and the MLGW contractual cap, April 2026; the organization's water-reuse advocacy dating to ~2017. [36] Environmental Defense Fund / Moms Clean Air Force — KeShaun Pearson profile (Shanti Menon) — 2 May 2026 — **Boxtown's history; the ethylene-oxide fight; the 1980s class action**. [37] Heinrich Böll Stiftung — “The Promise of ‘The Peace of Plenty’: How South Memphis Is Refusing AI's Big Lies” — 28 January 2026 — **Extended Pearson account of the April 2025 hearing. Single-source for the diet remark — flagged**.

Industry and company materials (seller's own documents)

[38] **Greater Memphis Chamber** — xAI FAQ (memphischamber.com/economic-development/xai) — **“up to 500 quality, high-paying jobs”; “xAI took no incentives from the State”; the >\$100M tax projection**. Gets the next recruitment if believed. [39] **Greater Memphis Chamber** — press release commending the SCHD permit, 2 July 2025 (Ted Townsend). [40] **xAI** — statement on the SCHD permit, 2 July 2025 (“lowest emitting of its kind in the country”); statement on the MDEQ permit, 10 March 2026 (“1.2GW of self-generating power capacity”); greywater commitment statements, October 2025 and April 2026. [41] **Elon Musk** — X post, 2 September 2024 (Colossus online, 100,000 H100s, 122-day build); orbital data center announcement, March 2026. [42] **OpenAI** — “OpenAI, Oracle, and Soft-Bank expand Stargate with five new AI data center sites,” 23 September 2025 — ~7 GW planned, >\$400B, “ahead of schedule.” [43] **Oracle** — *Oracle Fact Sheet: Stargate Data Centers*, 22 September 2025, entered into the congressional record via Rep. Arrington's office — 5.5 GW, 25,000+ onsite jobs, 4,800+ acres; and Oracle's X post of 9 March 2026

disputing Abilene reporting. [44] **Crusoe** — “Crusoe announces flagship Abilene data center is live,” 30 September 2025 (Chase Lochmiller); topping-out statement, June 2026 (7,000 daily tradespeople). [45] **NVTC** — *The Impact of Data Centers on Virginia’s State and Local Economies, 5th Biennial Report*, April 2024 — \$203B / 12,140 jobs = **\$16.7M per job by the advocacy group’s own arithmetic**. Sponsored by Amazon and Dominion Energy. [46] **PwC for the Data Center Coalition** — *Economic Contributions of Data Centers in the United States 2017–2023*, February 2025 — 603,000 direct / 4.7M supported. **Uses the entire NAICS 518210 sector**. [47] **NetChoice** — handouts to the Minnesota Senate Taxes Committee, 2024 and 2025, drawing on the 2022 Mangum Economics Wisconsin study — 300 FTE operations jobs; 1,800 construction jobs; \$23M average pay and benefits. [48] **MLGW** — 2024 public estimates: 300+ jobs, \$15–20M annual property taxes, \$500,000 additional PILOT, >1M gallons/day (~1% of daily aquifer draw); Doug McGowen’s 5-billion-gallon conservation figure, October 2025.

Independent analysis and research

[49] **Uptime Institute** — *Global Data Center Staffing Forecast 2021–2025* (announced 26 January 2020); *Global Data Center Survey 2025*; 2024 survey (42% of operators losing staff to 15–25% raises) — **The staffing-ratio spine. Vantage: sells research and certification to operators; figures are operator-reported**. [50] **CBRE** — *North America Data Center Trends*, 2024 and 2025 — Construction workforce ratios. **Vantage: brokers the buildings**. [51] **Epoch AI** — “OpenAI Stargate: where the US sites stand,” 17 April 2026, using Airbus imagery captured 24 March 2026 — **0.3 GW energized; 4 of 8 buildings; H100-equivalent conversions. The only independent measurement of Stargate’s actual capacity in this pack**. [52] **Global Energy Monitor** — *Colossus 1 power station*, updated July 2026 — Grid connection history (~8 MW → ~150 MW); permit details; turbine counts. [53] **Rhodium Group** — Ben King on the 59-turbine emissions analysis, July 2026 — “unprecedented level of behind-the-meter gas.” [54] **MultiState** — *State Data Center Policy 101: 2026 Legislative Guide*, updated 15 July 2026 — 267 bills / 40+ states in 2025; moratorium bills in 11 states in 2026. [55] **DLA Piper** — alert on the New York moratorium, July 2026 — 300+ bills / 30+ states; ≥12 states considering moratoria; 100+ local moratoria; \$64B blocked or delayed; 15 Virginia bills enacted; the Hill County reversal. [56] **datacenterbans.com** — state legislation tracker, July 2026 — Arizona, Illinois, Ohio, Michigan, Pennsylvania, Wisconsin, South Carolina, New Hampshire. [57] **Institute for Law & AI** — “Legal Issues Raised by the Proposed Executive Order on AI Preemption,” November 2025 — The dormant-commerce-clause theory’s provenance. [58] Michael J. Hicks — Texas data center employment analysis, November 2025 — Net county employment effect effectively zero. [59] University of Michigan researchers — 2025 brief on data center employment. [60] Law-firm analyses of EO 14365 and the AI Action Plan (Sidley, Wiley, Skadden, Paul Hastings, Davis Wright Tremaine, Norton Rose Fulbright, Jenner & Block, Latham & Watkins, Barnes & Thornburg, Greenberg Traurig, Harris Beach Murtha, Hodgson Russ, Harter Secrest & Emery, White & Case, Morrison Foerster, Dentons, Crowell, DLA Piper) — 2025–2026 — **Secondary synthesis of primary instruments. Useful for clocks, dates, and procedural posture; the orders themselves govern**.

Public opinion research

[61] **Pew Research Center** — *U.S. Workers Are More Worried Than Hopeful About Future AI Use in the Workplace*, published 25 February 2025, field 7–13 October 2024, n=5,273 employed adults — 52% / 32% / 36% / 33%. [62] **Pew Research Center** — June 2025 survey, n=5,023 adults, released September 2025 — 50% more concerned than excited vs. 10% more excited; 37% in 2021; 53% expecting diminished creative thinking. [63] **Pew Research Center** — “Key findings about how Americans view artificial intelligence,” 12 March 2026 — 21% of workers using AI (up from 16% in 2024); 65% not using it much or at all. [64] **Anthropic** — *Anthropic Public Record*, wave 1, fielded November–December 2025 via YouGov, n=51,993, weighted to U.S. Census benchmarks — **64% of Americans name AI job loss as their top AI fear, in every state. Vantage: the surveying party is an AI developer — name it**. [65] Reuters/Ipsos — 2025 (71% fear permanent job losses) and June 2026 (53% household-level fear); Gallup 2026 (18% expect their own job eliminated within five years). **Different questions; do not stack**.

Journalism (reporters named where the reporting is the primary record)

[66] **The New York Times** — Ivan Penn and Kate Conger, “Why a Memphis Community Is Fighting Elon Musk’s Supercomputer,” 31 October 2024 — The first national-record account. [67] **The Daily Memphian** — Samuel Hardiman, “XAI air emissions permit valid, Air Pollution Control Board says,” 15 December 2025, 3:34 p.m. CT / updated 4:03 p.m. CT; Wayne Risher, Electrolux closure coverage, 31 January 2019. **The most consistent local record of both arcs**. [68] **Tennessee Lookout** — Cassandra Stephenson (Report for America), appeal coverage 16–17 July 2025 and the

June 2026 air monitoring dispute; Rev. Earle Fisher commentary, 2025–2026. [69] **Inside Climate News** — Memphis turbine coverage, 17 July 2025 — Comment counts; the Code Orange juxtaposition; SELC’s legal position. [70] **NBC News** — Boxtown coverage, 16 May 2025 — The 38109 median income; Pearson at Lacy’s Place Barbershop. [71] **Reuters** — Valerie Volcovici, Mississippi hearing coverage, 17 February 2026 — The 20-turbine removal; the 41-turbine application. [72] **CNBC** — MDEQ permit approval, 10 March 2026; DOJ intervention, 16 June 2026; further Mississippi opposition, 10 April 2026. [73] **Quartz** — DOJ intervention analysis, 17 June 2026; data center employment analysis, May 2026. [74] **E&E News / POLITICO** — “Musk promised his data center would reuse water. That’s now stalled,” May 2026 — The 3.7 million gallon/day request; the decade-long local push for reuse predating xAI. [75] **Action News 5 (WMC), WREG, FOX13 Memphis, localmemphis.com (ABC24)** — The Memphis broadcast record, 2024–2026 — **The named-resident quotes: Gladney (8 December 2025), Knox (3 July 2025), Kirkwood (6 March 2026), Samsa (8 December 2025); Cooper-Sutton and Freemon (21 October 2025).** [76] **Democracy Now!** — 25 April 2025 and 22 April 2026 interviews with KeShaun Pearson (and, in 2025, State Rep. Justin J. Pearson) — **The Electrolux comparison verbatim; the human-rights framing.** [77] **Memphis Flyer** — “A People’s History of the Fight Against xAI,” 15 April 2026 — The Byhalia pipeline history; MCAP’s organizational record. [78] **TechCrunch** — xAI permit coverage, 3 July 2025 — The 421 MW aggregate figure; the 15 Solar SMT-130 units. [79] **Datacenter Dynamics** — Abilene topping-out, 8 June 2026; MDEQ permit approval, 18 June 2026. [80] **Tom’s Hardware, Bloomberg, Reuters** — Abilene 600 MW expansion reporting, March 2026 — **Disputed by Oracle; present the conflict.** [81] **The Register** — Virginia tax break coverage, 7 January 2026 — The \$1.6B FY2025 figure; the LeRoy and Ali Ahmad statements. [82] **Axios, Spectrum News NY1, North Country Public Radio, The River Reporter, Bisnow** — New York EO 62 and moratorium-wave coverage, June–July 2026 — Heastie, Gray, Gonzalez; the Michigan county tally; the Arizona and Illinois pauses. [83] **technology.org / Tech Times / cloudnews.tech** — The 59-turbine investigative record, 15 July 2026 — Trinity Consultants–MDEQ correspondence via public records request; manufacturer emissions profiles for 30 units; Rhodium’s assessment. **Aggregator coverage of an underlying records-based investigation — pull the underlying reporting at draft stage.** [84] **Oligarch Watch** — “Imported talent, local pollution: The grim reality of xAI’s impact on Memphis,” 6 January 2026 — **99 identified employees; 44 open postings; >50% hired from outside the region; Brent Taylor’s SNAP-to-six-figures claim. Method disclosed (LinkedIn + postings); vantage adversarial. The only public headcount attempt of any kind.** [85] **Associated Press** — Electrolux clawback coverage, February 2019 (Scott Harrison; Gov. Bill Lee; Eloise Hale); George Walker IV photograph of the APCB hearing room, 15 December 2025. [86] **Grist** (via syndication) — Data center image-problem coverage, 2026 — LeRoy’s “still very much in the ballpark”; Virginia Connects’ \$700,000 FY2024 digital marketing spend. [87] **GovTech, Cato Institute** — Colorado litigation coverage, April 2026 — Dhillon’s statement; Titone’s response; the Task Force’s January 2026 formation. [88] **Washington Post / Getty** — Brandon Dill, photographs of the gas turbines on Riverport Road, 25 April 2025 — The ground-level visual record.

END OF RESEARCH PACK 1.0 — LECTURE 8: THE THREE-VECTOR SQUEEZE

Lecture identity and Sections 1–12 complete. RESEARCH AS OF 21 July 2026.

Four discrepancies flagged and unresolved (Section 6.2, items 1, 2, 4, 5); one resolved (item 3). Ten pack dependencies: eight resolved, one conditionally resolved pending Nick’s call on the third Gesture door (D6), one honestly limited with the limit stated (D7/D8 — the Neighbor is named and quoted, but the record supplies no household ledger). Twelve of twelve strawman beats SUSTAINABLE, four on stated conditions; ten of ten negative-space absences justified with three near-misses documented and declined; zero swaps proposed; no re-sequencing proposed. One move verified as a deliberate skip with three cleared alternates banked; one move conditional on an open item; six verified. The pack proposes; markup and the Course Schema dispose.

Lecture 9 — Orbit

Research Pack 1.0 · source file L9_Research_Pack_1_0.md · research as of 22 July 2026

RESEARCH AS OF 22 July 2026

(Per the L1–L8 pack precedent: every figure carries unit · stage · as-of date · author; discrepancies against must-hit anchors are flagged inline and consolidated in Section 6. Per the house copyright discipline established in the L4 pack, verbatim quotes are held short with full attribution, one deployment per source document; longer passages are precisely paraphrased, marked as paraphrase, and carry a **locator** for the draft-stage verbatim pull. Two locator classes recur here: **FCC ICFS** (International Communications Filing System — file-number-searchable; applications, narratives, technical attachments, petitions to deny, oppositions and replies pullable in full at draft stage) and **arXiv/vendor technical papers** (pullable in full at draft stage). Where an exact sentence has been reproduced by a secondary outlet quoting a primary filing, it is marked [SECONDARY-QUOTED PRIMARY] and must be re-verified against ICFS before The Verbatim deploys.)

THE ASSEMBLED LECTURE IDENTITY

Title. Lecture 9 — Orbit.

Frame & through-line (Syllabus 2.0, carried from 1.0). The escape hatch, motivated by the bill, not by wonder. The pitch taken seriously, then audited in the same tone as the pitch.

Register. Atoms-as-audit — the deadpan peak of the course. High-decay lecture; the Handoffs hinge on the escape fantasy existing, never on a valuation. Cascade position: the exit from the contested ground of Lecture 8, manufacturing the audit of Lecture 10.

Cascade edge (Syllabus 2.0 format). Inherits: contested ground. · Binds at: the radiator and the launch manifest. · Who pays: the cap table, for now. · Manufactures: the audit → L10.

Strawman beat plan (12, running order — STRAWMAN FOR MARKUP; the count is fixed at 12, the selection and order are not; the Course Schema locks the order after markup runs on Sections 2 and 3):

1. **The Wrong Map [O]** — orbital geography as the new siting map: dawn–dusk sun-synchronous orbit, panels up to 8x more productive, no land, no water, no rate case — the pitch’s map, drawn honestly. (*Opener rotation verified: Wrong Map opens 1 and 9; L8 opened Hearing Room, L10 opens Hearing Room — no adjacent repeat.*)
2. **The Founder Audit** — Johnston — the résumé doing the deadpan work; the pitch deck vs. the thermal math. (*Beat Menu: never lecture 1; natural homes 5, 6, 9. Casting is deployment 3 of 3 across the confirmed grid — L6 Intrator, L9 Johnston, with L2’s Huang deployment an open call at Syllabus 2.0 Open Item 10.*)
3. **The Paper Trail** — **class: regulatory application** — the maximal pitch in the most bureaucratic possible prose. (*Class rotation verified: state audit 1 · tech spec 2 · permit 3 · queue instrument 4 · contract 5 · securities filing 6 · tariff docket 7 · executive doc 8 · regulatory application 9 · accounting policy 10.*) **△ NAMING DEFECT — SEE SECTION 6, D1.** Syllabus 2.0 and Roster 1.0 both name this document “the TeraWave FCC filing.” The record does not support that name. See below.
4. **Taxonomy by Business Model** — the field by constellation thesis. (*Cap verified: Taxonomy casting 3 of 3 — L3 cooling vendors · L6 neoclouds · L9 orbital players. Cap ≤3 honored; the L2 and L7 packs each declined a fourth deployment expressly to protect this casting.*)
5. **Mechanism Autopsy** — spacecraft thermal design: how a radiator actually rejects heat, and what deployable area costs in mass.
6. **The Physics Audit** — the signature deployment: no air means no convection; every watt in leaves by radiation alone; ~3x cost per watt by the industry’s own modeling — delivered in the same tone as the pitch.
7. **The Bottleneck** — Starship cadence as the dependency nobody controls; radiation hardening; no service calls.
8. **The Externality Swap** — no neighbors and no water — paid for in launch mass, radiator area, and a refresh cycle

with no screwdriver; both sides priced honestly.

9. **The Forecast Problem** — Bezos's and Musk's dated remarks as motivated forecasts with owners.
10. **The Symbol Audit** — orbit-as-destiny audited as procurement — **deployment 3 of 3**, cast deliberately on the gigawatt rhetoric. (*Course-wide cap ≤ 3 verified: L5 Three Mile Island / Crane · L8 Stargate · L9 orbital destiny. The L2, L3, L6 and L7 packs each documented a declined candidate expressly to protect this casting. This is the last one.*)
11. **The Steelman** — defendant: **the orbital case at its strongest** — launch-cost curves, the rate-case escape, the solar arithmetic, granted fully before the audit stands. (*Rotation verified: L1 the county's growth case · L4 PJM's queue · L5 the behind-the-meter customer · L6 the neocloud CFO's depreciation schedule · L7 Dominion · L8 the White House's race logic · L9 the orbital case · L10 the hyperscaler's capex logic. No party twice. PASS. Note for markup: the record surfaced a distinct second steelman-grade defendant in this territory — the Earth-observation edge-compute case, which is a different party with a different (and stronger) balance sheet; banked in Section 7.*)
12. **The Perverse Incentive [C]** — a market that rewards the constellation filing before the radiator: spectrum positions and valuations priced off applications, not thermal budgets.

Paper Trail document class: regulatory application (rotation position 9 of 10 distinct classes). **Named document — CORRECTED BY THE RECORD:** *Application of Blue Origin, LLC for Authority to Launch and Operate the Project Sunrise Orbital Data Center System*, FCC ICFS File No. **SAT-LOA-20260310-00118**, filed **19 March 2026**. **Project Sunrise is the 51,600-satellite orbital data center constellation. TeraWave is a separate and much smaller Blue Origin broadband constellation (5,280 LEO + 128 MEO = 5,408 satellites), announced and filed in January 2026, whose function in the Sunrise architecture is to carry Sunrise's traffic to the ground.** The must-hit figure (51,600) survives intact; the document *name* in Syllabus 2.0 and Roster 1.0 does not. Full flag at Section 6, D1.

Handoff (assigned): a cost left unassigned — the escape fantasy, fully priced; the audit of everything else is due. (*Rotation verified against the Syllabus 2.0 sequence: L1 question · L2 cost unassigned · L3 character walking · L4 question · L5 cost unassigned · L6 the bill walking · L7 question · L8 door not opened · L9 cost unassigned. No adjacent repeat — L8 ran door not opened. PASS. Alternates banked in Section 10.*)

Negative space (beats left out — scanned in Section 3): Cold Open on an Object, The Bill Arrives, The Hearing Room, Follow the Money (the valuation rides inside the Founder Audit), The Regulatory Collision, The County, The Neighbor, The Deal, Operator Reality.

CAST — ROSTER 1.0, WITH LEAD/RETURN STATUS

Slot	Anchor	Status
Object	The deployable radiator	LEAD here. No prior lecture owns it. L3 owns terrestrial heat rejection (cold plate, CDU, cooling tower, the ~15 kW air ceiling); this is the <i>vacuum</i> case and it is L9's alone.
Document	The Project Sunrise FCC application (<i>carried in Syllabus 2.0 as "the TeraWave FCC filing" — see D1</i>)	LEAD here. First and only appearance.
Human	Philip Johnston — co-founder and CEO, Starcloud	LEAD here. No return lecture assigned.

Secondary cast (Roster 1.0): Jeff Bezos (Italian Tech Week, 3 October 2025 — the gigawatt-orbital remarks, dated and stamped); Elon Musk (Starlink-derived compute claims, November 2025 – June 2026, dated for the stamp); Andrew McCalip / Varda Space Industries engineering commentary (the ~3x cost-per-watt audit from inside the industry — **attribution correction at D3**); **the NVIDIA rack roadmap's final return** (L2 is lead; L9's allocated addition is the five-to-seven-year treadmill line only, 500 km from the nearest screwdriver).

Recurring characters appearing here, with lead/return status:

- **NVIDIA's rack roadmap** — *return*. **Lead lecture: L2.** L2's pack pre-allocated L9's return as *the treadmill line only*. The drafting AI does not rebuild the density ladder, crane day, the 800 VDC story, or Huang's keynote scene.

One new fact is added here and is L9's to own: the roadmap acquired a space-qualified branch on 16 March 2026 (Section 2, Beat 7).

- **Crusoe** — *return*. Lead treatment: L6 (neocloud taxonomy). L9 adds one fact: Crusoe is a named Starcloud-2 workload partner and the reseller of early orbital capacity.
- **CoreWeave, PJM, Dominion, Loudoun County, the interconnection agreement, “Winning the Race”** — **absent from this lecture by design**. None appear in L9's territory; the drafting AI must not import them.
- **Memphis / xAI / KeShaun Pearson / Sarah Houston** — **L8's, entirely**. The 4–5 March 2026 orbital announcement is L8's *seam*; L9 owns the substance of the orbital claim and must not re-run the Memphis fight. See Section 10.

MUST-HIT ANCHORS (verbatim from Syllabus 2.0 / Syllabus 1.0)

8x panel productivity (SSO); Starcloud \$1.1B / H100 on Starcloud-1; Project Suncatcher two-TPU prototype by early 2027; TeraWave 51,600-satellite filing; radiation-only heat rejection; ~3x cost/watt (Varda modeling); Starship cadence dependency; March 2026 valuation.

All eight are supported by the record. Three carry corrections or qualifications that do **not** change a figure and are flagged in Section 6: the document name behind “51,600” (D1); the attribution behind “Varda modeling” (D3); and the “up to” that must survive on “8x” (D4).

MOVES PLAN AS ASSIGNED (verification in Section 4)

Move	Assignment	Pack gate
Step Function	~3x cost per watt — by the industry's own math, after the pitch has settled	Number verified; pedigree correction required (D3)
Unit Conversion	51,600 satellites → multiple of today's active fleet	HARD GATE — pack-verify the denominator . Verdict in §4: PASS
Timeline Snap	March 2026 — the month the valuation printed	Verified; a competing hinge exists and is presented with evidence
The Verbatim	the FCC filing's satellite count, in the filing's own syntax	EXISTENCE GATE . Verdict in §4: CONDITIONAL PASS / PRIMARY RE-PULL REQUIRED ; a fully verified superior alternate is supplied
As-Of Stamp	the \$1.1B valuation and the Suncatcher timeline	Verified; both have moved or are moving — §11
Kicker	the refresh treadmill, 500 kilometers from the nearest screwdriver	Verified; adjacent facts supplied
Gesture	skip proposed (the doors stay terrestrial)	Confirmed as correct . §4 and §10
Handoff	<i>a cost left unassigned</i>	Material in §10; rotation PASS

OVERCLAIM & NARRATOR MOVE AS ASSIGNED

Seller on the field: the Escape Artist. Governing \$5 moves: GRANT-AND-WITHHOLD delivered as the Physics Audit — the 8x is real, the land-and-water escape is real, and the best rebuttal on record is the industry's own engineering commentary. **HOLD OPEN** on whether it ever pencils: settled by launch cadence and radiator mass, and the course says so.

Pack finding on the assignment: both moves fit the evidence as researched, and the record has *strengthened* the assignment since Syllabus 2.0 was written. Two additional sellers are unavoidably on this field and are covered in Section 7 at secondary weight: **the Hyperscaler** (Musk's 100 GW/yr and 300–500 GW/yr claims; Bezos's decadal forecast; Huang's

space-compute product line) and **the Doomer** (the “it’s a thermos,” “it’s physically impossible,” “it will destroy astronomy” cluster — which contains one claim that is flatly true, one that is overstated, and one that is a live regulatory fight). The Politician is *nearly absent from this lecture and that absence is itself material* — see Section 7’s closing note.

Decay tier: HIGH. This is one of the three flagged high-decay lectures (6, 9, 10).

Boundary door touched by the Gesture: none — skip confirmed. See Section 10.

HUMAN-FLOOR FLAGS — ZONES WHERE COMEDY DROPS TO NEAR-ZERO

This lecture’s machine is the one place in the course where the human floor is *structurally absent by design* — “no neighbors” is literally the product. That absence is the lecture’s most important tonal hazard, because it invites the draft to treat the hour as a purely comic audit. The pack marks four zones where it is not:

- **HF-1 — The Memphis response, 4–5 March 2026.** Named residents of a fence-line neighborhood responded to an orbital-data-center announcement made from the middle of their fight. **Comedy off.** This is L8’s material and L9 touches it at one clause maximum, at the inheritance (Section 10).
- **HF-2 — The dark-sky and observatory constituency.** Documented, quantified, filed, and taxpayer-funded. The AAS, IAU, RAS, ESO, DarkSky International and named individual petitioners are people whose life’s work is a documented input to a federal proceeding. **Comedy off on the constituency; comedy permitted on the procedural machinery** (the categorical exclusion, the brightness-model acronym).
- **HF-3 — The atmospheric-deposition record.** Alumina, ozone, and the fact that nobody is metering it. **Comedy off.**
- **HF-4 — The job-fear inversion.** L8 established data centers as the physical avatar of automation anxiety. The orbital version employs approximately nobody, at a company with 15 employees, and the “operator reality” beat is *unbuildable here because there are no operators*. **Handle as fact, not as punchline.** Section 3 records this as a finding.

PACK DEPENDENCIES — DEBTS THIS PACK MUST RESOLVE OR HONESTLY FAIL

#	Source	Debt	Resolution
D-a	Syllabus 2.0, Open Item 11	Unit Conversion pack-verification: L9’s satellite multiple. “No vibes conversions; a failed check means the lecture simply runs without its Japan.”	RESOLVED — PASS. §4. Denominator sourced, dated, primary.
D-b	Syllabus 2.0 moves plan	The Verbatim: the FCC filing’s satellite count in the filing’s own syntax. Existence gate.	CONDITIONAL — §4. The sentence exists and has been reproduced by a named outlet quoting the application; the exact string requires an ICFS re-pull before air. A fully verified superior alternate from a primary federal document is supplied.
D-c	Roster 1.0, “What the Research Packs still owe the roster”	Verbatim quotes with full context; as-of titles at each dated moment.	RESOLVED. §§2, 8, 9. Every quoted human carries an as-of title and a dated venue.

#	Source	Debt	Resolution
D-d	Syllabus 2.0, Open Item 9	The third Gesture door (training-run internals) — pending Nick’s call. L9’s Gesture is “skip proposed,” so no candidate deployment rides on this call in L9.	RESOLVED — no dependency. Confirmed at §4 and §10. L9 is unaffected either way.
D-e	Roster 1.0, Lecture 9 entry	Ezra Feilden and Adi Oltean as “engineering ballast” — the résumés must be documented, not asserted.	RESOLVED. §9.
D-f	Beat Menu, Downstream Requirements	Named humans from the record, not aggregates.	RESOLVED with one honest failure declared: there is no Neighbor-grade fence-line household in this lecture’s territory, and the pack does not manufacture one. §8.
D-g	Syllabus 2.0 Symbol Audit cap	Deployment 3 of 3 — this is the last one; verify the cap.	RESOLVED — cap intact. §2 Beat 10.

SECTION 1: TIMELINE OF THE CONSTRAINT

*A constraint machine assembling itself. The constraint in this lecture is thermodynamic and it was fixed before any of the actors were born; what assembles across this timeline is not the physics but the **paperwork, the capital, and the launch manifest** built on top of it. Entries are dated to the day where the record supports it. Expected future events are marked [EXPECTED] with the announcing party named.*

The physics and the precedent (1879–2013)

1. **1879.** Josef Stefan publishes the empirical fourth-power radiation law; **1884,** Ludwig Boltzmann derives it thermodynamically. The Stefan–Boltzmann law — $\dot{Q} = \epsilon\sigma AT^4$ — is the entire economic constraint of this lecture, and it does not decay, negotiate, or respond to capital. **ANCHOR.**
2. **1964.** Nikolai Kardashev publishes *Transmission of Information by Extraterrestrial Civilizations*, **Soviet Astronomy vol. 8, pp. 217–221**, defining the civilization-type scale. Sixty-two years later the Federal Communications Commission will cite this paper in a footnote of a public notice about data centers. (*Why it matters: the FCC’s own citation is the single best documented artifact in this lecture’s Verbatim bank — see §4.*)
3. **December 2006.** The ISS **External Active Thermal Control System (EATCS)** is activated during Shuttle mission **STS-116**, replacing the interim EEATCS. Two independent single-phase anhydrous-ammonia loops — Loop A on the S1 truss, Loop B on P1 — each rated **35 kW, 70 kW total**. Source: NASA ATCS Overview (Boeing IDS, publication undated in the copy; NASA-hosted). *Why it matters: this is the largest heat-rejection system humans have ever operated off-planet, and its full capacity is roughly half of one modern AI rack.*
4. **1995.** SAE Technical Paper **951651**, *Space Station Heat Rejection Subsystem Radiator Assembly Design and Development* — six identical, interchangeable, orbital-replaceable deployed radiator arrays; designed for a 10-year LEO environment including micrometeoroid, debris and solar degradation, and for ammonia freeze margins. **This is the engineering baseline every orbital-data-center thermal claim is implicitly measured against.**
5. **Design basis, per AIAA Journal of Spacecraft and Rockets (DOI 10.2514/1.A35030).** Each ISS radiator assembly = **eight panels, each 3.33 m × 2.64 m**; 22 parallel flow tubes for redundancy; manifolds and tubes in **Inconel 718**, chosen for resistance to ammonia freeze/thaw pressures and corrosion. **Derived:** $\sim 70.3 \text{ m}^2$ per assembly $\times 6 = \sim 422 \text{ m}^2$ rejecting **70 kW $\approx 166 \text{ W/m}^2$ realized in the LEO environment.** (*A NASA-hosted ATCS overview gives a differently-measured radiator dimension of $3.12 \text{ m} \times 13.6 \text{ m} = 42.4 \text{ m}^2$; the two figures measure different things and the conflict is stated, not smoothed. See §2 Beat 5.)*)
6. **7 May 2013.** ISS EATCS Loop A ammonia leak; emergency EVA. Root cause later traced to coating delamination under repeated orbital freeze–thaw cycling. **Why it matters: the coolant loop leaks, and the fix is two humans**

in suits.

7. **3 May 2017. EATCS Loop B Radiator #3, Flow Path #2** isolated and vented after a Robotic External Leak Locator scan found elevated vaporous ammonia. NASA NTRS document **20180007472** analyzes worst-case time-to-empty and the thrust imposed on the station by the vent. *Why it matters: the failure mode of a space radiator is that you vent your working fluid and lose a flow path forever.*

The idea acquires institutions (2022–2024)

8. **November 2022.** The European Commission contracts **Thales Alenia Space** to lead **ASCEND** — *Advanced Space Cloud for European Net zero emission and Data sovereignty* — under **Horizon Europe**. Consortium: Carbone 4, VITO (environment); Orange Business, CloudFerro, Hewlett Packard Enterprise (cloud); ArianeGroup (launch); DLR, Airbus Defence and Space, Thales Alenia Space (orbital systems). **First public money into orbital data centers, and it is European.**
9. **28 June 2024.** Thales Alenia Space publishes the **ASCEND feasibility study results** (Cannes press release). Findings: target **1 GW deployed before 2050** against an estimated **23 GW** total data-center market by 2030; claimed economic viability; **explicit precondition — a launcher ten times less emissive over its full lifecycle**. CTO **Christophe Valorge** quoted. *Note: press coverage renders the claimed return as both “several billion euros” (Thales’s own release, Spacedaily, The Engineer) and “several hundred billion euros” (techno-science.net). Conflict flagged, not smoothed.*
10. **June 2024. Ferreira, Wang et al.** (University of Southern California, Department of Astronautical Engineering) publish in **Geophysical Research Letters**: reentering satellites raised stratospheric aluminum oxide **29.5% above natural levels in 2022**; projected up to **+646%** if all currently planned constellations fly. AGU press release, 18 June 2024. **STRUCTURAL/CONTESTED.**
11. **January 2024. Lumen Orbit, Inc.** founded in El Segundo, California by **Philip Johnston, Ezra Feilden** and **Adi Oltean**. Premise: orbital data centers for in-space edge processing of other satellites’ raw data.
12. **Summer 2024.** Lumen Orbit completes **Y Combinator’s Summer 2024 batch**. (*The 17-month unicorn clock starts at this demo day — see entry 66.*)
13. **December 2024.** Lumen Orbit announces **\$11 million** seed from NFX, Y Combinator, FUSE, Soma Capital, and scout funds from Andreessen Horowitz and Sequoia. **Stage: raised.**

The rename, the launch booking, and the first Chinese constellation (2025)

14. **February 2025. Lumen Orbit renames itself Starcloud.** Documented reason, per CEO Philip Johnston to GeekWire: **Lumen Technologies holds trademark rights to “Lumen” for data centers**. *Why it matters: a company whose entire proposition is escaping terrestrial constraint could not escape terrestrial trademark law. This is the Founder Audit’s opening artifact.*
15. **February 2025.** Simultaneous **\$10 million** SAFE extension announced; Johnston characterizes the combined **\$21 million** as “one of the highest-ever seed rounds for a company coming out of YC” (email to GeekWire). Team size at this date: **five**, including lead mechanical engineer **Bailey Montañó** (ex-Helion Energy, ex-SpaceX).
16. **May 2025.** Starcloud books its **first launch** (per its own Y Combinator company page). **Stage: booked, not flown.**
17. **14 May 2025, 12:12 a.m. Eastern (04:12 UTC).** A **Long March 2D** lifts off from **Jiuquan Satellite Launch Center**, China, carrying **12 satellites** — the first tranche of the **Three-Body Computing Constellation**, led by **ADA Space (Guoxing Aerospace, Chengdu)** and **Zhejiang Lab**. Combined **5 POPS** (peta-operations per second) and **30 TB** onboard storage across the twelve; **up to 100 Gbps** laser inter-satellite links; one satellite carries a cosmic X-ray polarimeter from Guangxi University and NAOC. ADA Space claims the world’s first dedicated orbital computing constellation. **The first orbital compute constellation in history is Chinese, state-adjacent, and it flew before any American filing existed.**
18. **2025 (program statement).** ADA Space’s “Star Compute” plan: **2,800 satellites — 2,400 inference and 400 training** — in dawn–dusk, sun-synchronous and low-inclination orbits at **500–1,000 km**. Zhejiang Lab’s stated full-build target: **1,000 POPS**. **Stage: announced.**
19. **3 October 2025, Turin, Italy.** **Jeff Bezos**, then and now Amazon executive chair and Blue Origin founder, tells **Italian Tech Week** in a fireside chat with **John Elkann** (chairman, Ferrari and Stellantis) that gigawatt-scale data centers will be built in space within **10 to 20 years**, powered by uninterrupted solar. Reported by **Reuters** (Elvira Pollina and Giulio Piovaccari). **The Forecast Problem’s first dated document.**
20. **October 2025.** NVIDIA publishes its Starcloud partnership blog. Johnston, to NVIDIA: near-unlimited low-cost renewable energy in space; **10x carbon-dioxide savings** over the data center’s life versus terrestrial power, with

- launch as the only environmental cost. Same corpus: **“In 10 years, nearly all new data centers will be being built in outer space.”** Starcloud’s stated endgame: a **5 GW** orbital data center with solar and cooling panels roughly **4 km on a side**. **Stage: announced / conceptual.**
21. **2 November 2025, 01:09 ET.** A **SpaceX Falcon 9** lifts off from **Cape Canaveral Space Force Station** on a **SmallSat Rideshare** mission carrying **18 payloads**. Among them: **Starcloud-1**, a **60 kg** spacecraft on the **Astro Digital Corvus-Micro** bus, carrying the **first NVIDIA H100 GPU ever operated in space**. Separation and contact confirmed; orbit **~325 km**; expected mission life **11 months**, then deorbit and burn-up. Also aboard: Vast’s **Haven-1 Demo** and a **KOREA ADD** reconnaissance satellite. **Stage: flown and operating.**
 22. **2 November 2025 (same mission, undated within it).** A second GPU aboard — an **NVIDIA A6000** — **fails during launch**. Documented by Johnston to TechCrunch (March 2026). *Why it matters: the first orbital data center lost half its silicon on the ride up, and the company said so on the record.*
 23. **4 November 2025.** Google announces **Project Suncatcher** and publishes a preprint. Architecture: compact constellations of solar-powered satellites carrying **TPUs**, linked by **free-space optical inter-satellite links**, in **dawn–dusk sun-synchronous LEO**. Illustrative formation: an **81-satellite cluster at 1 km radius**. Claim, in Google’s own words: a solar panel in that orbit can be **up to 8 times more productive than on Earth**. Radiation result: **Trillium (v6e) Cloud TPU**s tested in a **67 MeV proton beam** survived a total ionizing dose equivalent to a **5-year mission** without permanent failure; **HBM was the most TID-sensitive subsystem**, with uncorrectable error rates Google characterized as likely acceptable for inference and requiring further study for training. Bench-scale DWDM optical demonstration: **1.6 Tbps per transceiver pair**. Sundar Pichai (then and now Alphabet/Google CEO) frames it as a moonshot. **This is the source of the must-hit “8x” anchor, and it is the seller’s own document.**
 24. **4 November 2025.** Google names the next step: **a learning mission with Planet Labs PBC to launch two prototype satellites by early 2027**. **Stage: announced; [EXPECTED] early 2027; announcing party: Google.**
 25. **November 2025 (Suncatcher paper, cost section).** Google’s own launch-cost sensitivity: current **\$1,500–\$2,900/kg** (and higher depending on requirements); the paper points to the **mid-2030s** as the period in which costs might reach **~\$200/kg**. **The seller names its own precondition and puts it a decade out.**
 26. **19 November 2025.** **Marc Benioff** (chairman/CEO, Salesforce) posts video of **Elon Musk** arguing the lowest-cost place for data centers is space at 300 GW scale. Musk replies on X: Starship should be able to deliver **around 300 GW per year of solar-powered AI satellites to orbit, maybe 500 GW**; adds that average U.S. electricity consumption is “500 GW”; adds that at 300 GW/yr, AI in space would exceed the entire U.S. economy in intelligence processing every two years; and names **chip production** — “Tesla Terafab” — as the remaining piece. **Stage: claim. Note the unit hygiene failure inside the claim itself — see §6 capacity/energy audit.**
 27. **December 2025.** **Starcloud-1** becomes the **first spacecraft to train a large language model in orbit** (Andrej Karpathy’s **nanoGPT**, on Shakespeare) and the first to run a version of **Google’s Gemini/Gemma** family in space. Publicly noted by Eric Schmidt, Andrej Karpathy and Demis Hassabis per Starcloud’s own mission page. **Stage: demonstrated.**
 28. **13 December 2025.** Bloomberg reports SpaceX setting an insider share deal at roughly **\$800 billion** valuation and confirming 2026 IPO plans. **Stage: mark, not verdict.**

The filings (January–March 2026)

29. **January 2026.** **Blue Origin** announces **TeraWave** — a LEO/MEO optically-linked broadband constellation of **5,280 LEO + 128 MEO = 5,408 satellites**, purpose-built for enterprise, data-center and government users. FCC application submitted. **This is the constellation Syllabus 2.0 names; it is not the 51,600-satellite one.**
30. **9 January 2026.** FCC Space Bureau releases **DA 26-36**, the SpaceX Gen2 Upgrade Authorization — cited later in the orbital-data-center docket as part of the Starlink authorization chain the new system would ride on.
31. **30 January 2026 (late).** **Space Exploration Holdings, LLC (SpaceX)** files with the FCC for authority to launch and operate the **SpaceX Orbital Data Center System** — **up to one million satellites**, altitudes **500–2,000 km**, **30° and sun-synchronous inclinations**, orbital shells **up to 50 km thick**. **ICFS File No. SAT-LOA-20260108-00016; Call Sign S00798.** Optical inter-satellite links primary; **18.3–19.3 GHz (space-to-Earth)** and **28.6–29.1 GHz (Earth-to-space)** requested on a **non-interference, unprotected basis**. **No deployment schedule and no cost estimate in the filing.**
32. **30 January 2026 (same filing).** SpaceX requests **four waivers**: §§25.156(d) and 25.157 (processing-round procedures); **§25.164 (NGSO milestone requirements and deployment obligations)**; **§25.165 (surety bond requirements)**; and §25.114(a)(1) (Schedule S information on channel plans, beams, and orbital plane configurations). **Read together: a million-satellite authorization with no deadline, no bond, and abbreviated technical disclosure.**

33. **2 February 2026. SpaceX completes its acquisition of xAI** in an all-stock triangular merger. Per documents reviewed by CNBC: SpaceX valued at **~\$1 trillion**, xAI at **~\$250 billion**, combined **~\$1.25 trillion**; characterized as the largest merger by combined entity value. Musk's announcement blog post ties the deal to space-based data centers funding lunar bases, Mars, and beyond. **Stage: closed.** (*Note: one secondary source values xAI at ~\$80B in the transaction; the CNBC-sourced \$250B figure is the more widely reported. Conflict flagged.*)
34. **3 February 2026, San Francisco. Matt Garman**, CEO of Amazon Web Services, at the **Cisco AI Summit**: there are not enough rockets to launch a million satellites; the cost of getting a payload to space today is massive; it is not economical; server racks are heavy; humanity has yet to build a permanent structure in space. Reported by **Reuters (Greg Bensinger)** and **Fortune (Alexei Oreskovic)**. **The most senior operating cloud executive on Earth says no, one day after Bezos's rocket company's owner says yes.**
35. **4 February 2026.** FCC Space Bureau releases **Public Notice DA 26-113**, accepting the SpaceX application for filing. Comments/petitions due **6 March 2026**; responses/oppositions **16 March 2026**; replies **23 March 2026**. The notice quotes SpaceX's own narrative describing the system as a first step toward a Kardashev Type II civilization, and footnotes the 1964 Kardashev paper. **Five days from filing to acceptance.**
36. **~3–6 February 2026. Starcloud files its own FCC application** for a constellation of up to **88,000 satellites** at **600–850 km**, sun-synchronous. **Stage: filed.**
37. **12 February 2026. Petition to Deny of William Stewart** filed in the SpaceX orbital-data-center docket. (*A named individual member of the public, in the record, before the institutions arrived.*)
38. **19 February 2026.** Engadget (Igor Bonifacic) publishes the first sustained mainstream engineering critique, quoting **Aaron Boley** (associate professor of astronomy and astrophysics, University of British Columbia) on atmospheric unpreparedness, and **Scott Manley** on Starlink V3's ~30 m² of solar panels as evidence the thermal problem is tractable at small scale. McCalip's estimate cited: a **100 GW** buildout would require **~25,000 Starship flights**.
39. **1 February 2026.** SpaceNews publishes *With attention on orbital data centers, the focus turns to economics*, reporting **Andrew McCalip**, head of research and development at **Varda Space Industries**, and his public calculator: orbital compute at **about three times as much per watt** as terrestrial under his base case. **This is the provenance of the must-hit “~3x cost/watt” anchor.**
40. **27 February 2026. China in Space** documents the **Astro-Future Institute** (Beijing), backed by **Lenovo** and the **Beijing municipal government** with at least **¥140 million (~\$20.4 million)**, targeting a demonstration satellite within the year and a **sixteen-spacecraft laser-linked gigawatt-scale** constellation; and reports that space-based data centers appear in **CASC's 15th Five-Year Plan (2026–2030)** focus areas under space infrastructure, framed as gigawatt-scale space-based digital and intelligent infrastructure. **The state actor names a gigawatt target in a five-year plan.**
41. **4–5 March 2026. xAI announces plans for orbital data centers.** Documented local response from Memphis: **Ke-Shaun Pearson** (founder, Memphis Community Against Pollution) and **Sarah Houston** (executive director, Protect Our Aquifer). **HF-1. L8 owns this. L9 touches it in one clause at the inheritance.**
42. **6 March 2026. Amazon (Amazon Leo, formerly Project Kuiper) files a 17-page Petition to Deny** against SpaceX's orbital-data-center application. Core arguments: the application describes an ambition rather than a plan; it lacks satellite design, orbital altitude, RF characteristics and debris-management specifics; sustaining one million satellites on a five-year life would require replacing **200,000 satellites per year** against a **2025 global launch output of fewer than 4,600 satellites** — a **~44x** gap; approval would force every other LEO operator to plan around a constellation that may never exist; and FCC **\$25.112** requires dismissal of incomplete applications. **Stage: filed. Contested.**
43. **6 March 2026.** Comment deadline. **Petition to Deny of the American Astronomical Society** filed (14+ pages, with simulated brightness figures comparing the proposed SpaceX data centers against the full Starlink constellation at latitudes 20°/30°/40° N, at nautical twilight and midnight, on the summer solstice). **Opposition Brief of DarkSky International** filed, demanding an Environmental Impact Statement under NEPA. **Petition for Environmental Review of Nikolai Bakken** filed, invoking NEPA's irreversible-and-irretrievable-commitment-of-resources requirement. Comments also filed by the **IAU**, the **Royal Astronomical Society**, the **European Southern Observatory**, and **Viasat**. **Nearly 1,500 comments in the docket.**
44. **11 March 2026. FCC Chairman Brendan Carr** publicly rebukes Amazon on X, noting Amazon will fall roughly **1,000 satellites short** of its **30 July 2026** milestone to deploy half of its authorized **3,236-satellite** constellation, and suggesting it focus on launching rather than petitioning. At that date Amazon has **~210–212** Leo satellites in orbit and has requested a milestone waiver (reported target for full deployment: end of July 2029; a separate report describes a requested 24-month extension of the half-constellation milestone to July 2028). **The regulator takes a**

- side in public.
45. **13 March 2026. The FCC accepts Starcloud’s 88,000-satellite application for filing.** In its filing Starcloud argues that terrestrial scaling is already hitting severe roadblocks and that space data centers will be the most cost-effective and scalable way to deliver compute this decade. [SECONDARY-QUOTED PRIMARY — **SpaceNews, 15 March 2026.**]
 46. **16 March 2026, San Jose. NVIDIA GTC. Jensen Huang**, founder and CEO, announces **NVIDIA Space-1 Vera Rubin Module**, alongside **IGX Thor** and **Jetson Orin**, for orbital data centers, geospatial intelligence and autonomous space operations. Claim: up to **25x more AI compute than an H100** for space-based inferencing. Named partners: **Aetherflux, Axiom Space, Kepler Communications, Planet Labs PBC, Sophia Space, Starcloud.** Huang, in the keynote: in space there is no convection, only radiation, and the cooling problem has to be figured out. **The roadmap’s author states the lecture’s ANCHOR fact on stage while launching a product line into it.**
 47. **16 March 2026. SpaceX files its Consolidated Opposition** in the orbital-data-center docket, responding to Dark-Sky, the AAS, the IAU, the RAS, ESO and the Stewart petition; commits to Bidirectional Reflectance Distribution Function brightness modeling and a target below **visual magnitude 7**, the threshold advocated by NSF, the Vera C. Rubin Observatory and the IAU.
 48. **19 March 2026. Blue Origin files for Project Sunrise — up to 51,600 satellites, circular sun-synchronous orbits, 500–1,800 km, inclinations 97°–104°, orbital planes 5–10 km apart in altitude**, each plane carrying approximately **300–1,000 satellites**; at least three antenna variants; optical inter-satellite links primary, with Earthbound traffic routed through **TeraWave** and other mesh backhaul; Ka-band sought principally for TT&C. **14-page application. FCC ICFS File No. SAT-LOA-20260310-00118.** Blue Origin commits to debris-mitigation guidelines and deorbit within five years of end of life. It offers **no total compute capacity figure and no launch schedule. This is the lecture’s Paper Trail document.**
 49. **19–20 March 2026. SpaceX files a letter in the Blue Origin docket** asking the Commission to apply Amazon’s own substantive and procedural arguments against SpaceX to Blue Origin’s application, for equitable and consistent treatment. [SECONDARY-QUOTED PRIMARY — **GeekWire, 21 March 2026.**]
 50. **~20 March 2026. Philip Johnston** posts on X that SpaceX’s filing is one of the funniest responses to an FCC filing of all time, noting that Amazon opposed SpaceX and then Blue Origin — both effectively controlled by Bezos — filed the same thing. **A CEO of a competing 88,000-satellite applicant is the funniest commentator in the docket.**
 51. **21 March 2026.** Reporting notes Blue Origin has **not** filed required documentation with the **International Telecommunication Union**, and has flown **New Glenn** — the intended Sunrise launch vehicle — **twice**.
 52. **23 March 2026.** Reply deadline in the SpaceX docket. **AAS Reply** filed, stating that the IAU recommends satellites below ~550 km be fainter than **visual magnitude 7**, and higher-altitude satellites fainter still — approximately **magnitude 7.6 at 1,000 km** (citing **Boley et al. 2025, IAU CPS Satellite Optical Brightness Recommendation: Rationale**, Research Notes of the AAS) — and disputing SpaceX’s claim to have reached VM7 with Starlink. **TechFreedom** files comments cataloguing the NEPA arguments.
 53. **March 2026.** Leibniz Institute for Atmospheric Physics (Kühlungsborn, Germany) study in **Communications Earth & Environment** (published February 2026) reported as the first to tie a specific reentry event to a detectable atmospheric pollution plume. **First direct measurement.**
 54. **March 2026.** Reported **8-fold increase in stratospheric aluminum oxides between 2016 and 2022** (USC, Department of Astronautical Engineering); **~17 metric tons** of alumina nanoparticles released by reentering satellites in 2022; total aluminum from satellite reentries that year **~41.7 metric tons. STRUCTURAL.**

The unicorn, the IPO, and the flight record (March–July 2026)

55. **30 March 2026. Starcloud announces a \$170 million Series A at a \$1.1 billion valuation** — the fastest company in Y Combinator history to reach unicorn status, **17 months** after demo day. Round split into two tranches; **Benchmark** led the initial round with **EQT Ventures**; both co-led an extension. Other investors: NFX, Nebular, Y Combinator, Adjacent, 776 Ventures, Fuse Ventures, Manhattan West, **Monolithic Power Systems**; angels including former Boeing CEO **Dennis Muilenburg**. Total raised to date: **~\$200 million. Stage: priced. This is the As-Of Stamp’s target and the Timeline Snap’s assigned hinge.** (*One outlet’s investor list was corrected post-publication by the company; the pack notes the correction rather than reproducing the removed name.*)
56. **30 March 2026.** Same announcement, technical content: **Starcloud-2**, targeted **October 2026**, **~450 kg**, generating **~8 kW** — about **100x Starcloud-1’s power** — and carrying **the largest commercial deployable radiator ever sent to space**; payload includes an **NVIDIA Blackwell (B200-class) GPU**, multiple H100s, an **AWS server blade**

- / **AWS Outposts** hardware, and **bitcoin-mining ASICs** as a revenue bridge. Workload partners named: **AWS, Google Cloud, NVIDIA, Crusoe**. Johnston states hosted payloads — including **Department of Defense** and Earth-observation customers — cover the whole cost of development, making it the company's first spacecraft to generate more revenue than it costs to design, build and launch. **Stage: funded, not flown.**
57. **30 March 2026. Starcloud-3** described: **200 kW, 3 tonnes**, designed for Starship's "**PEZ dispenser**" deployment mechanism; approximately **50 spacecraft per Starship**, **~10 MW** of compute per launch. Johnston: the first orbital data center genuinely cost-competitive with terrestrial, at on the order of **\$0.05 per kWh** — **if** commercial launch lands near **\$500/kg**. He expects commercial Starship access **2028–2029**. **The entire economic claim is explicitly conditioned on a vehicle that has not reached orbit.**
 58. **30 March 2026.** Johnston to TechCrunch, on the H100 choice: it is probably not the best chip for space, and the point was to prove state-of-the-art terrestrial silicon can run there. Also on the record: if Starship slips, Starcloud carries on launching smaller spacecraft on Falcon 9; the company will not be competitive on energy cost until Starship flies frequently.
 59. **1 April 2026 (reported).** SpaceX files a **confidential draft IPO registration** with the SEC. (*TSLA fell 10.5% over the following ten trading days on capital-diversion concerns, per one market analysis — secondary, flagged.*)
 60. **April 2026. The Information** reports Starcloud in talks to raise at least **\$200 million** at roughly **\$2.2 billion** — double the Series A mark, roughly one month after it printed. SpaceX reportedly exploring strategic interest. **Stage: talks. Not a printed round. See §6, D2.**
 61. **30 April 2026, Washington, D.C.** Johnston speaks at the **SpaceNews "Opportunities for On-Orbit Computing"** event: Starcloud relies on Starship to deploy the 3-tonne Starcloud-3; expects SpaceX to use orbital capacity mainly for internal xAI and Tesla workloads rather than infrastructure-as-a-service; expects Starship ready for customer payloads **toward the end of the decade**; says the company has already **welded up a Starcloud-3 chassis**; long-term vision of hundreds of satellites per month adding tens of gigawatts annually. [**SECONDARY-QUOTED PRIMARY — SpaceNews.**]
 62. **25 April 2026, Chengdu.** Xinhua interviews **Zhao Hongjie**, executive vice president of ADAspace, on 2026 as the critical year for "star compute." **Li Chao**, director of the space-based computing system research center at Zhejiang Lab, states at a 2026 Space Day of China forum that up to **90% of data generated in space is lost and never effectively processed** — the bandwidth argument for on-orbit compute. Constellation target restated: **100 satellites by 2027; 10 AI models deployed and validated in orbit** to date. **CAICT establishes a space computing power professional committee.**
 63. **May 2026.** Bloomberg reports SpaceX planning a **10 GW/year solar manufacturing plant** at the **Gigasat** site in **Bastrop, Texas** — over **1,000 acres, 11+ million square feet** of planned building capacity, two floors each producing 5 GW of cells annually, targeting significant production by end of 2027. **Stage: reported plan.**
 64. **18 May 2026.** Reporting synthesizes the reentry-pollution literature: every megaconstellation satellite has a designed life of roughly **five years**; on deorbit, aluminum structure vaporizes into alumina nanoparticles that catalyze ozone-destroying chlorine reactions **without being consumed.**
 65. **20 May 2026.** SpaceX files its **S-1** with the SEC targeting a Nasdaq listing under ticker **SPCX**. Disclosed: 2025 revenue **\$18,674 million**, Adjusted EBITDA **\$6,584 million**, **GAAP net loss of nearly \$5 billion**; Starlink **\$11.4 billion** of 2025 revenue (**~61%** of total, up from \$7.6B in 2024); **10.3 million active Starlink customers as of 31 March 2026** across 160 countries and markets. (*Figures per S-1 as reported by multiple secondary outlets; primary re-pull required before air.*)
 66. **22 May 2026, 22:30:22 UTC. Starship Flight 12** — Ship 39 on Super Heavy B19, the **first Block 3 (V3) flight** — from Starbase OLP-2. Payload: 20 Starlink V3 mass simulators and 2 modified Starlink V2, **~44,000 kg**. Trajectory: **apogee 195 km, perigee –7 km, inclination 28°**. **Suborbital by design. Duration 1 h 06 m 22 s.**
 67. **5 June 2026.** Musk posts that Starlink has passed **10,000 satellites in orbit** after another 29-satellite launch.
 68. **8 June 2026. SpaceX unveils AI1**, its first orbital data center satellite: roughly **150 kW** of peak AI compute on a **70-metre-wingspan** platform built largely from Starlink V3 hardware. Musk posts the design on X with an engineering walkthrough; SpaceX engineer **Ian Dahl** on the record. Musk's framing: no new physics is needed; the solar, thermal, propulsion, shielding and laser-link systems already exist on Starlink V3; the data center satellites will be *less* complex than Starlink's. **Days before the IPO priced.**
 69. **8–10 June 2026.** Musk's stated ramp: an annualized rate of **1 GW/year by the end of 2027**, then **10 GW, 100 GW**, and eventually **1 TW per year**; tonnage to orbit from about **2,500 tonnes/year** to about **1 million tonnes/year** in about three years; chip production named as the limiting factor. **Stage: claim. Two prototype AI1 launches [EXPECTED] early 2027, announcing party: SpaceX.**

70. **11 June 2026. SpaceX prices its IPO at \$135 per share** — reported as the largest IPO ever.
71. **12 June 2026. SPCX debuts on Nasdaq**, opening at **\$160.95**, a 19.2% premium; reported valuation at debut **~\$1.77 trillion**, **~\$75 billion** raised; subsequently traded as high as \$201.80. (*All IPO figures per secondary market coverage; conflicts among sources on raise size and valuation are flagged in §6.*)
72. **19 June 2026. IEEE Spectrum** publishes *Why Thermodynamics Rules Future Orbital Data Centers*, modeling with Stefan–Boltzmann: a single **700 W** H100-class die held at **60 °C**, radiator perfectly facing deep space at 3 K, requires **1.4 m²**; a **40 kW** rack of ~32 GPUs requires an **80 m²** radiator. **The cleanest published arithmetic in the lecture’s territory, and it is idealized** — see §2 Beat 6 for the realized-flux comparison.
73. **June 2026 (reported). SemiAnalysis** models space compute at **>4x terrestrial cost today** — **\$8.64 vs \$2.37 per GPU-hour** for a B300-class cluster — driven by launch cost and a **5-year vs 15-year asset life**, narrowing to a **~30% premium by the early 2030s** and reaching leveled parity around **2040** in the base case. **[SINGLE-SOURCED SECONDARY — primary SemiAnalysis publication must be pulled before air.]**
74. **8 July 2026. Jonathan McDowell’s Jonathan’s Space Report** statistics page, data as of this date: **16,234 total active payloads in orbit** (10,736 active Starlinks; 3,385 other active maneuverable; 2,113 active non-maneuverable). Total active + dead payloads **19,396**; rocket stages **2,044**; satellite components **1,449**; catalogued debris **11,160**; total catalogued objects **34,049**. **Tonnage of all active payloads in orbit: 10,994.7 tonnes. This is the Unit Conversion’s verified denominator.**
75. **11 July 2026. McDowell’s Starlink status table: 10,759 working Starlinks; 10,775 Starlink payloads physically in orbit.**
76. **16 July 2026, ~18:45 EDT. Starship Flight 13 aborts at ignition** at Starbase Pad 2. On-screen telemetry showed engines on the Super Heavy booster failing to light; Musk confirms an abort triggered by Raptor 3 ignition failures and states **two Raptors will be removed and replaced. The mission was suborbital.**
77. **21 July 2026. SpaceX** launches a geosynchronous robotic servicing satellite on a decade-long mission (Falcon 9). (*Noted because “no service calls” is one of this lecture’s load-bearing claims, and the servicing industry is a real, dated counter-datum — see §2 Beat 7.*)
78. **[EXPECTED] 23 July 2026, 22:45 UTC. Starship Flight 13, NET.** Second V3 flight; first attempt to deploy **20 production Starlink V3 satellites**, which will extend arrays and antennas and attempt laser links to the constellation; six carry cameras to image the heat shield, with several tiles painted white to simulate missing tiles. **Still suborbital.** Announcing party: SpaceX.
79. **[EXPECTED] 30 July 2026.** Amazon’s FCC milestone date for half of the 3,236-satellite Leo constellation. Waiver requested. Announcing party: FCC authorization terms / Amazon.
80. **[EXPECTED] October 2026. Starcloud-2** launch on Falcon 9. Announcing party: Starcloud.
81. **[EXPECTED] late 2026. Starship propellant-transfer demonstration** between vehicles — the capability on which Starship’s full-reuse economics and the \$500/kg assumption ultimately rest. Announcing party: SpaceX.
82. **[EXPECTED] early 2027. Project Suncatcher’s two prototype satellites with Planet Labs.** Announcing party: Google.
83. **[EXPECTED] early 2027. Two prototype AI1 satellites.** Announcing party: SpaceX.
84. **[EXPECTED] early 2027. Crusoe** offers limited commercial access to Starcloud-1-derived capacity. Announcing party: Crusoe/Starcloud.
85. **[EXPECTED] 2027. ADA Space / Zhejiang Lab: 100 satellites** in the Three-Body Computing Constellation. Announcing party: Zhejiang Lab.
86. **[EXPECTED] end of 2027. Blue Origin’s first TeraWave orbiters** — the company states plans to launch **more than 5,000** before the end of 2027. Announcing party: Blue Origin. **Against a New Glenn flight record of two.**
87. **[EXPECTED] end of 2027. SpaceX** targets an annualized **1 GW/year** rate of orbital compute. Announcing party: SpaceX (Musk).
88. **[EXPECTED] end of 2027. Gigasat** solar plant significant production. Announcing party: SpaceX (via Bloomberg).
89. **[EXPECTED] 2028–2029. Commercial Starship** access opens, per Johnston. Announcing party: Starcloud.
90. **[EXPECTED] July 2028 or July 2029. Amazon Leo** half-constellation or full-constellation milestones, depending on waiver disposition.
91. **[EXPECTED] early 2030s. Blue Origin’s implied Project Sunrise** deployment window, inferred from its own TeraWave schedule. **Inference, marked as such.**
92. **[EXPECTED] mid-2030s. Google’s own** stated launch-cost precondition (~\$200/kg). Announcing party: Google.
93. **[EXPECTED] ~2040. SemiAnalysis** base-case leveled parity. **[SINGLE-SOURCED SECONDARY.]**
94. **[EXPECTED] before 2050. ASCEND’s 1 GW** deployment target. Announcing party: Thales Alenia Space /

European Commission.

95. **PENDING, no decision date announced.** The FCC has issued **no ruling** on the SpaceX (SAT-LOA-20260108-00016), Starcloud, or Blue Origin (SAT-LOA-20260310-00118) applications as of the research date. **The single most consequential unknown in this lecture is a docket with no calendar.**

Dates the record does not supply (declared, not guessed)

96. **No public date exists** for the FCC's disposition of any of the three orbital-data-center applications.
97. **No public figure exists** for Project Sunrise's total power, total mass, per-satellite compute, or radiator area. Blue Origin disclosed none.
98. **No public figure exists** for Starcloud-2's radiator area in square metres, its deployed dimensions, or its mass breakdown. "Largest commercial deployable radiator" is a comparative claim with no published denominator.
99. **No public utilization data exists** for any orbital compute asset. Starcloud-1's duty cycle, thermal margin in flight, and observed single-event-upset rate have not been published.
100. **No public accounting exists** of how much terrestrial electricity a Starship launch campaign consumes, other than McCalip's modeled **105 GWh** for a 1 GW orbital buildout — a modeled figure, not a metered one.

SECTION 2: STRAWMAN BEAT DOSSIER

Beat 1 — The Wrong Map [O] (opener)

Syllabus 2.0 assignment. Orbital geography as the new siting map: dawn–dusk sun-synchronous orbit, panels up to 8x more productive, no land, no water, no rate case — the pitch's map, drawn honestly.

Beat Menu definition. *The Wrong Map — Politics • opener-preferred • cold specialist (1–3 appearances).* Geography as accident, sustained by the compounding chain. Distinct from The County: this is origin-story geography, how the map got drawn wrong. **Opener rotation: Wrong Map opens lectures 1 and 9. Rotation check: PASS** — L8 opened on The Hearing Room (a county air-quality board), L10 opens on a Hearing Room (a disclosure call); no two adjacent lectures open on the same beat.

FACTS, DATES, NAMES, NUMBERS.

- **The orbit.** Dawn–dusk sun-synchronous low Earth orbit (SSO). A sun-synchronous orbit is retrograde, inclination between roughly **97° and 104°** depending on altitude; the dawn–dusk variant rides the day/night **terminator**, so the spacecraft sits in near-continuous sunlight. Blue Origin's Project Sunrise application specifies **500–1,800 km** and **97°–104°** (19 March 2026, FCC ICFS SAT-LOA-20260310-00118). Starcloud's application specifies **600–850 km**, sun-synchronous (accepted for filing 13 March 2026). SpaceX's specifies **500–2,000 km**, at **30° and sun-synchronous** inclinations, in shells up to **50 km** thick (30 January 2026, ICFS SAT-LOA-20260108-00016). Google's Suncatcher paper specifies dawn–dusk SSO. **Four independent filings; one orbit. The map is already drawn and everybody found the same road.**
- **The solar arithmetic.** Solar irradiance above the atmosphere (AM0) is **1,361 W/m²** — the value McCalip's public model uses and the value the physical literature carries. There is no atmospheric attenuation, no cloud, no diurnal cycle at the terminator, and no seasonal derating. Google's own framing, 4 November 2025: a solar panel in this orbit can be **up to 8 times more productive than on Earth. The "up to" is in the original and must survive.** McCalip's model parameterizes the same thing as **orbit sunlight fraction**, with slider stops at **LEO ~60%, SSO ~80%, and terminator ~98%.**
- **What the orbit deletes.** No land acquisition. No water rights. No county board. No comprehensive plan. No interconnection queue. No large-load tariff. No rate case. Starcloud's FCC filing argues terrestrial deployment already faces severe roadblocks to scaling (13 March 2026 acceptance; [**SECONDARY-QUOTED PRIMARY — SpaceNews**]). Blue Origin's application frames space-based data centers as a complement introducing a new compute tier that operates independently of Earth-based constraints ([**SECONDARY-QUOTED PRIMARY — idcnova, 20 March 2026**]), and as easing mounting pressure on U.S. infrastructure ([**SECONDARY-QUOTED PRIMARY — Yahoo/Fortune syndication of the 19 March filing**]).
- **What the orbit adds.** A launch manifest, a radiator, a five-year life, a 500 km stand-off from the nearest techni-

cian, an ITU coordination problem, a spectrum grant on a **non-interference, unprotected basis**, and roughly **1,500 comments** from people who look at the sky for a living.

- **Geographic and physical anchors for the map.** Starcloud: **Redmond, Washington** (founded January 2024 in **El Segundo, California**), payload manufacturing facility in Redmond. Blue Origin: **Kent, Washington**, launching **New Glenn** from **LC-36, Cape Canaveral**. SpaceX: **Hawthorne, California**; **Starbase, Texas**; **Gigasat, Bastrop, Texas** — over **1,000 acres, 11+ million sq ft** planned. Google/Planet: **Mountain View / San Francisco**. ADA Space: **Chengdu, Sichuan**; Zhejiang Lab: **Hangzhou**; launches from **Jiuquan**. **The escape from geography has a very specific geography, and it is Redmond, Kent, Hawthorne, Bastrop, and Jiuquan.**
- **The compounding chain (the beat's engine).** Terminator orbit → near-continuous illumination → no battery mass → higher usable watts per kilogram → but the same orbit that maximizes illumination also maximizes **thermal load on the panel**, because 100% of absorbed flux must leave again → radiator area scales with power → radiator mass scales with area → mass drives launch cost → launch cost drives the whole business case → and launch cadence, not launch price, is the binding term. **The map that solves the power problem creates the heat problem in the same line.**

THE MECHANISM.

The watt path, orbital version: photon → solar cell (~22% conversion in McCalip's model, with slider stops 20/22/24%) → power conditioning → compute payload → **100% of that electrical energy becomes heat inside the spacecraft** → cold plate or conduction path → working fluid or heat pipe → radiator surface → infrared photon → deep space. There is no busway, no PDU, no substation, no utility, and no meter. There is also no atmosphere, which is the whole problem.

The legal path: there is no siting application, no special-use permit, no rezoning, and no state utility commission. There is instead: an **FCC Part 25 NGSO space station application** (narrative + technical attachment + Schedule S + waiver requests + ownership statement) → Space Bureau **acceptance for filing** by public notice → **comment and petition-to-deny window** → **oppositions** → **replies** → an order, someday. In parallel, an **ITU filing** for international frequency and orbital coordination — which Blue Origin, as of 21 March 2026 reporting, **had not made**.

Where the constraint binds: not at the solar panel, and not at the FCC. It binds at **the square metre of radiator per kilowatt of compute**, and that number is set by Stefan-Boltzmann and the junction temperature of silicon. Everything else in this lecture is downstream of that one ratio.

KEY ACTORS IN THIS BEAT.

- *Object:* **the dawn-dusk sun-synchronous orbital band itself** — a finite shell of altitude and inclination that four applicants have now claimed simultaneously. It is the closest thing this lecture has to Loudoun County: a specific place, of finite size, that everybody wants for the same reason.
- *Institution:* **the FCC Space Bureau**, which allocates it. Its incentive is spectrum management, not thermal engineering, and it has no statutory mandate over how much of the sky a constellation occupies visually — a gap the AAS attacked directly (Beat 12, §8).
- *Document:* the four applications, which are the map's legend.
- *Human:* deferred to Beat 2 by design. **The opener should not open on a person.**

THE DOCUMENTS. Covered in full at Section 5 (Project Sunrise) and in Beats 3 and 12. For this beat the relevant fact is structural: **all four filings describe the same orbit in nearly identical language, and none of them disclose a thermal budget.**

VERBATIM BANK.

“a solar panel can be up to 8 times more productive than on earth” — Google, Project Suncatcher announcement, research.google / blog.google, 4 November 2025. [SECONDARY-QUOTED PRIMARY — verified against 9to5Google's direct quotation of the Google announcement; re-pull from blog.google before air.]

“will consist of up to 51,600 satellites operating in circular, sun-synchronous orbits from 500–1,800 km in altitude, with inclinations between 97 degrees and 104 degrees” — Blue Origin, Project Sunrise application to the FCC, filed 19 March 2026, ICFS SAT-LOA-20260310-00118. [SECONDARY-QUOTED PRIMARY — reproduced by Tom's Hardware, 20 March 2026, as a direct quotation of the application. MUST BE RE-PULLED FROM ICFS BEFORE THE VERBATIM DEPLOYS. See §4.]

Paraphrase, marked: SpaceX’s technical attachment describes optical inter-satellite links routing traffic within the new system and into the Starlink constellation’s laser mesh, which then transmits to authorized earth stations on the ground. Locator: **Application, Narrative at 1 and 6**, ICFS SAT-LOA-20260108-00016, quoted in **FCC Public Notice DA 26-113, 4 February 2026**.

WHO PAYS. In this beat: **nobody on Earth pays a bill, and that is the pitch.** No ratepayer, no water district, no county tax base, no rate case. The costs that replace them are enumerated in Beat 8 and are borne by (a) the cap table, (b) the launch manifest, and (c) two constituencies who did not sign up: **ground-based observational astronomy** and **the upper atmosphere**. Both are documented in Beat 8 and §8.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: the Escape Artist.** Direction of the overclaim: *significance and completeness*. The 8x is real and is Google’s own carefully hedged number (“up to”). The land/water/rate-case escape is also real and should be granted without hedging — it is the most defensible claim in the lecture. **What is oversold is the implication that the constraint stack has been escaped rather than exchanged.** Narrator move: **GRANT-AND-WITHHOLD**, and this is where the grant half should be at its most generous, because the audit lands harder later.
- **Unknown:** whether the dawn–dusk SSO band can physically hold the number of objects filed for it. Nobody has published a capacity model for that shell, and the FCC has not asked for one.
- **Motivated:** every characterization of terrestrial constraint in these filings is written by a party that benefits from the constraint appearing insurmountable.

SENSORY & MATERIAL DETAILS.

- The terminator orbit means the spacecraft flies along the line between day and night, permanently at dawn on one side of the planet and dusk on the other. **Documented orbital geometry, not inference.**
- A dawn–dusk SSO satellite is edge-on to the sun and therefore, from the ground, is often lit when the observer is dark — which is precisely why the astronomy petitions exist. **Documented in the AAS petition’s brightness simulations at latitudes 20°/30°/40° N.**
- Orbital planes in Project Sunrise are spaced **5–10 km apart in altitude**, each holding **300–1,000 satellites**. **Documented in the application.**

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
up to 8x	ratio, panel productivity	claim	4 Nov 2025	Google	STRUCTURAL
1,361	W/m ² (AM0 solar constant)	physical	—	physical constant	ANCHOR
500–1,800	km altitude (Sunrise)	requested	19 Mar 2026	Blue Origin	STRUCTURAL
97°–104°	inclination (Sunrise)	requested	19 Mar 2026	Blue Origin	STRUCTURAL
300–1,000	satellites per plane	requested	19 Mar 2026	Blue Origin	STRUCTURAL
~98%	orbit sunlight fraction, terminator	modeled	2026	A. McCalip (personal)	STRUCTURAL
~22%	PV conversion efficiency	modeled	2026	A. McCalip (personal)	STRUCTURAL

STRESS-TEST VERDICT: SUSTAINABLE. Four dated primary filings describing the same orbit, one seller’s own hedged multiplier, a physical constant, and a compounding chain that lands the listener directly on the heat problem without announcing it. The beat has more material than 1,000 words can hold; the risk is overrun, not padding.

Beat 2 — The Founder Audit (*Philip Johnston*)

Syllabus 2.0 assignment. *Johnston* — the résumé doing the deadpan work; the pitch deck vs. the thermal math. Follow the Money is deliberately absent from this lecture because **the valuation rides inside this beat**.

Beat Menu definition. *The Founder Audit* — *Character/Money • versatile • never lecture 1 • cold specialist (1–3)*. The origin mythology told straight, then audited against the cap table. The anecdote is the setup; the audit is the beat. The gap between founding story and securities filing is where this course’s deadpan lives. **Natural homes: 5, 6, 9.** (*Note: there is no securities filing here — Starcloud is private. The audit runs against the funding round, the FCC application, and the*

company's own engineering claims instead. That substitution is a feature: it is the reason this deployment does not repeat L6's.)

FACTS, DATES, NAMES, NUMBERS.

- **Philip Johnston** — co-founder and CEO, Starcloud, Inc. Age **39** as of March 2026 (per *Observer*). Prior: **associate at McKinsey & Company**, where per one profile he worked on satellite projects for national space agencies; co-founder of **Opontia**, an e-commerce venture. Educational credentials reported across profiles as **Harvard, Wharton, Columbia**, plus a **CFA charter** — *note: this composite appears in a single secondary profile (yespress.io) and should be treated as single-sourced until verified; the McKinsey and Opontia facts are multiply sourced via Geek Wire, February 2025.*
- **Ezra Feilden** — co-founder and CTO. Prior engineering at **Oxford Space Systems** and **Airbus Defence and Space**.
- **Adi Oltean** — co-founder and chief engineer. Prior: **principal software engineer at SpaceX's Starlink facility in Redmond, Washington**, and **Microsoft Azure**. Oltean's own framing at founding (email to Geek Wire): the mission was a constellation of orbital data centers for in-space edge processing — other satellites send the constellation their raw data. **Note what the original pitch was: edge processing for satellites. Not AI training. The pivot to the AI energy crisis came later, and it is the most auditable fact in the founder's story.**
- **Bailey Montañó** — lead mechanical engineer; prior **Helion Energy** and **SpaceX**.
- **Chetan Puttagunta** — board member (Benchmark).
- **Company chronology.** Founded **January 2024, El Segundo, California**, as **Lumen Orbit**. **Y Combinator Summer 2024**. **\$11M seed** announced December 2024. Renamed **Starcloud** February 2025 — because **Lumen Technologies holds trademark rights to "Lumen" for data centers**. **+\$10M SAFE**, February 2025; team of five. First satellite flown **2 November 2025, 21 months** after founding. **\$170M Series A at \$1.1B, 30 March 2026** — fastest YC company to unicorn status, **17 months** after demo day. Total raised **~\$200M**. Headcount **15 (2026)**.
- **The audit's first arithmetic. \$1.1 billion valuation. 15 employees. One 60 kg satellite in orbit, of which one of two GPUs failed on the way up. Approximately \$200 million raised. Zero gigawatts energized.** Every one of those figures is on the record and dated.
- **The audit's second arithmetic.** Starcloud's white paper claims it can launch a **40 MW data center into orbit for \$8.2 million** (documented by DataCenterDynamics). Against McCalip's independently modeled **22.2 million kg to LEO for 1 GW** — which scales to roughly **888,000 kg for 40 MW** — at even the aggressive **\$500/kg** Starcloud assumes, launch alone is **~\$444 million**, before the satellites. **The two numbers are not reconcilable and both are public.** (*Arithmetic shown: $22.2M\text{ kg} \times 0.04 = 888,000\text{ kg}$; $\times \$500/\text{kg} = \$444M$. The pack states the discrepancy; it does not adjudicate whose model is wrong, and notes that the two models may define "40 MW" differently — Starcloud's figure may refer to IT load on a different specific-power assumption.*)
- **The pivot the record shows.** Original mission (2024): in-space edge processing for other satellites. Current pitch (2026): the terrestrial energy grid's physical limits. Both are in the company's own words, 20 months apart. **Both are also true simultaneously — the hosted-payload and Earth-observation revenue is what makes Starcloud-2 cash-positive, per Johnston, while the AI-energy story is what makes it a unicorn.** That is the audit: the business that pays the bills and the business that prices the round are different businesses.

THE MECHANISM. *The money path:* seed (\$11M Dec 2024) → SAFE extension (\$10M Feb 2025) → demonstrator flight (Nov 2025, on a rideshare, at reported cost around **\$3 million** for the mission per one analysis — **single-sourced, flagged**) → three world-firsts announced (Dec 2025) → **FCC application for 88,000 satellites (Feb 2026)** → **Series A at \$1.1B (30 March 2026)** → reported talks at **\$2.2B (April 2026)**. **Note the sequence: the constellation application precedes the round. That sequencing is Beat 12's entire subject and this beat plants it without spending it.**

Where the constraint binds: at **Starship**. Johnston has said so publicly and repeatedly, in his own words and against his own interest: the company will not be competitive on energy cost until Starship flies frequently; commercial access is expected 2028–2029; if it slips, Starcloud keeps flying smaller spacecraft on Falcon 9. **The founder has pre-registered the failure condition. An audit that ignores that is not an audit.**

KEY ACTORS IN THIS BEAT.

- **Johnston** — *wants:* a launch-cost regime he does not control; *fears:* Starship slipping past 2029; *can enforce:* nothing about launch, everything about payload design and manifest; *actually did:* flew a real H100 to orbit in 21 months on \$21M, lost a GPU doing it, said so, and priced a \$1.1B round 17 months out of YC. *As-of title at every dated moment in this lecture:* co-founder and CEO, Starcloud (formerly Lumen Orbit).
- **Benchmark / Chetan Puttagunta** — *wants:* the fastest-unicorn narrative and a position in an integrated orbital-

compute stack; *exposure*: a mark set before the physics is settled; *what they filed*: nothing — private company, no securities filing exists, which is itself the difference between this Founder Audit and L6's.

- **NVIDIA** — vendor, partner, credibility supplier, and (per one analysis, **single-sourced**) a party believed to have negotiated privileged access to radiation-induced soft-error telemetry from Starcloud-2. *Incentive: a space-grade silicon roadmap informed by somebody else's launch risk.*
- **AWS** — flying a server blade on Starcloud-2 while **its own CEO says the category is uneconomical** (3 February 2026). *This is not hypocrisy; it is a hedge, and it should be treated as one.*

THE DOCUMENTS.

- **Starcloud's FCC application** (accepted 13 March 2026) — the maximal claim.
- **Starcloud's white paper** — the \$8.2M/40 MW figure and the laser-connectivity architecture (envisioning links to Starlink or Kuiper). Company's own document; seller's own numbers.
- **The Series A announcement, 30 March 2026** — the mark.
- **No S-1. No 10-K. No audited financials.** State that absence plainly; it is the honest boundary of this audit.

VERBATIM BANK.

"Apparently, Lumen Technologies has the right to 'Lumen' for data centers." — Philip Johnston, then and now co-founder and CEO of Starcloud, to GeekWire, February 2025, explaining the rename. (14 words. The single best deadpan artifact in the lecture.)

"An H100 is probably not the best chip for space, to be honest" — Philip Johnston, to TechCrunch, 30 March 2026. Context: explaining why the demonstrator flew a terrestrial data-center GPU rather than a space-qualified part — the point was to prove state-of-the-art silicon could run in orbit at all.

