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Power scarcity for US data centers requires creative thinking, off-grid solutions

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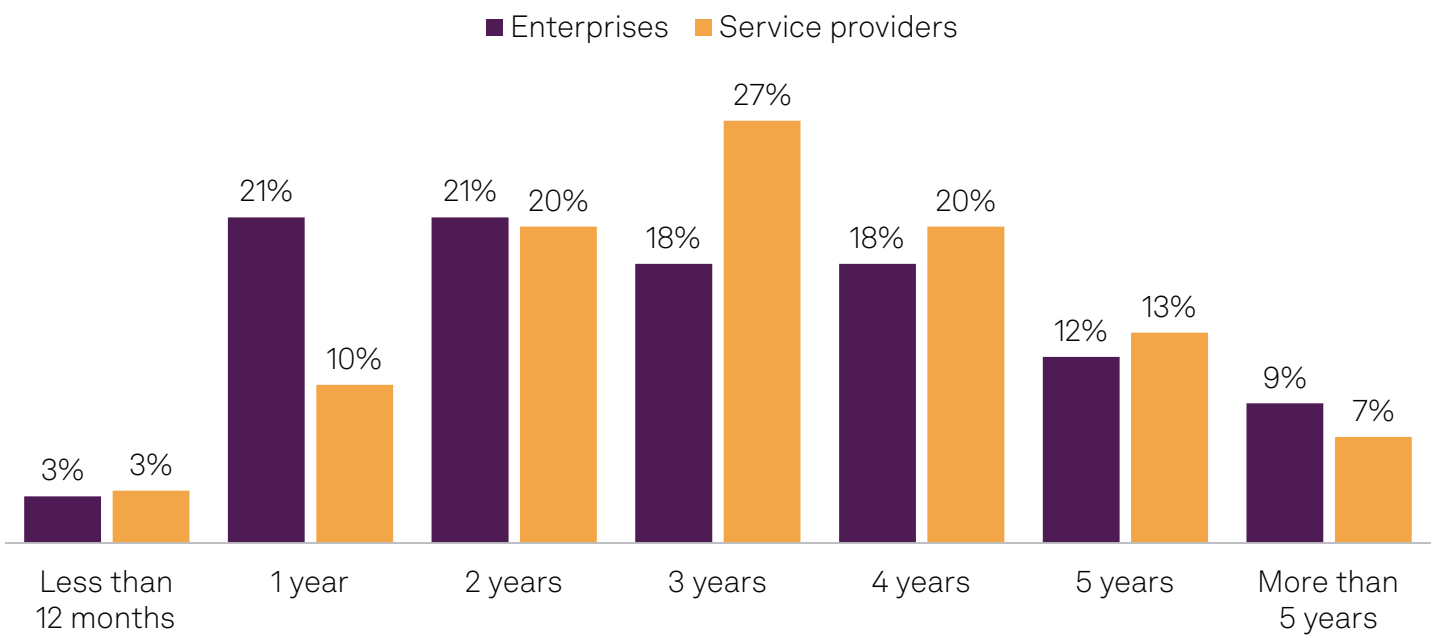
Introduction

Rapid adoption of AI is driving a surge in global data center growth, with a heavy concentration of growth in North America. By 2030, data center operators are projected to consume an additional 1,084 TWh of power, reflecting a compound annual growth rate of 13% from 2025 to 2030, with North America alone accounting for 483 TWh of this increase, according to 451 Research's Data Center Services & Infrastructure Market Monitor & Forecast, September 2025. This growth introduces significant challenges in power procurement, as longer lead times to grid interconnection and a lack of available power for large-scale projects complicate data center development, particularly in popular markets. Our research shows that both enterprises and data center service providers often experience one- to four-year lead times for grid connection, with some reporting lead times exceeding five years (see Figure 1).

While some workloads, such as AI model training, have fewer constraints on physical location, many workloads still need to be near the end user. In response to these challenges, utilities are bolstering grid capacity, while data center operators are increasingly considering off-grid or "islanded" power to continue development despite these obstacles. While traditional grid connections remain desirable, creative power solutions will be necessary to bridge the gap between available grid capacity and data center demand.

Figure 1: Energy utility lead times among organizations that postponed or canceled a data center expansion project



Q. What has been the energy utility's lead time to provide the power requirements for your organization's datacenter expansion project(s) (e.g., building, buying, leasing, or expanding a datacenter)? - Expansion project that was postponed/canceled in the past 24 months.
Base: Respondents whose organizations postponed/canceled plans to increase datacenter capacity in the past 24 months (service providers n=30; enterprises n=34).
Source: 451 Research's Voice of the Enterprise: Data Centers, Energy Supply 2025.

