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An Era of Unprecedented Power Demand

The race to power AI is on, with AI companies and developers competing fiercely for physical sites and grid connections.

Nearly 9,000 U.S. power projects are vying for approval to serve surging power demands (Rand et al. 2025). More than 700 new gas-fired power plants totaling 260 gigawatts (GW) of capacity are lined up, a 270% increase since the advent of large AI models in 2022 (Interconnection.fyi 2026). Tens of gigawatts more are in development for onsite, "behind-the-meter" generation (GEM, 2026). Ultimately, the 550 GW U.S. gas power fleet could grow by more than 50%, with a build-out cost exceeding $400 billion (GEM 2026; GridLab et al. 2025).

These plants alone would meet the projected growth in U.S. electricity demand (GridStrategies 2025), driven largely by data centers whose energy use is projected to double or even triple from 2023 levels by 2028 (Shehabi et al. 2024). However, it's highly uncertain which plants will ultimately go online and when, due to rapidly escalating costs, supply-chain backlogs and other factors. Recently, fewer than one in five proposed power projects has become operational (Rand et al. 2025).

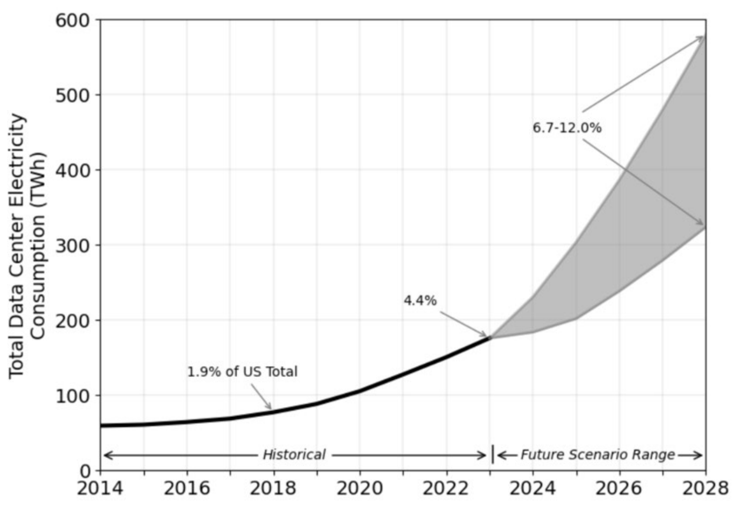

Figure 1: Total US data center electricity use from 2014 through 2028 (Shehabi et al. 2024)

Uncertainty in meeting demand poses risks. With narrowing reliability margins across the North American grid, higher outage risks are projected in nearly every region (NERC, 2024). Wholesale power and energy prices are soaring in certain markets, putting upward pressure on energy costs and fueling public opposition. These uncertainties affect global competition over AI—and by extension, automation, robotics, medicine, and military might.

Scrambling for solutions, utilities, grid operators, developers, and AI builders are increasingly looking to demand flexibility to bridge the supply-demand gap. Demand flexibility pays consumers to reduce or shift power use away from times when energy prices are highest, power supplies are most stressed, and reliability is most at risk. It also uses on-site energy resources to reduce facility power needs and fluctuations.

Few industries are better suited to demand flexibility than data centers: Electricity is the only fuel. Redundancy, performance margins, and energy storage are all built in. Power demand is easily and routinely managed with caps on processor power and speed. AI training can be stretched over time. AI inference is highly portable across networks and can be served outside of grid-strained areas. Demand-flexible data centers thus offer a promising lever to balance numerous pressures facing the industry. Whether it will embrace them remains to be seen.

Mechanisms for Flexible Operations

Although they're often characterized as inflexible, data centers have substantial flexibility potential to ease their integration with the grid (Norris et al. 2025). Four strategies enable flexible data center operations: computational load flexibility, core facility infrastructure flexibility, energy storage, and on-site electricity generation. As shown in Figure 2, these strategies present a spectrum of benefits and tradeoffs that allow data centers to align electricity demand with grid conditions, and to maximize existing power infrastructure to meet that demand.