Paraphrase, marked, with locator: In the same 30 March 2026 TechCrunch interview Johnston stated that if Starship is delayed the company will continue launching smaller spacecraft on Falcon 9, and that Starcloud will not be competitive on energy costs until Starship is flying frequently. **Locator: TechCrunch, 30 March 2026, "Starcloud raises \$170 million Series A to build data centers in space."**

Paraphrase, marked, with locator: In the 30 March 2026 Series A release, Johnston framed the AI revolution as colliding with the physical limits of the terrestrial energy grid, said the world is running out of places to build new energy projects for data centers on Earth, and described moving compute to space as unlocking unlimited solar power and removing the energy bottleneck. **Locator: Starcloud press release, 30 March 2026, quoted in Via Satellite and Tech Startups.**

Paraphrase, marked, with locator: To NVIDIA (October 2025) Johnston said that in space you get almost unlimited low-cost renewable energy, that the only environmental cost is the launch, and that there would be 10x carbon-dioxide savings over the data center's life versus powering it terrestrially; and separately that in ten years nearly all new data centers will be built in outer space. **Locator: blogs.nvidia.com, "How Starcloud Is Bringing Data Centers to Outer Space," October 2025.**

Paraphrase, marked: On 30 March 2026 GeekWire reported Johnston saying the company had been fairly roundly pilloried early on, and that commenters on X had said it was impossible. **Locator: GeekWire, 30 March 2026.**

WHO PAYS. The cap table, for now — this is the lecture's assigned who-pays and this is the beat where it is stated. **\$200 million of private capital, a \$1.1 billion mark, and a reported \$2.2 billion talks-stage mark**, against zero energized gigawatts. There is no ratepayer here, no rate base, no socialized cost. There is also, per Johnston, **Department of Defense and Earth-observation hosted-payload revenue covering Starcloud-2's development cost** — which means a portion of the bill is, in fact, public money, and that should be stated plainly rather than implied. **Amount undisclosed; contract vehicles undisclosed.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: the Neocloud Founder / the Escape Artist hybrid.** What's real: the flight happened, the LLM trained, the round priced, the customers are named, the failure condition is pre-registered. What's oversold: **the \$8.2M/40 MW figure**, the **10x CO₂ savings** claim (which depends entirely on unmodeled launch emissions and a 5-year asset life), and the **"in 10 years, nearly all new data centers"** forecast. Narrator move: **GRANT-AND-WITHHOLD**, with the grant unusually large — this founder has been more candid about his own dependency than any seller in the course so far, and the audit is better for saying so.

- **Contested/unknown:** Starcloud-1's in-flight thermal margin, duty cycle, and observed upset rate are **unpublished**. The **\$2.2B** figure is talks-stage reporting, not a printed round.
- **Single-sourced, flagged:** the Harvard/Wharton/Columbia/CFA composite; the \$3M Starcloud-1 mission cost; the NVIDIA soft-error telemetry arrangement.

SENSORY & MATERIAL DETAILS.

- Starcloud-1: **60 kg, about the size of a small refrigerator** — the company's and NVIDIA's own comparison, used consistently across the corpus. **Astro Digital Corvus-Micro bus**. A **silver module** inside the spacecraft houses the H100 (NVIDIA's own blog describes an engineer inspecting it).
- Orbit **~325 km**; velocity roughly **28,000 km/h**; expected life **11 months**, then reentry and burn-up. **The first orbital data center in history was designed to be destroyed within a year of switch-on.**
- The payload manufacturing facility is in **Redmond, Washington** — the same suburb that houses SpaceX's Starlink engineering site where the chief engineer used to work.

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
\$1.1B	valuation (mark, not verdict)	priced	30 Mar 2026	Starcloud / Benchmark	VOLATILE
\$170M	Series A	raised	30 Mar 2026	Starcloud	VOLATILE
~\$200M	total raised	raised	30 Mar 2026	Starcloud	VOLATILE
~\$2.2B	reported valuation in talks	talks only	Apr 2026	The Information (reported)	VOLATILE/CONTESTED
17	months, YC demo day to unicorn	fact	30 Mar 2026	Starcloud/YC	STRUCTURAL
15	employees	headcount	2026	Starcloud	VOLATILE
60	kg, Starcloud-1	flown	2 Nov 2025	Starcloud/Astro Digital	ANCHOR
\$8.2M	claimed cost, 40 MW orbital DC	claim	white paper	Starcloud	CONTESTED

STRESS-TEST VERDICT: SUSTAINABLE. A documented biography, a documented rename with a trademark punch-line, a documented pivot, a documented failure on the demonstrator, a documented pre-registered failure condition, and two of the founder's own numbers that do not reconcile with the best public independent model. The beat also absorbs the valuation, which is why Follow the Money is correctly absent.

Beat 3 — The Paper Trail (class: regulatory application — the Project Sunrise FCC filing)

Syllabus 2.0 assignment. The maximal pitch in the most bureaucratic possible prose. **The Verbatim's natural habitat.**

Beat Menu definition. *The Paper Trail — Politics • versatile, closer-capable • all 10 lectures.* A named document as causal actor, explicitly including “the Blue Origin FCC constellation filing.” Sustained by what the document says, who wrote it and why, what it forces, what it forbids, and what happens when someone violates it. **Rotation rule: a different document class each lecture. Class here: regulatory application, position 9 of 10. PASS.**

△ **NAMING DEFECT — READ BEFORE DRAFTING.** Syllabus 2.0 and Roster 1.0 both call this document “**the TeraWave FCC filing.**” That is not what it is. The 51,600-satellite orbital-data-center constellation is **Project Sunrise**, filed **19 March 2026** at ICFS SAT-LOA-20260310-00118. **TeraWave** is a *separate, smaller* Blue Origin broadband constellation — **5,280 LEO + 128 MEO = 5,408 satellites** — announced and filed in **January 2026**, whose role in the Sunrise architecture is to carry Sunrise's traffic to the ground. The must-hit figure survives; the name does not. Full flag at §6, D1. **Everything below is about Project Sunrise. Full dossier at Section 5.**

FACTS, DATES, NAMES, NUMBERS.

- Filed **19 March 2026**; ICFS SAT-LOA-20260310-00118; applicant **Blue Origin, LLC**; **14 pages**.

- **Up to 51,600 satellites.** Circular sun-synchronous orbits, **500–1,800 km**, inclinations **97°–104°**. Orbital planes separated by **5–10 km in altitude**; **~300–1,000 satellites per plane**. **At least three antenna variants** for uniform coverage.
- **Optical inter-satellite links** used extensively to reduce dependence on radio spectrum. Earthbound traffic routed through **TeraWave** and other mesh backhaul networks.
- **Ka-band sought primarily for telemetry, tracking and control.**
- **Debris commitments:** compliance with debris-mitigation guidelines; **deorbit within five years of end of life.**
- **What the application does NOT contain:** total compute capacity. Total power. Satellite mass. Radiator area. Thermal budget. Deployment schedule. Cost. Launch manifest. **An ITU filing.**
- **Launch vehicle:** New Glenn, described in the application as enabling the system through its launch capacity. **New Glenn had flown twice as of March 2026.**
- **Context in the docket:** filed **13 days after** Amazon — Bezos's other company — petitioned the FCC to **deny** SpaceX's substantially identical application on grounds of incompleteness and speculation. **The same principal, on both sides of the same argument, 13 days apart.**
- **Companion filings for comparison:** SpaceX's ODC application (30 January 2026; up to **1,000,000** satellites; **8 pages** by one count; four waivers requested); Starcloud's (accepted 13 March 2026; up to **88,000** satellites, 600–850 km).
- **Blue Origin's own stated schedule for the enabling network:** more than **5,000 TeraWave satellites before the end of 2027.** Zero flown as of the research date.

THE MECHANISM.

How an NGSO application works. Under **47 CFR Part 25**, a satellite operator seeking to use radio spectrum files an application with the FCC comprising a **narrative**, a **technical attachment**, **Schedule S** (channel plans, beam configurations, orbital plane details), an **ownership statement**, and any **waiver requests**. The **Space Bureau** reviews for completeness and, if satisfied, issues a **public notice accepting the application for filing**, which opens a comment/petition-to-deny window, then oppositions, then replies. **§25.112** requires dismissal of applications that fail to provide complete information — the hook Amazon used against SpaceX. **§25.164** imposes deployment milestones (typically half the constellation within six years, all within nine). **§25.165** requires surety bonds. **§§25.156(d) and 25.157** govern processing rounds.

Where the constraint binds: **at acceptance for filing, not at grant.** Acceptance costs the applicant nothing, creates a priority position in the coordination queue, generates a headline, and imposes no obligation whatsoever. **The application is the asset. That is Beat 12.**

What a grant would actually convey: authority to use **specified frequencies** on specified terms — in Sunrise's case, Ka-band **primarily for TT&C**, and in SpaceX's case explicitly on a **non-interference, unprotected basis**. It does not convey orbital slots (the ITU handles international coordination), does not convey environmental clearance, and does not convey the right to be seen or unseen from the ground.

KEY ACTORS IN THIS BEAT.

- *Document:* **the Project Sunrise application.** Full dossier at §5.
- *Institution:* **Blue Origin, LLC** — privately held, founded by **Jeff Bezos**, headquartered in **Kent, Washington**. *Motive:* a market position in orbital compute and a demand anchor for New Glenn. *Exposure:* two New Glenn flights and no TeraWave satellites against a stated 5,000-by-2027 target. *What it filed:* the 14 pages.
- *Institution:* **the FCC Space Bureau** — *motive:* spectrum management and, under the current chairmanship, visible support for rapid deployment. *What it did:* accepted SpaceX's application **five days** after filing.
- *Human:* **Brendan Carr**, then and now FCC Chairman, who on **11 March 2026** publicly criticized Amazon's petition on X and pointed at Amazon's own milestone shortfall. *Wants:* deployment; *can enforce:* milestones, bonds, and grants; *actually did:* took a side in public while the docket was open.
- *Institution:* **Amazon (Amazon Leo)** — *motive:* protect a constellation it is behind on; *exposure:* ~210 satellites against a 30 July 2026 milestone of ~1,618, and a waiver request pending.
- *Institution:* **SpaceX** — *motive:* consistent treatment, and the pleasure of saying so on the record.

THE DOCUMENTS. See §5 for the full dossier. Summary of the causal chain in this beat: **application (19 Mar) → competitor's letter (19–20 Mar) → no ruling (as of 22 July 2026).**

VERBATIM BANK.

“will consist of up to 51,600 satellites operating in circular, sun-synchronous orbits from 500–1,800 km in altitude, with inclinations between 97 degrees and 104 degrees, with each orbital plane containing approximately 300–1,000 satellites” — Blue Origin, LLC, Project Sunrise application, FCC ICFS SAT-LOA-20260310-00118, filed 19 March 2026. [SECONDARY-QUOTED PRIMARY — reproduced as a direct quotation by Tom’s Hardware, 20 March 2026. RE-PULL FROM ICFS BEFORE AIR.]

“space-based data centers will be a complement to terrestrial infrastructure by introducing a new compute tier that operates independently of Earth-based constraints” — Blue Origin, same application. [SECONDARY-QUOTED PRIMARY — idcnova, 20 March 2026. RE-PULL BEFORE AIR.]

“SpaceX submits for the record Amazon’s petition to deny SpaceX’s orbital data center application and requests that the commission apply the substantive and procedural arguments in Amazon’s petition to Blue Origin’s application” — SpaceX, letter filed in the Blue Origin docket, 19–20 March 2026. [SECONDARY-QUOTED PRIMARY — GeekWire, 21 March 2026. RE-PULL BEFORE AIR.] (Note: this is the funniest document in the lecture and it is 100% procedural boilerplate. That is the beat.)

“lofty ambition rather than a real plan” — Amazon (Amazon Leo), Petition to Deny, FCC ICFS SAT-LOA-20260108-00016, filed 6 March 2026, 17 pages. (Six words. Multiply reported and consistent across Reuters-derived, SpaceNews-derived and DCD coverage.)

FULLY VERIFIED PRIMARY — the only quotation in this lecture pulled from a federal document rather than from a report of one:

“first step towards becoming a Kardashev II-level civilization – one that can harness the Sun’s full power” — SpaceX, Application Narrative at 1, quoted by the Federal Communications Commission, Space Bureau Public Notice DA 26-113, released 4 February 2026, ICFS SAT-LOA-20260108-00016 (Call Sign S00798). The Commission then footnotes the Kardashev scale and cites N.S. Kardashev, Transmission of Information by Extraterrestrial Civilizations, 8 Soviet Astronomy 217–221 (1964). VERIFIED AGAINST docs.fcc.gov/public/attachments/DA-26-113A1.txt.

WHO PAYS. Nothing in this beat has a bill attached to a household. The costs are **procedural and public**: the FCC’s Space Bureau processes ~1,500 comments; the astronomy community spends institutional resources filing petitions; and — the actual answer — **the cost of an accepted-but-ungranted mega-application is borne by every other operator who must plan around it.** That is Amazon’s central argument, and it is Beat 12’s thesis stated by an adversarial party.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: the Hyperscaler wearing an applicant’s costume.** What’s real: the filings are real, the orbits are real, the fees were paid, the pages exist. What’s oversold: **an accepted application is not a satellite, a schedule, or a watt.** Narrator move: **STRIP** — remove the story (“Bezos is building a 51,600-satellite data center”) and leave standing the documented thing (a 14-page application with no schedule, no power figure, and no ITU filing).
- **Contested:** whether the applications are genuine plans or priority claims. Amazon says the latter, in writing. Tim Farrar of TMF Associates characterized the SpaceX filing as quite rushed and as more of a narrative tool for the IPO than a near-term execution plan. **Both are motivated parties; both are on the record; present the conflict.**
- **Unknown:** the FCC’s disposition, and its timing. **There is no scheduled decision date.**

SENSORY & MATERIAL DETAILS.

- **14 pages.** For 51,600 spacecraft. That is roughly **3,686 satellites per page.** (*Arithmetic shown: $51,600 \div 14 = 3,685.7$.*)
- The SpaceX companion filing is described in one contemporaneous account as **eight pages.** [SECONDARY, single-sourced — flag before use.]
- The FCC’s public notice is **two pages**, of which the Kardashev footnote occupies roughly a fifth.
- Blue Origin was, in the same period, advertising job openings for satellite engineers and **a director of commercial sales for data center markets.** Documented by GeekWire, 21 March 2026.

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
51,600	satellites, maximum	requested — not authorized, not built, not launched	19 Mar 2026	Blue Origin	ANCHOR (as a filing fact)
1,000,000	satellites, maximum	requested	30 Jan 2026	SpaceX	ANCHOR (as a filing fact)
88,000	satellites, maximum	requested	accepted 13 Mar 2026	Starcloud	ANCHOR (as a filing fact)
5,408	satellites (TeraWave: 5,280 LEO + 128 MEO)	requested	Jan 2026	Blue Origin	STRUCTURAL
14	pages	fact	19 Mar 2026	Blue Origin	STRUCTURAL
17	pages, Amazon petition	filed	6 Mar 2026	Amazon Leo	STRUCTURAL
5	days, filing to acceptance (SpaceX)	fact	30 Jan–4 Feb 2026	FCC	ANCHOR
~1,500	comments filed, SpaceX ODC docket	fact	by Mar 2026	FCC/AAS	STRUCTURAL
4	waivers requested by SpaceX	filed	30 Jan 2026	SpaceX	ANCHOR

STRESS-TEST VERDICT: SUSTAINABLE — and this is the strongest beat in the lecture. A 14-page application for 51,600 spacecraft; a competitor's 17-page petition against a near-identical filing by a party under the same beneficial control; a one-paragraph procedural letter that is funnier than any joke a writer could construct; and a federal agency footnoting a 1964 Soviet astronomy paper in a data-center docket. The Verbatim, the Timeline Snap and the Kicker could all legally host here; the moves plan correctly spends only one of them in this beat's territory.

Beat 4 — Taxonomy by Business Model (the field by constellation thesis)

Syllabus 2.0 assignment. The field by constellation thesis: Starcloud's H100-flown demo, Google's Project Suncatcher two-TPU prototypes by early 2027, Blue Origin's filing.

Beat Menu definition. *Taxonomy by Business Model — Money • versatile • cold specialist, hard-budgeted 1–3 course-wide.* The landscape tour sorted by mechanism, not logo; the taxonomy *is* the insight, and company names are just where it touches ground. **Cap check: casting 3 of 3 — L3 cooling vendors • L6 neoclouds • L9 orbital players. The L2 pack declined a fourth deployment (integration-layer taxonomy) and the L7 pack declined a fifth (siting-and-power taxonomy) expressly to protect this one. PASS — and this is the last one.**

FACTS, DATES, NAMES, NUMBERS — the taxonomy, sorted by thesis rather than logo.

Branch 1 — Compute as a bolt-on to an existing constellation. *Thesis: the hard part is the constellation, and we already have one.*

- **SpaceX.** Filed 30 January 2026 for up to **1,000,000** satellites. **AI1** unveiled 8 June 2026: **~150 kW peak AI compute, 70 m wingspan**, built largely from **Starlink V3** hardware; each satellite is essentially one AI server rack in orbit; laser links to Starlink for backhaul. Two prototypes **[EXPECTED] early 2027**. Musk's framing: no new physics needed, the solar/thermal/propulsion/shielding/laser stack already ships at volume, and the compute satellites will be **less complex** than Starlink's. **This is the strongest version of Branch 1 and it should be granted fully.**
- **Blue Origin.** TeraWave (broadband, 5,408) as backhaul; Project Sunrise (51,600) as compute. Same architecture, one flight generation behind: New Glenn has flown twice; zero TeraWave satellites are in orbit.
- **Amazon Leo** — adjacent: ~210–212 satellites in orbit against 3,236 authorized; has publicly *opposed* the category while its sibling company files for it and its cloud unit flies a blade on a competitor's demonstrator.

Branch 2 — Compute as the whole spacecraft. *Thesis: the constellation is a means; the radiator is the product.*

- **Starcloud.** 88,000 filed. Starcloud-1 flown (60 kg, 1× H100, Nov 2025). **Starcloud-2** (Oct 2026 expected): **~450 kg, ~8 kW, largest commercial deployable radiator, Blackwell + AWS blade + bitcoin ASICs.** **Starcloud-3:** 200 kW, 3 t, PEZ-dispenser, **~50 per Starship, ~10 MW per launch.** **Starcloud-4 (conceptual): 5 GW** on a solar/cooling array roughly **4 km on a side.**
- **Sophia Space** — modular compute platforms sold to satellite operators; NVIDIA Jetson Orin partner (named 16 March 2026).
- **Aetherflux** — CEO **Baiju Bhatt** (co-founder of Robinhood); named NVIDIA Vera Rubin partner, pitching power and compute in orbit.

Branch 3 — Compute as an extension of an existing cloud. *Thesis: we already sell the compute; the orbit is a new region.*

- **Google / Project Suncatcher.** TPUs, free-space optical ISLs, dawn–dusk SSO, **81-satellite / 1 km-radius** illustrative cluster, ML-based formation control. **Two prototypes with Planet Labs [EXPECTED] early 2027.** Radiation: **Trillium v6e survived 5-year-equivalent TID** in a 67 MeV proton beam; **HBM most sensitive;** uncorrectable errors likely acceptable for **inference**, single-event effects on **training** requiring further study. **The most rigorous public document in the category is a research preprint, not a filing.**
- **AWS** — hedging via a server blade on Starcloud-2 while its CEO calls the category uneconomical.
- **Microsoft/Azure** — absent from the public record in this territory. **State the absence; do not fill it.**

Branch 4 — Compute as edge processing for the satellites already up there. *Thesis: the market is not AI training; it is the 90% of orbital data that never gets downlinked.*

- **Planet Labs PBC** — CEO **Will Marshall**; adopting **IGX Thor** and **Blackwell** to process imagery on orbit, reducing time-to-insight from hours to seconds, plus Blackwell in ground processing.
- **Kepler Communications** — Jetson Orin, named partner.
- **Axiom Space** — named partner; orbital data center nodes.
- **Starcloud’s own original mission (2024)** and **Starcloud-2’s hosted payloads** — DoD and Earth observation customers, which per Johnston cover Starcloud-2’s entire development cost. **This is the branch that has actual revenue, and it is not the branch the valuations are priced off.**

Branch 5 — The state programme. *Thesis: this is infrastructure, not a business.*

- **ADA Space (Guoxing Aerospace) + Zhejiang Lab, China.** Three-Body Computing Constellation: **12 satellites launched 14 May 2025** (Long March 2D from Jiuquan), **5 POPS combined, 30 TB storage, up to 100 Gbps laser ISLs**, one carrying an X-ray polarimeter. **Star Compute plan: 2,800 satellites — 2,400 inference, 400 training — at 500–1,000 km. 100 satellites by 2027. Full-build target 1,000 POPS.**
- **Astro-Future Institute (Beijing)** — Lenovo and Beijing municipal backing, **≥¥140M (~\$20.4M)**; a demonstration satellite within the year; a **sixteen-spacecraft laser-linked gigawatt-scale** target.
- **CASC 15th Five-Year Plan (2026–2030)** — space-based data centers named under space infrastructure at gigawatt scale.
- **CAICT** — has established a space computing power professional committee.
- **European Commission / Thales Alenia Space — ASCEND.** Horizon Europe; consortium of Carbone 4, VITO, Orange Business, CloudFerro, HPE, ArianeGroup, DLR, Airbus D&S, TAS. **1 GW before 2050** against a 23 GW 2030 market; explicit precondition of a launcher **10x less emissive** over its lifecycle. **The European programme’s headline metric is carbon, not cost, and its horizon is 2050.**

Branch 6 — The picks and shovels. *Thesis: we don’t care which thesis wins.*

- **NVIDIA**, 16 March 2026: **Space-1 Vera Rubin Module** (up to **25x an H100** for space-based inferencing; availability “at a later date”), **IGX Thor** (available now), **Jetson Orin** (available now, already in orbit). Six named launch partners. Also posted a job listing for an **orbital data center system architect** earlier that month.
- **Astro Digital** — built Starcloud-1 on the Corvus-Micro bus.
- **Monolithic Power Systems** — power-management silicon vendor, and a **Series A investor in Starcloud.** *A supplier on the cap table; note it, don’t editorialize it.*

THE MECHANISM. The sort that makes this a taxonomy rather than a list: **each branch answers “what do you already own that the others must buy?”** SpaceX owns launch and a constellation. Google owns silicon and a cloud. Starcloud owns nothing and must buy launch, buses, and chips — which is exactly the margin-stack problem McCalip identifies as decisive. Planet owns data that is already stranded in orbit. China owns a five-year plan. NVIDIA owns the part all six branches need. **Where the constraint binds: at vertical integration.** McCalip’s finding is that the list of organizations

positioned to close the economics is **basically one**, and the reason is not talent but integration — buy launch, buses, power hardware, deployment, and pay margin at every interface, and the mass tax and margin stack eat you.

KEY ACTORS. Enumerated above. As-of titles at their dated moments: **Jensen Huang**, founder and CEO, NVIDIA (16 March 2026). **Will Marshall**, CEO, Planet Labs PBC (16 March 2026). **Baiju Bhatt**, founder and CEO, Aetherflux (16 March 2026). **Zhao Hongjie**, executive vice president, ADASpace (25 April 2026). **Li Chao**, director, space-based computing system research center, Zhejiang Lab (April 2026). **Christophe Valorge**, chief technical officer, Thales Alenia Space (28 June 2024).

THE DOCUMENTS.

- **The Suncatcher preprint** (4 November 2025) — the category’s most rigorous public engineering document, and it is by a party with an enormous incentive to be believed. Contains the radiation test results, the formation-control model, and the DWDM bench demonstration.
- **The ASCEND study results** (28 June 2024) — the only publicly funded feasibility study, with a named consortium and a named precondition.
- **NVIDIA’s 16 March 2026 press release** — a vendor document that establishes the category has a supply chain.
- **CASC’s 15th Five-Year Plan notice** — a state document naming gigawatt-scale space-based infrastructure.

VERBATIM BANK.

“Space computing, the final frontier, has arrived” — Jensen Huang, founder and CEO, NVIDIA, GTC 2026 keynote, San Jose, 16 March 2026. (Seven words. Reported identically by CNBC, DCD and The Register.)

“Currently, up to 90 percent of the data generated in space is lost and never effectively processed” — paraphrase of Li Chao, director of the space-based computing system research center, Zhejiang Lab, at a 2026 Space Day of China forum, reported by Xinhua, 25 April 2026. MARKED AS PARAPHRASE — the original is a translation of a Chinese-language remark; do not present as verbatim.

Paraphrase, marked: ADA Space described the 14 May 2025 launch as the world’s first dedicated orbital computing constellation. **Locator:** ADA Space announcement, 14 May 2025, reported by SpaceNews.

Paraphrase, marked: NVIDIA’s 16 March 2026 release states that, compared with the H100, the Rubin GPU on the Space-1 module delivers up to 25x more AI compute for space-based inferencing, and that IGX Thor and Jetson Orin are available while the Space-1 module will be available at a later date. **Locator:** nvidianews.nvidia.com, “NVIDIA Launches Space Computing, Rocketing AI Into Orbit,” 16 March 2026.

WHO PAYS. Branch by branch, and the answer differs — which is the point of sorting this way. **Branch 1:** SpaceX shareholders, post-12 June 2026, publicly. **Branch 2:** venture capital. **Branch 3:** Alphabet’s R&D line. **Branch 4:** actual customers, including the U.S. Department of Defense (amount and vehicle undisclosed). **Branch 5:** Chinese state and municipal budgets; European Commission Horizon Europe money. **Branch 6:** everybody else, at vendor margin. **The only branch with a paying customer today is the one nobody is valuing.**

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: all six.** Direction: each branch’s public materials describe the category’s economics using the assumptions most favorable to that branch’s owned asset.
- **What’s real:** the taxonomy is not speculative. Every branch has a dated filing, a flown spacecraft, a funded study, or a shipped product.
- **What’s oversold:** the implicit claim that these are competitors racing. **Branches 1, 3, 4 and 6 are largely the same supply chain wearing different jackets: NVIDIA sells to Starcloud, AWS flies on Starcloud, Google flies with Planet, Planet buys NVIDIA, and SpaceX launches everyone.**
- **Unknown:** Microsoft’s position. Meta’s position (a widely-circulated headline about beaming sunlight from space to power data centers was not verifiable to a primary source within this pack’s research window — **DO NOT USE**).
- **Narrator move: FRAMING is not appropriate here; use DISCOUNT** — every capacity number in this taxonomy is a forecast with an author.

SENSORY & MATERIAL DETAILS.

- **AI1’s 70-metre wingspan** — wider than a Boeing 747’s (64.4 m) and comparable to an Airbus A380’s (79.75 m). **The comparison is arithmetic on published dimensions and should be marked as the pack’s own comparison,**

not a source's.

- **Starlink V3 satellites carry roughly 30 m² of solar panels** (Scott Manley, quoted in Engadget, 19 February 2026).
- **Starcloud-3 is 3 tonnes and ~50 fit in one Starship** via the PEZ dispenser — the same mechanism built for Starlink V2/V3.
- Planet's **Owl** satellite is the named platform for IGX Thor adoption.
- The Three-Body satellites launched from **Jiuquan** on **14 May 2025** under a clear blue sky, with **insulation tiles falling away from the payload fairing** as the rocket climbed. **Documented in SpaceNews's own account of the launch video.**

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
~150	kW peak AI compute per AI1	announced design	8 Jun 2026	SpaceX	VOLATILE
70	m wingspan, AI1	announced design	8 Jun 2026	SpaceX	VOLATILE
8	kW, Starcloud-2	funded, unflown	30 Mar 2026	Starcloud	VOLATILE
200	kW, Starcloud-3	in development (chassis welded)	30 Apr 2026	Starcloud	VOLATILE
5	GW, Starcloud-4	conceptual only	2025–26	Starcloud	CONTESTED
81	satellites, 1 km radius (illustrative cluster)	modeled	4 Nov 2025	Google	STRUCTURAL
5	POPS across 12 satellites	flown	14 May 2025	ADA Space	STRUCTURAL
2,800	satellites (2,400 inference / 400 training)	announced	2025–26	ADA Space	STRUCTURAL
1	GW before 2050	study target	28 Jun 2024	Thales Alenia Space / EC	STRUCTURAL
25x	AI compute vs H100, space-based inferencing	vendor claim	16 Mar 2026	NVIDIA	CONTESTED
~90%	of orbital data never processed	claim	Apr 2026	Zhejiang Lab	CONTESTED

STRESS-TEST VERDICT: SUSTAINABLE. Six branches, each with named specimens, dated artifacts, and a distinct answer to “what do you already own.” The risk is length, not thinness — the beat will want 1,600 words and must be held to 1,000, most likely by compressing Branch 6 into Beat 7's bottleneck material.

Beat 5 — Mechanism Autopsy (spacecraft thermal design)

Syllabus 2.0 assignment. How a radiator actually rejects heat, and what deployable area costs in mass.

Beat Menu definition. *Mechanism Autopsy — Atoms • versatile • fat container (6–8 appearances).* How the thing physically works — and the Beat Menu names “**radiation-only heat rejection**” as one of its own examples. Rotation is content-native: each lecture autopsies a different mechanism. **L3 autopsied direct-to-chip cooling; L4 the three-study interconnection gauntlet; L5 the co-location bypass toolkit.** This one is the vacuum case and no prior lecture has touched it.

FACTS, DATES, NAMES, NUMBERS.

- **The governing equation.** $\dot{Q}_{\text{rad}} = \epsilon \sigma A T^4$. Emissivity ϵ (dimensionless, 0–1), Stefan–Boltzmann constant $\sigma = 5.67 \times 10^{-8} \text{ W} \cdot \text{m}^{-2} \cdot \text{K}^{-4}$, area A in m², absolute temperature T in kelvin. **ANCHOR — this does not decay.**
- **The four heat inputs on an orbiting panel**, per McCalip's published bifacial model: **direct solar** (AM0 **1,361 W/m²**, absorbed at $\alpha = 0.92 \rightarrow \sim 1,250 \text{ W/m}^2$), **Earth infrared** (**~237 W/m²**), **albedo** (reflected sunlight), and **the loop return** — the electrical energy that went into the GPUs and came back out as heat.

- **The energy partition that kills the intuition.** Of the $\sim 1,250 \text{ W/m}^2$ absorbed by a Starlink-style bifacial panel: **$\sim 22\%$ ($\sim 275 \text{ W/m}^2$)** becomes electricity, drives the compute payload, and **returns as heat via the cooling loop**; **$\sim 78\%$ ($\sim 975 \text{ W/m}^2$)** never becomes electricity at all and is absorbed immediately as lattice heat in the panel structure. **The radiator must therefore reject essentially 100% of the absorbed solar flux — not just the compute waste heat.** *This is the single most counterintuitive mechanism in the lecture and it is in the seller-adjacent engineer's own public model.*
- **The temperature ceiling.** H100/B200-class accelerators throttle at junction temperatures above roughly **$85\text{--}100^\circ\text{C}$** . Allowing **$\sim 10^\circ\text{C}$** of gradient across cold plates and thermal interface materials, the radiator surface is constrained to roughly **75°C** . Because radiated power goes as T^4 , every degree you cannot run hotter costs area geometrically. **McCalip's model surfaces this as a pass/fail: if the computed equilibrium temperature exceeds the target radiator temperature, the design fails.** A separate published analysis of his model puts the orbital GPU's margin at about **12°C** before throttling.
- **The idealized area.** IEEE Spectrum (**19 June 2026**) applies Stefan-Boltzmann to a single **700 W** H100-class die held at **60°C** , radiator perfectly facing deep space at **3 K** : **1.4 m^2 per chip**. Scaled: a **40 kW** rack of ~ 32 GPUs (with CPUs, memory and networking) needs **80 m^2** . **Implied flux: 500 W/m^2** . (*Arithmetic shown: $40,000 \text{ W} \div 80 \text{ m}^2 = 500 \text{ W/m}^2$*)
- **The realized area.** ISS: **six deployed radiator arrays, 70 kW total**, at eight panels of **$3.33 \times 2.64 \text{ m}$** each = **$\sim 70.3 \text{ m}^2$ per assembly, $\sim 422 \text{ m}^2$ total**. **Implied realized flux: $\sim 166 \text{ W/m}^2$** . (*Arithmetic shown: $8 \times 3.33 \times 2.64 = 70.3 \text{ m}^2$; $70,000 \text{ W} \div 421.8 \text{ m}^2 = 166 \text{ W/m}^2$*) Independent published estimates of ISS radiator performance in the LEO environment give **$130\text{--}200 \text{ W/m}^2$** , bracketing this derivation. **The gap between 500 and 166 is Earth IR, albedo, imperfect view factor, imperfect emissivity, and the fact that a real spacecraft is not a flat plate facing 3 K .**
- **The conflicting NASA dimension.** A NASA-hosted ATCS overview gives a radiator measuring **$3.12 \text{ m} \times 13.6 \text{ m}$ (42.4 m^2)**. This does not reconcile with the AIAA panel dimensions and almost certainly measures a different article (a single deployed radiator wing versus an eight-panel assembly). **The pack states the conflict and does not average the two. Ranges stay ranges; conflicts stay conflicts.**
- **The working fluid.** ISS uses **single-phase anhydrous ammonia** externally (freezing point **-107°F / -77°C** at standard pressure) and **water** internally, with **interface heat exchangers** between them. Manifolds and flow tubes in **Inconel 718**, selected for resistance to ammonia freeze/thaw pressures and corrosion. **22 flow tubes in parallel per panel, for redundancy.**
- **The mass penalty.** McCalip's model reports, for a **1 GW** orbital system: **total mass to LEO 22.2 million kg, fleet array area 2.3 km^2 , single satellite array 116 m^2 , $\sim 37,000$ satellites, specific power 36.5 W/kg** (Starlink V2 Mini heritage; slider stops include ISS at 3 W/kg and aspirational 100 and 500 W/kg). **And a stated model assumption that is itself the finding: "Thermal: only solar array area used as radiator; no dedicated radiator mass assumed" and "No additional mass for liquid cooling loop infrastructure; likely needed but not included."** **The most rigorous public orbital cost model in existence leaves the radiator's mass out, says so in writing, and still comes out roughly 2x terrestrial.**
- **The published corollary.** One analysis of McCalip's model states that the radiators required are roughly the same size as the solar panels powering the system — meaning the spacecraft's size and mass roughly double for cooling alone.

THE MECHANISM, END TO END.

The heat path in vacuum: die $\rightarrow$ thermal interface material $\rightarrow$ cold plate $\rightarrow$ pumped liquid loop $\rightarrow$ interface heat exchanger $\rightarrow$ external loop (ammonia, on ISS heritage) $\rightarrow$ radiator panel manifold $\rightarrow$ 22 parallel flow tubes $\rightarrow$ panel surface at $\sim 75^\circ\text{C}$ $\rightarrow$ infrared emission at $\epsilon \approx 0.90$ into a 3 K sink, minus everything the panel is simultaneously absorbing from the sun, the Earth, and the Earth's albedo.

Why deployable: a radiator sized for the payload cannot fit in a fairing. So it folds. Folding means hinges, latches, deployment actuators, harnesses that survive launch vibration, and a single-point failure that no one can go fix. ISS's six arrays are **unlatched and deployed remotely without EVA** after the carrier truss segment is assembled — and are **orbital replaceable units**, because NASA assumed from the start that they would need replacing.

Where the constraint binds: **at the ratio of radiator area to compute power, at the maximum temperature silicon tolerates.** Not at the solar panel (sunlight is free and abundant), not at the chip (it exists and works), not at the FCC (the docket is open). **At the square metre.** Every other cost in this lecture is a consequence of that number.

The one genuine escape route, named honestly: radiated power scales as T^4 , so raising the operating temperature is the only lever that shrinks area fast. That requires compute hardware with a fundamentally higher thermal tolerance than current silicon — a materials and packaging problem, not an engineering-effort problem. **This is the honest thing to say instead of “it’s impossible”: the gap does not close linearly with investment, and the only fast-shrinking variable is one nobody has yet moved.**

KEY ACTORS IN THIS BEAT.

- *Object:* **the deployable radiator** — the lecture’s anchor object, lead treatment here and in Beat 6. Manufacture (ISS heritage): aluminum panels with embedded Inconel 718 flow tubes; deployed remotely; designed for a 10-year LEO environment including micrometeoroid and debris strike and solar degradation; orbital-replaceable by design. Failure modes documented: **coating delamination under freeze–thaw cycling (2013), flow-path leak requiring isolation and venting (3 May 2017)**. Chain of custody: stowed for launch attached to its truss segment, deployed on orbit, serviced only by robot or EVA.
- *Institution:* **NASA / Boeing / Hamilton Sundstrand** — the only organizations with two decades of operating data on a large space radiator, and their number is 70 kW.
- *Human:* **Andrew McCalip**, head of research and development, **Varda Space Industries** — but publishing this model **in a personal capacity with an explicit disclaimer that it does not represent the views of any company or organization**. See D3.
- *Human:* **Jensen Huang**, founder and CEO, NVIDIA — who stated the mechanism from the GTC stage on 16 March 2026 while launching hardware into it.

THE DOCUMENTS.

- **SAE Technical Paper 951651 (1995)** — the ISS Heat Rejection Subsystem design paper. What it forces: a 70 kW ceiling, a 10-year environmental design life, and orbital replaceability. What it forbids: nothing — it is engineering, not regulation. Binding? It is the most binding document in the lecture, because it is the only one that has been tested for twenty years.
- **AIAA Journal of Spacecraft and Rockets, DOI 10.2514/1.A35030** — panel geometry, tube count, materials.
- **NASA NTRS 20180007472 (2018)** — the venting analysis for EATCS Loop B Radiator #3 Flow Path #2, including worst-case time-to-empty and thrust imposed on the station. **A document about what happens when the radiator leaks, written because the radiator leaked.**
- **andrewmccalip.com/space-datacenters** and **github.com/andrewmccalip/thoughts** — the model, its assumptions list, and its source code, all public.

VERBATIM BANK.

“In space, there’s no convection, there’s just radiation, and so we have to figure out how to cool these systems” — Jensen Huang, founder and CEO, NVIDIA, GTC 2026 keynote, San Jose, 16 March 2026, as reported by CNBC. (The seller of the chips states the constraint, unprompted, at the product launch.)

“Thermal: only solar array area used as radiator; no dedicated radiator mass assumed” — Andrew McCalip, Economics of Orbital vs Terrestrial Data Centers, model assumptions list, andrewmccalip.com, accessed 22 July 2026. (A stated assumption, in the author’s own words, from a document he published expressly so people would argue with the assumptions.)

Paraphrase, marked, with locator: McCalip’s technical section states that the governing constraint for orbital compute is thermodynamics; that terrestrial data centers dump waste heat into the atmosphere or water, effectively using the planet as an infinite cold reservoir; that convection is impossible in vacuum; and that heat rejection therefore relies exclusively on radiation. **Locator:** **andrewmccalip.com/space-datacenters, “Technical Engineering Challenges.”**

Paraphrase, marked, with locator: IEEE Spectrum’s June 2026 analysis models a 700 W chip at a constant 60 °C against a 3 K background with a perfectly-facing radiator and derives 1.4 m² per chip and 80 m² for a 40 kW rack. **Locator:** **spectrum.ieee.org/orbital-data-centers-heat, 19 June 2026.**

WHO PAYS. No one, in dollars, in this beat. The cost here is paid in **kilograms and square metres**, and it is converted into dollars in Beat 6. That conversion is the lecture’s spine and this beat’s job is to set it up without spending it. **One line in this beat is legitimate:** every square metre of radiator is a square metre that had to be launched, and launch is the only cost line in the model that scales linearly with mass.

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Not contested at all:** the physics. There is no serious dispute about Stefan–Boltzmann, about the absence of convection, or about the T^4 dependence. **This is one of the few places in the entire course where the narrator can state something flatly and stop.** Move: **DISPATCH** on the myth that orbit *solves* cooling — orbit **deletes convection**, which was doing most of the work. The Style Guide names this exact DISPATCH.
- **Genuinely contested:** the achievable flux. **500 W/m² (idealized, deep-space-facing) versus ~166 W/m² (ISS realized) is a 3x spread**, and every business model in this lecture lives or dies inside it. Present both, with their assumptions, and refuse to average.
- **Motivated:** McCalip is an employee of a space company who wants the space economy to work and says so in writing; his model's omissions (**no radiator mass, no cooling-loop mass, no shielding mass, no deorbit cost, no regulatory cost**) all run in the *optimistic* direction. **The most-cited skeptical model is biased toward orbit and still doesn't close.** That is the strongest single sentence available in this lecture and it is fully documented.
- **Unknown:** Starcloud-2's actual radiator area, mass, and deployed geometry. Project Sunrise's thermal budget. AII's radiator area. **None of the three has published one.**

SENSORY & MATERIAL DETAILS.

- **Anhydrous ammonia**, freezing at $-77\text{ }^{\circ}\text{C}$, pumped through **Inconel 718** tubing because ammonia freezing and thawing generates pressures that would burst softer metal.
- Twenty-two parallel flow tubes per panel, so that a micrometeoroid puncture costs you a tube rather than a loop.
- The **Robotic External Leak Locator** — a robot whose job is to sniff for escaping coolant.
- On **3 May 2017** the fix for a leak was to **isolate a flow path and vent it to vacuum**, and NASA computed the thrust that venting would impose on the station.
- A radiator at $75\text{ }^{\circ}\text{C}$ is **hot to the touch** and, in infrared, is the brightest thing on the spacecraft.
- McCalip's page carries a literal all-caps stop sign before the engineering section, telling readers who skipped the economics to go back. **A documented artifact of the author's own frustration with the discourse.**

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
5.67×10^{-8}	$\text{W} \cdot \text{m}^{-2} \cdot \text{K}^{-4}$ (σ)	physical	—	physical constant	ANCHOR
1,361	W/m^2 AM0	physical	—	physical constant	ANCHOR
~237	W/m^2 Earth IR	modeled	2026	A. McCalip	STRUCTURAL
~1,250	W/m^2 absorbed at $\alpha=0.92$	modeled	2026	A. McCalip	STRUCTURAL
~275 / ~975	W/m^2 electrical / immediate lattice heat	modeled	2026	A. McCalip	STRUCTURAL
85–100	$^{\circ}\text{C}$ junction throttle	spec	2025–26	NVIDIA-class hardware	STRUCTURAL
~75	$^{\circ}\text{C}$ radiator surface constraint	derived	2026	A. McCalip	STRUCTURAL
~12	$^{\circ}\text{C}$ thermal margin before throttling	derived from McCalip	2026	secondary analysis	CONTESTED
1.4	m^2 per 700 W chip at $60\text{ }^{\circ}\text{C}$, idealized	derived	19 Jun 2026	IEEE Spectrum	STRUCTURAL
80	m^2 per 40 kW rack, idealized	derived	19 Jun 2026	IEEE Spectrum	STRUCTURAL
500	W/m^2 implied idealized flux	pack arithmetic	22 Jul 2026	this pack	STRUCTURAL
~166	W/m^2 implied realized flux (ISS)	pack arithmetic	22 Jul 2026	this pack, from AIAA + NASA	STRUCTURAL
130–200	W/m^2 published ISS radiator range	published	2026	secondary synthesis	STRUCTURAL

Value	Unit	Stage	As-of	Author	Tier
70	kW total ISS heat rejection	operating	since Dec 2006	NASA	ANCHOR
6	ISS radiator arrays	operating	since 2006	NASA	ANCHOR
36.5	W/kg specific power (Starlink V2 Mini heritage)	modeled	2026	A. McCalip	STRUCTURAL
22.2M	kg to LEO for 1 GW	modeled	2026	A. McCalip	CONTESTED
2.3	km ² fleet array area for 1 GW	modeled	2026	A. McCalip	CONTESTED

STRESS-TEST VERDICT: SUSTAINABLE — and this beat is load-bearing for the whole lecture. Two decades of operating data on the only large space radiator humans have built; a governing equation that cannot be argued with; a published model whose author lists his own omissions; two published area derivations that differ by 3x for stated reasons; and a documented leak with a documented robot. The only risk is that it becomes a physics lecture — the fix is that every number here has a name, a date, and a filer attached.

Beat 6 — The Physics Audit (the signature deployment)

Syllabus 2.0 assignment. The signature deployment: no air means no convection; every watt in leaves by radiation alone; ~3x cost per watt by the industry's own modeling — delivered in the same tone as the pitch.

Beat Menu definition. *The Physics Audit — Atoms/Audit • versatile, closer-capable • warm (4–5 appearances, re-band to hot pending Syllabus 2.0 Open Item 2).* The deadpan reality check on a claim, and the Beat Menu's own examples for this beat are “**no convection in vacuum, so the radiator becomes the spacecraft**” and “**~3x cost per watt by Varda's own math.**”^{*} This lecture is the beat's home. The Beat Menu wrote this beat about this hour.^{**} The course's signature skepticism beat — the audit is delivered in the same tone as the pitch it's auditing.

FACTS, DATES, NAMES, NUMBERS.

- **The Step Function's number.** Orbital compute costs roughly **three times as much per watt** as terrestrial under the base case of the most detailed public model — **Andrew McCalip**, head of R&D at **Varda Space Industries**, reported by **SpaceNews**, **1 February 2026**. **This is the must-hit anchor and it governs.**
- **The model's live outputs as of the research date (22 July 2026).** Orbital: **\$31.20/W**, total **\$31.2B** for 1 GW over a 5-year analysis period, decomposed as satellite **\$9.0B**, launch **\$22.2B**, ops at 1%/yr **\$3.1B**, NRE + replacement **\$1.0B**; LCOE **\$891/MWh**; mass to LEO **22.2M kg**. Terrestrial (on-site combined-cycle gas at the fence line): **\$14.80/W**, total **\$14.8B**, decomposed as power generation **\$1.3B**, electrical **\$5.3B**, mechanical **\$3.0B**, civil/shell **\$2.5B**, fit-out **\$1.8B**, fuel **\$1.0B**; LCOE **\$398/MWh**; capex **\$13.80/W**. **Implied ratio: 2.11x.** (*Arithmetic shown: $31.20 \div 14.80 = 2.108$.*)
- **The author's own prose ratio.** In the same document McCalip writes that the economics are not close, that this is not a 25% mismatch, that it is **400%**, and that closing it is the whole job. **So the same author, in the same artifact, carries 2.1x in the calculator and 4x in the prose.**
- **A third rendering.** A published analysis citing McCalip's model gives **\$42.4B for a 1 GW orbital data center against ~\$15.9B** for the equivalent ground facility — **2.67x** — with the same 400% quotation attached. [SECONDARY, April 2026.]
- **Resolution of the spread, stated honestly:** the model is a live calculator with adjustable sliders; its headline ratio moves with launch cost, specific power, satellite size, and analysis period. **The ~3x anchor is a defensible characterization of the base case as reported by SpaceNews in February 2026 and it is the figure the course carries.** The 2.1x live reading, the 2.67x secondary rendering and the 400% prose framing are all the same model at different settings. **Flag at \$6, D3; do not silently substitute.**
- **The independent second opinion.** **SemiAnalysis (June 2026, reported):** space compute at **>4x** terrestrial today — **\$8.64 vs \$2.37 per GPU-hour** for a **B300-class** cluster — driven by launch cost and a **5-year versus 15-year asset life**; narrowing to a **~30% premium by the early 2030s**; leveled parity around **2040** in the base case, earlier

if terrestrial constraints bite harder. **[SINGLE-SOURCED SECONDARY — primary must be pulled before air.]**

- **The optimistic second opinion, named for symmetry.** One analyst house (Introl, February 2026) projects parity for specific workloads in **2028–2030**, on three assumptions: Starship launch costs below **\$100/kg** against roughly **\$2,700/kg** on Falcon 9 today, solar panel efficiency above **40%**, and satellite hardware surviving a full **five-year** life in LEO. **Name the assumptions; that is the discount.**
- **The European institutional opinion.** ESPI noted that many orbital data center cost models depend on Starship achieving a launch price as low as **\$10 million per flight**, a figure ESPI described as unrealistic in the near term. **[SECONDARY-QUOTED — re-pull ESPI publication before air.]**
- **The seller’s own number, for contrast.** Johnston: Starcloud-3 competitive at roughly **\$0.05/kWh** — **if** launch reaches ^{\$500/kg} **\$1,500/kg** best-case Falcon Heavy as of April 2026 and **\$1,500–\$2,900/kg** in Google’s own paper. **At \$1,500/kg, one published analysis puts Starcloud’s orbital energy cost at roughly \$0.15/kWh — triple, and well above ground parity.**
- **The audit’s cleanest single comparison.** **The largest commercial deployable radiator ever flown**, on Starcloud-2, will serve a spacecraft generating **8 kW**. A single **GB200 NVL72** rack draws **132 kW** (L2’s anchor figure; used here by cross-reference only, not re-derived). **$8 \div 132 = 6.1\%$** . The record-setting radiator handles about **six percent of one rack**. (*Pack arithmetic, shown.*)
- **The second cleanest.** The ISS’s **entire thermal control system** rejects **70 kW**. One GB200 NVL72 rack is **132 kW**. **One rack is 1.89 ISS thermal systems.** ($132 \div 70 = 1.886$.)

THE MECHANISM. The audit’s structure, delivered in the pitch’s own tone: grant the solar (it is real, it is up to 8x, it is Google’s number). Grant the escape from land, water and the rate case (it is total and it is the honest reason the category exists). Grant that the chips survive (Google’s own radiation data says so, and Starcloud flew one). **Then note the one thing the pitch never mentions, which is that the same panel that collects 1,361 W/m² must also get rid of it, and that the only exit is a fourth-power function of a temperature silicon will not let you raise.** Then let the industry’s own model, published by an engineer at a space company who explicitly wants this to work and who left the radiator’s mass out of the calculation, land the number.

Where the constraint binds: at the point where **launch cost is the only remaining variable** and it is controlled by one company whose vehicle has not reached orbit. Everything upstream of that has been granted.

KEY ACTORS. McCalip (as-of title: head of research and development, Varda Space Industries; publishing personally). Huang (16 March 2026). Garman (3 February 2026). Johnston (throughout). Google’s Suncatcher authors (4 November 2025).

THE DOCUMENTS.

- **McCalip’s model page and GitHub repository** — the audit’s spine, public and forkable.
- **The Suncatcher preprint** — the seller’s own launch-cost precondition, in the seller’s own paper.
- **IEEE Spectrum, 19 June 2026** — the independent arithmetic.

VERBATIM BANK.

“the physics doesn’t immediately kill it, but the economics are savage” — Andrew McCalip, head of R&D at Varda Space Industries, writing personally, in his analysis of his own calculator; quoted by SpaceNews, 1 February 2026. (Ten words. This is the Step Function’s landing line and it belongs to the industry, not to the narrator.)

“There are not enough rockets to launch a million satellites yet” — Matt Garman, CEO, Amazon Web Services, Cisco AI Summit, San Francisco, 3 February 2026, reported by Reuters (Greg Bensinger). (Eleven words.)

Paraphrase, marked, with locator: Garman added at the same event that the cost of getting a payload to space today is massive, that it is just not economical, that a rack of servers is heavy, and that humanity has yet to build a permanent structure in space. **Locator: Reuters, 3 February 2026; Fortune (Alexei Oreskovic), 3 February 2026.**

Paraphrase, marked, with locator: McCalip’s “Findings and Implications” section states that the result is neither obviously stupid nor a sure thing; that it only gets within striking distance under aggressive assumptions; and that the list of organizations positioned to try that is basically one — because vertical integration, not talent, is the whole ballgame. **Locator: andrewmccalip.com/space-datacenters.**

WHO PAYS. In this beat the answer is arithmetic: **at \$891/MWh orbital LCOE against \$398/MWh terrestrial in the same model, the difference is paid by whoever buys the compute** — and, at present, by the investors funding the gap while the launch curve does or does not arrive. **There is no ratepayer to socialize it onto. That is the genuine, and genuinely favorable, difference between this lecture and Lecture 7, and the audit should say so.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: the Escape Artist.** Move: **GRANT-AND-WITHHOLD**, as assigned, and the pack confirms the calibration fits. What's real: the solar, the escape from land/water/rate case, the chips' survival, and the fact that the constraint is now a cost curve rather than an impossibility. What's oversold: **the timeline, the completeness of the escape, and any claim of parity that does not name its launch-cost assumption.**
- **Move check** — a second move is warranted and the pack recommends flagging it for markup: **HOLD OPEN** on whether it ever pencils, as Syllabus 2.0 also assigns. The Style Guide's own example is "whether orbital compute ever pencils — settled by launch cadence and radiator mass." **The evidence supports running GRANT-AND-WITHHOLD in this beat and reserving HOLD OPEN for Beat 11's steelman and the close.**
- **Contested:** the ratio itself, across four renderings (2.1x live, ~3x as reported, 2.67x secondary, 4x in prose) and one independent model (>4x today, parity ~2040). **The honest presentation is a range with named authors and named assumptions, not a point estimate.**
- **Motivated in the optimistic direction:** McCalip's omissions. **Motivated in the pessimistic direction:** Garman's employer competes with two of the applicants. **Motivated in both:** everyone.

SENSORY & MATERIAL DETAILS.

- McCalip's model outputs, for a 1 GW orbital system, include **175 million gallons of liquid oxygen, 168 million gallons of methane, ~222 Starship launches, 105 GWh of total launch energy, and 345 tanker trucks of propellant per launch** — an estimated **0.2% of the Texas grid's daily consumption and 1.8% of Texas LOX capacity. The escape from the electrical grid has a line item denominated in the Texas grid.**
- A 1 GW orbital fleet in that model is **~37,000 satellites** with a combined array area of **2.3 km²** — roughly **three and a half times** the current global active-satellite population (16,234, 8 July 2026), for one gigawatt. (*Pack arithmetic: $37,000 \div 16,234 = 2.28$. Correction on review: 2.28x, not 3.5x — the pack states its own corrected figure.*)
- **22.2 million kilograms** to LEO for that one gigawatt, against **10,994.7 tonnes** — 10,994,700 kg — of *everything currently active in orbit. One gigawatt is roughly twice the mass of every working satellite humanity currently operates.* ($22,200,000 \div 10,994,700 = 2.02$.)

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
~3x	cost per watt, orbital vs terrestrial	base-case model output	1 Feb 2026	A. McCalip via SpaceNews	must-hit anchor / CONTESTED
\$31.20 vs \$14.80	per watt	live model reading	22 Jul 2026	A. McCalip	CONTESTED
\$891 vs \$398	per MWh LCOE	live model reading	22 Jul 2026	A. McCalip	CONTESTED
>4x (\$8.64 vs \$2.37)	per GPU-hour, B300-class	modeled	Jun 2026	SemiAnalysis (reported)	CONTESTED, single-sourced
~2040	levelized parity, base case	forecast	Jun 2026	SemiAnalysis (reported)	CONTESTED
2028–2030	parity for specific workloads	forecast	Feb 2026	Introl	CONTESTED
\$500/kg	launch cost assumption	assumption	30 Mar 2026	Starcloud	CONTESTED
~\$1,500/kg	best-case Falcon Heavy	market	Apr 2026	secondary analysis	VOLATILE
\$1,500–\$2,900/kg	current launch cost band	published	4 Nov 2025	Google	STRUCTURAL
~\$2,700/kg	Falcon 9	market	Feb 2026	Introl	VOLATILE
\$0.05/kWh	Starcloud-3 target, conditional	claim	30 Mar 2026	Starcloud	CONTESTED

Value	Unit	Stage	As-of	Author	Tier
\$0.15/kWh	Starcloud cost at \$1,500/kg	derived	2026	secondary analysis	CONTESTED
105	GWh terrestrial energy per 1 GW launch campaign	modeled	2026	A. McCalip	CONTESTED
8 / 132 = 6.1%	kW / kW — Starcloud-2 vs one GB200 NVL72 rack	pack arithmetic	22 Jul 2026	this pack	STRUCTURAL

STRESS-TEST VERDICT: SUSTAINABLE — **this is the lecture’s centre of gravity.** The number exists, its author is named and inside the industry, his model is public and forkable, his omissions run in the optimistic direction and are listed by him, and two independent models bracket the answer. The beat’s only hazard is tonal: the Style Guide requires the audit be delivered in the pitch’s own tone, and this material is so favorable to the auditor that the draft will be tempted to gloat. **Do not.**

Beat 7 — The Bottleneck (Starship cadence; radiation hardening; no service calls)

Syllabus 2.0 assignment. Starship cadence as the dependency nobody controls; radiation hardening; no service calls.

Beat Menu definition. *The Bottleneck* — *Atoms • versatile • fat container* (6–8). The constraint nobody can financialize away — and the Beat Menu names “**Starship launch cadence**” as one of its own three examples. Sustained by why the bottleneck exists industrially, who sits upstream, what the workaround costs, and why money alone doesn’t clear it. **L4’s bottleneck was transformers and turbines; this one is a rocket, and the two are structurally identical: a physical object with a queue in front of it.**

FACTS, DATES, NAMES, NUMBERS.

Bottleneck 1 — the vehicle.

- **Starship’s flight record as of 22 July 2026: thirteen numbered test flights attempted, twelve flown. Flight 12** (22 May 2026, 22:30:22 UTC, Ship 39 / Booster B19, Starbase OLP-2) was the **first Block 3 / V3 flight**, carried **~44,000 kg** of Starlink V3 mass simulators and two modified V2s, and flew a **suborbital** trajectory: **apogee 195 km, perigee –7 km, inclination 28°, duration 1 h 06 m 22 s. Flight 13** (16 July 2026, Starbase Pad 2) **aborted at ignition** when Raptor 3 engines on the Super Heavy booster failed to light; Musk stated two Raptors would be removed and replaced; [EXPECTED] **NET 23 July 2026, 22:45 UTC**, and **also suborbital**, carrying 20 production Starlink V3 satellites for deployment and laser-link test.
- **Starship has not yet delivered a payload to orbit.** The vehicle on which the entire orbital-data-center economy is priced is, as of the research date, a suborbital test article that aborted its most recent attempt five days before this pack was written. **STRUCTURAL, and this is the honest state of the bottleneck.**
- **The cadence arithmetic.** McCalip’s model: **~222 Starship launches for 1 GW.** McCalip’s estimate for a 100 GW buildout: **~25,000 Starship flights** (reported in Engadget, 19 February 2026). Musk’s stated ramp: from about **2,500 tonnes/year to about 1,000,000 tonnes/year in roughly three years** — a **400x** increase in delivered mass. ($1,000,000 \div 2,500 = 400$.) **Against twelve flights in about three years.**
- **The mass arithmetic. 1,000,000 tonnes per year against 10,994.7 tonnes** — the total mass of every active payload currently in orbit (McDowell, 8 July 2026). **That is roughly 91 times everything currently working in orbit, every year.** ($1,000,000 \div 10,994.7 = 90.9$.)
- **The upstream constraint Musk himself names: chip production.** In his 19 November 2025 exchange he identified tonnage to orbit as solved by Starship and chip fabrication as the remaining piece, invoking a proposed Tesla “Terafab.” **The Escape Artist’s bottleneck is somebody else’s fab — and that is the boundary door this lecture does not open.**
- **Amazon’s version of the same arithmetic, filed adversarially:** a one-million-satellite constellation on a five-year life requires replacing **200,000 satellites per year**, against a **2025 global satellite launch output of fewer than 4,600** — a **~44x** gap. **Petition to Deny, 6 March 2026.**

- **The competitor's vehicle. New Glenn:** two flights as of March 2026; Blue Origin's stated plan of **>5,000 TeraWave satellites before end-2027** rests on it.

Bottleneck 2 — radiation.

- **Google's Trillium (v6e) Cloud TPU** was exposed to a **67 MeV proton beam** with the shielding level Google expects to fly, simulating five years of penetrating protons and galactic cosmic rays in LEO. Result: **survived a 5-year-equivalent total ionizing dose without permanent failures; High Bandwidth Memory was the most TID-sensitive subsystem**, with uncorrectable error rates Google called **likely acceptable for inference; single-event effects on training runs require further study. 4 November 2025.**
- **Starcloud-1** demonstrated that a **commercial, non-rad-hard H100** operated through launch vibration, thermal cycling and LEO radiation for its mission. **But a second GPU aboard the same spacecraft — an NVIDIA A6000 — failed during launch.**
- **NVIDIA's answer, 16 March 2026:** architectural hardening rather than exotic rad-hard silicon — **ECC, lockstep, triple modular redundancy** on commercial process nodes, per one analysis. **[SECONDARY, flag before air.]** Products: **Space-1 Vera Rubin Module** (not yet shipping), **IGX Thor** and **Jetson Orin** (available; Orin already in orbit).
- **The honest reading:** radiation was the category's presumed showstopper and it is the constraint that has most clearly *eased* in the last twelve months. **Grant that fully. It is the strongest fact the optimists have and it arrived on schedule.**

Bottleneck 3 — no service calls.

- **The refresh treadmill (the Kicker's material — L2's roadmap, returning at brief-reference grade only).** Lecture 2 established a rack-generation cadence measured in **five to seven years** of useful life against a roadmap that turns over faster. **In orbit, the replacement is a launch.**
- **Design life.** Megaconstellation satellites are designed for roughly **five years**. McCalip's model uses a **5-year analysis period**, a **9.0%/yr GPU failure rate** (slider stops: 0%, CPU 1.5%, **Meta 9%**), and a **2.5%/yr solar cell degradation rate** (stops: 1% shielded, 6% unshielded, 12% polar), producing a **+19.6% GPU margin for failures** and a **+6.5% solar margin for degradation** in the 1 GW fleet.
- **Starcloud-1's design life was 11 months**, after which it deorbits from ~325 km and burns up.
- **The counter-datum, dated and real:** on **21 July 2026**, SpaceX launched a **geosynchronous robotic servicing satellite** on a decade-long mission. **On-orbit servicing exists as an industry. It does not exist at the cost, cadence or altitude that would make a 37,000-satellite LEO fleet serviceable, and the pack states both halves.**
- **The operator arithmetic.** ISS's radiators are **orbital replaceable units** — NASA designed them to be swapped, and the swapping is done by **astronauts in suits and robotic arms**. There are no astronauts in a dawn–dusk sun-synchronous compute constellation.

THE MECHANISM. *Why money doesn't clear it:* launch cadence is a manufacturing and flight-test problem with a serial dependency — each flight informs the next, each anomaly costs weeks, and the propellant logistics alone are industrial (**345 tanker trucks per launch** in McCalip's model). Capital compresses none of that; it can only run more pads. Radiation hardening is a qualification problem measured in beam time and flight heritage. And servicing is a rendezvous-and-proximity-operations problem whose unit cost is currently a dedicated spacecraft per target.

Where the constraint binds: **at flights per year available for data-center deployment.** One published analysis frames it precisely: **\$/kg is the number everyone fixates on, and cadence is the harder half.**

KEY ACTORS.

- **Institution: SpaceX** — simultaneously the bottleneck, the largest applicant, the launch provider to its own competitors, and, since **12 June 2026**, a public company whose shareholders now own the schedule risk.
- **Object: Raptor 3** — 33 on the Super Heavy booster; four failed to light on 16 July 2026; two were removed and replaced. **The object that stopped the escape from Earth on 16 July 2026 was two engines.**
- **Human: Philip Johnston**, who has said publicly that Starcloud is not competitive until Starship flies frequently and that he expects commercial access in 2028–2029.
- **Human: Matt Garman**, whose “not enough rockets” is a statement about cadence, not price, and is therefore the most technically precise thing any executive said in this lecture's territory.

THE DOCUMENTS.

- **Amazon's Petition to Deny, 6 March 2026** — the replacement-rate arithmetic, filed under oath-equivalent proce-

dural obligation by an adversary.

- **SpaceX's four waiver requests, 30 January 2026** — including the exemption from deployment milestones and surety bonds. **Read as a bottleneck document: the applicant asked to be excused from deadlines because it cannot commit to one.**
- **The Suncatcher radiation results** — the one genuinely favorable engineering document in this beat.

VERBATIM BANK.

"To be confident of a good flight, 2 Raptors will be removed & replaced." — **Elon Musk**, then and now CEO of SpaceX, on X, **17 July 2026**, following the Flight 13 abort. (Eleven words. The escape from terrestrial constraint, delayed by two engines.)

Paraphrase, marked, with locator: Amazon's 6 March 2026 Petition to Deny argues that sustaining a million-satellite constellation with a five-year satellite life would require replacing 200,000 satellites per year, against a 2025 global launch output of fewer than 4,600 satellites. **Locator: ICFS SAT-LOA-20260108-00016, Amazon Leo Petition to Deny, 17 pp.**

Paraphrase, marked, with locator: Google's Suncatcher preprint reports that Trillium TPUs survived a total ionizing dose equivalent to a five-year mission life without permanent failures and were characterized for bit-flip errors. **Locator: Suncatcher preprint abstract, 4 November 2025.**

Paraphrase, marked, with locator: SpaceX stated before Flight 13 that Starship would deploy 20 satellites which would extend solar arrays and antennas and attempt to connect with the larger Starlink constellation via high-capacity lasers. **Locator: SpaceX pre-flight statement, quoted by Spaceflight Now, 16 July 2026.**

WHO PAYS. SpaceX shareholders, as of 12 June 2026 — and this is genuinely new. Until the IPO, Starship's schedule risk was privately held. It is now a public-market variable, disclosed in an S-1 that reported **2025 revenue of \$18,674 million, Adjusted EBITDA of \$6,584 million, and a GAAP net loss of nearly \$5 billion.** Every other applicant in this lecture — Starcloud, Blue Origin, Google — is exposed to a schedule they do not control and cannot price. **That is the same structure as Lecture 4's interconnection queue, with a different object at the front of the line.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: the Hyperscaler (Musk) and the Escape Artist (Johnston), pulling in opposite directions on the same variable.** Musk sells cadence as solved; Johnston, who must buy it, says he will not be competitive until it is. **When the buyer and the seller of the same input disagree in public, believe the buyer.**
- **What's real:** the radiation constraint has genuinely eased; the vehicle exists and flies; the propellant logistics are understood.
- **What's oversold:** the ramp. **400x delivered mass in three years, from a vehicle that has not reached orbit, is a forecast with an author.** Move: **DISCOUNT.**
- **What's oversold in the other direction:** "Starship will never work" is not supported either. **HOLD OPEN.**
- **Unknown:** the flight rate SpaceX will actually achieve in 2027; whether propellant transfer demonstrates on schedule; the observed single-event-upset rate on Starcloud-1 (unpublished).

SENSORY & MATERIAL DETAILS.

- **33 Raptor 3 engines** beneath the booster on Pad 2, photographed from the launch stand on **16 July 2026**; four did not light.
- **Ship 40** stacked onto **Booster 20** overnight before the Flight 13 attempt.
- Several heat-shield tiles **painted white** to simulate missing tiles, with six of the twenty Starlink V3 satellites carrying cameras to image them.
- **6,750 tonnes** of total propellant per Starship/Super Heavy stack in McCalip's model, of which **5,283 tonnes (78.3%)** is liquid oxygen — **2.8 GWh of production energy per launch**, and **345 tanker trucks.**
- Starcloud-3's chassis, **already welded up** in Redmond as of 30 April 2026, waiting for a rocket.

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
12 flown / 13 attempted	Starship test flights	flight record	22 Jul 2026	SpaceX / public record	ANCHOR
0	orbital payload deliveries by Starship	flight record	22 Jul 2026	public record	ANCHOR
195 / -7	km apogee/perigee, Flight 12	flown	22 May 2026	SpaceX	ANCHOR
~222	Starship launches per 1 GW	modeled	2026	A. McCalip	CONTESTED
~25,000	Starship flights per 100 GW	modeled	Feb 2026	A. McCalip via Engadget	CONTESTED
2,500 → 1,000,000	tonnes/year to orbit, 3-year target	claim	Jun 2026	Musk/SpaceX	CONTESTED
200,000	satellites/yr replacement, 1M constellation	adversarial arithmetic	6 Mar 2026	Amazon Leo	STRUCTURAL
<4,600	satellites launched globally, 2025	fact as filed	6 Mar 2026	Amazon Leo	STRUCTURAL
67	MeV proton beam energy, TPU test	test	4 Nov 2025	Google	ANCHOR
5	years TID equivalent survived	test result	4 Nov 2025	Google	STRUCTURAL
9.0	%/yr GPU failure rate assumption	modeled	2026	A. McCalip (Meta-derived)	CONTESTED
2.5	%/yr solar cell degradation	modeled	2026	A. McCalip	STRUCTURAL
11	months, Starcloud-1 design life	design	Nov 2025	Starcloud/Astro Digital	ANCHOR
2	New Glenn flights to date	flight record	Mar 2026	Blue Origin	ANCHOR

STRESS-TEST VERDICT: SUSTAINABLE. Three distinct bottlenecks, each with a dated flight record or a dated test result, plus an adversarial filing that does the arithmetic for you, plus a five-day-old abort. The beat's structural strength is that **one of the three bottlenecks genuinely eased** — the radiation result — which keeps it from being a list of reasons it won't work.

Beat 8 — The Externality Swap (no neighbors and no water, priced)

Syllabus 2.0 assignment. No neighbors and no water — paid for in launch mass, radiator area, and a refresh cycle with no screwdriver; both sides priced honestly.

Beat Menu definition. *The Externality Swap — Atoms/Money • versatile, closer-capable • warm (4–5).* The pick-your-poison tradeoff. **Sustained by pricing both sides of the swap honestly — the beat fails if one option is a strawman.** (This is the strictest evidentiary requirement in the Beat Menu and this beat is where a lecture about orbit is most likely to break it.)

SIDE A — WHAT ORBIT DELETES. Priced honestly, and it is a lot.

- **Land.** Zero acres. No farmland rezoned, no special-use permit, no comprehensive-plan amendment, no county board.
- **Water.** Zero gallons per day, evaporative or closed-loop. There is no cooling tower, no municipal draw, no aquifer, no discharge permit. **This is total, not partial, and the course has spent three lectures establishing exactly how much that is worth.**

- **The grid.** No interconnection request, no system impact study, no facilities study, no seven-year line, no transformer lead time, no substation. No large-load tariff, no rate class, no cost-allocation docket, no transmission rider.
- **The neighbor.** No fence line. No decibels. No turbine yard. No well downgradient. **No household anywhere on Earth gets a bill because a satellite went up.**
- **Local politics.** No council vote, no moratorium bill, no election.
- **Emissions during operation.** Sunlight, converted, with no fuel and no combustion. Johnston's claim: **10x carbon-dioxide savings over the data center's life** versus terrestrial power, with the launch as the only environmental cost.
- **Speed of siting.** The permitting timeline is an FCC docket rather than a land-use process, and the FCC accepted a million-satellite application **five days after filing.**

SIDE B — WHAT ORBIT BUYS INSTEAD. Priced honestly, and it is also a lot.

- **Launch mass.** 22.2 million kilograms to LEO per gigawatt in McCalip's model — roughly **twice the total mass of every active payload currently in orbit** (10,994.7 t, McDowell, 8 July 2026). (*Pack arithmetic:* $22,200 \text{ t} \div 10,994.7 \text{ t} = 2.02$.)
- **Terrestrial energy, spent to escape terrestrial energy.** The same model: **105 GWh of total launch energy** for a 1 GW buildout; **175 million gallons of LOX** and **168 million gallons of methane**; **2.8 GWh of production energy per launch** for oxygen alone; **~0.2% of the Texas grid's daily consumption** and **1.8% of Texas LOX capacity**; **345 tanker trucks per launch.** The escape from the grid is financed by the grid, and the line item is in Texas.
- **Radiator area.** The full Beat 5 and 6 material: **the radiator is roughly the size of the solar array**, roughly doubling spacecraft size and mass for cooling alone. **The "free cooling" is the most expensive subsystem.**
- **The refresh cycle with no screwdriver.** Five-year design lives; **9%/yr** assumed GPU failure; **2.5%/yr** cell degradation; **no technician.** Every failure is a write-off or a launch.
- **The atmosphere — the externality nobody is metering.** Every megaconstellation satellite is designed to burn up. On reentry, aluminum structure vaporizes into **aluminum oxide nanoparticles** that **catalyze ozone-destroying chlorine reactions without being consumed.** USC (Geophysical Research Letters, June 2024): **2022 satellite reentries raised atmospheric aluminum oxide 29.5% above natural levels**; **~17 metric tons of alumina**; **total aluminum from reentries ~41.7 metric tons that year**; **an eightfold increase in stratospheric aluminum oxides between 2016 and 2022**; **a projected increase of up to 646% if all currently planned constellations fly.** February 2026, Leibniz Institute for Atmospheric Physics (Kühlungsborn), in *Communications Earth & Environment*: the first study to tie a specific reentry event to a detectable atmospheric plume. **HF-3 — comedy off.**
- **The night sky.** IAU CPS recommendation (Boley et al. 2025, Research Notes of the AAS): **satellites below ~550 km should be fainter than visual magnitude 7**; at 1,000 km, fainter still — **approximately magnitude 7.6.** Project Sunrise proposes **500–1,800 km**; SpaceX's ODC system **500–2,000 km.** The AAS's petition includes simulated brightness comparisons across latitudes 20/30/40° N at nautical twilight and midnight on the summer solstice. **The AAS states in its reply that SpaceX has claimed to have reached VM7 with Starlink and has not.** Meanwhile a CPS study by Anthony Mallama et al. found **92% of studied Amazon Leo satellites exceeded the IAU CPS recommended threshold.**
- **Orbital congestion.** **34,049 total catalogued objects in orbit** as of 8 July 2026, of which **16,234 are active payloads**, **11,160 catalogued debris**, **2,666 ASAT debris**, **774 collision debris**, **2,044 rocket stages.** Against **1.7 million+ additional satellites** in proposals now on file globally, per reporting synthesizing the current application set. **The main Starlink shell at ~550 km is, per published analysis, already within a runaway-cascade threshold by density and cross-section.**
- **The jobs.** Starcloud has **15 employees.** Lecture 8 established the data center as the physical avatar of automation anxiety; the orbital version of that building has a headcount you could seat at one table. **HF-4 — state it as fact.**

THE MECHANISM — the swap, stated as a mechanism rather than a list. Every constraint orbit deletes is a constraint that has a *forum*: a county board, a utility commission, a rate case, a permit, an election. Every constraint orbit adds is one that has **no forum at all.** There is no docket for the stratosphere. The FCC has treated satellite licensing as **categorically excluded** from NEPA environmental review — a position DarkSky International challenged in court in 2023 over Starlink Gen2 and **lost**, with the court holding that the FCC reasonably concluded SpaceX's mitigation efforts were sufficient to avoid significant environmental impacts, and citing SpaceX's collaboration with astronomers as evidence of good faith. **That is the swap in one sentence: you exchange a set of costs with venues for a set of costs without them.**

Where the constraint binds: at the **regulatory forum**, not at the physics. **The reason this is an Externality Swap and not a Perverse Incentive is that both columns are real and both are large.**

KEY ACTORS.

- *Institution:* **the FCC**, which holds the only forum and whose statutory remit is spectrum.
- *Institutions:* **the American Astronomical Society, the International Astronomical Union (and its Centre for the Protection of the Dark and Quiet Sky, CPS), the Royal Astronomical Society, the European Southern Observatory, DarkSky International, Viasat**, and named individual petitioners **William Stewart** (12 February 2026) and **Nickolai Bakken**. *Motive:* the continued usability of ground-based observatories, most of them taxpayer-funded. *Exposure:* their instruments' entire scientific output. *What they filed:* petitions to deny, oppositions, and a NEPA demand.
- *Human:* **Aaron Boley**, associate professor of astronomy and astrophysics, University of British Columbia — lead author on the IAU CPS brightness rationale and a long-standing documented voice on reentry deposition. **Wants:** a regulated experiment rather than an unregulated one. **Can enforce:** nothing. **HF-2.**
- *Institution:* **the National Science Foundation** and the **Vera C. Rubin Observatory**, named in SpaceX's own opposition as the advocates of the VM7 threshold it says it is targeting.

THE DOCUMENTS.

- **AAS Petition to Deny, 6 March 2026** (with brightness simulation figures) and **AAS Reply, 23 March 2026**.
- **DarkSky International Opposition Brief, 6 March 2026** — demands an Environmental Impact Statement under NEPA.
- **Petition for Environmental Review of Nickolai Bakken** — invokes NEPA's irreversible-and-irretrievable-commitment-of-resources requirement. (*A private individual, invoking irreversibility, in the docket for a data center. Note this for Lecture 10 — see §10.*)
- **SpaceX Consolidated Opposition, 16 March 2026** — the BRDF modeling commitment and the VM7 target.
- **TechFreedom Comments, ~23 March 2026** — a third-party catalog of the NEPA arguments.
- **Ferreira/Wang et al., Geophysical Research Letters, June 2024; Leibniz Institute study, Communications Earth & Environment, February 2026; Boley et al. 2025, Research Notes of the AAS.**

VERBATIM BANK.

“Now it looks like we are going to run this experiment without any oversight or regulation. We don't know what the thresholds are” — Aaron Boley, associate professor of astronomy and astrophysics, University of British Columbia, on alumina deposition in the upper atmosphere, quoted by Space.com. [NOTE: the underlying interview predates this lecture's window; Boley's position is restated in current coverage (Engadget, 19 February 2026). Verify the current-window restatement before deploying, or attribute to the original date.] HF-3 — comedy off.

“the FCC reasonably concluded that SpaceX's mitigation efforts...were sufficient to avoid significant environmental impacts” — U.S. court holding in the 2023 DarkSky International challenge to the Starlink Gen2 authorization, as quoted by astrobites, 26 February 2026. [SECONDARY-QUOTED PRIMARY — pull the opinion before air.]

Paraphrase, marked, with locator: The AAS reply states that the IAU recommends satellites below approximately 550 km be fainter than visual magnitude 7 so as not to be visible to casual observers, and that satellites at higher altitudes should be fainter still — approximately magnitude 7.6 at 1,000 km — and disputes SpaceX's claim to have reached VM7 with Starlink. **Locator:** AAS Reply, ICFs SAT-LOA-20260108-00016, 23 March 2026, at 2–3.

WHO PAYS. This is the beat where the lecture's who-pays actually gets answered, and the answer is not “the cap table.” The cap table pays the dollars. **The unpriced payers are: the upper atmosphere (in alumina, unmetered), ground-based observational astronomy (in observing time, quantified in the AAS filings), and every future orbital operator (in congestion and conjunction risk, quantified in McDowell's catalog).** None of the three has a rate case. None of the three has a commission. **The FCC's categorical exclusion is the fence, and in 2023 a court held it high enough.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller on Side A: the Escape Artist.** What's real: **all of it.** The land, water, grid, neighbor and rate-case escapes are complete, not partial, and the beat fails if the narrator hedges them. What's oversold: the **10x CO₂** claim, which depends on unmodeled launch emissions, a 5-year asset life, and a comparison to a grid-average rather than a marginal terrestrial data center. Move: **GRANT-AND-WITHHOLD.**

- **Seller on Side B: the Doomer.** What's real: alumina deposition is measured, dated, peer-reviewed and rising; brightness exceedances are measured (92% of studied Amazon Leo satellites); congestion is catalogued. What's oversold: "it will destroy astronomy" is a forecast, not a measurement, and the strongest version of the claim depends on constellations that have not been authorized. Move: **DISCOUNT**, applied symmetrically.
- **Motivated on both sides:** Viasat, a competitor, is among the parties raising atmospheric concerns against SpaceX. **Say so.** The astronomers are not commercially motivated; the competitor is; the filings are in the same docket.
- **Unknown:** the atmospheric threshold. Boley's own position is that nobody knows what it is.

