pillsbury Gravel2Gavel
Construction & Real Estate Law Blog

Powering Data Centers with Nuclear Generation

by **Robert A. James**, **Elina Teplinsky**, **Jeffrey S. Merrifield** and **M.C. Hammond**
Posted May 30, 2025

   

The rapid growth of electricity demand from data centers has emerged as a major challenge for the U.S. power sector. Much of this demand is being driven by the deployment of large learning models (LLMs) and generative artificial intelligence (AI). These workloads require large-volume, high-uptime computational infrastructure, and correspondingly large, reliable power supplies.

Combined with broader electrification across transportation, buildings and industry, this surge is pushing generation planning as well as grid capacity toward and beyond their limits across many national and international jurisdictions. For utilities and grid operators—many of which have faced decades of ho-hum flat or predictable load growth—this new environment demands rapid, large-scale planning. Build too little, and the risk of blackouts increases. Build too much or in the wrong places or sequence, and ratepayers are stuck funding stranded assets.

Data centers are approaching and exceeding gigawatt-magnitude loads and demand exceptional reliability—up to 99.999% online service—due to the computational and financial costs of power interruptions, and many data center developers are committed to identifying carbon-free generation for their facilities. Traditional generation sources have their limitations. Natural gas-fired projects have been delayed by the current long lead times to procure turbines, and carbon capture is presently an expensive pathway to zero-emission power. Variable renewable energy (VRE) sources like solar and wind, paired with lithium-ion battery storage, have attractive near-term economics but face longer-term impediments for data center applications when taking into account the useful life of panels, turbines and especially batteries, and the large amount of land required for renewable deployment at this enormous scale. **Advanced geothermal** is promising for some quantity of generation or heat content focused in certain geographies and geologies.

The challenge with any mix of existing generation sources is that the demand for power occasioned by data centers is dwarfing the capabilities of gas, renewables/storage and geothermal for baseline operation. “It’s crazy because […] the [entire] state of Oregon is about 6 gigawatts (GW),” **says one Amazon manager**, “and you have these large hyperscalers [asking,] ‘Can I get 6 GW too?’”

Enter Reliable and Carbon-Free Nuclear Energy

Nuclear power in the United States has long served as a cornerstone of the country's low-carbon energy mix. As of 2025, there are 94 commercial nuclear reactors operating across 28 states, collectively providing nearly 20% of the nation's electricity and almost half of its carbon-free generation. These reactors offer unparalleled reliability, with average capacity factors exceeding 94%, far outperforming most other generation sources. Increasingly, the nuclear fleet is being viewed not only as clean energy infrastructure but as a strategic asset for powering AI workloads and data centers.

In this context, several shuttered nuclear plants are being actively pursued for restart, reversing what had been a trend of premature closures due to market pressures. Most notably, the Palisades Nuclear Plant in Michigan—shut down in 2022 and acquired by Holtec International—is now on track to become the first U.S. commercial nuclear plant to restart after closure, with support from the U.S. Department of Energy's Loan Programs Office (LPO). The plant could return to service as early as 2025.

Another notable example is the 2024 power purchase agreement between Microsoft and Constellation Energy, structured to support the restart of the Three Mile Island Unit 1 (TMI-1) reactor in Pennsylvania. (This is not the TMI-2 unit that was the subject of the 1979 incident.) The deal is among the first of its kind to link a corporate clean energy buyer directly to the revitalization of a retired nuclear asset and reflects growing interest in pairing existing nuclear infrastructure with long-term digital energy demand.

These restart efforts are not sufficient to meet the scale and speed of demand driven by the explosive growth of AI. Even if all viable U.S. reactors currently under consideration for restart were successfully brought back online, their combined capacity would represent only a fraction of projected demand growth—let alone offer the geographical diversity or scalability needed to support the decentralized digital infrastructure emerging across the country. Similarly, many existing nuclear units will be seeking power uprates—potentially adding several thousand megawatts to the grid—but this too will not meet AI-based demand. To close this gap, companies are pursuing a new wave of nuclear construction focused not only on traditional large-scale plants but also on Small Modular Reactors (SMRs). To understand the attraction of SMRs for this application, it is useful first to step back and understand what these reactors are and how they are distinctive in two dimensions—different from prior nuclear builds and suited for the data-center context.

