APPLIED FUTURES RESEARCH

The Bridge and the Bedrock

Gas Now, Nuclear Next, and the Grid That Has to Carry Both

A strategic assessment of the two-track power buildout behind American AI: what each track can deliver and when, what the grid requires of both, how the handoff between them must be designed, and where it fails.

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ABSTRACT

The United States leads the world in AI compute and trails badly in the electricity needed to run it. Closing that gap has become a national security project, and it is being pursued on two tracks at once: gas-fired generation for the decade that has already started, and new nuclear for the half-century after it.

This paper assesses both tracks and the grid that sits between them. It finds that neither track is a solution alone, that the data centers themselves have become a measurable hazard to grid stability, and that the decisive variable is the handoff: whether gas built now is designed to become the reserve behind the reactors or becomes the reason the reactors are never built. It closes with a three-scenario verdict, the levers that move the odds, and a dated list of signposts.

HOW TO READ THIS PAPER

GROUNDED Documented in primary or reputable secondary sources, cited by number.

ANALYTIC AFR reasoning from grounded facts. Contestable, but the logic is shown.

PROJECTION Forward estimates with stated assumptions.

SPECULATIVE Plausible, weakly evidenced, flagged so the reader can discount it.

Research current to November 10, 2026. “Gas” in this paper always means natural-gas-fired generation. Gas-cooled reactor designs are named individually.

Executive Summary

BOTTOM LINE

America's lead in AI rests on chips. Its vulnerability is power. The country holds roughly 72% of the world's AI chip compute, while China adds generating capacity several times faster. Keeping the lead means building firm power faster than the United States has built it in two generations.

The workable strategy has two tracks. **Gas is the bridge:** the only new firm capacity available at scale before the early 2030s. **Nuclear is the bedrock:** the only firm, fuel-secure, sixty-year capacity on offer after that. Neither is sufficient alone, and neither is as close as its advocates claim.

The strategy succeeds or fails at the handoff. Gas plants financed for thirty years will not step aside for reactors unless the step-down is written into siting, permits and contracts now. And the grid between the two tracks is being destabilized by the same data centers both are built to serve.

KEY JUDGMENTS

1. ANALYTIC **Power, not chips, is the binding constraint on the U.S. lead.** The United States holds about 72% of AI chip compute delivered since 2022, against about 10% for China [1]. China added 543 GW of generating capacity in 2025 and is projected to add nearly six times as much as the United States over the next five years [2]. A chip lead that cannot be plugged in is a stockpile, not a capability.

2. GROUNDED **Gas is the only new firm capacity available at scale this decade, and it is not available "now."** GE Vernova holds 122 GW of gas turbine backlog and reservations against about 20 GW a year of output [3]. New large-turbine orders deliver around 2030–2031 [4]. The fastest options are small turbines and engines, which cost more and burn more fuel per megawatt-hour [5].

3. GROUNDED **Nuclear is moving faster than at any time in fifty years and is still a 2030s resource.** The NRC issued two commercial construction permits in 2026 [6, 7]. But even restarts of existing plants are slipping [8], the first Western SMR is due around 2030 [9], and commercial HALEU fuel is unlikely before 2030 [10].

4. GROUNDED **The grid is short of capacity and is being shaken by its newest customers.** NERC projects peak demand rising 224 GW in ten years [11]. PJM's latest auction fell 6,831 MW short of its reliability requirement [12]. On July 22, 2026, about 3,800 MW of data center load left the grid in Northern Virginia in under two minutes, the largest such event PJM has recorded [13].

5. ANALYTIC **Gas and nuclear are physical complements, not rivals.** Both are synchronous machines that give the grid inertia, fault current and voltage support. Gas ramps quickly and suffers in winter. Nuclear runs flat and carries its fuel on site. PJM credits nuclear at 96% of nameplate and gas at 67–79% [14]. Each covers the other's weakness.

6. ANALYTIC **On-site generation helps the grid only if it is connected and obligated.** Behind-the-meter gas adds megawatts to a campus and nothing to system stability unless it is synchronized, visible to operators and bound by reliability rules. Those rules are being written now. Ride-through requirements are not expected until 2027 [15, 16].

7. ANALYTIC **The handoff is the hard part, and almost no one is designing it.** Most gas-for-data-center sites were chosen for fuel and fiber, not for nuclear siting. One project, in Texas, has been engineered from the start to convert from gas to reactors [17]. It is the exception that shows what the rule would require.

8. ANALYTIC **Both tracks draw on one industrial base.** Turbines, transformers, forgings, heavy-haul capacity and skilled trades are shared and scarce. Generator step-up transformers now take more than three years [18]. The same vendor sells the gas turbines and the leading SMR [3].

9. GROUNDED **Public consent is the scarcest input.** Gallup found 71% of Americans oppose a local AI data center, against 53% for a local nuclear plant [19]. Data center costs were an issue in the November 2026 midterms, which gave Democrats control of both chambers of Congress [20]. Nearly all of 41 local ballot measures on data centers went against development [21].

10. PROJECTION **The most likely outcome to 2035 is a permanent bridge.** Gas carries the AI load and stays. Nuclear arrives as restarts, uprates and a handful of first units. A managed handoff becomes likely only if Washington underwrites the first reactor fleet and the fuel, and if regulators condition today's gas build on tomorrow's step-down.

THREE-SCENARIO VERDICT TO 2035

Scenario	What it looks like by 2035	AFR assessment
A. Managed Handoff	Gas carries the load to the early 2030s, then steps down to a reserve role as a standardized reactor fleet comes online on shared sites. Data center campuses operate under enforceable reliability rules. The U.S. has a reference reactor to export.	PROJECTION Plausible. Roughly one in four.
B. Permanent Bridge	Gas carries the load and keeps it. Nuclear grows through restarts, uprates and a few first-of-a-kind units. Reactor projects slip behind fuel and financing. The grid holds, at higher fuel-price and winter exposure.	PROJECTION Most likely. Roughly one in two.
C. Capex Break	AI capital spending contracts mid-build. Turbines on order and reactors under construction lose their anchor customers. Costs are socialized and both tracks lose political support.	PROJECTION Material. Roughly one in four.

A major reliability event caused by large-load behavior is a wild card that could strike in any scenario. It is treated in Sections 5 and 10.

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1. The Strategic Problem: Ahead in Chips, Behind in Power

Every hyperscale data center is a promissory note written against electricity that does not yet exist. The United States has written more of those notes than any nation in history. This paper is about how they get paid.

1.1 The asymmetry

GROUNDED The American position in AI rests on hardware. Epoch AI's customs-based estimates put the U.S. share of AI chip compute delivered worldwide since 2022 at about 72% as of mid-2026, up from 57.5% in late 2023. China's share fell to about 10% over the same period [1]. Export controls are a large part of the reason. Epoch notes that its Chinese figures exclude smuggled chips, so the true gap is somewhat narrower [1].

GROUNDED On electricity the positions are reversed. China added 543 GW of generating capacity in 2025 alone, according to its National Energy Administration. BloombergNEF projects that China will add about 3.4 terawatts over the next five years, nearly six times the U.S. total, and has warned of effective power shortfalls in some U.S. markets by 2030 [2].

ANALYTIC Each country leads in the input the other finds hardest to obtain. China can power far more compute than it can buy. The United States can buy far more compute than it can power. Chips are a lead that policy can erode in either direction: controls can loosen, smuggling can grow, and domestic Chinese chips can improve. Power is a lag that only construction can close. That is why the electricity buildout is a national security question first and a commercial one second.

1.2 The scale of the demand, and its uncertainty

GROUNDED NERC's 2025 Long-Term Reliability Assessment projects North American summer peak demand rising by more than 224 GW over ten years, a 24% increase, with winter peak rising 245 GW. New data centers are the main driver. That forecast was 69% higher than the one NERC published a year earlier [11, 22].

GROUNDED The money behind it is real. The four largest hyperscalers spent a combined $202 billion on capital expenditures in the third quarter of 2026, more than double the same quarter a year earlier, and are on track for more than $720 billion in 2026 against about $410 billion in 2025. Three of the four reported negative free cash flow for the quarter, and one trimmed its guidance because third-party data center capacity was arriving late [23]. Enverus forecasts about 62 GW of new data center capacity in the Lower 48 through 2030 [24].

GROUNDED The paper demand is larger still. ERCOT's queue of large-load interconnection requests reached 474 GW by mid-2026, about 90% of it data centers, against an all-time system peak of 91 GW. Texas now requires applicants to post financial security of $50,000 per megawatt to stay in line [25].

ANALYTIC Planners therefore face two risks at once. If the demand is real and the power is not built, the U.S. lead in compute stalls at the substation. If the power is built and the demand is not

real, someone holds stranded turbines and half-built reactors. Any serious strategy must work under both. That requirement shapes everything that follows.

1.3 The nuclear competition: China builds, Russia sells

GROUNDED China has 36 power reactors under construction, about 38.9 GW, which is more than 49% of world nuclear construction, according to IAEA data reported by the U.S. Energy Information Administration. The World Nuclear Association counts 37 to 39 depending on the date [26]. On July 31, 2026, the State Council approved eight more units [27].