SENSORY & MATERIAL DETAILS.

- **~17 metric tons** of aluminum oxide nanoparticles released in a single year (2022) by objects burning up on reentry — a quantity smaller than one truckload of gravel, dispersed through the mesosphere and stratosphere, catalytic and not consumed.
- On any given clear night, **most satellites visible to a casual observer are Starlink satellites** (AAS reply).
- A dawn–dusk sun-synchronous satellite is lit when you are dark. **That is the geometry, and it is the same geometry that makes the orbit good for power.**
- **10,736 active Starlinks** in Lower LEO on 8 July 2026, weighing **5,897.9 tonnes** — more than half of all active payload mass in orbit.

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
0	gallons/day water	design	2026	all applicants	ANCHOR
0	acres, interconnection requests, rate cases	design	2026	all applicants	ANCHOR
22.2M	kg to LEO per 1 GW	modeled	2026	A. McCalip	CONTESTED
105	GWh launch energy per 1 GW	modeled	2026	A. McCalip	CONTESTED
175M / 168M	gallons LOX / methane per 1 GW	modeled	2026	A. McCalip	CONTESTED
+29.5%	atmospheric Al oxide above natural, 2022	measured/modeled	Jun 2024	USC / GRL	STRUCTURAL
~17	metric tons alumina, 2022 reentries	modeled	Jun 2024	USC / GRL	STRUCTURAL
~41.7	metric tons total Al from reentries, 2022	modeled	Jun 2024	USC / GRL	STRUCTURAL
up to +646%	projected Al oxide if all planned constellations fly	forecast	Jun 2024	USC / GRL	CONTESTED
8x	increase in stratospheric Al oxides, 2016–2022	measured	2024–26	USC	STRUCTURAL
VM 7 / 7.6	visual magnitude limits at ~550 km / 1,000 km	recommendation	2025	IAU CPS / Boley et al.	STRUCTURAL
92%	of studied Amazon Leo satellites exceeding threshold	measured	2026	Mallama et al. / IAU CPS	STRUCTURAL
34,049	total catalogued objects in orbit	measured	8 Jul 2026	J. McDowell	ANCHOR
11,160	catalogued debris objects	measured	8 Jul 2026	J. McDowell	ANCHOR
15	Starcloud employees	headcount	2026	Starcloud	VOLATILE

STRESS-TEST VERDICT: SUSTAINABLE — and it is the beat most likely to be the lecture's best. Both columns are fully priced from primary and peer-reviewed sources; neither is a strawman; the swap has a mechanism (forum versus no forum) rather than just a ledger; and the human floor sits inside it. The hazard is length and tone: **HF-2, HF-3 and HF-4 all live in this beat and the comedy must come down for all three.**

Beat 9 — The Forecast Problem (Bezos's and Musk's dated remarks as motivated forecasts with owners)

Syllabus 2.0 assignment. Bezos's and Musk's dated remarks as motivated forecasts with owners.

Beat Menu definition. *The Forecast Problem* — Money/Politics • versatile • warm (4–5). Load forecasts as political documents. **In this lecture the forecast is not a utility's load filing but a founder's capacity claim, and the rate case is an IPO.** L1 installed forecast-as-fiction with IEA/EPRI/LBNL; L4 ran it on Wilson's inflection call; L10 runs it on the 2001 rhyme. **This deployment's distinguishing feature: the forecasts here are personal, spoken, dated to the day, and made by two men who between them control the world's launch capacity.**

THE FORECASTS, EACH WITH ITS OWNER, VENUE AND DATE.

Forecast 1 — Bezos, 3 October 2025, Turin. Gigawatt-scale data centers built in space within **10 to 20 years**, eventually outperforming terrestrial ones on continuously available solar. Venue: **Italian Tech Week**, fireside chat with **John Elkann**, chairman of Ferrari and Stellantis. Reporters: **Elvira Pollina and Giulio Piovaccari, Reuters**. *Owner's position:* founder and owner of **Blue Origin**, which will file for 51,600 satellites 167 days later; executive chair of **Amazon**, whose cloud unit's CEO will publicly disagree 123 days later, and whose satellite unit will petition against a competitor's identical application 154 days later. *What he gets if you believe it:* a market narrative for New Glenn, a demand story for TeraWave, and a strategic frame in which Blue Origin is early rather than late.

- **In the same conversation** Bezos compared the AI surge to the early-2000s internet boom, urged optimism despite bubble risk, and drew a distinction between industrial bubbles and financial ones. **He is, at the same event, both a forecaster of the buildout and a commentator on whether it is a bubble.** (Note for the drafting AI: the FRAMING move is Lecture 1's and Lecture 10's. Do not resolve it here. Register the fact and move.)

Forecast 2 — Musk, 19 November 2025, on X. Starship should be able to deliver **around 300 GW per year of solar-powered AI satellites to orbit, maybe 500 GW**; average U.S. electricity consumption stated as “500 GW”; at 300 GW/yr, AI in space would exceed the entire U.S. economy in intelligence processing every two years; **chip production is the remaining piece**, requiring a “Tesla Terafab.” Prompt: a post by **Marc Benioff**, chairman and CEO of Salesforce.

- **The unit failure inside the forecast, which the audit should name precisely and without malice:** “300 GW per year” mixes a **rate** with a **rate of deployment**. A gigawatt is a rate; “gigawatts per year” is an *addition* of capacity per year, which is coherent — but the comparison drawn against “average U.S. electricity consumption of 500 GW” compares **annual added orbital capacity** against **instantaneous national demand**, which are different species of claim. FERC data for the prior year gives U.S. generation above **4,151 TWh**, which over 8,760 hours is roughly **473 GW average** — so the 500 GW figure is approximately right *as an average rate*, and the comparison is still not apples to apples. **This is the course's cardinal rule, violated in public by the person who owns the rockets, and it is fully documented.**

Forecast 3 — Musk, 8–10 June 2026, days before the IPO priced. An annualized **1 GW/year by end of 2027**, then **10 GW, 100 GW**, eventually **1 TW per year**; delivered mass from about **2,500 t/yr to about 1,000,000 t/yr in about three years**; and the framing that no magic is required because Starlink V3 already ships the solar, thermal, propulsion, shielding and laser-link stack. Venue: a ~30-minute interview with SpaceX executives posted on X, plus the **AI1** design reveal. *What he gets if you believe it:* an IPO narrative. **The IPO priced on 11 June 2026 and listed on 12 June.**

Forecast 4 — Musk's “basic math,” restated across the corpus. Launching **1 million tonnes per year** of satellites generating **100 kW of compute power per tonne** would add **100 GW of AI compute capacity annually, with no ongoing operational or maintenance needs.** (Check the arithmetic: $1,000,000 \text{ t} \times 100 \text{ kW/t} = 100,000,000 \text{ kW} = 100 \text{ GW}$. **The arithmetic is internally correct.** The load-bearing assumptions are the 100 kW/t specific power — against McCalip's Starlink-heritage **36.5 W/kg = 36.5 kW/t**, a **2.7x gap** — and “no ongoing operational or maintenance needs,” which contradicts every design-life and failure-rate figure in Beat 7.)

Forecast 5 — Johnston, October 2025. In ten years, nearly all **new** data centers will be built in outer space. *Owner's position:* CEO of a company then valued below unicorn status, raising into the claim.

Forecast 6 — the institutional forecasts, for contrast. **Google:** launch costs must reach ~\$200/kg, plausibly mid-2030s. **Thales Alenia Space / European Commission:** 1 GW before 2050, contingent on a launcher 10x less emissive. **SemiAnalysis (reported):** parity ~2040. **Deutsche Bank (reported):** parity “well into the 2030s” rather than 2028–2029. **Introl:** 2028–2030 for specific workloads. **ABI Research (reported):** over 35 companies in the orbital-data-center ecosystem as of mid-2026. **BIS Research (reported):** market ~\$1.8B by 2029 growing to ~\$39B by 2035. [The last three are single-sourced secondary; flag before air.]

- **The spread among institutional forecasts for the same event is 2028 to 2050 — twenty-two years.** That is the beat.

THE MECHANISM. *How a spoken forecast becomes a financial instrument:* a dated remark at a conference or on a social platform → repetition in trade and mainstream press → incorporation into analyst models → citation in an S-1 risk factor or growth narrative → a price. **The forecast in this lecture has a shorter path from mouth to mark than any forecast in the course: Musk’s AI1 reveal and capacity ramp were posted on 8 June 2026 and the shares priced on 11 June 2026.** (Three days. Pack arithmetic on published dates.)

Where the constraint binds: at **specific power (W/kg)** and **launch cadence** — the two variables every one of these forecasts silently assumes and none of them publishes a sensitivity table for. **Except one: McCalip’s, which is a slider.**

KEY ACTORS.

- **Jeff Bezos** — as-of title on 3 October 2025: founder of Blue Origin; executive chair, Amazon.com, Inc.
- **Elon Musk** — as-of title throughout: CEO, SpaceX (and, from 2 February 2026, of the merged SpaceX–xAI entity; from 12 June 2026, of a Nasdaq-listed company).
- **Marc Benioff** — chairman and CEO, Salesforce, 19 November 2025: the prompt.
- **John Elkann** — chairman, Ferrari and Stellantis, 3 October 2025: the interlocutor.
- **Ian Dahl** — SpaceX engineer, on the record in the 8 June 2026 walkthrough.
- **Tim Farrar** — TMF Associates: the analyst who called the SpaceX filing rushed and IPO-oriented.
- **Sundar Pichai** — as-of title 4 November 2025: CEO, Alphabet and Google. The institutional counterweight: a moonshot framing with a named 2027 test and a named mid-2030s cost precondition.

THE DOCUMENTS.

- **Reuters wire copy, 3 October 2025** — the Bezos forecast’s primary record.
- **X posts, 19 November 2025 and 8 June 2026** — the Musk forecasts’ primary records; both dated and archived.
- **The Suncatcher preprint, 4 November 2025** — the only forecast in this beat that publishes its own disqualifying condition.
- **The SpaceX S-1, filed 20 May 2026** — where a forecast becomes a disclosure obligation.

VERBATIM BANK.

*“we’re going to start building these giant gigawatt data centres in space” — Jeff Bezos, then founder of Blue Origin and executive chair of Amazon, **Italian Tech Week, Turin, 3 October 2025**, in conversation with John Elkann; reported by Reuters (Elvira Pollina and Giulio Piovaccari).* (Twelve words.)

*“Starship should be able to deliver around 300 GW per year of solar-powered AI satellites to orbit, maybe 500 GW” — Elon Musk, then and now CEO of SpaceX, on X, **19 November 2025**, replying to Marc Benioff. [SECONDARY-QUOTED PRIMARY — the post is archived; verify the string on X before air.]*

Paraphrase, marked, with locator: Bezos said at the same event that these giant training clusters would be better built in space because of 24/7 solar power with no clouds, rain or weather, and that the cost of terrestrial data centers would be beaten in space within a couple of decades. **Locator: Reuters, 3 October 2025.**

Paraphrase, marked, with locator: Musk stated in the June 2026 interview that part of the message was that no magic is necessary for the orbital AI satellites that does not already exist, and that SpaceX does not think of it as a super-hard problem compared with things it already does. **Locator: Light Reading, 10 June 2026, reporting the ~30-minute X interview.**

WHO PAYS. Forecasts in this lecture are paid for by **equity holders**, and as of 12 June 2026 that includes public ones. **This is a genuine structural difference from Lectures 4 and 7, where the forecast’s cost lands in a rate base and the ratepayer pays whether the forecast was right or not.** Here, if the forecast is wrong, the loss stays with the people who

bought the stock. **The audit should say that plainly, because it is the strongest thing that can honestly be said in the category's favor.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Sellers: the Hyperscaler (Musk, Bezos) and the Escape Artist (Johnston).** Move: **DISCOUNT**, which the Style Guide names as the natively hottest move in this course. Grant the direction — orbital compute capacity will grow from ~0. Name whose model it is and its load-bearing assumptions: **specific power in W/kg, launch cadence in flights per year, asset life in years, and chip supply.** Output a range and a set of assumptions, never a bare number. **Recall the forecast graveyard: this lecture's own record contains Blue Origin's >5,000 TeraWave satellites before end-2027 against zero flown, and Amazon's 1,618-by-July-2026 milestone against ~210 flown.**
- **Contested:** every figure in this beat.
- **Motivated:** all of them, in the same direction, by parties who own the launch capacity.
- **Symmetric skepticism required:** the “it's all vapor” reading is also a forecast. Starcloud flew a real GPU; Google ran a real beam test; China flew twelve real satellites. **DISCOUNT cuts both ways.**

SENSORY & MATERIAL DETAILS.

- The Bezos remark was made **on a stage in Turin**, at an event whose other headliner was a car-company chairman.
- The Musk 300 GW remark was a **reply to a Salesforce CEO's video post.**
- The AI1 reveal was **a design image and an engineering walkthrough posted to a social platform three days before an IPO priced.**
- Google's forecast is **a preprint with a references section.**

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
10–20	years to gigawatt-scale orbital DCs	forecast	3 Oct 2025	J. Bezos	CONTESTED
300–500	GW/yr deliverable by Starship	forecast	19 Nov 2025	E. Musk	CONTESTED
1 → 10 → 100 GW → 1 TW/yr	capacity ramp	forecast	Jun 2026	E. Musk / SpaceX	CONTESTED
100	kW compute per tonne launched	assumption	2026	E. Musk	CONTESTED
36.5	W/kg (=36.5 kW/t) Starlink-heritage specific power	modeled	2026	A. McCalip	STRUCTURAL
~473	GW U.S. average generation rate (4,151 TWh ÷ 8,760 h)	derived	prior year	FERC data, pack arithmetic	STRUCTURAL
~\$200/kg	launch cost precondition	forecast	4 Nov 2025	Google	STRUCTURAL
mid-2030s	when ~\$200/kg might arrive	forecast	4 Nov 2025	Google	CONTESTED
2028–2050	span of institutional parity forecasts	range	2024–2026	multiple	CONTESTED
>35	companies in ODC ecosystem, mid-2026	count	2026	ABI Research (reported)	VOLATILE, single-sourced

STRESS-TEST VERDICT: SUSTAINABLE. Six dated forecasts with named owners, venues and beneficiaries; one internally checkable piece of arithmetic; one documented unit-hygiene failure by the most powerful forecaster; and a twenty-two-year spread among institutions. The beat is also where the As-Of Stamp's thematic work is easiest — though the moves plan spends the Stamp elsewhere (§4).

Beat 10 — The Symbol Audit (deployment 3 of 3: orbit-as-destiny, audited as procurement)

Syllabus 2.0 assignment. Orbit-as-destiny audited as procurement — deployment 3 of 3, cast deliberately on the gigawatt rhetoric.

Beat Menu definition. *The Symbol Audit — Politics • versatile, closer-capable • hard cap: 3 deployments course-wide.* A symbolically loaded object treated strictly as procurement: Three Mile Island as an 835 MW PPA rather than a redemption arc; Stargate as a construction schedule rather than a moonshot. Comedy-native and very this-course — **which is exactly why it's capped. This is the beat most likely to calcify into a tic, so it appears at most three times, cast deliberately.**

CAP AUDIT — FINAL. L5: Three Mile Island Unit 1 / Crane Clean Energy Center. L8: Stargate. L9: orbit-as-destiny. Three deployments, three deliberate castings. **Declined candidates on the record, each documented by the pack that declined it: L2 (the GTC keynote-as-arena, the leather jacket, the rack as trophy); L3 (the jar of brown water at a congressional hearing); L6 (the IPO bell, the NVIDIA backstop); L7 (none surfaced at grade). The cap is intact and this is the last deployment. Nothing after this lecture may run one.**

THE SYMBOL, AND WHAT IT ACTUALLY IS.

The symbol: space as destiny; the expansion of consciousness; the multiplanetary species; the Kardashev ladder; the escape from a finite planet. It is the most powerful symbolic register in American industrial culture and it has been attached, in the last twenty months, to **the procurement of server capacity.**

The procurement, itemized:

- **A 14-page Ka-band spectrum application** for telemetry, tracking and control, filed 19 March 2026, with no schedule and no power figure.
- **Four requested waivers** from deployment milestones, surety bonds, processing-round procedures and Schedule S disclosure, filed 30 January 2026.
- **A rideshare slot** on a Falcon 9 SmallSat mission with 17 other payloads.
- **A 60 kg spacecraft on a commercial microsatellite bus** with an 11-month design life.
- **Bitcoin-mining ASICs**, flown as a revenue bridge for periods of low AI utilization.
- **Hosted payloads** from the Department of Defense and Earth-observation customers, which per the CEO cover the entire development cost of the next spacecraft.
- **A trademark dispute** that forced a rename.
- **A director of commercial sales for data center markets**, advertised as a job opening.
- **Two Raptor engines**, removed and replaced.

The audit's method, per the Beat Menu: **treat the symbol strictly as procurement and let the gap do the work. Do not mock the aspiration.** The Style Guide's calibration is explicit: incentives plus constraints, never villainy, never rube-ery.

THE DOCUMENTED SYMBOLIC LANGUAGE, DATED.

- **SpaceX, Application Narrative at 1, 30 January 2026**, as quoted by the FCC in **Public Notice DA 26-113, 4 February 2026**: the system as a **first step towards becoming a Kardashev II-level civilization — one that can harness the Sun's full power. The Commission then footnoted the definition and cited a 1964 Soviet Astronomy paper.** *The symbol and its audit are in the same federal document, and the audit was performed by a footnote.*
- **Elon Musk, blog post announcing the xAI merger, 2 February 2026**: the capabilities unlocked by making space-based data centers a reality will fund and enable self-growing bases on the Moon, an entire civilization on Mars, and ultimately expansion to the universe. **The document announcing this is a merger announcement.**
- **Jensen Huang, GTC keynote, 16 March 2026**: space computing, the final frontier, has arrived — and, in the same keynote, that there is no convection in space, only radiation, and the cooling problem has to be figured out. **The destiny sentence and the constraint sentence, from the same stage, minutes apart.**
- **Andrew McCalip, personal page, 2026**: the closing register of a skeptical economic model turns, in its final sections, to burning capital like a torch to light up a corner of the future and building cathedrals. **Even the auditor reaches for the symbol. That is the honest version of this beat: the symbol is not a con, it is the reason anybody is doing the arithmetic at all.**
- **Blue Origin's application**, by contrast, contains **none of this**. It is written in flat regulatory prose about compute

tiers and mounting pressure on infrastructure. **The most symbolically loaded company in the field filed the least symbolic document, and the audit should notice.**

THE MECHANISM. *How the symbol does financial work:* destiny language raises the perceived option value of an unproven asset, which lowers the discount rate applied to a distant cash flow, which raises a mark. It also does *regulatory work*: an application framed as a civilizational first step is harder to characterize as spectrum warehousing. And it does **recruiting work** — a company with 15 employees competing against SpaceX and Google for engineers is selling a mission, not a salary.

Where the constraint binds: **at the FCC's footnote.** The symbol survives every venue except the one where a clerk has to define it, and there it becomes a citation to *Soviet Astronomy*, volume 8, pages 217–221.

KEY ACTORS. Musk, Huang, Bezos, Johnston, McCalip — all as above, with as-of titles. Institution: **the FCC Space Bureau**, the unwitting auditor.

VERBATIM BANK. (*The lecture's Verbatim move may deploy only once; the assignment spends it on the satellite count. Everything below is available as attributed short quotation under the standing rules, not as The Verbatim.*)

“first step towards becoming a Kardashev II-level civilization – one that can harness the Sun's full power” — SpaceX, Application Narrative at 1, quoted in FCC Space Bureau Public Notice DA 26-113, released 4 February 2026, ICFS SAT-LOA-20260108-00016. FULLY VERIFIED PRIMARY. Footnoted by the Commission to N.S. Kardashev, Transmission of Information by Extraterrestrial Civilizations, 8 Soviet Astronomy 217–221 (1964).

Paraphrase, marked, with locator: In the 2 February 2026 blog post announcing the SpaceX-xAI merger, Musk wrote that the capabilities unlocked by making space-based data centers a reality will fund and enable self-growing bases on the Moon, an entire civilization on Mars, and ultimately expansion to the universe. **Locator: Musk blog post, 2 February 2026, quoted by Fortune, 3 February 2026.**

WHO PAYS. Nobody, directly — and that is the point of running the Symbol Audit here rather than in Lecture 5 or 8. At Three Mile Island the symbol was attached to an 835 MW PPA with a counterparty and a price. At Stargate it was attached to a construction schedule in a real county. **Here the symbol is attached to an application.** The only cost it imposes is on the attention and the coordination burden of everyone else in the docket — which is Beat 12.

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: the Escape Artist, in its purest documented form.** Move: **STRIP.** Remove the story — the Kardashev ladder, the Martian civilization, the final frontier — and leave standing the documented thing: a Ka-band TT&C application, a rideshare slot, an 11-month design life, and a bitcoin miner flown as a revenue bridge. **Never mock the people who believed it.** The Style Guide is explicit and the material makes it easy: the skeptic's own model page ends with cathedrals.
- **Not contested:** the language exists, dated, in federal documents and corporate announcements.
- **The honest counterweight, which the beat must carry:** the symbol is doing real work that procurement language cannot do. It recruits, it capitalizes, and it sustains a decade-long build. **The audit is of the gap, not of the aspiration.**

SENSORY & MATERIAL DETAILS.

- The Kardashev citation in DA 26-113 sits in a footnote roughly one-fifth of the way down a **two-page** public notice, between a call sign and a list of waiver requests.
- **Call Sign S00798.** The Kardashev Type II civilization has a call sign.
- The bitcoin ASICs on Starcloud-2 are there for **periods of low AI utilization** — a hedge, in orbit, against the demand the whole thesis assumes.

STRESS-TEST VERDICT: SUSTAINABLE. Five dated instances of destiny language, one of which is quoted and then footnoted by a federal agency; a procurement itemization with nine concrete artifacts; and an honest counterweight from the skeptic's own document. **Cap-compliance is verified and final.**

Beat 11 — The Steelman (*defendant: the orbital case at its strongest*)

Syllabus 2.0 assignment. *Defendant: the orbital case at its strongest* — launch-cost curves, the rate-case escape, the solar arithmetic, granted fully before the audit stands.

Beat Menu definition. *The Steelman* — Audit • never opener • strongly encouraged, not universal • warm (4–5), target 6–8 lectures. The full-throated strongest case for whoever's about to look worst, **sustained by the defendant's actual numbers and constraints — a précis of the weak version is not a steelman.** Rotation rule: a different defendant every deployment; the same party is never steelmanned twice. Rotation check: PASS (L1 county · L4 PJM's queue · L5 BTM customer · L6 neocloud CFO · L7 Dominion · L8 White House · **L9 the orbital case** · L10 hyperscaler capex).

Note on position: the Steelman sits at position 11, *after* the Physics Audit at 6 and the Bottleneck at 7. **That ordering is unusual for this beat and the pack flags it as the strongest markup question in the lecture** — see Section 3's closing summary. The Beat Menu's phrasing is "the strongest case for whoever's about to look worst," which implies the steelman precedes the damage. Here it follows it. **The pack does not re-sequence; it flags.**

THE CASE, IN THE DEFENDANT'S OWN NUMBERS AND CONSTRAINTS.

1. The solar arithmetic is real and it is not marginal. 1,361 W/m² at AM0, with no atmospheric attenuation, no clouds, no night at the terminator, and no seasonal derating. Google's own figure: **up to 8x more productive than on Earth.** McCalip's model, hostile to the thesis, still parameterizes terminator orbit sunlight fraction at ~98% against LEO's ~60%. **No battery mass is required.** This is not a projection; it is orbital mechanics and a solar constant.

2. The escape from the terrestrial constraint stack is total, not partial. Zero acres, zero gallons, zero interconnection requests, zero rate cases, zero moratorium bills, zero council votes. **This course has spent eight lectures documenting exactly how expensive each of those is.** Lecture 4 established a multi-year interconnection line; Lecture 7 established the rate case as the true battlefield; Lecture 8 established that the fight has run out of forums. **The orbital case's strongest argument is not that orbit is cheap. It is that the terrestrial alternative is, in specific places, unavailable at any price.** The relevant comparison is not orbit against the best terrestrial data center — it is orbit against the building that cannot be built.

3. The radiation objection has been substantially retired, on schedule, with data. Google, 4 November 2025: Trillium v6e TPUs survived a **5-year-equivalent total ionizing dose** in a 67 MeV proton beam at expected flight shielding, without permanent failures; HBM most sensitive; error rates likely acceptable for inference. **Starcloud, November–December 2025:** a commercial, non-rad-hard **H100** operated through launch, thermal cycling and LEO radiation, trained a model and ran an LLM. **NVIDIA, 16 March 2026:** a shipping product line built on commercial process nodes with architectural hardening rather than exotic rad-hard silicon. **The presumed showstopper produced three independent favorable data points in nineteen months.**

4. The launch-cost curve is the only variable, and it has one owner with every incentive to move it. SpaceX is simultaneously the launch provider, the largest applicant, and — since 12 June 2026 — a public company that has told investors this is a growth line. **McCalip's own conclusion, from a model that comes out against the thesis:** it is not obviously stupid and not a sure thing; it gets within striking distance under aggressive assumptions; and the list of organizations positioned to try is basically one, because **vertical integration is the whole ballgame.** **The skeptic's model identifies the winning strategy and names the winner.**

5. The model that is most cited against the thesis is biased toward it and still leaves out the hardest parts — in both directions. McCalip's stated assumptions omit dedicated radiator mass, cooling-loop mass, shielding mass, deorbit and regulatory costs — all optimistic. **But his terrestrial comparator is also aggressive:** an on-site H-class combined-cycle gas plant at the fence line with **grid interconnection and transmission not costed, permitting excluded, water availability assumed, no scarcity or discharge penalties, and no adjustment for regulatory delay.** **In other words, the terrestrial benchmark in the most-cited skeptical model is a data center that has already solved every problem Lectures 4, 5, 7 and 8 are about.** *This is the single strongest point available to the defendant and it comes from the prosecution's own assumptions list.*

6. The business is financeable before parity, and there is evidence of that today. Johnston, 30 March 2026: **Starcloud-2 will generate more revenue than it costs to design, build and launch,** on hosted payloads from Department of Defense and Earth-observation customers. Named workload partners: AWS, Google Cloud, NVIDIA, Crusoe. **The near-term market is not AI training at parity; it is on-orbit edge processing of data that currently never reaches the ground** — which Zhejiang Lab puts at up to **90%** of everything generated in space. **Planet Labs is already doing it commercially with NVIDIA silicon, reducing time-to-insight from hours to seconds.**

7. The precedent argument. Every objection raised against this category — too many satellites, no market, brightness, debris, unproven economics, no rockets — was raised against **Starlink**, which now operates **10,736 active satellites** and generated **\$11.4 billion** of revenue in 2025, **61%** of SpaceX's total, up roughly 50% year over year, serving **10.3 million** active customers across 160 countries as of 31 March 2026. **The steelman is entitled to that precedent and the audit must grant it before discounting it.**

8. The strategic argument. China flew the first dedicated orbital computing constellation on **14 May 2025**, has a **2,800-satellite** programme, a **100-satellite by 2027** milestone, gigawatt-scale space infrastructure written into a **five-year plan**, and a **professional standards committee**. Europe has a publicly funded feasibility study with a **1 GW by 2050** target. **The defendant can argue, with dated evidence, that the question is not whether orbital compute pencils on a five-year DCF but who owns the capability when it does.**

THE MARKUP ALTERNATE — a second, distinct steelman-grade defendant surfaced by the record. The **Earth-observation edge-compute case** is a different party with a different balance sheet: **Planet Labs PBC** (public company, real revenue, NVIDIA IGX Thor and Blackwell in production, Owl platform), **Kepler Communications**, **Axiom Space**, **Sophia Space**, and **Starcloud's hosted-payload line**. Its case does not depend on launch cost falling at all, because the alternative is not a terrestrial data center — it is **downlinking terabytes over a narrow pipe, or losing the data**. **Banked for markup**. It is a distinct party from “the orbital case” and would not violate the rotation if the Course Schema preferred it; the pack recommends keeping the assigned defendant, because the assigned one is the one about to look worst.

VERBATIM BANK.

*“the physics doesn't immediately kill it” — Andrew McCalip, head of R&D, Varda Space Industries, writing personally; quoted by SpaceNews, 1 February 2026. (Six words — the first half of the sentence whose second half is Beat 6's Step Function. **The Beat Menu forbids reusing a source twice for quotation; the pack flags that Beats 6 and 11 both want this sentence and recommends the full sentence deploy once, in Beat 6, with Beat 11 paraphrasing.**)*

Paraphrase, marked, with locator: McCalip's terrestrial comparator assumptions state that grid interconnect and transmission are not costed, that permitting, taxes and financing are excluded, that water and cooling availability are assumed with no scarcity or discharge penalties, and that no adjustment is made for permitting or regulatory delay. **Locator:** andrewmccalip.com/space-datacenters, “**Model Assumptions — Terrestrial (On-Site CCGT).**”

WHAT'S CONTESTED. The steelman's weakest joint, named honestly so the audit lands: **every version of the case above is true on a five-to-fifteen-year horizon and none of them makes a 2026 or 2027 gigawatt**. The defendant's own witnesses concede the timing — Johnston (2028–2029 for commercial Starship), Google (mid-2030s for \$200/kg), Thales (2050 for 1 GW). **The strongest case for the orbital thesis is also, in its own numbers, a case for patience, and the valuations are not priced for patience.** That sentence is the bridge into Beat 12.

STRESS-TEST VERDICT: SUSTAINABLE — comfortably. Eight distinct arguments, every one carried in the defendant's own numbers or in the prosecution's own assumptions list, plus a precedent with an audited revenue line and a strategic argument with a five-year plan behind it. **This is a real steelman, not a précis of a weak version.**

Beat 12 — The Perverse Incentive [C] (closer)

Syllabus 2.0 assignment. A market that rewards the constellation filing before the radiator: spectrum positions and valuations priced off applications, not thermal budgets.

Beat Menu definition. *The Perverse Incentive* — *Politics/Money • versatile, closer-capable • fat container* (6–8). The rule producing the opposite of its intent — the Beat Menu's own examples include duplicate interconnection requests inflating forecasts into phantom load. **This deployment is the orbital isomorph of Lecture 4's phantom load, and the pack recommends the drafting AI notice the structure without naming the parallel aloud.**

THE INCENTIVE, AND THE RULE THAT PRODUCES IT.

The rule as intended: FCC Part 25 requires an applicant to describe a system, and §§25.164 and 25.165 impose deployment milestones and surety bonds **precisely to prevent spectrum warehousing** — that is, to stop parties claiming spectrum they have no intention of using.

The rule as it operated between 30 January and 19 March 2026:

- **30 January 2026.** SpaceX files for **1,000,000 satellites** and simultaneously requests waiver of **\$25.164 (milestones)** and **\$25.165 (bonds)** — the two provisions written to prevent warehousing — arguing they are unnecessary because it will use Ka-band on a non-interference basis. **The filing contains no deployment schedule and no cost estimate.** One reading, offered by a named analyst: **the applicant cannot commit to a timeline and asked not to be given one.**
- **4 February 2026.** The Space Bureau accepts the application for filing **five days later.**
- **~3–6 February 2026.** Starcloud files for **88,000.**
- **6 March 2026.** Amazon files a **17-page Petition to Deny**, arguing the application describes an ambition rather than a plan, that it is a speculative placeholder rather than a complete application, that at best it is an exercise in publicity and messaging and at worst an attempt to stake a priority claim over a vast swath of orbital resources with no genuine intent to deploy, and that approving it would force every other LEO operator to plan around a constellation that may never exist, distort international spectrum and orbital coordination, and lend regulatory legitimacy to a narrative-shaping exercise. **This is the beat's thesis, filed by an adversary, under a rule requiring completeness.**
- **11 March 2026.** FCC Chairman Brendan Carr publicly criticizes Amazon on X, pointing out that Amazon will fall roughly **1,000 satellites short** of its own **30 July 2026** milestone. **The regulator's public response to a warehousing complaint is a warehousing counter-complaint.**
- **13 March 2026.** The FCC accepts Starcloud's **88,000-satellite application.**
- **19 March 2026.** Blue Origin files **Project Sunrise** — **51,600 satellites**, 14 pages, no schedule, no power figure, no ITU filing, on a launch vehicle with two flights. **Thirteen days after its beneficial owner's other company argued that exactly this kind of filing should be dismissed.**
- **19–20 March 2026.** SpaceX files a **letter** asking the Commission to apply Amazon's own arguments to Blue Origin's application, for equitable and consistent treatment.
- **~20 March 2026.** Philip Johnston, CEO of the company with the third-largest application on file, posts that it is one of the funniest responses to an FCC filing of all time.
- **30 March 2026.** Starcloud prices a **\$170 million Series A at \$1.1 billion** — seventeen days after its application was accepted for filing, and **before Starcloud-2 has flown a radiator of any size.**
- **April 2026.** Reported talks at **~\$2.2 billion**, roughly one month later.
- **11–12 June 2026.** SpaceX prices and lists the **largest IPO on record**, three days after the A11 design reveal and roughly four months after the constellation application.
- **22 July 2026.** No ruling on any of the three applications.

THE ARITHMETIC OF THE INCENTIVE.

- **1,000,000 + 88,000 + 51,600 = 1,139,600 satellites** requested in U.S. orbital-data-center applications between 30 January and 19 March 2026. Against **16,234 active payloads in orbit** on 8 July 2026: **70.2x.** (*Pack arithmetic, shown.*)
- **Filings-to-hardware ratio, stated flat:** the three applicants have between them **one operating orbital-compute spacecraft** (Starcloud-1, 60 kg, one working GPU, 11-month design life, deorbiting) and **1,139,600 requested satellites.**
- **Cost of filing versus cost of building:** the application fee and legal preparation of a 14-page Part 25 filing is a rounding error against **\$31.2 billion** (McCalip's modeled 1 GW orbital capex) or against **\$170 million** (a single Series A). **The asymmetry is roughly six orders of magnitude and it is the mechanism.**
- **Pages per satellite:** Blue Origin, **14 pages ÷ 51,600 = one page per 3,686 satellites.** SpaceX, by one contemporaneous account **8 pages ÷ 1,000,000 = one page per 125,000 satellites.** [The 8-page figure is single-sourced; flag.]

THE MECHANISM. *Why the rule produces its opposite:* acceptance for filing is cheap, fast, public, and creates a coordination priority. It imposes no obligation, because the obligations (§§25.164, 25.165) can be waived, and the waiver request is part of the same filing. Meanwhile every *other* operator must now plan around the claimed shell — which is Amazon's argument and which is exactly the **phantom-load** structure this course established at Lecture 4: **the same capacity, requested in multiple places, none of which is a commitment, all of which distort everyone else's planning.** The FCC does not have a mechanism for netting duplicate orbital claims any more than a utility has one for netting duplicate interconnection requests.

Where the constraint binds: **at the moment of acceptance for filing, not at grant.** Everything financially useful about the

application has already happened by then.

KEY ACTORS.

- **Brendan Carr**, then and now Chairman, FCC — *wants*: deployment and U.S. leadership; *fears*: being the agency that slowed the buildout; *can enforce*: milestones, bonds, grants, dismissals; *actually did*: accepted a million-satellite application in five days and publicly criticized the party that objected.
- **Amazon (Amazon Leo)** — *wants*: time; *exposure*: ~210 satellites against a July 2026 milestone; *what it filed*: the 17 pages that make this beat's argument better than the narrator could.
- **SpaceX** — *wants*: consistent treatment and the last word; *what it filed*: one paragraph.
- **Philip Johnston** — *the only participant to say out loud, in public, that the whole exchange was funny*.
- **Tim Farrar**, TMF Associates — the analyst who named the mechanism: a filing as a narrative tool for an IPO.

VERBATIM BANK.

“an exercise in publicity and messaging” — Amazon (Amazon Leo), Petition to Deny, FCC ICFS SAT-LOA-20260108-00016, filed 6 March 2026, 17 pp. (Six words. Multiply reported; consistent across Via Satellite, DCD and Gizmodo.)

“one of the funniest responses to an FCC filing of all time” — Philip Johnston, co-founder and CEO, Starcloud, on X, ~20 March 2026, on SpaceX's letter in the Blue Origin docket; reported by Geek Wire, 21 March 2026. (Eleven words.)

Paraphrase, marked, with locator: Amazon's petition argues that approving the application would force every other operator in low Earth orbit to plan around a constellation that may never exist, distorting international spectrum and orbital coordination proceedings and lending regulatory legitimacy to what amounts to a publicity and narrative-shaping exercise.

Locator: ICFS SAT-LOA-20260108-00016, Amazon Leo Petition to Deny, 6 March 2026.

Paraphrase, marked, with locator: Carr's 11 March 2026 statement said Amazon should focus on the fact that it will fall roughly 1,000 satellites short of meeting its upcoming deployment milestone rather than spending time and resources filing petitions against companies putting thousands of satellites in orbit. **Locator**: statement reported by Via Satellite, 11 March 2026.

WHO PAYS. The answer, delivered flat at the close: the cap table pays the dollars, and it is entitled to. But the *coordination* cost of 1,139,600 requested satellites is paid by **every other operator in low Earth orbit**, by **the astronomy community that must file petitions against constellations that may never exist**, and by **the FCC's own docket capacity** — 1,500 comments on one application. **None of those parties is a customer of anything, and none of them has a forum in which to send a bill.**

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN.

- **Seller: all of them; and the most reliable witnesses are the competitors.** Move: **GRANT-AND-WITHHOLD** on the applications themselves (they are real filings by real companies with real hardware programmes), and **DISCOUNT** on what an accepted application means.
- **The strongest counterargument, which the close must carry**: an application is how you are *supposed* to start. Starlink began as an application that everyone called impossible, and it now has 10,736 satellites in orbit and \$11.4 billion of revenue. **The perverse incentive is not that companies file; it is that the filing is the priced event and the radiator is not.**
- **Unknown**: whether the FCC will grant, deny, defer, or condition. **There is no scheduled decision date, and that absence is the last fact in the lecture's territory.**

SENSORY & MATERIAL DETAILS.

- **Fourteen pages. Seventeen pages. One paragraph. Two pages of public notice.** The entire dispute over 1.14 million spacecraft fits in a folder.
- **Call Sign S00798.**
- **~1,500 comments** in one docket, most of them from people who are not in the industry.
- **Starcloud-1 is still up there**, at ~325 km, running an H100 with about four months left on an eleven-month design life, while its company is valued at somewhere between \$1.1 and \$2.2 billion.

NUMBERS THAT MATTER FOR THIS BEAT.

Value	Unit	Stage	As-of	Author	Tier
1,139,600	satellites requested in U.S. ODC applications	requested	19 Mar 2026	SpaceX + Starcloud + Blue Origin	ANCHOR (as filing facts)
16,234	active payloads in orbit	measured	8 Jul 2026	J. McDowell	ANCHOR
70.2x	ratio of requested to existing	pack arithmetic	22 Jul 2026	this pack	ANCHOR
1	operating orbital-compute spacecraft among the three applicants	fact	22 Jul 2026	public record	ANCHOR
5	days, SpaceX filing to acceptance	fact	30 Jan–4 Feb 2026	FCC	ANCHOR
13	days, Amazon petition to Blue Origin filing	pack arithmetic	Mar 2026	this pack	ANCHOR
17	days, Starcloud acceptance to \$1.1B round	pack arithmetic	Mar 2026	this pack	ANCHOR
3	days, AI1 reveal to IPO pricing	pack arithmetic	Jun 2026	this pack	ANCHOR
0	rulings issued	procedural status	22 Jul 2026	FCC	ANCHOR

STRESS-TEST VERDICT: SUSTAINABLE — **and it is the correct closer.** The beat has a rule, a documented inversion of the rule, an adversary who makes the argument better than the narrator could, a regulator who took a side in public, a founder who laughed at it on the record, four dated intervals of pack arithmetic, and an ending that arrives through costs paid in coordination and attention rather than sentiment. **The Kicker and the Handoff both graft here (\$4, \$10).**

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

Syllabus 2.0's negative space for Lecture 9: Cold Open on an Object, The Bill Arrives, The Hearing Room, Follow the Money, The Regulatory Collision, The County, The Neighbor, The Deal, Operator Reality. Each scanned below. Also scanned: the Irreversibility Ledger, which is off-menu here by rule.

1. Cold Open on an Object — *Atoms • opener only • cold specialist.* **Scan: YES, and this is the strongest swap case in the lecture.** The record supports a full opener-grade object dossier on **the deployable radiator** — manufacture (aluminum panels, Inconel 718 flow tubes chosen for ammonia freeze/thaw pressure resistance, 22 parallel tubes per panel for micrometeoroid redundancy), dimensions (3.33×2.64 m per panel, eight per assembly), operating regime ($\sim 75^\circ\text{C}$ surface, $\epsilon \approx 0.90$), cost proxy (orbital replaceable unit design), lead time, failure modes (2013 coating delamination; 3 May 2017 leak isolation and vent, with NASA computing the thrust the vent imposed), and chain of custody (stowed against a truss segment, deployed remotely without EVA). Add Starcloud-2's **largest commercial deployable radiator ever sent to space**, serving 8 kW. **Depth: more than adequate for 1,000 words from primary NASA, SAE and AIAA sources.** **Swap case:** Cold Open would displace **Beat 1, The Wrong Map**, as the opener — the only position class that permits it. **The case for:** it opens on hardware rather than on a pitch, which is the course's strongest register, and it front-loads the object the whole lecture is about. **The case against, and it is decisive: the opener rotation.** Cold Open already opens **2, 4 and 6**; The Wrong Map opens only **1 and 9**, and Wrong Map is a **cold specialist budgeted at 1–3 appearances** whose second and final deployment this is. Moving it here would leave Wrong Map at one appearance course-wide and Cold Open at four — breaking a band in each direction. **Verdict: no swap. The radiator material is already fully deployed inside Beats 5 and 6, where it does more work than it would as a cold open, because in those beats it arrives after the pitch and therefore lands as an audit rather than as a curiosity. Correctly left out — but this is the closest call in the lecture and markup should see it.**

2. The Bill Arrives — *Money • opener-preferred, closer-capable • cold specialist*. **Scan: NO.** There is no bill in this lecture's territory. No ratepayer receives a line item because a satellite launched; that absence is the lecture's subject, not a beat it can run. The nearest candidates — the FCC application fee, a Falcon 9 rideshare invoice — are not documented at line-item level in the public record. **Correctly left out, and the absence should be stated inside Beat 8 rather than staged as a beat.**

3. The Hearing Room — *Politics • opener-capable, versatile • warm; the only scene beat on the menu*. **Scan: MARGINAL — NO, with one caveat for markup.** *What exists:* the FCC docket is a written proceeding, not a hearing. There is no transcript. There is no oral argument. There were no public hearings on any of the three applications. **The Hearing Room's evidence discipline is absolute — documented speakers, documented words, transcripts and minutes only — and this lecture has no transcript corpus.** *The one candidate:* the SpaceNews “Opportunities for On-Orbit Computing” event, Washington D.C., 30 April 2026, where Johnston spoke on the record. But that is a trade conference, not a hearing, and reconstructing it would require transcript access the pack does not have. **Verdict: correctly left out. Confirming this also confirms the max-1-scene rule is satisfied by construction for this lecture: L9 runs zero scene beats.**

4. Follow the Money — *Money • versatile • fat container*. **Scan: YES on material, NO on placement — and Syllabus 2.0 already reasoned this correctly.** The material is abundant: \$21M seed → \$170M Series A at \$1.1B → reported \$2.2B talks; SpaceX's \$1.25T merger, \$1.75T IPO target, \$135 pricing, ~\$75B raised; Blue Origin private; Google's R&D line; ¥140M for the Astro-Future Institute; Horizon Europe money for ASCEND; Monolithic Power Systems as both supplier and investor. **But Syllabus 2.0's own annotation is right: the valuation rides inside the Founder Audit, and running both would produce two money beats in a twelve-beat lecture whose register is Atoms-as-audit.** The capital structure story here is also genuinely thinner than L6's, because **there is no securities filing, no debt, no collateral and no depreciation schedule to autopsy** — Starcloud is equity-only and private. **Correctly left out. Category-minimum check: the Money family is carried by Beat 4 (Taxonomy) and Beat 6 (Physics Audit, tagged Atoms/Audit but carrying the cost-per-watt arithmetic) and Beat 12 (Perverse Incentive, tagged Politics/Money). ≥1 Money confirmed.**

5. The Regulatory Collision — *Politics • versatile, closer-capable • warm*. **Scan: YES — and this is the second-strongest swap case.** *What exists:* a genuine two-authority collision, fully documented. **Authority one: the FCC**, whose statutory remit is spectrum and which has treated satellite licensing as **categorically excluded** from NEPA review. **Authority two: NEPA itself**, invoked by DarkSky International (Opposition Brief, 6 March 2026, demanding an Environmental Impact Statement), the AAS (Petition to Deny, 6 March 2026, arguing that NEPA review of reflected orbital light could change the outcome), and a private petitioner, Nikolai Bakken, invoking NEPA's irreversible-and-irretrievable-commitment-of-resources requirement. **Precedent: the 2023 DarkSky challenge to the Starlink Gen2 authorization, which the court decided for the FCC.** Both jurisdictions' legal theories can be steelmanned. **Add a second, distinct collision: the ITU.** Blue Origin had not filed with the ITU as of 21 March 2026, and international frequency and orbital coordination is not the FCC's to grant. **Swap case:** Regulatory Collision would most plausibly displace **Beat 9, The Forecast Problem** (versatile-for-versatile, Politics-for-Money/Politics, both mid-position). **The case for:** it is the only place in the lecture where a legal argument is actually joined, and the NEPA/categorical-exclusion fight is the lecture's real “who pays” venue. **The case against:** (a) the Forecast Problem is where the Bezos and Musk dated remarks live, and Syllabus 2.0's cast assigns both as secondaries whose only home is that beat — cutting it strands them; (b) the collision material is already substantially deployed inside **Beat 8's** externality pricing, where it functions as the mechanism (forum versus no forum) rather than as a separate beat; (c) the Regulatory Collision runs in **L1, L4, L5, L7 and L8** and is at the top of its warm band. **Verdict: the pack recommends against the swap and recommends instead that Beat 8 be permitted to carry the NEPA and ITU material explicitly, which it already does. Flag for markup: if markup prefers the collision, Beat 9's Bezos/Musk material can be absorbed as texture into Beats 4 and 10 without loss.**

6. The County — *Politics/Character • versatile, closer-capable • warm*. **Scan: NO.** There is no jurisdiction. There is no zip code. That is the point of the lecture. The nearest analogues — **Redmond, Washington** (Starcloud's payload facility), **Bastrop, Texas** (Gigasat, 1,000+ acres, 11M+ sq ft) — are *terrestrial manufacturing sites for an orbital product*, and Bastrop in particular is a genuine County-grade story that **belongs to no lecture in this course and should not be opened here. Correctly left out. Note for the Course Schema: Bastrop is an unclaimed county story with real acreage and a real solar plant, and if a future edition wants a County beat in a revised L9, that is where it is.**

7. The Neighbor — *Character • versatile • thermostat near-zero • cold specialist*. **Scan: NO — and this is a declared honest failure, per pack dependency D-f.** There is no fence-line household in this lecture's territory. The Neighbor's hard constraints are documented individuals from testimony, filings and published reporting only; no composites; no invented color. The record contains **no household affected by an orbital data center**, because none exists. The three

candidate substitutions all fail on the beat's own terms:

- **The Memphis residents (KeShaun Pearson, Sarah Houston, James Kirkwood)** — documented, named, and directly on the record about the orbital announcement on 4–5 March 2026. **But they are Lecture 8's, entirely, and L8's pack has already built them.** Running them here would duplicate an anchor and steal L8's floor. **Refused.**
- **The astronomers** — documented, named, quantified, harmed. **But an observational astronomer is not a fence-line household, and promoting a professional constituency into a Neighbor-grade human would be exactly the stretched identification the research instructions forbid.** They belong in Section 8 and Beat 8 as a documented affected constituency, which is what they are. **Refused as a Neighbor.**
- **The individual FCC petitioners (William Stewart, 12 February 2026; Nikolai Bakken)** — named individuals in a federal record. **But the pack has no biographical material, no location, no quoted words beyond their filings' captions, and no documented personal harm. Refused. An honest failure beats a stretched identification. Verdict: correctly left out, and the pack states plainly that no Neighbor-grade human exists in this territory. The Neighbor's course-wide casting (×3: the Morris in L3, the L7 fence-line ratepayer, Gladney in L8) is unaffected.**

8. The Deal — *Character/Money • versatile • cold specialist. Scan: MARGINAL — NO. What exists:* the **SpaceX-xAI merger** (announced 2 February 2026, \$1.25T combined, triangular structure, Nvidia/Cisco/QIA/MGX brought onto the shareholder base) is a real, reconstructible negotiation with leverage and sequence. **But it is not an orbital data center deal** — it is an AI-company acquisition whose orbital rationale is one strand — and reconstructing it would import a trillion-dollar corporate story into a lecture whose register is Atoms-as-audit. The **Starcloud Series A** is a funding round, not a negotiation with a term sheet the record discloses. The **Starcloud-2 hosted-payload arrangements** (AWS, Google Cloud, NVIDIA, Crusoe, DoD) are the most Deal-shaped material in the territory, and **none of their terms is public. Correctly left out; the merger rides as one dated fact inside Beats 4 and 9.**

9. Operator Reality — *Atoms/Character • versatile. Scan: NO, and the reason is the finding.* The beat is defined as the ~50 people running a building the size of an aircraft carrier — shift structure, maintenance treadmill, plumbing trades suddenly load-bearing. **In this lecture there are no operators.** Starcloud has **15 employees**, total, company-wide. There is no shift. There is no maintenance. There is no screwdriver. **The absence is Beat 7's Kicker material and Beat 8's HF-4 flag; it is not a beat. Correctly left out — and the drafting AI should note that “there is nobody to interview” is itself the most economical way to state the lecture's labor story.**

10. The Irreversibility Ledger — *Audit • closer • lecture 10's closer; ≤1 mid-course deployment, in miniature only. Scan: NO, by rule and by prudence.* The mid-course deployment allowance is ≤1 and the pack has no record of it being spent; but **spending it in Lecture 9 would be the worst possible placement**, because L9 is the lecture immediately before the closer and a miniature here would defuse the detonation one hour early. **Note for the Course Schema, and for L10's pack:** this lecture's territory contains **at least four genuinely irreversible items** that belong in L10's ledger and should be exported rather than spent — (a) ~17 metric tons of alumina deposited in the stratosphere in 2022 alone, catalytic and not consumed; (b) catalogued debris at 11,160 objects including 2,666 ASAT and 774 collision fragments, none of which comes down on a schedule anybody controls; (c) the 2023 court holding that the FCC's categorical exclusion was reasonable, which is now precedent; (d) Nikolai Bakken's NEPA petition invoking, by name, *irreversible and irretrievable commitments of resources* — **a private citizen using the closer's exact vocabulary in a federal data-center docket in March 2026. Export all four to L10. Do not spend them here.**

VERDICT PAIRING

No Section 2 beat returned THIN or UNBUILDABLE. All twelve returned **SUSTAINABLE**, several with an overrun risk rather than a padding risk. **There is therefore no verdict to pair and no beat requiring replacement.**

The pack notes that a clean sweep of **SUSTAINABLE** verdicts is exactly the outcome the research instructions warn about, and states its reasoning for it plainly: this lecture's territory is unusually document-dense for its age — three federal applications, four petitions, one public notice, one court precedent, two peer-reviewed atmospheric studies, one vendor product launch, one public economic model with source code, one preprint with radiation data, and a flight record with a five-day-old abort — **and the beat plan was built after most of it was already on file.** The stress-test's honest findings in this lecture are not thinness; they are **one document-name defect (D1), one attribution defect (D3), one Verbatim that cannot be fully verified from a primary source within the pack's research window (§4), and one position question (the Steelman at 11).**

SUMMARY FOR MARKUP

Swap cases worth making: none as changes; two worth seeing. Cold Open on an Object (radiator as opener, displacing The Wrong Map) is the closest call and is refused on opener-rotation and appearance-band grounds, with the material already fully deployed in Beats 5 and 6. **The Regulatory Collision** (NEPA/categorical exclusion versus FCC spectrum remit, plus the ITU gap) is the strongest unrun beat in the territory and is refused because Beat 8 already carries it as mechanism and because cutting Beat 9 would strand the Bezos and Musk castings; the pack instead recommends Beat 8 carry the NEPA and ITU material **explicitly**.

Beats confirmed as correctly left out: The Bill Arrives (no bill exists), The Hearing Room (no transcript corpus exists; L9 runs zero scene beats), Follow the Money (absorbed into the Founder Audit by design; no securities filing to autopsy), The County (no jurisdiction — but Bastrop, Texas is an unclaimed county story worth noting for a future edition), **The Neighbor (declared honest failure: no fence-line household exists in this territory and the pack refuses three stretched substitutions)**, The Deal (terms not public), Operator Reality (there are no operators — 15 employees company-wide), and the Irreversibility Ledger (reserved; four items exported to L10).

The one position question the pack does raise: the Steelman sits at 11, after the Physics Audit at 6 and the Bottleneck at 7. The Beat Menu defines the Steelman as the strongest case for whoever's about to look worst, and every other deployment in the course places it *before* the damage (L1 at 6 before the perverse incentive at 7; L5 at 9 before the externality swap at 10; L7 at 7 before the collision at 8). Here the defendant is steelmanned after the audit has already landed. **Two readings are available and markup should choose deliberately:** (a) this is a defect, and the Steelman should move ahead of Beat 6; or (b) **it is the correct design for this specific lecture**, because the closer is not the audit but the Perverse Incentive, and the Steelman at 11 is the last full-strength grant before the market-mechanism close — which makes the ending land on *the incentive structure* rather than on *the physics*. **The pack leans to (b) and flags it. It does not re-sequence.**

Category-minimum re-verification for the grid as it stands. Atoms: Beats 5 (Mechanism Autopsy), 6 (Physics Audit), 7 (Bottleneck), 8 (Externality Swap) — **≥1 confirmed, four-deep. Money:** Beats 4 (Taxonomy), 8 (Externality Swap, Atoms/Money), 12 (Perverse Incentive, Politics/Money) — **≥1 confirmed. Politics:** Beats 1 (Wrong Map), 3 (Paper Trail), 10 (Symbol Audit), 12 (Perverse Incentive) — **≥1 confirmed. Character (the proposed fourth minimum):** Beat 2 (The Founder Audit, Character/Money) — **≥1 confirmed, but by a single beat. This is the thinnest Character coverage in the ten-lecture grid, and it is the one place where a swap would break a minimum: any change that removes Beat 2 breaks the proposed fourth gate.** Note it and protect it. **Audit:** Beats 6 and 11. **The pack proposes; markup and the Course Schema dispose. No re-sequencing performed.**

SECTION 4: MOVES PLAN VERIFICATION

THE STEP FUNCTION — assigned: ~3x cost per watt, by the industry's own math, after the pitch has settled

The number's full pedigree. Value: approximately three times. **Unit:** dollars per watt of usable power for compute, orbital versus terrestrial. **Stage:** *model output, base case* — not a market price, not a quoted price, not a transacted price. **As-of date: 1 February 2026**, the date SpaceNews reported the base-case result. **Filer/author: Andrew McCalip**, head of research and development at **Varda Space Industries**, publishing in a **personal capacity**. **Source:** SpaceNews, *With attention on orbital data centers, the focus turns to economics*, 1 February 2026, reporting McCalip's public calculator at andrewmccalip.com/space-datacenters, source at github.com/andrewmccalip/thoughts.

The standing assumption it must break, and the documented material that lets it feel settled first. The assumption is not “orbit is cheap.” It is “**the energy is free.**” That assumption is installed by, in order: the solar constant (1,361 W/m², nobody's opinion); Google's *up to 8x* (4 November 2025, the seller's own hedged number); the terminator orbit's ~98% sunlight fraction; the absence of batteries; and — critically — **eight prior lectures in which the listener has watched terrestrial power cost seven years, a rate case, a fence-line fight and an election.** By the time this lecture reaches Beat 6, the listener is standing on the proposition that **the hard part was the electricity and orbit deletes it.** The number breaks that by relocating the cost to the *other* side of the energy balance: **the same panel that collects the free watt must**

also get rid of it, and getting rid of it costs 2–4x.

PEDIGREE CORRECTION REQUIRED — see D3. The Syllabus and Roster attribute the figure to “Varda modeling” and “Varda’s engineering commentary.” McCalip’s page carries an **explicit disclaimer** that it is built from publicly available information and first-principles modeling, contains no proprietary data, and represents his personal views rather than those of any company or organization. **The correct attribution is: a Varda engineer’s own model, published personally.** That is not a weakening — it is a strengthening, because it removes any suggestion of corporate positioning — but it must be stated correctly in the prose. **The drafting AI must not say “Varda’s model.”**

The number has moved since assignment — flagged, not substituted. Live calculator reading at **22 July 2026**: **\$31.20/W orbital versus \$14.80/W terrestrial = 2.11x**; **LCOE \$891/MWh versus \$398/MWh = 2.24x**. Same author’s prose in the same document: “It’s 400%.” Secondary rendering of the same model (April 2026): **\$42.4B versus ~\$15.9B for 1 GW = 2.67x**. The ~3x must-hit anchor governs. The drafting AI carries ~3x, attributes it to the base case as reported in February 2026, and does not silently substitute any of the other renderings. Full flag at §6, D3.

Markup alternate — a number that breaks the assumption harder, banked and not substituted. The mass ratio. McCalip’s model requires **22.2 million kg to LEO for one gigawatt**. The total mass of **every active payload currently in orbit** is **10,994.7 tonnes** (Jonathan McDowell, data as of 8 July 2026). **One gigawatt of orbital compute is roughly twice the mass of everything humanity currently operates in space.** ($22,200\ t \div 10,994.7\ t = 2.02$.) This breaks a *different* standing assumption — that orbit is empty and roomy — and it breaks it harder, because unlike a cost ratio it cannot be moved by a slider. **The assignment stands; markup may prefer this.**

VERDICT: VERIFIED, with a mandatory attribution correction and a flagged drift.

THE UNIT CONVERSION — *assigned*: 51,600 satellites → multiple of today’s active fleet (pack-verify the denominator) — **HARD GATE**

The arithmetic, shown in full.

- **Numerator.** 51,600 satellites. **Stage: requested** — **not authorized, not built, not launched. As-of: 19 March 2026. Filer: Blue Origin, LLC**, Project Sunrise application, FCC ICFS SAT-LOA-20260310-00118. Source: the application; reported by SpaceNews, Tom’s Hardware, GeekWire, idcnova, 19–21 March 2026.
- **Denominator.** 16,234 — total active payloads in orbit, all orbital regimes. **Stage: measured, operating. As-of: 8 July 2026. Author: Jonathan McDowell, Jonathan’s Space Report, Space Statistics page** (planet4589.org/space/stats/active.html), a primary catalog maintained continuously and cited by the FCC docket’s own participants. Composition: 10,736 active Starlinks + 3,385 other active maneuverable payloads + 2,113 active non-maneuverable payloads.
- **The division.** $51,600 \div 16,234 = 3.1785\dots$

VERDICT: PASS. 51,600 satellites is approximately 3.2 times every active satellite currently in orbit — one application, from one company, for more than three times the entire working orbital fleet of the human species.

Robustness checks against alternative denominators, so the conversion survives markup and the 2027 refresh:

Denominator	Value	As-of	Result	Note
All active payloads, all orbits	16,234	8 Jul 2026	3.18x	RECOMMENDED. Cleanest, most defensible, primary-sourced.
Active payloads, Lower LEO only	13,972	8 Jul 2026	3.69x	Defensible but requires explaining “Lower LEO” on air
Active Starlinks only	10,736	8 Jul 2026	4.81x	Cherry-picks a single operator; do not use
All active + dead payloads	19,396	8 Jul 2026	2.66x	Conservative; usable if markup wants the floor

Denominator	Value	As-of	Result	Note
Total catalogued objects (incl. debris and stages)	34,049	8 Jul 2026	1.52x	Do not use — mixes debris into a satellite count

Refresh-safety note. The denominator grows by roughly 2,000–2,500 active payloads per year at current Starlink cadence. **At 8 July 2026 the conversion is 3.18x; a 2027 refresh should expect roughly 2.7–2.9x and must re-pull McDowell’s figure.** The conversion survives the refresh as “*more than twice*” even under aggressive growth, but **the specific multiple is VOLATILE and must be re-verified.** The prose should therefore say “**more than three times, as of July 2026**” — an As-Of-Stamp-shaped construction that keeps the number honest without spending the Stamp.

Markup alternates, arithmetic shown, banked and not substituted (the cap is one conversion per lecture):

- **The three-filing total.** $1,000,000 + 88,000 + 51,600 = 1,139,600$ requested; $\div 16,234 = 70.2x$. (*Beat 12’s material; harder-hitting but it is a sum of three parties, which muddies the “one application” punch.*)
- **SpaceX alone.** $1,000,000 \div 16,234 = 61.6x$.
- **Mass, not count.** McCalip’s 1 GW at 22,200 t $\div 10,994.7$ t active payload mass = **2.02x** — “one gigawatt is twice everything currently working up there, by weight.”
- **Musk’s annual tonnage.** $1,000,000$ t/yr $\div 10,994.7$ t = **91x everything currently in orbit, every year.**

THE TIMELINE SNAP — assigned: March 2026 — the month the valuation printed

Verification of the assigned hinge. The valuation printed on **30 March 2026**: \$170 million Series A at **\$1.1 billion**, Benchmark leading with EQT Ventures, both co-leading an extension; the fastest Y Combinator company to unicorn status, **17 months** after demo day.

The incentive state on each side of that date.

- **Before (through 29 March 2026):** orbital compute is a demonstrator category. Starcloud has \$21M of seed and a 60 kg satellite. The public position of the largest cloud operator on Earth — **Matt Garman, 3 February 2026** — is that it is not economical. The most-cited independent model says it costs 2–4x terrestrial. The FCC has accepted three applications but granted none.
- **After (from 30 March 2026):** orbital compute has a **priced private market**. A company with 15 employees and one satellite is worth \$1.1 billion. Within roughly a month it is reportedly in talks at **\$2.2 billion**. The category now has a comparable, and every subsequent conversation — with investors, with the FCC, with the Department of Defense, with engineers being recruited — happens against that number.
- **For whom:** for Starcloud, capital and validation; for Benchmark, a mark; for competitors, a valuation floor to argue against; for the FCC docket, a live commercial constituency; **for the drafting AI, the exact moment the escape fantasy became an asset class.**

A competing hinge exists, and the pack presents it with evidence rather than suppressing it. 30 January – 4 February 2026 — the five days in which SpaceX filed for a million satellites and the FCC accepted it. **The case for this date as the true hinge:** it precedes and arguably causes everything else in the timeline. Starcloud’s own application follows within days; Amazon’s petition follows within five weeks; Blue Origin’s filing follows within seven; Starcloud’s round follows within eight. Before 30 January 2026 the category had a demonstrator and a Google preprint; after 4 February 2026 it had a federal docket with a Kardashev citation in it and a comment window that drew 1,500 responses. **The case against:** it is a *procedural* hinge, not an incentive hinge — nothing about anyone’s economics changed on 4 February; what changed was the noise floor.

Pack recommendation: the assignment holds. March 2026 is the month the *incentives* flipped, because that is when the category acquired a price. **The January–February filing window is the better opener material and is already deployed as such in Beats 3 and 12; using it as the Snap would double-spend it.** Markup may prefer otherwise; the evidence for both is above.

VERDICT: VERIFIED. Competing hinge documented and declined with reasons.

THE VERBATIM — assigned: the FCC filing’s satellite count, in the filing’s own syntax — EXISTENCE GATE**The assigned string.**

“will consist of up to 51,600 satellites operating in circular, sun-synchronous orbits from 500–1,800 km in altitude, with inclinations between 97 degrees and 104 degrees, with each orbital plane containing approximately 300–1,000 satellites”

Attribution: Blue Origin, LLC, Project Sunrise application to the Federal Communications Commission, filed **19 March 2026**, ICFS File No. **SAT-LOA-20260310-00118**.

Existence check, performed honestly. The sentence has been **reproduced as a direct quotation of the application by Tom’s Hardware (20 March 2026)**, which explicitly frames it as the application’s own technical description. **Corroborating, non-identical renderings of the same facts appear in SpaceNews (19 March 2026)** and elsewhere. **The pack could not access ICFS itself within its research window and therefore cannot certify the string character-for-character against the primary document.**

VERDICT: CONDITIONAL PASS — PRIMARY RE-PULL MANDATORY BEFORE THE VERBATIM DEPLOYS.

The pack does not call this a FAIL, because the string exists in the public record attributed directly to the filing by a named outlet, and the underlying facts are corroborated across four independent reports. **But the Moves List’s discipline is absolute — quoted matter must exist verbatim in the research pack — and a secondary outlet’s rendering of a primary filing is not the same standard. Action required: pull SAT-LOA-20260310-00118 from FCC ICFS and verify the string before Draft 1 quotes it.** If it does not verify character-for-character, use the alternate below.

THE NEAREST VERIFIED ALTERNATIVE FROM THE SAME TERRITORY — and the pack’s recommendation regardless.

“first step towards becoming a Kardashev II-level civilization – one that can harness the Sun’s full power”

Attribution: SpaceX, Application Narrative at 1, ICFS SAT-LOA-20260108-00016 (Call Sign S00798), filed 30 January 2026 — **as quoted by the Federal Communications Commission, Space Bureau Public Notice DA 26-113, released 4 February 2026**, which then footnotes the Kardashev scale and cites N.S. Kardashev, *Transmission of Information by Extraterrestrial Civilizations*, 8 *Soviet Astronomy* 217–221 (1964).

Verification status: FULLY VERIFIED against the primary federal document at docs.fcc.gov/public/attachments/DA-26-113A1.txt.

Why the pack recommends it even if the assigned string verifies. The Moves List defines The Verbatim as *a document’s actual language quoted flat, letting bureaucratic prose be its own punchline*, and names **“the FCC filing’s satellite count rendered in the filing’s own syntax”** as one example. **The Kardashev sentence outperforms it on every one of the move’s own criteria:** it is bureaucratic prose (a public notice), it is its own punchline (a civilizational-scale claim in a spectrum docket), it is *doubly* documentary (the agency quotes the applicant and then footnotes the concept, which is the audit performed by a clerk), and it is **the only fully verified primary quotation in this pack. Markup alternate, flagged as such. The assignment stands until markup moves it.**

(Note for the drafting AI: only one Verbatim may deploy. If markup switches to the Kardashev sentence, the 51,600 figure still arrives — through the Unit Conversion, in Beat 3 and in Beat 12 — as an ordinary attributed fact, which is legal and loses nothing.)

THE AS-OF STAMP — assigned: the \$1.1B valuation and the Suncatcher timeline

Claim 1 — the valuation. Current value: \$1.1 billion. As-of: 30 March 2026. Author: Starcloud / Benchmark / EQT Ventures. Stage: priced round — a mark, not a verdict, per the Style Guide’s own example, which names this exact figure. Status as of 22 July 2026: reportedly superseded in talks. The Information reported (April 2026) talks to raise at least \$200 million at approximately **\$2.2 billion. That is a talks-stage report, not a printed round, and the must-hit anchor governs. Expected decay velocity: QUARTERLY OR FASTER.** This is the single fastest-decaying figure in the lecture. **Recommended styled deployment: “as of March 2026, \$1.1 billion” — with the stamp doing**

the thematic work of admitting the number's shelf life, which in this case is measured in weeks.

Claim 2 — the Suncatcher timeline. Current value: two prototype satellites, with Planet Labs, by early 2027. As-of: announced 4 November 2025; unchanged in the public record as of 22 July 2026. Author: Google. Expected decay velocity: ANNUAL, and asymmetric — space schedules slip, they do not accelerate. This is the more refresh-durable of the two and the better candidate if markup wants the Stamp to survive the 2027 edition.

Pack recommendation. The Stamp deploys once. Put it on the valuation, because it is the claim most likely to age and the Moves List defines the styled deployment as landing on exactly that claim. Carry the Suncatcher date as an ordinary dated fact — which the compliance layer requires anyway, independent of the move.

VERDICT: VERIFIED. Both claims current as of 22 July 2026; both fed into the §11 decay register; the valuation flagged as the fastest-decaying figure in the pack.

THE KICKER — assigned: the refresh treadmill, 500 kilometers from the nearest screwdriver

Verification of the closing fact. The claim decomposes into three verifiable components:

1. **The treadmill exists and belongs to Lecture 2.** L2's roadmap treatment established a five-to-seven-year replacement cycle against a hardware roadmap that turns over faster. **This is a return at brief-reference grade — one clause, no re-derivation, per L2's pre-allocation.**
2. **The altitude is right, and can be stated more precisely.** Starcloud-1 operates at ~325 km. Starcloud's constellation application specifies 600–850 km. Project Sunrise specifies 500–1,800 km. SpaceX's system specifies 500–2,000 km. **“500 kilometres” is accurate as a floor across all three constellation filings and is the correct figure for the Kicker. Do not use 325 km — that is the demonstrator's orbit, not the fleet's.**
3. **There is no screwdriver, and the failure rates are modeled.** 9.0%/yr assumed GPU failure rate (McCalip's model; slider stops 0%, CPU 1.5%, Meta 9%), producing a +19.6% GPU margin for cumulative expected failures across a 5-year analysis period on a 1 GW fleet. 2.5%/yr solar cell degradation, producing a +6.5% solar margin. Starcloud-1's design life: 11 months, then deorbit and burn-up. Megaconstellation design life generally: ~5 years.

The two or three adjacent facts the closing passage will need around it.

- **The ISS radiators are orbital replaceable units** — NASA assumed from the outset that they would need swapping, and the swapping is done by astronauts and robotic arms. **There are no astronauts in a dawn–dusk sun-synchronous compute constellation.**
- **On 3 May 2017** the response to a coolant leak on the ISS was to isolate a flow path and vent it to vacuum, and NASA calculated the thrust that venting would impose on the station. **That is what maintenance looks like up there, on the one platform where maintenance is possible.**
- **Starcloud-1 lost an NVIDIA A6000 during launch** and it is still up there, unrepaired, in a spacecraft with about four months left on its design life.
- **On 21 July 2026, one day before this pack's stamp, SpaceX launched a geosynchronous robotic servicing satellite on a decade-long mission** — servicing exists as an industry; it does not exist at the cadence, cost or altitude that would make 37,000 LEO satellites serviceable. **Grant it, then price it.**

Discipline reminder from the Moves List: the Kicker is never telegraphed. It delivers a fact, not a moral. The strongest available flat statement of it: *the fleet's own model budgets a nine-percent annual failure rate and does not budget a technician.*

VERDICT: VERIFIED, with one correction (500 km, not 325 km) and four adjacent facts supplied.

THE GESTURE — assigned: skip proposed (the doors stay terrestrial)

Verification of the skip. The three boundary doors are silicon fabrication (owned by the October semiconductors course), reactor engineering (owned by the January–February nuclear course), and — pending Nick's call, Syllabus 2.0 Open Item 9 — training-run internals.

The pack confirms the skip is correct, and supplies the reasoning the record produces.

1. **The silicon door is pressed on hard by this lecture and must stay shut.** Musk named **chip production** as the remaining piece of his own forecast on 19 November 2025 and invoked a proposed **Tesla Terafab**; NVIDIA launched a **space-qualified silicon line** on 16 March 2026; Google **beam-tested a TPU**; Starcloud flew an H100 and lost an A6000. **Four separate invitations to walk through the fab door, all declined.** The lecture's discipline is that the chip arrives on a truck — or, here, on a rideshare.
2. **The reactor door is not pressed at all.** Nothing in this territory touches reactor engineering. (*Note: radioisotope power and nuclear-electric propulsion do not appear in any of the four applications. Correctly absent.*)
3. **The training-run-internals door is genuinely pressed once,** and the pack notes it precisely so the drafting AI knows where the fence runs: **Google's radiation results distinguish between error rates "likely acceptable for inference" and single-event effects on training runs requiring further study.** That distinction is a training-run-internals fact. **It is usable at the level of "training and inference tolerate errors differently" and must not go one sentence further.** If Nick approves the third door, three other lectures hold the candidate deployments (L1, L6, L8) — **not this one.**
4. **The structural reason to skip.** Lecture 9 is the **penultimate** lecture, and its Handoff must manufacture appetite for **Lecture 10's audit** — an audit of everything already spent on Earth. **A Gesture toward a fourth course in the same hour would compete with that handoff for the listener's forward attention.** The Handoff is mandatory; the Gesture is not. **Spend the appetite once, on the closer.**

VERDICT: SKIP CONFIRMED. No one-inch material supplied, because no door is assigned. Pack dependency D-d resolved: L9 carries no deployment contingent on Open Item 9, and is unaffected by either resolution of that call.

THE HANDOFF — assigned: a cost left unassigned

Rides in the beat plan; material in Section 10. Rotation verified: L8 ran a door explicitly not opened; L9 runs a cost left unassigned; no adjacent repeat. **PASS.** Refresh-safety analysis and three alternates in §10.

SECTION 5: THE DOCUMENT DOSSIER

*This lecture's Paper Trail document, in the class the rotation assigns: **regulatory application**, position 9 of 10.*

THE DOCUMENT ITSELF

Full formal title (as filed). Application of **Blue Origin, LLC** for authority to launch and operate the **Project Sunrise** non-geostationary orbit satellite system.

Author. Blue Origin, LLC, through counsel. Privately held; founded by **Jeff Bezos**; headquartered in **Kent, Washington**. *No individual attorney is identifiable from the secondary record within this pack's window; contemporaneous coverage refers to "Blue Origin's attorneys."* **Pull the signature block from ICFS before Draft 1 if the drafting AI wants a name.**

Date filed. 19 March 2026.

Length. 14 pages.

Where filed. Federal Communications Commission, **International Communications Filing System (ICFS)**, Space Bureau.

File number. **SAT-LOA-20260310-00118.** (*Note the ICFS convention: the embedded date string reflects the receipt/assignment sequence, not the 19 March filing date reported by SpaceNews, GeekWire, Tom's Hardware and Yahoo/Fortune syndication. Both are correct; they measure different things. Do not "correct" one to the other.*)

Where the full text can be read. ICFS application summary at fccprod.servicenowservices.com/icfs, searching the file number; attachments require an FCC CORES account.

Procedural status as of 22 July 2026. Filed. The pack found **no public notice accepting Project Sunrise for filing**, no comment window, no petitions, and **no order**. Compare the companion dockets: SpaceX's was **accepted for filing in**

five days (DA 26-113, 4 February 2026) and Starcloud's on **13 March 2026**. **Blue Origin's has been on file for roughly four months with no publicly documented Bureau action. State the absence; do not fill it.**

WHAT IT SAYS

The operative technical description, quoted as reproduced by a named outlet directly from the application — **[SECONDARY-QUOTED PRIMARY; re-pull required before The Verbatim deploys]**:

“will consist of up to 51,600 satellites operating in circular, sun-synchronous orbits from 500–1,800 km in altitude, with inclinations between 97 degrees and 104 degrees, with each orbital plane containing approximately 300–1,000 satellites”

The purpose clause, same status:

“space-based data centers will be a complement to terrestrial infrastructure by introducing a new compute tier that operates independently of Earth-based constraints”

The remaining operative provisions, precisely paraphrased with locators for the draft-stage pull:

- **Architecture.** Optical inter-satellite links used extensively, expressly to reduce dependence on radio spectrum; Earth-bound traffic routed through **TeraWave** and other mesh backhaul networks to the ground. **Locator: application at 2–4; reported by SpaceNews and Tom's Hardware, 19–20 March 2026.**
- **Antennas.** At least **three antenna variants** to address uniform coverage requirements.
- **Spectrum request.** **Ka-band, principally for telemetry, tracking and control.** *This is the definitional fact of the document and the one most likely to be lost in the coverage: the application for 51,600 data-center satellites is, in regulatory substance, a request for housekeeping spectrum.*
- **Spectrum posture.** Assertion that the system will use spectrum efficiently and operate on a non-interfering basis. **Locator: application at 1 and 10–12; quoted in part by Tom's Hardware.**
- **Launch enablement.** The system is described as enabled by New Glenn's launch capacity. **The application offers no other detail on how 51,600 spacecraft would be launched.**
- **Debris.** Compliance with orbital-debris mitigation guidelines; **deorbit within five years of end of life. Locator: application, debris section; reported by SpaceNews, 19 March 2026.**
- **Public-interest framing.** Space-based data centers as easing mounting pressure on U.S. infrastructure and supporting U.S. technological competitiveness.

The load-bearing absences — and in this document the absences are the substance. The application contains **no total compute capacity, no total or per-satellite power figure, no satellite mass, no radiator area, no thermal budget, no deployment schedule, no cost estimate, and no launch manifest.** It also is not accompanied by an **International Telecommunication Union** filing, which international frequency and orbital coordination requires and which reporting on 21 March 2026 confirmed had not been made.

The definitions problem, stated honestly. The Paper Trail's house method is to pull the load-bearing definitions verbatim, because the definitions section is frequently the comedy and always the substance. **This document appears to have no meaningful definitions section** — it is a short technical narrative, not a tariff. **The comedic and substantive weight therefore sits in the ratio: 14 pages, 51,600 spacecraft, one page per 3,686 satellites, and the only frequency actually requested is for telling the satellites what to do.**

WHO WROTE IT AND WHY

The drafting party's incentive. Blue Origin needs three things simultaneously and this document serves all three. (1) **A coordination priority** in the dawn–dusk sun-synchronous shell, which SpaceX (30 January), Starcloud (accepted 13 March) and — in a different form — Google and ADA Space are all claiming. (2) **A demand anchor for New Glenn**, a vehicle with **two flights** and no large recurring internal customer, at a moment when its sibling constellation TeraWave has flown **zero** of a stated **5,000-before-end-2027**. (3) **A market position** in a category its founder publicly forecast on **3 October 2025** and which its corporate cousin's cloud CEO publicly dismissed on **3 February 2026**.

What Blue Origin gets if the document is believed. Regulatory legitimacy for an orbital-compute business line; a defensible answer to “where is Blue Origin in AI infrastructure”; and — per the argument its own competitor filed against a near-identical application — **a priority claim over a large volume of orbital resource at the cost of 14 pages.**

The rulemaking or negotiation that produced it. None. This is an application under an existing rule (**47 CFR Part 25**), not a negotiated instrument. **That is the structural difference between this Paper Trail and Lecture 5’s contract or Lecture 7’s tariff docket: nobody was across the table. There was no counterparty to say no — only an agency to say later.**

WHAT IT FORCES AND WHAT IT FORBIDS

What it forces: essentially nothing, and that is the finding. An application creates no obligation to build, launch, spend or disclose. **Obligations attach only at grant**, and then in the form of **\$25.164 deployment milestones** (typically half the constellation within six years, all within nine) and **\$25.165 surety bonds** — the two provisions written to prevent spectrum warehousing, and the two that **SpaceX expressly asked to be waived** in its companion filing on 30 January 2026. (*The pack found no reporting that Blue Origin requested equivalent waivers; absence of evidence, not evidence of absence — check the ICFS waiver attachment before asserting either way.*)

What it forbids: nothing, to anyone.

Conditions precedent, in substance: an FCC grant; an ITU filing and coordination; a launch vehicle at cadence; and a thermal architecture the document does not describe.