SMRs have the capability to have significant portions of the plants built in a factory environment, where economies of scale can be captured and weather-related impacts are avoided. While today's large nuclear power plants can involve 30-35% fabricated content, many SMRs are **expected** to have 50-60% of such content. The modules are also smaller and designed to be shipped either entirely within a standard rail or truck container or in a modest number of containers for ready assembly on site. The more modules built in a given factory with the same workforce, the better the cost and schedule expectations.

SMRs are generally considered to be reactors between 50 and 300 megawatts of electricity output or MWe, though there are examples, such as the Rolls Royce 440 MWe design, that are larger. Designs smaller than 50 MWe are considered to be microreactors. The range of designs encompasses (a) compact versions of the "Gen III+" widely deployed technology based on light water cooling (either pressurized water reactors (PWR) or boiling water reactors (BWR)), as well as (b) new "Gen IV" designs using non-water cooling and moderating materials (including molten salt, sodium and lead, among others) at higher temperatures for greater efficiency.

Here is the **Pillsbury Guide to Advanced Reactor Designs**, so you can see a subset of the dozens of modular designs being evolved in the regulatory and commercial domains.

SMRs are especially compelling for the data-center use case. They offer:

- Baseload reliability critical for high-throughput AI workloads;
- A small physical footprint compared to land-intensive VRE;
- Flexibility for siting near data centers to minimize latency and interconnection issues. This is because the U.S. Nuclear Regulatory Commission, which normally requires an Emergency Planning Zone (EPZ) of at least

10 miles, supports SMRs having a smaller EPZ that extends only to the plant's site boundary (as little as 1,000 yards from the plant);

- Support for "behind-the-meter" installations that allow developers to bypass increasingly lengthy grid interconnection timelines. (**FERC proceedings are currently under way** that will help determine the contributions co-located facilities will make to share in the grid costs.)

New Nuclear Economic and Regulatory Outlook
Can the promise of new reactor deployments be realized to meet the energy demand occasioned by the data center and other drivers for electrification?

According to a recent study by the Idaho National Laboratory, which facilitates nuclear research, powering a 300 MWe data center entirely with VRE and batteries could cost more than a similarly sized SMR over time. That study recognizes that to address issues of intermittency, wind or solar generation would have to be overbuilt to meet the demand need. Additionally, due to the degradation curves of lithium batteries, their limited useful lives will require more capital investment during the lifespan of a typical data center facility. Admittedly, the study also assumes that SMRs can be built on budget and in about 4.5 years, as is currently envisioned.

Other studies hedge their bets on the possible cost, schedule and efficiency performance of SMRs, given the early stage in their development. Nonetheless, there are certainly conceptual attractions of having a **large amount of zero-emission power** generated with **high uptime** on a **small footprint**. An SMR should be able to achieve 57,000 MWh/acre/year at only 38 GW/acre, better than either gas or VRE on the one hand or large nuclear on the other.

Each SMR design outlined on the chart above is pursuing its own distinctive path to regulatory approvals and commercialization in the United States and beyond. Kairos Power obtained a construction permit from the NRC in December 2023 and completed the first safety-related concrete pour for its Hermes reactor earlier this month. And in April 2025, Ontario Power Generation (OPG) in Canada obtained a construction permit from the Canadian Nuclear Safety Commission (CNSC) for the construction of the first GE-Hitachi BWRX-300 reactor on the site of its Darlington nuclear power plant. TerraPower started site preparation activities last year for its commercial scale reactor in Wyoming. NuScale has now achieved NRC standard design approval for its larger 77 MWe design. Other designs are well along in the regulatory approval and pre-application processes. The various hyperscalers are aligning with several of the modular reactor developers, placing bets in most cases on more than one horse.