GROUNDED China's own small modular reactor offers a calibration point. Linglong One (ACP100, 125 MWe) began construction in July 2021, missed its target of commercial operation in the first half of 2026, and was in hot functional testing in October 2026 with fuel loading and grid connection planned by year-end [28].

GROUNDED Russia leads in exports. Rosatom reports a foreign order book of roughly $200 billion and 26 power units under construction abroad [29]. China's exports remain thin, limited mainly to Pakistan [30]. Russia and China are the only countries able to produce HALEU fuel at scale [31].

ANALYTIC These are separate contests. China's build rate buys a learning curve. Russia's exports buy decades of fuel and service dependence in client states. A U.S. reactor fleet built on data center demand addresses the first directly and the second only later, because no country buys a reactor that has not been built at home.

1.4 Washington's posture

GROUNDED Federal action over the past eighteen months has been broad:

- **Nuclear.** Executive orders in May 2025 set an 18-month NRC decision deadline and targets of ten large reactors under construction by 2030 and 400 GW of nuclear capacity by 2050. The NRC finalized its Part 53 framework for advanced reactors in March 2026. The government announced an $80 billion partnership with Westinghouse and awarded $2.7 billion for domestic enrichment [32, 33].
- **Defense.** The Army's Janus program has selected five installations for 1–20 MW microreactors, backed by about $2.2 billion over fiscal 2027–2031, with a first operating reactor required by September 30, 2028 [34].
- **Existing plants.** DOE has issued more than 40 emergency orders under Section 202(c) of the Federal Power Act since May 2025 to keep fossil plants from retiring. Coal retirements in 2025 were the lowest since 2010. Supporters cite reliability. Opponents cite cost and question the legal basis [35].
- **Grid rules.** FERC ordered all six regional grid operators in June 2026 to justify or rewrite their rules for connecting large loads, and in July directed NERC to file mandatory reliability standards for data centers by December 31, 2026 [36, 15].

GROUNDED The political setting changed on November 3, 2026. Democrats won control of both the House and the Senate, producing divided government from January 2027 [20]. **ANALYTIC** Executive-branch policy on nuclear, gas and data centers will continue. Legislation, appropriations and oversight will now reflect a Congress elected in part on electricity bills. A strategy that depends

on one party's priorities is fragile. One that both can claim is durable, and firm domestic power for national security is among the few energy positions with support in both.

1.5 The question this paper answers

ANALYTIC "How does America power AI?" is three questions with three different answers:

- **The now (2026–2031):** what can physically be energized in time for data centers already under construction. The answer is mostly existing plants, flexible load and gas.
- **The next (2030–2060):** what firm capacity the country wants to own for two generations. The strongest answer on fuel security and reliability is nuclear.
- **The between:** how the grid stays stable while both are built and while its largest new customers behave unlike any load it was designed for.

The sections that follow take each in turn, then examine the handoff from the first to the second.

2. Three Clocks

The data center runs on quarters. The gas plant runs on years. The reactor runs on decades. Strategy here is mostly the management of that mismatch.

ANALYTIC The table ranks every firm resource by when it can deliver at meaningful scale. It is the paper's central organizing fact. Almost everything available before 2030 is either existing capacity or gas. Almost everything that offers long-term fuel security arrives after 2030.

Resource	Earliest delivery at scale	Scale in view	Binding constraint
Flexible load and curtailment	Now	76–126 GW of system-level headroom if new loads accept brief curtailment [37]	Contracts, tenant service levels, local transmission
Existing nuclear: contracts and uprates	Now–2030	Several GW of redirected or uprated output [32]	Takes power from other customers unless uprated
Small gas turbines and engines, on site	1–3.5 years	29.6 GW behind the meter through 2030 [5]	Cost, fuel efficiency, air permits
Nuclear restarts	2027–2029	2.25 GW at three plants [38]	Plant condition; schedules already slipping
Large gas turbines and combined cycle	2029–2032 for new orders	122 GW in one vendor's backlog and reservations [3]	Manufacturing slots, transformers, pipelines
Light-water SMRs	2030 onward	First unit in Ontario by end of 2030; U.S. units early 2030s [9]	First-of-a-kind cost; order book
Advanced reactors (HALEU-fueled)	2030–2035	Natrium targeted for 2030; most others later [6]	Fuel supply
Large reactors (AP1000)	Mid-2030s	Ten proposed; none under construction [33]	Capital, licensing, construction workforce

ANALYTIC Three conclusions follow. First, there is no nuclear answer to the next five years beyond what already exists. Second, there is no gas answer to this year or next that has not already been ordered. Third, the only resource that is both immediate and cheap is the one the industry has resisted: flexibility in the load itself.

3. Track One: Gas for the Now

Gas is not the future of American power. It is the part of the future that can be bought this decade. That is a large claim in its favor and a strict limit on it.

3.1 Why gas

GROUNDED The case for gas begins with the fuel. The United States is the world's largest gas producer, and the EIA expects production to keep setting records. Its October 2026 outlook has the Henry Hub price averaging $3.48 per million Btu in 2026 and $3.16 in 2027 [39]. The fuel moves by pipeline from domestic basins. Nothing about it depends on a foreign enrichment plant.

GROUNDED The second argument is performance under stress. During Winter Storm Fern in January 2026, gas-fired generation at the peak hour ran 84 GW above its average for the rest of the winter, the largest surge of any fuel. Coal added 40 GW and fuel oil 14 GW [40, 41].

ANALYTIC The third is that nothing else is on offer. Section 2 shows that no other new firm resource can be delivered in volume before 2030. For a planner who needs a gigawatt in 2029, the choice is gas or no data center.

3.2 The gas queue

GROUNDED Gas has a clock of its own. GE Vernova reported 122 GW of gas turbine backlog and slot reservations at the end of September 2026 and expects at least 130 GW by year-end. Its output is about 20 GW a year, rising to 24 GW in 2028 [3]. In April the company said it had roughly 10 GW of slots left across 2029 and 2030 combined, and that prices on new orders were running 10 to 20 points higher than a few months earlier [42]. Mitsubishi Power indicated in October 2026 that new orders would deliver around 2031 [4].

GROUNDED Delivery of the turbine is not delivery of the plant. Enverus puts the lead time for a large combined-cycle plant at up to six years. Small and medium frame turbines can arrive within two years, and aeroderivative units in about 40 months [5].

GROUNDED Speed has a price. Lazard's 2026 analysis puts new combined-cycle gas at $51 to $129 per megawatt-hour. The high end reflects market quotes of $2,400 to $2,600 per kilowatt for plants entering service after 2028. Gas peaking plants, the category closest to the small fast units, run $144 to $276 [43]. On-site plants often use simple-cycle machines that need 10 to 11 million Btu of gas per megawatt-hour, against about 6.8 for a combined-cycle plant [44].

ANALYTIC The practical meaning: "gas now" is three different products. Gas already ordered arrives in 2027–2029. Small gas ordered today arrives in 2027–2029 at a premium and with a fuel penalty of roughly 50%. Large efficient gas ordered today arrives in 2030–2032, the same window as the first reactors. For new orders, the bridge and the bedrock are closer in time than the debate assumes.

3.3 What is being built

GROUNDED The buildout is already large and is increasingly paid for by the data center owner:

- **Meta and Entergy, Louisiana.** Three combined-cycle plants of about 2.3 GW were approved in 2025 for Meta's Hyperion campus. In March 2026 Meta agreed to fund seven more, 5.2 GW at a planned $12.9 billion, for ten plants and more than 7 GW in all. Entergy has signed a 20-year gas supply agreement for them [45].
- **Homer City, Pennsylvania.** A 4.5 GW gas plant built on seven GE Vernova 7HA.02 turbines at a former coal site, paired with a data center campus, with first power targeted for 2027 [46].
- **Williams "Socrates," Ohio.** A 200 MW on-site plant of small turbines and reciprocating engines for a Meta affiliate, supplied by two dedicated 24-inch pipelines [47].
- **Stargate, Abilene, Texas.** On-site turbines of up to about 300 MW alongside a grid connection [48].

GROUNDED In aggregate, RBC counts about 101 GW of behind-the-meter gas capacity announced by data center developers as of 2026 [49]. Enverus expects 29.6 GW of it to be built through 2030, with data centers accounting for 88% [5].

3.4 Fuel: the question is deliverability, not reserves

GROUNDED RBC forecasts that data centers will consume about 6.1 billion cubic feet of gas a day by 2030, roughly a 20% increase in gas burned for power [49]. East Daley's risk-adjusted figure is about 10 Bcf/d, against roughly 5 Bcf/d of credible pipeline and compression projects positioned to serve it [44].

GROUNDED Data centers are not the largest new claim on that gas. U.S. LNG exports are forecast at 17.0 Bcf/d in 2026 and 18.6 in 2027, both records. The EIA notes that disruption to LNG shipments through the Strait of Hormuz has widened the gap between U.S. and overseas prices, which pulls more American gas toward export [50].

ANALYTIC The United States is not short of gas. It can be short of pipe. A gas plant is only as firm as its transportation contract, and a new plant in a constrained region competes with heating customers who hold older, firmer rights. The plants that choose their site for the pipeline rather than the fiber will be the ones that run in January.