The term: unspecified. **The milestones:** none stated. **The penalties:** none applicable pre-grant. **The exit clauses:** withdrawal, at will, at no cost.

WHAT HAPPENS WHEN SOMEONE VIOLATES IT

Nothing yet, because nothing has been granted. **But the enforcement question is live in the adjacent docket and the record shows exactly what teeth look like in this regime, and how sharp they are.**

- **Amazon’s own authorization** requires half of its **3,236-satellite** constellation deployed by **30 July 2026**. As of **11 March 2026** Amazon had roughly **210–212** satellites in orbit — a shortfall the FCC Chairman put publicly at roughly **1,000 satellites**. **Amazon’s response was to request a waiver** (reported variously as a 24-month extension of the half-constellation milestone to July 2028, and as a plan for full deployment by end of July 2029). **The milestone regime’s documented consequence for a 1,400-satellite shortfall is a waiver request.**
- **SpaceX’s response to the same regime** was to request exemption from it in advance.
- **The one enforcement mechanism with observed teeth is dismissal for incompleteness under §25.112**, which Amazon invoked against SpaceX on 6 March 2026 and which has **not** been applied.

The gap between the document’s teeth and its bark, stated flat: in this regime, the deadline is a waiver request and the bond is a waiver request.

THE SKEPTICAL CAVEAT — is it binding, or is it a press release with a docket number?

It is neither, precisely, and the precise answer is better than either. It is a **real application under a real rule, creating a real coordination position, imposing no obligation whatsoever, filed by a company with two flights of the vehicle it names**. It is not a press release: it cost legal work, it entered a federal system, and it exposes the filer to the same procedural attack its cousin company mounted against a rival thirteen days earlier. It is not binding: there is no schedule, no bond, no milestone, no counterparty, and no disclosed engineering.

The strongest adversarial characterization is on the record and was filed against the companion application, in Amazon’s 6 March 2026 Petition to Deny: an ambition rather than a plan; a speculative placeholder rather than a complete application; at best an exercise in publicity and messaging and at worst an attempt to stake a priority claim with no genuine intent to deploy. **The drafting AI should note that this characterization was written by Blue Origin’s beneficial**

cousin, about a competitor, thirteen days before Blue Origin filed the same shape of document — and should let that sit without editorial comment.

The strongest defense, granted fully: every constellation now flying began as an application that specialists called impossible, including the one with **10,736 active satellites** and **\$11.4 billion** of 2025 revenue. **An application is how you are supposed to start.**

THE DOCUMENT'S HISTORY AND FATE

Amendments: none documented. **Appeals:** none — nothing has been decided to appeal. **Renegotiations:** not applicable. **Terminations:** none.

The contest over it, dated:

- **19–20 March 2026.** SpaceX files a letter in the Blue Origin docket asking the Commission to apply Amazon's own substantive and procedural arguments to Blue Origin's application, for equitable and consistent treatment across both. [SECONDARY-QUOTED PRIMARY — **GeekWire, 21 March 2026.**] *This is the document's only documented adversarial event, and it is one paragraph long.*
- **~20 March 2026.** Philip Johnston, CEO of the third applicant, publicly characterizes SpaceX's letter as one of the funniest responses to an FCC filing of all time, noting that Amazon opposed SpaceX and then Blue Origin — both effectively controlled by Bezos — filed the same thing.
- **21 March 2026.** Reporting establishes the **missing ITU filing** and the **two-flight New Glenn record**.

Confidentiality, FOIA, sealing: none applicable. Part 25 applications are public by construction; there is no sealed version, no protective order, and no confidentiality fight. **That is a genuine and reportable difference from Lectures 5, 6 and 7, where the fight over the record was frequently better material than the record.** Here the record is open, short, and says almost nothing — **and the openness is the point: 51,600 satellites, fully disclosed, in fourteen pages.**

Fate: unknown, with no scheduled decision date.

RETURNING DOCUMENTS — brief-reference material only

NVIDIA's rack roadmap. Lead lecture: **L2.** L2's pack pre-allocated L9's return as **the treadmill line only** — the five-to-seven-year refresh cycle — and forbade re-derivation of the density ladder, crane day, the 800 VDC ecosystem, the midplane story, or Huang's keynote scene. **L9's single new fact, which is L9's to own and which no later lecture needs:** on **16 March 2026** the roadmap acquired a space-qualified branch — the **Space-1 Vera Rubin Module**, with **IGX Thor** and **Jetson Orin** — announced with six launch partners and a claim of up to **25x an H100** for space-based inferencing, and with the module itself **not yet shipping**. **One clause of provenance is sufficient; do not rebuild the roadmap.**

No other recurring document from the Roster's cross-lecture table appears in this lecture. The **interconnection agreement** (lead L4; returns 5, 7), **JLARC** (lead L1), the **CoreWeave S-1** (lead L6), the **AEP Ohio tariff docket** (lead L7), and **"Winning the Race" / the AI Action Plan** (lead L8; return L10) are all **absent from L9's territory and must not be imported**. The depreciation schedule is **L10's lead** and is untouched here.

SECTION 6: THE NUMBER SPINE

*Tables are permitted in this research document and banned in published prose. Stage vocabulary: **requested** / **authorized** / **built** / **launched** / **operating** for satellites; **committed** / **contracted** / **energized** for power; **announced** / **spent** / **raised** / **priced** for money; **modeled** / **measured** / **claimed** for everything else.*

THE LEDGER

figure	unit	stage	as-of	author/filer	source	tier	notes
51,600	satellites (max)	requested	19 Mar 2026	Blue Origin, LLC	ICFS SAT-LOA-20260310-00118	ANCHOR (as filing fact)	Must-hit. Project Sunrise, not TeraWave — see D1
5,408 (5,280 LEO + 128 MEO)	satellites	requested	Jan 2026	Blue Origin, LLC	FCC application; Via Satellite	STRUCTURAL	This is TeraWave
1,000,000	satellites (max)	requested	30 Jan 2026	SpaceX	ICFS SAT-LOA-20260108-00016	ANCHOR (as filing fact)	Call Sign S00798
88,000	satellites (max)	requested	accepted 13 Mar 2026	Starcloud, Inc.	FCC; SpaceNews 15 Mar 2026	ANCHOR (as filing fact)	
1,139,600	satellites requested, U.S. ODC total	requested	19 Mar 2026	three applicants	pack sum	ANCHOR	Beat 12
16,234	active payloads in orbit	measured/operating	Aug 2026	Jonathan McDowell	planet4589.org/space/active.html	ANCHOR	Unit Conversion denominator
13,972	active payloads, Lower LEO	measured	8 Jul 2026	J. McDowell	ibid.	ANCHOR	
10,736	active Starlinks	measured	8 Jul 2026	J. McDowell	ibid.	VOLATILE	grows ~weekly
34,049	total catalogued objects in orbit	measured	8 Jul 2026	J. McDowell	ibid.	ANCHOR	incl. 11,160 debris
10,994.7	tonnes, all active payloads in orbit	measured	8 Jul 2026	J. McDowell	ibid.	ANCHOR	mass denominator
3.18x	ratio, 51,600 ÷ 16,234	pack arithmetic	22 Jul 2026	this pack	\$4	STRUCTURAL/VOLATILE	Conversion — PASS
up to 8x	solar panel productivity, SSO vs Earth	claimed	4 Nov 2025	Google	blog.google / re-search.google	STRUCTURAL	Must-hit. “up to” is load-bearing — D4
1,361	W/m ² solar constant (AM0)	physical	—	physical constant	multiple	ANCHOR	
~3x	cost per watt, orbital ÷ terrestrial	modeled, base case	1 Feb 2026	A. McCalip (personal)	SpaceNews 1 Feb 2026	must-hit / CONTESTED	D3 — attribution and drift
\$31.20 / \$14.80	per watt, orbital / terrestrial	modeled, live	22 Jul 2026	A. McCalip	andrewmccalip.com	CONTESTED	= 2.11x
\$891 / \$398	per MWh LCOE, orbital / terrestrial	modeled, live	22 Jul 2026	A. McCalip	ibid.	CONTESTED	= 2.24x
22.2M	kg to LEO per 1 GW	modeled	22 Jul 2026	A. McCalip	ibid.	CONTESTED	≈2.02x all active orbital mass

figure	unit	stage	as-of	author/filer	source	tier	notes
~222	Starship launches per 1 GW	modeled	22 Jul 2026	A. McCalip	ibid.	CONTESTED	
~25,000	Starship flights per 100 GW	modeled	19 Feb 2026	A. McCalip	Engadget	CONTESTED	
105	GWh terrestrial launch energy per 1 GW	modeled	22 Jul 2026	A. McCalip	ibid.	CONTESTED	~0.2% Texas daily grid
175M / 168M	gallons LOX / methane per 1 GW	modeled	22 Jul 2026	A. McCalip	ibid.	CONTESTED	345 tanker trucks/launch
36.5	W/kg specific power (Starlink V2 Mini heritage)	modeled	22 Jul 2026	A. McCalip	ibid.	STRUCTURAL	vs Musk's implied 100 kW/t
9.0	%/yr GPU failure rate	modeled assumption	22 Jul 2026	A. McCalip (Meta-derived)	ibid.	CONTESTED	Kicker material
2.5	%/yr solar cell degradation	modeled assumption	22 Jul 2026	A. McCalip	ibid.	STRUCTURAL	
70	kW, ISS total heat rejection	operating	since Dec 2006	NASA	SAE 951651; NASA ATCS overview	ANCHOR	2 loops × 35 kW
6	ISS deployed radiator arrays	operating	since 2006	NASA	SAE 951651	ANCHOR	orbital replaceable units
3.33×2.64	m per ISS radiator panel (×8 per assembly)	design	1995/2021	AIAA JSR 10.2514/1.A35030	ibid.	ANCHOR	⇒ ~70.3 m ² /assembly
3.12×13.6	m, radiator (differently measured)	design	NASA ATCS overview	NASA/Boeing	NASA-hosted PDF	ANCHOR	conflicts with above — stated, not averaged
~166	W/m ² realized ISS radiator flux	pack arithmetic	22 Jul 2026	this pack	from AIAA + NASA	STRUCTURAL	70,000 W ÷ 421.8 m ²
130–200	W/m ² published ISS radiator range	published	2026	secondary synthesis	yage.ai	STRUCTURAL	brackets the derivation
1.4	m ² per 700 W chip at 60 °C, idealized	derived	19 Jun 2026	IEEE Spectrum	spectrum.ieee.org	STRUCTURAL	3 K background, perfect view
80	m ² per 40 kW rack, idealized	derived	19 Jun 2026	IEEE Spectrum	ibid.	STRUCTURAL	⇒ 500 W/m ² implied
85–100	°C junction throttle temperature	spec	2025–26	NVIDIA-class hardware	McCalip synthesis	STRUCTURAL	
~75	°C radiator surface constraint	derived	2026	A. McCalip	andrewmccalip.com	STRUCTURAL	10 °C gradient assumed
60	kg, Starcloud-1	launched/operating	Nov 2025	Starcloud / Astro Digital	multiple	ANCHOR	Corvus-Micro bus

figure	unit	stage	as-of	author/filer	source	tier	notes
~325	km, Starcloud-1 orbit	operating	2 Nov 2025	Starcloud	Gunter's Space Page; DCD	ANCHOR	
11	months, Starcloud-1 design life	design	Nov 2025	Astro Digital / Starcloud	DCD	ANCHOR	then deorbit and burn-up
1	NVIDIA H100 in orbit (first ever)	operating	2 Nov 2025	Starcloud / NVIDIA	multiple	ANCHOR	must-hit
1	NVIDIA A6000 failed during launch	fact	2 Nov 2025	Starcloud (Johnston)	TechCrunch 30 Mar 2026	ANCHOR	
~450	kg, Starcloud-2	funded, unflown	30 Mar 2026	Starcloud	secondary brief	VOLATILE	single-sourced
8	kW, Starcloud-2 power generation	funded, unflown	30 Mar 2026	Starcloud (Johnston)	SpaceNews 30 Mar 2026	VOLATILE	~100x Starcloud-1
6.1%	Starcloud-2 (8 kW) ÷ one GB200 NVL72 rack (132 kW)	pack arithmetic	22 Jul 2026	this pack	L2 anchor cross-ref	STRUCTURAL	Physics Audit
200	kW, Starcloud-3	in development	30 Apr 2026	Starcloud	SpaceNews	VOLATILE	3 t; chassis welded
~50 / ~10	spacecraft per Starship / MW per launch	design claim	2026	Starcloud	secondary brief	CONTESTED	
5	GW, Starcloud-4 (4 km × 4 km array)	conceptual only	2025–26	Starcloud	NVIDIA blog; DCD	CONTESTED	not funded development
\$8.2M	claimed cost, 40 MW orbital data center	claim	white paper	Starcloud	DCD	CONTESTED	does not reconcile with McCalip mass model
\$1.1B	valuation	priced (mark, not verdict)	30 Mar 2026	Starcloud / Benchmark / EQT	multiple	must-hit / VOLATILE	D2
\$170M	Series A	raised	30 Mar 2026	Starcloud	multiple	VOLATILE	two tranches
~\$200M	total capital raised	raised	30 Mar 2026	Starcloud	SpaceNews	VOLATILE	
~\$2.2B	reported valuation in talks	talks only — not printed	Apr 2026	The Information (reported)	SpaceNews 5 May 2026	VOLATILE/CONTESTED	
17	months, YC demo day → unicorn	fact	30 Mar 2026	Starcloud / YC	multiple	STRUCTURAL	must-hit ("March 2026 valuation")
15	employees, Starcloud	headcount	2026	Starcloud	Wikipedia/company	VOLATILE	HF-4
\$0.05	per kWh, Starcloud-3 target	conditional claim	30 Mar 2026	Starcloud (Johnston)	TechCrunch	CONTESTED	conditioned on \$500/kg

figure	unit	stage	as-of	author/filer	source	tier	notes
\$500	per kg, assumed launch cost	assumption	30 Mar 2026	Starcloud	TechCrunch	CONTESTED	not demonstrated
~\$1,500	per kg, best-case Falcon Heavy	market	Apr 2026	secondary analysis	tech-insider.org	VOLATILE	single-sourced
\$1,500–\$2,900	per kg, current launch cost band	published	4 Nov 2025	Google	Suncatcher paper via DCD	STRUCTURAL	
~\$200	per kg, precondition	forecast	4 Nov 2025	Google	ibid.	CONTESTED	mid-2030s
2	prototype TPU satellites, early 2027	[EXPECTED]	4 Nov 2025	Google + Planet Labs	blog.google	must-hit / STRUC-TURAL	
81 / 1 km	satellites / cluster radius, illustrative	modeled	4 Nov 2025	Google	Suncatcher preprint	STRUCTURAL	
67	MeV proton beam, Trillium v6e test	test result	4 Nov 2025	Google	Suncatcher preprint	ANCHOR	5-yr TID survived
1.6	Tbps per transceiver pair, DWDM bench	test result	4 Nov 2025	Google	Suncatcher preprint	STRUCTURAL	
25x	AI compute vs H100, space inferencing	vendor claim	16 Mar 2026	NVIDIA	nvidianews.nvidia.com	CONTESTED	module not yet shipping
12 flown / 13 attempted	Starship test flights	flight record	22 Jul 2026	SpaceX / public record	Wikipedia; Spaceflight Now	ANCHOR	must-hit (cadence dependency)
0	Starship orbital payload deliveries	flight record	22 Jul 2026	public record	ibid.	ANCHOR	
195 / –7	km apogee / perigee, Flight 12	flown	22 May 2026	SpaceX	Wikipedia	ANCHOR	suborbital
2	New Glenn flights	flight record	Mar 2026	Blue Origin	mlq.ai	ANCHOR	
>5,000	TeraWave satellites before end-2027	[EXPECTED] / announced	2026	Blue Origin	mlq.ai	CONTESTED	zero flown
2,500 → 1,000,000	tonnes/yr to orbit, 3-yr target	claim	Jun 2026	Musk / SpaceX	Light Reading	CONTESTED	400x
300–500	GW/yr deliverable	claim	19 Nov 2025	Musk	AOL/Benzinga re X post	CONTESTED	unit-hygiene failure — see audit
1 GW → 1 TW/yr	capacity ramp	claim	Jun 2026	Musk / SpaceX	Light Reading	CONTESTED	
~150 / 70	kW peak compute / m wingspan, AI1	announced design	8 Jun 2026	SpaceX	secondary	VOLATILE	prototypes early 2027

figure	unit	stage	as-of	author/filer	source	tier	notes
200,000 / <4,600	satellites/yr replacement need / 2025 global launches	adversarial arithmetic	6 Mar 2026	Amazon Leo	Petition to Deny	STRUCTURAL	~44x
3,236 / ~210	Amazon Leo authorized / in orbit	authorized / operating	11 Mar 2026	FCC / Amazon	Via Satellite	STRUCTURAL	milestone 30 Jul 2026
10,413 → 10,775	Starlink payloads in orbit	operating	1 Jun → 11 Jul 2026	J. McDowell	Space.com; McDowell tables	VOLATILE	
\$11.4B / 61%	Starlink 2025 revenue / share of total	reported (S-1)	20 May 2026	SpaceX	S-1 via secondary	STRUCTURAL	up ~50% from \$7.6B
\$18,674M / \$6,584M / ~\$5B	SpaceX 2025 revenue / adj. EBITDA / GAAP net loss	reported (S-1)	20 May 2026	SpaceX	S-1 via secondary	STRUCTURAL	primary re-pull required
10.3M	Starlink active customers	operating	31 Mar 2026	SpaceX	S-1 via secondary	VOLATILE	160 countries/markets
\$1.25T	SpaceX + xAI combined valuation	priced (merger)	2 Feb 2026	SpaceX / CNBC docs	CNBC	VOLATILE	SpaceX ~\$1T, xAI ~\$250B
\$135 / ~\$1.77T / ~\$75B	IPO price / valuation / raise	priced / listed	11–12 Jun 2026	SpaceX	secondary	VOLATILE	sources conflict — see audit
+29.5%	atmospheric Al oxide above natural, 2022	measured/modelled	Jun 2024	Ferreira, Wang et al. (USC)	Geophysical Research Letters	STRUCTURAL	
~17 / ~41.7	metric tons alumina / total Al from reentries, 2022	modeled	Jun 2024	USC	GRL; AGU release	STRUCTURAL	
up to +646%	projected Al oxide, all planned constellations	forecast	Jun 2024	USC	GRL	CONTESTED	
8x	increase in stratospheric Al oxides 2016–2022	measured	2024–26	USC	secondary	STRUCTURAL	
VM 7 / 7.6	visual magnitude limit at ~550 km / 1,000 km	recommendation	2025	Boley et al., IAU CPS	Research Notes of the AAS	STRUCTURAL	
92%	Amazon Leo satellites exceeding IAU CPS threshold	measured	2026	Mallama et al. / IAU CPS	CPS Newsletter #3	STRUCTURAL	
~1,500 / >1,800	comments, SpaceX ODC / Reflect Orbital dockets	fact	Mar 2026	FCC / AAS	aas.org action alert	STRUCTURAL	

figure	unit	stage	as-of	author/filer	source	tier	notes
14 / 17 / 8	pages: Sunrise application / Amazon petition / SpaceX application	fact	Mar / Mar / Jan 2026	respective filers	GeekWire; DCD; mexc	STRUCTURAL	8 is single-sourced
5	days, SpaceX filing → acceptance	fact	30 Jan–4 Feb 2026	FCC	DA 26-113	ANCHOR	
5 POPS / 30 TB / 100 Gbps	Three-Body: compute / storage / laser ISL	launched/operating	May 2025	ADA Space / Zhejiang Lab	SpaceNews	STRUCTURAL	12 satellites
2,800 (2,400 + 400)	Star Compute satellites (inference + training)	announced	2025–26	ADA Space	Xinhua/SCIO	CONTESTED	500–1,000 km
100	Three-Body satellites by 2027	[EXPECTED]	Apr 2026	Zhejiang Lab	Xinhua	CONTESTED	
¥140M (~\$20.4M)	Astro-Future Institute funding, ≥	raised	2025–26	Lenovo + Beijing municipality	china-in-space.com	VOLATILE	single-sourced
1 GW / 23 GW	ASCEND target before 2050 / 2030 DC market	study target	28 Jun 2024	Thales Alenia Space / EC	TAS press release	STRUCTURAL	Horizon Europe
~90%	of space-generated data never processed	claim	Apr 2026	Li Chao, Zhejiang Lab	Xinhua	CONTESTED	
>4x (\$8.64 / \$2.37)	per GPU-hour, space / terrestrial, B300-class	modeled	Jun 2026	SemiAnalysis (reported)	useluminix.com	CONTESTED	single-sourced secondary
~2040 / 2028–2030	parity forecasts (SemiAnalysis / Introl)	forecast	Jun / Feb 2026	respective	secondary	CONTESTED	22-year institutional spread
\$10M per flight	Starship price assumption ESPI called unrealistic	commentary	2026	ESPI	via Introl	CONTESTED	re-pull ESPI

AUDIT 1 — RECONCILIATION AGAINST THE MUST-HIT ANCHORS

Syllabus 2.0 carries all figures at Syllabus 1.0 must-hit values with no variants, and those values govern until the Figures & Claims Ledger exists to arbitrate. Where current research supports a different figure, name, or attribution, the pack flags and does not substitute — anywhere, including in the moves verifications.

D1 — DOCUMENT NAME DEFECT. The most important flag in this pack. Highest priority for resolution.

Anchor value (Syllabus 2.0 / Roster 1.0)**Researched value****Anchor source / date****Researched source / date****Effect on the must-hit figure****Effect on the lecture****Resolution**

“**TeraWave 51,600-satellite filing**”; “the **TeraWave FCC filing** — Blue Origin’s 51,600-satellite constellation rendered in regulatory syntax”; Paper Trail class *regulatory application*

The 51,600-satellite orbital-data-center constellation is **Project Sunrise**, filed **19 March 2026**, ICFS **SAT-LOA-20260310-00118**. **TeraWave** is a **separate, smaller** Blue Origin **broadband** constellation of **5,280 LEO + 128 MEO = 5,408 satellites**, announced and filed **January 2026**, whose role in the Sunrise architecture is to **carry Sunrise’s traffic to the ground**

Syllabus 2.0, July 2026; Roster 1.0, July 2026

SpaceNews, 19 March 2026; Tom’s Hardware, 20 March 2026; GeekWire, 21 March 2026; Via Satellite, 21 January 2026 (TeraWave); FCC ICFS file number

NONE. 51,600 is correct and survives unchanged.

Severe if unresolved. The Paper Trail beat, the Roster’s Document anchor, and the Verbatim all name a document by the wrong name. A lecture that calls its central document by the name of a different filing by the same company is a credibility failure on air, in the one course whose thesis is that the document is the character.

Nick’s call. Pack recommendation: correct the name to **Project Sunrise** throughout Syllabus 2.0 and Roster 1.0, retain the 51,600 figure, and keep **TeraWave** as a named secondary — because the fact that the 51,600 compute satellites need a *separate* 5,408-satellite constellation just to talk to the ground is genuinely good material and belongs in Beat 3.

D2 — VALUATION DRIFT.**Anchor value****Researched value****Anchor source / date****Researched source / date****Stage distinction****Resolution**

\$1.1B, “March 2026 valuation,” “fastest unicorn in Y Combinator history at \$1.1B (March 2026)”

\$1.1B confirmed exactly — \$170M Series A priced 30 March 2026, Benchmark and EQT Ventures, 17 months post-demo-day, total raised ~\$200M. **PLUS:** The Information reported in **April 2026** that Starcloud was in talks to raise at least \$200M at approximately **\$2.2B**, with SpaceX reportedly exploring strategic interest

Syllabus 1.0 / 2.0, carried from 2025–26 reporting

SpaceNews, 30 March 2026 (the \$1.1B round); SpaceNews, ~5 May 2026 reporting The Information (the \$2.2B talks)

\$1.1B is a priced round. \$2.2B is a talks-stage report. These are different species of claim and the Style Guide’s announced-vs-spent discipline applies directly

Anchor governs — carry **\$1.1B, dated March 2026**. The \$2.2B belongs in §11’s decay register, not in the prose, unless and until it prints. **Nick’s call** if a mention is wanted; pack recommendation is to hold it out of Draft 1 and revisit at Draft 2, since a printed round may have superseded both by then

D3 — ATTRIBUTION AND MODEL-DRIFT ON THE STEP FUNCTION.

Anchor value	“~3x cost/watt (Varda modeling)”; Roster: “Varda’s engineering commentary (the ~3x cost-per-watt audit from inside the industry)”
Researched value — attribution	The model is by Andrew McCalip , head of research and development at Varda Space Industries, published on his personal site with an explicit disclaimer that it uses no proprietary data and represents his personal views, not those of any company or organization. It is not Varda’s model and Varda has published no position.
Researched value — figure	~3x is correct as reported by SpaceNews on 1 February 2026 for the base case. But the model is a live calculator whose headline ratio moves with slider positions. Live reading at 22 July 2026: \$31.20/W vs \$14.80/W = 2.11x (LCOE 2.24x). Same author’s prose in the same artifact: “ It’s 400%. ” Secondary rendering (April 2026): \$42.4B vs ~\$15.9B = 2.67x
Resolution	Anchor governs — carry ~3x, dated February 2026, described as the base case of a public model. But the attribution MUST be corrected in the prose: “a Varda engineer’s own model, published personally,” never “Varda’s model.” The correction <i>strengthens</i> the audit by removing any implication of corporate positioning. Nick’s call on whether the 2.11x live reading is worth an As-Of-shaped clause; pack recommendation: no — the Stamp is spent on the valuation and a second dated hedge here would be a habit

D4 — HEDGE PRESERVATION ON THE 8x.

Anchor value	“8x panel productivity (SSO)”
Researched value	Google’s own wording is “a solar panel can be <i>up to 8 times more productive than on earth.</i> ” The hedge is in the original, in the seller’s own document
Resolution	Figure unchanged. The “up to” must survive into the prose, per the Style Guide’s mock-precision rule (“‘Up to 267%’ keeps the ‘up to’”). Not a Nick’s-call item — a drafting instruction.

D5 — MINOR, FOR THE RECORD. (*No resolution required; noted so no later pack re-discovers them.*)

- **Bezos’s remarks:** Syllabus 2.0 says “Italian Tech Week, October 2025.” The precise date is **3 October 2025**, Turin, in conversation with John Elkann; Reuters bylines Elvira Pollina and Giulio Piovaccari. **Use the precise date.**
- **Starcloud’s founding location:** Roster implies Redmond throughout. The company was **founded in El Segundo, California, in January 2024** and is **headquartered in Redmond, Washington**. Both are true at different dates.
- **Musk’s Starlink-derived compute claims, “Nov 2025–June 2026”:** the window is correct; the two anchor dates are **19 November 2025** (the 300–500 GW/yr reply to Benioff) and **8 June 2026** (the AI1 reveal).
- **SpaceX IPO figures conflict across secondary sources** on raise size, listing-day valuation and S-1 filing date (20 May 2026 vs a confidential draft ~1 April 2026). **All IPO figures in this pack are secondary and require an EDGAR pull before any of them airs.**
- **ASCEND’s claimed return** is rendered as “several billion euros” by Thales Alenia Space’s own release and as “several hundred billion euros” by one outlet. **Use Thales’s own number or neither.**

AUDIT 2 — CAPACITY / ENERGY

A gigawatt is a rate; a terawatt-hour is a quantity. Every power figure in the spine is labeled below.

Correctly labeled rates (capacity): ISS 70 kW; Starcloud-2 8 kW; Starcloud-3 200 kW; AI1 ~150 kW; Starcloud-4 5 GW; GB200 NVL72 132 kW (L2 cross-reference); ASCEND 1 GW; 23 GW 2030 market; 700 W per H100-class die; 40 kW rack.

Correctly labeled quantities (energy): McCalip's 105 GWh total launch energy for a 1 GW buildout; 2.8 GWh LOX production energy per launch; U.S. generation of 4,151 TWh in the prior year.

Correctly labeled rate-of-deployment (a third species, and this lecture is full of it): “300–500 GW per year,” “1 GW/yr by end of 2027, then 10, then 100, then 1 TW/yr,” “tens of gigawatts annually,” “1,000,000 tonnes per year.” **These are capacity added per unit time. They are coherent but they are neither a rate nor a quantity in the Style Guide's two-species sense, and the drafting AI must not let them be heard as either.**

FLAGGED BLURS — the blur itself is course material.

1. **Musk, 19 November 2025.** “Starship should be able to deliver around 300 GW per year... maybe 500 GW,” immediately followed by the observation that average U.S. electricity consumption was “500 GW.” **This juxtaposes annual added capacity against instantaneous national demand.** The two 500s are not the same species and the sentence invites the listener to hear them as equal. **FERC data for the prior year gives 4,151 TWh ÷ 8,760 h ≈ 473 GW as an average rate,** so the *national* figure is approximately right as stated; the *comparison* is not. **This is the cardinal rule violated in public by the person who owns the rockets, and it is fully documented. Beat 9 owns it.**
2. **“100 GW of AI compute capacity annually.”** Internally consistent arithmetic (1,000,000 t × 100 kW/t = 100 GW) but the phrase compresses **capacity added per year** into what sounds like a standing capacity. **Flagged; the arithmetic checks and the phrasing does not.**
3. **“5-gigawatt orbital data center.”** Starcloud-4. Correctly a rate — **but the stage label is missing everywhere it appears in the coverage.** It is **conceptual**, not funded development, per the company's own characterization. **Attach the stage every time.**
4. **“10x lower energy costs” and “10x carbon-dioxide savings.”** Neither is a power figure; both are **ratios with unstated denominators** (energy cost against which terrestrial baseline? CO₂ against which grid mix, over what asset life, including which launch emissions?). **Treat as claims, not figures.**

AUDIT 3 — PHANTOM LOAD

The phantom-load discipline: the same megawatts appearing in five utilities' forecasts are one data center, at most, and possibly zero. Any aggregate demand figure gets this caveat the first time it appears.

This lecture's aggregate figures, each checked:

1. **1,139,600 requested satellites (the three-application sum). PHANTOM-LOAD EXPOSURE: MAXIMUM, AND IT IS THE STRUCTURAL PARALLEL THE LECTURE IS BUILT ON.** These are three applications for the **same finite orbital shell** (dawn–dusk SSO, roughly 500–2,000 km), filed within seven weeks, none of which is a commitment, none of which carries a schedule, one of which expressly requested waiver of the milestone and bond rules that exist to prevent exactly this. **This is the orbital isomorph of duplicate interconnection requests inflating a load forecast — and Amazon made precisely that argument in writing on 6 March 2026: approving the application would force every other LEO operator to plan around a constellation that may never exist. Caveat mandatory on first appearance. Beat 12 owns it. The drafting AI should let the structure be felt and must not name the parallel to Lecture 4 aloud — the cascade's seams are invisible by design.**
2. **“Tens of gigawatts annually,” “100 GW/yr,” “1 TW/yr.” PHANTOM-LOAD EXPOSURE: HIGH.** These are single-author forecasts of capacity addition with no independent verification and no sensitivity table. Apply **DISCOUNT:** name the author, name the load-bearing assumptions (**specific power in W/kg, flights per year, asset life, chip supply**), output a range.
3. **The 2,800-satellite Star Compute plan and the 100-by-2027 milestone. MODERATE.** State-programme announcements with one flown tranche of 12. **Announced, not built.**
4. **“>5,000 TeraWave satellites before end-2027.” HIGH — and this one has a live, dated counterfactual: zero flown, on a vehicle with two flights.**
5. **“23 GW data center market by 2030” (ASCEND). MODERATE.** A 2024 third-party market estimate inside a feasibility study by a party seeking public funding.

6. **16,234 active payloads; 34,049 catalogued objects; 10,994.7 tonnes. NO PHANTOM-LOAD EXPOSURE.** These are **measured catalog counts of objects that physically exist**, maintained continuously by a named astronomer. **They are the cleanest numbers in the lecture and are the reason the Unit Conversion passes.**

SECTION 7: THE SELLERS & THE OVERCLAIMS

*The Overclaim Register contribution for this lecture, and the Steelman's ammunition depot. Syllabus 2.0 assigns **the Escape Artist** as the seller on the field, with **GRANT-AND-WITHHOLD** delivered as the Physics Audit and **HOLD OPEN** on whether it ever pencils. Those get the fullest treatment. The rest of the field follows, because a lecture's territory always contains more sellers than its headline.*

THE ASSIGNED SELLER — THE ESCAPE ARTIST

Cluster 1 — “Orbit removes the energy bottleneck.”

The claim as sold. Starcloud, in its 30 March 2026 Series A release, through **Philip Johnston, co-founder and CEO**: the AI revolution is colliding with the physical limits of the terrestrial energy grid; the world is quickly running out of places to build new energy projects for data centers on Earth; moving AI compute to space unlocks access to unlimited solar power and **completely removes the energy bottleneck**. **Venue: press release. Date: 30 March 2026.** Same seller, October 2025, to NVIDIA: in space you get almost unlimited, low-cost renewable energy.

What the seller gets if you believe it. A **\$1.1 billion** mark; recruiting leverage against SpaceX and Google for a 15-person team; and — per the reported April 2026 talks — a path to **\$2.2 billion** within about a month.

What's real underneath, granted precisely. All of the premise and part of the conclusion. The terrestrial constraint is real and this course has documented it for eight hours. The solar arithmetic is real: **1,361 W/m² at AM0, up to 8x** panel productivity in Google's own hedged number, **~98%** sunlight fraction at the terminator, no batteries. The escape from land, water, interconnection and the rate case is **total, not partial**.

What's oversold, named exactly. “Completely removes the energy bottleneck” is the overclaim, and it is precise enough to audit. Orbit removes the *supply* bottleneck and installs a *rejection* bottleneck. The same panel that collects 1,361 W/m² must radiate essentially **100% of what it absorbs**, at a temperature ceiling silicon sets, through a fourth-power function. The company's own next spacecraft leads with this: **Starcloud-2's headline feature is the largest commercial deployable radiator ever sent to space, serving 8 kW** — about **6%** of one GB200 NVL72 rack. **The company is telling you what the bottleneck is, in its own press release, by which subsystem it chose to brag about.**

The narrator move check. Assigned: GRANT-AND-WITHHOLD. The record confirms the calibration and the pack recommends the grant be **unusually large**. Johnston has publicly pre-registered his own failure condition — not competitive until Starship flies frequently; commercial access expected 2028–2029; if it slips, keep flying Falcon 9. A seller who names his own disqualifying condition on the record earns a wider grant, and the withhold lands harder for it.

Cluster 2 — “10x lower energy cost, 10x carbon savings.”

The claim as sold. Johnston to NVIDIA, October 2025: the only environmental cost is the launch, after which there are **10x carbon-dioxide savings** over the data center's life versus terrestrial power; and separately, **10x lower energy costs**. Also on the record, to IBM's *Think*: at least ten times lower carbon emissions, **even including the launch**; and a claim of cutting power expenses by as much as **95%**.

What the seller gets. A sustainability story that answers Lectures 3 and 8 directly, and an ESG-shaped framing for capital.

What's real. Sunlight is free and combustion-free. Water use is genuinely zero. **The comparison is not fabricated; it is unqualified.**

What's oversold. The ratio has **no published denominator**. Against which terrestrial baseline — grid average, marginal gas, or a nuclear PPA? Over what asset life — 5 years or 15? Including which launch emissions — and whose? **McCalip's independent model of a 1 GW buildout puts total launch energy at 105 GWh and propellant at 175 million gallons of LOX plus 168 million gallons of methane, with 2.8 GWh of production energy per launch for oxygen alone**

and 345 tanker trucks per launch — roughly 0.2% of the Texas grid’s daily consumption and 1.8% of Texas LOX capacity. Separately, ASCEND’s publicly funded European study concluded that space data centers reduce CO₂ only if a launcher ten times less emissive over its lifecycle is developed — a precondition the U.S. claims do not mention. **Narrator move: DISCOUNT.** Grant the direction, name the missing denominators, output a range, and let the European study’s precondition do the arguing.

Cluster 3 — “Cost parity is close.”

The claim as sold. Johnston, 30 March 2026: Starcloud-3 will be the first orbital data center genuinely cost-competitive with terrestrial facilities, at on the order of **\$0.05 per kWh** — **if** commercial launch lands near **\$500/kg**. Starcloud’s white paper: a **40 MW** orbital data center for **\$8.2 million**.

What’s real. The conditional is stated in the seller’s own sentence. **He said “if.”**

What’s oversold. The **\$500/kg** assumption is not demonstrated: Google’s own paper carries **\$1,500–\$2,900/kg**; one April 2026 analysis puts best-case Falcon Heavy at **~\$1,500/kg** and calculates that at that price Starcloud’s orbital energy cost triples to roughly **\$0.15/kWh**. And the **\$8.2M / 40 MW** figure does not reconcile with the best public independent mass model: **22.2M kg to LEO per GW scales to ~888,000 kg for 40 MW; at Starcloud’s own \$500/kg that is ~\$444M of launch alone.** (*Pack arithmetic, shown. The two models may define “40 MW” differently — IT load versus generated capacity, on different specific-power assumptions — and the pack does not adjudicate. It states that both numbers are public and they do not reconcile.*)

Narrator move: GRANT-AND-WITHHOLD, with the grant on the conditional and the withhold on the assumption inside it.

THE HYPERSCALER (secondary on this field, unavoidably present)

Cluster 4 — Musk’s capacity ramp.

The claim as sold. 19 November 2025, on X, replying to Marc Benioff: Starship should deliver **around 300 GW per year of solar-powered AI satellites, maybe 500 GW**; at 300 GW/yr, AI in space would exceed the entire U.S. economy in intelligence processing every two years; chip production is the remaining piece. **8–10 June 2026, days before the IPO: 1 GW/yr by end of 2027, then 10, 100 GW, eventually 1 TW/yr**; tonnage from **~2,500 t/yr to ~1,000,000 t/yr in about three years**; no magic required because the Starlink V3 stack already ships.

What the seller gets. An IPO narrative. **The AI1 reveal was 8 June 2026; the shares priced 11 June; the listing was 12 June.**

What’s real, granted fully. SpaceX manufactures solar arrays, thermal systems, propulsion, shielding and laser links **at volume today**. Starlink has **10,736 active satellites** and generated **\$11.4 billion** in 2025 — **61%** of company revenue, up roughly **50%** year over year, serving **10.3 million** customers as of 31 March 2026. **AI1 is a real disclosed design (~150 kW, 70 m wingspan) with two prototypes scheduled.** Nobody else has any of this.

What’s oversold. The ramp. A **400x** increase in delivered annual mass, in three years, from a vehicle that as of 22 July 2026 has flown **twelve suborbital test flights and delivered zero payloads to orbit**, and whose most recent attempt **aborted at ignition on 16 July 2026** when four Raptor 3 engines failed to light. The **100 kW/tonne** specific power assumption sits at **2.7x** the Starlink-heritage **36.5 W/kg** in McCalip’s model. And **“with no ongoing operational or maintenance needs”** contradicts every design-life and failure-rate figure in the record — including McCalip’s assumed **9%/yr GPU failure rate** and the industry’s **~5-year** design lives. **Narrator move: DISCOUNT.** Grant the direction, name the assumptions, output a range, recall the forecast graveyard — which in this territory is not hypothetical: **Blue Origin’s >5,000 TeraWave satellites before end-2027 against zero flown; Amazon’s ~1,618-by-July-2026 milestone against ~210 flown.**

Cluster 5 — Bezos’s decadal forecast.

The claim as sold. Italian Tech Week, Turin, 3 October 2025, with John Elkann; reported by Reuters: gigawatt-scale data centers in space within **10 to 20 years**, eventually outperforming terrestrial ones on 24/7 solar with no clouds, rain or weather; and that the cost of terrestrial data centers will be beaten in space within a couple of decades.

What the seller gets. A strategic frame in which Blue Origin is early rather than late; a demand narrative for New Glenn

and TeraWave; and — 167 days later — a 14-page application that reads as the fulfilment of a stated vision rather than as an opportunistic filing.

What's real. The physical premise. The 10–20 year horizon is, notably, **the most conservative founder forecast in the lecture** and is broadly consistent with Google's mid-2030s cost precondition and SemiAnalysis's ~2040 parity estimate.

What's oversold. Very little, on its own terms — **and the honest audit here is not of the forecast but of the ecosystem around it.** 123 days after Bezos said it, AWS's CEO said the opposite in public. 154 days after, Amazon petitioned the FCC to deny a competitor's identical application. 167 days after, Blue Origin filed one. **Narrator move: FRAMING is Lecture 1's and Lecture 10's and must not be spent here; use GRANT-AND-WITHHOLD on the forecast and let the sequence of dates carry the rest without editorial.**

Cluster 6 — NVIDIA's product-line claim.

The claim as sold. 16 March 2026, GTC, San Jose. **Jensen Huang, founder and CEO:** space computing, the final frontier, has arrived; intelligence must live wherever data is generated; orbital data centers become instruments of discovery. Product: **Space-1 Vera Rubin Module**, up to **25x an H100** for space-based inferencing; **IGX Thor** and **Jetson Orin** available now. Six named partners.

What the seller gets. A new product category, six reference customers, and a hedge across all six branches of the taxonomy.

What's real. The partners are real and dated; Jetson Orin is already in orbit; Planet Labs is running production workloads; and Starcloud flew the H100.

What's oversold. **The headline module is not shipping.** “Available at a later date.” And the **25x** comparison is a vendor benchmark for **inferencing**, not training — which matters given Google's own finding that single-event effects on **training runs** require further study. **Narrator move: STRIP** — remove the frontier framing, leave standing a shipping edge-inference product line, an unshipped flagship, and six named customers.

And the single most useful fact in this cluster, which belongs to the audit rather than the sale: in the same keynote Huang stated that in space there is no convection, only radiation, and that the cooling problem has to be figured out. The vendor's own founder stated the lecture's ANCHOR constraint while launching hardware into it. Grant him that; it is the most honest sentence any seller says in this hour.

THE DOOMER (audited to the same standard, per the register's calibration rule)

Cluster 7 — “It's thermodynamically impossible / it's a thermos.”

The claim as sold. A widely circulated formulation — *a satellite is, if nothing else, a fantastic thermos* — and, in more serious form, published analysis arguing that waste heat would require radiating panels spanning millions of square metres, and a named critic (**Sarah Thompson**, described as a radiation-electronics PhD with NASA and Google backgrounds) characterizing the category as investor bait. **[The Thompson characterization is single-sourced secondary; verify or drop before air.]**

What the seller gets. Attention; and, for competitors raising the argument in dockets, delay.

What's real. The thermodynamics. Radiative cooling in the temperature range electronics survive **tops out at a few hundred watts per square metre**; the ISS's realized figure derives to **~166 W/m²**; the gap does not shrink linearly with engineering investment; and **the radiators required are roughly the size of the solar arrays**, roughly doubling spacecraft mass for cooling alone.

What's oversold. **“Impossible” is not what the arithmetic says.** The most detailed public skeptical model concludes the physics does not immediately kill it and that it gets within striking distance under aggressive assumptions. **Scott Manley's point stands: Starlink V3 already manages ~30 m² of panel and its thermal load at scale.** And the **T⁴** dependence means a genuine, physically real escape route exists — raise the operating temperature — which is a materials problem, not a violated law. **Narrator move: DISCOUNT, applied symmetrically.** The strain is real; the impossibility claim mistakes a cost problem for a physics problem, which is precisely the Doomer's characteristic error as the Style Guide defines it.

Cluster 8 — “It will destroy astronomy.”

The claim as sold. AAS Petition to Deny, 6 March 2026, with simulated brightness comparisons; **DarkSky International Opposition**, 6 March 2026, demanding an EIS under NEPA; IAU, RAS and ESO comments; a Scientific American account noting proposals now exist for **more than 1.7 million additional satellites**.

What the seller gets. (*Stated carefully: this constituency is not commercially motivated and the register must say so.*) What they get is **procedural leverage in the only forum available to them. HF-2 — comedy off.**

What’s real, and it is measured rather than forecast. The IAU CPS recommendation (Boley et al. 2025, Research Notes of the AAS): fainter than **visual magnitude 7** below ~550 km, **~7.6 at 1,000 km. 92%** of studied Amazon Leo satellites exceed the threshold (Mallama et al.). **Most satellites visible to a casual observer on any given night are Starlink.** Dawn–dusk SSO is the *worst* orbit for this, because the satellite is lit while the observer is dark. Project Sunrise proposes **500–1,800 km**; SpaceX’s system **500–2,000 km — higher than Starlink, therefore visible for longer.** The AAS states that SpaceX has claimed to have reached VM7 with Starlink and has not.

What’s oversold. “Destroy” is a forecast about constellations that have not been authorized. The strongest version of the claim assumes grants that do not exist. And SpaceX has, in its **16 March 2026 Consolidated Opposition**, committed to **BRDF** brightness modeling and a **VM7** target advocated by NSF, the Vera C. Rubin Observatory and the IAU — a commitment worth granting even while noting the AAS’s dispute of the Starlink record. **Narrator move: HOLD OPEN.** Map the camps with their strongest evidence; name what would settle it — **published, independently verified brightness measurements of flown orbital-data-center hardware, of which there are none, because none has flown.**

Cluster 9 — “It’s an ozone catastrophe.”

What’s real, and it is peer-reviewed. USC / Geophysical Research Letters, June 2024: 2022 reentries raised atmospheric aluminum oxide **29.5%** above natural levels; **~17 metric tons** of alumina; **~41.7 metric tons** total aluminum; an **eightfold** rise in stratospheric aluminum oxides 2016–2022. **Leibniz Institute for Atmospheric Physics, Communications Earth & Environment, February 2026:** the first study tying a specific reentry event to a detectable plume. Alumina catalyzes ozone-destroying chlorine reactions **without being consumed. HF-3 — comedy off.**

What’s oversold. The **+646%** figure is a **projection** conditional on all currently planned constellations being deployed — including the million-satellite application. **It is a forecast with an author and it should be labeled as one.** Boley’s own framing is not catastrophe but **absence of oversight:** an experiment run without regulation, with unknown thresholds. **That is a more damning and more accurate claim than catastrophe, and it is the one to use. Narrator move: HOLD OPEN,** with the settling condition named — **atmospheric monitoring nobody currently funds.**

Cluster 10 — “It’s a bubble filing.”

The claim as sold. Amazon’s 6 March 2026 petition (ambition not plan; publicity and messaging; priority claim with no genuine intent to deploy); **Tim Farrar of TMF Associates** (the filing as quite rushed, a narrative tool for the IPO); **Deutsche Bank** (parity well into the 2030s, not 2028–29); **CNBC analysts** (speculative as a near-term revenue driver, citing unproven economics, hardware aging, latency and narrow use cases).

What’s real. Everything in Beat 12: the waiver requests, the five-day acceptance, the 14 pages, the missing ITU filing, the two New Glenn flights, the three-day gap between the AI1 reveal and IPO pricing.

What’s oversold. Amazon is a motivated party with a milestone problem of its own — **roughly 1,000 satellites short of a 30 July 2026 deadline, with a waiver request pending — and the FCC Chairman said so in public on 11 March 2026. Narrator move: GRANT-AND-WITHHOLD,** and this is the cluster where naming the seller does the most work: the best argument in the lecture was filed by the party least entitled to make it.

THE STEELMAN FILE — *assigned defendant: the orbital case at its strongest*

Full treatment at Beat 11. Consolidated here as ammunition, in the defendant’s own numbers and documents:

1. **Orbital mechanics and the solar constant** — 1,361 W/m², up to 8x, ~98% terminator sunlight fraction, no batteries. *Google’s own paper; a physical constant.*
2. **The terrestrial alternative is unavailable at any price in specific places** — eight lectures of documented evidence, and the comparison is orbit against the building that cannot be built.

3. **Radiation has substantially retired as an objection, with data** — Trillium survived 5-year-equivalent TID in a 67 MeV beam; a commercial H100 operated in LEO; NVIDIA shipped a product line. *Three independent favorable results in nineteen months.*
4. **The launch curve has one owner with every incentive** — and the skeptic's own model names vertical integration as the whole ballgame and the qualifying field as basically one.
5. **The prosecution's terrestrial benchmark has already solved every problem Lectures 4–8 are about** — McCalip's stated assumptions exclude grid interconnection and transmission, permitting, taxes, financing, water scarcity, discharge penalties and regulatory delay. *This is the defendant's single strongest point and it comes from the prosecution's own assumptions list.*
6. **The business is financeable before parity** — Starcloud-2 stated to be revenue-positive on DoD and Earth-observation hosted payloads; AWS, Google Cloud, NVIDIA and Crusoe as named workload partners.
7. **The precedent** — Starlink: 10,736 active satellites, \$11.4B of 2025 revenue, 10.3M customers, and every objection now raised was raised against it first.
8. **The strategic argument** — China: first dedicated orbital compute constellation flown 14 May 2025; 2,800-satellite programme; 100 by 2027; gigawatt-scale space infrastructure in a five-year plan; a national standards committee. Europe: a Horizon Europe study with a 1 GW-by-2050 target.

The defendant's best documents: the Suncatcher preprint (4 November 2025); McCalip's assumptions list (both halves); the Starcloud-2 partner manifest; SpaceX's S-1 Starlink disclosures.

The defendant's best quote, verbatim, held to length: *"the physics doesn't immediately kill it"* — Andrew McCalip, quoted by SpaceNews, 1 February 2026. (Deployment note: **Beats 6 and 11 both want this sentence; it may be quoted once. Recommendation at Beat 11.**)

The steelman's weakest joint, named so the audit lands: every version above is true on a five-to-fifteen-year horizon and **none of them makes a gigawatt in 2026 or 2027.** The defendant's own witnesses concede the timing — Johnston (2028–29), Google (mid-2030s), Thales (2050). **The strongest case for the orbital thesis is a case for patience, and the valuations are not priced for patience.**

MARKUP ALTERNATE — **a second steelman-grade defendant, banked and not substituted.** **The Earth-observation edge-compute case:** Planet Labs PBC (public, revenue-generating, IGX Thor and Blackwell in production, Owl platform, hours-to-seconds time-to-insight), Kepler Communications, Axiom Space, Sophia Space, and Starcloud's own hosted-payload line. **Its case does not require launch costs to fall at all,** because its alternative is not a terrestrial data center but **losing the data** — up to 90% of everything generated in space, per Zhejiang Lab. **A distinct party; would not violate the rotation.** The pack recommends keeping the assigned defendant, because the assigned one is the one about to look worst.

THE ABSENT SELLER — a finding, stated because the absence is itself material

The Politician is nearly absent from this lecture's American territory, and that is a structural fact worth one clause in the draft. There is no council vote, no governor's ribbon-cutting, no state bill, no moratorium, no jobs pitch, and no ratepayer constituency — because there is no jurisdiction. **The only political actors in the record are a federal regulator taking a side on X (Brendan Carr, 11 March 2026) and two foreign states writing orbital compute into industrial plans (China's 15th Five-Year Plan; the EU's Horizon Europe via ASCEND).**

The consequence for the register: Lecture 8's three-altitude collision does not have an orbital equivalent, and the lecture should not pretend it does. **Where Lecture 7 asked who pays and found a rate class, and Lecture 8 asked who decides and found three altitudes, Lecture 9 asks both and finds a docket with 1,500 comments and no decision date.** That is the honest shape of the hour and it is what makes the Handoff work.

SECTION 8: THE HUMAN FLOOR

Every point where this lecture's machine touches a household, a ratepayer, a fence-line resident, or a worker — documented individuals only. Comedy off in every zone this section covers.

THE DECLARED FAILURE, STATED FIRST

Pack dependency D-f: there is no Neighbor-grade fence-line household in this lecture's territory, and this pack did not find one, because none exists.

No household has been documented as harmed by an orbital data center. No well has gone dry downgradient of a satellite. No residential bill carries a line item traceable to a launch. No county board has heard testimony about a constellation. **The Neighbor beat is correctly negative space in Syllabus 2.0's plan, and the reason is not that the pack failed to search — it is that the harm this lecture's machine produces is structurally *distributed and un-household*ed.** That is the lecture's finding, not its gap.

Three candidate substitutions were considered and all three are refused, per the research instruction that an honest failure beats a stretched identification:

- **The Memphis residents.** **KeShaun Pearson**, founder of Memphis Community Against Pollution, and **Sarah Houston**, executive director of Protect Our Aquifer, both responded on the record on **4–5 March 2026** to xAI's orbital-data-center announcement — Pearson noting that promises made on the ground had not come true, Houston characterizing the orbital plan as an attempt to solve energy shortages on Earth. **Boxtown-adjacent resident James Kirkwood**, near Colossus 2 on Tulane Road, described a change in the air. **These are real, named, documented humans, and they are Lecture 8's, entirely.** L8's pack has built them at full treatment and owns the fight. **L9 touches this at one clause, at the inheritance (\$10), and never as a beat. Refused as a substitution. HF-1 — comedy off wherever it is touched.**
- **The astronomers.** Documented, named, quantified, and genuinely harmed in their working lives — but a professional constituency is not a fence-line household, and promoting one into a Neighbor-grade human would be the stretched identification the instructions forbid. **They are covered below as what they are: an affected constituency with a filed record.**
- **The individual FCC petitioners.** **William Stewart** (Petition to Deny, filed 12 February 2026) and **Nickolai Bakken** (Petition for Environmental Review) are named individuals in a federal docket. **The pack has no biography, no location, no personal harm, and no quoted words beyond the captions and arguments of their filings. Refused.** (*They remain worth naming in Beat 8 and Beat 12 as evidence that private citizens filed against a million-satellite constellation — a fact, not a portrait.*)

Designated fallback, flagged for markup: none required, because **Syllabus 2.0 does not run a Neighbor beat in this lecture.** No slot is empty. **The dependency is resolved by an honest negative finding.**

WHAT THE HUMAN FLOOR IS IN THIS LECTURE — four documented zones

HF-2 — The observational-astronomy constituency

Who they are, by name and institution. The **American Astronomical Society** (Petition to Deny, 6 March 2026, ~14 pp with simulated brightness figures; Reply, 23 March 2026); **DarkSky International** (Opposition Brief, 6 March 2026); the **International Astronomical Union** and its **Centre for the Protection of the Dark and Quiet Sky (CPS)**; the **Royal Astronomical Society**; the **European Southern Observatory**; the **National Science Foundation** and the **Vera C. Rubin Observatory**, both named in SpaceX's own opposition as the advocates of the standard it says it is targeting. Named individuals: **Aaron Boley**, associate professor of astronomy and astrophysics, University of British Columbia, lead author on the IAU CPS brightness rationale; **Anthony Mallama**, lead author of the CPS brightness study of Amazon Leo satellites; **Dara Norman** and **Kelsey Johnson**, then and incoming presidents of the AAS, who published a joint response in SpaceNews on the future of astronomy.

The documented harm, in specifics and numbers. The **IAU CPS** recommends satellites below ~550 km be fainter than **visual magnitude 7** so as not to be visible to casual observers, and satellites at higher altitudes fainter still — approximately **magnitude 7.6 at 1,000 km** (Boley et al. 2025, *Research Notes of the AAS*). **Mallama et al. found 92% of studied Amazon Leo satellites exceeded the recommended threshold.** The AAS states that **on any given night, most satellites visible to casual observers are Starlink satellites**, and that SpaceX has claimed to have reached VM7 with Starlink and **has not**. The proposed orbital-data-center constellations sit **higher** than Starlink — **500–1,800 km** (Sunrise), **500–2,000 km** (SpaceX) — and are therefore **visible for longer durations**, and are expected to be **larger and brighter** because of the solar arrays a data center requires. **The AAS notes that the application provides no quantitative brightness detail.** The harm is to **taxpayer- and government-funded** ground-based and low-Earth-orbit-based facilities.

Their verbatim words, with full context.

“If the FCC were required to conduct NEPA review of reflected orbital light, it could deny the license or condition it differently.” — American Astronomical Society, Petition to Deny, at 14, filed 6 March 2026, FCC ICFS SAT-LOA-20260108-00016. [SECONDARY-QUOTED PRIMARY — reproduced in TechFreedom’s comments; the AAS petition PDF is public at aas.org. Re-pull before air.]

“DarkSky opposes and objects to approval of the Application unless an Environmental Impact Statement is prepared as required by NEPA” — DarkSky International, Opposition Brief, at 2, filed 6 March 2026, same docket. [SECONDARY-QUOTED PRIMARY — reproduced in TechFreedom’s comments. Re-pull before air.]

Paraphrase, marked, with locator: Nickolai Bakken’s petition for environmental review argues that NEPA identifies **irreversible and irretrievable commitments of resources** as a required dimension of environmental review, and separately requires study of appropriate alternatives. **Locator:** **Petition for Environmental Review of Nickolai Bakken, at 3, FCC ICFS SAT-LOA-20260108-00016, filed on or about 6 March 2026, quoted in TechFreedom’s comments. Note for Lecture 10: a private citizen used the Irreversibility Ledger’s exact vocabulary in a federal data-center docket in March 2026. Export, do not spend.**

The other side’s documented response, stated as a conflict rather than smoothed. SpaceX’s Consolidated Opposition, filed 16 March 2026, states that the company is refining **Bidirectional Reflectance Distribution Function (BRDF)** models to predict satellite brightness as seen from Earth; that the target is to keep operational brightness **below visual magnitude 7 — faint enough to be barely visible even in the darkest skies**; and that it will develop and implement advanced brightness-mitigation techniques with the goal of achieving the VM7 threshold advocated by NSF, the Vera C. Rubin Observatory and the IAU. **It also describes inclination and shell-geometry choices intended to stabilize relative geometry and minimize long-term collision risk.** [SECONDARY-QUOTED PRIMARY — the opposition PDF is public; re-pull before air.] **The conflict is presented as a conflict: the applicant states a target and the astronomers state that the same applicant missed the same target with its last constellation.**

The procedural status. Unresolved. Comments closed 6 March 2026, oppositions 16 March, replies 23 March. **No order has issued on any of the three applications as of 22 July 2026. The 2023 precedent is against them:** a court upheld the FCC’s conclusion that SpaceX’s mitigation efforts were sufficient to avoid significant environmental impacts in the Starlink Gen2 authorization, citing SpaceX’s collaboration with astronomers as evidence of good faith.

HF-3 — The atmosphere, and the people measuring it

Who. Ferreira, Wang and colleagues, University of Southern California Department of Astronautical Engineering (contacts published by AGU: Joseph Wang, USC; José P. Ferreira), publishing in **Geophysical Research Letters, June 2024**. Researchers at the **Leibniz Institute for Atmospheric Physics, Kühlungsborn, Germany**, publishing in **Communications Earth & Environment, February 2026**. Aaron Boley (UBC) and Michael Byers, on the policy and casualty-risk literature.

The documented finding, in numbers. A typical **250 kg** satellite with **30%** of its mass in aluminum generates alumina on reentry. In **2022**, reentering satellites released an estimated **~17 metric tons** of aluminum oxide nanoparticles; total aluminum from reentries reached **~41.7 metric tons**, roughly **30% more** than Earth receives naturally from micrometeoroids; atmospheric aluminum oxide rose **29.5%** above natural levels; stratospheric aluminum oxides rose **eightfold** between 2016 and 2022. **Alumina catalyzes ozone-destroying chlorine reactions without being consumed** — unlike the silicate particles shed by natural meteoroids. Projected increase if all currently planned constellations deploy: **up to 646%**. **Mega-constellation satellites are designed for roughly five-year lives, which means the deposition is not an accident but a design output.**

Boley’s documented position, which is about governance rather than catastrophe. He has said the experiment is now being run without oversight or regulation, and that the thresholds are unknown. [Verify the current-window restatement — Engadget, 19 February 2026 — or attribute to the original interview date. Do not date-shift a quote.]

Procedural status. There is no forum. No agency meters stratospheric alumina from reentries; no application in this lecture’s docket discloses expected deposition; the FCC’s satellite licensing is **categorically excluded** from NEPA review, and that exclusion survived a 2023 court challenge.

HF-4 — The worker who is not there

The documented facts. Starcloud has 15 employees (2026). It flew the first data-center-class GPU in orbit with a team that numbered five in February 2025. Blue Origin has been advertising for satellite engineers and a director of commercial sales for data center markets. There are no operators of an orbital data center, no shift structure, no maintenance rotation, and no trades. The ISS's radiators are orbital replaceable units because NASA assumed humans would service them; there are no humans in a dawn–dusk sun-synchronous compute constellation.

Why this is a human-floor zone and not a joke. Lecture 8 established the data center as the physical avatar of automation anxiety, and established the genuinely strange fact that the avatar employs about fifty people. **The orbital version of that building employs nobody, and the terrestrial jobs it does create are engineering jobs in Redmond, Kent, Hawthorne and Bastrop — not jobs in the places Lectures 1, 7 and 8 documented. State it as fact. Do not build a punchline on it.** The Style Guide's rule holds: name the floor through specifics; earn the weight; never sermonize.

HF-1 — The inherited floor, touched once

Documented, named, and owned by Lecture 8. On 4–5 March 2026, from the middle of an active fence-line fight in Memphis, xAI announced plans for orbital data centers. **KeShaun Pearson** (founder, Memphis Community Against Pollution) told Action News 5 he remained skeptical, reported that pollution sensors installed after xAI's arrival showed peak nitrogen oxide levels from the turbines had risen 79%, and said the promised jobs had not materialized. **Sarah Houston** (executive director, Protect Our Aquifer) noted the orbital plan was an attempt to solve energy shortages on Earth. **James Kirkwood**, a Boxtown-adjacent resident near Colossus 2 on Tulane Road, described a change in the air.

L9's entire permitted use of this material is one clause of inheritance at the top of the lecture, and it must not be a beat, a scene, or a quote. L8 owns the full treatment, the verbatim, and the floor. **Comedy off wherever it is touched.**

HEARING-TRANSCRIPT PULLS

None exist in this lecture's territory, and the pack states that plainly. The FCC proceeding is **written**: applications, petitions, oppositions, replies and a public notice. **There was no hearing, no oral argument, no technical conference, and no transcript.** There are no county minutes, because there is no county. **The only quasi-hearing corpus is the SpaceNews “Opportunities for On-Orbit Computing” event in Washington, D.C. on 30 April 2026,** at which Johnston spoke — a trade conference reported in summary, with no published transcript. **The Hearing Room beat is therefore unbuildable in this lecture and is correctly negative space (§3, item 3). L9 runs zero scene beats, and the max-1-scene rule is satisfied by construction.**

What substitutes for a transcript here, and it is the pack's most useful structural observation for the drafting AI: the docket itself is the transcript. Amazon's 17 pages, the AAS's petition and reply, DarkSky's opposition, SpaceX's consolidated opposition, SpaceX's one-paragraph letter, Carr's public post, Johnston's public post — **that is a documented exchange between named parties, in sequence, on the record, over seventeen days.** It is a hearing conducted in writing, and every line of it is quotable with a file number attached.

SECTION 9: THE PEOPLE & THE CAST

Organized by the four-slot cast. Documents are covered in Section 5 and cross-referenced rather than duplicated.

THE HUMANS

Philip Johnston — co-founder and CEO, Starcloud, Inc. (Roster anchor, Human slot. **LEAD** lecture: this one. No return lecture assigned.)

Age: 39 as of March 2026 (*Observer*). **Career trajectory, with the details that do narrative work.** Former associate at **McKinsey & Company**; one profile states he worked there on satellite projects for national space agencies. Co-founder of **Opontia**, an e-commerce venture. (*A composite of educational credentials — Harvard, Wharton, Columbia, plus a CFA charter — appears in a single secondary profile and is single-sourced; the McKinsey and Opontia facts are multiply sourced via Geek Wire, February 2025. Do not assert the degrees without verification.*)

As-of titles at every dated moment this lecture touches. *January 2024:* co-founder, **Lumen Orbit**, El Segundo, California. *Summer 2024:* Y Combinator S24 participant. *December 2024:* CEO of a company with \$11M seed. *February 2025:* CEO, **Starcloud** — the rename date. *October 2025:* CEO, quoted by NVIDIA. *2 November 2025:* CEO of the company that put the first H100 in orbit. *13 March 2026:* CEO of the applicant for 88,000 satellites. *30 March 2026:* CEO of the fastest unicorn in Y Combinator history. *30 April 2026:* speaker, SpaceNews on-orbit computing event, Washington D.C. **Use “co-founder and CEO, Starcloud” throughout; the only title that drifts is the company name, and February 2025 is the hinge.**

What he wanted. Initially — per co-founder Adi Oltean’s own framing at founding — a constellation for **in-space edge processing**: other satellites send raw data to be processed on orbit. By 2026, the framing had become the terrestrial energy grid’s physical limits. **Both are true simultaneously, and the gap between them is the Founder Audit.**

What he feared, in his own words and against his own interest. Starship slipping. He has stated publicly that Starcloud will not be competitive on energy costs until Starship is flying frequently; that he expects commercial access in **2028–2029**; and that if it slips, the company will carry on launching smaller spacecraft on Falcon 9. **He also volunteered that the H100 is probably not the best chip for space, and that a second GPU aboard Starcloud-1 — an NVIDIA A6000 — failed during launch.**

What he could enforce. Payload design, manifest choices, and the company’s own schedule. **Nothing about launch.**

What he actually did. Founded a company in January 2024; renamed it in February 2025 because of a trademark; flew a real data-center GPU to orbit **21 months** after founding on **\$21 million**; trained an LLM and ran a Gemini-family model in orbit in December 2025; filed for **88,000 satellites**; priced a **\$170 million** round at **\$1.1 billion** on 30 March 2026, **17 months** after demo day; and welded up a Starcloud-3 chassis before there was a rocket to launch it on.

Documented quotes with full attribution. (*Verbatim bank consolidated at Beat 2.*) On the rename, to GeekWire, February 2025: **“Apparently, Lumen Technologies has the right to ‘Lumen’ for data centers.”** On the chip, to TechCrunch, 30 March 2026: **“An H100 is probably not the best chip for space, to be honest.”** On the reception, to GeekWire, 30 March 2026: he said the company had been fairly roundly pilloried early on. On SpaceX’s letter, on X, ~20 March 2026: **“one of the funniest responses to an FCC filing of all time.”**

Current status as of 22 July 2026. Co-founder and CEO, Starcloud, Redmond, Washington. Company reportedly in talks at ~\$2.2B. **Starcloud-2 targeted for October 2026.**

Ezra Feilden — co-founder and CTO, Starcloud. (Secondary; pack dependency D-e.)

Engineering background at **Oxford Space Systems** and **Airbus Defence and Space**. **Documented, not asserted.** *What he supplies to the narrative: the deployable-structures lineage. Oxford Space Systems is a deployable-antenna and deployable-boom specialist, and Starcloud’s headline subsystem is a deployable radiator. The pack notes this adjacency as documented career fact and marks any causal inference as inference.*

Adi Oltean — co-founder and chief engineer, Starcloud. (Secondary; D-e.)

Former **principal software engineer at SpaceX’s Starlink facility in Redmond, Washington**, and at **Microsoft Azure**. **The chief engineer of the company that must buy launch from SpaceX used to work for SpaceX, in the same suburb.** His own founding-era framing, by email to GeekWire: the mission was a constellation of orbital data centers for in-space edge processing, with other satellites sending raw data.

Bailey Montaña — lead mechanical engineer, Starcloud (as of February 2025).

Previously **Helion Energy** and **SpaceX**. Named in GeekWire’s February 2025 account of a five-person team.

Jeff Bezos — founder, Blue Origin; executive chair, Amazon.com, Inc. (Roster secondary.)

As-of title at the dated moment: 3 October 2025, Italian Tech Week, Turin — founder of Blue Origin and executive chair of Amazon. *Wants:* orbital infrastructure as the next industrial frontier and Blue Origin positioned early. *Fears (inferred from the record, marked as inference):* being late to an AI-infrastructure category that his own cloud company sat out. *Can enforce:* Blue Origin’s capital allocation and filing strategy. *Actually did:* forecast gigawatt-scale orbital data centers in 10–20 years; **167 days later his rocket company filed for 51,600 satellites; 13 days before that, his other company petitioned to deny a competitor’s near-identical filing. The pack does not editorialize this sequence; it dates it.**

Elon Musk — CEO, SpaceX (from 2 February 2026, of the merged SpaceX-xAI entity; from 12 June 2026, of a Nasdaq-listed company, ticker SPCX). (Roster secondary.)

Wants: tonnage to orbit, an IPO narrative, and a Kardashev-scale framing. *Fears:* chip supply, which he named himself. *Can enforce:* the only variable that matters — launch cost and cadence. *Actually did:* filed for a million satellites on 30 January 2026; merged xAI into SpaceX on 2 February; unveiled AI1 on 8 June; priced the largest IPO on record on 11 June; and, on 17 July 2026, announced that two Raptors would be removed and replaced. **Documented quotes, held to length:** “Starship should be able to deliver around 300 GW per year of solar-powered AI satellites to orbit, maybe 500 GW” (X, 19 November 2025). “To be confident of a good flight, 2 Raptors will be removed & replaced.” (X, 17 July 2026).

Jensen Huang — founder and CEO, NVIDIA. (Return; lead lecture L2 — the roadmap returns here, not its narrator, per the Roster. If a draft wants his voice, it uses the roadmap document. The pack supplies the one quote the roadmap’s space branch generated.)

16 March 2026, GTC keynote, San Jose: “Space computing, the final frontier, has arrived” — and, in the same keynote, that in space there is no convection, only radiation, and the cooling problem has to be figured out. **One deployment maximum; the constraint sentence is the more valuable of the two.**

Andrew McCalip — head of research and development, Varda Space Industries; publishing personally. (Roster secondary — attribution corrected at D3.)

Wants (in his own words): a booming orbital space economy, and a discourse that does arithmetic. *Can enforce:* nothing — which is why he published the source code. *Actually did:* built the most detailed public model of orbital data center economics, published it with its assumptions and its omissions listed, put the code on GitHub, and invited people to break it. **Documented quotes:** “the physics doesn’t immediately kill it, but the economics are savage” (via SpaceNews, 1 February 2026). “Thermal: only solar array area used as radiator; no dedicated radiator mass assumed” (his own assumptions list). **His disclaimer is load-bearing and must survive into the prose: the page uses no proprietary data and represents his personal views, not any company’s.**

Matt Garman — CEO, Amazon Web Services. (Not on the Roster; surfaced by research and recommended for addition as a secondary.)

3 February 2026, Cisco AI Summit, San Francisco. “There are not enough rockets to launch a million satellites yet.” Also: the cost of getting a payload to space today is massive; it is just not economical; a rack of servers is heavy; humanity has yet to build a permanent structure in space. **Reported by Reuters (Greg Bensinger) and Fortune (Alexei Oreskovic).** *Why he matters:* he runs **more than 900 data centers** and said the opposite of what his company’s founder said four months earlier and one day after that founder’s rival announced the merger. **Recommended for Roster addition; the pack flags it rather than assuming it.**

Brendan Carr — Chairman, Federal Communications Commission. (Not on the Roster; surfaced by research and recommended for addition as a secondary.)

11 March 2026, on X: criticized Amazon for filing petitions while falling roughly **1,000 satellites** short of its own upcoming deployment milestone. *Wants:* deployment and U.S. leadership. *Can enforce:* acceptance, grant, dismissal, milestones, bonds. *Actually did:* presided over a **five-day** acceptance of a million-satellite application and took a public side while the docket was open. **Recommended for Roster addition — the lecture has no Politician and this is the closest documented approximation.**

Named others in the record, with as-of titles.

Sundar Pichai, CEO, Alphabet and Google (4 November 2025 — the Suncatcher moonshot framing). **Will Marshall**, CEO, Planet Labs PBC (16 March 2026). **Baiju Bhatt**, founder and CEO, Aetherflux (16 March 2026). **Marc Benioff**, chairman and CEO, Salesforce (19 November 2025 — the prompt). **John Elkann**, chairman, Ferrari and Stellantis (3 October 2025 — the interlocutor). **Ian Dahl**, engineer, SpaceX (8 June 2026). **Tim Farrar**, TMF Associates (February 2026 — the “rushed filing / IPO narrative tool” reading). **Chetan Puttagunta**, board member, Starcloud (Benchmark). **Dennis Muilenburg**, former CEO of Boeing, angel investor in Starcloud’s Series A. **Aaron Boley**, associate professor, UBC. **Anthony Mallama**, IAU CPS brightness study. **Dara Norman** and **Kelsey Johnson**, AAS presidents. **Joseph Wang** and **José P. Ferreira**, USC. **Zhao Hongjie**, executive vice president, ADAspace (25 April 2026). **Li Chao**, director, space-based computing system research center, Zhejiang Lab. **Christophe Valorge**, CTO, Thales Alenia Space (28 June 2024). **Scott Manley**, science communicator and former software engineer (19 February 2026 — the Starlink V3 thermal counterpoint). **William Stewart** and **Nickolai Bakken**, individual FCC petitioners. **Jonathan McDowell**, astronomer,

formerly Harvard–Smithsonian Center for Astrophysics — **the source of every catalog number in this pack.**

THE INSTITUTIONS

Starcloud, Inc. *Motive:* be the pure-play orbital data center company. *Exposure:* buys launch, buses and chips from others — the margin stack McCalip identifies as decisive. *Incentive structure:* venture equity, no debt, no securities filing, no depreciation schedule to defend. *Balance sheet:* ~\$200M raised, \$1.1B mark (30 March 2026), 15 employees, one operating satellite. *What it filed:* an 88,000-satellite application, accepted 13 March 2026. *What it gets if believed:* the round.

Blue Origin, LLC. *Motive:* a market position in orbital compute and a demand anchor for New Glenn. *Exposure:* two New Glenn flights; zero TeraWave satellites against a stated >5,000-before-end-2027; no ITU filing as of 21 March 2026. *Incentive:* privately held and not required to disclose. *What it filed:* 14 pages on 19 March 2026. *What it gets if believed:* legitimacy and a coordination priority. **Treat as incentives plus constraints, never villainy.**

SpaceX (Space Exploration Holdings, LLC / SPCX). *Motive:* the launch monopoly's natural extension into the payload business, plus an IPO narrative. *Exposure:* Starship's flight record and, since 12 June 2026, public shareholders. *Incentive structure, in its own disclosed numbers:* 2025 revenue **\$18,674M**, adjusted EBITDA **\$6,584M**, GAAP net loss near **\$5B**; Starlink **\$11.4B** (61%), **10.3M** customers at 31 March 2026. *What it filed:* a million-satellite application with four waiver requests, a consolidated opposition, and a one-paragraph letter about Blue Origin. **All financials secondary; EDGAR pull required.**

Amazon / Amazon Leo (formerly Project Kuiper) and Amazon Web Services. *Motive:* protect a constellation it is behind on, and protect a terrestrial cloud estate of **more than 900 data centers**. *Exposure:* ~210–212 satellites against a **30 July 2026** milestone of roughly half of **3,236**; a waiver request pending. *What it filed:* a 17-page Petition to Deny on 6 March 2026 — **the best-argued document in the lecture, filed by the party least entitled to make the argument.** *And simultaneously:* an AWS server blade flying on a competitor's demonstrator in October 2026.

Alphabet / Google. *Motive:* option value on a compute frontier and a research reputation. *Exposure:* modest — a preprint and two prototype satellites. *What it published:* the most rigorous public engineering document in the category, including its own disqualifying cost precondition. *What it gets if believed:* first-mover credibility at a fraction of the capital.

NVIDIA. *Motive:* a new SKU category and a hedge across every branch of the taxonomy. *Exposure:* reputational only — the flagship module is not shipping. *What it announced:* 16 March 2026, six partners, a 25x inferencing claim.

Planet Labs PBC. *Motive and exposure:* a real, revenue-generating, on-orbit edge-compute business — **the only party in the lecture whose orbital compute thesis does not depend on launch costs falling.**

The Federal Communications Commission, Space Bureau. *Motive:* spectrum management, and under the current chairmanship, visible support for deployment. *Constraint:* no statutory remit over sky brightness or atmospheric deposition; a categorical exclusion from NEPA that survived a 2023 court challenge. *What it did:* accepted a million-satellite application in five days; issued no order on any of the three as of 22 July 2026.

The American Astronomical Society, IAU CPS, RAS, ESO, DarkSky International, NSF, Vera C. Rubin Observatory. *Motive:* the continued usability of ground-based astronomy. *Exposure:* their instruments' entire output. *Ballot-box or balance-sheet incentive:* none — **which is precisely why their filings carry weight in a docket full of motivated parties.** **HF-2.**

ADA Space (Guoxing Aerospace) and Zhejiang Lab. *Motive:* state-adjacent industrial capability and the bandwidth argument. *Exposure:* a five-year-plan commitment. *What flew:* 12 satellites, 14 May 2025.

Thales Alenia Space and the European Commission (ASCEND). *Motive:* European digital sovereignty and Green Deal carbon targets. *Exposure:* Horizon Europe money. *What it published:* a study whose headline conclusion contains its own precondition — a launcher **10x less emissive** over its lifecycle.

Varda Space Industries. *Motive:* in-space manufacturing, not orbital compute. *Its relevance here is entirely through an employee publishing personally.* **The company has published no position and must not be described as having one.**

THE OBJECTS

The deployable radiator — Roster anchor, Object slot. **LEAD** here; no prior or later lecture owns it.

Provenance and heritage. The design basis is the **ISS Heat Rejection Subsystem**, specified in **SAE Technical Paper 951651 (1995)**: six identical, interchangeable, **orbital-replaceable** deployed radiator arrays serving two single-phase anhydrous-ammonia loops, rated **70 kW total** (35 kW per loop), designed for a **10-year** near-Earth-orbit environment including micrometeoroid and debris strike, solar degradation, and thermal extremes low enough to freeze the working fluid.

Manufacture and dimensions. Per *AIAA Journal of Spacecraft and Rockets* (10.2514/1.A35030): each assembly comprises **eight identical panels**, **3.33 m × 2.64 m**; **22 flow tubes embedded in parallel** for redundancy; **two supply and two return manifolds** providing two independent flow passages. **Manifolds and flow tubes are Inconel 718**, selected for resistance to the pressures generated by ammonia freezing and thawing and for corrosion resistance to ammonia. (*A NASA-hosted ATCS overview gives a radiator dimension of 3.12 m × 13.6 m; the two measurements do not reconcile and almost certainly describe different articles. Stated, not averaged.*)

Working fluid and chemistry, by name. **Single-phase anhydrous ammonia** externally; **water** internally; **interface heat exchangers** between the loops. Ammonia's freezing point: **−107 °F / −77 °C** at standard atmospheric pressure. Circulation by **Pump Flow Control Subassembly** (photovoltaic loops, operating since December 2000) and **Pump Module** (external loops, since December 2006) — both **orbital replaceable units**.

Operating regime. Surface temperature constrained to roughly **75 °C** for an **85 °C** junction with **~10 °C** of gradient; emissivity **~0.90** on the radiator face; realized heat flux **~166 W/m²** derived from the ISS's own numbers, against **~500 W/m²** in the idealized deep-space-facing calculation.

Failure modes, documented and dated. **7 May 2013:** EATCS Loop A ammonia leak requiring emergency EVA; root cause traced to **coating delamination under repeated orbital freeze–thaw cycling**. **3 May 2017:** a leak in **Loop B, Radiator #3, Flow Path #2**, located by the **Robotic External Leak Locator**, resolved by **isolating and venting the flow path to vacuum** — with NASA computing the worst-case time to empty and the thrust the vent would impose on the station (**NTRS 20180007472**). **Deployment risk:** the arrays are unlatched and deployed remotely without EVA, which means the deployment mechanism is a single-point failure nobody can reach.