The **Pillsbury Nuclear-Powered Data Center Project Tracker** is **available here**. (Fusion generation for data centers deserves, and will receive, its own Pillsbury article.) Pillsbury is active on multiple nuclear projects—both large reactors and SMRs. Please contact the authors for more information and assistance.

De-Risking First-Mover Investment
The on-again, off-again history of new nuclear construction in the U.S. has led to little stability in construction workforces and an inability to validate cost estimates. This has made sponsors and lenders wary of the economic viability of nuclear energy—whether large reactors or SMRs. Any lender is likely to require that project funding plans include some form of large and readily available financing reserves (e.g., cash, letters of credit, or funding availability) to cover unplanned costs. This contingency adds meaningfully to the overall capital commitment. Even with such project cost buffers, there remains some probability that costs will exceed committed financing.

To combat this risk, the Energy Futures Finance Forum—a program within the EFI Foundation—recently published a policy framework for a publicly funded cost stabilization facility (CSF) to address the risk of potential cost overruns to sponsors for early-stage projects, with the intent to mitigate a key hurdle to new nuclear energy projects.

Together, **EFI and Pillsbury developed a model term sheet** for such a CSF. Under this structure, a guaranteed loan would be drawn to support potential cost overruns of at least three SMR projects using the same underlying technology. The CSF could be backed by either a private lender or a public one, such as the Department of Energy's LPO.

The risk of cost overruns is greatest for the earliest projects, and later projects will benefit from identifying the issues encountered in prior projects and how to avoid or mitigate them. Thus, the sponsors should agree to share the repayment of the CSF, again on an equitable basis. In recognition that the first projects may face the greatest challenges, the model term sheet does not specifically allocate the CSF, so the first project could potentially absorb all of the capacity, unless the sponsors choose to specify an allocation.

The model term sheet is by its nature only a starting point, and eventual agreements for a CSF of this type may differ in various ways. However, this model can provide the required conceptual approach needed in order to share the risks of cost overruns across multiple projects and over an extended payback period.

Uncertainty Between Congress and the White House on Nuclear Financing
The Trump administration and Energy Secretary Chris Wright have continued to champion new nuclear development. Indeed, on May 23, 2025, **President Trump signed four executive orders** to speed up commercialization of nuclear power in the U.S., with a goal to quadruple nuclear power capacity by 2050.

The enthusiasm shown by the executive branch needs to be aligned with legislative proposals. The House budget bill proposed shortening the eligibility window for key federal incentives. Under the proposed change, construction would need to begin before the end of 2028 to qualify for Production Tax Credits (PTCs) or Investment Tax Credits (ITCs). This accelerated timeline could disqualify new nuclear projects without a current order book.

The House also proposed rescinding all unobligated credit subsidy funding for the DOE LPO. If enacted, this would require borrowers—particularly those developing first-of-a-kind projects—to bear the full cost of the loan risk, making LPO-backed financing less affordable and accessible. This is at odds with Secretary Wright's indication that LPO monies should be directed toward nuclear projects.

If these proposals were to become law, nuclear project development will rely even more heavily on anchor customers like the hyperscalers. These companies may need to provide upfront equity, development funding, or long-term power purchase agreements (PPAs) to catalyze early deployment.

The Senate is actively considering modifications to the budget bill. Senators Dave McCormick (R-PA) and Chris Coons (D-DE) recently introduced the International Nuclear Energy Financing Act to encourage more nuclear energy financing for projects that would create jobs in the United States. Senator John Barrasso (R-Wyo.) is the Senate Majority Whip and has historically supported nuclear development.

For tech companies aiming to scale AI data centers, nuclear offers firm, clean, scalable power. But making this opportunity a reality will take creative approaches to project finance, including new forms of risk-sharing.

Pillsbury's Energy Transition Group is actively engaging with clients on innovative funding structures for new nuclear. From engaging with the DOE and national laboratories to forming development consortia, we are supporting sponsors, developers, utilities and tech firms navigating this next chapter in energy infrastructure.

RELATED ARTICLES

Posted in: **Colocation**, **Data Centers**, **Hyperscale** and **Nuclear**
Edit Post
Comments are closed.