3.5 The winter weakness

GROUNDED The same FERC-NERC review that recorded gas's 84 GW surge also recorded its failures. Unplanned generator outages peaked at 68,169 MW during the 2026 Arctic cold period. More than 3,000 generators logged nearly 17,000 forced outages, derates, or failures to start. Gas demand peaked at 172 Bcf/d on January 24, and storage withdrawals matched the weekly record [40, 41]. Henry Hub averaged $7.72 for the month [39]. The review found that the system performed well, with no significant disruptions, and that gas-electric coordination remains a vulnerability [40].

ANALYTIC Both readings of Fern are correct. Gas carried the grid, and gas was the largest source of outages. The lesson for a gas-first strategy is that winter performance is bought, not assumed:

through firm transportation, on-site backup fuel and weatherization. Section 5.3 shows how grid operators already price that difference.

3.6 Permits and politics

GROUNDED On January 15, 2026, the EPA updated its standards for combustion turbines and confirmed that turbines used for primary power at a fixed site need Clean Air Act permits even when trailer-mounted. xAI's use of unpermitted turbines for its Memphis-area data centers has drawn a federal lawsuit from the NAACP. A judge denied the company's motion to dismiss in late October 2026, after the Justice Department had argued for dismissal. Mississippi's permit board approved 41 permanent turbines at the site in March, and that approval is under appeal [51].

ANALYTIC The episode marks the boundary of the fast path. On-site gas can be quick or it can be durable. It is rarely both. Projects that treat air permitting as an obstacle to route around are building political liability into the asset. With the 2026 elections behind them, state and federal officials of both parties have more reason to enforce those limits, not less.

3.7 Why bridges become destinations

ANALYTIC A combined-cycle plant is financed over 25 to 30 years. Its fuel is contracted for 15 to 20. Its owner earns a return only by running it. None of those facts changes when a reactor is finished nearby. Unless the step-down is priced at the start, the rational owner of a bridge keeps the traffic on it. "Temporary infrastructure" is a phrase that rarely survives contact with a financing schedule. Section 6 takes up what designing the step-down would require.

4. Track Two: Nuclear for the Future

Nuclear is the one firm resource whose fuel can sit on the site for two years, whose output does not depend on the weather, and whose plants are licensed for generations. It is also the one that has not been built on time in the United States in living memory.

4.1 Licensing is no longer the bottleneck

- GROUNDED **Natrium, Kemmerer, Wyoming.** On March 4, 2026, the NRC approved a construction permit for TerraPower's 345 MWe sodium-cooled reactor, the first for a commercial non-light-water reactor. The safety review finished ahead of schedule. Completion is targeted for 2030 [6].
- GROUNDED **Clinch River, Tennessee.** On September 29, 2026, the NRC issued the first U.S. construction permit for a commercial small modular reactor, a 300 MWe BWRX-300 for TVA, after a 14-month review. TVA has not announced a construction start [7, 52].
- GROUNDED **Long Mott, Texas.** NRC staff completed the final safety evaluation in October 2026 for Dow and X-energy's four Xe-100 reactors [53].
- GROUNDED **Test reactors.** Four DOE-authorized pilot reactors reached criticality by July 4, 2026. These were zero-power demonstrations of physics and fuel loading, not power plants [54, 55].

ANALYTIC The regulator has delivered what industry said it needed. What remains is fuel, capital, components, and execution. None of those is the NRC's to fix.

4.2 What arrives first

GROUNDED **Restarts are the nearest nuclear megawatts, and they are slipping.** Three retired plants totaling about 2.25 GW are being revived with up to $4.4 billion in DOE loans. Palisades began loading fuel on August 30, 2026, then paused after a fuel assembly tilted. The NRC approved a recovery plan in October and the owner has given no new restart date. Crane (the former Three Mile Island Unit 1) is targeted for 2027. Duane Arnold is targeted for early 2029. No U.S. reactor that entered decommissioning has yet returned to service [8, 38].

GROUNDED **Light-water SMRs come next.** Ontario Power Generation expects the first BWRX-300 at Darlington in service by the end of 2030 [9]. The four-unit project is budgeted at C$20.9 billion for 1,200 MW [56]. It is the reference plant for Clinch River and for every other BWRX-300 proposal.

GROUNDED **Large reactors are furthest out.** Westinghouse plans ten AP1000s with construction starting in 2030 under the federal partnership. The most advanced candidate is the completion of two abandoned units at V.C. Summer in South Carolina, where construction has not resumed. The NRC renewed the AP1000 design certification in October 2026 [33].

ANALYTIC The lesson of Palisades is not that restarts fail. It is that every nuclear schedule carries a tail risk that gas schedules do not. A tilted fuel assembly costs months. A planner who needs a firm date should treat every nuclear date as a range and hold other capacity against the far end of it.

4.3 The hyperscaler deal book

GROUNDED Announced hyperscaler nuclear agreements could total about 13 GW. Carnegie's June 2026 assessment found that these companies prefer to buy power rather than own or build plants, and that even full completion would cover less than 20% of projected data center demand through 2035 [32].

Buyer	Partner / asset	Technology	Scale	Earliest power
Microsoft	Constellation, Crane restart	Existing PWR	835 MW	2027
Google	NextEra, Duane Arnold restart	Existing BWR	615 MW	Early 2029
Amazon	Talen, Susquehanna	Existing plant	1.9 GW (to 2042)	Ramping to 2032
Meta	Vistra, extensions and uprates	Existing fleet	2.6 GW	Near-term
Google	Kairos / TVA	Salt-cooled (HALEU)	50 MW; 500 MW by 2035	2030
Amazon	X-energy / Energy Northwest	Xe-100 (HALEU)	320 MW first stage	Early 2030s
Meta	TerraPower Natrium	Sodium fast reactor (HALEU)	690 MW first two units; up to 2.8 GW	As early as 2032
Meta	Oklo, Ohio	Fast reactor	1.2 GW	Full by 2034
Crusoe	Blue Energy, Texas	Gas, then BWRX-300	1 GW gas; 1.5 GW nuclear	Gas 2030; nuclear 2032

Sources: Carnegie Endowment; World Nuclear Association; DOE; Nuclear Engineering International. Capacities are announced maximums, not firm commitments.

ANALYTIC The table has a clear shape. The megawatts before 2030 come from plants that already exist. The megawatts after 2030 are mostly options on reactors that need a fuel the country does not yet make. The private sector is buying options. The state is being positioned to underwrite the plant.

4.4 Fuel: the calendar beneath the calendar

GROUNDED Light-water SMRs such as the BWRX-300 run on conventional low-enriched uranium. Most advanced designs in the deal book need HALEU, enriched to between 5% and 20%. GAO found that no commercial HALEU market exists in the United States as of 2026 [57]. Centrus produced about 1,900 kg from a demonstration cascade between late 2023 and mid-2026, and DOE has funded two commercial enrichment projects [31]. Waivers allowing Russian enriched uranium imports end no later than January 1, 2028 [58]. Carnegie assessed in October 2026 that reliable commercial HALEU supply is unlikely before 2030 [10].

ANALYTIC The fuel calendar, not the licensing calendar, sets the earliest date for advanced reactors at scale. That makes the light-water designs the realistic first fleet, and it makes HALEU a strategic

material in the plain sense: a domestic capability the country must build regardless of what the market does.

4.5 Cost

GROUNDED Lazard puts new U.S. nuclear at $175 to $255 per megawatt-hour, based on Vogtle, with capital costs of $12,300 to $17,570 per kilowatt. Existing nuclear plants produce power at $26 to $36, among the cheapest on the system [43]. Vogtle finished seven years late and more than $30 billion over budget [32]. Darlington's budget works out to roughly C$17,000 per kilowatt across four units [56].

ANALYTIC Those two Lazard figures are the whole nuclear argument in one line. A reactor is expensive to build and cheap to own. Small reactors give up economies of scale and depend on economies of repetition. Repetition needs an order book, and an order book needs a buyer willing to commit to the fifth unit before the first one runs.

4.6 What nuclear contributes that gas cannot

- GROUNDED **Accredited reliability.** PJM credits nuclear at 96% of nameplate capacity for its 2028/29 auction, the highest of any generation class [14].
- ANALYTIC **Fuel on site.** A reactor refuels every one to two years. It has no pipeline to freeze and no daily fuel price.
- GROUNDED **Sixty-year life.** The BWRX-300 is designed for a 60-year operating life [59]. Most of the existing U.S. fleet has been licensed to 60 years, and 25 reactors have been approved to run to 80 [8].
- GROUNDED **Built-in flexibility, in some designs.** Natrium pairs its 345 MWe reactor with molten-salt storage that can raise output to 500 MWe for more than five hours [6]. That is a reactor designed to follow load without changing reactor power.
- ANALYTIC **An export product.** A reactor built at home can be sold abroad with fuel and service contracts attached. A gas turbine exports hardware. A reactor exports a fifty-year relationship.

5. The Grid Between: Reliability

A power system is a single machine the size of a continent, spinning at sixty cycles a second. Everything connected to it either helps hold that speed or disturbs it. For a century the disturbances came from generators and the weather. They now come from customers as well.

> **SCOPE OF THIS SECTION**
> This section describes the mechanisms a policymaker needs in order to judge whether building gas and nuclear together makes the grid more reliable. It draws on NERC, FERC and grid-operator records. It is not an engineering study. Conclusions about any specific site require interconnection and dynamic studies by the responsible planner.