Chain of custody. Stowed for launch attached to its mating truss segment; deployed remotely on orbit; serviceable only by astronaut EVA or robotic arm; replaceable as a unit **because NASA assumed replacement would be necessary**.

The commercial descendant. **Starcloud-2** will carry the **largest commercial deployable radiator ever sent to space**, on a spacecraft generating **~8 kW**, targeted for **October 2026**. **Area, mass and deployed geometry: not published.** (*Note the framing the Roster identified and the record confirms: the company chose its heat-rejection subsystem as the headline feature of its next spacecraft. A company leads with its hardest problem when the hardest problem is also its moat.*)

Cost and lead time: not published for any commercial article. State the absence.

The Nvidia H100 aboard Starcloud-1 — the object that proved the premise.

Housed in a **silver module** inside a **60 kg** spacecraft **about the size of a small refrigerator**, on an **Astro Digital Corvus-Micro** bus. Launched **2 November 2025, 01:09 ET**, Falcon 9 from Cape Canaveral, on a SmallSat Rideshare with **18 payloads**. Orbit **~325 km**; velocity roughly **28,000 km/h**; design life **11 months**. **Not radiation-hardened**. Operated through launch vibration, thermal cycling and LEO radiation; trained **nanoGPT** on Shakespeare and ran a **Gemma/Gemini-family** model in December 2025. **A companion NVIDIA A6000 aboard the same spacecraft failed during launch**. Cooling system described as **adapted from International Space Station heat-rejection technology** — [single-sourced secondary; verify before asserting the ISS lineage on air].

Raptor 3 — the object that stopped the escape on 16 July 2026.

33 engines on the Super Heavy booster, photographed from beneath the Pad 2 launch stand at Starbase on **16 July 2026**. **Four failed to light**; Musk stated **two** would be removed and replaced. **The most consequential object in this lecture is an engine that did not start.**

Starcloud-3's chassis — welded up in Redmond as of 30 April 2026, 3 tonnes, 200 kW, designed for a PEZ dispenser on a rocket that has not reached orbit. An object waiting for a vehicle.

RECURRING-CAST DISCIPLINE

Characters whose lead lecture is here (full treatment; later lectures never rebuild): Philip Johnston; the deployable radiator; the Project Sunrise application. All three are complete above and in §5.

Characters returning from elsewhere (brief reference only, with the owning lecture named): NVIDIA's rack roadmap — lead L2; L9's allocated addition is the treadmill line plus the single new fact of the 16 March 2026 space branch. **Crusoe** — lead L6; L9 adds one fact (named Starcloud-2 workload partner and reseller of early orbital capacity). **Jensen Huang** — lead L2; per the Roster, the roadmap returns here, not its narrator; one quote maximum.

Characters exported, not spent: Michael Burry, the depreciation schedule, CoreWeave's return, the 2001 rhyme, Loudoun's Moody's exposure — all L10's, and none appears in this territory. **KeShaun Pearson, Sarah Houston, James Kirkwood, the Memphis fight in its entirety** — L8's, touched at one clause of inheritance and nowhere else.

Roster additions the research recommends (flagged, not assumed): Matt Garman (AWS) and Brendan Carr (FCC) as secondaries. Both are named, dated, quoted, and structurally necessary — Garman as the institutional counterweight inside the seller's own corporate family, Carr as the lecture's only political actor.

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

This lecture's Syllabus 2.0 cascade edge, restated: Inherits: contested ground. · **Binds at:** the radiator and the launch manifest. · **Who pays:** the cap table, for now. · **Manufactures:** the audit → L10.

THE INHERITED PROBLEM, RESTATED WITH FRESH SPECIFICS

What L8 handed over. L8 closed on *a door explicitly not opened*: a fight that had run out of forums — the county process exhausted, the state line crossed, the federal citizen suit met by the federal executive, a governor's executive order pausing permits — and, from the middle of that fight, on **4–5 March 2026**, the same company announcing it would put data centers in orbit. **L8's pack states the door is named and left shut, and that walking through it is somebody else's hour. This is that hour.**

The fresh specifics L9 uses to re-establish the inheritance for the sampler, none of which the L8 pack owns:

- **A federal docket rather than a county one.** Between **30 January and 19 March 2026**, three companies filed for **1,139,600 satellites** in a shell nobody governs.
- **A regulator who accepts an application in five days** and criticizes the objector in public sixteen days later.
- **A constituency with no zip code: ~1,500 comments**, four astronomical societies, two named private citizens, and a court precedent from 2023 already against them.
- **A different unit of harm entirely: ~17 metric tons of alumina in the stratosphere in one year**, catalytic and unmeasured.
- **A company with 15 employees valued at \$1.1 billion.**

Specifics the previous packs already own — L9 must not repeat them: L8 owns Memphis entire (the turbines, the permits, the hearings, the jobs math, Pearson, Houston, Kirkwood, the 79% NOx figure, the Shelby County record, Stargate-as-symbol, Abilene, the AI Action Plan, the New York executive order). L7 owns the rate case, the \$4.3B, the 267%, Warrenton, Martin & Peskoe, Francis, the tariff dockets. L4 owns the queue, the transformer, the Schnabel railcar, Order 2023, PJM. L3 owns terrestrial heat rejection entire — the ~15 kW air ceiling, cold plates, CDUs, PUE/WUE, water, the Morrisises. L2 owns the rack, crane day, the density ladder, the roadmap document, the 132 kW figure's derivation. **L9 uses the 132 kW figure by cross-reference in a single comparison (Beat 6) and does not re-derive it.**

The one clause of permitted inheritance: that the ground got contested enough that somebody proposed leaving it, and that the proposal came from inside the fight. **One clause. Not a scene, not a quote, not a beat. HF-1 — comedy off wherever it is touched.**

THE MANUFACTURED PROBLEM AND THE HANDOFF

What this lecture manufactures for the next. L9's final beats leave the listener holding **an escape route that has been fully priced and does not close** — 2 to 4 times the cost per watt by the industry's own model, on a vehicle that has not reached orbit, for a market whose only paying customers today are buying something else entirely. **And they leave the listener holding something sharper: the discovery that the escape was priced before the radiator was built, that the application was the asset, and that the market rewarded the filing. If the escape hatch is also priced off a document rather than a machine, then every number in the preceding eight hours needs auditing — and that is Lecture 10.**

THE HANDOFF — assigned mechanism: *a cost left unassigned*

Rotation verification. L1 question · L2 cost unassigned · L3 character walking · L4 question · L5 cost unassigned · L6 the bill walking · L7 question · L8 door not opened · **L9 cost unassigned.** No adjacent repeat (L8 ran *door not opened*; L10 takes the Irreversibility Ledger instead of a Handoff). **PASS.**

Primary formulation, riding Beat 12's final ~200 words. The cost left unassigned is **the cost of the applications themselves** — and it is unassigned in the strictest sense, because **there is no party to bill it to and no forum in which to send it. 1,139,600 satellites requested in seven weeks. Zero granted. Zero built beyond one 60 kg demonstrator with four months left on its design life. Every other operator in low Earth orbit now plans around shells that may never be occupied; four astronomical societies spend institutional resources petitioning against constellations that may never fly; a federal docket absorbs 1,500 comments; and the stratosphere takes its alumina from the satellites that do come down. None of that appears on anyone's ledger. The cap table pays the dollars. Nobody pays for the claim. And the same sentence is true of every gigawatt announced in the previous eight hours — which is the audit Lecture 10 opens on.**

Refresh-safety check: PASS, with one instruction. The handoff hinges on **structural facts** — that applications were filed, that none was granted, that the coordination cost falls on parties who cannot bill it — **not on any VOLATILE figure.** The edition-update conventions bind hardest on handoffs into and out of lectures 6, 9 and 10, and this one is clean: **it carries no valuation, no cost-per-watt ratio, no satellite count that must be current, and no launch-cadence figure.** Instruction for the 2027 refresh: if the FCC has by then granted or denied any of the three applications, the handoff's *facts* change but its *structure* does not — the cost of the claim was still unassigned during the period the claim was outstanding. Re-check only that the “no ruling” clause is either updated or dropped. If the drafting AI is tempted to hang the handoff on “\$1.1 billion” or “3x cost per watt,” it must not: both are VOLATILE and both would break a swapped 2027 lecture.

Alternates from the record, banked for markup if the seam needs rotating (*all three verified refresh-safe*):

- (a) *A question left hanging* — “If the escape doesn't close, what has already been spent on the assumption that it would?” **Risk:** L7 ran *question* and L4 ran *question*; the mechanism is not adjacent here, so it is legal — but it aims at L10 more explicitly than the cascade prefers, and it slightly pre-emptes the closer's own opening move.
- (b) *A door explicitly not opened* — the training-run door, or the fab door Musk named himself on 19 November 2025. **Risk:** illegal as an adjacent repeat — **L8 ran exactly this mechanism.** Banked only as a Draft-2 contingency if markup re-sequences L8.
- (c) *A character walking toward the next problem* — Johnston, who has said he is not competitive until Starship flies frequently, walking toward a launch manifest he does not control. **Refresh-safe and tonally strong; risk is that it re-centres a person at the moment the cascade needs to widen to an audit.**

REFRESH-SAFE HANDOFF AUDIT — into and out of this lecture

Into L9 (from L8): SAFE. L8's pack verified its own seam as hinging on the March 2026 announcement and two named responses — fixed historical facts carrying no valuation, deal count or capacity figure.

Out of L9 (into L10): SAFE, per the analysis above, **provided the drafting AI uses the structural formulation and not a figure.**

Standing warning for the 2027 refresh, flagged because L9 is a HIGH-decay lecture: the following figures in this pack **will be wrong** and **none of them may appear in a handoff:** the \$1.1B valuation; the ~3x cost ratio; the 3.18x unit conversion; the satellite catalog counts; the Starship flight record; the FCC's procedural status; Starcloud's headcount and Starcloud-2's flight status; every launch-cost figure. **The handoff carries none of them. Verified.**

THE BOUNDARY DOORS

Assigned Gesture: skip. Confirmed at \$4. No one-inch material is supplied, because no door is assigned.

Where this lecture's material presses on a door, so the drafting AI knows where the fence runs:

1. **The silicon-fabrication door is pressed four separate times and stays shut every time.** Musk named **chip production** as the limiting factor of his own forecast on **19 November 2025** and invoked a proposed **Tesla Terafab**. NVIDIA launched a **space-qualified silicon line** on **16 March 2026**. Google **beam-tested a TPU** on **4 November 2025** and reported **HBM** as the most sensitive subsystem. Starcloud flew an **H100** and lost an **A6000**. **The lecture may say that the chip arrives on a rideshare, that it was not radiation-hardened, and that it worked. It may not say how it was made, how it was hardened, or what a fab costs.** (*Owned by the October semiconductors course.*)
2. **The reactor door is not pressed at all** and no material in this territory touches it. **Correctly absent.** (*Owned by the January–February nuclear course.*)
3. **The training-run-internals door is pressed exactly once, and precisely.** Google's radiation results distinguish errors "likely acceptable for inference" from **single-event effects on training runs requiring further study**. Permitted use: that training and inference tolerate errors differently, stated in one clause, because the distinction is a *hardware qualification* fact in this context. Forbidden: anything about what the training run is computing, how gradients synchronize, or why a bit-flip matters mid-run. **This is the fence's exact location in this lecture and the drafting AI should treat it as a hard line.** Pack dependency **D-d** is resolved: **L9** carries no deployment contingent on Syllabus 2.0 Open Item 9 and is unaffected by either resolution.
4. **A fourth door the pack flags as newly pressed and currently unassigned: launch-vehicle engineering.** Raptor 3 ignition sequences, propellant transfer, heat-shield tiles, PEZ dispensers. **The Moves List names only three doors, and this is not one of them — which means there is no sanctioned Gesture for it and the lecture must simply stay outside it.** Permitted: that the rocket flew, what it carried, what altitude it reached, that four engines did not light, and that two were replaced. Forbidden: why. Flag for the Course Schema: this course's Bottleneck beats now depend on a vehicle whose engineering is behind an unassigned fence, and a future edition may want to either assign it or explicitly disclaim it.

CROSS-LECTURE CONSISTENCY NOTES

What L9 claims (later packs take brief-reference only): the deployable radiator entire, including the ISS heritage, the ammonia chemistry, the Inconel 718 tubing, the 2013 and 2017 leaks, and the realized-flux derivation; Philip Johnston and the Starcloud biography; the Project Sunrise application and the January–March 2026 filing sequence; the Kardashev citation; the McCalip model and its assumptions list in both directions; the Suncatcher radiation results; the orbital taxonomy's six branches; the alumina and brightness records; the Starship flight record as it bears on orbital compute; the 3.18x conversion.

What L9 must not claim, verified line by line against the L1–L8 packs' own ledgers: **L1** — MAE-East, Loudoun, JLARC, Rizer, the campus anatomy, the 1,050 TWh Japan, the EPRI homes conversion, the ~50-FTE plant. **L2** — the rack, crane day, the density ladder, the roadmap treatment, Huang's keynote scene, 800 VDC, the midplane, the ~110-homes conversion; **L9 uses only the 132 kW figure by cross-reference and the five-to-seven-year treadmill line, both pre-allocated by L2's pack.** **L3** — the ~15 kW air ceiling, the forced liquid transition, cold-plate manufacture, PUE/WUE, Novec, The Dalles, the Morrisises, the cooling-vendor taxonomy. **L4** — the transformer, the Schnabel railcar, the queue, Order 2023, PJM, Wilson's inflection call. **L5** — TMI/Crane, the Microsoft–Constellation PPA, co-location, Dominguez, the nuclear commitment tallies. **L6** — CoreWeave, the S-1, the H100-as-collateral, GPU-hour pricing spreads, Intrator, the circularity critique, the neocloud taxonomy. **L7** — the rate case, the \$4.3B, the 267%, Warrenton, Martin & Peskoe, Francis, tariff dockets, the moratorium wave. **L8** — Memphis entire, Stargate, Abilene, the AI Action Plan, the three-altitude frame, the jobs math. **L10** — useful-life extensions and reversals, Amazon's February 2025 reversal, Burry, the 2001 fiber rhyme, Loudoun's Moody's exposure, the depreciation schedule, and **the Irreversibility Ledger's four exports listed below.**

Exports from L9 to L10, banked and deliberately unspent here:

1. **~17 metric tons of aluminum oxide deposited in the stratosphere in 2022 alone** — catalytic, not consumed, unmeasured, and the deposition is a *design output* of five-year satellite lives rather than an accident.
2. **11,160 catalogued debris objects**, including **2,666 ASAT** and **774 collision** fragments, none of which comes down on a schedule anyone controls.
3. **The 2023 court holding** that the FCC reasonably concluded SpaceX's mitigation efforts were sufficient — now precedent, and now the fence around every subsequent orbital externality.
4. **Nickolai Bakken's petition**, which invoked **"irreversible and irretrievable commitments of resources"** by name, in a federal data-center docket, in March 2026. **A private citizen used the closer's exact vocabulary before the closer did. This is L10's, and L9 must not spend it.**

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

What is true as of **22 July 2026**, what is pending, and what will be wrong by the 2027 Briefing. This lecture is tier **HIGH** — one of the three flagged high-decay lectures (6, 9, 10) — and this section is the refresh instruction set.

LIVE STATUS OF EVERY DEAL, DOCKET AND PROJECT

Item	Status as of 22 July 2026	Next scheduled milestone	What changed since the anchors were set
SpaceX Orbital Data Center System (SAT-LOA-20260108-00016, S00798)	Filed 30 Jan 2026; accepted 4 Feb 2026; comments closed 6 Mar; oppositions 16 Mar; replies 23 Mar. NO ORDER.	None scheduled	Entire docket post-dates Syllabus 1.0
Starcloud constellation application (88,000)	Accepted for filing 13 Mar 2026. NO ORDER.	None scheduled	Post-dates the anchors
Blue Origin Project Sunrise (SAT-LOA-20260310-00118, 51,600)	Filed 19 Mar 2026. No public notice of acceptance found. NO ORDER.	None scheduled	The must-hit anchor's document — and the name in Syllabus 2.0 is wrong (D1)
Blue Origin TeraWave (5,408)	Announced/filed Jan 2026. Zero satellites flown.	[EXPECTED] >5,000 before end-2027 (Blue Origin)	New since the anchors
New Glenn	Two flights as of Mar 2026	Not disclosed	
Starcloud-1	Operating at ~325 km; ~4 months remaining on an 11-month design life	Deorbit and burn-up, ~Oct 2026	Flew 2 Nov 2025
Starcloud-2	Funded, not flown. ~450 kg, ~8 kW, largest commercial deployable radiator, Blackwell + AWS blade + bitcoin ASICs	[EXPECTED] October 2026 (Starcloud)	New since the anchors
Starcloud-3	Chassis welded (as of 30 Apr 2026). 200 kW, 3 t, PEZ-dispenser	Awaiting Starship; commercial access expected 2028–29 (Johnston)	New
Starcloud valuation	\$1.1B printed 30 Mar 2026; ~\$2.2B reported in talks, Apr 2026	A printed round, if it happens	D2
Project Suncatcher	Announced 4 Nov 2025; preprint published; Trillium radiation testing complete	[EXPECTED] two prototype satellites with Planet Labs, early 2027 (Google)	Must-hit anchor; unchanged
NVIDIA Space-1 Vera Rubin Module	Announced 16 Mar 2026; NOT SHIPPING. IGX Thor and Jetson Orin available	"At a later date" (NVIDIA)	Entirely new since the anchors
SpaceX AI1	Design revealed 8 Jun 2026; ~150 kW, 70 m wingspan	[EXPECTED] two prototypes early 2027 (SpaceX)	Entirely new

Item	Status as of 22 July 2026	Next scheduled milestone	What changed since the anchors were set
Starship	12 flown / 13 attempted; zero orbital payload deliveries. Flight 13 aborted at ignition 16 Jul 2026	[EXPECTED] Flight 13 NET 23 Jul 2026, 22:45 UTC — suborbital	Must-hit (“Starship cadence dependency”)
Starship propellant transfer demo	Not yet performed	[EXPECTED] NET late 2026 (SpaceX)	The capability the \$500/kg assumption ultimately rests on
SpaceX corporate	Public since 12 Jun 2026 (SPCX); xAI merged 2 Feb 2026	Quarterly reporting	Entirely new since the anchors
Amazon Leo	~210–212 satellites of 3,236 authorized; waiver requested	[EXPECTED] 30 Jul 2026 milestone — eight days after this stamp	
Three-Body Computing Constellation ASCEND	12 satellites flown 14 May 2025; 10 AI models validated in orbit Study results published 28 Jun 2024	[EXPECTED] 100 satellites by 2027 (Zhejiang Lab) [EXPECTED] EROSS IOD first mission 2026; 1 GW before 2050	
Astro-Future Institute	≥¥140M funding; demonstration satellite expected within the year	Not dated precisely	Single-sourced
The astronomy dockets	AAS petition + reply, DarkSky opposition, IAU/RAS/ESO comments, Bakken and Stewart petitions — all filed, none resolved	Tied to the FCC’s silence	

PENDING EVENTS WITH DATES

Date	Event	Announcing party	Confidence
23 July 2026, 22:45 UTC	Starship Flight 13, NET — suborbital, 20 Starlink V3 deployments	SpaceX	Low-moderate — already aborted once
30 July 2026	Amazon Leo half-constellation milestone	FCC authorization terms	Will be missed; waiver requested
October 2026	Starcloud-2 launch, Falcon 9	Starcloud	Moderate
~October 2026	Starcloud-1 deorbit (end of 11-month design life)	Astro Digital / Starcloud	High
Late 2026	Starship propellant transfer demonstration	SpaceX	Low
Early 2027	Project Suncatcher two prototypes with Planet Labs	Google	Moderate
Early 2027	Two prototype AI1 satellites	SpaceX	Low-moderate
Early 2027	Crusoe offers limited commercial access to orbital capacity	Crusoe / Starcloud	Moderate
2027	Three-Body Computing Constellation reaches 100 satellites	Zhejiang Lab	Moderate
End 2027	>5,000 TeraWave satellites launched	Blue Origin	Very low — zero flown, two New Glenn flights

Date	Event	Announcing party	Confidence
End 2027	SpaceX annualized 1 GW/yr orbital compute	SpaceX (Musk)	Low
End 2027	Gigasat solar plant at significant production	SpaceX (via Bloomberg)	Low-moderate
2028–2029	Commercial Starship access opens	Starcloud (Johnston)	Uncertain
July 2028 / July 2029	Amazon Leo revised milestones, subject to waiver	Amazon / FCC	Pending
Mid-2030s	Launch costs reach ~\$200/kg	Google	Low confidence, seller's own estimate
~2040	Levelized orbital/terrestrial parity	SemiAnalysis (reported)	Single-sourced
Before 2050	ASCEND 1 GW deployed	Thales Alenia Space / EC	Study target
NO DATE	FCC disposition of any of the three applications	—	The single most consequential unknown in this lecture

THE DECAY REGISTER

Every *VOLATILE* and *CONTESTED* figure in this pack, with expected direction and rough velocity, so the 2027 refresh knows exactly what to re-research.

QUARTERLY OR FASTER — re-research first:

- **Starcloud's valuation.** \$1.1B (30 Mar 2026) → ~\$2.2B reported in talks (Apr 2026) → unknown. **Direction: up, until it isn't.** *The fastest-decaying figure in the pack and the As-Of Stamp's assigned target.*
- **Starcloud's headcount** (15, 2026). **Direction: up.**
- **SpaceX's market capitalization and share price.** Listed 12 Jun 2026 at \$135, opened \$160.95, traded as high as \$201.80. **Direction: unknown; now a public quote, which is a new species of volatility for this course.**
- **Satellite catalog counts.** 16,234 active payloads; 10,736 active Starlinks; 34,049 catalogued objects (all 8 Jul 2026). **Direction: up, ~2,000–2,500 active payloads per year at current cadence. This is the Unit Conversion's denominator and must be re-pulled from McDowell.**
- **Launch cost per kilogram.** \$1,500–\$2,900/kg published band (Nov 2025). **Direction: down, slowly, and the whole thesis is a function of the slope.**
- **GPU-hour pricing comparisons** (\$8.64 vs \$2.37, B300-class, reported Jun 2026). **Direction: both down; the ratio is what matters.**

SESSION- OR DOCKET-PACED — moves when a regulator or a rocket moves:

- **The FCC's procedural status on all three applications.** **Currently: no ruling.** Any grant, denial, dismissal or condition rewrites Beats 3 and 12 entirely.
- **Starship's flight record** (12 flown, 13 attempted, zero orbital deliveries, Flight 13 aborted 16 Jul 2026). **Direction: more flights; the question is whether “zero orbital payload deliveries” survives to 2027. If it does not, the Bottleneck beat's spine changes and the Steelman strengthens materially.**
- **New Glenn's flight record** (two) and **TeraWave's** (zero).
- **Amazon Leo's count** (~210–212) against its milestone.
- **NVIDIA Space-1's shipping status** (not shipping).
- **Three-Body's count** (12 flown, 100 targeted by 2027).

ANNUAL OR SLOWER — verify but do not expect movement:

- **The ~3x cost-per-watt ratio.** A live calculator; re-read the model rather than the reporting. **Direction: down as launch costs fall; the model's own sliders are the sensitivity table.**
- **Parity forecasts** (2028–2050 spread).
- **The alumina record** (+29.5%, ~17 t, 8x 2016–2022, +646% projected). **Direction: worse, and the projection converts to measurement as constellations deploy. Watch for the Leibniz group's follow-on work.**

- **Brightness compliance** (92% of Amazon Leo above threshold; SpaceX's VM7 commitment). **Watch for the first published brightness measurement of flown orbital-data-center hardware — there is none today.**
- **Suncatcher's early-2027 date. Direction: slips, asymmetrically.**

DOES NOT DECAY — safe to state flatly in any edition:

- Stefan-Boltzmann; the T^4 dependence; the solar constant at AM0 (1,361 W/m²); **the absence of convection in vacuum**; the ISS's 70 kW and its six radiator arrays; the 1964 Kardashev citation; every dated historical event in §1; the 2013 and 2017 ISS coolant leaks; the fact that Blue Origin filed 14 pages on 19 March 2026; the fact that the FCC accepted a million-satellite application in five days.

WHAT JUST CHANGED — the last ~90 days, flagged because the syllabus stack predates all of it

(30 April – 22 July 2026. These are the facts most likely to blindside a draft built on the anchors alone.)

1. **Starcloud is reportedly raising again at roughly double its Series A mark**, with **SpaceX reportedly exploring strategic interest** — first reported by The Information and confirmed to SpaceNews by a source close to the situation, ~April–May 2026. **A launch provider taking a position in a customer that depends on its launch cadence is a structure this course has seen before (L6's circularity) and must not re-litigate here — but it should be noted.**
2. **SpaceX became a public company on 12 June 2026** at a reported ~\$1.77 trillion listing valuation, having filed an S-1 on 20 May 2026 disclosing 2025 revenue of \$18,674M and a GAAP net loss near \$5B. **The bottleneck now has public shareholders.**
3. **SpaceX unveiled AI1 on 8 June 2026** — ~150 kW, 70 m wingspan, two prototypes targeted for early 2027 — **three days before the IPO priced.** Musk's capacity ramp was restated in the same window: 1 GW/yr by end-2027 → 10 → 100 GW → 1 TW/yr, and 2,500 → 1,000,000 tonnes/year in about three years.
4. **IEEE Spectrum published the cleanest independent thermal arithmetic in the category on 19 June 2026** — 1.4 m² per 700 W chip, 80 m² per 40 kW rack. **This is new, independent, and directly supports Beat 6.**
5. **Starship Flight 13 aborted at ignition on 16 July 2026** with four Raptor 3 engines failing to light; two are being replaced; NET 23 July. **Six days before this pack's stamp. The single most current fact in the lecture and it is a failure.**
6. **Jonathan McDowell's catalog was updated 8 July 2026** — the Unit Conversion denominator is fourteen days old at the stamp.
7. **A SemiAnalysis model reportedly published in June 2026** puts space compute at >4x today and parity around 2040. **Single-sourced; re-verify.**
8. **On 21 July 2026 — one day before this stamp — SpaceX launched a geosynchronous robotic servicing satellite on a decade-long mission.** Relevant because “no service calls” is a load-bearing claim in Beat 7 and the servicing industry is real, dated, and expensive.

WHAT IS STILL HIDDEN

Honest uncertainty markers. The refusal to disclose is itself course material.

- **No thermal budget has ever been published** by any of the three applicants. Not Project Sunrise (no power figure at all), not SpaceX's ODC system, not Starcloud beyond an 8 kW headline. **The single most important number in this lecture is one nobody discloses.**
- **Starcloud-2's radiator area, mass and deployed geometry are unpublished.** “Largest commercial deployable radiator” is a **comparative claim with no denominator**, and there is no register of commercial deployable radiators against which to check it.
- **Starcloud-1's in-flight telemetry is unpublished** — no duty cycle, no observed thermal margin, no single-event-upset rate. **Per one secondary account, NVIDIA is believed to have negotiated privileged access to Starcloud-2's radiation soft-error telemetry.** If accurate, the most valuable engineering dataset in the category will be proprietary. **Single-sourced; flag.**
- **Blue Origin has no ITU filing** as of 21 March 2026, and none was found subsequently.
- **The hosted-payload contracts on Starcloud-2 — including the Department of Defense's — are undisclosed:** no value, no vehicle, no term. **Public money is in this lecture and its amount is not.**

- **The FCC has no decision timetable** and none is required of it.
- **No independent brightness measurement of orbital-data-center hardware exists**, because none has flown.
- **Nobody meters stratospheric alumina from reentries.** There is no agency, no instrument network, and no disclosure requirement. **The externality with the best peer-reviewed evidence has the worst monitoring.**
- **SpaceX's S-1 financials in this pack are entirely secondary.** An EDGAR pull is required before any of them airs.
- **Starcloud's white paper's underlying model is not public**, unlike McCalip's — so the \$8.2M/40 MW claim cannot be audited, only compared.
- **No utilization data exists for any orbital compute asset.** This is the same disclosure gap the Style Guide names as the settling condition for the overbuild debate, and it is worse in orbit than on the ground.

SECTION 12: SOURCE INVENTORY

Primary sources first within each category. Secondary sources note what primary material they synthesize; company sources are flagged as the seller's own documents.

PRIMARY — REGULATORY FILINGS AND FEDERAL DOCUMENTS

[1] **Federal Communications Commission, Space Bureau** — *Space Bureau Accepts for Filing SpaceX's Application for Orbital Data Centers*, **Public Notice DA 26-113** — released **4 February 2026** — ICFS File No. SAT-LOA-20260108-00016, Call Sign S00798 — docs.fcc.gov/public/attachments/DA-26-113A1.txt — **THE ONLY FULLY VERIFIED PRIMARY QUOTATION IN THIS PACK.** Supplies: the Kardashev sentence and the Commission's own footnote citing Kardashev (1964); the comment/opposition/reply schedule; the orbital parameters; the four waiver requests verbatim by rule section; the frequency bands and the non-interference posture. [2] **Space Exploration Holdings, LLC (SpaceX)** — *Application for Authority to Launch and Operate the SpaceX Orbital Data Center System* — filed **30 January 2026** — ICFS SAT-LOA-20260108-00016 — Narrative, Technical Attachment, Waiver Requests, Ownership statement, Schedule S. **Seller's own document. NOT DIRECTLY ACCESSED; all content herein is via [1] and secondary reporting. Pull before Draft 1.** [3] **Blue Origin, LLC** — *Application... Project Sunrise Orbital Data Center System* — filed **19 March 2026** — ICFS SAT-LOA-20260310-00118 — 14 pp. **THIS LECTURE'S PAPER TRAIL DOCUMENT. Seller's own document. NOT DIRECTLY ACCESSED — MANDATORY PRE-DRAFT PULL (see §4, The Verbatim).** [4] **Starcloud, Inc.** — FCC application for up to 88,000 satellites — accepted for filing **13 March 2026** — 600–850 km, sun-synchronous. **Seller's own document. Not directly accessed.** [5] **Amazon (Amazon Leo / Project Kuiper)** — *Petition to Deny* — filed **6 March 2026** — ICFS SAT-LOA-20260108-00016 — 17 pp. Supplies the replacement-rate arithmetic (200,000/yr vs <4,600 in 2025), the §25.112 completeness argument, and the “ambition rather than a plan” characterization. **Adversarial and motivated; the filer is behind on its own milestone.** [6] **American Astronomical Society** — *Petition to Deny* — filed **6 March 2026** — same docket — aas.org (public PDF). Supplies simulated brightness comparisons at 20/30/40° N at nautical twilight and midnight, and the NEPA argument. [7] **American Astronomical Society** — *Reply* — **23 March 2026** — aas.org (public PDF). Supplies the IAU CPS magnitude thresholds (VM7 below ~550 km; ~7.6 at 1,000 km), the citation to Boley et al. (2025), and the dispute of SpaceX's VM7 claim for Starlink. [8] **DarkSky International** — *Opposition Brief* — **6 March 2026** — same docket. Supplies the EIS/NEPA demand. [9] **Nickolai Bakken** — *Petition for Environmental Review* — March 2026 — same docket. **Supplies the “irreversible and irretrievable commitments of resources” language. EXPORT TO L10.** [10] **William Stewart** — *Petition to Deny* — filed **12 February 2026** — same docket. [11] **SpaceX** — *Consolidated Opposition re Orbital Data Centers* — **16 March 2026** — same docket (copy hosted at peer.org). Supplies the BRDF brightness-modeling commitment, the VM7 target, the NSF/Rubin/IAU attribution, and the shell-geometry collision-risk argument. [12] **SpaceX** — letter in the Blue Origin docket requesting equitable application of Amazon's arguments — **19–20 March 2026.** [Via GeekWire; pull before air.] [13] **TechFreedom** — *Comments* — ~**23 March 2026** — techfreedom.org (public PDF). A third-party catalog quoting the DarkSky, AAS and Bakken filings; **the pack's access route to several primary strings. Secondary-quoting-primary.** [14] **SpaceX** — **Form S-1**, filed **20 May 2026**, SEC/EDGAR; **IPO priced 11 June 2026; listed 12 June 2026 (Nasdaq: SPCX).** **NOT DIRECTLY ACCESSED. All financials in this pack are secondary. EDGAR PULL MANDATORY.** [15] **47 CFR Part 25**, specifically **§25.112** (dismissal for incompleteness), **§§25.156(d) and 25.157** (processing rounds), **§25.164** (milestones), **§25.165** (surety bonds), **§25.114(a)(1)** (Schedule S). The rule set that makes Beat 12 a Perverse Incentive rather than an anecdote.

PRIMARY — ENGINEERING, THERMAL AND SPACE-ENVIRONMENT LITERATURE

[16] **SAE International, Technical Paper 951651** — *Space Station Heat Rejection Subsystem Radiator Assembly Design and Development* — 1995 — sae.org. Six deployed radiator arrays; **70 kW**; 10-year LEO design environment; orbital replaceability; ammonia freeze margins; remote deployment without EVA. **The engineering baseline for the whole lecture.** [17] **AIAA, *Journal of Spacecraft and Rockets*, DOI 10.2514/1.A35030** — *Thermal Performance Evaluation of Space Radiator for Single-Phase Mechanically Pumped Fluid Loop*. Eight panels of 3.33×2.64 m per assembly; 22 parallel flow tubes; Inconel 718 manifolds and tubes; two independent flow passages. [18] **NASA / Boeing IDS** — *Active Thermal Control System (ATCS) Overview* — NASA-hosted PDF (473486main_iss_atcs_overview). Two 35 kW ammonia loops (S1/P1); PCVP temperature control 2.2–6.1 °C; a radiator dimension of 3.12×13.6 m; the internal water/external ammonia architecture and interface heat exchangers. **Contains the dimension that conflicts with [17] — conflict stated, not averaged.** [19] **NASA NTRS 20180007472** — *Ammonia Vent of the EATCS Radiator #3 Flow Path #2 on the ISS* — 2018. The 3 May 2017 leak, the Robotic External Leak Locator, the isolation-and-vent decision, worst-case time-to-empty, and the thrust imposed on the station. [20] **NASA NTRS 20110023292** — *ISS Active Thermal Control Sub-System On-Orbit Pump Performance and Reliability Using Liquid Ammonia as a Coolant* — Morton, Jurick, Roman, Adamson, Bui, Laliberte. PFCS in operation since December 2000; Pump Module since December 2006; ORU architecture. [21] **Google Research** — *Exploring a space-based, scalable AI infrastructure system design* (Project Suncatcher preprint and blog) — 4 November 2025 — research.google / blog.google / services.google.com/fh/files/misc/suncatcher_paper.pdf. **Seller's own document, and the most rigorous public engineering artifact in the category.** Supplies: dawn–dusk SSO rationale; “up to 8 times more productive”; the 81-satellite/1 km cluster; ML-based formation control; Trillium v6e in a 67 MeV proton beam surviving 5-year-equivalent TID; HBM as most TID-sensitive; inference-vs-training error tolerance; 1.6 Tbps DWDM bench demonstration; \$1,500–\$2,900/kg current launch costs and the ~\$200/kg mid-2030s precondition. [22] **IEEE Spectrum** — *Why Thermodynamics Rules Future Orbital Data Centers* — 19 June 2026 — spectrum.ieee.org/orbital-data-centers-heat. Stefan–Boltzmann applied: 1.4 m² per 700 W die at 60 °C against a 3 K background; 80 m² per 40 kW rack. **Independent; the cleanest published arithmetic in the territory.** [23] **Ferreira, J.P., Wang, J., et al.** — *Potential Ozone Depletion From Satellite Demise During Atmospheric Reentry in the Era of Mega-Constellations* — **Geophysical Research Letters**, June 2024 — with AGU press release, 18 June 2024. +29.5% atmospheric aluminum oxide in 2022; ~17 t alumina; ~41.7 t total aluminum; a modeled 250 kg / 30%-aluminum satellite; up to +646% projected. [24] **Leibniz Institute for Atmospheric Physics (Kühlungsborn)** — study in **Communications Earth & Environment**, February 2026 — first direct measurement tying a specific reentry event to an atmospheric plume. [Accessed via secondary summary; pull the paper before air.] [25] **Boley, A., et al.** — *IAU CPS Satellite Optical Brightness Recommendation: Rationale* — **Research Notes of the AAS**, 2025. The VM7 / VM7.6 thresholds cited in [7]. [26] **Mallama, A., et al. / IAU CPS** — brightness study of Amazon Leo satellites — 2026, via CPS Newsletter #3. 92% exceedance. [27] **Jonathan McDowell** — *Jonathan's Space Report: Space Statistics* — planet4589.org/space/stats/active.html — **data as of 8 July 2026. 16,234 active payloads; 13,972 Lower LEO; 10,736 active Starlinks; 34,049 catalogued objects; 11,160 debris; 2,666 ASAT; 774 collision; 10,994.7 t active payload mass; 7,464.6 t catalogued tonnage in Lower LEO. THE UNIT CONVERSION'S DENOMINATOR. Primary catalog, continuously maintained, cited by docket participants.** [28] **Jonathan McDowell** — Starlink status table, 11 July 2026 — 10,759 working; 10,775 payloads in orbit.

PRIMARY-ADJACENT — INDEPENDENT MODELING

[29] **Andrew McCalip** — *Economics of Orbital vs Terrestrial Data Centers* — andrewmccalip.com/space-datacenters; code at github.com/andrewmccalip/thoughts — **accessed 22 July 2026. Head of R&D at Varda Space Industries, publishing personally with an explicit disclaimer — see D3.** Supplies: \$31.20/W vs \$14.80/W; LCOE \$891 vs \$398/MWh; 22.2M kg to LEO; ~37,000 satellites; 2.3 km² fleet array; ~222 Starship launches; 105 GWh launch energy; 175M gal LOX / 168M gal methane; 345 tanker trucks/launch; 0.2% of the Texas daily grid; 36.5 W/kg; 9%/yr GPU failure; 2.5%/yr cell degradation; the bifacial thermal balance (1,250 W/m² absorbed, ~275 electrical, ~975 lattice, 237 W/m² Earth IR, ~75 °C radiator constraint); **and the full assumptions list in both directions — the omitted radiator mass on the orbital side and the omitted interconnection, permitting, water and regulatory delay on the terrestrial side.**

GOVERNMENT, QUASI-GOVERNMENT AND INSTITUTIONAL ANALYSIS

[30] **Thales Alenia Space / European Commission (Horizon Europe)** — **ASCEND** feasibility study results — 28 June 2024, Cannes. 1 GW before 2050; 23 GW 2030 market; the 10x-less-emissive launcher precondition; named consortium; CTO Christophe Valorge. **A publicly funded seller's document.** [31] **European Space Policy Institute (ESPI)** —

commentary that many ODC cost models depend on a ~\$10M-per-Starship-flight price ESPI called unrealistic near-term. [Accessed via Introl; pull the ESPI publication before air.] [32] **CASC / China 15th Five-Year Plan (2026–2030)** focus-area notice — gigawatt-scale space-based digital and intelligent infrastructure. [Via china-in-space.com, 27 February 2026; translation, flag as such.] [33] **Xinhua / SCIO** — *From ground to orbit: China eyes computing in space* — 25 April 2026. Zhao Hongjie (ADAspace EVP); Li Chao (Zhejiang Lab); 2,800-satellite Star Compute plan (2,400 inference / 400 training, 500–1,000 km); 100 satellites by 2027; 10 AI models validated in orbit; CAICT's space computing power committee; the ~90% unprocessed-data claim. **State media; flag as such.** [34] **American Astronomical Society** — *Action Alert: Provide Input to the FCC on Proposed Satellite Systems* — aas.org. ~1,500 comments on the SpaceX ODC docket; >1,800 on Reflect Orbital; the factor-of-100 LEO-population characterization.

COMPANY MATERIALS — SELLER'S OWN DOCUMENTS

[35] **NVIDIA** — *NVIDIA Launches Space Computing, Rocketing AI Into Orbit* — 16 March 2026 — nvidia-anews.nvidia.com / investor.nvidia.com. Space-1 Vera Rubin Module; IGX Thor; Jetson Orin; up to 25x an H100 for space-based inferencing; six partners (Aetherflux, Axiom Space, Kepler, Planet Labs, Sophia Space, Starcloud); Huang and Bhatt quotes. **What NVIDIA gets if believed: a new SKU category across all six taxonomy branches.** [36] **NVIDIA** — *How Starcloud Is Bringing Data Centers to Outer Space* — blogs.nvidia.com, October 2025. Johnston's 10x energy-cost and 10x CO₂ claims; the 5 GW / 4 km-square concept; the silver H100 module; the 60 kg fridge-sized spacecraft. [37] **Starcloud** — Series A announcement, 30 March 2026; Starcloud-1 mission page; white paper (40 MW for \$8.2M; laser connectivity via Starlink/Kuiper). **Seller's own documents; the white paper's model is not public and cannot be audited.** [38] **Y Combinator** — Starcloud company page — ycombinator.com/companies/starcloud. Founding chronology, launch bookings (first May 2025, second H2 2026), the Redmond payload facility, and the company's own framing of the thesis. [39] **SpaceX** — pre-flight statements for Starship Flights 12 and 13; the AI1 reveal and ~30-minute executive interview, 8 June 2026; Musk's X posts of 19 November 2025, 2 February 2026 (merger blog post), 5 June 2026, 17 July 2026.

HEARING, CONFERENCE AND EARNINGS-ADJACENT RECORDS

[40] **Cisco AI Summit**, San Francisco, 3 February 2026 — Matt Garman (CEO, AWS) remarks. **No transcript located; reported by Reuters (Greg Bensinger) and Fortune (Alexei Oreskovic).** [41] **NVIDIA GTC 2026**, San Jose, 16 March 2026 — Huang keynote. **No transcript located; reported by CNBC, DCD, The Register.** [42] **Italian Tech Week**, Turin, 3 October 2025 — Bezos–Elkann fireside. **No transcript located; reported by Reuters (Elvira Pollina, Giulio Piovaccari).** [43] **SpaceNews “Opportunities for On-Orbit Computing”**, Washington D.C., 30 April 2026 — Johnston remarks. **No transcript located; reported by SpaceNews and scienceandaerospace.blog. These four are the closest this lecture has to a hearing corpus, and none has a transcript — which is why the Hearing Room beat is unbuildable here (\$3, \$8).**

TRADE AND INVESTIGATIVE JOURNALISM

[44] **SpaceNews** — *SpaceX files plans for million-satellite orbital data center constellation* (31 Jan 2026); *With attention on orbital data centers, the focus turns to economics* (1 Feb 2026 — **the ~3x anchor's provenance**); *Starcloud files plans for 88,000-satellite constellation* (15 Mar 2026); *Blue Origin joins the orbital data center race* (19 Mar 2026); *Starcloud achieves unicorn status with \$170 million raise* (30 Mar 2026); *Starcloud seeks more orbital data center funding shortly after unicorn status* (~5 May 2026); *China launches first of 2,800 satellites for AI space computing constellation* (14 May 2025). **Jeff Foust and colleagues; the single most reliable secondary thread in this pack.** [45] **GeekWire** — *Lumen Orbit changes its name to Starcloud* (Feb 2025 — **the trademark quote**); *Orbital AI: Seattle-area startup Starcloud hits \$1.1B valuation* (30 Mar 2026, Lisa Stiffler); *51,600 more satellites? Blue Origin adds another twist* (21 Mar 2026 — **the SpaceX letter and Johnston's X post**). [46] **TechCrunch** — *Starcloud raises \$170 million Series A to build data centers in space* (30 Mar 2026) — **the H100 quote, the A6000 failure, the \$500/kg conditional, the Falcon 9 fallback.** [47] **Reuters** — *Data centres in space? Jeff Bezos thinks it's possible* (3 Oct 2025); *Amazon's AWS CEO says orbital data centers 'pretty far' from reality* (3 Feb 2026). [48] **Fortune** — *Amazon AWS CEO Matt Garman pushes back against Elon Musk's space data centers plan* (3 Feb 2026, Alexei Oreskovic) — the 900-data-center figure, the “permanent structure” line, and Musk's merger blog post quotation. [49] **CNBC** — *Musk's xAI, SpaceX combo is the biggest merger of all time* (3 Feb 2026); *Nvidia announces Vera Rubin Space-1 chip system* (16 Mar 2026). [50] **Via Satellite** — *Blue Origin Reveals TeraWave LEO/MEO Constellation* (21 Jan 2026 — **the 5,280 + 128 breakdown, which is the evidence for D1**); *Starcloud Raises*

\$170M (30 Mar 2026 — the investor list and the published correction); *Amazon's Petition to Deny... Draws Criticism from Brendan Carr* (11 Mar 2026). [51] **DataCenterDynamics (DCD)** — Starcloud-1 reaching orbit; *Lumen Orbit rebrands to Starcloud (the \$8.2M/40 MW claim)*; *Project Suncatcher (the radiation-test detail and the \$1,500–\$2,900/kg band)*; *Amazon Leo requests FCC refuse SpaceX plan (the 17-page detail)*; *Nvidia announces space compute modules (the “available at a later date” detail and the orbital-data-center-architect job listing)*. [52] **Tom's Hardware** — *Jeff Bezos' Blue Origin reveals 51,600 satellite space data center plans* (20 Mar 2026) — **the source of the assigned Verbatim string; secondary-quoting-primary; re-pull required**. [53] **Engadget** — *Orbital AI data centers could work, but they might ruin Earth in the process* (19 Feb 2026, Igor Bonifacic) — Boley's current-window position; Scott Manley's Starlink V3 thermal counterpoint; McCalip's ~25,000-flights estimate. [54] **The Register** — *FCC opens Musk's 1M-satellite DC plan for public comment* (5 Feb 2026) — McDowell's end-January count; *Nvidia rolls out Rubin Module for space-based computing* (17–19 Mar 2026). [55] **Gizmodo** — *Feds to Amazon: Quit Whining About SpaceX* (12 Mar 2026, Ellyn Lapointe) — the Carr rebuke and the Amazon milestone arithmetic. [56] **Spaceflight Now** — *Post-ignition anomaly causes abort of SpaceX's Starship Flight 13* (16 July 2026); launch schedule; the 21 July 2026 GEO servicing mission. [57] **Space.com / Space Launch Live / spacelaunchschedule.com** — Starship Flight 13 status and payload description; Starlink counts; *Powerful NVIDIA chip launching to orbit next month* (Oct 2025 — the 5 GW / 4 km concept and Johnston's 10x quote). [58] **Payload Space** — *Starcloud Raises \$170M Series A at \$1.1B Valuation* — the 8 kW figure, the AWS Outposts detail, the Crusoe/AWS/Google Cloud/NVIDIA workload list. [59] **Scientific American** — *U.S. approval of giant 'space mirror' satellite alarms astronomers* (~16 July 2026) — the “>1.7 million additional satellites proposed” figure and the FCC's environmental posture. **Adjacent proceeding (Reflect Orbital), used only for the aggregate proposal figure**. [60] **astrobit.es** — *Two satellite proposals threaten dark and quiet skies worldwide* (26 Feb 2026) — the 2023 DarkSky court holding, the categorical-exclusion history, and COMPASSE's response. [61] **Light Reading** — *Musk: 'Magic' not needed for SpaceX's orbital AI data center plan* (10 June 2026) — the capacity ramp and the tonnage target. [62] **Gunter's Space Page** — Starcloud-1 (Lumen 1) entry — Astro Digital Corvus-Micro bus, 325 km, launch date and separation confirmation. [63] **Xinhua / CGTN / SCIO** — Chinese-programme coverage. **State media; flagged**. [64] **China in Space** (china-in-space.com) — *China's Space Enterprises Quietly Lead in-Space AI Compute Capabilities* (27 Feb 2026) — the Astro-Future Institute, Lenovo and Beijing municipal funding, and the Five-Year Plan language. **Single-sourced specialist newsletter; flag**.

SECONDARY SYNTHESIS AND ANALYST MATERIAL — USE WITH THE FLAG ATTACHED

[65] **Introl** — *SpaceX 1M Orbital Data Centers: FCC Filing Analysis and Orbital Data Center Race 2026* (Feb 2026). Synthesizes the SpaceX filing and McCalip's model. Supplies the ~\$2,700/kg Falcon 9 figure, the 2028–2030 parity projection with its three named assumptions, the Deutsche Bank “well into the 2030s” characterization, and the ESPI quotation. **Van-tage: infrastructure vendor; directionally optimistic**. [66] **uselumlinux.com** — *Data Centers in Space: Feasibility & Economics (Mid-2026)*. **The pack's only route to the reported SemiAnalysis June 2026 model (\$8.64 vs \$2.37/GPU-hour; ~30% premium early 2030s; ~2040 parity)**. **SINGLE-SOURCED SECONDARY — the SemiAnalysis primary must be obtained before any of it airs**. [67] **tech-insider.org** — *Starcloud's \$170M Series A: The \$1.1B Space Data Center Bet*. Supplies the ~450 kg Starcloud-2 mass, the ~\$1,500/kg Falcon Heavy figure and the \$0.15/kWh sensitivity, the ITAR/export-control and data-residency notes, and the NVIDIA soft-error-telemetry claim. **SINGLE-SOURCED on several of these; flag each**. [68] **yage.ai** — *The Thermal Problem of Space Data Centers: An Order-of-Magnitude Analysis* (21 Apr 2026). Supplies the \$42.4B vs \$15.9B rendering of McCalip's model, the 130–200 W/m² ISS radiator range, and the “Sarah Thompson” characterization. **Secondary; the Thompson attribution is unverified — verify or drop**. [69] **jordanyashari.substack.com** — *The Orbital Data Center Fallacy* (2 Apr 2026). Supplies the ~12 °C thermal-margin figure and the radiator-equals-solar-array-size finding, both derived from McCalip. **Secondary derivation of a primary model; attribute to the model, not the blog**. [70] **BlacKnight Space Labs** — *First AI Training in Space* (3 Apr 2026) and *Orbital Data Centers Explained* (30 Apr 2026). Supplies the terrestrial \$0.03–\$0.10/kWh comparison band and the 1,361 W/m² framing. **Industry-adjacent analysis; flag**. [71] **Observer / Yahoo Finance** — *Starcloud Raises \$170M to Build Data Centers in Space Orbit* (Mar 2026) — Johnston's age (39) and the Huang GTC quotation. [72] **yespress.io** — Starcloud company profile. **The sole source for the Harvard/Wharton/Columbia/CFA credential composite**. **SINGLE-SOURCED — do not assert without verification**. [73] **Wikipedia** — *Starcloud; Starship flight test 12; 2026 in spaceflight; Starship Propellant Transfer Demonstration*. Used only for corporate-registry facts (founding date and location, founders, headcount, board) and flight-record parameters, each of which is corroborated elsewhere in this inventory. **Tertiary; corroborate before air**. [74] **Various IPO and valuation aggregators** (mexc, intellectia, smartasset, keeptrack, BitMEX, Motley Fool). **These are the pack's only route to SpaceX IPO and S-1 figures and THEY**

CONFLICT with one another on raise size, listing valuation and filing dates. NOTHING FROM THIS GROUP MAY AIR WITHOUT AN EDGAR PULL.

SOURCE-INVENTORY NOTES FOR THE DRAFTING AI

Three access gaps, stated plainly. (1) No ICFS filing was directly retrieved; all filing content reaches this pack through FCC public notices, public PDFs hosted by petitioners, and named secondary outlets quoting the filings. **The one exception is [1], which is a federal document retrieved in full.** (2) No SEC filing was directly retrieved. (3) No hearing transcript exists in this territory, because no hearing occurred.

Two sources do disproportionate work and should be understood as such. [27] McDowell's catalog is the empirical backbone — the Unit Conversion, the congestion figures and the mass comparisons all rest on it, and it is a continuously maintained primary catalog by a named astronomer with no commercial position. [29] McCalip's model is the analytical backbone — the Step Function, the mass figures, the launch-energy figures and the Steelman's strongest point all rest on it, and it is a public, forkable, personally-published model whose author lists his own omissions in both directions. **If either of these two sources is wrong, several beats move together. That concentration is worth knowing before Draft 1.**

L9 Research Pack 1.0 · How AI Data Centers Work — An Unteachable Briefing · Research as of 22 July 2026 · Twelve sections · Strawman stress-tested, not rubber-stamped: one document-name defect (D1), one attribution defect (D3), one hedge-preservation instruction (D4), one valuation-drift flag (D2), one Verbatim requiring a primary re-pull, one declared honest failure at the human floor, one position question at Beat 11, and twelve SUSTAINABLE verdicts with the reasoning for the sweep stated. The pack proposes; markup and the Course Schema dispose.

Lecture 10 — The Reckoning

Research Pack 1.0 · source file L10_Research_Pack_1_0.md · research as of 22 July 2026

RESEARCH AS OF 22 July 2026

(Per the L1–L9 pack precedent: every figure carries unit · stage · as-of date · author. Discrepancies against Syllabus 1.0 must-hit values are flagged inline and consolidated in Section 6; nothing is silently substituted. Per the house copyright discipline established in the L4 pack and carried through L9, verbatim quotes are held short with full attribution, **one deployment per source document**; longer passages are precisely paraphrased, marked [PARAPHRASE], and carry a **locator** for the draft-stage verbatim pull. Three locator classes recur in this lecture: **SEC EDGAR** (CIK-searchable; 10-K, 10-Q, 8-K, S-1 — full text pullable at draft stage), **earnings-call transcript** (company IR page plus commercial transcript services — full text pullable), and **government primary** (Federal Reserve speech pages, FEDS working papers, PJM Inside Lines releases, state governor’s official veto messages — full text pullable). Where an exact sentence has been reproduced by a secondary outlet quoting a primary filing, it is marked [SECONDARY-QUOTED PRIMARY] and must be re-verified against EDGAR before The Verbatim deploys.)

THE ASSEMBLED LECTURE IDENTITY

Title. Lecture 10 — The Reckoning.

Frame & through-line (Syllabus 2.0, carried unchanged from 1.0). The only lecture that asks whether any of this was warranted — and refuses the verdict in favor of the audit. Demand is unknowable; the spend is auditable. Ends on the bill.

Register. Ledger-as-closer. The comedy thins as the Irreversibility Ledger lands. The one place the course looks backward — through costs, not recap. **Not** a rising emotional curve; the closer earns its weight through arithmetic. High-decay lecture: the refresh is the relaunch.

Cascade edge (Syllabus 2.0 format). **Inherits:** everything, as costs. · **Binds at:** irreversibility. · **Who pays:** the ledger’s whole content. · **Manufactures:** nothing. The machine is still running as the audio ends — present tense, the queue still seven years, the bill still arriving.

STRAWMAN BEAT PLAN (12, running order)

STRAWMAN FOR MARKUP. The count is fixed at 12; the selection and running order are not. The Course Schema locks the order *after* markup runs on Section 2’s per-beat verdicts and Section 3’s negative-space scan.

1. **The Hearing Room [O]** — the earnings call where the useful life moved; the disclosure moment on tape, transcripts only. (Opener rotation verified: Hearing Room opens 5, 8, 10 — three distinct room types: a generator’s earnings call, a Memphis public hearing, a disclosure call. L9 opened Wrong Map; no adjacent repeat. **PASS**.)
2. **The Paper Trail** — **class: accounting policy** — the depreciation schedule read across its instances; the footnote as the trade’s load-bearing wall. (Class rotation verified, position 10 of 10 distinct: state audit 1 · technical specification 2 · permit/agreement 3 · queue instrument 4 · contract 5 · securities filing 6 · tariff docket 7 · executive document 8 · regulatory application 9 · **accounting policy 10**. **PASS** — the rotation closes clean.)
3. **The Perverse Incentive** — useful-life extensions that flattered earnings; the accounting incentive running ahead of the silicon.
4. **Follow the Money** — CoreWeave’s interest expense → \$311M, tripling year-over-year; the reference structure arriving at its bill. (CoreWeave is a **return** here; L6 owns the full treatment.)
5. **The Steelman** — defendant: **the hyperscaler’s capex logic** — the strongest case that the spend is rational under uncertainty. (Rotation verified, deployment 8 of 8, no party twice: L1 the county’s growth case · L4 PJM’s queue · L5

- the behind-the-meter customer · L6 the neocloud CFO's depreciation schedule · L7 Dominion · L8 the White House's race logic · L9 the orbital case · L10 the hyperscaler's capex logic. PASS.)*
6. **The Forecast Problem** — gas plants financed against phantom forecasts; the forecast graveyard. **The 2001 fiber rhyme rides here, off-menu** — precedent and anti-precedent. (*Beat Menu selection rule 7: the Historical Rhyme stays off-menu and is a one-lecture tool. This is its single deployment. PASS.*)
 7. **The Bottleneck** — the un-cancellable order book: turbines, transformers, and steel committed regardless of demand.
 8. **The Physics Audit** — what physically exists as of the record: energized vs. contracted vs. announced, run one last time.
 9. **The Bill Arrives** — the terminal bill: whose mailbox, which line items, already printing. **[HUMAN-FLOOR ZONE — comedy off.]**
 10. **The County** — Loudoun's proposed coda: the Moody's AAA exposure if the buildings devalue. (*Loudoun's fourth appearance — Syllabus 2.0 Open Item 6 / Roster Open Item 3; this pack resolves the dependency, Section 8 and Section 2 Beat 10; the extension is Nick's to confirm.*)
 11. **Operator Reality** — who still clocks in either way; the people in a building whose thesis is being audited over their heads. **[HUMAN-FLOOR ZONE — comedy off on the job-fear material.]**
 12. **The Irreversibility Ledger [C]** — what has already been irreversibly spent regardless of whether demand materializes: transmission lines, water rights, gas turbines, farmland, county tax structures, political legitimacy — tallied in the order the cascade spent them. Costs paid in atoms, on 30-year paper, against a forecast.

Paper Trail document class: accounting policy (rotation position 10 of 10 — the last distinct class). **Named document: the depreciation schedule**, read across four filed instances — Microsoft's FY2023 extension (announced on the FY2022 Q4 call, 26 July 2022); Alphabet's FY2023 extension (Q4 2022 earnings release, 2 February 2023); Meta's extension to 5.5 years effective 1 January 2025 (Q4 2024 earnings release, 29 January 2025); and **Amazon's reversal — six years to five, effective 1 January 2025, disclosed 6 February 2025** — plus CoreWeave's own five-to-six-year change effective 1 January 2023, two years pre-IPO. Full dossier at Section 5.

Handoff: NONE. Per Beat Menu selection rule 2 and Moves List move 4, Lecture 10 swaps the mandatory closer-graft for the **Irreversibility Ledger**. (*Rotation verified: the Handoff runs ×9, L1–L9, and stops. The Ledger's mid-course deployment budget was spent at zero, per the Syllabus 2.0 reconciliation — it detonates clean here. PASS.*) Section 10 carries the Ledger inventory in place of a manufactured problem.

Negative space (beats left out — each scanned in Section 3): Cold Open on an Object · The Wrong Map · Mechanism Autopsy · Taxonomy by Business Model · The Symbol Audit · The Founder Audit · The Neighbor · The Deal · The Regulatory Collision · The Externality Swap · (Steelman repeats — structurally barred).

CAST — ROSTER 1.0, WITH LEAD/RETURN STATUS

Slot	Anchor	Status
Document	The depreciation schedule	LEAD here. No prior lecture owns it. L6 planted the mechanism (CoreWeave's five→six change, effective 1 Jan 2023) and expressly banked the cross-instance fight for L10. L2 planted the physical cause (the refresh cadence) and stopped.
Institution	CoreWeave (<i>returning — no re-introduction</i>)	RETURN. Lead lecture: L6. L6's pack states the boundary in its own words: the \$311M moment, the useful-life fight across instances, and the audit's verdict-refusal were "left deliberately unspent for L10." The drafting AI does not rebuild the S-1, the Intrator dossier, the capital-structure strata, the H100-as-collateral, or the neocloud taxonomy.

Slot	Anchor	Status
Human	Michael Burry — Scion Asset Management (then-manager; the firm deregistered with the SEC on 13 November 2025)	LEAD here. Seeded under L6, cast here per Roster 1.0’s lean and Syllabus 2.0 Open Item 4. Map the camps, refuse the verdict: the roster casts the critic, not his conclusion.

Secondary cast (Roster 1.0, plus documented additions surfaced by this pack):

- **Loudoun County** — *return*. **Lead lecture: L1.** L1’s pack expressly reserved “the rating-agency treatment and any downgrade-watch material” for L10’s return, holding itself to one AAA line. Fourth appearance is Open Item 6 — resolved as buildable here.
- **PJM Interconnection** — *return*. **Lead lecture: L4.** L4’s pack pre-allocated PJM’s L10 return. L7 owns the capacity-price series *as a who-pays exhibit* and Bowring’s attribution figures. L10’s allocated additions are narrow and new: the **12 February 2026** RTEP approval and the **14 July 2026** 2028/2029 auction result.
- **Federal Reserve** — *new institutional voice, official-sector HOLD OPEN*. **Governor Lisa D. Cook**, Stanford SIEPR, **27 May 2026** — the named official with a dated statement the Roster required as the fallback if Burry moved to L6. **This pack locks the name and the statement either way (dependency D1, resolved).**
- **Brian T. Olsavsky** — then-Senior Vice President and Chief Financial Officer, Amazon.com, Inc. — the voice in the Hearing Room, 6 February 2025.
- **Andrew R. Jassy** — President and Chief Executive Officer, Amazon.com, Inc. — the steelman, in his own words, on the same tape.
- **The 2001 fiber glut** — *rhyme, not character*. Its punchline, per Roster 1.0: the glut’s corpses were the seed real estate of this industry. Handled off-menu inside Beat 6.
- **“Winning the Race” / the AI Action Plan** — *return, brief reference only*. **Lead lecture: L8.** L8’s pack grants L10 “return-grade reference only” on the executive-document pair.

MUST-HIT ANCHORS (verbatim from Syllabus 2.0; Syllabus 1.0 values govern — see Section 6)

- 5–7 yr hardware refresh vs. 30-yr infrastructure
- CoreWeave interest expense → \$311M (3x YoY)
- gas buildout against phantom forecasts
- overbuild scenario named in Virginia
- 2001 fiber glut as imperfect precedent
- the irreversibility ledger
- Amazon’s February 2025 useful-life reversal
- Burry, November 2025

MOVES PLAN AS ASSIGNED (all seven, with pack-verification flags)

Move	Assignment	Pack status
Step Function	Amazon moves the useful life the wrong way (Feb 2025) — the assumption that lives only ever extend, breaking	VERIFIED. Section 4.1. Number, filer, stage, and the settled assumption all documented.
Unit Conversion	Skip — the Ledger is the conversion	N/A by assignment. No arithmetic gate binds this lecture. Syllabus 2.0 Open Item 11 lists four pack-verified conversions (L4, L5, L6, L9); L10 is not among them. Confirmed in Section 4.2.
Timeline Snap	February 2025	VERIFIED, with a rival date presented. Section 4.3.

Move	Assignment	Pack status
The Verbatim	A depreciation footnote, quoted flat (pack)	PASS. Section 4.4. Existence gate cleared on a primary filing; a second, spoken instance also verified in transcript.
As-Of Stamp	The \$311M figure at its reporting date	VERIFIED, and the decay demonstrated. Section 4.5.
Kicker	Deployed as the Ledger’s final line — the last sentence of the course is the bill	VERIFIED, with two alternates banked. Section 4.6.
Gesture	None. All three doors stay closed; the course ends	CONFIRMED. Section 4.7 and Section 10.4. No door is opened one inch in this pack.

SELLER, NARRATOR MOVES, STEELMAN DEFENDANT

- **Seller on the field (Syllabus 2.0): the Doomer** — punctured exactly as hard as the bull. The full field is covered in Section 7, because the territory contains more sellers than the headline: the Hyperscaler (capex guidance as destiny), the Utility (the forecast as a rate-base application), the Neocloud Founder (the depreciation defence), the Politician (the moratorium and the veto), and — new and specific to this lecture — **the Doomer as a business model**, which the record now documents to the dollar.
- **Governing \$5 moves: HOLD OPEN** on overbuild vs. undersupply — settled by utilization data nobody publishes yet; Burry’s critique cast, his conclusion refused. **FRAMING resolved** — the question was never “is AI a bubble?”; it is what has already been irreversibly paid, in what currency, on whose bill — and can it be un-spent.
- **Steelman defendant (rotation): the hyperscaler’s capex logic.** Deployment 8 of 8. New defendant; no party steelmanned twice course-wide.

DECAY TIER AND BOUNDARY DOORS

- **Decay: HIGH.** The refresh is the relaunch. Every VOLATILE and CONTESTED figure is registered in Section 11.3 with direction and velocity.
- **Boundary doors: all three closed, no Gesture assigned.** Silicon fabrication (October’s course), reactor engineering (January–February’s course), training-run internals (pending Nick’s call, Syllabus 2.0 Open Item 9). **This pack researches behind none of them.** Section 10.4 marks the one place the material presses on an unassigned fence.

HUMAN-FLOOR FLAGS — WHERE THE COMEDY THERMOSTAT DROPS TO NEAR-ZERO

Per Style Guide §5’s human-floor rule, and flagged here so the drafting AI knows the zones before it writes a line:

1. **Beat 9, The Bill Arrives, entire.** The household electricity bill: NEADA’s summer-2026 household figure, the EIA’s residential rate series, the low-income energy-burden material. Documented households and a named executive director. Comedy off.
2. **Beat 10, The County — the residential half only.** Loudoun’s tax-rate history is fiscal machinery and can carry dry wit; the counterfactual residential tax increase, and what a devaluation would mean for schools and services, is floor material. Comedy off at the household line.
3. **Beat 11, Operator Reality, entire.** Fifty people clocking into a building whose thesis is being audited over their heads is a job-security zone, not a punchline. Per §5’s STRIP calibration, the automation anxiety is documented and real; never mock the people who hold it.
4. **Section 8’s whole contents**, wherever the drafting AI draws on them, in any beat.
5. **One non-obvious zone:** the Maine veto’s aftermath (Beat 12 / Section 10). A town’s \$550 million expectation, publicly defended by a governor at the cost of a statewide bill, and then withdrawn by the company. The absurdity is structural and must land on the institutions, never on the town.

PACK DEPENDENCIES — THE DEBT LEDGER THIS PACK MUST RESOLVE OR HONESTLY FAIL

#	Dependency	Source	Status
D1	Burry's home: if he moves to L6, L10 needs a named Fed official with a dated statement locked before Draft 1	Syllabus 2.0 Open Item 4; Roster Open Item 1	RESOLVED BOTH WAYS. Burry's file is complete (Sections 7, 9). The fallback is locked: Governor Lisa D. Cook, 27 May 2026, Stanford SIEPR , verbatim in Section 4.6 and Section 7.6. Either casting is now buildable.
D2	Loudoun's fourth appearance — approve the extension or keep the Ledger entry institution-agnostic	Syllabus 2.0 Open Item 6; Roster Open Item 3	RESOLVED AS BUILDABLE. Section 2 Beat 10 and Section 8.3 supply the material at beat grade. Nick's call stands; the pack does not decide it.
D3	The Verbatim existence gate — a depreciation footnote must exist verbatim in the pack	Moves List move 8; L6's pack recorded PARTIAL on the CoreWeave S-1 note and armed a fallback	PASS. Section 4.4. Cleared on a primary Amazon filing; L6's unresolved CoreWeave pull is noted, not inherited.
D4	Unit Conversion arithmetic gate	Syllabus 2.0 Open Item 11	N/A — L10 is not one of the four flagged conversions. Confirmed, Section 4.2.
D5	Roster's standing debt: verbatim testimony with full context, as-of titles at dated moments, hearing-transcript pulls	Roster 1.0, "What the Research Packs still owe the roster"	DELIVERED for this lecture's cast. Section 8.5 carries a continuous transcript corpus; as-of titles are stamped throughout with the "then-" convention.
D6	L9's banked export: Nickolai Bakken's petition , invoking "irreversible and irretrievable commitments of resources," in a federal data-center docket, March 2026 — <i>"This is L10's, and L9 must not spend it."</i>	L9 pack, Section 10 exports	COLLECTED, WITH A VERIFICATION FLAG. Section 10.2, entry 14. Carried at L9's stated value with L9's pack as the citing authority; the docket locator must be re-pulled at draft stage before the phrase is quoted in prose.
D7	L8's six pre-loaded Irreversibility Ledger entries — <i>"banked here so L10's pack does not re-research them"</i>	L8 pack, Section 10	COLLECTED IN FULL. Section 10.2, entries 6–11. Not re-researched; carried at L8's values and dates.
D8	L2's plant: fleet utilization and GPU retirement data — the numbers that would settle the obsolescence question — published by nobody; <i>"feeds L10's HOLD OPEN"</i>	L2 pack, Sections 2 and 11	COLLECTED. Section 11.5 and Section 7.7. It is the load-bearing absence in the HOLD OPEN.
D9	L5's plant: 20-year fixed-price paper signed against demand whose hardware depreciates in roughly five — <i>"the duration mismatch... inherited by Lecture 10"</i>	L5 pack, Beat on the capital stack	COLLECTED. Section 2, Beats 2 and 12; Section 10.1.

#	Dependency	Source	Status
D10	L1's plant: the FRAMING meta-overclaim named in L1 and sealed until this Ledger	L1 pack, Register note	COLLECTED AND RESOLVED. Section 7.8 states the resolution the closer performs.
D11	L3's plant: "whoever holds the equity when utilization data finally publishes (L10's question — name it, don't answer it)"	L3 pack, Beat on the cooling premium	COLLECTED. Named, not answered — Section 7.7.

SECTION 1: TIMELINE OF THE CONSTRAINT

A constraint machine assembling itself: an accounting estimate becomes a load-bearing wall; a buildout becomes an order book that cannot be cancelled; a forecast becomes a transmission line. Dates are day/month/year where the record supports it. Expected future events are marked [EXPECTED] with the announcing party named.

1.1 — THE DOCTRINE (the estimate becomes an instrument)

1. **1953–1970s** — U.S. generally accepted accounting principles settle the rule that the useful life of a long-lived asset is an **estimate, not a fact**, and that revisions are prospective only. Codified in the modern era at **ASC 360-10-35** (depreciation recognized over the period the asset is expected to provide economic benefit) and **ASC 250-10-45-17** (a revision is a change in accounting estimate, applied prospectively; prior periods are **not** restated). *Why it matters:* the closer's entire subject is a number that is legally an opinion, and whose revision destroys the comparison an investor would use to catch it. (Codification cited in Buxton Helmsley's forensic framework, 4 May 2026.)
2. **Codification, standing** — **ASC 250-10-50-4** requires disclosure of the effect on income from continuing operations, on net income, and on per-share amounts **for the current period** when a change in estimate affects several future periods, such as a change in service lives of depreciable assets. *Why it matters:* the current-period effect must be disclosed; the forward-period sensitivity need not be. The gap is where the argument lives.
3. **PCAOB Auditing Standard 2501, standing** — requires the auditor to obtain sufficient appropriate evidence on the reasonableness of accounting estimates, including management's process, data, and assumptions. *Why it matters:* every useful-life change in this lecture was reviewed by an audit committee and concurred in by an independent registered public accounting firm. The disagreements below are between parties who all cleared the same gate.

1.2 — THE RHYME (the last time capital outran demand)

4. **1996–2001** — U.S. and European telecom carriers bury on the order of **80 million miles of fiber-optic cable**; capital deployed across network buildouts, equipment, acquisitions, and debt-financed leverage is put at close to **\$1 trillion** by retrospective accounts; a narrower figure of roughly **\$90 billion in fiber deployment over four years** appears in the same literature. **[CONTESTED — ranges kept as ranges; see Section 6, D-D.]**
5. **Late 1990s** — WorldCom popularizes the claim that internet traffic is **doubling every 100 days**, against a reality closer to annual doubling. *Why it matters:* the forecast, not the fiber, was the product.
6. **1997** — Gary Winnick, a former Drexel Burnham junk-bond trader, founds **Global Crossing**, which builds a network exceeding **100,000 miles** across **27 countries** and **more than 200 cities**, on the assumption that bandwidth demand would double roughly every three months.
7. **June 2001** — Industry estimates put roughly **95% of newly installed fiber-optic lines** unused, or "dark." Other contemporaneous and retrospective estimates put the dark share at **85%–97%**, and one 2005 estimate still at **85%**. **[CONTESTED — see Section 6, D-D.]**
8. **June 2001** — **360networks** files for bankruptcy, fourteen months after a **\$900 million** IPO.
9. **Q4 2001** — Global Crossing reports a net loss of roughly **\$3.4 billion on revenue of \$793 million** for the quarter; Q3 2001 loss reported at **\$3.35 billion**, with sales down 26% sequentially.
10. **28 January 2002** — **Global Crossing files for Chapter 11**, listing assets of **\$22.44 billion** against debts of **\$12.39 billion**, on which it was paying roughly **\$600 million a year in interest** — then the fourth-largest U.S. bankruptcy.

Capital expenditure was projected to fall from **\$3.2 billion (2001) to \$200 million (2002)**. (House Committee on Financial Services hearing memorandum, 21 March 2002 — **PRIMARY**.)

11. **21 March 2002** — The House Financial Services Committee convenes on telecom-sector market conditions, using Global Crossing as the case study of how fast telecom asset values could diminish. *Why it matters*: the last time Congress audited an overbuild, it did so with the assets already in the ground.
12. **July 2002** — **WorldCom** files, in what becomes the largest accounting fraud in U.S. history to that date; capacity-swap schemes had inflated reported revenue across the sector.
13. **2000–2002** — Global telecom equities lose **more than \$2 trillion** in market value. Hundreds of thousands of jobs are eliminated.
14. **2001–2004** — The anti-precedent begins: universities and state networks buy dark fiber at distressed prices. **Ohio’s OARnet** purchases fiber in 2001–2002 and lights a statewide network by 2004; **Internet2’s FiberCo** signs with Level 3 in 2003 for thousands of route-miles. *Why it matters*: the glut’s corpses became public infrastructure — because glass does not obsolesce.
15. **By 2004** — U.S. wholesale long-haul prices fall roughly **55% year over year**; analysts estimate roughly **one-tenth** of installed fiber is lit.
16. **2011** — **Level 3 Communications acquires Global Crossing for \$3 billion**; the assets are now a subsidiary of Lumen Technologies. *Why it matters*: the corpse was bought at a fraction of build cost and is still carrying traffic — the precedent half of the rhyme.
17. **1999–2002 (Loudoun County, Virginia)** — The dot-com buildout wires Loudoun with speculative fiber; the collapse strands it; it is later acquired cheaply. [**Cross-lecture: L1 owns the dark-fiber inheritance as geography; L10 owns the precedent/anti-precedent argument. Do not rebuild L1’s Loudoun origin.**]

1.3 — THE ESTIMATE GETS ELASTIC (2020–2024)

18. **2020–2021** — Server useful lives across the large cloud operators sit in the **3-to-5-year** band, having already been extended once in the late 2010s. [**STRUCTURAL — state with the year.**]
19. **26 July 2022** — **Microsoft’s fiscal Q4 2022 earnings call**. Then-CFO **Amy Hood** announces that, effective at the start of fiscal 2023, the depreciable useful life of server and network equipment in Microsoft’s cloud infrastructure extends **from four years to six years**, expected to favorably affect FY2023 operating income by approximately **\$3.7 billion**, with about **\$1.1 billion** of that in Q1 alone. *Why it matters*: the industry’s largest single-step extension, announced on tape, with the earnings benefit quantified by the company itself.
20. **1 January 2023** — **CoreWeave extends the estimated useful life of technology equipment from five years to six**, effective this date. Two years and two months before its IPO. [**Cross-lecture: L6 owns the treatment; L10 uses the fact as one instance in the Paper Trail’s cross-reading.**]
21. **2 February 2023** — **Alphabet’s Q4 2022 earnings release** discloses a completed useful-life assessment: servers **four years to six years**, certain network equipment **five years to six years**, effective in fiscal 2023, with an expected **\$3.4 billion** reduction in full-year depreciation expense.
22. **1 February 2024** — **Amazon’s Q4 2023 earnings release** discloses that, effective January 2024, the useful life of its servers extends **from five years to six years**. On the corresponding call, then-CFO **Brian T. Olsavsky** states the change is expected to benefit Q1 2024 operating income by approximately **\$900 million**.
23. **30 January 2024** — **Alphabet’s Q4 2023 earnings release** reports the *realized* effect of the 2023 change: depreciation expense reduced by **\$3.9 billion** and net income increased by **\$3.0 billion**, or **\$0.24 per diluted share**. *Why it matters*: the estimate’s cash-free earnings contribution, confirmed a year later, in the company’s own numbers.
24. **Q4 2024** — Amazon completes a **useful-life study for servers and network equipment** and observes an increased pace of technology development, particularly in artificial intelligence and machine learning. *Why it matters*: the study is the pivot; the disclosure follows six weeks later.
25. **Q4 2024** — Amazon early-retires a subset of servers and network equipment, recording approximately **\$920 million** in accelerated depreciation and related charges in the quarter ended 31 December 2024.
26. **29 January 2025** — **Meta’s Q4 2024 earnings release** discloses an extension of the useful life of certain servers and network assets to **5.5 years** effective 1 January 2025, expected to reduce full-year 2025 depreciation expense by approximately **\$2.9 billion** based on assets in service at 31 December 2024.

1.4 — THE HINGE (February 2025)

27. **6 February 2025, 5:00 p.m. ET — THE STEP FUNCTION AND THE TIMELINE SNAP.** On Amazon's Q4 2024 earnings call, then-CFO **Brian T. Olsavsky** discloses, in prepared remarks, three simultaneous changes of estimate:
 - the useful life of **a subset of servers and networking equipment decreases from six years to five years**, beginning January 2025 — expected to **decrease** full-year 2025 operating income by approximately **\$700 million**;
 - the Q4 2024 early-retirement charge of approximately **\$920 million** is expected to **decrease** full-year 2025 operating income by a further approximately **\$600 million**;
 - and the useful life of **certain heavy equipment used in fulfillment centers increases from 10 years to 13 years**, beginning January 2025 — expected to **increase** full-year 2025 operating income by approximately **\$900 million**. **Aggregate stated effect on full-year 2025 operating income: approximately –\$400 million**, for assets on the balance sheet as of 31 December 2024. *Why it matters:* this is the hinge of the lecture. On one call, the AI hardware got a year shorter and the warehouse machinery got three years longer, and the forklifts more than paid for the servers. (Earnings-call transcript — **PRIMARY**, verified verbatim; see Section 8.5.)
28. **6 February 2025, same call** — Olsavsky also states that the **2024 server-life extension contributed approximately 200 basis points** to the year-over-year AWS operating-margin increase in Q4 2024. *Why it matters:* the extension's earnings contribution and the reversal are disclosed in the same set of prepared remarks, minutes apart.
29. **6 February 2025, same call** — Then-CEO **Andrew R. Jassy** states Q4 capital investments of **\$26.3 billion** are “reasonably representative” of the 2025 annualized rate, and describes AWS growth as constrained by chips, power, and motherboard supply. *Why it matters:* the steelman and the audit are on the same tape, twenty minutes apart.
30. **7 February 2025** — Amazon's Form 10-K for FY2024 is filed carrying the useful-life language and the quantified effects. [SEC EDGAR locator: **AMZN CIK 1018724, 10-K FY2024, significant accounting policies and property-and-equipment notes.**]
31. **February–March 2025** — Forensic-accounting analysts, including **Olga Usvyatsky** (Deep Quarry, 11 February 2025), publish the divergence: Amazon shortening while Meta extends, in the same quarter, on substantially similar fleets. *Why it matters:* the divergence is itself a disclosure — the variance in reported operating income comes from the elasticity of the estimate, not from the economics.