Topics

Construction Generally (642) | **Environmental (628)** | **Real Estate (326)** | **Government Contracts (133)** | **Energy (99)** | **COVID-19 (Coronavirus) (98)** | **Infrastructure (85)** | **Renewables (73)** | **Insurance (70)** |

Pillsbury Guide to Advanced Reactor Designs

Design	Capacity	Details & Status
Pressurized Water Reactor (PWR)		
Nuscale VOYGR	77 MWe	NRC Certified 50 MWe design in 2022, 77 MWe design certification expected in July 2025. Established supply chains with Doosan in Korea, and ability to use commercial fuel.
Holtec SMR-300	300 MWe	$116 million risk reduction award through DOE ARDP program. Two units to be deployed at Palisades site in Michigan. Pre-application activities with the NRC.
Westinghouse AP300	300 MWe	Smaller version of AP1000. Early discussions with USNRC.
Westinghouse AP1000	1100 MWe	Full size AP1000 PWR. NRC design certified and successfully constructed at Vogtle Units 3 & 4. Installed in many locations in the U.S. and abroad.
Rolls Royce RR SMR	470 MWe	Great British Nuclear selected the RR SMR along with five other SMRs to progress to the next phase of the UK's innovative nuclear technology competition for potential deployment in the country.
Deep Fission Borehole Reactor 1 (DFBR-1)	15 MWe	Pre-application activities with the NRC.
Last Energy PWR-20	20 MWe	Announced plans to build 30 microreactors in Northwest Texas. Nonbinding commercial agreements to deploy 80 units in UK and EU markets.
Boiling Water Reactor (BWR)		
GE-Vernova BWRX-300	300 MWe	Approved for construction by Ontario Power Generation (OPG) at Darlington New Nuclear Project in Lake Ontario. TVA submitted USA's first construction permit application for BWRX-300 SMR at the Clinch River site, near Oak Ridge, Tenn.
High-Temperature Gas Reactor (HTGR)		
BWXT BANR	15-20 MWe	Contract with Wyoming Energy Authority to evaluate placement at mining/ industrial sites. Signed a collaboration agreement with Tata Chemicals Soda Ash Partners (TCSAP) to explore the potential deployment of the BANR SMR at the TCSAP's Green River site in Wyoming.
NANO Nuclear Energy KRONOS MMR	15 MWe	Working with University of Illinois at Urbana-Champaign to go through NRC licensing approvals.
Radiant Energy Kaleidos	1.2 MWe	Selected by U.S. DOE in April 2025 to receive HALEU for first reactor test.
X-Energy XE-100	80 MWe	Selected for DOE ARDP—two units at Dow Texas site. Four units at Amazon/ EnergyNorthwest with direct investment from Amazon. Allocated initial HALEU amounts by DOE.
Molten Salt Reactor (MSR)		
Natura Resources MSR-1	Non-power research 100 MWe commercial	Initial prototype research reactor received construction license for deployment at Abilene Christian University.
Terrestrial Energy Integral Molten Salt Reactor (IMSR)	195 MWe	NRC pre-application and CNSC review.
Kairos Power KP-FHR (Fluoride-Cooled High Temperature Reactor)	150 MWe (2x75 MWe plants)	Selected for $303 million risk reduction award by DOE. First non power units at Oak Ridge. 500 MWe deal with Google. Allocated initial HALEU amounts by DOE.
Liquid Metal-Cooled Reactor (LMR)		
TerraPower Natrium Sodium Fast Reactor	345 MWe 500 MWe (5.5 hrs)	Selected for DOE ARDP demonstration award. Non-Nuclear construction has begun for coal-to-nuclear site in Kemmerer, Wyo. Allocated initial HALEU amounts by DOE.
ARC Clean Technology ARC-100	100 MWe	The ARC-100 reactor has been selected by NB Power, the primary electric utility in the Canadian province of New Brunswick for deployment at their Point Lepreau Nuclear Generating Station.
Oklo Aurora Sodium Fast Reactor	15 MWe 50 MWe	Power agreement signed in December 2014 with Switch, a data center developer.
High-Temperature Sodium Heat Pipe		
Westinghouse eVinci Microreactor	5 MWe	$7.4 million cost share award through DOE ARDP risk reduction program. Allocated initial HALEU amounts by DOE.