5.1 Three problems that share one word

ANALYTIC "Reliability" covers three distinct problems. They have different causes, different owners and different fixes. Treating them as one is the most common error in the public debate.

Problem	The question	Timescale	What fixes it
Adequacy	Is there enough capacity and energy to meet demand on the worst day?	Hours to seasons; planned years ahead	Firm generation, storage, demand that can be curtailed
Deliverability	Can the power physically reach the load?	Continuous; built over years	Transmission lines, substations, transformers
Stability	Does the system stay synchronized through a sudden disturbance?	Milliseconds to minutes	Inertia, fast reserves, protection settings, and well-behaved equipment on both sides of the meter

ANALYTIC New generation addresses adequacy directly. It helps stability only if it is the right kind of machine in the right place. It does nothing for deliverability on its own, and can make it worse. The data center buildout strains all three at once, which is why "build more power plants" is a necessary answer and an incomplete one.

5.2 Adequacy: the shortfall is already here

GROUNDED NERC's 2025 assessment found 13 of 23 North American assessment areas at elevated or high resource-adequacy risk within five years, with MISO, PJM, ERCOT and two Western areas reaching high risk by 2030. Confirmed and announced generator retirements total more than 105 GW over the decade [11, 60, 22].

GROUNDED In PJM the shortfall is no longer a forecast. The capacity auction for 2028/29, held in July 2026, cleared at its price cap for the third straight year and came up 6,831 MW short of the reliability requirement, after a 6,516 MW shortfall the year before. The resulting reserve margin is about 14.4%, against a target of 20% [12, 61].

GROUNDED Grid operators have responded by pushing the problem back onto the load. PJM's board directed a one-time backstop procurement of new generation in autumn 2026. It also ruled that large new loads that have not brought their own generation by June 1, 2027 will be curtailed in a shortage before other emergency measures are used [62]. Texas law already requires loads of 75 MW or more to accept curtailment in emergencies and lets ERCOT direct them onto backup generation [63]. FERC's June 2026 orders told all six regional operators to create transmission services for flexible large loads and to prevent cost shifting [36].

ANALYTIC These rules are the regulatory engine behind Track One. "Bring your own generation or accept curtailment" is, in practice, an instruction to build on-site gas, because nothing else can be brought by 2027. Policy is already selecting the bridge. It has not yet said anything about what the bridge should lead to.

5.3 A megawatt is not a megawatt

GROUNDED Operators do not count nameplate capacity. They count what a resource can be expected to deliver in the hours of greatest risk. PJM calls this the Effective Load Carrying Capability, or ELCC, and publishes a rating for each class of resource [14]:

Resource class	PJM rating, 2028/29	What 1,000 MW of nameplate is worth
Nuclear	96%	960 MW
Demand resource (curtailable load)	91%	910 MW
Coal	85%	850 MW
Gas combustion turbine, dual fuel	79%	790 MW
Gas combined cycle	78%	780 MW
Gas combustion turbine	67%	670 MW
Storage, 4-hour	59%	590 MW
Onshore wind	34%	340 MW
Tracking solar	10%	100 MW

ANALYTIC Three things in this table bear directly on the two-track strategy.

- **Nuclear is worth about a quarter more than gas, megawatt for megawatt.** A thousand megawatts of reactors does the adequacy work of roughly 1,230 MW of combined-cycle gas or 1,430 MW of simple gas turbines.
- **The gas discount is a winter discount.** Gas plants fail together in extreme cold, when fuel is short and equipment freezes. A turbine with backup fuel on site earns twelve points more than one without. Fuel security is visible in the rating.
- **Curtailable load is credited at 91%.** A data center that can reliably reduce demand is rated close to a reactor and above every class of gas plant.

GROUNDED The winter of 2026 shows why. Gas delivered 84 GW above its seasonal average at the peak of Winter Storm Fern, and unplanned generator outages still reached 68,169 MW across the cold period [40]. **ANALYTIC** A fleet built on gas alone concentrates the grid's exposure on one fuel in the one season when that fuel is scarcest. A fleet that adds nuclear diversifies it. That is the adequacy case for building both, and it is a strong one.

5.4 The load is the hazard

GROUNDED The grid was designed around the risk of losing a large generator. It was not designed for large customers that remove themselves. NERC describes a pattern that has now recurred several times [64]:

- A transmission line faults. Protection systems clear the fault correctly, and voltage dips briefly as breakers reclose.
- Data centers on the affected circuits sense the dips and transfer to their backup power to protect their equipment.
- A large block of demand vanishes within seconds. Generation now exceeds load, frequency and voltage rise, and the system oscillates while generators rebalance.

GROUNDED Because every data center on a circuit sees the same disturbance and takes the same action, NERC calls this a common-mode failure risk [64]. The record so far:

Date	Region	Load lost	What happened
July 10, 2024	Northern Virginia	About 1,500 MW	First major documented event; subject of a NERC incident review [64]
February 17, 2025	Northern Virginia	About 1,500 MW	Similar event in the same zone [13]
April 18, 2026	Northern Virginia	About 500 MW	Similar fault, smaller loss after some data centers changed their protection settings [64]
July 22, 2026	Northern Virginia	About 3,800 MW	Largest on record. Two waves: 2,970 MW, then 1,099 MW triggered by the high voltage the first wave caused [13, 65]

GROUNDED The July 22 event began at 7:56 a.m. with a mechanical failure on a 230 kV line. The fault cleared properly. There were no relay mis-operations. PJM's total load fell from 99,984 MW to 96,205 MW in about a minute. The imbalance between generation and load reached 3,928 MW, frequency rose to 60.092 Hz, and operators restored balance within nine minutes, inside the 30-minute standard [13]. PJM said the grid did not suffer significant reliability impacts but did experience large swings in voltage and frequency [65].

ANALYTIC The system held. Three features of the event should still concern a planner:

- **Scale.** The load that disappeared was equal to the output of roughly three large reactors. No single generator loss in North America is that large. Reserves are sized for generator trips, not for this.

- **Cascade.** The second wave was caused by the first. Loss of load raised voltage, and the higher voltage tripped more load. A disturbance that feeds itself is the signature of an unstable system.
- **Direction of travel.** The April event suggested the problem was being solved. July showed it was growing faster than the fixes. NERC's own conclusion is that the risk is increasing, not abating [64].

GROUNDED The exposure is not confined to Virginia. ERCOT is assessing where load loss after a transmission disturbance could exceed 3,200 MW and require operational mitigation, and is developing ride-through requirements of its own [66]. NERC has also documented large loads whose demand swings within seconds during normal operation, leaving operators little time to respond [67].

ANALYTIC Interconnection size matters here. PJM sits inside the Eastern Interconnection, the largest synchronous grid in North America, which absorbed a 3,800 MW swing with a frequency rise of less than a tenth of a hertz. ERCOT is an island with a peak of about 91 GW and far less rotating mass. The same event there would be a much more serious matter, and Texas is where the largest queue of new data centers is waiting.

WHAT THE RULES WILL AND WILL NOT DO

GROUNDED On July 16, 2026, FERC directed NERC to file mandatory reliability standards and registration criteria for "computational loads" by December 31, 2026, with a work plan for further standards due March 1, 2027 [15, 68]. NERC's proposed registration threshold would reach sites of 20 MW or more connected at 60 kV or above [69]. The first phase covers foundational duties: interconnection requirements, commissioning, communications and modeling data. It will not set minimum voltage or frequency ride-through. Those requirements are expected in 2027 [70, 16].

ANALYTIC This is the central point for anyone who assumes more generation will stabilize the grid. A load-loss event is a surplus of generation, not a shortage. Building more power plants does not prevent it. Only two things do: data centers that stay connected through routine faults, and resources that can reduce output very quickly when they do not. The first is a matter of standards that do not yet exist. The second is where the choice of generation matters, and it is the subject of the next section.

5.5 What spinning machines do

ANALYTIC Gas turbines and nuclear steam turbines are both synchronous generators: large rotating masses locked electrically to the grid's frequency. That shared property is the technical foundation of the two-track argument. Such machines provide four services that keep a grid stable.

Service	What it does	Who provides it
Inertia	The stored energy of rotating mass resists sudden changes in frequency. It buys the seconds that other controls need to act.	Any large synchronous machine. Nuclear and gas both contribute, in proportion to size.
Fault current	A strong surge of current during a short circuit lets protective relays detect and isolate the fault quickly.	Synchronous machines supply several times their rated current. Typical inverters supply little more than rated current.
Voltage support	Generators absorb or supply reactive power to hold voltage within limits as conditions change.	Synchronous machines do this inherently. Inverters can if designed and required to.
Frequency response	Governors raise or lower output automatically within seconds when frequency moves.	Gas units are well suited. U.S. reactors have traditionally run at steady full output and are not relied on for fast regulation.

ANALYTIC Read against the July 22 event, the table shows how the two technologies divide the work. Nuclear contributes mass: steady inertia and fault current around the clock, which slow a frequency excursion and keep protection systems working. Gas contributes agility: it can cut output in seconds when load disappears and raise it when load returns. A grid with only the first is stiff but slow. A grid with only the second is quick but exposed to its fuel. Together they cover both.