The Take

As power challenges continue to delay and even derail data center projects globally, data center developers, operators and equipment manufacturers will need to embrace a creative mindset to secure power supply and support demand. While data centers have conventionally relied on grid energy backed up by diesel generators, islanded power from a variety of fuel types, including natural gas, is helping operators add capacity more quickly. While large-scale, AI-focused data center campuses may be making the most headlines, our research indicates that all data center sizes and types are impacted, and may need to consider alternate power sources or accept longer build times.

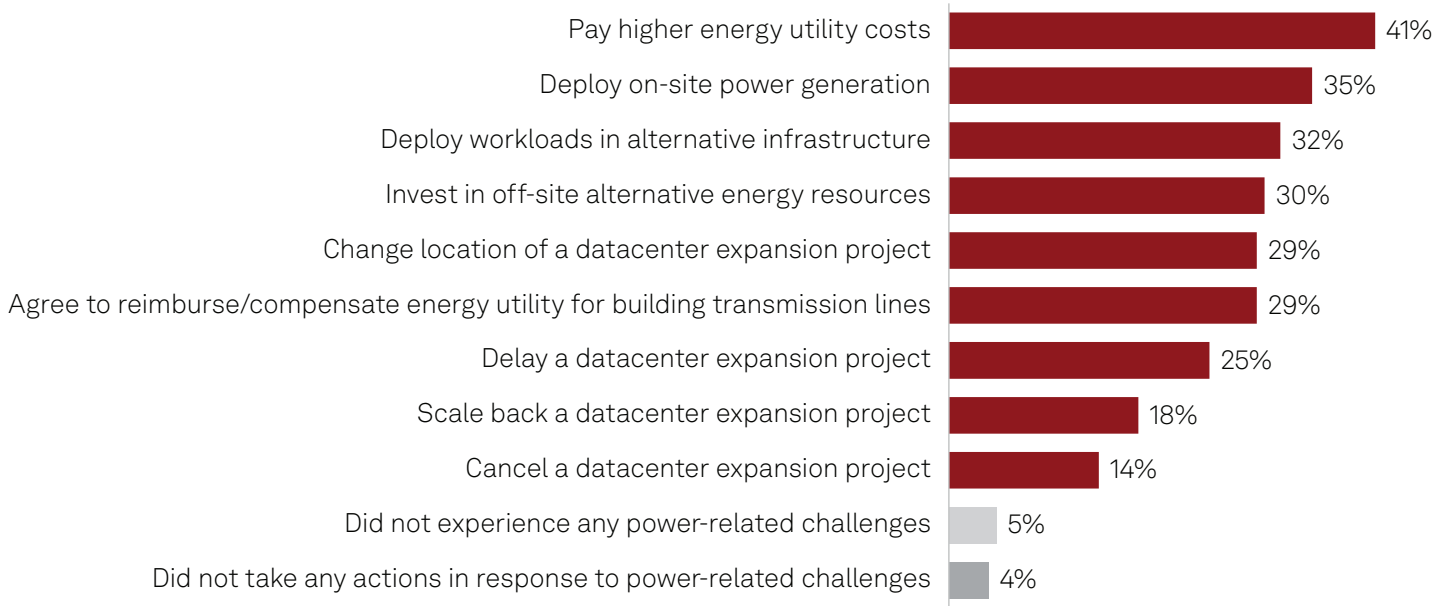
However, the onus is not solely on data center operators to bridge the gap. Grid operators, and perhaps even legislators, will need to find alternative solutions to support data centers. Natural gas-fired generation has, in some cases, allowed utilities to expedite service for data centers and other large loads. However, recent enthusiasm for natural gas and growing demand for gas generation have created new challenges. Gas turbine orders are increasing, resulting in higher costs, significant backlogs and additional delays in the manufacturing supply chain. This underscores the fact that there cannot be one solution to the challenge of supporting our nation's technological ambitions.

Use cases

The data center planning and development landscape faces myriad challenges that threaten to impede progress. Global supply chain delays, coupled with lengthy permitting cycles in numerous regions, are complicating the construction of new facilities. Power challenges, including interconnection delays, power shortages, and tariffs and regulations specific to large loads, are exacerbating these issues. The fallout has enterprises spending more, delaying or relocating projects, and in some cases canceling new data center projects (see Figure 2). Furthermore, local opposition to data center projects is becoming a significant hurdle, delaying approvals and stalling development.

In July 2024, the US Department of Energy published its Recommendations on Powering Artificial Intelligence and Data Center Infrastructure. The report suggests that in grid-constrained areas, new data centers can usually be accommodated, except for about 15 high-strain days per year. In other words, the interconnection of new data centers is often held back by about 4% of their total operation time. In response, various companies have suggested ways in which data centers could be more flexible with their load. Verrus, a spinoff of Alphabet, hopes to design data centers that are "grid assets." The proposed model is to build facilities of about 70 MW that are fully backed by a matching 70-MW modular battery deployment. This deployment could power all operations for about 4 hours or could quickly take over portions of the electrical load, such as cooling systems. Verrus recently announced a simulated proof of concept in collaboration with the National Renewable Energy Laboratory (NREL), and the company hopes to have operational data centers by the end of 2026.