Pillsbury Nuclear-Powered Data Center Project Tracker

June 2025 Edition

Advanced Reactors and Small Modular Reactors (SMRs)

Data Center Offtaker	Reactor Design	Anticipated Operator	Nameplate Capacity/Unit	Anticipated MW in Deal	Announced Deal Structure	Potential Location
Amazon Web Services	X-energy XE-100	Energy Northwest	80 MWe	320 MW with option to scale up to 960 MW	$500 Series C-1 round led by Amazon's Climate Pledge fund, with investment from Citadel founder Ken Griffen, NGP and the University of Michigan.	Pacific Northwest
Amazon Web Services	X-energy XE-100	Dominion	80 MWe	300 MW	$500 Series C-1 round led by Amazon's Climate Pledge fund, with investment from Citadel founder Ken Griffen, NGP and the University of Michigan.	Virginia (North Anna Power Station)
Google	Kairos Power KP-FHR	Various	75 MWe (deployed two at a time for 150 MWe total)	500 MW (1 initial 50 MW reactor with 6x75MW reactors subsequently)	Master Plant Development Agreement	Multiple
Standard Power	NuScale VOYGR	ENTRA1 Energy	77 MWe	Up to 2 GW	In October 2023 Standard Power announced it had selected NuScale as the SMR technology partner for two planned gigawatt-scale data centers. ENTRA1 has the rights to develop, manage, own and operatre the plants.	Ohio, Pennsylvania
Switch	Oklo Aurora Powerhouse	Various	50 MWe	12 GW	Master Power Agreement	Nevada
Meta				1–4 GW	Requests for proposals were due February 7, 2025. Over 50 qualified submissions received for RFP.	
Oracle				TBD	Designing a data center that would be powered by three SMRs	
Google				2.4 GW (at least three sites will deploy 600 MW each)	Elementl Power, an advanced nuclear development company, will identify, acquire and prepare locations to accommodate the reactors.	

Existing Nuclear Plants and Nuclear Plant Restarts

Data Center Offtaker	Nuclear Power Plant	Project Type	Owner	Announced Deal Structure	Expected Online Year	Potential Location
Microsoft	Crane Clean Energy Center (formerly Three Mile Island, Unit 1)	Plant Restart + Long-Term PPA	Constellation	20-year PPA at approximately $100/MWh	Mid-2028	Londonderry Township, Penn.
Amazon Web Services	Susquehanna Nuclear Station	Existing Plant + Co-Location/ Behind-the-Meter	Talen Energy	Direct sale of data center campus to Amazon Web Services	Challenges asserted for co-located data centers and behind-the-meter load.	Salem Township, Penn.
Meta	Clinton Clean Energy Center	Existing Plant + 30 MW	Constellation	20-year Corporate Nuclear Energy Agreement for Zero Emissions Credits (ZEC), taking over when state ZEC program expires	2027	Clinton, Illinois
Public reporting of discussions	Calvert Cliffs Clean Energy Center	Existing Plant + Co-Location/ Behind-the-Meter	Constellation			Calvert County, Md.
Public reporting of discussions	Comanche Peak	Existing Plant + Co-Location/ Behind-the-Meter	Vistra	Vistra in discussion with several parties. Comanche Peak is in ERCOT and outside FERC jurisdiction.	Public reports also note Vistra is in discussion to build new gas power plants to support data center projects directly.	Dallas, Texas
Public reporting of discussions	Hope Creek Nuclear Generating Station	Existing Plant	PSEG		According to public reporting on PSEG, deal is possible this year and is not contingent on the outcome of FERC investigation into PJM colocation rules.	Lower Alloways Creek Township, N.J.
Public reporting of discussions	Salem Nuclear Power Plant	Existing Plant	PSEG		According to public reporting on PSEG, deal is possible this year and is not contingent on the outcome of FERC investigation into PJM colocation rules.	Lower Alloways Creek Township, N.J.