ANALYTIC Solar, wind and batteries connect through inverters and do not provide these services in the same inherent way, although grid-forming inverters and fast-acting batteries can supply some of them when specified and required. This is not an argument against those resources, which supplied a meaningful share of energy during Winter Storm Fern in several regions [71]. It is an observation that a system adding tens of gigawatts of volatile load needs more rotating mass and more fast reserves, and that both tracks in this paper supply the first while gas and batteries supply the second.

> **THE CONDITION THAT DECIDES EVERYTHING**
>
> These services reach the grid only from machines that are connected to it, synchronized with it, visible to its operators and obligated to respond.
>
> A gas plant behind a data center's meter that serves only the campus contributes megawatts to the campus and nothing to system stability. Worse, it is what allows the campus to disconnect. On-site generation is the mechanism by which load "transfers to backup" and vanishes from the grid.
>
> Whether the two-track buildout strengthens or weakens the grid therefore depends less on what is built than on how it is connected and governed.

5.6 Co-location: the physics of sharing a fence

ANALYTIC Putting generation and a data center on one site creates specific reliability effects in both directions.

- **A large campus is a large contingency.** Operators hold reserves against the loss of their largest single element, typically a generating unit of 1.1 to 1.4 GW. A multi-gigawatt campus that can leave or return within seconds is larger than that element. Unless its behavior is controlled, it becomes the event the system must be sized for.
- **A reactor trip becomes a grid event.** If on-site reactors serve the campus and one trips, the campus either sheds load instantly or draws the lost power from the grid. In the second case the grid sees the equivalent of a sudden generator loss it did not plan for. Which of the two happens is set by the interconnection agreement, and it should be decided before the site is energized, not during the event.
- **Small units make smaller contingencies.** This is a real advantage of SMRs. Losing one 300 MW unit out of five removes 20% of site output. Losing one large reactor removes all of it. A campus built on several small units carries its own spare capacity.
- **Reactors lean on the grid too.** NRC design criteria for conventional light-water reactors have long required reliable offsite power for safety systems in addition to on-site emergency supplies [72]. Newer passive designs reduce that dependence and are built to cool themselves for days without external power. Even so, most U.S. reactors are designed to shut down, not to keep running in isolation, when they lose their grid connection. A reactor serving an islanded data center is not established practice.
- **Reactors change output slowly; AI load does not.** A reactor prefers steady operation. A training cluster can swing a large fraction of its demand in seconds. Something has to sit between them: batteries, gas turbines, or thermal storage of the kind Natrium builds in [6].
- **Refueling is scheduled downtime.** Each reactor goes offline for refueling every one to two years. A campus needs either spare units, on-site gas, or a firm grid supply to cover it.

ANALYTIC Every item on that list points to the same design. The reactor supplies steady bulk energy and inertia. On-site gas and batteries absorb the fast swings, cover refueling and trips, and stand by. The grid connection carries what remains in both directions under defined limits. This is the physical logic of building both: the gas plant built first as the campus's primary supply is the same machine that later makes the reactor workable as a neighbor.

GROUNDED Regulators are converging on the same view from the other side. FERC found PJM's rules for co-located load unjust and unreasonable in December 2025 and ordered new transmission service options for it. SPP's conditional service for large loads, accepted in June 2026, requires real-time telemetry and gives the operator the ability to disconnect the load remotely [73].

5.7 Deliverability: wires and iron

GROUNDED Every power plant reaches the grid through a generator step-up transformer. Lead times for those units averaged 144 weeks in 2025 and passed 160 weeks in early 2026, with some orders stretching to four years. Demand for them has risen 274% since 2019. High-voltage circuit breakers have gone from 77 weeks to 125 [18].

ANALYTIC This equipment is common to both tracks and to the data centers themselves. A turbine delivered in 2029 without a transformer is a very expensive lawn ornament. Because the transformer and the switchyard are sized once, the decision about whether a site will ever host reactors has to be made when the gas plant's electrical interconnection is designed, not later.

ANALYTIC Transmission is the slowest piece of all. On-site generation is attractive precisely because it avoids waiting for new lines. But a campus that relies on the grid for backup, for refueling outages or for exporting surplus power still needs a connection sized for those flows. Avoiding the transmission queue is not the same as not needing transmission.

5.8 The cheapest gigawatt

GROUNDED Duke University researchers estimated in 2025 that the existing U.S. grid could absorb 76 GW of new load if that load could be curtailed for 0.25% of the year, about 85 hours, and 126 GW at 1%. Curtailment events would average about two hours. The study did not model transmission constraints [37].

ANALYTIC The limits of that finding are real. It is a system-level estimate, not a guarantee that any given substation has room, and data center operators sell uptime, not curtailment. But the direction is unmistakable, and PJM's own ratings confirm it by crediting curtailable load at 91%. A data center with on-site gas can reduce its grid demand without reducing its computing. That converts on-site generation from the mechanism of uncontrolled disconnection into a tool the operator can call on. The hardware is identical. The difference is entirely in the rules.

5.9 What a grid-citizen campus looks like

ANALYTIC Drawing the section together, a data center campus with on-site gas and, later, reactors strengthens the grid if it meets the following conditions, and weakens it if it does not.

Requirement	Why it matters	Who sets it
Ride through routine faults	Prevents the mass disconnections seen in Virginia	NERC standards (expected 2027); grid operators; utilities
Controlled ramps and reconnection	Stops sudden load loss or return from exhausting reserves	Grid operators; interconnection agreements
Real-time visibility and operator-directed curtailment	Turns the campus into a resource the operator can use	FERC-approved tariffs; state law
On-site generation synchronized and obligated	Delivers inertia, voltage support and frequency response to the system, not only the campus	Interconnection agreements; NERC registration
Firm fuel with on-site backup	Keeps the gas running in the cold; raises accredited capacity	Developers; state regulators
No single trip larger than the system can absorb	Favors several smaller units over one large one	Planners; project design
Accurate models and data for planners	Lets operators predict behavior before an event rather than investigate after	NERC Phase 1 standards (due December 31, 2026)
Defined behavior when on-site generation trips	Settles in advance whether the campus sheds load or leans on the grid	Transmission service terms

5.10 The reliability verdict

ANALYTIC Does building gas and nuclear together make the U.S. grid more reliable? On the evidence, the answer has three parts.

- **On adequacy, yes, clearly.** The two resources fail under different conditions. Gas covers the decade nuclear cannot reach. Nuclear covers the winter exposure gas cannot shed. Operators already price the difference.
- **On stability, yes, conditionally.** Both add the rotating mass a grid with tens of gigawatts of volatile load needs, and gas adds the fast response. But those benefits reach the system only from machines that are grid-connected and bound by reliability obligations. Behind an unregulated meter, the same machines enable the disconnections that threaten stability.
- **On deliverability, no, not by themselves.** Both tracks compete for the same transformers and breakers, and neither removes the need for transmission.

ANALYTIC The buildout is currently adding load-side risk faster than it is adding supply-side strength. That balance is set by rules, and the most important of them will be written in the next eighteen months.

6. The Handoff

Building two things at once is a program. Getting the first to make way for the second is a strategy. The United States has the program. It does not yet have the strategy.

6.1 The default outcome

ANALYTIC Left to ordinary incentives, the sequence runs as follows. A hyperscaler needs power by 2029. It funds or contracts a gas plant with a 20-year fuel agreement and a 30-year financing term. The plant is sited for pipeline access, land and fiber. It is permitted as a permanent facility. Around 2032 a reactor becomes available at several times the cost per megawatt-hour of running the gas plant that already exists. The hyperscaler declines. The bridge has become the destination, and nobody decided that it should.

ANALYTIC Nothing in that sequence is irrational, and nothing in current policy interrupts it. Changing the outcome requires acting at four points: the site, the hardware, the contract and the permit.

6.2 The site: nuclear-ready or not

ANALYTIC A reactor cannot go wherever a gas plant can. NRC siting rules consider seismic conditions, flooding, population density, an exclusion area, emergency planning and cooling water. A reactor also needs a route for components that no highway permit covers (Section 7). A gas site chosen without those criteria in mind is unlikely to qualify later.

GROUNDED The one U.S. project engineered for conversion shows what selection looks like. Blue Energy's campus at the Port of Victoria, Texas, will start with two GE Vernova 7HA.02 gas turbines supplying about 1 GW by 2030 and add up to five BWRX-300 reactors, about 1.5 GW, from around 2032. The first part of its NRC construction permit application was filed in September 2026, and a final investment decision is planned for 2027. The site was studied for nuclear use once before: Exelon pursued an early site permit there for larger reactors of the design family the BWRX-300 descends from, before abandoning the effort in 2012 [17]. The port is served by a barge canal to the Gulf Intracoastal Waterway.

ANALYTIC The same logic explains why the first advanced reactor is being built beside a retiring coal plant in Wyoming [6], and why SMR proposals cluster at existing nuclear sites and former fossil stations. Those sites already have the grid connection, the water, the industrial zoning and often a community that has lived with a power plant for decades. The cheapest way to make a gas site nuclear-ready is to choose one that already was.

6.3 The hardware: what can actually be shared

ANALYTIC A gas-to-nuclear campus can share a good deal. The assets fall into three groups.