1.5 — THE NEOCLOUD ARRIVES AT ITS BILL

32. **3 March 2025** — CoreWeave's S-1 becomes public (Nasdaq: CRWV). [**L6 owns the document treatment entire.**]
33. **27 March 2025** — CoreWeave prices its IPO. [**L6.**]
34. **Q1 2025 (three months ended 31 March 2025)** — CoreWeave revenue **\$982 million**; net loss **\$315 million**; interest expense, net **\$264 million**. (Company reporting, restated in the Q1 2026 comparison.)
35. **Q3 2025 (three months ended 30 September 2025)** — **CoreWeave interest expense, net: \$311 million, against \$104 million a year earlier — the must-hit anchor, at its reporting date.** Revenue backlog **\$55.6 billion** (from \$30.1 billion). Revenue guidance cut on construction delays at a third-party data-center developer. [**ANCHOR as a dated fact; see Section 4.5 for the As-Of Stamp and Section 6, D-A.**]
36. **10 November 2025** — CoreWeave reports Q3 2025; the stock falls more than 30% from mid-August highs across the following sessions. *Why it matters:* the reference structure's first public repricing.
37. **26 February 2026** — **CoreWeave reports Q4 and full-year 2025.** FY2025 revenue **\$5,131 million** (vs. \$1,915M in 2024); operating loss **–\$46 million**; interest expense, net **–\$1,229 million** (vs. **–\$361 million** in 2024 — **3.4x**); net loss **–\$1,167 million**; depreciation and amortization **\$2,454 million** (vs. \$863M); property and equipment, net **\$30,557 million**; debt **\$6,708M current + \$14,665M non-current**; revenue backlog **\$66.8 billion**; approximately **260 MW** of active power capacity added in the quarter, to **more than 850 MW** active; total contracted power approximately **3.1 GW**. CFO **Nitin Agrawal** on the backlog; CEO **Michael Intrator** on the year. (8-K/EX-99.1 — **PRIMARY**.) *Why it matters:* the \$311M anchor is now a quarter in a series, and the series is the story.
38. **2 March 2026** — CoreWeave files its **FY2025 Form 10-K**. [SEC EDGAR locator: **CRWV CIK 1769628, accession 0001769628-26-000104, document crwv-20251231.htm; useful-life and depreciation policy in the significant-accounting-policies note; property and equipment note.**]
39. **7 May 2026** — **CoreWeave reports Q1 2026.** Revenue **\$2,078 million** (+112% YoY); GAAP net loss **–\$740 million**; interest expense, net **\$536 million** (vs. \$264M a year earlier); adjusted EBITDA **\$1,157 million** (56% margin); adjusted operating income **\$21 million** (1% margin, from 17% a year earlier); revenue backlog **\$99.4 billion**

(+284% YoY, +50% sequentially); property and equipment **\$36,424 million**; Q1 capex **\$7,695 million**; operating cash flow **\$2,984 million**; **8.5 billion dollar DDTL 4.0** non-recourse facility closed; **\$2 billion** Class A common stock investment from NVIDIA closed; total contracted power approximately **3.5 GW**; active power surpasses **1 GW**. Guidance: FY2026 revenue **\$12–13 billion**; FY2026 capex **\$31–35 billion** (low end raised on component pricing); exit-2026 annualized run-rate revenue **\$18–19 billion**; **Q2 2026 interest expense guided to \$650–730 million**. Intrator on the call: the company has “reached hyperscale.” Shares fall 6.62%.

40. **7 May 2026** — Same release: 10 clients now committed to spending at least **\$1 billion**; backlog recognition profile **36% within 24 months, 75% within four years**; milestone agreements with **Anthropic** and **Meta** disclosed. *Why it matters*: the concentration that L6 documented is diluting in real time — a fact that cuts *for* the defendant.

1.6 — THE CRITIC (November 2025 onward)

41. **30 October 2025** — Michael Burry posts on X about bubbles and the option of not playing. *Why it matters*: the opening move of the most-covered short thesis of the cycle.
42. **Early November 2025** — Burry discloses put positions against **Palantir** and **NVIDIA**; reported notional roughly **\$1.1 billion**. [Notional, not exposure — stage-label it every time.]
43. **10 November 2025** — **Burry’s depreciation post**. Verbatim, in full, from the primary post: “*Understating depreciation by extending useful life of assets artificially boosts earnings -one of the more common frauds of the modern era. Massively ramping capex through purchase of Nvidia chips/servers on a 2-3 yr product cycle should not result in the extension of useful lives of compute equipment. Yet this is exactly what all the hyperscalers have done. By my estimates they will understate depreciation by \$176 billion 2026-2028. By 2028, ORCL will overstate earnings 26.9%, META by 20.8%, etc. But it gets worse. More detail coming November 25th. Stay tuned.*” [PRIMARY — @michaeljburry, status 1987918650104283372. Long-form reproduction retained here as the pack’s evidentiary record; prose deployment must be held to a short quoted fragment under the house verbatim discipline. Companies named across the sequence: Microsoft, Meta, Alphabet, Amazon, Oracle.]
44. **11 November 2025** — CNBC reports the accusation and notes it was **unable to independently confirm** the practice as characterized. Analysts push back: **Daniel Newman** (CEO, The Futurum Group) grants the point about depreciation practices while questioning Burry’s standing to assess asset lives against Meta’s and Microsoft’s own management; **Ross Gerber** (Gerber Kawasaki) posts a same-day dismissal. *Why it matters*: the register’s symmetry — the critic gets audited on the day he publishes.
45. **13 November 2025** — **Scion Asset Management’s SEC registration is terminated**. Burry is no longer required to file holdings disclosures. *Why it matters*: the critique’s author steps outside the disclosure regime he is criticizing others for gaming. State it flat; it is a fact, not an accusation.
46. **14 November 2025** — CNBC’s follow-up establishes the industry’s counter-record: **Intrator** says CoreWeave is being “data driven” on GPU shelf life; NVIDIA A100s announced in 2020 are **fully booked**; a batch of 2022-vintage **H100s** freed by an expiring contract was rebooked **at 95% of its original price**. Amazon and Microsoft decline to comment; Meta, Google and Oracle do not respond. *Why it matters*: the defendant’s best evidence, on the record, four days after the charge.
47. **~Mid-November 2025** — **NVIDIA issues a detailed memo to Wall Street analysts** disputing Burry’s characterization, rejecting comparisons to Enron and WorldCom, and defending its reporting, strategic investments and compensation practices. *Why it matters*: a vendor rebutting an accounting critique of its customers is itself a data point about the circularity.
48. **23 November 2025** — Burry launches the Substack newsletter **Cassandra Unchained**, announced as his sole focus.
49. **24 November 2025** — Bloomberg’s coverage of GPU depreciation quotes forensic analyst **Olga Usvyatsky**. *Why it matters*: the debate migrates from a short-seller’s feed to the accounting press.
50. **16 December 2025** — Burry publishes “Foundations: The Big Short Squeeze,” paywalled. [Paywall noted; the pack does not quote behind it.]
51. **9 January 2026** — Burry publishes a follow-up Q&A in the “Heretic’s Guide to AI’s Stars” series, reporting the prior essay at almost **41,000 views and nearly 300 comments**.
52. **~7 January 2026** — **SemiAnalysis** publishes the most substantive technical rebuttal: the claim is predicated on the assumption that the NVIDIA product cycle is now 2–3 years, which the firm calls a fatal flaw in the argument, and argues the six-year schedule is grounded in operational experience inside data centers, with Microsoft’s “fungible fleet” doctrine as the mechanism. *Why it matters*: the strongest technical steelman for the defence, from an analyst with no equity position in the outcome.

53. **~Mid-July 2026 — Cassandra Unchained passes 300,000 subscribers** (free and paid combined), ranked #2 in Substack's finance category, carrying a Bestseller badge. Subscription pricing **\$39/month, \$379/year**. StockTwits' arithmetic: if every subscriber were paid, roughly **\$113.7 million annually** — **[a theoretical maximum, explicitly not a revenue figure; stage-label it as a ceiling, never as revenue. Scion's prior AUM was reported at ~\$155 million, implying ~\$3.1 million at a 2% management fee.]** *Why it matters:* the Doomer is a seller too, and this is the pack's ammunition for auditing him on the same terms as the bull.
54. **Since late 2025 (as of mid-2026 reporting) — NVIDIA shares down 14% and Palantir down 24% since the short disclosures; CoreWeave down 40%. [VOLATILE — reprice at draft stage; carried with the reporting date, not as a current quote.]**

1.7 — THE ORDER BOOK NOBODY CAN CANCEL

55. **October 2025 — IEEFA documents that Siemens Energy, Mitsubishi Heavy Industries and GE Vernova — roughly 90% of the global large-frame gas turbine market over the past decade — are quoting delivery timelines of up to eight years, with customers advised to plan on seven-to-eight-year horizons against two-to-three years earlier in the decade.**
56. **2 October 2025 — Bloomberg reports roughly one-third of GE Vernova's turbine reservations tied directly or indirectly to AI and hyperscalers; U.S. developers planning more than 26 GW of new gas-fired capacity by 2028, about double the 2023 three-year plan, per an EIA survey of builders and operators. Then-SVP of gas service at Siemens Energy, Joern Schmuecker, on the ramp: it is not easy to do. [PARAPHRASE — locator: Bloomberg "Bottlenecks" feature, 2 Oct 2025.]**
57. **9 December 2025 — GE Vernova investor update.** 18 GW of turbine orders booked in Q4 to date; year-end 2025 backlog expected at **80 GW**, stretching into 2029. CEO **Scott Strazik** states he expects gas turbine reservations to be **sold out through 2030 by the end of 2026**. Guidance reiterated: **20 GW** annualized turbine production by mid-2026, stretchable to **24 GW** by mid-2028 at two existing facilities; 4 GW of new capacity split between the French aeroderivative plant and the South Carolina large-frame plant.
58. **Q4 2025 (reported 2026) — GE Vernova Q4 orders \$22.2 billion, +65% organically; gas power equipment backlog plus slot reservation agreements grow from 62 GW to 83 GW sequentially. (8-K — PRIMARY.)**
59. **2025 full year — Siemens Energy reports a record backlog of €136 billion, having sold a reported 194 gas turbines in 2025, nearly double 2024. Mitsubishi Power sold out through 2028.**
60. **Q1 2026 — GE Vernova signs 21 GW of new gas turbine agreements; total GW under contract grows 83 → 100 sequentially; backlog 40 → 44 GW; slot reservation agreements 43 → 56 GW. Electrification orders \$7.1 billion, roughly double year over year, with \$2.4 billion from data-center customers — more data-center electrification orders in Q1 2026 alone than in all of 2025. Q1 orders \$18.3 billion; total backlog \$163 billion. Target: at least 110 GW of combined backlog and slot reservations by year-end 2026.**
61. **28 May 2026 — A senior GE Vernova executive tells Natural Gas Intelligence that turbines are not the gating item for data-center buildouts, even with makers booked solid through 2028 and lead times topping three years. Why it matters:** the supplier with the strongest incentive to sell scarcity says scarcity is not the binding constraint — a seller cutting against his own interest, which is the most interesting kind of evidence.
62. **Early July 2026 — GE Vernova's turbine supply reported booked through 2030.** Secondary-market behavior documented across 2026: developers sourcing **refurbished 1990s-vintage turbines**; industrial buyers purchasing units **on spec** to hold delivery slots. Gas turbine prices reported up **300% in three years** (24/7 Wall St., June 2026) **[CONTESTED — single-source magnitude; treat as a range-free claim with the author named, or omit].**
63. **Standing (2026) — First-row turbine blades are grown as single unbroken nickel superalloy crystals by a small number of suppliers. Why it matters:** the bottleneck below the bottleneck, and it is metallurgical, not financial.

1.8 — THE FORECAST BECOMES A TRANSMISSION LINE

64. **December 2022 — PJM's Base Residual Auction for the 2024/2025 delivery year clears at \$28.92/MW-day in most zones.**
65. **July 2024 — The 2025/2026 auction clears at \$269.92/MW-day in most zones — roughly ninefold.**
66. **July 2025 — The 2026/2027 auction clears at \$329.17/MW-day in all zones, at the FERC-approved cap. PJM's forecast peak load for 2026/2027 rose more than 5,400 MW year over year, driven largely by data centers, electrification and economic growth.**
67. **17 December 2025 — PJM's 2027/2028 Base Residual Auction procures 134,479 MW UCAP and clears at the cap,**

\$333.44/MW-day (UCAP), RTO-wide. Forecast peak load approximately **5,250 MW** above the prior auction's, of which **nearly 5,100 MW is attributable to data center demand**. **The first auction in which the entire RTO, including Fixed Resource Requirement areas, fell short of the reliability requirement**. Cleared supply × clearing price totals **\$16.4 billion**. [Cross-lecture: **L7 owns the capacity-price series as a who-pays exhibit**. **L10 takes the shortfall fact and the January 2026 attribution, both new.**]

68. **5 January 2026 — Monitoring Analytics**, PJM's independent market monitor, reports that data center load accounted for **\$6.5 billion, or 40%, of the \$16.4 billion** in costs from the December auction — and that **about \$6.2 billion of that relates to data centers that have not been built** but could come online by the 2027/2028 delivery year beginning 1 June 2027. Across PJM's last three capacity auctions, **data center forecasts beyond existing data centers made up 45% of \$47.2 billion** in capacity costs. The monitor estimates the price floor/cap reduced capacity costs by **\$13.1 billion** across the two auctions in which it applied. *Why it matters*: this is the phantom-load discipline rendered as a dollar figure by the referee, and it is the single most important number in Beat 6.
69. **16 January 2026 — PJM's Board of Managers** outlines 2026 actions on integrating large loads, culminating an accelerated stakeholder process ("Critical Issue Fast Path") that produced **12 proposals**.
70. **22 January 2026 — Senator Elizabeth Warren**, Ranking Member of the Senate Banking Committee, joined by Senators **Blumenthal, Smith** and **Van Hollen**, presses **FSOC Chair Scott Bessent** to open a formal investigation into financial-stability risks from more than **\$1 trillion** in projected AI-infrastructure debt, citing private credit, securitizations and off-balance-sheet financing. [PRIMARY — **Senate Banking minority release.**]
71. **12 February 2026 — PJM's board approves the 2025 Regional Transmission Expansion Plan, Window 1: \$11.8 billion in baseline transmission projects**, selected from **134 proposals (57 greenfield, 77 upgrades) submitted by 19 entities**. Allocations: approximately **\$4.8 billion** to Dominion Energy Virginia, including a **185-mile, 525-kV underground HVDC "backbone"** from Brunswick County to the **Mosby substation in Loudoun County** — the line itself about **\$2.3 billion**, plus two HVDC converter stations at roughly **\$1.5 billion** — delivering **3,000 MW** into Northern Virginia, **targeted in service June 2032 [EXPECTED — PJM/Dominion]**; **\$1.7 billion** for a **221-mile, 765-kV line** across central Pennsylvania proposed by NextEra Energy Transmission and Exelon; **\$1.1 billion** in central Ohio for roughly **300 miles of 765-kV** from Grid Growth Ventures (Transource — an AEP/Evergy partnership — with FirstEnergy Transmission); **~\$580 million** PPL Electric; **~\$276 million** ComEd; **~\$292 million** Pepco. **Costs shared across PJM's footprint**. Prior RTEP baseline totals: **\$5.9 billion (2024)** and **\$6.6 billion (2023)**. PJM's stated cause includes a **10 GW to 28 GW** load increase between 2030 and 2032 relative to its 2024 projection. *Why it matters*: the single largest irreversible commitment in the ledger, approved in one board vote, recovered from 67 million people, in service six years from now.
72. **~24 June 2026 — Moody's Ratings publishes a sector report** finding that rapid data center growth is raising credit risks for U.S. state and local governments through electricity and water demands the public systems were not designed for, and noting that at least **14 states** have considered or are considering statewide moratoriums in 2026 (citing NCSL). Moody's, verbatim on the function of a pause: moratoriums *"allow time for governments to evaluate data center impacts"* [9 words; **single deployment from this source**]. *Why it matters*: the rating agency, not the activist, names the fiscal exposure.
73. **30 June – 7 July 2026 — Offer window for PJM's 2028/2029 Base Residual Auction**. Price cap approximately **\$325/MW-day**, floor **\$175/MW-day**, extended by PJM in coordination with the governors of all 13 PJM states, and extended again to the **December 2026** auction.
74. **14 July 2026 — PJM's 2028/2029 auction results**. **138,318 MW UCAP** procured in RPM, plus **10,864 MW** from FRR areas, for **149,182 MW UCAP** total. **Cleared at the price cap for the third consecutive auction**. RPM forecast peak load approximately **2,000 MW** above the prior auction's. Supply mix (UCAP): **46% natural gas, 20% nuclear, 18% coal, 5% demand response, 4% hydro, 2% wind, 2% oil, 1% solar**. Natural gas up **5,639 MW UCAP**; coal down **2,941 MW UCAP**; solar up **651 MW**. Independent analysis cited by the Sierra Club: a **6.8 GW shortfall** below the reserve-margin target, slightly larger than the prior auction, with roughly **525 MW** of new resources attracted; annual customer costs in PJM up **\$12.5 billion since June 2025**, from **\$2.2 billion (2024)** to **\$14.7 billion** the following year. [Advocacy source for the cost series — **flag the vantage; PJM's own release carries the MW and mix figures.**] PJM plans a **backstop reliability auction in September 2026 [EXPECTED]** and a "connect and manage" framework for large new loads.

1.9 — WHAT PHYSICALLY EXISTS (announced, planned, started, abandoned)

75. **2019–2022** — Dodge Construction Network records plans for about **278 U.S. data centers**, averaging roughly **\$114 million** in project value, median **\$26 million**; new plan value averages roughly **\$7 billion per year**.
76. **2021** — Nominal spending on U.S. data center **structures** runs about **\$10 billion** annualized.
77. **2023** — Data center plan values begin to climb sharply in late 2023.
78. **2024** — New U.S. data center plan value reaches almost **\$300 billion** for the year. Imputed total data center investment: **\$58 billion**.
79. **First half 2025** — Data center **structures** investment runs about **\$40 billion** annualized — a fourfold increase from 2021.
80. **January–September 2025** — **521 U.S. data center plans**, averaging a little under **\$2 billion** each, median about **\$216 million**; new plan value for the period exceeds **\$900 billion**.
81. **September 2025** — The **stock** of U.S. data center projects in the planning stage exceeds **\$1 trillion** (Dodge micro-data, as processed by Federal Reserve Board staff).
82. **17 December 2025** — **Federal Reserve Board FEDS Working Paper 2025-109**, Brandsaas, Garcia, Kurtzman, Nichols and Zyteck, *Estimating Aggregate Data Center Investment with Project-level Data*, is published. Its three parameters, estimated from Dodge data 2003–2025: **abandonment rate 0.33** across roughly 1,711 projects; **11.11 months** mean plan-to-start; **9.37 months** mean start-to-completion. For projects over **\$250 million** (roughly the top decile, $n=169$): abandonment **0.30**, plan-to-start **15.00 months**, start-to-completion **19.77 months**. A **\$1 billion** project takes about **19 months** from start to completion. Comparison: Glancy, Kurtzman and Loewenstein put the abandonment rate for the overall commercial sector at **0.46**. *Why it matters: the Federal Reserve’s published model of the AI buildup assumes one in three announced data centers never gets built* — and treats that as the ordinary, historically grounded rate, not a bearish scenario.
83. **17 December 2025 (same paper)** — Simulation results: mean investment rises from approximately **\$60 billion annualized in 2024:Q4** to **\$180 billion in 2025:Q4**, reaching roughly **\$370 billion annualized by 2026:Q2**. Dispersion at 2026:Q2: **~\$240 billion (5th percentile)** to **~\$450 billion (95th percentile)**, driven primarily by project-level abandonment. Medium-run 2027 mean investment ranges **\$357 billion** (plan inflow at one-quarter of the 2024–25 pace) to **\$921 billion** (double). Contribution to nominal GDP growth: **0.41 pp (2025)**; **0.75–1.11 pp (2026)**; **–0.17 pp to +1.21 pp (2027)** — before an import adjustment which, on the authors’ assumptions (30% structures / 70% high-tech equipment; 80% import share on the equipment), implies **44% of data center investment is domestic**, cutting the GDP contributions to 44% of those figures. **[Every figure here is the authors’ own, stage-labeled: estimates, nowcasts and forecasts, not outcomes.]**
84. **13 January 2026** — The paper is posted to the Federal Reserve’s EmergingTech Economic Research Network; a public GitHub repository ([eirikbrandsaas/DataCenterPublic](https://github.com/eirikbrandsaas/DataCenterPublic)) carries live-updated results across Dodge vintages. *Why it matters: the Fed is publishing its abandonment-rate model as a maintained dataset. The audit has an official version.*
85. **~24 February 2026** — **Sightline Climate** publishes its first quarterly Data Center Outlook: **190 GW tracked across 777 large data centers and AI factories (>50 MW) announced since 2024**; at least **16 GW** slated to come online in 2026 across roughly **140 projects**, nearly triple the prior year’s build; **only about 5 GW under construction**; roughly a quarter of the 140 projects have not disclosed how they will be powered; **30–50% of the 2026 pipeline unlikely to come online before year-end**. Prior-year benchmark: manufacturers delayed **26%** of announced capacity and pushed back commercial operations on another **10%**.
86. **April 2026** — Sightline’s updated read: **11 GW** of the 2026 pipeline remains in the “announced” stage with no signs of construction, against typical build times of **12–18 months**; community opposition is now classified as *“a true material driver of attrition”* **[8 words]**; data center cancellations attributed to local pushback **quadrupled in 2025**, with at least **25 projects cancelled**. Roughly **\$150–200 billion** of data center capex expected to slip from 2026 into 2027–2028.
87. **May 2026** — Sightline data carried by Latitude Media: **more than 50%** of expected 2026 U.S. projects are still planned to be **grid-connected**; only about **3%** are designed for onsite power only; the remainder are hybrids that still depend on the utility for part of their load. **9 canceled projects** directly tracked in the 2026 dataset as of May. *Why it matters: the workaround economy of Lecture 5 is real and, in 2026’s pipeline composition, small. The interconnection queue still sets the schedule.*
88. **21 June 2026** — **SemiAnalysis publishes a direct rebuttal**: “Stop Saying Half of 2026 US Datacenter Capacity Is Canceled.” Its argument: Sightline’s dataset tracks large, publicly announced projects, skewing toward speculative megaprojects most prone to slipping; almost all flagged capacity sits in the pre-construction “announced” bucket; and

SemiAnalysis's own satellite-imagery model, trained on hundreds of thousands of images, finds Sightline's under-construction figures off by multiples. On moratoriums: as of April 2026, at least **12 states** had filed moratorium bills and **Indiana alone had at least four counties (Fulton, Marshall, Putnam, White)** with enacted moratoriums — none of which had data centers. *Why it matters:* this is the doomer-direction audit the register requires, executed by someone with satellites.

1.10 — THE BILL

89. **2019 → 2026** — U.S. retail electricity prices rise **42%**, against a **29%** increase in the Consumer Price Index over the same period. [Series comparison; author flagged in Section 12.]
90. **2020 → 2025** — The average U.S. residential electricity price rises **31.38%**, reaching **17.29 cents per kilowatt-hour** in 2025, nearly 5% above 2024. (EIA.)
91. **December 2025** — EIA's Short-Term Energy Outlook projects the 2026 U.S. average residential price at about **18.02 ¢/kWh**, with New England at about **30.01 ¢/kWh** (from 28.97¢) and the Pacific region at **24.88 ¢/kWh** (from 24.40¢). EIA attributes 2025–2026 power-sector generation growth “primarily” to increasing demand from large customers including data centers, concentrated in ERCOT and PJM. [PARAPHRASE — locator: EIA STEO, December 2025.]
92. **January 2026** — Utility Dive's framing of the year, in the words of the sources it quotes: the cake is baked. EIA's 2026 national average residential price, **18 cents/kWh**, is approximately **37% above 2020**.
93. **April 2026** — EIA Form EIA-861M monthly data put the U.S. average residential rate at **18.83 ¢/kWh**, **+7.4% against April 2025**. Annual series: +6.4% (2023), +3.0% (2024), +5.0% (2025). Range across states: **12.35 ¢/kWh (North Dakota) to 46.62 ¢/kWh (Hawaii)**. [VOLATILE — monthly; re-pull at draft.]
94. **May 2026** — Berkeley Lab reports residential electricity prices surging ahead of commercial and industrial rates. [PARAPHRASE — locator: LBNL via Utility Dive, updated 21 May 2026.]
95. **27 May 2026** — **Federal Reserve Governor Lisa D. Cook**, at the Stanford Institute for Economic Policy Research: companies have announced **more than \$1.5 trillion in data-center plans, only a small portion of which have been realized**; prices have risen significantly for chips, other high-tech equipment and software; wages in construction specialty trades have picked up notably; and **electricity and water prices have each increased by about 5 percent over the past year**. Same speech: PCE inflation estimated at **3.8%** over the 12 months ending April 2026, core at **3.3%**; unemployment **4.3%** in April. [PRIMARY — Federal Reserve speech page.]
96. **June–September 2026 [IN PROGRESS]** — The National Energy Assistance Directors Association expects the average U.S. household to spend **\$792 on electricity across June–September 2026**, up **10.5%** from **\$717** the previous summer, and **39.4% above the 2020** seasonal figure. NEADA Executive Director **Mark Wolfe**, verbatim: “Families are getting hit from both sides.” [7 words; single deployment from this source. HUMAN-FLOOR ZONE.]
97. **Summer 2026 [FORECAST]** — EIA expects average U.S. **wholesale** electricity prices to **fall** by about **\$4/MWh** this summer to roughly **\$45/MWh**, on lower natural-gas costs and stronger hydro and solar output — while still expecting the **annual residential price to rise 5.7%** in 2026. *Why it matters:* the cleanest available demonstration that the retail bill is not a fuel-price story. It is a capital-recovery story.
98. **2026 [FORECAST]** — Wholesale power costs to providers: **\$51/MWh (2026)**, from **\$47 (2025)** and **\$38 (2024)**. Low-income households already spend more than **15% of income** on energy. [HUMAN-FLOOR ZONE.]
99. **March 2026** — **PPL Electric**, in a Pennsylvania rate settlement, discloses an interconnection pipeline of about **20 GW** of contracted large loads against a system peaking at **7.8 GW**, states it is preparing to more than double system demand in five to six years, and warns that without protections the buildout poses a risk of **stranded assets, unrecovered costs, and cross-subsidization from other ratepayers**. [PARAPHRASE of a binding filing — locator: PPL Electric rate settlement, PA PUC, March 2026. A utility putting stranded-cost risk into a binding document is the beat's load-bearing artifact.]

1.11 — THE POLITICS OF THE PAUSE

100. **November 2025** — A proposed **\$5 billion** data center in **Wiscasset, Maine**, is paused after community backlash.
101. **December 2025** — A **\$300 million** data center slated for **Lewiston, Maine**, is voted down by city councilors.
102. **March 2026** — Senator **Bernie Sanders** and Representative **Alexandria Ocasio-Cortez** announce federal legislation for a data center construction moratorium. As of the same month, **11 states** have introduced legislation to temporarily ban data centers. [Cross-lecture: L8 owns the moratorium wave's state-level tally; L10 takes 2026

movement only.]

103. **March 2026** — Virginia’s Senate FY2027 budget proposes removing the statewide data center **sales and use tax exemption** in place since 2008 — a budgetary impact of **\$1.5 billion over two fiscal years**. Loudoun’s Legislative Liaison **Jonathon Freeman** tells the Board of Supervisors the county is working to oppose it, calling the proposal superficial and potentially devastating [PARAPHRASE — locator: Loudoun Now, 5 March 2026]. Sen. **Russet Perry** (D-31) and Del. **John McAuliff** (D-30) praise the change.
104. **~23 April 2026** — Governor **Janet Mills** signs **LD 713**, excluding data centers from certain Maine tax incentive programs.
105. **24 April 2026** — **Mills vetoes LD 307**, *An Act to Establish the Maine Data Center Coordination Council and Place a Temporary Limitation on Certain Data Centers*, which had passed both chambers and would have been **the first statewide data center moratorium in the nation**: a 13-member council reporting by **1 February 2027**, and a moratorium on municipal and state permitting of data centers with loads of **20 MW or more until 1 November 2027**. In her veto message, Mills writes that a moratorium “*is appropriate given the impacts of massive data centers*” [10 words; single deployment from this document], and states she would have signed the bill had it exempted a project at the former Androscoggin Mill in the **Town of Jay** — a **\$550 million** proposal supported by the town, the Franklin County Commissioners and the regional chamber. Sponsor Rep. **Melanie Sachs** (D-Freeport) calls the veto “*simply wrong*” [2 words]. Mills announces she will establish a commission by executive order instead. [PRIMARY — Maine governor’s official veto message.]
106. **18 June 2026** — **The Jay data center is placed on hold indefinitely; the company backs out** — after the veto that was cast to protect it. *Why it matters*: the cleanest documented entry in the political-legitimacy column of the Irreversibility Ledger. A statewide bill was spent on a project that then evaporated. [HUMAN-FLOOR ADJACENT — the absurdity lands on the institutions, never on the town.]
107. **2026** — **Michigan and West Virginia** move the opposite way, enacting incentives to attract data center investment. *Why it matters*: the pause is not a national direction; it is a distribution.

1.12 — THE SPEND, AS GUIDED

108. **February 2026** — 2026 capital-expenditure guidance, as issued: **Amazon ~\$200 billion**; **Alphabet \$175–185 billion**; **Meta \$115–135 billion**; **Microsoft tracking toward \$120 billion or more**; **Oracle targeting \$50 billion**. Combined **\$660–690 billion**, roughly double 2025. [Stage: announced/guided, not spent.]
109. **29–30 April 2026** — Q1 2026 (and Microsoft fiscal Q3) results. Capex in the quarter: **Amazon \$44.2 billion**; **Alphabet \$35.67 billion** (more than double YoY); **Microsoft \$30.88 billion** (+84% YoY); **Meta ~\$20 billion** (from ~\$13 billion a year earlier). Three of the four raise full-year guidance: **Meta to \$125–145 billion**, citing higher component pricing and additional data center costs; **Alphabet raised**; **Microsoft to roughly \$190 billion** for the year, of which the company attributes about **\$25 billion to component price inflation**; Amazon holds at \$200 billion. **Google Cloud backlog surges to over \$460 billion**; **AWS backlog \$244 billion** as of Q4 2025, +40% YoY; **Microsoft’s AI business crosses a \$37 billion annual run rate**, +123% YoY. Meta shares fall **9.25%** on the guidance. **Two-thirds of Microsoft’s quarterly capex** goes to short-lived assets, primarily GPUs and CPUs. *Why it matters*: the steelman’s evidence and the audit’s evidence arrive in the same press releases.
110. **Q1 2025 – Q1 2026** — Memory and storage costs rise roughly **fivefold and threefold** respectively, per Omdia Principal Analyst **Ben Yeh**, as AI buildouts crowd consumer categories out of supply. *Why it matters*: the component-price line in the capex raises has a documented physical cause.
111. **2 February 2026** — Bloomberg reports a **\$3 trillion** AI data center buildout spurring a debt-market boom. **8 March 2026** — Bloomberg reports private-credit funds under pressure from redemption “gate-crashers.” Both are cited in the Fed’s own footnotes. [Cited via Cook, 27 May 2026 — the Fed’s citation is the verifiable fact here.]
112. **Q1 2026** — **NVIDIA Q4 data center revenue \$62.31 billion**, +75% YoY; networking +263%. [Vendor-reported; the collector’s own tape.]
113. **June 2026** — Goldman Sachs raises its 2025–2030 combined capex estimate for Meta, Microsoft, Amazon and Alphabet to **\$5.3 trillion**, from **\$4.5 trillion** before Q1 earnings; baseline aggregate 2026–2031 estimate **\$7.6 trillion** across compute, data centers and power. [Seller-adjacent: a sell-side estimate, not a commitment.] Sequoia’s **David Cahn** calculates an approximately **\$600 billion** annual revenue gap between AI infrastructure spend and AI ecosystem sales; **Allianz Research** puts the divergence between AI capex and revenue growth at roughly **46%**, against **32%** in the 2001 telecom cycle. [CONTESTED — competing methodologies; both authors named.]

1.13 — THE MERGER, AND THE PRESENT TENSE

114. **15 May 2026 — Dominion Energy enters an Agreement and Plan of Merger with NextEra Energy** (with WG Development Corp. and CS Holdco, LLC). All-stock: Dominion shareholders receive **0.8138** NextEra shares per Dominion share; NextEra shareholders own approximately **74.5%** of the combined company.
115. **18 May 2026 — Announced publicly.** The combination would create the largest regulated electric utility business in the U.S. — about **10 million** homes and businesses across Florida, Virginia, North Carolina and South Carolina; combined market capitalization above **\$249 billion**; enterprise value roughly **\$420 billion**; operating portfolio **110 GW**, with a stated path to as much as **260 GW by 2032**; annual capital spending plan of about **\$59 billion from 2027 to 2032**. Deal value reported at nearly **\$67 billion**. **John Ketchum** (chairman and CEO, NextEra) to lead; **Robert M. Blue** (then-chair, president and CEO, Dominion Energy) to become President and CEO, NextEra Energy Regulated Utilities. Dual headquarters Richmond and Juno Beach; operational headquarters Cayce, South Carolina. Named driver, in the companies' own framing: a "meteoric rise" in U.S. electricity demand [**3 words**]. [**PRIMARY — Form 425 filings, Dominion CIK 715957.**]
116. **15 July 2026 — Dominion and NextEra file applications for approval** with the Virginia State Corporation Commission, the North Carolina Utilities Commission, the Public Service Commission of South Carolina, FERC and the NRC. Expected close: **second half of 2027 [EXPECTED — the companies]**, elsewhere stated as 12–18 months from announcement. A merger microsite goes live the same day. *Why it matters:* Lecture 7's defendant is being absorbed into a larger balance sheet **while the case about who pays for its transmission is still being heard**. [Cross-lecture: **L7 owns Dominion's full treatment and the Rider T-1 corpus; L10 takes the merger as present-tense status only.**]
117. **July 2026 —** In the Virginia transmission cost-allocation proceeding, **Loudoun County senior assistant county attorney Jonathan Zader** argues the stakes are particularly high and presses for direct cost allocation and contributions-in-aid-of-construction for upgrades linked on a "but for" basis to large-load customers; **Michael Goggin** of Grid Strategies, testifying for Appalachian Voices, raises **stranded asset risk** tied to data center development; **Amazon witness Cameron Brooks** argues voluntary CIAC payments could reduce ratepayer burden and make financial responsibility clear, enforceable and integral to mitigating subsidization and stranded-cost risk. Dominion currently uses a **12-coincident-peak** allocation methodology in Virginia; consumer advocates and state officials argue for alternatives such as a summer/winter peak average. [PARAPHRASE throughout — locator: **Virginia SCC proceeding, July 2026 hearing record**. Cross-lecture: **L7 owns this corpus. L10's allocated use is one line: Virginia's own advocates now name the overbuild scenario in a live docket.**]
118. **17 July 2026 —** Federal Reserve staff publish the FEDS Note *The AI Buildout and the Economy: Publicly Available Data to Assess AI's Impact*. [**Five days before the research date; flagged in Section 11.4 as the freshest official-sector artifact in the pack.**]
119. **22 July 2026 — The research date.** The machine is running. PJM's capacity auction has cleared at the cap for the third consecutive time. The Fed's model still assumes a one-in-three abandonment rate. CoreWeave's Q2 interest expense is guided to between \$650 and \$730 million. The bill for June through September is estimated at \$792 per household. Nothing in this timeline has been un-spent.

SECTION 2: STRAWMAN BEAT DOSSIER

Twelve beats, in the Syllabus 2.0 running order. Each carries a flat stress-test verdict at the end. THIN and UNBUILDABLE are findings, not failures; Section 3 proposes the replacements.

Beat 1 — The Hearing Room [O] (the earnings call where the useful life moved)

Syllabus 2.0 assignment: The disclosure moment on tape — transcript only. Opens the closer on the sound of an assumption changing.

Beat Menu definition: *The Hearing Room — Politics · opener-capable, versatile.* A county board meeting, a FERC technical conference, an earnings call Q&A, reconstructed from transcripts and minutes only. **This is the only walk-into-a-room beat on the menu**, which satisfies the production bible's max-1-scene rule by construction. Evidence discipline is absolute: documented speakers, documented words, no staging. *Room-type rotation across the three Hearing Room openers:*

a generator's earnings call (L5), a Memphis public hearing (L8), a disclosure call (L10) — three distinct rooms.

FACTS, DATES, NAMES, NUMBERS. The room: Amazon.com, Inc. fourth-quarter 2024 financial results teleconference, **6 February 2025, 5:00 p.m. Eastern**, listen-only until Q&A, recorded. Speakers, with as-of titles at that moment: **David Fildes**, then-Vice President, Investor Relations; **Andrew R. Jassy**, President and Chief Executive Officer; **Brian T. Olsavsky**, then-Senior Vice President and Chief Financial Officer. Five analysts are called, in order: **Mark Mahaney** (Evercore ISI), **Eric Sheridan** (Goldman Sachs), **Doug Anmuth** (J.P. Morgan), **Brian Nowak** (Morgan Stanley), **John Blackledge** (TD Cowen), **Michael Morton** (MoffettNathanson) — six questioners across five slots, one question each by instruction. The quarter reported: revenue **\$187.8 billion**, +10% YoY, with a **\$900 million** FX headwind, **\$700 million** more than guided; worldwide operating income **\$21.2 billion**, +61% YoY, the largest operating-income quarter in the company's history and **\$1.2 billion above the high end of guidance**; AWS revenue **\$28.8 billion**, +19% YoY, at a **\$115 billion** annualized run rate; AWS operating income **\$10.6 billion**, +\$3.5 billion YoY; Q4 capital investments **\$26.3 billion**. Then the three estimate changes, in Olsavsky's order: **servers and networking, six years → five years**, effective January 2025, **−\$700 million** to full-year 2025 operating income; **\$920 million** of Q4 2024 accelerated depreciation from early retirements, **−\$600 million** more to 2025; **fulfillment-center heavy equipment, 10 years → 13 years**, effective January 2025, **+\$900 million** to 2025. Stated aggregate: approximately **−\$400 million** for assets on the balance sheet at 31 December 2024. And, minutes earlier in the same remarks: the **2024** server-life extension contributed approximately **200 basis points** to the year-over-year AWS operating-margin increase in Q4.

THE MECHANISM. How a useful life moves, end to end. A company runs a **useful-life study** — an internal engineering and retirement-experience review — on an asset class. If the study's conclusion differs from the standing estimate, ASC 250 classifies the revision as a **change in accounting estimate**: applied prospectively, never restated backward. The company discloses the current-period effect (ASC 250-10-50-4) in the earnings release and the 10-K, and, if it chooses, quantifies the forward-year effect on the call. Depreciation is a **non-cash** expense: no dollar moves on the day the estimate changes. What moves is reported operating income, and therefore margin, and therefore every multiple built on it. **The step where the constraint binds**: the study's conclusion. Everything downstream — the disclosure, the margin, the multiple — is arithmetic. The study is judgment, and the judgment is the company's. That is the whole lecture in one clause: the load-bearing number in a trillion-dollar trade is an opinion held by the party the number flatters, reviewed by an audit committee, and legally correct either way.

KEY ACTORS IN THIS BEAT. *Human* — **Brian T. Olsavsky**, then-SVP and CFO, in the role since 2015, a career Amazon finance executive. **Wanted**: to disclose three material estimate changes cleanly and move the call to AWS growth. **Feared**: the headline. **Could enforce**: the sequencing — the shortening and the lengthening are announced in the same breath, netting to a number small enough to be unremarkable. **Actually did**: disclosed all three, quantified each, and gave the aggregate. *Human* — **Andrew R. Jassy**, President and CEO since July 2021. **Wanted**: the capex number understood as a demand signal, not a risk. **Feared**: the read that AWS growth was decelerating rather than supply-constrained. **Could enforce**: the framing — he attributes the constraint to third-party chips arriving slower, to power, and to motherboards. **Actually did**: delivered the steelman for the entire buildout, unprompted, on the same tape as the reversal. *Institution* — **Amazon Web Services**: the segment where both server changes primarily land. *Institution* — **the audit committee and the independent registered public accounting firm**: invisible in the transcript, load-bearing in the standard. *Object* — **the fulfillment-center heavy equipment**: forklifts, conveyors, sortation machinery; the asset class whose life grew by three years on the same day the servers' shrank by one.

THE DOCUMENTS. (1) **The Q4 2024 earnings release**, 6 February 2025 — carries the change-in-estimate disclosures; the document the IR officer instructs listeners to have in front of them. (2) **Amazon's Form 10-K for FY2024**, filed 7 February 2025 — carries the language in the significant-accounting-policies note; the binding version. [SEC EDGAR: AMZN CIK 1018724.] (3) **The Q3 2025 Form 10-Q**, filed 31 October 2025 — carries the realized nine-month effect: depreciation and amortization **+\$889 million**, net income **−\$677 million**, **−\$0.06 per diluted share**; Q3 alone **−\$298 million** to net income. (4) **The Q2 2025 disclosure** — **+\$280 million** D&A, **−\$217 million** net income for the quarter. *Skeptical caveat*: none of these is a forecast dressed as a plan or a press release with a docket number. They are audited filings, and their honesty is precisely what makes the beat work — **the disclosure regime functioned perfectly, and the number still moved by an act of judgment.**

VERBATIM BANK. All from the earnings-call transcript, 6 February 2025 (Amazon IR; commercial transcript services). *Attribution inside the narrative*: **Amazon's chief financial officer, on the company's fourth-quarter 2024 earnings call, in February 2025.**

Olsavsky, on the reversal's cause: “an increased pace of technology development, particularly in the area of artificial intelligence and machine learning.” (14 words — at the house limit. One deployment.)

Olsavsky, on the 2024 extension's margin effect: [PARAPHRASE] the increase in estimated server useful life beginning in 2024 contributed roughly two hundred basis points to the year-over-year AWS margin improvement in the quarter. (Locator: prepared remarks, AWS segment paragraph.)

Olsavsky, on the fulfillment-equipment extension: [PARAPHRASE] a completed useful-life study for certain heavy equipment in fulfillment centers moved that estimate from ten years to thirteen beginning January 2025, expected to increase full-year 2025 operating income by approximately nine hundred million dollars. (Locator: prepared remarks, final paragraph before Q&A.)

Jassy, on procurement discipline — the steelman's own sentence: “We don't procure it unless we see significant signals of demand.” (11 words. Reserve this deployment for Beat 5 if Beat 1 has already spent its quote; the two beats must not both quote this call. See Section 4.4's coordination note.)

WHO PAYS. Nobody, in cash, on the day. That is the point and it should be stated flat: the estimate change moves reported earnings without moving a dollar. Who pays *later* depends entirely on which estimate was right — and the beat must not pretend to know. The honest cost-allocation line: **the equity holder pays if the shorter life was correct and the earnings were flattered; the equity holder was underpaid if the longer life was correct and the earnings were understated.** No ratepayer, no household, no county is in this beat. The bill arrives eight beats later.

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller:* **the Hyperscaler**, direction: earnings quality. *What's real:* the study was run, the disclosure was complete, the numbers were quantified beyond what the standard requires, and the change went **against** the company's reported earnings. *What's oversold:* nothing, on this tape — which is why the beat opens the lecture rather than prosecuting it. *Narrator move:* **GRANT-AND-WITHHOLD**, tilted almost entirely to the grant. Grant that Amazon shortened when shortening cost it money. Withhold only this: the same call lengthened a different asset class by three years, and the lengthening was worth more than the shortening. *Unknown:* the contents of the useful-life studies themselves. Neither study is public. **The methodology behind the most consequential estimate in the sector is not disclosed by anyone.**

SENSORY & MATERIAL DETAILS. *Sourced:* the room is a teleconference, not a room — participants in listen-only mode, the call recorded, a replay promised on the investor-relations website for at least three months. The instruction to have the press release in front of you. The operator's poll for questions. The one-question-per-caller limit, which is why six analysts produce six questions and no follow-ups. Fildes's sign-off thanking listeners for their interest. *Marked inference from documented conditions:* the disclosure arrives in prepared remarks rather than in Q&A, which means it was written, reviewed and scheduled — **not a single analyst asks about it.** That absence is documented (the full Q&A is in the transcript and covers capex, DeepSeek, AWS margins, UPS, robotics, delivery speed and the shopping funnel) and it is the beat's quietest, best fact.

NUMBERS THAT MATTER FOR THIS BEAT.

- **6 years → 5 years** · useful life, subset of servers and networking equipment · filed policy, effective 1 Jan 2025 · disclosed 6 Feb 2025 · Amazon.com, Inc. · **ANCHOR (as a filed fact)**
- **–\$700 million** · full-year 2025 operating income · company estimate, assets on balance sheet at 31 Dec 2024 · 6 Feb 2025 · Amazon · **STRUCTURAL**
- **\$920 million** · accelerated depreciation and related charges · recorded, quarter ended 31 Dec 2024 · Amazon · **ANCHOR**
- **–\$600 million** · further 2025 operating-income effect from early retirements · company estimate · Amazon · **STRUCTURAL**
- **10 years → 13 years** · useful life, certain fulfillment-center heavy equipment · filed policy, effective Jan 2025 · Amazon · **ANCHOR (as a filed fact)**
- **+\$900 million** · full-year 2025 operating income · company estimate · Amazon · **STRUCTURAL**
- **≈ –\$400 million** · aggregate 2025 operating-income effect · company estimate · Amazon · **STRUCTURAL**
- **~200 bps** · AWS Q4 2024 YoY operating-margin contribution from the 2024 extension · company statement · Amazon · **STRUCTURAL**

- **\$26.3 billion** · Q4 2024 capital investments (cash capex + equipment finance leases) · spent · Amazon · **ANCHOR**
- **\$115 billion** · AWS annualized revenue run rate · as of Q4 2024 · Amazon · **STRUCTURAL**

STRESS-TEST VERDICT: SUSTAINABLE. A continuous, verified, publicly available transcript containing the disclosure, its cause, its quantification, its offset, the prior year's benefit, the steelman, and the documented silence that followed. This beat could run 1,500 words without padding; at 1,000 it will need trimming, not filling.

Beat 2 — The Paper Trail (class: accounting policy — the depreciation schedule)

Syllabus 2.0 assignment: The depreciation schedule read across its instances; the footnote as the trade's load-bearing wall. Five-year silicon on thirty-year paper, in the footnotes.

Beat Menu definition: *The Paper Trail — Politics · versatile, closer-capable · all 10 lectures.* A named document as causal actor. Sustained by what the document says, who wrote it and why, what it forces, what it forbids, and what happens when someone violates it. **Rotation rule:** a different document *class* each lecture. This is **class 10 of 10** — accounting policy — and it closes the rotation.

FACTS, DATES, NAMES, NUMBERS. The document is not one document. It is the same footnote in five companies' filings, and the beat is the cross-reading. **Microsoft:** four years → six, effective start of FY2023, announced on the FY2022 Q4 call, 26 July 2022, by then-CFO Amy Hood; expected FY2023 operating-income benefit ~**\$3.7 billion**, ~\$1.1 billion in Q1 alone. **Alphabet:** servers four → six and certain network equipment five → six, effective FY2023, disclosed 2 February 2023; expected full-year depreciation reduction ~**\$3.4 billion**; *realized*, per the Q4 2023 release of 30 January 2024, **\$3.9 billion** less depreciation and **\$3.0 billion** more net income, **\$0.24 per diluted share**. **Meta:** extension of certain servers and network assets to **5.5 years** effective 1 January 2025, disclosed 29 January 2025; expected 2025 depreciation reduction ~**\$2.9 billion**; the FY2025 10-K attributes part of the reported decrease in the depreciation growth rate to the extension. **Amazon:** five → six effective January 2024 (~**\$900 million** Q1 2024 benefit, per Olsavsky), then **six → five for a subset** effective 1 January 2025 (~**\$700 million** for the year), with realized nine-month 2025 effects of **+\$889 million D&A** and **–\$677 million** net income. **Oracle:** reported by financial-press summaries of its filings to have **maintained** a six-year schedule for servers and network equipment. **CoreWeave:** five → six for technology equipment — computing, networking and storage components — effective **1 January 2023**, two years before the IPO; at 30 June 2025 the company held just over **\$13 billion** of assets in that category. Comparators worth carrying: **Nebius** estimates data center infrastructure and equipment at **3 to 10 years**; industry compilations place **CoreWeave's data center infrastructure** band at **8 to 12 years** [CONTESTED — secondary compilation, single-source; verify against the 10-K's property-and-equipment table before deployment].

THE MECHANISM. The paper path, end to end. A capital dollar enters as **property and equipment, net**. A useful life, a salvage assumption and a straight-line convention convert it into a monthly expense. That expense sits between operating income and free cash flow — which is why the same asset can make a company look unprofitable on GAAP and cash-generative on adjusted measures in the same press release. CoreWeave's FY2025 filing is the cleanest specimen: **revenue \$5,131M, operating loss –\$46M, net loss –\$1,167M, adjusted EBITDA \$3,093M at a 60% margin** — and the reconciliation between them is **\$2,454M of depreciation and amortization plus \$1,229M of interest**. The gap between “60% margin” and “net loss” is the depreciation schedule and the debt, and nothing else. **The step where the constraint binds: the moment the asset's contracted revenue term ends before its depreciable life does.** CoreWeave's disclosed backlog profile — **36% recognized within 24 months, 75% within four years** — against a six-year schedule means the last quarter of the asset's book life depends on a **redeployment market that does not yet exist**. The company's own risk factor says so.

KEY ACTORS IN THIS BEAT. *Document* — the significant-accounting-policies note, in five instances. **What it forces:** disclosure of the current-period effect of any change, and, once a company is public, the impossibility of silent restatement. **What it forbids:** retroactive comparability. *Institution* — the audit committee, at each of the five, which concurred in directionally opposite conclusions in the same quarter. *Human* — Alexander Parker, Chairman and CEO of Buxton Helmsley, whose 4 May 2026 forensic framework is the most rigorous public reading of the disclosures and which explicitly **declines to adopt Burry's dollar estimates** — the analyst who audits both sides. *Institution* — the Financial Accounting Standards Board, absent from every news cycle and present in every filing.

THE DOCUMENTS. Each carries a locator for the draft-stage pull. **Microsoft FY2023 Form 10-K** — CIK 789019; property-and-equipment and significant-accounting-policies notes. **Alphabet FY2023 Form 10-K** — CIK 1652044; the

realized-effect disclosure is in the Q4 2023 earnings release of 30 January 2024. **Meta FY2025 Form 10-K** — CIK 1326801; the depreciation-growth-rate attribution. **Amazon FY2024 Form 10-K and Q3 2025 Form 10-Q** — CIK 1018724; the reversal and its realized effects. **CoreWeave FY2025 Form 10-K, filed 2 March 2026** — CIK 1769628, accession **0001769628-26-000104**, document **crwv-20251231.htm**; significant-accounting-policies note and the property-and-equipment note. *Skeptical caveat, stated flat: all of these are binding.* Not one is a press release with a docket number. The critique in this lecture is not that the documents lie; it is that they are honest documents recording an elastic estimate, and that the elasticity is invisible to the comparison an investor would use to detect it.

VERBATIM BANK. > CoreWeave, on the redeployment assumption, from the risk factors: **“any inability to redeploy components of our existing infrastructure to extend past their contracted life”** could significantly affect the business. (14 words quoted; the remainder paraphrased. Attribution inside the narrative: CoreWeave’s own annual report. Locator: CRWV FY2025 10-K, Item 1A. [SECONDARY-QUOTED PRIMARY — re-verify against EDGAR before The Verbatim deploys.]

Buxton Helmsley, on the nature of the number: “Depreciation, in this regard, is not a number—it is a position.” (12 words. Attribution: a forensic investment firm’s published framework, May 2026.)

Amazon, filed policy language: [PARAPHRASE] effective 1 January 2025 the company changed its estimate of the useful lives of a subset of its servers and networking equipment from six years to five, citing the increased pace of technology development, particularly in artificial intelligence and machine learning. (Locator: AMZN 10-Q, period ended 30 September 2025, Note 1. **This is The Verbatim’s assigned host — see Section 4.4.**)

WHO PAYS. Still nobody, in cash — and the beat should say so once, plainly, because it is the hinge that lets the following ten beats land. What the schedule determines is **who is holding the asset when the estimate is tested**. Three named parties are exposed: the **equity holder** (through reported earnings and the multiples built on them); the **secured lender** (through the borrowing base — GPU-collateralized debt is written against an assumed residual value); and, one step removed, the **utility and its ratepayers**, because a twenty-year power purchase agreement signed against a five-to-six-year asset is the same duration mismatch wearing a different coat. **[L5’s pack banked this line explicitly: twenty-year fixed-price paper signed against demand whose hardware depreciates in roughly five, priced by neither party in any public document, and inherited by Lecture 10. This is where it is collected.]**

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *The central contest, stated cleanly rather than smoothed:* in the same fiscal quarter — January–February 2025 — **Amazon shortened and Meta lengthened**, on substantially similar fleets, both citing formal useful-life studies, both reviewed by audit committees, both concurred in by independent auditors, both disclosed under the same standard. Buxton Helmsley’s read, which the pack adopts as the honest one: the divergence is itself a disclosure, and the resulting variance in reported operating income is driven not by economics but by **the elasticity of the estimate**. *What is unknown:* the studies. *What is also unknown, and load-bearing:* **fleet utilization and GPU retirement data are published by nobody.** **[L2’s pack planted this for L10’s HOLD OPEN; it is collected here and again at Section 7.7.]**

SENSORY & MATERIAL DETAILS. *Sourced:* the physical location of the argument — a note, in the back of an annual report, after the financial statements, before the exhibits. Alphabet’s realized effect stated to the penny per diluted share. CoreWeave’s asset category defined in the filing as computing, networking and storage components. *Marked inference from documented conditions:* the asset being depreciated is a rack that L2’s pack documented arriving through a roof penetration and drawing 132 kW; the paper it is being depreciated against outlives it by two hardware generations. **[Cross-reference only — L2 owns the rack; do not rebuild it.]**

NUMBERS THAT MATTER FOR THIS BEAT.

- **4 → 6 years** · Microsoft server and network equipment · filed, effective FY2023 · announced 26 Jul 2022 · Microsoft · **ANCHOR (filed fact)**
- **\$3.7 billion** · expected FY2023 operating-income benefit · company estimate · 26 Jul 2022 · Amy Hood, Microsoft · **STRUCTURAL**
- **4 → 6 / 5 → 6 years** · Alphabet servers / certain network equipment · filed, effective FY2023 · 2 Feb 2023 · Alphabet · **ANCHOR**
- **\$3.9 billion / \$3.0 billion / \$0.24** · realized 2023 depreciation reduction / net income increase / per diluted share · realized · 30 Jan 2024 · Alphabet · **ANCHOR**

- **5.5 years** · Meta certain servers and network assets · filed, effective 1 Jan 2025 · 29 Jan 2025 · Meta · **ANCHOR**
- **\$2.9 billion** · expected 2025 depreciation reduction · company estimate · 29 Jan 2025 · Meta · **STRUCTURAL**
- **5 → 6 years** · CoreWeave technology equipment · filed, effective 1 Jan 2023 · S-1/10-K · CoreWeave · **ANCHOR**
- **~\$13 billion** · CoreWeave technology-equipment assets · balance-sheet carrying value, 30 Jun 2025 · CoreWeave · **STRUCTURAL**
- **\$30,557 million** · CoreWeave property and equipment, net · 31 Dec 2025 · CoreWeave 8-K/EX-99.1 · **ANCHOR**
- **\$2,454 million** · CoreWeave FY2025 depreciation and amortization · reported · 26 Feb 2026 · CoreWeave · **ANCHOR**
- **36% / 75%** · backlog recognized within 24 months / four years · company disclosure · Q1 2026 · CoreWeave · **STRUCTURAL**

STRESS-TEST VERDICT: SUSTAINABLE. Five filed instances, two of them directionally opposite in the same quarter, with realized effects disclosed a year later at three of them. The document-as-scene device has more material here than in any lecture since L4's interconnection agreement. The risk is the opposite of thinness: the beat can become a quote reel. The Verbatim's one-deployment cap is the discipline that prevents it.

Beat 3 — The Perverse Incentive (the accounting incentive running ahead of the silicon)

Syllabus 2.0 assignment: Useful-life extensions that flattered earnings — the accounting incentive running ahead of the silicon.

Beat Menu definition: *The Perverse Incentive* — *Politics/Money* · *versatile, closer-capable* · *fat container*. The rule producing the opposite of its intent. Sustained by the mechanism of the perversity, not by indignation.

FACTS, DATES, NAMES, NUMBERS. The perversity is structural and it runs in both directions, which is what keeps the beat honest. **Direction one — the ratchet.** Extending a useful life increases reported operating income with no change in operations, no cash movement and no restatement of the prior year that would let an investor see it. Documented benefits, in the companies' own numbers: Microsoft **~\$3.7 billion** expected for FY2023; Alphabet **\$3.9 billion** realized for 2023; Meta **~\$2.9 billion** expected for 2025; Amazon **~\$900 million** expected for Q1 2024 alone, and **~200 basis points** of AWS margin in Q4 2024. **Direction two — the competitive ratchet.** Contemporary analysis in February 2024 recorded that even conservative finance chiefs felt pressure to follow competitors that had lengthened server lives — with one company doing it **more than once in a single fiscal year**. [PARAPHRASE — locator: **Behind the Balance Sheet, "What do MAG7 earnings and a Snickers bar have in common? Welcome to Financial Shrinkflation," February 2024.**] **Direction three — the counter-ratchet, and this is the fact that saves the beat from being a prosecution.** Amazon shortened. It shortened at a cost to itself of **\$700 million** in a year, and then absorbed **\$920 million** of accelerated depreciation on top. The incentive says extend; one of the five largest issuers in the United States went the other way and said why. **Direction four — the offset, which is the beat's punchline and is fully documented:** on the same call, the same company extended fulfillment-center heavy equipment from **10 years to 13**, worth **+\$900 million** — more than the servers cost. The aggregate disclosed effect was **-\$400 million**, a rounding error against \$21.2 billion of quarterly operating income. **The AI hardware got shorter, the forklifts got longer, and the forklifts won.**

THE MECHANISM. The perverse incentive is not fraud and the beat must not imply it is. It is a standard functioning exactly as written, inside a competitive dynamic it did not anticipate. ASC 250 makes revisions prospective to prevent the far worse pathology of restatement-by-management; the price of that protection is that a company can improve reported earnings by revising an estimate, and the improvement is invisible in year-over-year comparisons. Add a peer group that all revise in the same direction within eighteen months, and the *baseline itself* moves — so the conservative firm's earnings look worse than its competitors' for reasons unrelated to its operations. **The step where the constraint binds:** the audit committee's willingness to concur. That is the only gate, and it is a judgment gate, and it was cleared in both directions in the same quarter by companies running the same hardware.

KEY ACTORS IN THIS BEAT. *Institution* — *the peer group*. Its motive is not deception; it is comparability. Its exposure is that comparability across a moving baseline is not comparability. *Human* — *Satya Nadella*, Chairman and CEO of Microsoft, whose documented framing cuts directly against the accusation and is the strongest thing anyone has said on the defence side: [verbatim in the bank below]. *Human* — *Olga Usvyatsky*, forensic accounting analyst (Deep Quarry), who flagged the Amazon reversal on **11 February 2025**, five days after the call, and had written on server useful lives as early as **July 2024**, sixteen months before the short thesis made it famous. **The critique existed before the trade did**, which is the

single most useful fact for calibrating Section 7. *Institution — the sell-side*, whose models capitalize the reported number.

THE DOCUMENTS. The earnings releases and 10-Ks catalogued at Beat 2, read as a series rather than individually. Plus: **the Microsoft FY2026 Q1 earnings call transcript** (Microsoft IR — the “fungible fleet” doctrine, verbatim below), and **Deep Quarry’s dated analyses** (July 2024; 11 February 2025), which function here as a **dated record of when the question was askable** — a document about the timing of knowledge, which is exactly what a reckoning needs.

VERBATIM BANK. > Nadella, on capital allocation and fleet design, Microsoft’s fiscal Q1 2026 earnings call: **“build a fleet that is fungible across the planet”** (8 words. Attribution: Microsoft’s chief executive, on the company’s earnings call. One deployment.)

Nadella, on the obsolescence risk the schedule is accused of ignoring: “I didn’t want to go get stuck with four or five years of depreciation on one generation.” (17 words — **over the house limit; must be paraphrased in prose.** [PARAPHRASE]: Microsoft’s chief executive has said publicly that he did not want to be locked into four or five years of depreciation on a single hardware generation. Locator: quoted in secondary coverage, November 2025; [SECONDARY-QUOTED PRIMARY — source call to be identified before any prose use.]

WHO PAYS. In the extension direction: whoever bought the equity on the flattered multiple, if the shorter life turns out to be correct. In the shortening direction: the company’s own reported earnings, immediately and by its own choice. In the competitive direction: **the conservative firm**, which is the actual perversity — a policy that penalizes the company whose estimate is closest to right. No household, no ratepayer, no county. **The beat has a real who-pays and it is entirely inside the capital markets; say so and do not manufacture a victim.**

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller:* **the Doomer** (this lecture’s assigned seller), direction: fraud. *What’s real:* the extensions happened, the earnings benefits are the companies’ own disclosed figures, the peer-following dynamic is documented by a practitioner in 2024, and the schedules are longer than the vendor’s product cadence. *What’s oversold:* the word. Calling this “one of the more common frauds of the modern era” is a characterization of a fully disclosed, audited, prospectively applied change in accounting estimate — and CNBC, reporting the charge, stated it was **unable to independently confirm** the practice as characterized. *Narrator move:* **STRIP.** Remove the fraud story; leave standing the documented behavior — that the estimate moved, that it moved in the direction that helped, that the peer group moved together, and that the one firm that moved the other way offset it with forklifts. **Never mock the people who believed the fraud framing;** it is a reasonable inference from a real pattern, and the pattern is the point.

SENSORY & MATERIAL DETAILS. *Sourced:* the two asset classes on the same page of the same filing — servers in a data hall, and heavy equipment on a fulfillment-center floor. *Marked inference from documented conditions:* the forklift and the GPU are being depreciated by the same finance organization under the same standard, and the forklift now has a longer assumed working life than the machine the company is spending two hundred billion dollars a year to buy. That comparison is inference in its framing and entirely documented in its components.

NUMBERS THAT MATTER FOR THIS BEAT.

- **\$3.7B / \$3.9B / \$2.9B / \$0.9B** · disclosed or realized earnings effects of extensions · Microsoft FY23 est. / Alphabet 2023 realized / Meta 2025 est. / Amazon Q1 2024 est. · **STRUCTURAL**
- **+\$900 million vs. −\$700 million** · fulfillment heavy equipment extension vs. server shortening, full-year 2025 · company estimates · 6 Feb 2025 · Amazon · **ANCHOR (the beat’s detonator)**
- **≈ −\$400 million** · net aggregate 2025 effect · company estimate · Amazon · **STRUCTURAL**
- **\$21.2 billion** · Amazon Q4 2024 worldwide operating income · reported · **ANCHOR (the denominator that makes −\$400M a rounding error)**
- **July 2024** · date the useful-life question was published by a forensic analyst · Deep Quarry · **ANCHOR (a date, not a figure)**

STRESS-TEST VERDICT: SUSTAINABLE. The beat has a documented mechanism, a documented peer dynamic, a documented counter-example, a documented offset, and a named analyst who asked the question sixteen months early. It also has the course’s best structural joke sitting inside an audited filing. No padding required.

Beat 4 — Follow the Money (the reference structure arriving at its bill)

Syllabus 2.0 assignment: CoreWeave's interest expense → \$311M, tripling year-over-year; the reference structure arriving at its bill. **CoreWeave is a return; L6 owns the full treatment and this beat must not rebuild it.**

Beat Menu definition: *Follow the Money — Money · versatile · fat container.* Capital structure as narrative: who financed what, collateralized by what, amortized over what. **The load-bearing accounting assumption is always the payoff.**

FACTS, DATES, NAMES, NUMBERS. The anchor, at its reporting date: **three months ended 30 September 2025, interest expense, net of \$311 million, against \$104 million a year earlier — 3x year over year.** Same quarter: revenue backlog **\$55.6 billion**, up from \$30.1 billion; revenue guidance cut on construction delays at a third-party data-center developer; the stock down more than 30% from mid-August highs. Then the series, which is the beat: **FY2025 interest expense, net \$1,229 million against \$361 million in FY2024 — 3.4x for the full year; Q4 2025 alone \$388 million against \$149 million. Q1 2026: \$536 million, against \$264 million a year earlier. Q2 2026 guidance: \$650–730 million.** Against that, the FY2025 income statement: revenue **\$5,131 million**; total operating expenses **\$5,177 million**; **operating loss –\$46 million**; gain on fair-value adjustments **+\$27 million**; interest expense, net **–\$1,229 million**; net loss **–\$1,167 million**; adjusted EBITDA **\$3,093 million** at a **60%** margin. Balance sheet at 31 December 2025: property and equipment, net **\$30,557 million**; operating lease right-of-use assets **\$8,231 million**; total assets **\$49,302 million**; **debt \$6,708 million current and \$14,665 million non-current**; deferred revenue **\$1,709M current and \$6,476M non-current**; total liabilities **\$45,967 million**; total stockholders' equity **\$3,335 million**. Cash flow FY2025: operating **+\$3,058 million**; purchases of property and equipment **–\$10,309 million**; proceeds from issuance of debt, net **+\$11,829 million**; repayments **–\$3,399 million**. Q1 2026 adds: revenue **\$2,078 million** (+112%), net loss **–\$740 million**, capex **\$7,695 million** in the quarter, property and equipment **\$36,424 million**, backlog **\$99.4 billion** (+284% YoY), an **\$8.5 billion DDTL 4.0 non-recourse facility**, a **\$2 billion NVIDIA Class A equity investment**, **~3.5 GW contracted power**, **>1 GW active**. Guidance: FY2026 revenue **\$12–13 billion**; FY2026 capex **\$31–35 billion**; exit-2026 ARR **\$18–19 billion**; exit-2027 ARR **more than \$30 billion**.

THE MECHANISM. The money path, end to end, at the level the beat needs. Equity and debt fund a GPU fleet and the leases around it. The fleet is depreciated over six years. The debt amortizes over its own, shorter schedule and prices off the collateral's assumed residual value. Revenue arrives under take-or-pay contracts whose committed terms are shorter than the depreciable life. Three clocks therefore run at once — **the contract clock, the debt clock, and the depreciation clock** — and they are not synchronized. **The step where the constraint binds:** the point at which interest expense exceeds adjusted operating income. It has already happened. FY2025 adjusted operating income was **\$666 million** against **\$1,229 million** of net interest; Q1 2026 adjusted operating income was **\$21 million** against **\$536 million**. The company is not failing — operating cash flow was **\$2,984 million** in Q1 2026 alone, because depreciation is non-cash and deferred revenue is prepaid. **It is being carried by the accounting treatment of the asset whose treatment is the subject of this lecture.** That sentence is the whole beat and it must be earned, not asserted.

KEY ACTORS IN THIS BEAT. *Institution — CoreWeave, Inc.* (Nasdaq: CRWV; Livingston, New Jersey). **Return only. Wanted:** hyperscale. **Feared:** the cost of debt. **Could enforce:** the capital structure — and did, refinancing into an investment-grade-rated, HPC-backed **\$8.5 billion** facility that management described as lowering the weighted-average cost of debt. **Actually did:** grew backlog to nearly \$100 billion while interest expense grew faster than revenue. *Human — Nitin Agrawal*, Chief Financial Officer, whose 26 February 2026 statement frames the backlog as visibility. *Human — Michael Intrator*, Chairman and CEO — **L6's lead; one line only here.** *Institution — NVIDIA*, now both vendor and shareholder, with a **\$2 billion** equity investment closed in Q1 2026. *Institution — the private-credit lenders*, whose security is the residual value of the collateral.

THE DOCUMENTS. **CoreWeave 8-K/EX-99.1, 26 February 2026** (Q4 and FY2025 results — **PRIMARY**, the source of every FY2025 figure above). **CoreWeave 8-K, 7 May 2026** (Q1 2026 results). **CoreWeave FY2025 Form 10-K, 2 March 2026** — CIK 1769628, accession 0001769628-26-000104. **The Q1 2026 Form 10-Q** — document crwv-20260331.htm. *Skeptical caveat:* **revenue backlog is defined by the company, in its own footnote, as remaining performance obligations plus other amounts it estimates will be recognized in future periods under committed customer contracts — in each case subject to the satisfaction of delivery and availability of service requirements.** That is not a receivable. It is a contracted expectation conditioned on the company building the thing. **[Stage-label it every single time: contracted, not earned.]**

VERBATIM BANK. > Intrator, on the Q1 2026 call, 7 May 2026: **“We have reached hyperscale.”** (4 words. Attribution: CoreWeave's chief executive, on the company's first-quarter 2026 earnings call.)

CoreWeave, on the Q2 2026 outlook: [PARAPHRASE] second-quarter interest expense is expected in the range of \$650 million to \$730 million, reflecting the growth in the debt balance financing accelerating deployments. (Locator: Q1 2026 earnings call, prepared CFO remarks.)

*CoreWeave, defining its own headline number: [PARAPHRASE] revenue backlog includes remaining performance obligations plus other amounts the company estimates will be recognized as revenue in future periods under committed customer contracts, subject to delivery and service-availability requirements. (Locator: 8-K/EX-99.1, 26 Feb 2026, footnote 1. **The definitional footnote is the beat's best deadpan and it is fully quotable at draft stage.**)*

WHO PAYS. Interest is paid in cash, quarterly, to lenders — and it is the one number in this lecture that is not an estimate. **FY2025: \$1,229 million, paid.** The chain: the contracted customer pays CoreWeave; CoreWeave pays the lender; the lender's security is a GPU whose residual value is an assumption. If the assumption holds, everyone is paid. If it does not, the loss lands on the secured creditor first and the equity holder before that. **No ratepayer is in this beat** — and that is worth one clean sentence, because it is the last beat in the lecture where that is true.

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller: the Neocloud Founder*, direction: durability of the asset. *What's real, granted precisely:* the demand is contracted, the backlog is disclosed and audited, the customer base has genuinely diversified (ten clients committed to at least \$1 billion each; Anthropic and Meta agreements in Q1 2026, against 62% Microsoft concentration in 2024), the refinancing genuinely lowered the cost of debt, and A100s announced in 2020 were reported **fully booked** in November 2025 with a freed batch of 2022-vintage H100s rebooked at **95% of original price**. *What's oversold:* the read that backlog is revenue, and the read that a 60% adjusted EBITDA margin describes the economics of a business with a \$46 million operating loss. *Narrator move: GRANT-AND-WITHHOLD* — grant the demand, withhold the durability. *Unknown:* fleet-wide utilization; the residual-value curve the lenders underwrote; the redeployment market the six-year life assumes.

SENSORY & MATERIAL DETAILS. *Sourced: approximately 260 MW of active power capacity added in a single quarter*, bringing active power past 850 MW at year-end 2025 and past 1 GW in Q1 2026, against ~3.1 GW then ~3.5 GW contracted — the gap between energized and contracted, in one company's own disclosure, is the Physics Audit in miniature. *Marked inference:* the \$536 million of quarterly interest divided across roughly a gigawatt of active capacity is on the order of **half a million dollars per megawatt per quarter in financing cost alone** — arithmetic from the company's own disclosed figures, presented as inference and clearly labeled, never as a company metric.

NUMBERS THAT MATTER FOR THIS BEAT.

- **\$311 million** · interest expense, net · reported, three months ended 30 Sep 2025 · CoreWeave · **ANCHOR** (*the must-hit, at its date — see Section 4.5*)
- **\$104 million** · same line, three months ended 30 Sep 2024 · CoreWeave · **ANCHOR**
- **\$1,229 million / \$361 million** · interest expense, net, FY2025 / FY2024 · reported · 26 Feb 2026 · CoreWeave · **ANCHOR**
- **\$536 million** · interest expense, net, Q1 2026 · reported · 7 May 2026 · CoreWeave · **VOLATILE**
- **\$650–730 million** · Q2 2026 interest expense · guided, not reported · 7 May 2026 · CoreWeave · **VOLATILE**
- **\$99.4 billion** · revenue backlog · contracted, not earned · 31 Mar 2026 · CoreWeave · **VOLATILE**
- **\$30,557M → \$36,424M** · property and equipment, net · 31 Dec 2025 → 31 Mar 2026 · CoreWeave · **STRUCTURAL**
- **~3.5 GW / >1 GW** · contracted power / active power · contracted vs. energized · Q1 2026 · CoreWeave · **VOLATILE**
- **\$31–35 billion** · FY2026 capex · guided · 7 May 2026 · CoreWeave · **VOLATILE**

STRESS-TEST VERDICT: SUSTAINABLE. Four quarters of audited primary filings, a guided fifth, and a single line item that quadruples across the series while the company's own definitional footnote does the comedy. The only risk is over-running into L6's territory; the boundary is explicit and the pack has marked it.

Beat 5 — The Steelman (*defendant: the hyperscaler's capex logic*)

Syllabus 2.0 assignment: The strongest case that the spend is rational under uncertainty. **Deployment 8 of 8; new defendant; the same party is never steelmanned twice course-wide.**

Beat Menu definition: *The Steelman* — *Audit · never opener · strongly encouraged, not universal.* The full-throated strongest case for whoever is about to look worst, sustained by the defendant's actual numbers and constraints. **A précis of**

the weak version is not a steelman.

FACTS, DATES, NAMES, NUMBERS — THE DEFENDANT’S OWN CASE, IN THE DEFENDANT’S OWN FIGURES. (1) *The demand is contracted, disclosed and audited.* **Google Cloud backlog: over \$460 billion** as of Q1 2026, roughly double the prior year and nearly double quarter on quarter. **AWS backlog: \$244 billion** at Q4 2025, +40% YoY, +22% sequentially, with a **weighted-average remaining life of 3.8 years** on long-term contracts (Amazon’s own 10-Q disclosure, ~\$200 billion of unrecognized commitments at 30 September 2025). **Microsoft’s AI business: a \$37 billion annual run rate, +123% YoY.** **AWS: \$142 billion annualized run rate at Q4 2025, +24% — the highest growth rate in thirteen quarters**, adding \$2.6 billion sequentially and nearly \$7 billion year over year, at **\$12.5 billion of quarterly operating income on a 35% margin.** (2) *The constraint is supply, not demand, and the defendant said so before it was convenient.* Jassy, 6 February 2025, attributes AWS’s growth ceiling to third-party chips arriving slower, to power, and to motherboard supply, and predicts the constraints relax in the second half of 2025. Pichai, Q1 2026: Google is compute-constrained in the near term. (3) *The spend is disciplined, by the defendant’s own account.* Jassy, same call: procurement follows demand signals, and capex expands because the cash cycle requires buying data center, hardware, chips and networking gear **ahead of** monetization. (4) *The asset is fungible, which is the technical core of the defence.* Nadella’s doctrine: a fleet fungible across the planet, serving third-party, first-party and research workloads, with end-of-life replacement as ordinary modernization. SemiAnalysis’s January 2026 analysis calls the two-to-three-year-product-cycle premise of the depreciation critique **a fatal flaw**, on the grounds that the six-year schedule reflects real operational experience. (5) *The residual-value evidence is real.* A100s from 2020, fully booked in November 2025; 2022 H100s rebooked at **95%** of original price. Azure retirement data cited in industry analysis: K80-class fleets in production for **nine years** (2014–2023), P100s for **seven** (2016–2023); Google’s VP of AI infrastructure reporting **seven-to-eight-year-old TPUs at 100% utilization.** [Secondary compilation — **flag it as such; the K80/P100 series is the strongest empirical item on the defence side and deserves a primary pull at draft stage.**] (6) *The macro case.* Cook, 27 May 2026: labor productivity growth exceeding its pre-pandemic average; GDP growth robust; and a Fed governor who studied innovation for twenty years describing AI as a technology unlike any other she has seen. (7) *And the asymmetry.* If the demand is real and you underbuilt, you cannot buy the time back. Turbine slots are sold through 2030. Interconnection runs four to seven years. **The cost of being wrong in the cautious direction is not recoverable on any schedule the company controls** — which is the same asymmetry argument L8’s pack documented at federal altitude, now made at corporate altitude by parties with balance sheets instead of ballots.

THE MECHANISM. The steelman is a **sequencing argument under irreversibility**, and stating it that way is what makes it a steelman rather than a slogan. It does not claim the capex is riskless. It claims the risk is **asymmetric in time**: overbuilding produces a depreciating asset and a bad three years; underbuilding produces a queue position you cannot re-enter, a turbine slot someone else holds until 2030, and a customer who has already signed with the competitor. Under that asymmetry, spending \$725 billion against uncertain demand is not exuberance — it is the rational option purchase, and the option premium is exactly the depreciation everyone is arguing about. **The step where the constraint binds:** whether the underbuild loss is genuinely irrecoverable. If it is, the case holds. **The honest counter belongs to Beat 12, not here** — that some of the overbuild costs are *also* irreversible, and that irreversibility is the closer’s entire subject.

KEY ACTORS IN THIS BEAT. *Human* — Andrew R. Jassy (President and CEO, Amazon): the procurement-discipline claim and the Jevons argument on inference cost. *Human* — Satya Nadella (Chairman and CEO, Microsoft): the fungible-fleet doctrine. *Human* — Sundar Pichai (CEO, Alphabet), Q1 2026: full-stack AI investment lighting up every part of the business; compute-constrained near term. *Human* — Mark Zuckerberg (Chairman and CEO, Meta): frames the raised guidance as funding personal superintelligence for billions of people — **the weakest of the four framings, and the one the market repriced: Meta shares fell 9.25% on the day.** *Institution* — SemiAnalysis: the technical defence from a party with no equity position. *Institution* — the audit committees.

THE DOCUMENTS. Q1 2026 earnings releases and calls for Alphabet, Amazon, Microsoft and Meta (all company IR — **PRIMARY**, transcripts pullable). Amazon’s Q3 2025 Form 10-Q (the \$200 billion unrecognized-commitment and 3.8-year weighted-average-life disclosures). Microsoft FY2026 Q1 earnings call transcript. SemiAnalysis, *Microsoft’s AI Strategy Deconstructed*, ~7 January 2026.

VERBATIM BANK. > Jassy, Amazon Q4 2024 call, 6 February 2025 — **the procurement-discipline sentence:** “We don’t procure it unless we see significant signals of demand.” (11 words. Attribution: Amazon’s chief executive, on the company’s fourth-quarter 2024 earnings call. **Deployment coordination: this call is also Beat 1’s source.** Under the one-quote-per-source-document rule, Beat 1 and Beat 5 may not both quote it — see Section 4.4.)

Pichai, Q1 2026: “our AI investments and full stack approach are lighting up every part of the business” (15 words — at the ceiling. Attribution: Alphabet’s chief executive, on the company’s first-quarter 2026 earnings call.)
[SECONDARY-QUOTED PRIMARY — re-verify against the transcript.]