Figure 2: Enterprise implications of energy-related challenges



Q. Which of the following actions - if any - has your organization taken in response to power-related challenges with its datacenter expansion project(s)? Please select all that apply.
Base: Enterprise Respondents whose organizations completed or postponed/canceled datacenter expansion projects during the last 24 months, or plan expansions during the next 24 months (n=133).
Source: 451 Research's Voice of the Enterprise: Datacenters, Energy Supply 2025.

A particularly innovative piece of the Verrus model is the ability to curtail segments of the electrical system. Rather than removing the entire facility from the grid, facilities using this model can shed percentages of load as needed. Unfortunately, because existing data centers have not been designed with this in mind, retrofitting facilities for this capability could be prohibitively difficult. Electrical systems would need to be separable at will. While new data centers could take this approach, these solutions entail additional costs and challenges and are not universally applicable.

As the hyperscalers and others in their supply chain have been seeking ways to reduce grid strain, utilities have been working to bring new energy generation online quicker, with natural gas as the current solution of choice. According to S&P Global Commodity Insights, the total development cycle for natural gas, from planning to commissioning, is roughly 6 years or less, versus the 11- to 25-year cycle for nuclear, allowing for a faster response to endlessly growing demand from data centers. Natural gas is also dispatchable, unlike wind and solar, meaning energy production can be ramped up and down to meet demand.

Utilities across the US have been pursuing new gas generation in various forms. For example, AEP Ohio and Hope Utilities' subsidiary Northeast Ohio Natural Gas Corp. (NEO) are implementing natural gas solutions to support the grid while transitioning to cleaner energy sources. The project includes building a natural gas pipeline, to be completed by October 2026, that will connect to fuel cells to support data center growth. AEP Ohio has partnered with Bloom Energy to deploy 1 GW of power to support data centers in Ohio. Similarly, Duke Energy is using natural gas turbines in partnership with Siemens Energy and GE Vernova to bolster capacity by up to 14 GW. Meanwhile, Texas' Permian Basin is garnering interest from technology and energy companies seeking to leverage the region's plethora of natural gas pipelines to power data centers.

In response to extended timelines to access grid power, data center operators are also exploring islanded solutions. This approach, often referred to as "bring your own power," allows data center operators to control their energy sources and costs, creating a pathway to maintain development momentum regardless of regulatory hurdles. EdgeConneX recently announced plans to spin off a sister company, PowerConneX, which will develop a 120-MW natural gas-fired plant in New Albany, Ohio, adjacent to EdgeConneX's planned data center campus. The company also took ownership of the substation build-out next to EdgeConneX's new Mesa, Arizona, facility. Meanwhile, Meta is partnering with Williams Cos., which will develop multiple natural gas-fired generation plants to support Meta's ongoing expansion in New Albany.

These projects will not be connected to the grid — at least not immediately. In Texas, data center developers and operators can avoid the high cost of load studies and regulated financial and business disclosures required by the recently passed SB6 (2025 regular session) by working with companies such as New Era Helium, LandBridge or Diamondback Energy. These companies are looking to deploy a variety of off-grid power generation plants, specifically targeting data centers as consumers. As the demand for data center capacity continues to rise, navigating these complexities will be essential for operators committed to building resilient, reliable and efficient facilities in an increasingly energy-conscious market.

Conclusion

The current US administration, as well as other government entities around the world, have expressed high levels of support for AI, including committing significant resources to its advancement.

As AI continues to drive data center growth worldwide, and especially in the US, industry stakeholders must rethink how data center operators interact with the grid and access power. A multi-pronged solution will be required, with all sides — data center operators, utilities and local governments — approaching the challenges together. On the one hand, data center operators need to consider designs that maximize responsiveness to the needs of the power grid and that mitigate impacts on surrounding communities. On the other hand, utilities must find a way to serve large-load customers, and particularly data centers, faster. Whether power comes from in front of the meter or behind it, from natural gas turbines, battery energy storage systems or other sources, the AI race requires quick delivery.

About the authors

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Stefanie Williams is a senior research analyst on the 451 Research Datacenter Services & Infrastructure team within S&P Global Market Intelligence. Stefanie's research includes analysis of datacenter providers, market size and supply/demand in key and emerging markets in North America and Australia-New Zealand. Additional areas of focus include US state-level legislated incentives, datacenter compliance, and datacenter management and optimization software.

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