Asset	Shared between gas and nuclear?	Design implication
Land, security perimeter, roads, heavy-haul access	Yes	Size and route for the reactor from the first day
Grid interconnection, switchyard, step-up transformers	Yes, if sized for the final plant	Order electrical equipment once, for the end state
Cooling water intake and discharge	Largely	Permit water rights for the nuclear phase up front
Steam turbines, condensers, generators	Possibly, with compromises	See the caution below
Gas turbines and heat-recovery boilers	No	These remain as reserve capacity or are retired
Workforce, training, operations center	Partly	Nuclear qualification takes years; start early

GROUNDED Blue Energy describes its approach as switching the steam supply: the plant starts on gas, and the reactors later take over, reusing turbines, cooling and grid infrastructure [17].

SPECULATIVE A caution belongs here. A combined-cycle plant's steam turbine is designed for hot, high-pressure superheated steam from the gas turbine's exhaust. A boiling water reactor produces cooler saturated steam at lower pressure. A turbine built for one is not well matched to the other. AFR has not seen public engineering detail on how the conversion is achieved, and assumes the steam plant is designed for nuclear conditions from the start at some cost in gas-phase efficiency. A specialist reader should treat the shared steam cycle as a claim to be demonstrated. The sharing of site, switchyard, water and grid connection does not depend on it.

6.4 The role shift: from workhorse to reserve

ANALYTIC In a managed handoff the gas plant does not disappear. Its job changes. Before the reactors arrive it runs most hours of the year. Afterwards it runs when a reactor is refueling or tripped, when the campus needs to ramp faster than a reactor can, and when the grid calls for support. Section 5.6 showed that a reactor campus needs exactly that capability. The gas plant built as the bridge is the reserve the bedrock requires.

ANALYTIC The economics of that shift are the obstacle. A plant that drops from running 85% of the time to 20% earns far less from energy sales. Its capital still has to be recovered. Three mechanisms can close the gap:

- **Front-loaded recovery.** Depreciate the gas plant over the bridge period of ten to twelve years, not thirty, and charge the data center accordingly. Meta's agreement to pay for ten Entergy plants shows hyperscalers will accept direct cost responsibility [45].

- **Capacity payments for the reserve role.** Pay the plant to be available, not to run. PJM's accreditation already values firm dual-fuel gas at 79% of nameplate [14].
- **Fuel contracts with step-downs.** Write gas transportation and supply agreements that reduce volumes on a schedule tied to reactor milestones. Twenty-year flat commitments lock in the bridge.

6.5 The contract and the permit

ANALYTIC The handoff becomes real when someone is obligated to perform it. Several instruments are available to regulators and counterparties:

- **Milestone-linked offtake.** The hyperscaler's power contract commits it to take nuclear output when it arrives and steps down gas purchases as it does.
- **Nuclear-ready conditions on gas approvals.** A state siting board or utility commission can require that a large gas plant built for a data center demonstrate that its site, interconnection and water rights could host reactors, or explain why not.
- **Early licensing.** An early site permit or the first part of a construction permit can be filed while the gas plant is under construction, as at Victoria. Licensing time then runs in parallel with the bridge instead of after it.
- **Step-in rights.** If the data center tenant leaves, the generation continues to serve the grid under terms agreed in advance.

ANALYTIC None of these requires new federal law. Most sit with state commissions, grid operators and the contracting parties. That matters after the 2026 elections, because it means the handoff does not depend on a divided Congress.

6.6 A phased roadmap

Phase	Primary supply	Nuclear milestone	Grid obligation
2026–2029 Bridge-building	Existing plants, flexible load, small on-site gas; large turbines on order	Restarts online; first SMR construction; site permits filed at gas campuses	Ride-through and registration standards adopted; campuses visible to operators
2029–2033 Overlap	Large gas enters service; first reactors commissioning	Darlington and first U.S. SMRs operating; HALEU supply begins	On-site gas synchronized and obligated; curtailment rights in force
2033–2040 Step-down	Reactors carry baseload; gas falls to reserve duty	Fleet orders for standardized designs; first advanced units at scale	Gas paid for availability; campus behaves as a dispatchable resource
After 2040 Bedrock	Nuclear fleet with gas and storage as reserve	Export reference plants; life extension decisions	Reactor campuses anchor regional inertia and voltage

PROJECTION *Illustrative sequence for Scenario A. Dates assume first-of-a-kind reactors arrive within two years of current targets.*

6.7 What breaks the handoff

- ANALYTIC **Cheap gas stays cheap.** At $3 gas, an existing combined-cycle plant produces power for a fraction of new nuclear's cost [43]. The handoff must be justified on fuel security, winter reliability and strategic value, because it will not win on price for a decade.
- ANALYTIC **The first reactors disappoint.** A Darlington overrun or a further Palisades-style delay would give every hyperscaler a reason to wait.
- ANALYTIC **The fuel is late.** If HALEU slips past 2030, only light-water designs can perform the handoff on schedule.
- ANALYTIC **The demand moves.** If AI capital spending contracts, neither track has a customer for the second phase.

7. One Industrial Base, Two Tracks

"Modular" does not remove construction complexity. It moves it from the site to the factory, the forge and the road between them. The same is true of a gas turbine. What sets the schedule in both cases is everything that must arrive at the site intact and on time.

7.1 The same vendors, the same queues

GROUNDED GE Vernova holds the largest gas turbine backlog in the industry and, through its nuclear joint venture, supplies the BWRX-300 chosen for Darlington, Clinch River and Victoria [3, 74, 17]. Both tracks need steam turbines, generators, step-up transformers and high-voltage breakers from an overlapping set of suppliers, and both wait in the same lines for them [18].

GROUNDED On the nuclear side the base is thinner. The United States has no domestic capacity for ultra-large reactor forgings [75]. BWXT is the only U.S. manufacturer of reactor pressure vessels [76]. In May 2026 DOE awarded about $94 million to strengthen the light-water SMR supply chain, including $21.4 million for BWXT's vessel assembly plant at Mount Vernon, Indiana [77].

ANALYTIC Two tracks drawing on one base can starve each other. A forge, a transformer plant or a crane fleet committed to gas projects through 2031 is not available to the reactor program that is supposed to follow. Sequencing the two tracks is therefore an industrial planning question, not only an energy one. A firm multi-unit reactor order does more for a forge than any grant, because it gives the forge a schedule to build against while the gas work is still paying the bills.

7.2 The transport envelope

GROUNDED The largest single component of a BWRX-300 is its reactor pressure vessel. Ontario Power Generation describes the Darlington vessel as more than 30 meters long, more than six meters in diameter and 550 tonnes [9]. The vendor's specification gives an inside diameter of about four meters and an inside height of about 27 meters [59]. That is roughly 600 short tons in one piece, longer than a basketball court.

GROUNDED Gas plants are lighter but not light. Heavy-transport records show individual gas turbines of about 340 tonnes, generators of 300 to 470 tonnes and large transformers near 300 tonnes, moved on multi-axle modular trailers with total transport weights above 500 tonnes [78].

ANALYTIC None of these moves under a routine highway permit. They travel by barge, by specialized rail car, or on self-propelled modular transporters over surveyed and often reinforced routes. Every bridge rating, lock chamber, overhead clearance and turning radius becomes a design input. Four consequences follow for a two-track campus.

- **Route the site for the heaviest future lift, not the first one.** A campus that can receive a 340-tonne turbine by road may have no way to receive a 550-tonne vessel five years later. The reactor's delivery route has to be proven before the gas plant is sited. This is the logistics form of "nuclear-ready."
- **Navigable water is a siting criterion.** The pattern is already visible: Clinch River on the Tennessee River system, Darlington on Lake Ontario, the Victoria campus on a barge canal to the Gulf, BWXT's vessel plant on the Ohio River at Mount Vernon. Data centers look for fiber, land and substations. Reactors look for a barge landing. The overlap between those maps is smaller than the announcements suggest.
- **Module size is a transport decision disguised as an engineering decision.** A design is only as standardized as the routes that can carry it. One that is optimal at the factory and undeliverable to half the candidate sites is not modular in any useful sense.
- **The heavy-haul fleet is finite.** Turbines, generators, transformers and reactor components all draw on the same small national pool of specialized trailers, rail cars, heavy-lift cranes, escort crews and state permit offices. A decade of simultaneous gas and nuclear construction will test that pool in a way it has not been tested since the last nuclear build cycle.

ANALYTIC A federal inventory of waterways, locks, rail clearances and bridge ratings able to carry 500-tonne-class components, with pre-cleared corridors to candidate sites, would cost little and remove a constraint that is otherwise discovered one project at a time.

7.3 Fuel logistics

ANALYTIC The two fuels move in opposite ways. Gas arrives continuously by pipeline and stores poorly on site. A plant's reliability is the reliability of its lateral and its transportation contract, and a dedicated lateral can take as long to permit and build as the plant itself. Nuclear fuel arrives rarely, by truck, in small volumes under strict security, and sits in the reactor for a year or more. HALEU shipments carry additional material-security requirements.

GROUNDED Spent fuel does not leave. With no federal repository, it stays on site indefinitely, joining fuel already stored at 79 sites in 39 states [32]. **ANALYTIC** A county that accepts a reactor campus is accepting a storage facility with no end date. That belongs in the host agreement from the start.

7.4 People

GROUNDED In the 2026 AGC/NCCER workforce survey, 58% of construction firms that had worked on a data center project in the past year said those projects increased competition for skilled workers, and 49% reported more wage pressure [79]. Ontario Power Generation projects up to 17,000 jobs across its four-unit Darlington build [80].