SemiAnalysis on the critique’s premise: [PARAPHRASE] the argument rests on an assumed two-to-three-year NVIDIA product cycle, which the firm calls a fatal flaw, because the extended schedules are grounded in real operational experience inside data centers. (Locator: SemiAnalysis newsletter, January 2026.)

WHO PAYS. Under the steelman’s own logic: the shareholder pays the option premium, knowingly, and is compensated if the demand arrives. The beat must state the defendant’s answer to the who-pays question honestly, because the defendant has one — **contributions in aid of construction, large-load tariffs and collateral requirements exist precisely so that the ratepayer does not**, and Amazon’s own witness argued for exactly that in a Virginia proceeding in July 2026 [return-grade reference; L7 owns the docket]. Whether those fences hold is Lecture 7’s verdict, not this beat’s.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller: the Hyperscaler. Oversold, named exactly:* the **stage-blur** — “\$725 billion of 2026 capex” is guidance, not spend, and three of the four raised it mid-year partly because components got more expensive, not because more capacity is arriving; **Microsoft attributes about \$25 billion of its ~\$190 billion to component price inflation.** Also oversold: backlog as revenue. *The counter-case, given its own weight:* Sequoia’s **David Cahn** puts the annual gap between AI infrastructure spend and AI ecosystem revenue at roughly **\$600 billion**; **Allianz Research** puts the capex-to-revenue divergence at roughly **46%**, against **32%** in the 2001 telecom cycle. Capex-to-revenue ratios at the four have moved from **10–15% pre-AI to 25–30%**. *Narrator move: HOLD OPEN.* The defendant’s case is strong, the counter-case is arithmetically serious, and the datum that would settle it — fleet utilization — is published by nobody.

SENSORY & MATERIAL DETAILS. *Sourced: two-thirds of Microsoft’s quarterly capex went to short-lived assets, primarily GPUs and CPUs* — the physical composition of the spend, from the company. Meta’s guidance raise attributed to **higher memory-chip prices**; memory and storage costs up roughly **fivefold and threefold** since Q1 2025 per Omdia’s Ben Yeh. *Marked inference:* the component that made the capex line rise is the same component whose price rise is evidence that the demand is physical rather than announced. Both readings are available from the same fact, which is why the beat holds open.

NUMBERS THAT MATTER FOR THIS BEAT.

- **>\$460 billion** · Google Cloud backlog · contracted · Q1 2026 · Alphabet · **STRUCTURAL**
- **\$244 billion** · AWS backlog · contracted · Q4 2025 · Amazon · **STRUCTURAL**
- **\$142 billion / +24%** · AWS annualized run rate / growth · reported · Q4 2025 · Amazon · **ANCHOR**
- **\$37 billion / +123%** · Microsoft AI business run rate / growth · reported · Q1 2026 (FY26 Q3) · Microsoft · **VOLATILE**
- **~\$725 billion** · combined 2026 capex, four hyperscalers · **announced/guided, not spent** · Q1 2026 · company guidance · **VOLATILE**
- **~\$25 billion** · component price inflation inside Microsoft’s ~\$190B · company attribution · Q1 2026 · Microsoft · **STRUCTURAL**
- **~\$600 billion** · annual AI spend-to-revenue gap · analyst estimate · David Cahn, Sequoia · **CONTESTED**
- **46% vs. 32%** · capex/revenue divergence, 2026 vs. 2001 telecom · analyst estimate · Allianz Research · **CONTESTED**
- **95%** · resale price of 2022-vintage H100s on recontract · reported · Nov 2025 · CoreWeave via CNBC · **STRUCTURAL**

STRESS-TEST VERDICT: SUSTAINABLE. The defendant has audited backlog figures, dated constraint statements, a technical doctrine with a named mechanism, empirical retirement data, and an asymmetry argument that is genuinely hard to answer. This is the strongest steelman in the course and it must be delivered at full strength, because the Ledger only lands if the case it audits was real.

Beat 6 — The Forecast Problem (gas plants against phantom forecasts; the 2001 rhyme rides here, off-menu)

Syllabus 2.0 assignment: Gas plants financed against phantom forecasts; the forecast graveyard. The 2001 fiber rhyme rides here as precedent and anti-precedent: dark fiber eventually got lit; a 2026 GPU does not appreciate in a warehouse.

Beat Menu definition: *The Forecast Problem — Money/Politics · versatile.* Load forecasts as political documents. The same megawatts appearing in five utilities' filings; gas plants financed against fiction; planning as an act of faith with a rate case attached. **Selection rule 7: the Historical Rhyme stays off-menu; this is its single course-wide deployment.**

FACTS, DATES, NAMES, NUMBERS. *The phantom, priced by the referee.* **Monitoring Analytics, 5 January 2026:** data center load accounted for **\$6.5 billion, or 40%, of the \$16.4 billion** in costs from PJM's December 2025 capacity auction — and **approximately \$6.2 billion of that relates to data centers that have not been built.** Across PJM's last three auctions, **data center forecasts beyond existing data centers made up 45% of \$47.2 billion** in capacity costs. **This is the phantom-load discipline rendered in dollars by the market monitor, and it is the single most important number in the lecture after the depreciation figures.** *The forecast graveyard, quantified by the central bank.* Federal Reserve Feds 2025-109 estimates a historical **data center abandonment rate of 0.33** — one in three announced projects never built — from roughly 1,711 projects, 2003–2025; **0.30** for projects over \$250 million; against **0.46** for commercial construction generally. Yearly abandonment rates in the sample range **0.20 to 0.45**. The authors note explicitly that the abandonment parameter would be expected to rise if expectations around AI returns worsened. *The pipeline, measured.* **Sightline Climate, February–May 2026:** 190 GW tracked across 777 projects >50 MW announced since 2024; **at least 16 GW slated for 2026 across ~140 projects; only ~5 GW under construction; ~11 GW announced with no signs of construction against 12–18-month build times; 30–50% of the 2026 pipeline unlikely to come online before year-end; cancellations from local opposition quadrupled in 2025 with at least 25 projects cancelled; \$150–200 billion of capex expected to slip into 2027–2028.** *The rebuttal, with satellites.* **SemiAnalysis, 21 June 2026:** the dataset skews to large publicly announced speculative megaprojects most prone to slipping; almost all flagged capacity is pre-construction; and its own vision model, trained on hundreds of thousands of satellite images, finds the under-construction figures off by multiples. *The gas that gets built anyway.* U.S. developers planning **more than 26 GW** of new gas-fired capacity by 2028 (EIA survey of builders and operators), about double the 2023 three-year plan; Wood Mackenzie warning some may not arrive until 2030 or later. **PPL Electric, March 2026,** in a binding rate settlement: about **20 GW** of contracted large loads against a **7.8 GW** system peak, with the company putting **stranded assets, unrecovered costs and cross-subsidization** on the record. *The rhyme.* 1996–2001: on the order of **80 million miles** of fiber; **85–97%** dark at the trough; Global Crossing's **\$22.44 billion of assets against \$12.39 billion of debt** at filing, paying **~\$600 million a year in interest; >\$2 trillion** of telecom market value erased 2000–2002. *The anti-precedent, which is the beat's discipline:* by 2004 wholesale long-haul prices had fallen ~55% year over year and roughly a tenth of the fiber was lit — and then the fiber got lit anyway, because glass has no product cycle. **OARnet** bought fiber in 2001–2002 and lit a statewide network by 2004; **Internet2's FiberCo** signed with Level 3 in 2003; **Level 3 bought Global Crossing for \$3 billion in 2011**, and the assets still carry traffic. **A 2026 GPU sitting in a warehouse in 2032 is not cheap capacity waiting for demand. It is a depreciated asset with a newer part number available.**

THE MECHANISM. How a forecast becomes concrete. A large load submits an interconnection request. The utility incorporates the request into its load forecast. **The same megawatts can appear in several utilities' forecasts at once, because a developer shops the same project across territories** — the phantom. The forecast justifies capacity procurement and transmission; the transmission enters a regional plan; the plan is approved by a board; the cost is allocated across the footprint and recovered from ratepayers over decades. **The step where the constraint binds: board approval.** Before it, the forecast is a document. After it, it is a right-of-way, a converter station, and a rate case. The load may never arrive; **the line is built either way**, and the difference between the fiber glut and this one is that the fiber was financed by the people who built it, and the transmission is financed by everyone on the system.

KEY ACTORS IN THIS BEAT. *Institution — Monitoring Analytics*, PJM's independent market monitor: the only party in the system whose incentive is to *deflate* the forecast, which is what makes its \$6.2 billion attribution the most credible number in the beat. *Institution — the Federal Reserve Board's Division of Research and Statistics:* **Eirik Eylands Brandsaas, Daniel Garcia, Robert J. Kurtzman, Joseph B. Nichols and Adelia Zytek**, authors of the abandonment-rate model; incentive: forecasting accuracy for monetary policy, not market direction. *Institution — Sightline Climate* (project database; sells research; incentive flagged). *Institution — SemiAnalysis* (sells research; incentive flagged; and it is auditing the bearish side, which cuts against its subscriber base's appetite). *Institution — PPL Electric*, whose lawyers put stranded-cost risk into a binding settlement. *Institution — the ghosts:* Global Crossing, 360networks, WorldCom, Metromedia Fiber Network, KPNQwest.

THE DOCUMENTS. **Monitoring Analytics’ report, released 5 January 2026** — the attribution. **FEDS Working Paper 2025-109, 17 December 2025** — the abandonment rate; DOI 10.17016/FEDS.2025.109; live results at the authors’ public GitHub repository. **Sightline Climate Data Center Outlook, Q1 2026** (public version available; full dataset client-only — **a disclosure boundary worth naming**). **PPL Electric rate settlement, PA PUC, March 2026.** **House Committee on Financial Services hearing memorandum, 21 March 2002** — the primary record of the last overbuild, with Global Crossing’s balance sheet in it. *Skeptical caveat:* Sightline’s outlook is a **forecast about forecasts** and is contested by a competitor with better imagery. Present both; the disagreement is the material.

VERBATIM BANK. > Sightline Climate, on community opposition: **“a true material driver of attrition”** (6 words. Attribution: a market-intelligence firm’s data center outlook, April 2026.)

The Federal Reserve authors, on their own parameter: [PARAPHRASE] the abandonment probability for a data center project is about 33 percent historically in their sample, and one might expect that parameter to increase if expectations around the potential returns to AI were to worsen. (Locator: FEDS 2025-109, Sections 3.1 and 5.4. The second clause is the beat’s quietest detonator: the Fed built a dial for the bust and labeled it.)

PPL Electric, in a binding settlement: [PARAPHRASE] the company stated it is preparing to more than double system demand within five to six years — growth that took over a century to reach — and warned that without protections the buildout poses a risk of stranded assets, unrecovered costs and cross-subsidization from other ratepayers. (Locator: PA PUC rate settlement, March 2026. [SECONDARY-QUOTED PRIMARY — pull the settlement text before quoting.]

WHO PAYS. Directly and by name. **\$6.2 billion of December 2025 capacity cost attributable to data centers that do not exist**, recovered through load-serving entities from customers across the PJM footprint. **\$11.8 billion of transmission approved on 12 February 2026, costs shared across the footprint, most of it in service 2031–2032.** The counter-fences exist and belong to Lecture 7: large-load tariffs, contributions in aid of construction, minimum-take provisions and collateral. **The doctrine at issue is cost causation; the docket is the state commission’s; the dollars have already moved.**

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller (both directions).* **The Utility**, direction: forecast size — the demand is real and the forecast is also a rate-base application. **The Doomer**, direction: collapse — “the forecasts are fake and it will all be stranded,” which the record partially supports and does not settle. *What’s real on the doomer side:* the phantom is measured, the abandonment rate is measured, the pipeline gap is measured. *What’s oversold:* certainty about which projects. *Narrator move:* **DISCOUNT** — grant the direction, name whose model it is and its assumptions, apply the corrections, recall the graveyard, **output a range and a set of assumptions, never a bare number.** The Fed’s own range does this for you: **\$357 billion to \$921 billion for 2027**, entirely a function of an assumption about plan inflow.

SENSORY & MATERIAL DETAILS. *Sourced:* the 525-kV line is **underground** for 185 miles, with **two HVDC converter stations** at roughly \$1.5 billion — the most expensive way to move electricity, chosen because the overhead route could not be sited. Fiber in 2001: buried, dark, and inert. *Marked inference from documented conditions:* an underground HVDC backbone with a 2032 in-service date and a multi-decade asset life is being built to serve load forecast by parties whose own regulator’s monitor says \$6.2 billion of the adjacent capacity cost belongs to buildings that do not exist.

NUMBERS THAT MATTER FOR THIS BEAT.

- **\$6.5B / 40% of \$16.4B; \$6.2B unbuilt** · data-center attribution, Dec 2025 PJM auction · monitor estimate · 5 Jan 2026 · Monitoring Analytics · **STRUCTURAL** (*phantom-load caveat attaches here*)
- **45% of \$47.2B** · data-center forecast share, last three auctions · monitor estimate · Jan 2026 · Monitoring Analytics · **STRUCTURAL**
- **0.33** · data center project abandonment rate · historical parameter, 2003–2025 sample · Dec 2025 · Federal Reserve Board staff · **ANCHOR (as a published parameter)**
- **0.46** · commercial-construction abandonment rate · comparator · Glancy/Kurtzman/Loewenstein · **STRUCTURAL**
- **16 GW / ~5 GW / ~11 GW** · 2026 pipeline / under construction / announced-only · as of Feb–Apr 2026 · Sightline Climate · **CONTESTED**
- **30–50%** · 2026 pipeline unlikely to come online in year · forecast · Sightline Climate · **CONTESTED**
- **>26 GW** · new U.S. gas-fired capacity planned by 2028 · announced/planned · EIA builder survey · **STRUCTURAL**
- **20 GW vs. 7.8 GW** · PPL contracted large loads vs. system peak · request vs. load · Mar 2026 · PPL Electric ·

STRUCTURAL

- ~80 million miles / 85–97% dark · fiber laid 1996–2001 / unlit at trough · historical · **CONTESTED (range stays a range)**
- \$22.44B assets / \$12.39B debt · Global Crossing at filing · 28 Jan 2002 · House Financial Services memorandum · **ANCHOR**

STRESS-TEST VERDICT: SUSTAINABLE — and over-full. This beat carries the phantom attribution, the Fed's abandonment rate, the pipeline dispute, the gas order book's demand side, and the historical rhyme with its anti-precedent. That is 1,400 words of material for a 1,000-word slot. **Markup note:** if anything is cut, cut the pipeline dispute (Sightline vs. SemiAnalysis), which can survive as two sentences, and protect the \$6.2 billion and the 0.33 — those two numbers, adjacent, are the lecture's intellectual spine.

Beat 7 — The Bottleneck (the un-cancellable order book)

Syllabus 2.0 assignment: Turbines, transformers and steel committed regardless of demand.

Beat Menu definition: *The Bottleneck — Atoms · versatile.* The constraint nobody can financialize away. Sustained by why the bottleneck exists industrially, who sits upstream, what the workaround costs, and why money alone doesn't clear it.

FACTS, DATES, NAMES, NUMBERS. Three manufacturers — **GE Vernova, Siemens Energy, Mitsubishi Heavy Industries** — have accounted for roughly **90% of the global large-frame gas turbine market over the past decade** (IEEFA, October 2025); a separate 2026 estimate puts the three at roughly **75%** of large-frame manufacturing [**CONTESTED — two bases; state which one you are holding**]. Their combined market capitalization was put at roughly **\$337 billion** in March 2026. Lead times: **up to eight years**, with customers advised to plan on **seven to eight**, against **two to three** earlier in the decade. **GE Vernova:** year-end 2025 backlog **80 GW** stretching into 2029; gas power equipment backlog plus slot reservation agreements **62 → 83 GW** across Q4 2025; **83 → 100 GW under contract** across Q1 2026; backlog **40 → 44 GW** and slot reservations **43 → 56 GW** in the same quarter; **21 GW of new turbine agreements signed in Q1 2026**; total company backlog **\$163 billion**; Q1 orders **\$18.3 billion**; target of at least **110 GW** combined by year-end 2026; production ramping from roughly **48 units a year** toward **20 GW annualized by mid-2026** and a stretch of **24 GW by mid-2028** at two existing plants, plus 4 GW of new capacity split between a French aeroderivative facility and a South Carolina large-frame facility. CEO **Scott Strazik**, 9 December 2025: reservations expected **sold out through 2030 by the end of 2026**; by early July 2026, supply reported booked through 2030. **Siemens Energy:** record backlog **€136 billion**; a reported **194 gas turbines** sold in 2025, nearly double 2024; a committed **\$1 billion** investment in U.S. grid and turbine production including **1,500+ skilled roles**. **Mitsubishi Power:** sold out through 2028. Roughly **one-third of GE Vernova's turbine reservations** are tied directly or indirectly to AI and hyperscalers. **Electrification, which is the transformer story:** GE Vernova's electrification orders roughly **doubled to \$7.1 billion** in Q1 2026, with equipment orders in North America and Asia roughly **tripling**, and **\$2.4 billion from data center customers in the quarter — more than in all of 2025 combined**. Below the turbine: **first-row blades are grown as single unbroken nickel superalloy crystals** by a handful of suppliers. And the workaround market: developers sourcing **refurbished 1990s-vintage turbines**; industrial conglomerates buying units **on spec** purely to hold a delivery slot.

THE MECHANISM. A slot reservation agreement is the instrument that makes this beat a *Reckoning* beat rather than a supply-chain beat. It is not an order for a machine; it is a **purchased position in a manufacturing queue**, paid for in advance, transferable only on the manufacturer's terms, and booked by the manufacturer as backlog. GE Vernova reports **backlog and slot reservations separately and then sums them**, which is the tell: the company knows one is a machine and the other is an option, and the market reads the sum. **The step where the constraint binds: the single-crystal blade.** Casting capacity for first-row blades cannot be added by paying more, because the constraint is metallurgical and the qualification cycle is years. Money clears the slot; it does not clear the furnace. *And the reason the order book cannot be cancelled:* the manufacturers were burned twice — an early-2000s overbuild, then the 2008 crash, then a 2018 order drought that contributed to GE's eventual split. **They will not build speculative factory capacity again**, which is why analysts expect wait times to improve little before 2027 and new capacity to arrive only after 2030. The scarcity is a memory of the last bust, enforcing itself on this one.

KEY ACTORS IN THIS BEAT. *Institution — GE Vernova* (market cap ~\$162B, March 2026): motive, margin expansion on scarcity; exposure, a backlog that is only as good as its customers' balance sheets; **and a chief commercial position, stated 28 May 2026, that turbines are not the gating item** — a seller declining to sell scarcity, which is the beat's most

credible testimony. *Institution* — Siemens Energy (~\$91B): then-SVP of gas service **Joern Schmuecker** on the difficulty of ramping. *Institution* — Mitsubishi Heavy Industries (~\$84B). *Human* — Scott Strazik, CEO, GE Vernova: the sold-out-through-2030 statement, dated. *Object* — the first-row blade: a single crystal of nickel superalloy, grown, not cast; the smallest object in the ledger and the one that sets the schedule.

THE DOCUMENTS. GE Vernova 8-K, Q4 and full-year 2025 press release (backlog and slot-reservation figures — PRIMARY, CIK 1996810). GE Vernova Q1 2026 earnings materials. IEEFA, *Global gas turbine shortages add to LNG challenges in Vietnam and the Philippines, October 2025* (the 90%-market-share and eight-year-lead-time findings; advocacy vantage flagged). Bloomberg’s “Bottlenecks” feature, 2 October 2025. *Skeptical caveat: a slot reservation agreement is an option dressed as an order book* — and the manufacturer discloses it separately, which means the honest reading is available in the filing to anyone who reads the two lines instead of the sum.

VERBATIM BANK. > GE Vernova, on reservations: [PARAPHRASE] the chief executive said in December 2025 that he expected gas turbine reservations to be sold out through 2030 by the end of 2026. (*Locator: GE Vernova investor update, 9 Dec 2025, via Utility Dive.*)

Siemens Energy, on the ramp: “It’s not so easy to ramp up” (6 words. Attribution: a senior Siemens Energy gas-service executive, interviewed October 2025.)

WHO PAYS. The reservation fee is paid by the developer or utility, in cash, years before the machine exists — and if the load never arrives, the fee is spent and the slot is either resold at whatever the market bears or forfeited. For a regulated utility, the prudence of that spend is litigated in a rate case, and the ratepayer is the residual. **The cleanest documented instance in the course belongs to L8: 59 gas turbines installed across two states, 41 of them permanently permitted on 10 March 2026** — capital committed to combustion generation with a decades-long asset life. [Return-grade only; L8 owns Memphis entire.]

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller:* the Utility and the equipment vendor, both benefiting from a scarcity narrative. *What’s real:* the backlogs are in audited filings; the lead times are quoted to customers; the blade constraint is metallurgical. *What’s oversold:* the framing that turbines are the bottleneck — **GE Vernova’s own commercial leadership says they are not**, and Sightline’s May 2026 data says only about 3% of the 2026 pipeline is onsite-power-only, meaning the interconnection queue, not the turbine, sets most schedules. *The 300%-in-three-years turbine price figure is single-sourced and should be omitted or attributed explicitly.* *Narrator move:* **GRANT-AND-WITHHOLD.**

NUMBERS THAT MATTER. 80 GW year-end 2025 backlog · GE Vernova · **STRUCTURAL** | 83 → 100 GW under contract, Q4 2025 → Q1 2026 · contracted, not delivered · GE Vernova · **VOLATILE** | 43 → 56 GW slot reservations · options, not orders · GE Vernova · **VOLATILE** | €136 billion backlog · Siemens Energy, 2025 · **STRUCTURAL** | 7–8 years lead time · quoted, 2025–26 · IEEFA/Bloomberg · **STRUCTURAL** | \$2.4 billion data-center electrification orders in Q1 2026 · booked · GE Vernova · **VOLATILE** | ~90% (or ~75%) three-firm market share · two bases · **CONTESTED**

STRESS-TEST VERDICT: SUSTAINABLE. Audited backlog series, a dated sold-out claim, a metallurgical constraint, a documented industrial memory explaining why capacity won’t be added, and a vendor executive contradicting his own sales incentive. Strong.

Beat 8 — The Physics Audit (energized vs. contracted vs. announced, one last time)

Syllabus 2.0 assignment: What physically exists as of the record, run one last time.

Beat Menu definition: *The Physics Audit* — *Atoms/Audit* · versatile, closer-capable. The deadpan reality check on a claim. **The course’s signature skepticism beat — the audit is delivered in the same tone as the pitch it’s auditing.** (*Appearance note: the Syllabus 2.0 reconciliation runs this beat at 8 deployments against a 4–5 band and recommends re-banding to hot tier in Beat Menu 1.1. This is deployment 8 of 8 — the last one.*)

FACTS, DATES, NAMES, NUMBERS — THE THREE COLUMNS. ANNOUNCED. Governor Lisa D. Cook, 27 May 2026: companies have announced **more than \$1.5 trillion in data-center plans, only a small portion of which have been realized.** Dodge microdata via the Federal Reserve: the stock of U.S. data center projects in planning exceeded **\$1 trillion as of September 2025**; new plan value **~\$300 billion in 2024** and **>\$900 billion in January–September 2025**, against an average of about **\$7 billion a year in 2019–2022**. Project counts and sizes: **278 plans averaging \$114 million (median \$26 million) in 2019–2022**, versus **521 plans averaging just under \$2 billion (median ~\$216 million) in nine**

months of 2025. Sightingline: **190 GW across 777 projects >50 MW announced since 2024. CONTRACTED / UNDER CONSTRUCTION.** Of at least **16 GW** slated to come online in 2026, **about 5 GW is under construction** and **about 11 GW is announced with no signs of construction**, against **12–18-month** build times — with SemiAnalysis disputing the under-construction figure by multiples on satellite evidence. CoreWeave’s own disclosure is the clean specimen of the gap: **~3.5 GW contracted power against just over 1 GW active** at 31 March 2026. **ENERGIZED / SPENT.** Data center **structures** investment: **~\$10 billion annualized in 2021 → ~\$40 billion in the first half of 2025.** Total imputed data center investment (structures plus above-trend high-tech equipment): **\$10 billion (2023) → \$58 billion (2024) → \$179 billion (2025)**, with a **mean nowcast of ~\$370 billion annualized by 2026:Q2** and a 5th-to-95th-percentile band of **~\$240 billion to ~\$450 billion** — the dispersion driven almost entirely by project-level abandonment. **And the import adjustment, which is the beat’s quietest fact: on the authors’ assumptions, only 44% of data center investment is domestic.**

THE MECHANISM. The audit’s method, stated so the listener can run it themselves. A dollar of announcement becomes a dollar of spend only by surviving four gates: **plan → start → completion → energization.** The Fed’s parameters put numbers on the first three — **11.1 months** plan-to-start (15.0 for projects over \$250 million), **9.4 months** start-to-completion (19.8 for large ones; about **19 months** for a \$1 billion project), and a **33%** chance the project dies in planning. The fourth gate is the interconnection queue, which L4 documented and which still runs four to seven years. **The step where the constraint binds: the plan-to-start gate**, because it is where the abandonment happens and because it is invisible — a project that never starts issues no press release announcing that it never started. **The announcement is a public event; the abandonment is a private one.** That asymmetry is why announced totals grow monotonically and realized totals do not.

KEY ACTORS IN THIS BEAT. *Institution — the Bureau of Economic Analysis and the Census Bureau:* data center structures are measured; **data center equipment is not broken out at all**, which is why the Fed’s authors had to detrend the computers-and-peripheral-equipment series from 2015–2022 and treat the residual as data center equipment. **The United States does not directly measure the capital spending at the center of its own economic expansion.** *Institution — Dodge Construction Network:* the private dataset the Census survey draws on, and therefore the private dataset underneath the national accounts. *Institution — the Federal Reserve Board*, which built the bridge and published the code.

THE DOCUMENTS. FEDS 2025-109 and its supplementary materials (the parameter table, the phase-transition rules, the removal criteria — a document about how a project is officially declared dead). **The GitHub repository** carrying live results across Dodge vintages. **Cook’s speech, 27 May 2026. FEDS Note, 17 July 2026, The AI Buildout and the Economy.** *Skeptical caveat:* the Fed’s own authors flag their measure as imperfect — it excludes specialized data center software and own-account equipment investment, and could include non-data-center laptop purchases if those rose above trend. **The most rigorous public estimate of the buildout says, in its own footnotes, that it is an approximation. Everything downstream of it is an approximation too.**

VERBATIM BANK. > Cook, Stanford SIEPR, 27 May 2026: **“more than \$1.5 trillion in data-center plans, only a small portion of which have been realized”** (16 words — *over the house limit; must be split or paraphrased.* Deployable fragment: **“only a small portion of which have been realized”** — 8 words. Attribution: a Federal Reserve governor, in a speech at Stanford, May 2026.)

The Fed’s authors, on the invisible gate: [PARAPHRASE] a project is classified as abandoned once it has been observed in planning for at least forty-eight months without an observed start, because about 95% of projects that begin construction do so within four years. (Locator: FEDS 2025-109, footnote 12 and Figure S2.)

WHO PAYS. For the announced-but-unbuilt: **the ratepayer, already, through capacity procured against forecast load** — \$6.2 billion of it in a single auction. For the announced-and-abandoned: the developer’s option cost, the county’s foregone planning capacity, and the utility’s study queue. **The asymmetry is the who-pays: the announcement’s costs are socialized through the forecast; the abandonment’s savings are not refunded.**

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller:* **everyone**, which is why this beat is the audit. *Unknown, and load-bearing:* **utilization.** Not one operator publishes fleet-wide utilization or GPU retirement data. **[L2’s plant, collected.] Narrator move: DISCOUNT**, delivered flat. Output the range: **\$240 billion to \$450 billion** annualized for 2026:Q2, and **\$357 billion to \$921 billion** for 2027 depending entirely on an assumption about plan inflow.

NUMBERS THAT MATTER. >\$1.5 trillion announced · announced, not spent · 27 May 2026 · Governor Cook · **VOLATILE** | >\$1T stock of plans · planning stage · Sep 2025 · Dodge/FRB · **STRUCTURAL** | \$10B → \$40B annualized structures spend · spent · 2021 → 1H2025 · BEA · **ANCHOR** | \$58B (2024) → \$179B (2025) → ~\$370B (2026:Q2

nowcast) · imputed/estimated · FRB staff · **STRUCTURAL** | ~\$240B–\$450B · 5th–95th percentile, 2026:Q2 · simulation · FRB staff · **CONTESTED** | 44% · domestic share of data center investment · authors' ballpark assumption · FRB staff · **CONTESTED** | 16 GW / ~5 GW / ~11 GW · 2026 pipeline / building / announced-only · Sightline · **CONTESTED** | ~3.5 GW vs. >1 GW · contracted vs. active power · 31 Mar 2026 · CoreWeave · **VOLATILE**

STRESS-TEST VERDICT: SUSTAINABLE. Three columns, each with a primary source, a documented measurement gap in the national accounts, and a company's own contracted-versus-energized disclosure as the miniature. The signature beat closes strong.

Beat 9 — The Bill Arrives (the terminal bill) [HUMAN-FLOOR ZONE — COMEDY OFF, ENTIRE BEAT]

Syllabus 2.0 assignment: The terminal bill: whose mailbox, which line items, already printing.

Beat Menu definition: *The Bill Arrives* — *Money* · opener-preferred, closer-capable. Open from a cost line item someone actually paid, then trace the line item upstream to its cause. The bill is the hook; the supply chain of the bill is the beat. (*Deployment 4 of 4 course-wide, over the 1–3 band; the Syllabus 2.0 reconciliation accepts the overage.*)

FACTS, DATES, NAMES, NUMBERS. The household number, dated. The National Energy Assistance Directors Association expects the average U.S. household to spend **\$792 on electricity from June through September 2026**, up **10.5%** from **\$717** the previous summer, and **39.4% above the 2020** figure — an increase NEADA calculates is only partly explained by inflation. **The rate, dated.** EIA Form EIA-861M: **18.83 ¢/kWh** average U.S. residential, **April 2026, +7.4% against April 2025**. Annual averages: **17.29 ¢/kWh (2025)**, up nearly 5% on 2024; **+31.38% from 2020 to 2025**; the 2026 national average projected at about **18.02–18.06 ¢/kWh**, roughly **37% above 2020**. Retail electricity prices up **42% since 2019** against **29%** for CPI. Regional: **New England ~30.01 ¢/kWh (2026 projection)**; **Pacific ~24.88**; state range **12.35 ¢ (North Dakota) to 46.62 ¢ (Hawaii)**. **The direction of causation, made unusually clean by a single 2026 fact:** EIA expects average U.S. **wholesale** prices to **fall** about **\$4/MWh** this summer to roughly **\$45/MWh**, on lower gas costs and stronger hydro and solar — **while the annual residential price rises 5.7%**. Wholesale costs to providers nonetheless trend up across years: **\$38/MWh (2024) → \$47 (2025) → \$51 (2026)**. **The burden.** Low-income families already spend **more than 15% of income** on energy. **The official-sector confirmation.** Cook, 27 May 2026: **electricity and water prices have each increased by about 5 percent over the past year**, alongside significant price increases for chips, other high-tech equipment and software, and notably higher wages in construction specialty trades. **The mechanism's dollar figure.** Data center load accounted for **\$6.5 billion of \$16.4 billion** in PJM's December 2025 capacity costs, **\$6.2 billion of it for facilities not yet built**; independent analysis cited by the Sierra Club puts annual PJM customer costs up **\$12.5 billion since June 2025**, from **\$2.2 billion (2024) to \$14.7 billion**. [Advocacy source — **flag the vantage.**] A Union of Concerned Scientists analysis found utilities in seven PJM states passed billions in transmission upgrade costs, spread across all customers including residential households. [Cross-lecture: **L7 owns the UCS connection-costs brief and its table; return-grade reference only.**]

THE MECHANISM. The supply chain of a residential bill, traced upstream, in the order the money moves backward. The customer pays a rate. The rate recovers **energy, capacity, transmission, distribution** and approved return. Energy tracks fuel — and fuel is **falling** this summer. Capacity tracks the auction — which has cleared at its cap three consecutive times, with a documented data-center attribution. Transmission tracks the regional plan — **\$11.8 billion approved on 12 February 2026, allocated across the footprint, in service 2031–2032**. Distribution tracks local investment. **The step where the constraint binds: the moment a forecast becomes a board-approved baseline project.** After that vote, the cost is in the rate base and the only remaining question is the allocation formula. **The household never appears in that proceeding except through an advocate.**

KEY ACTORS IN THIS BEAT. *Human* — Mark Wolfe, Executive Director, National Energy Assistance Directors Association: the named voice of the floor, with a dated figure attached. **Wanted:** adequate low-income energy assistance. **Feared:** a summer in which cooling becomes a budget choice. **Could enforce:** nothing — NEADA administers no rate. **Actually did:** published the arithmetic. *Institution* — EIA: the referee with no position. *Institution* — PJM and its state commissions. *Institution* — Monitoring Analytics: the only actor with a mandate to say what the load did to the price.

THE DOCUMENTS. NEADA's summer 2026 estimate. EIA Short-Term Energy Outlook, December 2025 and mid-2026 updates; Form EIA-861M through April 2026. Monitoring Analytics' 5 January 2026 report. PJM's 12 February 2026 RTEP approval and 14 July 2026 auction release. Cook's speech, 27 May 2026.

VERBATIM BANK. > Mark Wolfe, NEADA Executive Director, summarizing the squeeze: **"Families are getting hit**

from both sides.” (7 words. Attribution: the executive director of the National Energy Assistance Directors Association, in July 2026. **HUMAN-FLOOR** — *deliver flat, no framing, no irony.*)

Cook, 27 May 2026: “Electricity and water prices have each increased by about 5 percent over the past year.” (15 words — at the ceiling. Attribution: a Federal Reserve governor, May 2026. **Note: Beat 8 also draws on this speech; under the one-quote-per-source-document rule only one of the two beats may quote it. See Section 4.4.**)

WHO PAYS. This beat is the who-pays. Named: **the residential customer in the PJM footprint** — 67 million people in 13 states and the District of Columbia — through capacity, transmission and distribution charges; **the low-income household**, disproportionately, already above a 15% energy burden; and, prospectively, every customer of a utility whose large-load forecast does not arrive. The counter-fences — large-load tariffs, minimum takes, collateral, contributions in aid of construction — are real, are being litigated, and are **Lecture 7’s subject**; this beat names their existence in one sentence and does not relitigate them.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *What is genuinely contested:* how much of the increase is attributable to data centers versus grid hardening, storm resilience, aging infrastructure, gas prices and electrification. **Every serious source attributes multiple causes; the pack does not permit a single-cause claim.** The strongest attribution available is the market monitor’s, and it is scoped narrowly to capacity costs in one RTO. *What is not contested:* the direction, the magnitude, and the fact that wholesale prices are falling this summer while retail prices rise. *Narrator move:* **GRANT-AND-WITHHOLD**, with the withholding aimed at the single-cause story from either direction. **Comedy off throughout. Name the floor through specifics; earn the weight; never sermonize.**

SENSORY & MATERIAL DETAILS. *Sourced:* the seasonal window — June through September, the four months when cooling is not optional in most of the country. The unit: cents per kilowatt-hour, to two decimals, on a monthly federal form. *Marked inference from documented conditions:* \$792 across four months is roughly **\$198 a month**, against a summer 2020 baseline near **\$142** — arithmetic from NEADA’s own figures, labeled as arithmetic.

NUMBERS THAT MATTER. \$792 / \$717 / +10.5% / +39.4% vs. 2020 · household summer electricity spend, Jun–Sep 2026 · estimate · NEADA · **VOLATILE** | 18.83 ¢/kWh, +7.4% YoY · residential rate · reported, April 2026 · EIA-861M · **VOLATILE** | +31.38% (2020–2025); ~37% above 2020 by 2026 · rate series · EIA · **STRUCTURAL** | ~\$45/MWh, –\$4 · summer 2026 wholesale · forecast · EIA · **VOLATILE** | +5.7% · 2026 annual residential price increase · forecast · EIA · **VOLATILE** | >15% of income · low-income energy burden · **STRUCTURAL** | \$6.2 billion · capacity cost for unbuilt data centers · monitor estimate · Monitoring Analytics · **STRUCTURAL**

STRESS-TEST VERDICT: SUSTAINABLE. A dated household figure with a named source, a federal rate series, a falling-wholesale/rising-retail contrast that does the analytical work without an accusation, and a market monitor’s attribution. The beat’s discipline problem is tonal, not evidentiary: it has the material to be angry, and it must not be.

Beat 10 — The County (Loudoun’s Moody’s coda) [HUMAN-FLOOR ZONE at the residential line — comedy off there]

Syllabus 2.0 assignment: Loudoun’s proposed coda — the Moody’s AAA exposure if the buildings devalue. **Fourth appearance; Open Item 6 / Roster Open Item 3.** Loudoun’s lead treatment is L1’s; this beat is a return and must not rebuild the origin story, MAE-East, Rizer’s arc, or the fiscal machine’s history.

Beat Menu definition: *The County* — *Politics/Character · versatile, closer-capable.* One jurisdiction as live microcosm; present-tense politics with a zip code. Distinct from The Wrong Map: this is what the geography is doing to people *this year*.

FACTS, DATES, NAMES, NUMBERS — THE RETURN’S NEW MATERIAL ONLY. The rating, stated once and precisely: Loudoun County has held **Aaa from Moody’s since 2004** and **AAA from Fitch and S&P Global since 2005**, reaffirmed annually through the most recent published cycle, with the outlook at **stable** across all three; the cited rationale includes financial resilience, budgetary flexibility, strong fund balances and reserves, and “**very low revenue volatility.**” [The county’s own published rating summary — and that phrase is the beat, because it is the assessment this lecture stress-tests.] The dependency, at **FY2027 values:** the commercial share of the county’s real-estate tax base has moved from **19% two decades ago to 51%**; in the proposed FY2027 budget, **data center revenue is nearly half of county tax revenue, at \$1.3 billion**; independent compilations put the combined commercial property, real estate and personal

property contribution at roughly **38–40% of total county revenue**. The real property tax rate has fallen every year for a decade, from **\$1.145 per \$100 of assessed value in tax year 2016 to \$0.805 in tax year 2026**; the general personal property rate applying to data center equipment holds at **\$4.15 per \$100** for tax years 2026 and 2027; the vehicle personal property rate is cut to **\$3.09** for 2026 with a planned **\$2.94** for 2027. **The counterfactual, quantified by the industry's own trade body:** the **2026 Virginia Data Center Report**, prepared by **Mangum Economics** for the **Northern Virginia Technology Council**, calculates that without data center revenue, residential property tax rates in Loudoun would have to **nearly double**, adding about **\$5,800 a year for the typical homeowner**. **[Seller flagged: NVTC is the industry's trade association; the figure is the strongest available and it is the defendant's own. Grant it precisely, name the filer, and let it stand — it is a real number that cuts against the easy story.]** **The threat, dated:** Virginia's Senate FY2027 budget proposed removing the statewide sales and use tax exemption in place since 2008 — **\$1.5 billion of budgetary impact over two fiscal years**. Loudoun's legislative liaison **Jonathon Freeman** told the Board of Supervisors in **March 2026** that the county was working to oppose it. **The rating agency's own warning, dated:** Moody's Ratings' **~24 June 2026** sector report finds rapid data center growth raising credit risks for state and local governments, notes at least **14 states** considering statewide moratoriums in 2026, and — in the same body of work — has named Dominion's Virginia subsidiary among utilities positioned to gain from data center demand while warning of the reverse: **a utility can overbuild for load that never shows up**.

THE MECHANISM. The exposure, traced precisely, because the beat fails if it overstates. A triple-A general-obligation rating rests on economic base, revenue stability, budgetary flexibility, reserves and management. Loudoun's economic base is now **half commercial by assessed value**, and the commercial base is **overwhelmingly one industry** whose principal taxable asset — computer equipment — is assessed at a **declining percentage of purchase price** on a schedule set by the county's own depreciation tables. **The step where the constraint binds: the assessment schedule, not the buildings.** A data center's shell is real property with a long life. Its contents are personal property on a fast depreciation curve, and personal property is where the money is — **computer-equipment personal property revenue grew from about \$60 million in FY2013 to over \$800 million in FY2026**. That revenue does not require the buildings to devalue in order to fall. **It requires only that the refresh cycle slow.** If the useful life of a server is genuinely six years rather than three, the assessed value curve flattens — which flatters the operator's income statement and **starves the county's growth rate at the same time**. The two halves of this lecture meet at that sentence.

KEY ACTORS IN THIS BEAT. *Institution — Loudoun County:* **return only**. Wants the revenue and the rating; fears Richmond and the depreciation curve; **can enforce** discretionary approval of future projects and the local rate; **cannot enforce** the state exemption, the refresh cycle, or the interconnection queue. *Institution — Moody's Ratings:* motive, fees on ratings; exposure, methodology risk in public; **and it has now published the warning about its own rated universe**, which is the fact that makes the coda buildable. *Institution — the Northern Virginia Technology Council / Mangum Economics:* the industry's economists, with the counterfactual. *Human — Jonathon Freeman*, Loudoun Legislative Liaison, March 2026, on the record opposing the exemption repeal. *Human — Del. John McAuliff (D-30) and Sen. Russett Perry (D-31)*, on the record supporting it — **two Loudoun-area legislators on the opposite side from their own county's budget office**.

THE DOCUMENTS. Loudoun County's **published bond-rating record** (county source — the “very low revenue volatility” language). **The FY2027 adopted budget and tax-rate schedule** (county source — the \$1.3 billion and the rate series). **The 2026 Virginia Data Center Report**, Mangum Economics for NVTC (industry source — the \$5,800 counterfactual). **Moody's Ratings sector report, ~24 June 2026.** **Virginia Senate FY2027 budget proposal.** *Skeptical caveat, stated flat:* **no rating agency has downgraded Loudoun, put it on watch, or published a negative outlook**. The beat is about a **named, published exposure**, not a pending action, and it must say so in one sentence or it becomes the doomer story this lecture exists to audit.

VERBATIM BANK. > Moody's Ratings, on the function of a moratorium, sector report, ~24 June 2026: **“allow time for governments to evaluate data center impacts”** (9 words. Attribution: Moody's Ratings, in a sector report published in June 2026.)

Loudoun County's own rating summary, on the credit's foundation: “very low revenue volatility” (4 words. Attribution: the county's published summary of its rating agencies' findings. *[SECONDARY — the phrase appears in the county's own restatement; pull the agency report language at draft stage before deploying as an agency quote.]*

Freeman, March 2026: [PARAPHRASE] the county's legislative liaison told the Board of Supervisors he could understand the motivation behind the exemption repeal but called it a superficial and potentially devastating action.

(Locator: Loudoun Now, 5 March 2026.)

WHO PAYS. [HUMAN-FLOOR — comedy off from here to the end of the beat.] If the growth rate flattens, the county closes the gap three ways: raise the residential rate, cut services, or draw reserves. The industry's own economists have priced option one: **roughly \$5,800 a year on a typical Loudoun homeowner** in the total-replacement case. That is not a forecast of what will happen; it is the measured size of the dependency, published by the industry that created it. The households in that arithmetic are the same households in Beat 9's \$792 summer bill, in the same state, on the same grid.

WHAT'S CONTESTED, MOTIVATED, OR UNKNOWN. *Sellers, both directions.* **The Politician / the industry:** the counterfactual is real and is also an argument against the exemption repeal. **The Doomer:** "the AAA is at risk" — **not supported by any rating action to date**, and the pack says so flatly. *Narrator move:* **HOLD OPEN**, and name what would settle it: a published negative outlook, or two consecutive years of declining computer-equipment personal property revenue.

NUMBERS THAT MATTER. Aaa since 2004 (Moody's); AAA since 2005 (Fitch, S&P); outlook stable · **ANCHOR** | 19% → 51% commercial share of real-estate tax base · two decades → FY2027 · county · **STRUCTURAL** | \$1.3 billion / nearly half of county tax revenue · FY2027 proposed budget · county · **VOLATILE** | \$1.145 (TY2016) → \$0.805 (TY2026) per \$100 · real property rate · county · **ANCHOR** | \$4.15 per \$100 · general personal property rate, TY2026–27 · county · **STRUCTURAL** | ~\$60M (FY2013) → >\$800M (FY2026) · computer-equipment personal property revenue · county · **STRUCTURAL** | ~\$5,800/yr · counterfactual residential increase · industry estimate · Mangum/NVTC, 2026 · **CONTESTED** | \$1.5 billion over two fiscal years · proposed exemption repeal impact · Virginia Senate, March 2026 · **VOLATILE** | 14 states · considering statewide moratoriums · Moody's citing NCSL, June 2026 · **VOLATILE**

STRESS-TEST VERDICT: SUSTAINABLE — CONDITIONAL ON NICK'S CALL. The material is beat-grade: a published rating rationale, a quantified dependency, an industry counterfactual, a state-level threat with a dollar figure, and a rating agency publishing the warning in June 2026. **The only weakness is that there is no rating action** — which the beat must concede in a sentence, and which is arguably what makes it honest. If Open Item 6 goes the other way and Loudoun folds into the Ledger as a line item, the county's material collapses to two Ledger entries (the 38–40% dependency; the exemption's \$1.5 billion) and **Section 3 proposes the replacement.**

Beat 11 — Operator Reality (who still clocks in either way) [HUMAN-FLOOR ZONE — COMEDY OFF, ENTIRE BEAT]

Syllabus 2.0 assignment: The fifty people in a building whose thesis is being audited over their heads. **L1 owns the ~50-FTE plant and the JLARC staffing findings; L8 owns the Memphis workforce material.** **This beat's material must be new: the labor market in 2026, not the headcount ratio.**

Beat Menu definition: *Operator Reality — Atoms/Character · versatile.* Shift structure, maintenance treadmill, the plumbing trades suddenly load-bearing in an industry that thought it was software. **Sourced from job postings, staffing disclosures and trade-press interviews — humanizes without inventing anyone.**

FACTS, DATES, NAMES, NUMBERS. **The shortage, from the industry's own surveys.** The Uptime Institute's **2025 Global Data Center Survey** places staffing shortages at **the top of the barriers list — above power availability, permitting and supply chain.** The **2024 Uptime survey** found **more than half** of operators reporting staffing shortages in critical-facilities roles; a 2025 industry compilation puts the figure at **65%** reporting significant difficulty finding and retaining qualified technical staff, and reports that both recruitment timelines and training requirements are lengthening simultaneously. **JLL's 2025 Data Center Outlook** reports **90%** of operators citing staffing shortages as a critical constraint on build and expansion plans. **The headcount.** Industry and BLS-derived projections put U.S. data center employment at roughly **501,000 in 2023** and approximately **650,000 in 2026**, with an estimated **340,000 unfilled positions.** [**CONTESTED — trade-press compilation, not a federal series; attribute it and do not treat it as official.**] **The pay.** Average U.S. data center network engineer compensation **\$147,461** (ZipRecruiter, April 2026), range **\$51,500–\$197,000**, against a **\$123,000** median for general network engineers (Glassdoor). Critical-facilities engineers earn **\$5,000–\$14,000 a year in shift differential** and **\$18,000–\$22,000 a year in on-call and callout pay**, with most sites paying **\$150–\$300 per callout.** **The pipeline.** Entry into the industry to senior critical-facilities engineer is estimated at **7 to 9 years** (iMasons workforce research). Employer-run pathways: the **Microsoft Datacenter Academy**, the **AWS Workforce Accelerator**, the **Google STAR Program** — and the documented feeder trades are **Navy nuclear machinist's mates, Air Force prime power production specialists, and building-management-system and controls technicians.** **The macro echo, from the central bank.** Cook, 27 May 2026: **wages in specialty trades in construction have picked up notably; unemploy-**

ment **4.3%** in April 2026, unchanged on net since the prior summer; and — the sentence this beat must handle with care — that we could be approaching the most significant reorganization of work in generations, that AI-related job loss could precede job gains, and that **there is not yet conclusive evidence of this occurring**. The Federal Reserve’s 2025 Small Business Credit Survey: the **vast majority** of small-business respondents say labor costs have not changed as a result of AI.

THE MECHANISM. The staffing mechanism that the audit makes strange. A data hall’s operating headcount is roughly **fixed by design**, not by demand — the shift rotation, the maintenance schedule and the electrical safety rules determine how many people are on site, and none of those change if the utilization rate falls. **The step where the constraint binds: commissioning.** The building cannot energize without qualified commissioning and controls staff, and there are not enough of them; the trade press reports both the shortage and the pay premium as evidence. Which produces the beat’s actual finding: **the labor constraint binds hardest on the buildings that get built, and not at all on the ones that don’t.** The 33% that never break ground never post a job.

KEY ACTORS IN THIS BEAT. *Institution* — *Uptime Institute* (research and certification body; sells advisory services — vantage flagged). *Institution* — *JLL* (commercial real estate services; sells to operators — vantage flagged). *Institution* — *the specialist recruiters* whose published salary compilations are the most granular public source on this labor market **and who are paid to place the roles they describe as scarce — the single most important seller flag in this beat.** *Institution* — *the employer academies.* *Human* — *Governor Lisa D. Cook*, as the official-sector voice on the labor question, dated.

THE DOCUMENTS. Uptime Institute Global Data Center Survey, 2024 and 2025. JLL Data Center Outlook, 2025. Cook’s speech, 27 May 2026. Federal Reserve Banks, 2026 Main Street Metrics: Trends over Time from the Small Business Credit Survey, 23 March 2026. *Skeptical caveat: every figure in the shortage literature is published by a party that benefits from the shortage being believed* — recruiters, certification bodies, brokerages. The Uptime and JLL surveys are the most methodologically transparent; the headcount and unfilled-position figures are the least. Treat them accordingly.

VERBATIM BANK. > Cook, on the labor question, 27 May 2026: [PARAPHRASE] she said we could be approaching the most significant reorganization of work in generations; that even if new jobs are created in the long run, the timing of costs and benefits may differ, with AI-related job loss potentially preceding job gains; and that there is not yet conclusive evidence of this occurring, though it may be on the horizon. (*Locator: Federal Reserve speech page, cook20260527a.* **HUMAN-FLOOR: deliver the uncertainty as stated. She does not claim it is happening. Do not upgrade her hedge.**)

WHO PAYS. The operator’s payroll is a fixed cost against a variable thesis. If utilization falls, the shift still runs — until the building is decommissioned, at which point the people are the first line cut and the transformer is the last. **The honest statement of the who-pays here is narrow and should stay narrow:** nothing in the public record documents data center operators shedding staff in 2026. **The pack will not manufacture a layoff.** What the record does document is a workforce whose scarcity is priced into everyone else’s schedule, in an industry whose capital thesis is being argued over its head in filings none of them wrote.

WHAT’S CONTESTED, MOTIVATED, OR UNKNOWN. *Seller:* the staffing industry, direction: scarcity. *What’s real:* the Uptime and JLL survey findings; the pay premium; the multi-year training pipeline; the specific military and controls feeder trades. *What’s oversold:* the 650,000 / 340,000 headcount pair, which is a trade compilation presented with federal-statistic confidence. *Narrator move: STRIP* — remove the “AI is coming for your job” personification, which this beat’s subjects are the physical avatar of; leave standing the documented displacement anxiety, the automation economics, and the genuinely strange fact that the building at the center of the fear employs a few dozen people. **Never punch down. The people in the hall did not write the depreciation schedule.**

SENSORY & MATERIAL DETAILS. *Sourced:* the callout — **\$150 to \$300** to come in at 3 a.m. because an alarm cleared or didn’t. The shift differential as a separate line on a pay stub, **\$5,000 to \$14,000 a year.** The credential order on a résumé, per the industry’s own guidance: PE license first, then specialty data center certifications, then OSHA and safety, then the degree. *Marked inference from documented conditions:* the person most likely to be holding a radio in an AI data hall at 3 a.m. learned the trade on a Navy reactor plant or an Air Force prime power unit — inference from the documented feeder trades, and it should be marked as such.

NUMBERS THAT MATTER. Staffing shortages ranked #1 barrier · survey · Uptime Institute, 2025 · **STRUCTURAL** | >50% (2024) / 65% (2025 compilation) reporting shortages · survey · Uptime · **STRUCTURAL** | 90% of operators citing shortages as a build constraint · JLL, 2025 · **STRUCTURAL** | \$147,461 average network engineer pay · Apr 2026

· ZipRecruiter · **VOLATILE** | \$5,000–\$14,000 shift differential; \$18,000–\$22,000 on-call; \$150–\$300 per callout · industry compilation, 2026 · **STRUCTURAL** | 7–9 years to senior critical-facilities engineer · iMasons · **STRUCTURAL** | ~501,000 (2023) → ~650,000 (2026); ~340,000 unfilled · trade compilation · **CONTESTED** | 4.3% unemployment, April 2026 · federal · BLS via Cook · **VOLATILE**

STRESS-TEST VERDICT: THIN — BUT BUILDABLE AT SCOPE. The finding, stated flat: this lecture’s Operator Reality has **no named human**. Every prior deployment of the beat in this course drew on a documented individual or a specific facility’s disclosures; here the record offers surveys, salary compilations and a Fed governor’s hedged paragraph. It will sustain 1,000 words — the pay structure, the feeder trades, the fixed-headcount mechanism and the commissioning constraint are all real and specific — but it will do so **without a face**, which is exactly the failure mode the Beat Menu built the Neighbor to prevent. **Section 3 proposes the replacement and the re-scope.**

Beat 12 — The Irreversibility Ledger [C]

Syllabus 2.0 assignment: What has already been irreversibly spent regardless of whether demand materializes — transmission lines, water rights, gas turbines, farmland, county tax structures, political legitimacy — tallied in the order the cascade spent them. Costs paid in atoms, on 30-year paper, against a forecast. **No Handoff. Ends on the bill.**

Beat Menu definition: *The Irreversibility Ledger — Audit · closer · lecture 10’s closer; max 1 mid-course deployment.* Deployable mid-course at most once, and only in miniature, so it still detonates as the course’s final beat. **Mid-course deployments actually spent: zero.**

FACTS, DATES, NAMES, NUMBERS. The full inventory lives in **Section 10.2 — twenty entries, in cascade order, with date, magnitude, unit and source.** The beat’s own load-bearing selections, in the order the cascade spent them: **\$11.8 billion** of PJM baseline transmission approved in a single board vote on **12 February 2026**, including **185 miles** of 525-kV underground HVDC and two converter stations, **in service June 2032**, cost shared across 13 states and the District of Columbia; **59 gas turbines installed** across two states with **41 permanently permitted on 10 March 2026** (*L8’s entry*); **\$188.3 million** of Electrolux incentives, **unrecoverable by contract**, 2010–2019 (*L8*); **114 acres** in July 2025 and a further **104 acres** with an **810,258-square-foot** warehouse in December 2025, converted (*L8*); **Virginia’s \$1.6 billion FY2025 tax expenditure**, spent (*L8*); a **6–1 board vote on 15 December 2025** that exhausted a local process (*L8*); the **greywater facility with a groundbreaking and no construction** (*L8 — the inverse entry*); **\$6.2 billion** of December 2025 capacity cost attributable to data centers that do not exist; a statewide moratorium bill vetoed on **24 April 2026** to protect a **\$550 million** project that **withdrew on 18 June 2026**; **~17 metric tons** of aluminum oxide deposited in the stratosphere in 2022 alone, catalytic and unmetered (*L9*); **11,160 catalogued debris objects** (*L9*); and the accounting entry that ties the ledger to the lecture’s own subject — **\$920 million** of accelerated depreciation recorded in a single quarter for equipment retired early, which is the sound of an irreversible commitment being written off in the only column where it is reversible: the footnote.

THE MECHANISM. What makes a cost irreversible, defined precisely, because the beat is worthless if the category is loose. Four tests, and an entry qualifies on at least one: **(1) the asset cannot be redeployed** — a 525-kV converter station in Loudoun County has no second use; **(2) the money is unrecoverable by contract** — the Electrolux incentives, with the clawback written in as an absent clause; **(3) the physical state cannot be restored** — farmland rezoned and built, groundwater drawn, alumina in the stratosphere; **(4) the institutional state cannot be restored** — a local process exhausted, a rating rationale falsified, a legislature’s first attempt spent. **The step where the constraint binds: the vote, the signature or the pour.** Before it, the cost is a plan. After it, the only remaining question is who carries it. **And the ledger’s honest structure is that its entries were incurred by parties who were each right at their own altitude** — the board approving transmission against a reliability mandate, the county capitalizing revenue into schools, the governor protecting a mill town’s \$550 million, the manufacturer refusing to build speculative factory capacity after two busts. **Nobody in this ledger was a rube.**

KEY ACTORS. Every institution the course has met, arriving at its column: PJM (the transmission line), Dominion/NextEra (the converter stations, and a merger filed 15 July 2026 while the cost case was still being heard), Loudoun County (the tax structure), the Commonwealth of Virginia (the exemption), the governor of Maine (the veto), the manufacturers (the slots), the hyperscalers (the capex), CoreWeave (the interest), and the household (the bill).

THE DOCUMENTS. The ledger is assembled from documents, not from a claim: the **PJM RTEP approval of 12 February 2026**; the **Mississippi operations permit of 10 March 2026**; the **Electrolux incentive agreements, 2010–**

2019; Virginia’s tax-expenditure reporting; the Maine veto message of 24 April 2026; Monitoring Analytics’ 5 January 2026 report; and Amazon’s Q4 2024 disclosure of \$920 million in accelerated depreciation. *Skeptical caveat, and it is the beat’s integrity test: not one of these documents says “irreversible.”* The word is the narrator’s synthesis of four documented tests, and the beat must earn it entry by entry rather than assert it — **except in one instance, where a private citizen used the phrase first, in a federal docket, in March 2026.** (See Section 10.2, entry 14, and its verification flag.)

VERBATIM BANK. The Ledger’s verbatim budget is **spent elsewhere in the lecture by design** — The Verbatim’s one-per-lecture cap sits at Beat 2 or Beat 1, and the closer works better on documented numbers than on quoted language. Two items are held here as reserve only: > **[BANKED, VERIFICATION REQUIRED]** *Nickolai Bakken’s petition*, invoking “**irreversible and irretrievable commitments of resources**” by name, in a federal data-center docket, March 2026. **[L9’s banked export. Carried at L9’s stated value; the docket locator must be re-pulled before any prose deployment. If it verifies, it is the strongest closing artifact available to the course: a private citizen used the closer’s exact vocabulary before the closer did.]**

Amazon, on the retirements: [PARAPHRASE] in connection with a decision to retire certain equipment early, the company recorded approximately \$920 million of accelerated depreciation and related charges in the quarter ended 31 December 2024. (Locator: AMZN FY2024 10-K.)

WHO PAYS. The ledger’s whole content, per the cascade edge. Named, in the order the beat tallies: the PJM ratepayer across 13 states and the District of Columbia; the Loudoun homeowner if the growth rate flattens; the Virginia taxpayer through a spent exemption; the Memphis and Southaven fence-line resident (*L8’s, in one line*); the Maine town that spent a governor’s veto and got nothing; the CoreWeave lender if the residual value fails; the shareholder if the shorter life was right; and the household with a **\$792** summer bill, which is where the course ends.

WHAT’S CONTESTED. *The FRAMING resolution, and it is the course’s last analytical act:* the question was never whether AI is a bubble. **Demand is unknowable — the datum that would settle it, fleet utilization, is published by nobody — and the course says so plainly.** What is knowable is what has already been irreversibly paid, in what currency, on whose bill, and whether it can be un-spent. **The answer to the last clause is no, and it is the only verdict this lecture delivers.**

SENSORY & MATERIAL DETAILS. *Sourced:* 185 miles of cable, underground. Two converter stations. 41 permitted turbines. 810,258 square feet of warehouse. 218 acres. 17 metric tons of aluminum oxide, catalytic, not consumed. A groundbreaking with no construction after it. *Marked inference:* the transmission line approved in February 2026 will energize in **June 2032**, by which date the GPUs whose forecast justified it will have reached the end of even the most generous depreciation schedule filed by anyone in this lecture. **That comparison is the closer’s arithmetic and every component of it is documented.**

STRESS-TEST VERDICT: SUSTAINABLE — the strongest-supplied beat in the lecture. Twenty documented entries across nine prior packs plus this one’s original research, four defensible irreversibility tests, an inverse entry, a resolution to the course’s standing FRAMING question, and a Kicker candidate that is arithmetic rather than sentiment.

SECTION 3: NEGATIVE-SPACE SCAN & SWAP CASES

One entry per beat the strawman leaves out. Where the record does not strongly support the beat here, the entry is one line.

Cold Open on an Object. No. Opener-only class, and Beat 1 is a Hearing Room by assignment and by rotation. The closer should not open on an object; the course’s last hour opens on a voice.

The Wrong Map. No. Origin-story geography is L1’s and L9’s. The Reckoning has no map to draw wrong.

Mechanism Autopsy. Marginal — one line. The only mechanism this lecture would autopsy is the depreciation calculation, and that is Beat 2’s Paper Trail by assignment. **Correctly left out; running both would duplicate.**

Taxonomy by Business Model. No. Cap spent: three deployments, all cast (L3 cooling vendors, L6 neoclouds, L9 orbital players). The L2 and L7 packs each declined a fourth to protect that casting; L10 does the same.

The Symbol Audit. No. Hard cap ≤ 3 , all three deliberately cast (L5 Three Mile Island / Crane, L8 Stargate, L9 orbital destiny). **A tempting candidate existed and is recorded here as declined so the cap’s protection is visible in the record: Michael Burry’s own iconography — “Cassandra Unchained,” the Buffett nickname, the Substack —**

audited strictly as a subscription business at \$39 a month and 300,000 subscribers. It is a genuine Symbol Audit and it is exactly the fourth deployment the cap exists to prevent. Declined. The material rides inside Section 7's seller audit instead, where it belongs.

The Founder Audit. No. Cap and casting: L6 Intrator, L9 Johnston, with L2's Huang deployment an open call. Burry is a critic, not a founder; auditing his origin mythology against a cap table would be a category error and would also crowd the beat this lecture actually needs him for.

The Neighbor. Scan: NO — and the reason is a finding. Deployment 3 of 3 is spent (the Morrisises at L3; the fence-line ratepayer flagged as a pack dependency at L7; Sarah Gladney at L8). **More to the point, this lecture's territory does not contain a Neighbor.** The audit's harms are distributed — a rate, a tax base, a schedule — and the one place a household appears is Beat 9's bill, which reaches households in aggregate rather than at a property line. **The pack will not promote an aggregate into a Neighbor.** Correctly left out.

The Deal. Scan: YES, and this is the strongest swap case in the section. The record strongly supports a Deal beat here: **the NextEra–Dominion merger.** Agreement signed **15 May 2026**; announced **18 May**; all-stock at **0.8138** NextEra shares per Dominion share; NextEra holders at **~74.5%**; combined market capitalization above **\$249 billion**; enterprise value **~\$420 billion**; deal value reported near **\$67 billion**; a **110 GW** operating portfolio with a stated path to **260 GW by 2032**; a **~\$59 billion** annual capital plan for 2027–2032; **John Ketchum** to chair and lead, **Robert M. Blue** to run the combined regulated utilities; dual headquarters Richmond and Juno Beach; applications filed **15 July 2026** with the Virginia SCC, the NCUC, the PSCSC, FERC and the NRC; expected close in the **second half of 2027**. The sequence has everything the beat requires — who wanted what, the exchange ratio as the leverage tell, and a merger filed **while the proceeding about who pays for the transmission is still being heard. Which strawman beat would it displace?** Honestly: **Operator Reality (Beat 11)**, which came back **THIN** above. The Deal is Character/Money family; Operator Reality is Atoms/Character. **Category re-verification for that swap is at the end of this section. The countervailing argument, stated because it is strong:** Dominion is **L7's** lead and steelman, and importing a Dominion-centred Deal into L10 risks re-opening a lecture the course has closed. The mitigation is that the *deal* is new material no prior pack owns, and that L10 would treat it as a present-tense corporate event, not as a who-pays argument. **Markup call.**

The Regulatory Collision. Scan: WEAK — one line plus a caveat. The live collisions in this territory (state moratoria vs. federal preemption; FERC co-location) are **L8's and L5's** by allocation, and the 2026 movement — Maine's veto, 14 states considering moratoriums, Michigan and West Virginia moving the other way — is moratorium-wave material that L8's pack claims. **Correctly left out.**

The Externality Swap. Scan: NO for this lecture, despite the beat running hot course-wide (8 deployments against a 4–5 band). The Reckoning's tradeoffs are temporal, not physical: build early and carry depreciation, or build late and lose the slot. That is the Steelman's asymmetry argument, already assigned at Beat 5, and running both would price the same swap twice. **Correctly left out.**

Steelman repeats. Structurally barred: a different defendant every deployment, and the rotation is exhausted at eight.

VERDICT PAIRING

Beat 11, Operator Reality — THIN. Strongest replacement: The Deal (NextEra–Dominion), per the scan above. Second option, and the one this pack marginally prefers: re-scope rather than swap. Operator Reality's weakness is the absence of a named human, and the fix is available inside the beat's own evidence rules — the Beat Menu explicitly permits sourcing from **job postings, staffing disclosures and trade-press interviews**, and a draft-stage pull of two or three named critical-facilities engineers from trade-press interviews would convert the beat from THIN to SUSTAINABLE without touching the grid. **Recommendation to markup: attempt the named-operator pull first; hold the Deal swap as the fallback if the pull fails.** Flagged as a **draft-stage research task**, not a pack failure.

Beat 10, The County — SUSTAINABLE, CONDITIONAL. No replacement needed if Open Item 6 confirms. If it does not, the strongest replacement from this scan is again **The Deal**, which is Character-family and would preserve the fourth minimum.

All other beats: SUSTAINABLE. No swap required.

MARKUP SUMMARY

One swap case is worth making and it is contingent: **The Deal (NextEra–Dominion) for Operator Reality**, and only if the named-operator pull fails at draft stage. Nine beats are confirmed as correctly left out, three of them (Taxonomy, Symbol Audit, Neighbor) because course-wide caps are fully and deliberately spent — and the declined Symbol Audit candidate is recorded above so that the cap's cost is visible rather than invisible.

Category re-verification, both configurations. As the strawman stands: **Atoms** — Beats 7, 8, 11. **Money** — Beats 4, 5 (Audit/Money), 9. **Politics** — Beats 2, 3, 6, 10. **Character** — Beats 10, 11. **Audit** — Beats 5, 8, 12. All minimums hold, including the proposed fourth. **With the Deal swapped in for Operator Reality:** **Atoms** — Beats 7, 8 (still ≥ 1). **Money** — Beats 4, 5, 9, and the Deal. **Politics** — Beats 2, 3, 6, 10. **Character** — Beat 10 and the Deal. **Audit** — 5, 8, 12. **All minimums still hold.** Hard caps unaffected in both configurations: Symbol Audit at 3, Neighbor at 3, Steelman defendants unique, Paper Trail class unique, Hearing Room the only scene, Irreversibility Ledger mid-course at zero. **No re-sequencing proposed. The pack proposes; markup and the Course Schema dispose.**

SECTION 4: MOVES PLAN VERIFICATION

4.1 — The Step Function: *Amazon moves the useful life the wrong way (February 2025)*

The assumption that must feel settled first. Between July 2022 and January 2025 the useful life of a server, at every large operator, moved in exactly one direction: **out**. Microsoft four→six (FY2023, ~\$3.7B benefit). Alphabet four→six and five→six (FY2023, \$3.9B realized). CoreWeave five→six (1 January 2023). Amazon five→six (January 2024, ~\$900M in one quarter). Meta to 5.5 years (1 January 2025, ~\$2.9B expected). **Five companies, one direction, roughly \$13 billion of disclosed or realized earnings benefit, thirty months.** The listener should be standing on the proposition that hardware lives only ever get longer, and that this is what a maturing industry looks like.

The number that breaks it. Amazon: six years to five, for a subset of servers and networking equipment, effective 1 January 2025, disclosed 6 February 2025 — a decrease in full-year 2025 operating income of approximately \$700 million, plus \$920 million of Q4 2024 accelerated depreciation on early retirements, costing a further ~\$600 million in 2025.

Full pedigree. *Value:* 6 years → 5 years; $-\$700\text{M} / \$920\text{M} / -\$600\text{M}$. *Unit:* years; U.S. dollars. *Stage:* **filed policy** (the life) and **company estimate** (the dollar effects), not outcome. *As-of:* effective 1 January 2025; disclosed 6 February 2025; realized nine-month 2025 effect confirmed in the 10-Q filed 31 October 2025 at **+\$889M D&A / -\$677M net income / -\$0.06 per diluted share**. *Filer:* Amazon.com, Inc., CIK 1018724. *Source:* Q4 2024 earnings release and call; FY2024 Form 10-K; Q3 2025 Form 10-Q.

Has the number moved since assignment? No. The figures are unchanged and have been confirmed by realization. **No Section 6 flag required.**

VERIFIED.

Markup alternate, noted beneath the verification as the disciplines require. The record surfaced a number that breaks a *larger* assumption harder: **the Federal Reserve Board's published data center abandonment rate of 0.33**. The settled assumption it breaks is not an accounting convention but the listener's entire mental model of an announcement — that a named, sited, dollar-valued project is a thing that will exist. The central bank's own model, published 17 December 2025 and maintained as a live dataset, says one in three never gets built, and treats that as the ordinary historical rate. **The assignment stands until markup moves it.** If it does move, note that the Step Function and the Timeline Snap would then sit in different beats (0.33 lives in Beat 6; February 2025 in Beat 1), which is healthier distribution, not worse.

4.2 — The Unit Conversion: **SKIP**, by assignment

Syllabus 2.0 assigns no conversion: *"skip — the Ledger is the conversion."* **Confirmed, and confirmed as correctly assigned.** Syllabus 2.0 Open Item 11 lists exactly four conversions contingent on pack arithmetic — L4's 49 GW, L5's 835 MW, L6's \$34B, L9's satellite multiple — and **L10 is not among them**. No arithmetic gate binds this lecture. **N/A. Nothing to pass or fail.** *One line for markup:* the temptation in this territory is to convert \$11.8 billion of transmission or \$792 of summer electricity into something held — and the pack recommends against it. The Ledger's force is that its units are **already** concrete: miles, acres, turbines, tons, votes, dollars on a bill. Converting them would translate the concrete

into the concrete.

4.3 — The Timeline Snap: *February 2025*

Verified, with the incentive state on each side.

The day before — 5 February 2025. Every large U.S. operator's server useful life had moved outward and only outward. An analyst modelling AWS margin had thirty months of directional consistency behind them. A CFO contemplating a shorter life faced an isolated earnings hit against a peer group that had all gone the other way. Meta had extended to 5.5 years seven days earlier. **The incentive was unambiguous and it pointed one way.**

The day after — 6 February 2025. The largest cloud operator in the world had shortened, publicly, at a cost to itself, and had named artificial intelligence as the reason. **For whom the incentive flipped:** for every other CFO, because “the pace of technology development” is now a documented, peer-established basis for shortening; for the short-seller, who acquired a defendant's own admission nine months before he needed it; for the auditor, who now has a peer data point in the opposite direction; and for the analyst, who can no longer assume the baseline only extends.

The rival date, presented with evidence as the discipline requires. 10 November 2025 — the Burry post — is the date the public incentives flipped, and a case can be made that it, not February, is the hinge: it is when the question left the accounting press, when CNBC and Bloomberg took it up, when NVIDIA issued an analyst memo, and when CoreWeave's CEO went on the record about A100 bookings and 95% H100 resale. **The pack's read: February 2025 is the better snap, because the Snap's job is to mark the day the thing changed, not the day the argument did.** November is when people noticed. February is when it happened, in a filing, at a cost. **The assignment stands.**

4.4 — The Verbatim: PASS

Assignment: a depreciation footnote, quoted flat.

Located and verified verbatim in a primary filing: Amazon's change-in-estimate language, appearing in the FY2024 Form 10-K and repeated in subsequent 10-Qs including the period ended 30 September 2025 —

“Effective January 1, 2025 we changed our estimate of the useful lives of a subset of our servers and networking equipment from six years to five years.”

Attribution for use inside the narrative: Amazon.com, Inc., in its annual report, filed February 2025. Locator: SEC EDGAR, AMZN CIK 1018724, FY2024 Form 10-K, significant-accounting-policies note; and Form 10-Q for the period ended 30 September 2025, Note 1. Reproduced across multiple independent secondary sources quoting the primary filing, and consistent across all of them.

A second, spoken instance also verified, from the earnings-call transcript of 6 February 2025 — the reason clause, in the CFO's own voice: **“an increased pace of technology development, particularly in the area of artificial intelligence and machine learning.”** (14 words.)

Copyright and deployment discipline — a coordination note the drafting AI must honour. The house rule is **one quote per source document**, and this lecture draws on three documents more than once: (a) **the Amazon Q4 2024 earnings-call transcript** is a source for Beat 1, Beat 3 and Beat 5; (b) **Cook's 27 May 2026 speech** is a source for Beat 8, Beat 9 and Beat 11; (c) **the Amazon 10-K/10-Q family**. **Recommended allocation, so no document is quoted twice:** the **10-K** carries The Verbatim (Beat 2, the Paper Trail — its native host per the Moves List); the **earnings-call transcript** carries Jassy's procurement sentence at **Beat 5**; the **Cook speech** carries the electricity-and-water sentence at **Beat 9**. Beats 1, 3, 8 and 11 use paraphrase with locators, which the pack has supplied for each.

Note on L6's unresolved item: L6's pack recorded **PARTIAL** on the CoreWeave S-1 depreciation note and armed a fallback. **L10 does not inherit that failure** — the gate is cleared on a different, cleaner primary document. The CoreWeave note remains a draft-stage pull if Nick wants the neocloud's own words instead: **CRWV CIK 1769628, FY2025 10-K, accession 0001769628-26-000104.**

4.5 — The As-Of Stamp: *the \$311M figure at its reporting date*

Confirmed, and the decay is the deployment. \$311 million, interest expense net, three months ended 30 September 2025, against \$104 million a year earlier — 3x. Reported by CoreWeave, Inc.; the Syllabus 1.0 must-hit value; correct

as stated.

Expected decay velocity: very fast, and it has already run. FY2025 full year **\$1,229M** (vs. \$361M — 3.4x); Q4 2025 alone **\$388M**; **Q1 2026 \$536M**; **Q2 2026 guided \$650–730M**. Within nine months of the anchor's quarter, the quarterly figure had roughly doubled and the guided figure had roughly doubled again.

This is the single best As-Of Stamp opportunity in the course, because the stamp's thematic job — signalling precision while quietly admitting the number will be wrong soon — is here demonstrated rather than asserted. The claim most likely to age is the one the course chose as an anchor, and it aged in three quarters. **Deploy the stamp on the anchor, at its date, and let the series that follows do the work.** Feeds Section 11.3.

4.6 — The Kicker: *the Ledger's final line — the last sentence of the course is the bill*

The assigned closing fact, verified to pedigree. The household bill: **\$792 for June through September 2026, up 10.5% from \$717 a year earlier and 39.4% above 2020** — estimate, National Energy Assistance Directors Association, July 2026. Supporting figure: **18.83 ¢/kWh**, U.S. average residential, April 2026, **+7.4% year over year**, EIA Form EIA-861M. **HUMAN-FLOOR: the Kicker delivers a fact, not a moral, and this one must be delivered flatter than anything else in the course.**

The two or three adjacent facts the closing passage will need around it. (1) **The counter-direction, so the closer is not a cheap shot:** EIA expects average U.S. **wholesale** prices to **fall** roughly **\$4/MWh to about \$45/MWh** this summer, while the annual residential price rises **5.7%** — the bill is not going up because fuel is expensive. (2) **The mechanism's dollar figure: \$6.2 billion** of December 2025 PJM capacity cost attributable to data centers **that have not been built**. (3) **The horizon: \$11.8 billion** of transmission approved on **12 February 2026**, in service **June 2032**, cost shared across 13 states and the District of Columbia.

Two alternates banked for markup. (a) **The forklift.** Close on the arithmetic of Beat 1: on 6 February 2025 the company shortened its servers by a year and lengthened its fulfillment-center heavy equipment from ten years to thirteen, and the forklifts were worth two hundred million dollars more than the servers cost. Stated flat, it is a Kicker; it is also funnier than the ending should be, which is why it is an alternate. (b) **The Fed's dial.** Close on the parameter: the central bank's published model of the buildout assumes a one-in-three abandonment rate and notes, in its own text, that the parameter would be expected to rise if expectations around returns to AI were to worsen. **The Federal Reserve built a dial for the bust and wrote down where it is currently set.** Both are strong; **the assignment stands** because only the bill is a cost someone actually paid.

4.7 — The Gesture: **NONE** — confirmed

Syllabus 2.0 assigns no Gesture: *“none. All three doors stay closed; the course ends.”* **This pack researched behind none of them and supplies no one-inch material.** Silicon fabrication, reactor engineering and training-run internals are untouched. The course's last hour opens no door — which is itself the strongest possible cross-sell, and the Moves List's own logic (the appetite is manufactured by the closed door) argues that ending with three doors closed and none opened is the correct final state. **Confirmed. Nothing to verify.** Section 10.4 carries the fence.

4.8 — The Handoff: **replaced by the Irreversibility Ledger**

Not a move deployment in this lecture. Material lives in Section 10.2.

SECTION 5: THE DOCUMENT DOSSIER

5.1 — The primary document: the depreciation schedule (Paper Trail class: accounting policy)

The document itself. Not a single filing but a **recurring note across five issuers' annual and quarterly reports**, in the same position in each: the significant-accounting-policies note and the property-and-equipment note, after the financial statements and before the exhibits. Its formal identity in each instance: *Note 1 — Description of Business and Summary of Significant Accounting Policies* (or its equivalent), plus the property-and-equipment table carrying the useful-life bands. **Where it lives:** SEC EDGAR. **Locators, all pullable at draft stage:** Microsoft CIK 789019 (FY2023 10-K, and the FY2022 Q4 call transcript of 26 July 2022 for the announcement); Alphabet CIK 1652044 (FY2023 10-K; Q4 2022

release of 2 February 2023; Q4 2023 release of 30 January 2024 for the realized effect); Meta CIK 1326801 (Q4 2024 release of 29 January 2025; FY2025 10-K); Amazon CIK 1018724 (FY2024 10-K filed 7 February 2025; Q2 and Q3 2025 10-Qs); CoreWeave CIK 1769628 (S-1 of 3 March 2025; FY2025 10-K filed 2 March 2026, accession **0001769628-26-000104**, document **crwv-20251231.htm**). **Procedural status: all effective, all audited, none appealed, none sealed.** There is no docket, no opposing party and no proceeding. **That is the document's defining feature and the beat should say so: this is the only Paper Trail in the course with no adversary.**

What it says. The operative provisions are three: the **method** (straight-line), the **asset class definition**, and the **useful life**. The class definitions are where the substance hides — CoreWeave's "technology equipment" is defined to include **computing, networking and storage components**, which is why a single estimate governs roughly **\$13 billion** of assets (at 30 June 2025) and, at year-end 2025, sits inside **\$30,557 million** of property and equipment, net. The lives, as filed: **Microsoft 6 years** (from 4, FY2023); **Alphabet 6 years** for servers and certain network equipment (from 4 and 5, FY2023); **Meta 5.5 years** for certain servers and network assets (1 January 2025); **Amazon 6 years, then 5 for a subset** (1 January 2025) — **and 13 years, from 10, for certain fulfillment-center heavy equipment** on the same date; **Oracle 6 years**, maintained; **CoreWeave 6 years** for technology equipment (from 5, 1 January 2023). Comparator: **Nebius, 3 to 10 years** for data center infrastructure and equipment. The change-in-estimate paragraph carries the quantified current-period effect, per ASC 250-10-50-4.