ANALYTIC The labor collision is a national security issue. Data center electrical work, gas plant construction, nuclear construction, transmission and naval shipbuilding all draw on the same welders, electricians, pipefitters and quality inspectors. Nuclear-qualified welding and inspection take years to develop. Higher wages move workers between projects without adding to the total. A two-track program that peaks around 2029–2032 will meet the submarine industrial base in the same hiring halls.

7.5 Chokepoint summary

Chokepoint	Track	State of play, November 2026	Binding date or lead time	Who holds the lever
Large gas turbines	Gas	122 GW in one vendor's backlog and reservations; new orders for about 2030–2031	Three years for the turbine; up to six for the plant	Manufacturers; buyers with early slots
Step-up transformers and breakers	Both	Transformer lead times above 160 weeks; breakers at 125 weeks	Three to four years	Manufacturers; DOE; trade policy
Gas pipelines	Gas	Roughly 5 Bcf/d gap between projected demand and credible projects	Years to permit and build	FERC; states; pipeline companies
HALEU fuel	Nuclear	No U.S. commercial market; two enrichment build-outs funded	Russian waivers end January 1, 2028; supply about 2030 or later	DOE; NRC; Congress
Reactor forgings and vessels	Nuclear	No ultra-large forging capacity; one U.S. vessel maker	Firm orders needed before capacity expands	Allied suppliers; DOE; first buyers
Heavy-haul routes and equipment	Both	340- to 550-tonne components; barge and engineered routes	Fixed by geography	DOT; Army Corps; states
Skilled trades	Both	Data centers already tightening the market	Four- to five-year apprenticeships	DOL; unions; states; industry

8. The Host Community: Political Durability

Programs are rarely killed by engineering. They are killed by the people who live next to them, and by the officials who answer to those people. In November 2026 those people voted.

8.1 The reversed NIMBY

GROUNDED In March 2026 Gallup found that 71% of Americans oppose building an AI data center in their area, 48% strongly. In the same survey 53% opposed a nuclear plant in their area. Opposition to nuclear has not exceeded 63% since Gallup began asking in 2001 [19].

ANALYTIC For fifty years the reactor was the unwelcome neighbor. It is now being asked to stand beside a less welcome one. On a two-track campus the order of public acceptance is likely to be the reverse of the order of construction: the data center arrives first and is liked least, the gas plant arrives second with an air permit to defend, and the reactor arrives last with the strongest polling of the three. The reactor can lend legitimacy to the campus. The campus can also spend it before the reactor arrives.

8.2 The verdict of the 2026 elections

GROUNDED Democrats won control of both the House and the Senate on November 3, 2026 [20]. Data center costs and electricity bills were campaign issues in several states. The Senate sponsor of the Ratepayer Protection Act lost his seat to a challenger who campaigned on the issue [81]. Ballotpedia tracked 41 local ballot questions on data centers, and nearly every one went against development [21].

GROUNDED The bill itself illustrates the dividing line. It passed the House 417–3 in September and failed a Senate procedural vote 57–43. Its supporters called it a common-sense step that respects state authority over retail rates. Its opponents said protections that states may decline give ratepayers nothing [82]. Both sides claimed the same goal.

ANALYTIC Three implications follow for the two-track strategy. First, cost allocation will be legislated or regulated more tightly, at the federal or state level or both. Projects that already pay their own way, as Meta has agreed to do in Louisiana [45], are positioned for that. Second, local consent is now a binding constraint on siting, and it is harder to obtain for a data center than for a reactor. Third, neither party is hostile to firm power as such. The argument is over who pays and who bears the local burden. A strategy framed around national security, paid for by its beneficiaries and built on sites that already host power plants is the version most likely to survive a change of majority.

8.3 The bill

GROUNDED PJM's capacity auction for 2026/27 cleared at its cap for a record $16.1 billion [83, 84]. The independent market monitor attributed $9.3 billion of the previous year's $14.7 billion to data center load [84]. Residential electricity prices have risen more than 10% nationally since 2024, according to EIA data reported by Reuters [85]. FERC's June 2026 orders direct grid operators to prevent large-load costs from shifting to other customers and leave it to states to see that they do not [36].

ANALYTIC On-site generation is the industry's answer to the bill: a campus that brings its own power does not raise anyone else's capacity price. That answer is sound as far as it goes. It stops being sound when the campus leans on the grid for backup without paying for the capacity held in reserve for it. Section 5.6 identified that as the term to settle in advance. It is also the term voters will care about.

8.4 Anatomy of the construction project

Phase	Duration	Local upside	Local burden
Data center	About 2 years, often in several stages	Thousands of construction jobs at peak; large property tax base where not abated	Heavy truck traffic; noise; water use; few permanent jobs for the capital invested
Gas plant	2–4 years on site	Construction employment; pipeline and substation investment	Air emissions and permits; pipeline rights-of-way; noise
Reactor	Several years per unit	Largest and longest construction workforce; high-wage permanent operators	Housing pressure and worker camps; emergency planning; spent fuel stored on site indefinitely
Heavy-haul deliveries	Episodic, across all three	Bridge and road upgrades that outlast the project	Route closures, reinforcements, escorted moves
Operations	Reactor 60 years; gas 30; data center building about 15	Durable tax base; skilled permanent jobs at the power plants	A small permanent workforce relative to the construction peak

ANALYTIC Two features deserve a county commissioner's attention. The construction peaks arrive in sequence, so a two-track campus can mean a decade of continuous building, with the housing and road effects that implies. And the three assets have three different lifetimes. An agreement on taxes and community benefits should run with the power plants, which will outlast the tenant that justified them.

9. Security: A New Class of Critical Infrastructure

ANALYTIC A campus that combines a reactor, a gas plant, a gigawatt substation and a concentration of national compute is a more valuable target than any of them alone. Current security rules treat them as separate facilities under separate regimes. Co-location joins them physically without joining the rules.

- GROUNDED **Drones.** Facility operators have filed 67 reports of drones over or near 28 U.S. nuclear sites in 17 states since 2024, according to NRC records [86]. The NRC states that plant security forces have no authority to interdict aircraft, including drones, over their facilities [87].
- ANALYTIC **The authority gap.** A commercial campus with reactors would be guarded by a private force that cannot legally act against a drone overhead. Military installations have that

authority. The Army's Janus model, with reactors inside the fence, avoids the gap [34]. A commercial campus in a rural county does not.

- ANALYTIC **The pipeline as single point of failure.** During the bridge years, a gas-fed campus depends on one or two laterals. A physical or cyber attack on a pipeline or compressor station takes the campus down as surely as an attack on the campus. Fuel stored on site, or a second supply route, is a security measure as well as a reliability one.
- GROUNDED **Materials.** HALEU carries proliferation and security sensitivities that standard reactor fuel does not, and at least one hyperscaler-linked design plans to use fuel recovered from reprocessed spent fuel [32].
- ANALYTIC **Cyber.** A compute campus is among the most network-connected facilities in the economy. Reactor safety systems are meant to be among the least. Co-location demands hard separation that survives decades of tenant turnover. NERC has said it will consider cyber and physical security standards for large computational loads after the first phase [64].
- GROUNDED **Emergency planning.** NRC rules adopted in 2023 allow emergency planning zones scaled to a small reactor's risk, in some cases to the site boundary [88]. ANALYTIC That is what makes co-location physically possible. It also places the data center's workforce inside the planning perimeter.

10. Failure Modes

10.1 The bridge that stays

ANALYTIC The most likely failure is quiet. Gas plants get built, perform adequately, and are never displaced, because nothing obliges anyone to displace them. The country reaches 2040 with a grid more dependent on one fuel than at any time in its history, exposed to winter events and to an export market that links domestic gas prices to conflicts overseas. No single decision causes this. It is what happens when the handoff is left to incentives.

10.2 The winter the gas does not arrive

GROUNDED The grid held through Winter Storm Fern with 68 GW of unplanned outages and gas demand at 172 Bcf/d [40]. ANALYTIC Add 6 to 10 Bcf/d of data center gas demand and tens of gigawatts of new load, and the same storm in 2030 meets a tighter system. Data centers with firm fuel and on-site backup would ride through. Households on the same pipelines might not. A winter failure attributed to data center gas demand would be the most politically damaging event the industry could suffer.

10.3 The reliability event

ANALYTIC The July 22 disconnection did no lasting harm. A larger one on a smaller grid on a stressed day could. If a cascade of data center disconnections ever contributes to a regional blackout, the response will be swift and blunt: moratoria, forced curtailment, and suspicion of everything on a data center site, including its generation. The standards due at the end of 2026 and in 2027 are the industry's opportunity to prevent that. Their absence is the risk.

10.4 The lifetime mismatch

GROUNDED A reactor is designed for 60 years [59]. A gas plant is financed for about 30. Hyperscalers depreciate servers over five to six years [89]. **ANALYTIC** A reactor built for a 2032 data center will outlive ten generations of chips, several generations of buildings, and possibly the company that ordered it. Its real customer is whatever occupies that site in the 2050s. Generation has to be justified on its value to the grid, with the data center as its first customer and not its only one.

10.5 The capex break

GROUNDED Three of the four largest hyperscalers ran negative free cash flow in the third quarter of 2026 while guiding to still higher spending in 2027 [23]. **ANALYTIC** If that spending contracts in 2029, the consequences differ by track. A gas turbine can be resold or redeployed, and a gas plant can serve the grid. A half-built reactor has no secondary market. The stranded-asset risk of the two-track strategy sits almost entirely on the nuclear side, which is the side the state most wants built. That asymmetry is the argument for public underwriting of the first fleet.

10.6 The first-of-a-kind premium

GROUNDED New U.S. nuclear is priced at $175 to $255 per megawatt-hour on the Vogtle experience [43]. **ANALYTIC** Every reactor ordered singly is a first-of-a-kind reactor. A handoff that depends on one-off projects will fail on cost. It needs a series.

10.7 The off-grid fiction

ANALYTIC No reactor campus is truly off the grid. Reactors refuel, trip, and by design rely on outside power. Data centers need more availability than any single source provides. A campus marketed as self-sufficient is a grid-connected campus with an unusual ownership structure and, too often, an unpriced claim on the system’s reserves.

11. The Verdict in Detail

PROJECTION The three scenarios from the Executive Summary are set out below with the conditions each requires and the signposts that would show which is unfolding. The probabilities are AFR judgments, not model outputs.

Scenario	What must be true	Signposts, 2027–2030	What it means for the state
A. Managed Handoff (about 25%)	Large-load reliability standards with ride-through take effect; gas campuses are sited and contracted for conversion; Darlington and Clinch River deliver near plan; HALEU arrives around 2030; a federal or federally backed fleet order is placed	More projects on the Victoria model; state commissions attach nuclear-ready conditions; TVA breaks ground; a multi-unit SMR order of four or more; capacity payments for reserve gas	Firm power on two fuels; a domestic reference reactor for export; gas fleet preserved as strategic reserve
B. Permanent Bridge (about 50%)	Gas supply and turbines keep pace with load; reactor projects slip or price out; no instrument obliges a step-down	Turbine backlogs keep growing; 20-year flat gas contracts; hyperscaler nuclear deals stay at the option stage; restarts and first units slip further	Adequacy met at higher winter and fuel-price exposure; nuclear export credibility deferred; China and Russia keep the field
C. Capex Break (about 25%)	AI capital spending contracts mid-build because of efficiency gains, financing stress or demand that disappoints	Cuts to capex guidance; data center cancellations; turbine slots resold; reactor projects seek federal rescue	Stranded nuclear projects; costs socialized; both tracks lose political support for years

ANALYTIC B is the most likely outcome because it requires nothing. It is what the present arrangement produces if nobody acts. A requires deliberate choices by regulators, buyers and the federal government, most of them in the next three years while the gas plants are still being sited. C is the scenario that most needs protection planned in advance, because its costs fall on people who never signed the contracts.

ANALYTIC B is not a catastrophe. A gas-carried grid would power American AI through the 2030s. The loss is strategic: a nuclear industrial base that never reached scale, an export market conceded, and an electricity system whose resilience depends on a single fuel. The country would have kept its lead in compute and passed up the chance to convert that lead into a lasting energy advantage.

12. Levers and Tradeoffs

AFR does not advocate for policies. The levers below are the ones that move the scenario odds, each set out with its main tradeoff. Most do not require new federal legislation.

Condition the bridge on the handoff. State siting boards and utility commissions could require large gas plants built for data centers to show that the site, interconnection and water rights could host reactors, and that fuel and offtake contracts contain step-downs. *Tradeoff:* slower and costlier gas approvals in the years when speed matters most.

Make on-site generation a grid resource. Interconnection terms could require behind-the-meter plants above a threshold to be synchronized, visible to operators and bound by reliability obligations, in exchange for capacity credit. *Tradeoff:* data center owners give up some control of assets they paid for.

Finish the load standards, including ride-through. The first phase is due December 31, 2026. Ride-through, the requirement that addresses the Virginia events, is not expected until 2027. *Tradeoff:* retrofit costs for existing facilities, and the risk that hurried standards are poorly matched to how the equipment actually behaves.

Buy the first fleet, not the first unit. A federal or federally backed order for a standardized series of light-water SMRs would give forges, fuel fabricators and trades a schedule. *Tradeoff:* it picks a design and puts first-of-a-kind risk on taxpayers. Repetition is still the only proven way to bring the cost down.

Treat HALEU as a defense program. Guaranteed government offtake for enrichment and fabrication would break the standoff between reactor developers and fuel suppliers. *Tradeoff:* cost, and the safeguards burden of handling more higher-enriched material.

Winterize the bridge. Firm transportation, on-site backup fuel and weatherization could be made conditions of capacity credit for data center gas. *Tradeoff:* higher cost per megawatt, and more competition with households for firm pipeline capacity.

Map the heavy-haul envelope. A federal inventory of waterways, locks, rail clearances and bridge ratings for 500-tonne-class components, with pre-cleared corridors, would let siting reflect what can be delivered. *Tradeoff:* very little. This is among the cheapest high-leverage actions available.

Decide cost allocation explicitly. Options run from voluntary federal standards to mandatory large-load tariffs to direct funding of dedicated plants by the customer. *Tradeoff:* speed and state authority against certainty for ratepayers. The 2026 election suggests the question will be decided one way or another.

Underwrite the nuclear stranded-asset risk deliberately. Take-or-pay contracts backed by hyperscaler credit, step-in rights and a federal backstop for the first fleet would make the risk priced instead of discovered. *Tradeoff:* more expensive deals, and some buyers will walk away.

Plan the trades as industrial policy. Apprenticeship capacity could be coordinated across data center, gas, nuclear, transmission and shipbuilding demand. *Tradeoff:* the payoff takes longer than an election cycle.

Close the counter-drone gap and settle the waste question. Both are long-standing federal problems that co-location makes more pressing. *Tradeoff:* airspace authority and civil liberties in the first case, four decades of repository politics in the second.

13. Signposts

When	Event	Why it matters
December 31, 2026	NERC files first reliability standards and registration criteria for data centers [15]	Brings large loads inside the mandatory reliability framework
End of 2026	Linglong One fuel load and grid connection target [28]	Calibrates real SMR schedules, including China's
January 2027	New Congress seated [20]	Direction of cost-allocation and data center legislation
March 1, 2027	NERC work plan for further standards, including ride-through [15]	Whether the Virginia failure mode gets a rule
June 1, 2027	PJM deadline for large loads to bring their own generation or face earlier curtailment [62]	Converts the gas bridge from option to requirement
2027	Blue Energy investment decision; second part of its NRC application [17]	Whether the conversion model is financeable
2027	Palisades and Crane return to service [8]	Proves the nearest nuclear megawatts
2027	TVA construction start at Clinch River (not yet announced) [52]	The U.S. reference SMR becomes real
January 1, 2028	Russian uranium import waivers expire [58]	The fuel cliff
September 30, 2028	Deadline for an Army-regulated reactor at a domestic installation [34]	First operating test of the microreactor model
2029–2031	Large gas turbines ordered in 2026 enter service [4]	The bridge reaches full weight
2030	Darlington Unit 1 and Natrium targeted for operation [9, 6]	The Western cost and schedule benchmarks
Every July	PJM capacity auction results [12]	The size of the shortfall and the political temperature of the bill
Every winter	FERC-NERC cold-weather performance reviews [40]	Whether the gas bridge holds in the season that tests it

CLOSING NOTE

A bridge is judged by what stands on the far side. The United States is building the bridge now, quickly and at great expense, because it must. Whether anything is built on the far side is still undecided.

The reactors will not arrive on their own, and the gas plants will not step aside on their own. The grid that carries both will not steady itself. Each of those is a decision, and most of them fall due while the first turbines are still on order.

Appendix: Reliability Terms

Term	Meaning
Adequacy	Having enough generating capacity and energy to meet demand, including in extreme conditions.
Area control error (ACE)	The instantaneous gap between what a grid operator is generating and what it should be generating to hold frequency and scheduled flows. Large positive values mean too much generation.
Behind the meter	Generation located on the customer's side of the utility meter, serving the customer directly.
Bulk power system (BPS)	The high-voltage generation and transmission network that NERC standards govern.
Contingency	The sudden loss of a major element, such as a generator or transmission line. Reserves are sized to the largest credible one.
Curtailment	A reduction in a customer's grid demand at the operator's direction.
Deliverability	The ability of the transmission network to carry power from where it is generated to where it is used.
ELCC	Effective Load Carrying Capability. The share of a resource's nameplate capacity that it can be counted on to deliver in the hours of greatest risk.
Fault	A short circuit on the power system, usually cleared by protective relays within a fraction of a second.
Frequency response	The automatic adjustment of generator output within seconds to arrest a change in system frequency.
HALEU	High-assay low-enriched uranium, enriched to between 5% and 20%. Required by most advanced reactor designs.
Inertia	The energy stored in the rotating mass of synchronous generators, which resists sudden changes in frequency.
Inverter-based resource	Generation or storage connected to the grid through power electronics, such as solar, wind and batteries.
Ride-through	The ability of equipment to stay connected and operating through a brief voltage or frequency disturbance.
Synchronous generator	A rotating machine electrically locked to grid frequency. Gas, steam and hydro turbines drive generators of this kind.

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