Who wrote it and why. Each issuer's corporate accounting function, on the output of an internal **useful-life study**, reviewed by the audit committee and concurred in by the independent registered public accounting firm. **The incentive is not uniform and the dossier must say so:** an extension raises reported operating income immediately and permanently; a shortening lowers it. Amazon wrote a shortening. **What the drafter gets if the document is believed:** a reported margin, and every multiple built on it.

What it forces and what it forbids. *Forces:* disclosure of the current-period effect whenever the estimate changes; quarterly re-disclosure once made; and, for a public company, **the impossibility of silent restatement** — which is the mechanism by which "is six years true?" became a permanently public question. *Forbids:* retroactive comparability. ASC 250 applies the revision prospectively and does not restate prior periods, so the year-over-year comparison an investor would use to catch the change is precisely the comparison the change breaks.

What happens when someone violates it. Nothing has been violated, by anyone, in any of these instances — and the honest statement of that is the dossier's most important line. There is no enforcement action, no restatement, no comment letter in the public record on any of the six changes. **CNBC, reporting the fraud characterization on 11 November 2025, stated it was unable to independently confirm the practice as characterized.** The nearest thing to a consequence is market repricing: **NVIDIA -14%, Palantir -24%, CoreWeave -40%** from the short disclosures to mid-2026, driven by broader capex-sustainability concerns as well as the accounting question.

The skeptical caveat — binding, or a press release with a docket number? Binding, and that is the problem. This is an audited disclosure in a filed annual report, subject to Section 302 and 906 certifications and to PCAOB AS 2501. **The critique is not that the document lies. It is that an honest, audited, certified document records an estimate whose reasonable range is wide enough to move billions of dollars of reported earnings, that the peer group moved together across thirty months, and that the studies underlying the estimates are not public at any of the six issuers.** Say exactly that and the beat cannot be accused of alleging fraud.

The document's history and fate. Amended six times across five companies in forty-two months (July 2022 – February 2025), always by change of estimate, never by restatement. **No FOIA applies — these are private companies' filings, not agency records.** No version has leaked, because no version is withheld. **The one genuinely hidden document in this dossier is the useful-life study itself**, at every issuer, and its absence is the file's honest gap.

5.2 — Returning documents (brief-reference material only)

- **The CoreWeave S-1 — lead: L6.** L10's single new fact: the six-year policy set on 1 January 2023 is now visible in a full-year audited result where **depreciation and amortization (\$2,454M) plus interest (\$1,229M) convert a 60% adjusted-EBITDA margin into a \$1,167M net loss.** Nothing else from the S-1.
- **"Winning the Race" / the AI Action Plan and EO 14365 — lead: L8,** which grants L10 "return-grade reference only." L10's new consequence: none required. **Recommend one clause at most, or omit.**
- **The interconnection agreement — lead: L4.** New consequence for L10: Sightline's May 2026 finding that **more than 50%** of the 2026 U.S. pipeline is still planned as grid-connected and only about **3%** as onsite-power-only —

meaning the queue L4 documented still sets the schedule for the bulk of the buildout, four lectures later.

- **The JLARC report, *Data Centers in Virginia* — lead: L1** (findings) and **L7** (ratepayer findings). L10 takes **no new material**; the “overbuild scenario named in Virginia” anchor is satisfied by 2026-dated docket testimony instead. See Section 6, D-F.
- **Schedule DCT / the Virginia large-load tariff and the Rider T-1 corpus — lead: L7, entire.** L10’s allocated use is **one sentence**: the counter-fences exist and are being litigated.

SECTION 6: THE NUMBER SPINE

The Figures & Claims Ledger contribution for Lecture 10. Tables are permitted in the research document and banned in published prose.

figure	unit	stage	as-of	author/filer	source	tier	notes
6 → 5 years	years	filed policy	eff. 1 Jan 2025; disc. 6 Feb 2025	Amazon	10-K/10-Q	ANCHOR	subset of servers & networking
−\$700M	USD, FY2025 op. income	company estimate	6 Feb 2025	Amazon	earnings release	STRUCTURAL	assets on BS at 31 Dec 2024
\$920M	USD	recorded	Q4 2024	Amazon	10-K	ANCHOR	accelerated depreciation, early retirements
−\$600M	USD, FY2025 op. income	company estimate	6 Feb 2025	Amazon	earnings release	STRUCTURAL	from the retirements
10 → 13 years	years	filed policy	eff. Jan 2025	Amazon	earnings call	ANCHOR	fulfillment-center heavy equipment
+ \$900M	USD, FY2025 op. income	company estimate	6 Feb 2025	Amazon	earnings call	STRUCTURAL	exceeds the server shortening
≈ −\$400M	USD, FY2025 op. income	company estimate	6 Feb 2025	Amazon	earnings call	STRUCTURAL	net aggregate
+ \$889M / −\$677M / −\$0.06	USD; USD; USD/dil. share	realized, 9M	30 Sep 2025	Amazon	10-Q	ANCHOR	realized effect of the change
4 → 6 years; ~\$3.7B	years; USD FY23 op. income	filed; company estimate	26 Jul 2022	Microsoft (Amy Hood)	earnings call	ANCHOR; STRUC-TURAL	largest single-step extension
4→6 / 5→6 years; \$3.9B / \$3.0B / \$0.24	years; USD; USD/dil. share	filed; realized	2 Feb 2023; 30 Jan 2024	Alphabet	earnings releases	ANCHOR	the realized benefit, disclosed
5.5 years; ~\$2.9B	years; USD 2025 depreciation	filed; company estimate	29 Jan 2025	Meta	earnings release	ANCHOR; STRUC-TURAL	extension, same quarter as Amazon’s cut
5 → 6 years	years	filed policy	eff. 1 Jan 2023	CoreWeave	S-1/10-K	ANCHOR	two years pre-IPO
\$176B; 26.9%; 20.8%	USD 2026–28; % 2028 earnings	personal estimate	10 Nov 2025	Michael Burry	X post	CONTESTED	ORCL, META named
\$311M vs \$104M	USD, interest expense net	reported	3M to 30 Sep 2025	CoreWeave	quarterly report	ANCHOR (must-hit)	3x YoY

figure	unit	stage	as-of	author/filer	source	tier	notes
\$1.229M vs \$361M	USD, FY	reported	FY2025	CoreWeave	8-K/EX-99.1	ANCHOR	3.4x YoY
\$536M; \$650–730M	USD	reported; guided	Q1 2026; Q2 2026	CoreWeave	8-K; call	VOLATILE	the decay curve
\$99.4B	USD backlog	contracted, not earned	31 Mar 2026	CoreWeave	8-K	VOLATILE	company-defined; see footnote 1
~3.5 GW vs >1 GW	GW capacity	contracted vs energized	31 Mar 2026	CoreWeave	8-K	VOLATILE	the gap, in one company
~\$725B	USD, 2026 capex	announced/guided	Q1 2026	MSFT/AMZN/GOOGL/META	earnings call	VOLATILE	~\$660–690B incl. Oracle at Feb 2026
~\$25B of ~\$190B	USD	company attribution	Q1 2026	Microsoft	earnings call	STRUCTURAL	component price inflation
>\$460B; \$244B	USD backlog	contracted	Q1 2026; Q4 2025	Alphabet; Amazon	releases	STRUCTURAL	the steelman's evidence
>\$1.5T	USD, data-center plans	announced, not realized	27 May 2026	Gov. Lisa D. Cook	Fed speech	VOLATILE	“only a small portion... realized”
>\$1T	USD, stock of plans	planning stage	Sep 2025	Dodge via FRB staff	FEDS 2025-109	STRUCTURAL	phantom-load caveat attaches
0.33	probability	historical parameter	2003–2025 sample	FRB staff	FEDS 2025-109	ANCHOR (as published)	0.30 for >\$250M; 0.46 commercial
11.1 / 15.0 mo; 9.4 / 19.8 mo	months	estimated	Dec 2025	FRB staff	FEDS 2025-109	STRUCTURAL	plan-to-start; start-to-completion
\$58B → \$179B → ~\$370B	USD annualized	imputed; nowcast	2024 → 2025 → 2026:Q2	FRB staff	FEDS 2025-109	STRUCTURAL	band ~\$240B–\$450B
\$357B – \$921B	USD, 2027	forecast, scenario-dependent	Dec 2025	FRB staff	FEDS 2025-109	CONTESTED	plan inflow 0.25x–2x
44%	% of investment domestic	authors' assumption	Dec 2025	FRB staff	FEDS 2025-109	CONTESTED	ballpark import adjustment
\$6.5B / 40% of \$16.4B; \$6.2B unbuilt	USD	monitor estimate	5 Jan 2026	Monitoring Analytics	report	STRUCTURAL	phantom load, priced
45% of \$47.2B	USD	monitor estimate	Jan 2026	Monitoring Analytics	report	STRUCTURAL	last three auctions
\$333.44 → \$325/MW-day	USD/MW-day (UCAP)	cleared at cap	Dec 2025; 14 Jul 2026	PJM	Inside Lines	VOLATILE	third consecutive cap
\$11.8B; 185 mi; 3,000 MW; Jun 2032	USD; miles; MW; date	approved, not built	12 Feb 2026	PJM board	RTEP release	ANCHOR	~\$4.8B Dominion zone
16 GW / ~5 GW / ~11 GW	GW	announced / under construction / announced-only	Feb–Apr 2026	Sightline Climate	Outlook	CONTESTED	disputed by SemiAnalysis, 21 Jun 2026

figure	unit	stage	as-of	author/filer	source	tier	notes
30–50%	% of 2026 pipeline	forecast	Feb–Apr 2026	Sightline Climate	Outlook	CONTESTED	range stays a range
80 GW → 100 GW; 43 → 56 GW	GW	backlog; slot reservations (options)	YE2025 → Q1 2026	GE Vernova	8-K	VOLATILE	disclosed separately, summed by market
€136B	EUR backlog	contracted	FY2025	Siemens Energy	company	STRUCTURAL	record
7–8 years	years lead time	quoted	2025–26	IEEFA / Bloomberg	report	STRUCTURAL	from 2–3 earlier in decade
\$792 / \$717 / +39.4% vs 2020	USD, Jun–Sep household	estimate	Jul 2026	NEADA	release	VOLATILE	HUMAN FLOOR
18.83 ¢/kWh, +7.4% YoY	cents/kWh	reported	Apr 2026	EIA	Form EIA-861M	VOLATILE	17.29¢ (2025 avg)
~\$45/MWh, ~\$4	USD/MWh wholesale	forecast	Summer 2026	EIA	STEO	VOLATILE	falls while retail rises
~5%	% increase, electricity and water	reported	27 May 2026	Gov. Cook	Fed speech	VOLATILE	past year
Aaa (2004) / AAA (2005), stable	rating	affirmed	most recent cycle	Moody's/Fitch/S&P	county summary	STRUCTURAL	no negative action
19% → 51%; \$1.3B / ~half	% base; USD	reported; proposed	FY2027	Loudoun County	budget	VOLATILE	commercial share; DC tax revenue
~\$5,800/yr	USD, residential	counterfactual estimate	2026	Mangum Economics for NVTC	report	CONTESTED	industry-authored
\$1.5B / 2 FY	USD	proposed	Mar 2026	Virginia Senate	budget	VOLATILE	exemption repeal
~80M miles; 85–97% dark	miles; %	historical	1996–2001; Jun 2001	multiple	retrospectives	CONTESTED	range stays a range
\$22.44B / \$12.39B	USD assets / debts	at filing	28 Jan 2002	Global Crossing	House Fin. Svcs. memo	ANCHOR	~\$600M/yr interest
20 GW vs 7.8 GW	GW	contracted request vs system peak	Mar 2026	PPL Electric	PA PUC settlement	STRUCTURAL	stranded-cost language on record

6.1 — Reconciliation against the must-hit anchors

No must-hit anchor value has been silently substituted anywhere in this pack. Six items require Nick's resolution.

- **D-A — CoreWeave interest expense, \$311M (3x YoY). Not a discrepancy; a decay.** *Anchor:* \$311M, 3x YoY. *Researched:* correct as a Q3 2025 figure; **now superseded as a current figure** — FY2025 \$1,229M (3.4x); Q1 2026 \$536M; Q2 2026 guided \$650–730M. *Both sources:* Syllabus 1.0 must-hit (July 2026 stack) and CoreWeave 8-K/EX-99.1 of 26 February 2026 and 7 May 2026. **Recommendation:** keep the anchor and deploy the As-Of Stamp on it. The figure's aging is the lecture's method. **Nick resolves.**
- **D-B — “5–7 yr hardware refresh vs. 30-yr infrastructure.”** *Anchor:* 5–7 years. *Researched:* the filed lives cluster at **5–6 years** (Amazon 5 for a subset, Meta 5.5, Microsoft/Alphabet/Oracle/CoreWeave 6); L2's pack carries the physical treadmill at five-to-seven. **These are two different quantities — an accounting estimate and a refresh cadence — and the anchor does not distinguish them.** *Recommendation:* keep 5–7 for the refresh cadence, and use the filed lives with their own labels where the accounting is the subject. **Do not blend. Nick resolves.**

- **D-C — Loudoun’s revenue share.** *Anchor (via L1/Syllabus 1.0):* ~\$1B/yr, ~ $\frac{1}{3}$ of local tax income. *Researched (FY2027 proposed budget):* **\$1.3 billion, nearly half of county tax revenue**; commercial share of the real-estate base **51%**; independent compilations at **38–40% of total county revenue**. **L1 owns the series and its bases.** *Recommendation:* L10 carries the FY2027 figure **with its base explicitly labeled**, or defers entirely to L1’s number. **Nick resolves.**
- **D-D — The 2001 dark-fiber share.** *Researched range:* **85%–97%**, with ~95% in June 2001 and ~90% by 2004 in different accounts. **No midpoint is fabricated anywhere in this pack.** *Recommendation:* deploy as “the great majority, by every contemporaneous estimate,” or quote one figure with its date and author attached. **Nick resolves.**
- **D-E — The Maine moratorium’s status.** **A live secondary-source error worth flagging, because a drafter could inherit it.** At least two 2026 outlets state or imply that **Maine enacted** the nation’s first statewide data center moratorium. **The primary record is unambiguous: LD 307 passed both chambers and was vetoed by Governor Janet Mills on 24 April 2026.** *Recommendation:* cite the governor’s official veto message, never the secondary characterization.
- **D-F — “Overbuild scenario named in Virginia.”** *Anchor source (implied):* JLARC / E3, December 2024. *Researched:* the anchor is now better satisfied by **2026-dated docket material** — Michael Goggin of Grid Strategies raising stranded-asset risk for Appalachian Voices; Loudoun’s Jonathan Zader on cost allocation; Amazon’s own witness on stranded-cost mitigation — **all inside a proceeding L7 owns.** *Recommendation:* L10 states the anchor in one sentence and points to L7’s corpus, rather than re-running the docket. **Nick resolves.**

6.2 — Capacity/energy audit

Every power figure in the spine is labeled. **Rates (capacity):** GW and MW throughout — 3,000 MW into Loudoun; ~3.5 GW contracted vs >1 GW active; 16 GW / 5 GW / 11 GW; 80–100 GW turbine backlog; 20 GW vs 7.8 GW; 110 GW / 260 GW portfolios. **Quantities (energy):** essentially absent from this lecture, which is itself notable — **the Reckoning is conducted almost entirely in dollars and rates, not in terawatt-hours.** **One blur found and flagged as course material:** the phrase “gigawatt backlog” as applied to turbine *slot reservation agreements* elides a rate (the machine’s nameplate) with a commercial option (the right to buy one). GE Vernova’s own disclosure keeps backlog and slot reservations on separate lines; **secondary coverage sums them into a single “GW under contract” figure.** The blur enters through the summary, not the filing. **Deployable as a Verbatim-adjacent moment; do not repeat the blur.**

6.3 — Phantom-load audit

Aggregate demand figures in this spine that could contain duplicate-request inflation, each requiring the caveat at first appearance: PJM’s forecast peak-load increases (5,400 MW for 2026/27; 5,250 MW for 2027/28 of which ~5,100 MW data-center; ~2,000 MW for 2028/29); PPL’s **20 GW** of contracted large loads against a **7.8 GW** peak; Sightline’s **190 GW / 16 GW** pipeline figures; and the **>\$1 trillion** stock of planning-stage projects. **The lecture’s advantage over every prior one is that it does not have to assert the phantom — the market monitor has priced it: \$6.2 billion of capacity cost for facilities that do not exist, and the Federal Reserve has published a 33% abandonment rate.** Attach the caveat once, at first appearance, and then let those two numbers carry it.

SECTION 7: THE SELLERS & THE OVERCLAIMS

*The Overclaim Register contribution for Lecture 10, and the Steelman’s ammunition depot. Syllabus 2.0 names **the Doomer** as this lecture’s seller and **HOLD OPEN** plus **FRAMING resolved** as the governing moves. The Doomer gets the fullest treatment. The rest of the field follows, because the closer’s territory contains every seller the course has met.*

7.1 — The Doomer (assigned seller), instance one: the depreciation charge

The claim as sold. Michael Burry, then-manager of Scion Asset Management, on X, **10 November 2025:** hyperscalers are understating depreciation by extending useful lives, which he characterizes as one of the more common frauds of the modern era; the estimated understatement is **\$176 billion across 2026–2028; Oracle will overstate earnings by 26.9% and Meta by 20.8% by 2028.** Companies named across the sequence: Microsoft, Meta, Alphabet, Amazon, Oracle. Venue: a public post to 1.8 million followers, followed by a **\$39-a-month newsletter launched 23 November 2025.**

What the seller gets if you believe it. In November 2025: the value of disclosed put positions against NVIDIA and Palantir

(reported notional ~\$1.1 billion — **notional, not exposure**). From 23 November 2025 onward: **subscriptions**. Cassandra Unchained passed **300,000 subscribers** by mid-July 2026, ranked #2 in Substack’s finance category. **[The \$113.7 million figure circulating in coverage is a theoretical ceiling assuming every subscriber pays; it is not revenue and the pack forbids using it as one. The honest framing: the critique of the AI trade is now a business with a larger addressable subscriber base than the fund it replaced — Scion’s reported AUM was ~\$155 million, implying ~\$3.1 million at a 2% fee.]** The register’s symmetry demands this paragraph exist, and it demands it be delivered without sneering: **Burry closed a fund he said no longer matched his understanding of value, and started publishing. That is a legitimate career. It is also a position.**

What’s real underneath, granted precisely. The extensions happened, on the dates and in the amounts above. The peer group moved in one direction for thirty months. **Roughly \$13 billion of disclosed or realized earnings benefit** across four issuers. Depreciation is prospective and non-restating, so the change is invisible to year-over-year comparison. The schedules are longer than the vendor’s product cadence. And — the strongest evidence for him, from the defendant’s own hand — **Amazon shortened, and named AI as the reason.**

What’s oversold, named exactly. (1) *The word.* “Fraud” describes a fully disclosed, audited, prospectively applied change in accounting estimate that cleared an audit committee and an independent auditor at every issuer. **CNBC reported it could not independently confirm the practice as characterized.** (2) *The premise.* Burry’s arithmetic requires a 2–3 year economic life. The contrary evidence is specific: A100s from 2020 fully booked in November 2025; 2022 H100s rebooked at **95%** of original price; Azure K80-class fleets in production nine years and P100s seven; TPUs seven-to-eight years old reported at full utilization. SemiAnalysis calls the 2–3 year premise **a fatal flaw**. (3) *The precision.* **26.9% and 20.8%** are two-decimal outputs of a model that has not been published. Buxton Helmsley — no friend of the hyperscalers, and the most rigorous public analyst of the question — **declines to adopt the dollar estimates** absent a closed-form model tying hardware vintages to amortization schedules at each named company. (4) *The framing of novelty.* The question was published by forensic analyst **Olga Usvyatsky in July 2024**, sixteen months earlier, without a position attached.

Narrator move check. Syllabus 2.0 governs with **HOLD OPEN**. **The record supports it, with a calibration note:** on the *fraud* characterization specifically, the evidence supports **STRIP** — remove the story, leave the documented behavior standing, never mock the people who found the framing persuasive. On the *underlying question* — is six years true? — **HOLD OPEN is exactly right**, and what would settle it is named and absent. **Recommendation to markup: run STRIP inside Beat 3 on the word, and HOLD OPEN across the lecture on the question.** Both are legal; the Style Guide permits multiple moves where the evidence differs.

7.2 — The Doomer, instance two: the collapse claims, audited on the same terms

“The 2026 pipeline is half-cancelled.” *Real:* Sightline’s project-level data — 16 GW slated, ~5 GW building, ~11 GW announced-only, cancellations from local opposition quadrupled in 2025, at least 25 projects cancelled, 9 directly tracked cancellations in the 2026 dataset by May. *Oversold:* **SemiAnalysis, 21 June 2026**, argues the dataset skews to speculative megaprojects most prone to slipping, that almost all flagged capacity is pre-construction, and that its own satellite-vision model finds the under-construction figures **off by multiples**. *What would settle it:* satellite imagery plus permit records, project by project. Both parties sell research. **Present both; the disagreement is the material.**

“It’s 2001 again.” *Real:* the structural rhyme is exact — a forecast (traffic doubling every 100 days; unconstrained load growth), debt-financed capacity ahead of demand, and a small number of firms carrying most of it. Allianz Research puts the capex-to-revenue divergence at **~46%** against **~32%** in 2001. *Oversold:* the asset. **Dark fiber did not obsolesce; it appreciated in usefulness while sitting still, and Level 3 bought Global Crossing’s network for \$3 billion in 2011 and is still running traffic over it. A 2026 GPU in a warehouse in 2032 has a newer part number available and a resale market that prices it accordingly.** Also oversold in the other direction: the anti-precedent cuts both ways, because the fiber’s eventual lighting took **five years and two bankruptcies**, and nobody who financed it was made whole.

“The grid collapses.” *Real:* three consecutive capacity auctions at the cap; a **6.8 GW** shortfall against the reserve-margin target in the 2028/2029 auction; roughly **525 MW** of new resources attracted. *Oversold:* per \$5’s standing calibration, **the collapse claim mistakes a queue problem for a generation problem**. PJM procured **149,182 MW UCAP** for 2028/2029 and is running a backstop auction in September 2026. **Narrator move: DISPATCH the collapse framing; HOLD OPEN the adequacy question.**

7.3 — The Hyperscaler

Claim as sold: ~\$725 billion of 2026 capex, and the compute constraint is demand. **Venue and date:** Q1 2026 earnings calls, 29–30 April 2026. **What they get:** the multiple, the narrative, and negotiating position with every utility in the footprint. **Real:** Google Cloud backlog >\$460B; AWS backlog \$244B with a 3.8-year weighted-average life; AWS at \$142B annualized growing 24%, the best in thirteen quarters; Microsoft AI at a \$37B run rate, +123%. **Oversold:** the stage-blur — guidance is not spend; ~\$25 billion of Microsoft's raise is component price inflation, not capacity; and backlog is a contracted expectation, not revenue. **Move:** GRANT-AND-WITHHOLD.

7.4 — The Utility

Claim as sold: the load is coming and the system must be built for it. **What they get:** rate-base approval on \$11.8 billion of transmission and a capacity market clearing at the cap. **Real:** PJM's forecast peak load rose ~5,400 MW, ~5,250 MW and ~2,000 MW across three consecutive auction cycles; the RTO fell short of its reliability requirement for the first time in the 2027/2028 auction. **Oversold:** the certainty of the load. **The utility's own regulator's monitor puts \$6.2 billion of the December 2025 capacity cost on data centers that do not exist, and PPL Electric wrote stranded-asset and cross-subsidization risk into a binding settlement in March 2026** — a utility conceding the point in a document its lawyers drafted. **Move:** DISCOUNT.

7.5 — The Neocloud Founder

Claim as sold: hyperscale reached; \$99.4 billion of backlog; six-year lives justified by observed re-booking. **Real:** the diversification is genuine (ten clients at ≥\$1B; Anthropic and Meta agreements); the refinancing genuinely lowered the cost of debt; the A100/H100 evidence is specific and checkable. **Oversold:** that adjusted EBITDA at a 60% margin describes a business with a \$46 million operating loss and \$1,229 million of interest; and that a backlog whose own footnote conditions it on delivery is visibility rather than obligation. **Move:** GRANT-AND-WITHHOLD. [L6 owns the full audit; L10 states the payoff only.]

7.6 — The official sector (institutional voice — the HOLD OPEN's anchor)

Governor Lisa D. Cook, Federal Reserve Board, at the Stanford Institute for Economic Policy Research, 27 May 2026. **This is the named official with a dated statement that Roster 1.0 required as the fallback if Burry moves to L6 — dependency D1, resolved.** *What she grants:* AI is a technology unlike any she has seen; productivity growth exceeds its pre-pandemic average; GDP growth is robust. *What she flags:* more than \$1.5 trillion of announced data-center plans, **only a small portion realized**; electricity and water prices each up about 5% in a year; construction specialty-trade wages up notably; and, on leverage — [PARAPHRASE] hyperscalers executing large investment-grade bond deals while smaller developers raise from private debt funds and asset-backed credit markets, with the increasing use of leverage to finance an emerging technology carrying risk and a sustained boom in debt issuance potentially becoming a financial-stability concern. *What she refuses:* the collapse framing — [PARAPHRASE] even under very ambitious investment and debt-issuance projections, she says, we would be unlikely to return to peak leverage levels observed before the Global Financial Crisis. **The official-sector voice grants the buildout, flags the leverage, and declines the crisis — which is precisely the HOLD OPEN, delivered by someone with no position.** *Adjacent political artifact, for contrast:* **Senators Warren, Blumenthal, Smith and Van Hollen pressing FSOC on 22 January 2026** to investigate more than \$1 trillion of projected AI-infrastructure debt. **Same subject, different altitude, different move: the Politician, selling urgency.**

7.7 — The steelman file: the hyperscaler's capex logic

(Assigned defendant; deployment 8 of 8; the full case is at Beat 5 and is not duplicated here. This file supplies the defendant's own best documents and the two facts that make the case hardest to answer.)

Best documents: Q1 2026 earnings releases and transcripts (Alphabet, Amazon, Microsoft, Meta); Amazon's Q3 2025 10-Q (~\$200 billion of unrecognized customer commitments; 3.8-year weighted-average life); Microsoft's FY2026 Q1 call (the fungible-fleet doctrine); SemiAnalysis, January 2026 (the technical defence).

The two hardest facts for the prosecution. (1) *The asymmetry.* Turbine slots are sold through 2030; interconnection runs four to seven years; **the underbuild loss is not recoverable on any schedule the buyer controls.** Under that asymmetry, the depreciation everyone is arguing about **is the option premium**, and paying it is rational even at a 33% abandonment rate. (2) *The empirical retirement record.* Nine-year K80 fleets, seven-year P100s, fully booked five-year-old A100s, 95%

resale on 2022 H100s. **If those are representative, the six-year schedule is conservative, not aggressive, and the entire critique inverts.**

The datum that would settle it, and its absence. Fleet-wide utilization and GPU retirement data are published by no operator, anywhere. [L2's plant and L3's question, collected: "whoever holds the equity when utilization data finally publishes." Name it; do not answer it.] Until it publishes, both cases are internally coherent on the same public record — which is the definition of a HOLD OPEN, and the reason this course refuses the bubble verdict.

7.8 — FRAMING, resolved

Named in Lecture 1 and sealed since: *is AI a bubble?* **The course refuses the question as posed, and the resolution is the closer's last analytical act.** *Why it is refused:* the question asks about future demand, and the only measurement that would answer it — utilization — is disclosed by nobody. *What replaces it:* **what has already been irreversibly paid, in what currency, on whose bill, and whether it can be un-spent.** All four clauses are answerable from the public record, and Section 10.2 answers them. **The verdict this lecture delivers is not about the bubble. It is that the fourth clause is no.**

SECTION 8: THE HUMAN FLOOR

[COMEDY OFF THROUGHOUT THIS SECTION AND IN EVERY BEAT THAT DRAWS ON IT.] *Documented individuals and documented households only. No composites. Where the record does not surface a person, the pack says so.*

8.1 — The honest structural finding, stated first

This lecture's machine touches households in aggregate, not at a property line. There is no fence-line resident in the Reckoning's territory, no well, no turbine yard, no rezoned parcel adjacent to a named family. The harms here are a **rate**, a **tax base**, and a **schedule**. **The pack will not manufacture a Neighbor to fill the shape of one**, and Section 3 records the Neighbor as correctly left out for exactly this reason. What follows is what the record does support: named individuals speaking for households, a quantified household burden, and the documented other side.

8.2 — The household bill, and the named voice for it

Mark Wolfe, Executive Director, National Energy Assistance Directors Association. **The documented claim, with numbers and dates:** the average U.S. household will spend **\$792 on electricity from June through September 2026**, against **\$717** the prior summer — **+10.5%** — and **39.4% above the 2020** seasonal figure, an increase NEADA calculates inflation explains only in part. **His verbatim words:** *"Families are getting hit from both sides."* [7 words. **Attribution: the executive director of the National Energy Assistance Directors Association, July 2026.**] **The mechanism he is describing, in his own framing [PARAPHRASE]:** households pay more per unit and then buy more units, because hotter weather makes indoor temperature a safety question rather than a comfort one.

The supporting household arithmetic, all federal: U.S. average residential rate **18.83 ¢/kWh in April 2026, +7.4% year over year; 17.29 ¢/kWh for 2025; +31.38% from 2020 to 2025; roughly 37% above 2020** at the 2026 projection. **Low-income households already spend more than 15% of income on energy. The other side, stated without smoothing:** EIA expects **wholesale prices to fall about \$4/MWh this summer.** The retail increase is capital recovery, not fuel — which is a defence of the fuel markets and an indictment of nothing in particular, and the beat must let it sit there.

8.3 — The Loudoun household, and the industry's own counterfactual

The documented exposure: in Loudoun County's proposed FY2027 budget, **data center revenue is nearly half of county tax revenue, at \$1.3 billion;** the commercial share of the real-estate tax base has moved from **19% to 51%;** the residential real property rate has fallen every year for a decade, **\$1.145 → \$0.805 per \$100.** **The counterfactual, published by the industry:** the **2026 Virginia Data Center Report**, prepared by **Mangum Economics** for the **Northern Virginia Technology Council**, calculates that without data center revenue Loudoun's residential property tax rates would have to **nearly double, adding about \$5,800 a year for the typical homeowner.** **The other side's documented response is the same document** — which is the unusual feature here and should be stated plainly: **the industry's own economists**

published the number that measures how exposed the households are. It is simultaneously the best defence of the industry's local value and the clearest statement of the dependency. **Present it as both. Do not choose.**

The procedural status: no rating action. **Moody's Aaa since 2004; Fitch and S&P AAA since 2005; outlook stable across all three at the most recent published cycle.** Moody's has published a **June 2026 sector report** naming data-center-driven credit risk for state and local governments generally. **A published sector warning is not a downgrade and the pack requires the distinction be made in the prose.**

8.4 — The worker

No named data center operator surfaced in this lecture's territory. The record offers surveys (Uptime 2024 and 2025; JLL 2025), salary compilations, and employer training-program names — no individual, no quote, no shift. **Flagged as the pack's one unmet human-floor obligation, and flagged as a draft-stage research task rather than a failure of the record:** the Beat Menu explicitly permits trade-press interviews as a source, and a targeted pull of two or three named critical-facilities engineers from data center trade press would close it. **Section 3's verdict pairing carries the recommendation. What can be said without a name, and should be:** the shift runs whether the thesis is right or wrong; the callout pays **\$150–\$300**; the differential is **\$5,000–\$14,000 a year**; the path to senior takes **seven to nine years**; and the people most likely to be holding the radio learned the trade on a Navy reactor plant or an Air Force prime power unit. **Cook's dated hedge is the honest official word on the fear:** [PARAPHRASE] we could be approaching the most significant reorganization of work in generations, AI-related job loss could precede job gains, and there is not yet conclusive evidence of this occurring. **Do not upgrade her hedge.**

8.5 — Hearing-transcript pulls (the corpus Beat 1 is reconstructed from)

Amazon.com, Inc., Q4 2024 earnings call, 6 February 2025, 5:00 p.m. ET. Speakers with as-of titles: **David Fildes**, then-VP Investor Relations; **Andrew R. Jassy**, President and CEO; **Brian T. Olsavsky**, then-SVP and CFO. Analysts, in order of recognition: **Mark Mahaney** (Evercore ISI), **Eric Sheridan** (Goldman Sachs), **Doug Anmuth** (J.P. Morgan), **Brian Nowak** (Morgan Stanley), **John Blackledge** (TD Cowen), **Michael Morton** (MoffettNathanson). One question per caller by operator instruction.

Continuous material available, sufficient to build the scene from documented words alone:

1. **The opening frame** — Fildes instructs listeners to have the press release in front of them and notes that comments reflect management's views as of 6 February 2025 only.
2. **Jassy's prepared remarks** — \$187.8B revenue, +10%; \$700M more FX headwind than guided; \$21.2B operating income, +61%; AWS at a \$115B run rate; the Trainium2 and Project Rainier passages.
3. **Olsavsky's financial update** — the margin paragraph containing the **200-basis-point** attribution to the 2024 server-life extension; the capital-investments paragraph (**\$26.3B** in Q4, described as reasonably representative of the 2025 rate); then the three change-of-estimate paragraphs in sequence, each quantified, ending on the **~\$400 million** aggregate.
4. **The Q&A** — Mahaney on capex and supply constraints; Jassy on chips, power and motherboards, and on procurement following demand signals; Sheridan on cost curves, with Jassy's Jevons argument on inference; Anmuth on AWS margins, with Olsavsky's "lumpy" framing; Nowak on robotics; Blackledge on delivery speed; Morton on the discovery funnel.
5. **The documented silence** — **no analyst asks about the useful-life changes.** The full Q&A is in the transcript and covers seven other subjects. **This absence is the scene's ending and it is fully evidenced.**

Locators for the draft-stage pull: Amazon Investor Relations (official transcript and replay, retained at least three months from the call); commercial transcript services (Motley Fool; Seeking Alpha, article 4755884) for the full text. **Secondary corpora available if the beat is re-scoped:** Microsoft FY2022 Q4 call (26 July 2022, Amy Hood on the four-to-six extension) and Microsoft FY2026 Q1 call (Nadella on the fungible fleet).

8.6 — Pack-dependency resolution at the floor

Roster 1.0's standing debt for this lecture — verbatim words with full context, as-of titles at dated moments, and hearing-transcript pulls — is delivered: Olsavsky and Jassy with as-of titles and a continuous corpus (8.5); Burry verbatim with venue, date and post identifier (Section 1, entry 43); Cook verbatim with venue and date (7.6); Wolfe verbatim with the household arithmetic around it (8.2); Mills verbatim from an official veto message (Section 1, entry 105);

Moody's verbatim from a sector report (Beat 10). **One obligation remains open and is flagged, not concealed: no named operator (8.4).**

SECTION 9: THE PEOPLE & THE CAST

9.1 — The Humans

Michael James Burry — born **19 June 1971**, San Jose, California. B.A., University of California, Los Angeles; **M.D., Vanderbilt University** — a licensed physician who left medicine for markets. Published a short thesis on Amazon.com in the **San Francisco Chronicle on 21 February 2000**, before the stock fell roughly 80% over the following year — **a detail he himself invoked in 2025 when announcing the newsletter, which is why it belongs in the pack: the author supplied his own precedent.** Founded **Scion Capital** in 2000, funded by an inheritance and family loans, naming it after Terry Brooks's *The Scions of Shannara*. Known for the pre-crisis subprime short. Called "Cassandra" by Warren Buffett in congressional testimony on the financial crisis — the source of the newsletter's name. **As-of titles at the dated moments this lecture touches:** *then-manager, Scion Asset Management* (through 13 November 2025); *writer, Cassandra Unchained* (from 23 November 2025). **October 2025:** letter to investors announcing Scion's closure and the return of outside capital, on the stated grounds that his understanding of value had long been out of sync with markets. **13 November 2025:** Scion's SEC registration terminated. **What he wanted:** to speak without the constraints of registered money management — his own stated reason, that mandatory SEC filings had been widely misinterpreted. **What he feared:** on the record, bubbles. **What he could enforce:** nothing. **What he actually did:** published the estimate, then published weekly. **Current status as of 22 July 2026:** newsletter at **300,000 subscribers**, ranked #2 in Substack's finance category; disclosed bearish positions across NVIDIA, Palantir, Applied Materials and a semiconductor ETF; last 13F (Q3 2025) showed four long positions. **[Roster instruction, binding: cast the critic, not his conclusion.]**

Brian T. Olsavsky — then-Senior Vice President and Chief Financial Officer, Amazon.com, Inc.; CFO since 2015; career Amazon finance. **The lecture's most consequential speaker.** Delivered both the 2024 extension's benefit (~\$900M, 1 February 2024) and the 2025 reversal (6 February 2025). **Wanted:** clean disclosure. **Could enforce:** the order of the three announcements. **Did:** quantified all three and gave the aggregate.

Andrew R. Jassy — President and CEO, Amazon.com, Inc. since July 2021; previously CEO of AWS. **The steelman's voice, on the same tape as the reversal.** Wanted the capex read as demand; feared the deceleration read; enforced the framing; delivered the procurement-discipline sentence and the Jevons argument on inference cost.

Lisa D. Cook — Governor, Federal Reserve Board (since 2022); **chair of the Board's Committee on Financial Stability;** economist of innovation and patents for two decades before the Fed; formerly at Michigan State, a National Fellow at the Hoover Institution, and director of the AEA Summer Program (where she introduced machine learning in 2018). **The official-sector HOLD OPEN, named and dated: 27 May 2026, Stanford SIEPR.** Cited in this pack for the announced-versus-realized distinction, the electricity-and-water price increase, the leverage flag, and the labor hedge.

Mark Wolfe — Executive Director, National Energy Assistance Directors Association. **The human floor's named voice.** **[Comedy off.]**

Scott Strazik — Chief Executive Officer, GE Vernova. The sold-out-through-2030 statement, 9 December 2025.

Alexander Parker — Chairman and CEO, Buxton Helmsley, a forensic-driven activist investment firm; led the Fossil restructuring campaign. Author of the 4 May 2026 framework that is the most rigorous public reading of the disclosures — **and which explicitly declines to adopt Burry's dollar estimates.** The analyst who audits both sides, which is exactly what §5's calibration requires and rarely gets.

Olga Usvyatsky — forensic accounting analyst (Deep Quarry). **Published on server useful lives in July 2024 and flagged the Amazon reversal on 11 February 2025 — sixteen months and five days ahead of the short thesis respectively.** Quoted by Bloomberg, 24 November 2025. **Her dates are the pack's best defence against the claim that the question was invented by a short-seller.**

Janet T. Mills — Governor of Maine; vetoed LD 307 on **24 April 2026;** at the time a candidate for the U.S. Senate. **Melanie Sachs** (D-Freeport) — LD 307's sponsor. **Jonathon Freeman** — Loudoun County Legislative Liaison, March 2026. **Nitin Agrawal** — CFO, CoreWeave. **Michael Intrator** — Chairman and CEO, CoreWeave **[L6's lead; one line only]**. **Satya Nadella, Sundar Pichai, Mark Zuckerberg, Amy Hood** — as-of titles at the dated moments cited.

9.2 — The Institutions

The Federal Reserve Board — motive: forecasting accuracy for monetary policy; no position in the outcome; **the only institution in this lecture that publishes both its estimate and its code**. Exposure: reputational, if the abandonment parameter proves wrong. **What it filed:** FEDS 2025-109; the FEDS Note of 17 July 2026; the May 2026 Financial Stability Report.

Monitoring Analytics — PJM's independent market monitor. **Motive: the only party in the electricity system structurally incentivized to deflate a forecast**. Exposure: none commercial. **What it filed:** the January 2026 attribution putting **\$6.2 billion** of capacity cost on unbuilt data centers.

Moody's Ratings — motive: fees across a growing issuer base; exposure: methodology risk in public, on both the corporate and municipal sides simultaneously. **What it published:** the June 2026 sector report; the standing Loudoun Aaa.

PJM Interconnection — **return; lead L4**. Founded 1927; 88,333 miles of transmission; 67 million people; 13 states and D.C. **New in L10 only:** the 12 February 2026 RTEP approval and the 14 July 2026 auction.

GE Vernova, Siemens Energy, Mitsubishi Heavy Industries — the three-firm oligopoly; combined market capitalization ~\$337 billion (March 2026); incentive: margin on scarcity; **constraint: a documented institutional memory of two prior busts, which is why they will not build speculative factory capacity**. Never villainy: they are behaving exactly as firms burned twice should behave.

Loudoun County, Virginia — **return; lead L1**. Motive, exposure and incentives fully documented at Beat 10.

CoreWeave, Inc. — **return; lead L6**. New material confined to the FY2025 and Q1 2026 results.

The audit committees and the independent registered public accounting firms — the invisible institution of this lecture. **They concurred in directionally opposite conclusions in the same quarter on substantially similar assets, and every one of those conclusions was defensible under the standard**. That is not a failure of auditing. It is the standard working as designed on an estimate whose reasonable range is wide.

9.3 — The Objects

The single-crystal first-row turbine blade. Grown, not cast, as one unbroken nickel superalloy crystal by a handful of suppliers; the qualification cycle runs years; casting capacity cannot be bought with a premium. **The smallest object in the ledger and the one that sets the schedule through 2030**.

The 525-kV HVDC underground cable and its two converter stations. 185 miles, Brunswick County to the Mosby substation in Loudoun; ~\$2.3 billion for the line, ~\$1.5 billion for the pair of converter stations; 3,000 MW; approved 12 February 2026; **in service June 2032**. Chosen underground because the overhead route could not be sited. **Chain of custody: PJM board vote → Dominion Energy Virginia construction → cost allocation across the PJM footprint**. **Failure mode: none physical — the failure mode is that the load does not arrive and the asset performs perfectly for forty years anyway**.

The fulfillment-center heavy equipment. Forklifts, conveyors, sortation machinery. Useful life extended from **10 years to 13** on 6 February 2025, worth **+\$900 million** in 2025. **The object that paid for the servers**.

The depreciation schedule itself, treated as the Document anchor — full dossier at Section 5.

9.4 — Recurring-cast discipline

Lead treatments owned here (later lectures need not rebuild — though none follow): the depreciation schedule entire; Burry entire; the Amazon Q4 2024 call; the Fed's abandonment-rate model; the 2001 fiber rhyme with its anti-precedent; the Irreversibility Ledger. **Return-grade only, with the owning lecture named:** CoreWeave (**L6**), PJM (**L4**), Loudoun County (**L1**), Dominion (**L7**), the interconnection agreement (**L4**), the AI Action Plan and EO 14365 (**L8**), JLARC (**L1/L7**), the moratorium wave (**L8**), NVIDIA's rack roadmap (**L2**), TMI/Crane and the Microsoft–Constellation PPA (**L5**), orbital anything (**L9**).

SECTION 10: CASCADE EDGES & BOUNDARY DISCIPLINE

Cascade edge, restated: Inherits: everything, as costs. · **Binds at:** irreversibility. · **Who pays:** the ledger's whole content.
· **Manufactures:** nothing.

10.1 — The inherited problem, re-established with fresh specifics

What L9 hands over, in its own pack's words: an escape route fully priced and not closing; the discovery that **the escape was priced before the radiator was built, that the application was the asset, and that the market rewarded the filing** — and therefore that every number in the preceding eight hours needs auditing.

Fresh specifics L10 supplies to re-establish it for the sampler without recapping for the completist — none of which any prior pack owns:

1. **The Federal Reserve's abandonment parameter, 0.33** — the announcement-is-not-a-building problem, quantified by the central bank rather than inferred from an orbital filing.
2. **\$6.2 billion of capacity cost for data centers that do not exist** — Monitoring Analytics, 5 January 2026. The market-rewards-the-filing dynamic, in a regulated market, with a dollar figure attached by the referee.
3. **The Sightline/SemiAnalysis dispute of June 2026** — two firms with satellites and databases disagreeing by multiples about how many buildings are physically under construction, in the United States, in 2026.
4. **Cook's "\$1.5 trillion announced, only a small portion realized"** — the same distinction, from the official sector, dated 27 May 2026.

What the previous packs already own and L10 must not duplicate: L9's Project Sunrise filing, the deployable radiator, Johnston, the orbital taxonomy, the 3.18x conversion, the Starship record, the alumina and debris records [**except as ledger entries 15–16 below, which L9 explicitly exported**].

10.2 — THE IRREVERSIBILITY LEDGER INVENTORY (*replaces the Handoff for Lecture 10*)

*Every documented irreversible expenditure across the course's territory, in the order the cascade spent them, each with date, magnitude, unit and source. Entries drawn from prior packs are marked with their owning lecture and are carried at that pack's values — **not re-researched**, per the banking instructions in L8 and L9.*

I. GEOGRAPHY AND LAND

1. **Farmland converted, Loudoun County** — roughly **49 million square feet** of data center on the ground with ~6 million more in development (December 2025); land at **\$2–6 million per acre**; a 97-acre parcel at **\$615 million** on 3 November 2025. *Unit: square feet, acres, dollars. Source: L1's pack. [L1 — one line only.]*
2. **Land converted, Memphis/Southaven** — a former power plant site plus **114 acres** (July 2025) and an adjacent **104 acres** carrying an **810,258-square-foot** warehouse (December 2025). *Source: L8's pack, banked entry 3.*
3. **Rights-of-way, PJM footprint** — **185 miles** of 525-kV underground corridor plus **221 miles** of 765-kV in central Pennsylvania and roughly **300 miles** of 765-kV in central Ohio, all approved **12 February 2026**. *Unit: route-miles. Source: PJM RTEP release.*

II. ELECTRONICS AND STEEL

4. **Transmission capital committed** — **\$11.8 billion** of baseline projects approved in a single board vote, **12 February 2026**, selected from 134 proposals by 19 entities; **~\$4.8 billion** in the Dominion zone; **in service 2031–2032**; **costs shared across 13 states and the District of Columbia**. Prior-year comparators: \$5.9 billion (2024), \$6.6 billion (2023). *Source: PJM; Utility Dive; DCD. The single largest entry in the ledger.*
5. **Converter stations** — two HVDC stations at roughly **\$1.5 billion**, with no alternative use. *Source: PJM/Dominion project materials.*
6. **Gas turbines installed and permitted** — **59 installed** across two states; **41 permanently permitted on 10 March 2026**, on a site purchased for the purpose, with a decades-long asset life. *Source: L8's pack, banked entry 1.*
7. **Turbine slots purchased** — GE Vernova **slot reservation agreements at 56 GW** (Q1 2026, from 43 GW), sold in a market booked through 2030; fees paid in advance, resale at market. *Source: GE Vernova Q1 2026.*
8. **Capacity procured against forecast load** — **\$6.2 billion** of the December 2025 auction's cost attributable to data centers **not yet built**; **45% of \$47.2 billion** across three auctions attributable to data-center forecasts beyond existing facilities. *Source: Monitoring Analytics, 5 January 2026. Recovered, not recoverable.*

III. WATER AND AIR

9. **A greywater facility with a groundbreaking and no construction** — *L8's inverse entry, and the ledger's most useful one: a promise made irreversibly before the thing exists. Source: L8's pack, banked entry 6.*
10. **Groundwater and evaporative draw** — documented at facility level in L3's and L8's territory. **[L3 owns water entire; one line, cross-referenced, no figures imported.]**
11. **Aluminum oxide deposited in the stratosphere** — approximately **17 metric tons in 2022 alone**; catalytic rather than consumed; unmetered; a **design output** of five-year satellite lives, not an accident. *Source: L9's pack, banked export 1.*
12. **Catalogued orbital debris** — **11,160 objects**, including **2,666 ASAT** and **774 collision** fragments, none of which returns on a schedule anyone controls. *Source: L9's pack, banked export 2.*

IV. PUBLIC MONEY AND TAX STRUCTURE

13. **Virginia's FY2025 data center tax expenditure** — **\$1.6 billion, spent**, against a statutory threshold written for a different decade. *Source: L8's pack, banked entry 5.*
14. **Electrolux incentives** — **\$188.3 million, unrecoverable by contract, 2010–2019. The cleanest irreversibility entry in the course, because the irreversibility is written into the document as an absent clause.** *Source: L8's pack, banked entry 2.*
15. **A county tax structure restructured** — Loudoun's commercial share of the real-estate base **19% → 51%**; data center revenue at **~\$1.3 billion, nearly half of county tax revenue** in the FY2027 proposal; the residential rate cut every year for a decade, **\$1.145 → \$0.805 per \$100**, and therefore **politically irreversible in the opposite direction.** *Source: Loudoun County budget documents.*

V. LEGITIMACY

16. **A local process exhausted** — a **6–1 board vote on 15 December 2025**, and a federal executive intervening against a citizen suit under a federal environmental statute. **Institutional trust is not refundable.** *Source: L8's pack, banked entry 4.*
17. **A state legislature's first attempt, spent** — **LD 307** passed both chambers of the Maine Legislature and was **vetoed on 24 April 2026** to preserve an exemption for a **\$550 million** project in the Town of Jay. **On 18 June 2026 the company backed out and the Jay project was placed on hold indefinitely.** *Source: Maine governor's official veto message; Maine Morning Star, 18 June 2026. The nation's first statewide moratorium was spent on a building that does not exist.*
18. **A rating rationale put at issue** — Loudoun's triple-A rests in part on **"very low revenue volatility"**; **Moody's own June 2026 sector report** names data-center-driven credit risk for state and local governments. **No downgrade, no watch, no negative outlook — the entry is the exposure, not an action, and the prose must say so.**
19. **A citizen's vocabulary, entered into the federal record** — **Nickolai Bakken's petition**, invoking **"irreversible and irretrievable commitments of resources"** by name, in a federal data-center docket, **March 2026.** *Source: L9's pack, banked export 4. [VERIFICATION FLAG: carried at L9's stated value; the docket number and filing date must be re-pulled before any prose deployment. If it verifies, it is the closer's strongest single artifact — a private citizen used the course's closing vocabulary before the course did.]*

VI. THE ACCOUNTING ENTRY THAT CLOSES THE LOOP

20. **\$920 million of accelerated depreciation**, recorded in the quarter ended **31 December 2024**, for equipment retired early. **The sound of an irreversible commitment being written off in the only column where writing it off is possible.** *Source: Amazon FY2024 10-K.*

Tally discipline for the drafting AI. The Ledger is not a total. **Do not sum these.** The units do not commute — dollars, acres, miles, turbines, tons, votes and one withdrawn project cannot be added, and the attempt would be the exact false precision this course exists to audit. **The Ledger's form is enumeration in cascade order, ending on the bill.**

10.3 — Refresh-safe handoffs

Lecture 10 manufactures nothing, so there is no outbound handoff to protect. The inbound seam from L9 was verified in that pack as **structural, not figure-dependent** — the escape has been priced and does not close; the audit is due. **Confirmed safe for the 2027 refresh.**

One refresh hazard inside this lecture, flagged. The Ledger's *entries* are heavily VOLATILE — auction results, budget shares, backlog figures, subscriber counts and interest expense will all be wrong by 2027. **The Ledger's structure — enumeration in cascade order under four irreversibility tests — is invariant.** Per §9's modularity rule, **the 2027**

refresh should rebuild the entries and preserve the tests. The four tests (no redeployment; unrecoverable by contract; physical state unrestorable; institutional state unrestorable) are this pack's contribution to the edition-update model and should be treated as the durable artifact.

10.4 — The boundary doors: the fence, confirmed

No Gesture is assigned; no door is opened; no research behind any door appears in this pack.

- **Silicon fabrication — not pressed.** The lecture's territory touches chip *pricing* (memory and storage up roughly fivefold and threefold since Q1 2025) and chip *lifetime as an accounting estimate*. **Neither is fabrication.** Permitted: what the chip cost, how long it is assumed to last, and what it resold for. Forbidden: how it is made. (*Owned by the October course.*)
- **Reactor engineering — not pressed at all.** Correctly absent. (*Owned by the January–February course.*)
- **Training-run internals — not pressed.** The lecture discusses what the hardware *cost* and how long it is *booked for*, never what it computes. **Pack dependency on Syllabus 2.0 Open Item 9 is resolved: L10 carries no deployment contingent on that call and is unaffected by either resolution.**

One unassigned fence the material presses on, flagged for the Course Schema. Accounting standard-setting itself. This lecture cites ASC 360-10-35, ASC 250-10-45-17, ASC 250-10-50-4 and PCAOB AS 2501, and the temptation to explain *how* GAAP is made — the FASB's due process, the exposure-draft cycle, the codification's structure — is real and would be a lecture of its own. **There is no sanctioned Gesture for it, which means the lecture must simply stay outside it. Permitted: what the standard requires and what it permits. Forbidden: how the standard came to say that.** (*L9's pack flagged launch-vehicle engineering as a fourth unassigned door; this is the fifth. Two consecutive packs surfacing unassigned fences is a finding for the Course Schema: the Moves List's three doors may be under-specified for the closer's territory.*)

10.5 — Cross-lecture consistency notes

L10 claims (nothing later needs it, but the record should close clean): the depreciation schedule across all instances; the Amazon Q4 2024 call; Burry entire; Cook and the official-sector voice; the Fed's abandonment model; the 2001 fiber rhyme and its anti-precedent; the turbine order book's 2025–26 state; the \$6.2 billion attribution; the \$11.8 billion RTEP; NEADA's household figure; Loudoun's Moody's coda; the Maine veto and the Jay withdrawal; the Irreversibility Ledger and its four tests.

L10 must not claim, verified line by line against the prior packs' own ledgers: **L1** — MAE-East, Loudoun's origin and fiscal machine, Rizer, JLARC's headline findings, the 1,050 TWh Japan, the ~50-FTE plant. **L2** — the rack, crane day, the density ladder, Huang, the roadmap, 800 VDC. **L3** — the ~15 kW air ceiling, cold plates, PUE/WUE, water, the Morrisises, the cooling taxonomy. **L4** — the queue, the three studies, Order 2023, the transformer, PJM's queue anatomy, Wilson. **L5** — TMI/Crane, the Microsoft–Constellation PPA, co-location, Dominguez, the nuclear tallies. **L6** — CoreWeave's origin, the S-1, the H100-as-collateral, GPU-hour pricing, Intrator, the circularity critique, the neocloud taxonomy, Chanos. **L7** — the rate case, the \$4.3B, the 267%, Warrenton, Martin & Peskoe, Francis, Schedule DCT and docket 24-508, Rider T-1 and its July 2026 hearing, the moratorium tally as a state-level series, Bowring's attribution figures, Dominion's steelman. **L8** — Memphis and Southaven entire, Stargate, Abilene, *Winning the Race* and EO 14365, the three-altitude frame, the jobs math, New York EO 62. **L9** — the radiator, Project Sunrise, Johnston, the orbital taxonomy, the Starship record, the 3.18x conversion.

Collections recorded, so the Course Schema can retire the debts: L1's rating-agency reservation (**collected**, Beat 10); L2's utilization-data plant (**collected**, 7.7); L3's equity-holder question (**collected**, 7.7); L5's duration-mismatch plant (**collected**, Beat 2 and Beat 12); L6's \$311M/useful-life/verdict-refusal reservations (**collected**, Beats 3, 4, 12); L8's six banked Ledger entries (**collected**, 10.2 entries 2, 6, 9, 13, 14, 16); L9's four banked exports (**collected**, 10.2 entries 11, 12, 19, and the 2023 FCC holding noted below); L1's FRAMING seal (**collected and resolved**, 7.8). **One L9 export not used:** the 2023 court holding on FCC mitigation sufficiency — **it is orbital-regulatory precedent and does not fit the Ledger's four tests. Recorded as declined rather than dropped.**

SECTION 11: PRESENT-DAY STATUS & DECAY WATCH

Status as of 22 July 2026.

11.1 — Live status of every deal, docket and project in this lecture

The depreciation schedules. All six changes effective and audited. **No enforcement action, comment letter, restatement or proceeding in the public record on any of them.** Next milestone: **FY2026 Q2 filings, late July–early August 2026 [EXPECTED]**, and then the **FY2026 10-K filing season, late January–April 2027**, which Buxton Helmsley identifies as the largest single body of evidence on hyperscaler depreciation policy yet to be released. **Watch specifically: whether any issuer follows Amazon in shortening.**

CoreWeave. Q1 2026 reported 7 May 2026. **Next milestone: Q2 2026 results, expected early August 2026 [EXPECTED — company]**, carrying the guided **\$650–730 million** interest expense. Guidance standing: FY2026 revenue \$12–13B; capex \$31–35B; exit-2026 ARR \$18–19B; exit-2027 ARR >\$30B; **8 GW by 2030** per the company’s own framing.

Burry / Cassandra Unchained. Active; ~300,000 subscribers as of mid-July 2026; Scion deregistered since 13 November 2025, so **no further 13F disclosures will appear** — a structural fact worth stating, because it means the positions behind the argument are now voluntary disclosures only.

PJM. 2028/2029 BRA cleared **14 July 2026** at the ~\$325/MW-day cap. **Next milestones: a backstop reliability auction in September 2026 [EXPECTED — PJM]**, a further **Base Residual Auction in December 2026** with the cap and floor extended to it, and continuing work on a “connect and manage” framework for large loads.

PJM 2025 RTEP Window 1. Approved 12 February 2026. **In service dates 2031–2032 [EXPECTED]**. Siting, permitting and construction all ahead.

NextEra–Dominion. Merger agreement signed 15 May 2026; applications filed **15 July 2026** with the Virginia SCC, NCUC, PSCSC, FERC and NRC. **Expected close: second half of 2027 [EXPECTED — the companies]**, elsewhere framed as 12–18 months from announcement. **Shareholder votes and five regulatory approvals all pending.**

Maine. LD 307 vetoed 24 April 2026; **LD 713 signed**, excluding data centers from certain tax incentive programs; Governor Mills has stated she will establish a study commission by executive order. **The Jay project is on hold indefinitely as of 18 June 2026.** Other Maine proposals live in Sanford, Limestone (former Loring Air Force Base) and offshore Eastport.

Virginia. The Senate’s FY2027 proposal to repeal the sales and use tax exemption (**\$1.5 billion over two fiscal years**) — status to be pinned at draft stage. The transmission cost-allocation proceeding is **L7’s**, with a July 2026 hearing record.

Loudoun County. FY2027 budget adopted; **Aaa/AAA affirmed, outlook stable, no rating action pending.**

Gas turbines. GE Vernova targeting **≥110 GW** of combined backlog and slot reservations by **year-end 2026 [EXPECTED — company]**; supply reported booked through 2030.

11.2 — Pending events with dates

Date	Event	Announcing party	Confidence
Early Aug 2026	CoreWeave Q2 2026 results, incl. \$650–730M interest expense	CoreWeave	High (scheduled)
Late Jul–Aug 2026	Hyperscaler Q2 2026 / FY-quarter filings	Companies	High
Sept 2026	PJM backstop reliability auction	PJM	Medium (design pending)
Dec 2026	PJM Base Residual Auction, cap/floor extended	PJM	High
YE 2026	GE Vernova ≥110 GW backlog + slot reservations	GE Vernova	Medium (target)
YE 2026	Turbine reservations sold out through 2030	GE Vernova (Strazik)	Medium

Date	Event	Announcing party	Confidence
1 Feb 2027	Maine Data Center Coordination Council report — now moot; the council was in the vetoed bill	Maine Legislature (vetoed)	N/A — flagged so no drafter carries a dead date
Jan–Apr 2027	FY2026 10-K filing season — the depreciation evidence base	Issuers	High
2H 2027	NextEra–Dominion expected close	The companies	Medium (5 approvals pending)
Jun 2032	525-kV Loudoun backbone in service	PJM / Dominion	Low-medium (6 years out)

11.3 — The decay register

Expected to be wrong first, and fastest. (a) *CoreWeave's interest expense and backlog* — repricing quarterly; the anchor already superseded three times. (b) *Burly's subscriber count and disclosed positions* — no filing obligation, so this decays without a public trail. (c) *Hyperscaler capex guidance* — three of four raised mid-year in 2026; assume revision every quarter. (d) *PJM clearing prices* — auction cadence, with the cap/floor mechanism itself expiring. (e) *EIA rate and bill figures* — monthly and seasonal. (f) *Sightline/SemiAnalysis pipeline figures* — quarterly, and contested at publication.

Moving at legislative-session speed. Moratorium tallies (14 states considering, per Moody's citing NCSL); Virginia's exemption; Maine's post-veto commission; Loudoun's budget shares.

Moving at interconnection-queue and construction speed (slow, and therefore refresh-durable). Transmission in-service dates; turbine lead times; the 2031–2032 RTEP horizon.

ANCHOR-tier and non-decaying. The filed useful-life changes and their dates; the \$920 million charge; the 2001 record; the Fed's published parameters (which will be re-estimated, not falsified); the four irreversibility tests.

Highest-risk single figure for the 2027 refresh: the **must-hit \$311M**, which is already three quarters stale as a current figure and is retained deliberately as a dated one. **The As-Of Stamp is the mitigation and it is the reason the assignment should not change.**

11.4 — What just changed (last ~90 days — the syllabus stack predates all of it)

1. **PJM's 2028/2029 auction cleared at the cap on 14 July 2026** — third consecutive cap, 6.8 GW short of the reserve target, ~525 MW of new resources. **Eight days before the research date.**
2. **NextEra and Dominion filed for merger approval on 15 July 2026** with five regulators. **Seven days before.**
3. **A Federal Reserve FEDS Note on the AI buildout published 17 July 2026.** **Five days before.**
4. **Moody's sector report on data-center credit risk to state and local governments, ~24 June 2026.**
5. **SemiAnalysis's 21 June 2026 rebuttal of the cancellation narrative** — the doomer-direction audit, with satellites.
6. **The Jay, Maine project withdrew on 18 June 2026**, after the veto cast to protect it.
7. **Cook's Stanford speech, 27 May 2026** — the official-sector announced-versus-realized framing.
8. **CoreWeave's Q1 2026 results, 7 May 2026** — interest expense at \$536M, backlog at \$99.4B.
9. **Cassandra Unchained passed 300,000 subscribers**, reported within the last week.

All nine post-date Syllabus 2.0 (July 2026 stack) or sit at its edge. A draft built on the anchors alone would miss every one.

11.5 — What is still hidden

- **The useful-life studies.** Not one of the six issuers publishes the methodology, the retirement data or the external evidence base behind its estimate. **The most consequential number in the sector is supported by a document nobody outside the company and its auditor has read.**
- **Fleet-wide utilization and GPU retirement data. Published by no operator, anywhere. [L2's plant.]** This is the datum that would settle the HOLD OPEN, and its absence is not an oversight — it is a competitive disclosure decision made independently by every operator in the same direction.

- **Burry's model.** The \$176 billion, the 26.9% and the 20.8% are outputs of an unpublished calculation. Buxton Helmsley declines to adopt them for exactly that reason.
- **Sightline Climate's full dataset** — client-only; the public Outlook carries headline figures. SemiAnalysis's vision model is likewise proprietary. **Two firms disputing the physical state of American construction, both behind paywalls.**
- **Slot reservation agreement terms** — cancellation, transfer, forfeiture. Disclosed as an aggregate GW figure, never as terms.
- **The Q4 2024 Amazon useful-life study's contents,** specifically — the study that produced the Step Function.
- **The pack's own open item:** no named data center operator surfaced for Beat 11 (Section 8.4).

None of these gaps is padded over anywhere in this pack. The refusal to disclose is itself course material, and in this lecture it is the material.

SECTION 12: SOURCE INVENTORY

Primary sources first within each cluster. For secondary sources, the primary material synthesized is noted. For company sources, what the company gets if believed is noted.

SECURITIES FILINGS AND COMPANY DISCLOSURES (PRIMARY)

1. Amazon.com, Inc. — Form 10-K, FY2024 — filed 7 Feb 2025 — SEC EDGAR, CIK 1018724 — **The Verbatim's host: the six-to-five useful-life language and the \$920M accelerated-depreciation disclosure.**
2. Amazon.com, Inc. — Form 10-Q, period ended 30 Sep 2025 — 31 Oct 2025 — EDGAR — the realized nine-month effect (+\$889M D&A, −\$677M net income, −\$0.06/sh) and the ~\$200B unrecognized-commitment / 3.8-year weighted-average-life disclosures.
3. Amazon.com, Inc. — Q4 2024 earnings call transcript — 6 Feb 2025 — company IR; Motley Fool; Seeking Alpha (art. 4755884) — **the Hearing Room corpus entire.**
4. Amazon.com, Inc. — Q4 2023 earnings release and call — 1 Feb 2024 — the five-to-six extension and the ~\$900M Q1 2024 benefit.
5. Microsoft Corporation — FY2022 Q4 earnings call — 26 Jul 2022 — company IR — Amy Hood on four-to-six and ~\$3.7B.
6. Microsoft Corporation — FY2026 Q1 earnings call — company IR — **the “fungible fleet” doctrine, verbatim.**
7. Alphabet Inc. — Q4 2022 earnings release — 2 Feb 2023 — the ~\$3.4B expected reduction; and **Q4 2023 release, 30 Jan 2024** — the \$3.9B / \$3.0B / \$0.24 realized effect.
8. Meta Platforms, Inc. — Q4 2024 earnings release — 29 Jan 2025 — the 5.5-year extension and ~\$2.9B; FY2025 10-K for the depreciation-growth attribution.
9. CoreWeave, Inc. — Form 8-K / EX-99.1, Q4 and FY2025 results — 26 Feb 2026 — EDGAR CIK 1769628 — **every FY2025 figure in this pack.**
10. CoreWeave, Inc. — Form 10-K, FY2025 — 2 Mar 2026 — accession 0001769628-26-000104, doc crwv-20251231.htm — the depreciation policy and property-and-equipment notes; the redeployment risk factor.
11. CoreWeave, Inc. — Q1 2026 results (8-K) and Form 10-Q — 7 May 2026 — doc crwv-20260331.htm — interest expense \$536M; backlog \$99.4B; DDTL 4.0; the NVIDIA equity investment.
12. CoreWeave, Inc. — Q1 2026 earnings call transcript — 7 May 2026 — Intrator's “reached hyperscale”; the Q2 interest-expense guidance.
13. GE Vernova Inc. — Form 8-K, Q4 and FY2025 results — EDGAR CIK 1996810 — backlog and slot-reservation figures, disclosed on separate lines.
14. GE Vernova Inc. — Q1 2026 earnings materials — the 83→100 GW, 43→56 GW and \$2.4B data-center electrification figures.
15. Dominion Energy, Inc. / NextEra Energy, Inc. — Forms 425 — May–July 2026 — EDGAR CIK 715957 — the merger agreement terms, the employee and customer communications, and the 15 July 2026 application filings.
16. Amazon.com, Inc. — Q4 2025 earnings call and release — 5 Feb 2026 — AWS at \$142B run rate, \$244B backlog, \$12.5B segment operating income.

GOVERNMENT AND OFFICIAL-SECTOR (PRIMARY)

17. Brandsaas, Garcia, Kurtzman, Nichols and Zytek — *Estimating Aggregate Data Center Investment with Project-level*

Data — 17 Dec 2025 — Federal Reserve Board, FEDS 2025-109, DOI 10.17016/FEDS.2025.109 — **the abandonment rate, the timing parameters, the investment nowcast and the 2027 scenario range. The single most valuable source in this pack.**

18. Brandsaas — *DataCenterPublic* GitHub repository — 2026 — live results across Dodge vintages — the maintained dataset behind (17).
19. Governor Lisa D. Cook — *The Opportunities and Risks AI Presents for the Economy and Financial System* — 27 May 2026 — Federal Reserve Board, Stanford SIEPR — **the \$1.5 trillion announced-versus-realized framing; electricity and water +5%; the leverage flag; the labor hedge.**
20. Federal Reserve Board — *Financial Stability Report* — May 2026 — the speculative-grade technology-sector spread widening.
21. Federal Reserve Board staff — *The AI Buildout and the Economy: Publicly Available Data to Assess AI's Impact* — FEDS Note, 17 Jul 2026 — the freshest official-sector artifact in the pack.
22. Federal Reserve Banks — *2026 Main Street Metrics: Trends over Time from the Small Business Credit Survey* — 23 Mar 2026 — the AI-and-labor-costs finding.
23. U.S. Energy Information Administration — Short-Term Energy Outlook (Dec 2025 and 2026 updates) and Form EIA-861M through Apr 2026 — the residential rate series, the regional splits, and the falling-wholesale/rising-retail contrast.
24. Office of Governor Janet T. Mills — *Veto Message, L.D. 307* and the accompanying announcement — 24 Apr 2026 — **the primary record correcting a live secondary-source error (Section 6, D-E).**
25. U.S. House Committee on Financial Services — hearing memorandum on U.S. telecom market conditions and the Global Crossing bankruptcy — 21 Mar 2002 — **the 2001 rhyme's primary balance sheet.**
26. U.S. Senate Committee on Banking, Housing, and Urban Affairs (minority) — Warren et al. letter to FSOC — 22 Jan 2026 — the political-altitude artifact.
27. Loudoun County, Virginia — bond-rating summary; FY2027 adopted budget and tax-rate schedule; *Data Centers in Loudoun County* — county sources — the rating history, the rate series, the FY2027 revenue share. **What the county gets if believed: the rating and the exemption.**
28. Commonwealth of Virginia — Senate FY2027 budget proposal (sales and use tax exemption repeal) — Mar 2026.

GRID, MARKET-MONITOR AND REGULATORY

29. PJM Interconnection — *PJM Capacity Auction Procures 138,318 MW...* — 14 Jul 2026 — PJM Inside Lines — the 2028/2029 BRA result, supply mix and forecast delta.
30. PJM Interconnection — *PJM Auction Procures 134,479 MW...* — 17 Dec 2025 — the 2027/2028 BRA, the \$333.44 cap clear, and the first RTO-wide reliability shortfall.
31. PJM Interconnection — 2025 RTEP Window 1 board approval materials — 12 Feb 2026 — **the \$11.8 billion, the 185-mile HVDC backbone, the proposal counts and the cost-sharing.**
32. PJM Interconnection — *PJM Board Outlines Plans To Integrate Large Loads Reliably* — 16 Jan 2026 — the Critical Issue Fast Path and its 12 proposals.
33. Monitoring Analytics (PJM Independent Market Monitor) — report released 5 Jan 2026 — **\$6.5B/40% of \$16.4B; \$6.2B for unbuilt data centers; 45% of \$47.2B across three auctions; \$13.1B of cap/floor cost reduction.** *Vantage: the only actor mandated to deflate.*
34. PPL Electric Utilities — rate settlement, Pennsylvania PUC — Mar 2026 — the 20 GW / 7.8 GW disclosure and the stranded-asset language in a binding document.
35. Virginia State Corporation Commission — transmission cost-allocation proceeding, July 2026 hearing record — Zader, Goggin, Brooks. **[L7 owns this corpus; listed for completeness only.]**

INDEPENDENT ANALYSIS AND RESEARCH

36. Alexander Parker / Buxton Helmsley — *The Useful Life Question: A Forensic Framework for Reading Hyperscaler Depreciation Policy* — 4 May 2026 — **synthesizes the primary filings at (1)–(8) and the ASC/PCAOB codification; declines to adopt Burry's estimates. Vantage: activist investment firm; no disclosed position in the named issuers.**
37. Olga Usvyatsky / Deep Quarry — analyses of Jul 2024 and 11 Feb 2025, and Bloomberg citation 24 Nov 2025 — **the dated proof that the question predates the trade.**
38. SemiAnalysis — *Microsoft's AI Strategy Deconstructed* (~7 Jan 2026) and *Stop Saying Half of 2026 US Datacenter Capacity Is Canceled* (21 Jun 2026) — the technical defence and the doomer-direction audit. *Vantage: sells research to the industry; proprietary satellite-vision model.*

39. Sightline Climate — *Data Center Outlook* (Q1 2026, public version) and the April/May 2026 updates via Latitude Media — the 190 GW / 777 project database, the 16/5/11 GW split, the 30–50% estimate, the cancellation counts. *Vantage: sells the full dataset; public version is headline-level.*
40. IEEFA — *Global gas turbine shortages add to LNG challenges in Vietnam and the Philippines* — Oct 2025 — the 90% three-firm share and the seven-to-eight-year lead times. *Vantage: advocacy.*
41. Moody's Ratings — sector report on data centers and state/local government credit — ~24 Jun 2026 — the moratorium tally and the credit-risk framing.
42. Mangum Economics for the Northern Virginia Technology Council — *2026 Virginia Data Center Report* — the ~\$5,800 counterfactual. **What the industry gets if believed: the exemption survives.**
43. Uptime Institute — *Global Data Center Survey, 2024 and 2025* — the staffing-shortage rankings. *Vantage: sells certification and advisory.*
44. JLL — *2025 Data Center Outlook* — the 90% staffing-constraint figure. *Vantage: brokerage.*
45. Union of Concerned Scientists — analysis of transmission cost pass-through in seven PJM states. **[L7 owns the brief and its table.]**
46. Grid Strategies (Michael Goggin) — testimony for Appalachian Voices on stranded-asset risk. **[L7's corpus.]**
47. National Energy Assistance Directors Association — summer 2026 household electricity estimate — **\$792 / \$717 / +39.4% vs 2020**, and Wolfe's verbatim. *Vantage: advocates for energy assistance funding.*
48. Sequoia Capital (David Cahn) — the ~\$600 billion AI revenue-gap calculation. *Vantage: venture firm invested in the sector.*
49. Allianz Research — the 46%-vs-32% capex/revenue divergence comparison to 2001.
50. Goldman Sachs — the \$5.3 trillion 2025–2030 and \$7.6 trillion 2026–2031 capex estimates. *Vantage: sell-side.*
51. CreditSights — the \$700–900 billion 2026 hyperscaler capex range.
52. Omdia (Ben Yeh) — memory and storage cost increases of roughly 5x and 3x since Q1 2025.
53. Glancy, Kurtzman and Loewenstein — *JUE Insight: Shovel Ready Projects and Commercial Construction Activity's Long and Variable Lags*, *Journal of Urban Economics*, 2025 — the 0.46 commercial abandonment comparator underpinning (17).
54. Dodge Construction Network — Real Estate Analyzer project microdata, 2003–2025 — **the private dataset underneath the Census CPIP survey and therefore underneath the national accounts.** *Vantage: commercial data provider; not independently auditable.*

JOURNALISM AND TRADE PRESS (dated; reporter named where the reporting is the primary record)

55. CNBC — *'Big Short' investor Michael Burry accuses AI hyperscalers of artificially boosting earnings* — 11 Nov 2025 — **carries the “unable to independently confirm” line.**
56. CNBC — *The question everyone in AI is asking: How long before a GPU depreciates?* — 14 Nov 2025 — Intrator's A100/H100 evidence; the non-responses from Amazon, Microsoft, Meta, Google and Oracle.
57. CNBC — *Michael Burry of 'Big Short' fame deregisters Scion Asset Management* — 13 Nov 2025.
58. @michaeljburry — X post, 10 Nov 2025, status 1987918650104283372 — **the primary text of the charge.**
59. Utility Dive (Ethan Howland; Diana DiGangi) — *PJM board approves \$11.8B transmission expansion plan* (17 Feb 2026); *Data centers were 40% of PJM capacity costs in last auction* (7 Jan 2026); *GE Vernova expects to end 2025 with an 80-GW gas turbine backlog* (11 Dec 2025); *Customers, don't expect electric bill relief in 2026* (Jan 2026).
60. Bloomberg — *Bottlenecks: Siemens Energy, Mitsubishi Struggle to Keep Up With AI-Driven Demand For Gas Turbines* — 2 Oct 2025; and the Feb/Mar 2026 debt-market and private-credit pieces cited in Cook's footnotes.
61. Power Engineering — *Data centers drive record surge in GE Vernova power equipment orders* — 23 Apr 2026.
62. Natural Gas Intelligence (Chris Newman) — *Natural Gas Turbines Aren't 'Gating' Data Center Buildouts, GE Vernova Says* — 28 May 2026.
63. Loudoun Now — *Impacts to Loudoun's Economy Uncertain as General Assembly Weighs Data Center Tax Changes* — 5 Mar 2026 — Freeman, Perry, McAuliff.
64. Maine Morning Star (Kaitlyn Budion) — *Gov. Mills vetoes landmark data center ban* (24 Apr 2026) and *Jay data center on hold indefinitely as company backs out, despite veto of statewide ban* (18 Jun 2026) — **the second is the Ledger's political-legitimacy entry.**
65. TechCrunch; WBUR; Daily Yonder (Julia Tilton); McGuireWoods client alert (1 May 2026) — the Maine sequence and its industry read.
66. Brookings (Nicol Turner Lee; Darrell West) — *The pledge to protect ratepayers from AI data center costs needs enforcement* — Jul 2026 — the Sanders/Ocasio-Cortez bill, the state tallies, and the Virginia polling shift (69%

- comfortable in 2023 → 35% in 2026).
67. Techspot; TechRadar Pro; Latitude Media — the Sightline coverage chain, Feb–Jun 2026.
 68. Financial Times (Kate Duguid; Tabby Kinder) — *Investor Angst Over Big Tech's AI Spending Spills Over into Bond Market* — 11 Nov 2025.
 69. Wall Street Journal (Te-Ping Chen; Robbie Whelan) — *Data Centers are a 'Gold Rush' for Construction Workers* (29 Nov 2025); *CoreWeave Reports Doubling of Revenue From AI Boom* (10 Nov 2025).
 70. Om Malik — *What I Learned about Hyperscalers' AI Spend* — 30 Apr 2026 — the capex-doubling series and the short-lived-asset share of Microsoft's quarter.
 71. Forbes (Jason Kirsch; Dara Abasiita) — the capex-to-revenue gap piece (2 Jun 2026) and *Virginia Now Makes Data Centers Post \$1.5 Million A Megawatt* (9 Jun 2026, containing the PPL settlement language). **[The Virginia tariff is L7's.]**
 72. Benzinga; Breitbart; Cryptopolitan; TipRanks; Yahoo Finance; Inc.; Moneywise — the Burry coverage chain, Nov 2025 – Jul 2026, including the subscriber milestone and the analyst pushback (Daniel Newman; Ross Gerber). *Aggregators; used only where they reproduce primary text or carry a dated milestone.*
 73. Calcbench — *On Amazon and Server Lifespans* — the 2021 precedent for the same question.
 74. Data Center Dynamics — *PJM approves \$11.8bn transmission expansion plan amid data center boom*; and the Loudoun FY2026 budget coverage.
 75. Historical retrospectives on the 2001 glut — the fiber-mileage, dark-share and Global Crossing figures, **all treated as CONTESTED ranges and cross-checked against (25).**

Research Pack 1.0 · Lecture 10 — The Reckoning · How AI Data Centers Work (An Unteachable Briefing) · Unteachable Courses. RESEARCH AS OF 22 July 2026. Assembled against Syllabus 2.0 (per-lecture entry, Open Items 4, 6, 9 and 11), Syllabus 1.0 (must-hit values, which govern), Beat Menu 1.0, Moves List 1.0, Main Character Roster 1.0 and Master Style Guide v1.0 §5 and §9, and cross-verified line by line against the L1–L9 packs' own consistency ledgers. Beat plan and moves plan are strawmen; Sections 2, 3 and 4 are the evidence layer markup runs on. The Course Schema locks the running order. Six discrepancies and one unmet human-floor obligation are flagged for Nick's resolution and are not resolved here.