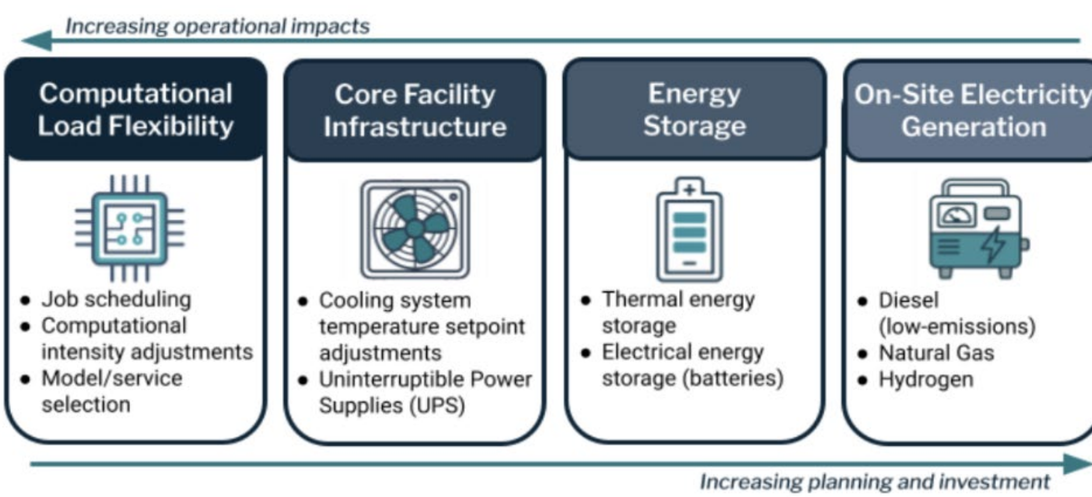

Figure 2: Data center flexibility mechanisms and tradeoffs.

Computational load flexibility involves adjusting when, where, and how jobs are processed. The three primary mechanisms are temporal load shifting (job scheduling), spatial load shifting (inter-facility migration), and intensity flexibility (throttling). Each helps align power demand with grid conditions, transforming data centers from grid stressors into stabilizing resources.

Temporal load shifting refers to rescheduling or stretching delay-tolerant computing tasks, such as AI model training, to periods of lower grid stress. With *spatial load shifting*, jobs are distributed geographically so that workloads shift to data centers in regions with less congested grids. *Intensity flexibility* reduces power or processor speeds for eligible workloads; data centers do this routinely to manage thermal stress.

Data center infrastructure, specifically cooling and power distribution systems, also provide operational flexibility. Cooling temperatures and humidity can be temporarily modified to reduce facility power needs using industry thermal guidelines that have been in place for more than 20 years (ASHRAE 2024). They include more relaxed “allowable” temperatures for the short term that do not bring meaningful risk to equipment operation or longevity. Liquid cooling guidelines are less mature, but some manufacturers are allowing temperature ranges for AI-critical GPUs that are significantly higher than those commonly used.

Uninterruptible power supplies (UPSs) provide immediate, short-term backup power that bridges the gap between an outage and when backup generators can pick up the load (Govindan et al. 2011). Modern UPSs can also charge or discharge their batteries in coordination with the grid to provide rapid grid stabilization support while still supporting critical data center load (Paananen and Nasr, 2021).

Core facility infrastructure can be co-optimized with microgrid assets - energy storage and on-site generation - to reshape the facility loads seen by the grid without materially altering data center operations. By charging batteries (or storing thermal energy) during off-peak periods and then discharging during peaks, facilities can reduce demand at critical times with limited changes in overall computational load or operations. Pairing storage with on-site generation further extends load management capabilities: many existing on-site generators, installed for emergency backup power, can offset grid consumption during periods of peak demand in compliance with applicable regulations. Since these strategies occur behind the meter and do not alter workloads or operating conditions, they generally pose lower operational risks than other mechanisms. However, they can require significant upfront capital investment, adequate space, and interconnection planning.

Combined, these flexibility mechanisms can help data centers maintain smooth operations while alleviating grid constraints and supporting system reliability. And due to the range of available mechanisms, nearly all data centers have some degree of operational or technical flexibility they can leverage.

Incentives for Flexibility

Well-designed tariffs and programs for large-load customers, such as data centers, can promote demand flexibility while limiting risks of rapid electricity grid expansion. In 2025, at least one large-load tariff was approved or proposed every month (Frick and Lam 2025). Emerging approaches generally fall into three categories: voluntary incentives, required flexible capabilities, and streamlined interconnection.

Numerous utilities offer tariffs to promote load flexibility through optional riders or interruptible service provisions. For example, Alliant Energy offers certain customers the ability to participate in an interruptible service rider option (Alliant Energy 2023, 2024). Similarly, Evergy Kansas allows certain customers (Evergy Kansas Central 2025a) the option to participate in its interruptible service rider (Evergy Kansas Central 2025b). While participation is voluntary, enrolled customers must reduce load during curtailment events or pay a penalty. In exchange, customers receive a credit ($/kW) based on the amount of interruptible demand they enrolled.

Some utilities now require flexibility from large-load customers. Idaho Power requires some customers to allow remote disconnection from the grid for up to ten hours per interruption event, and up to 225 hours per year (Idaho Power Company 2024). Similarly, certain large-power customers of Black Hills Energy must use their own backup generation during peak periods in exchange for lower electricity rates (Black Hills Energy 2020). Embedding flexibility into tariffs can enable utilities to maintain affordability and reliability while serving data centers and other large loads.

Industrial demand response programs have featured interruptible service and back-up generation for decades, offering data centers a proven model from utilities. Newer approaches incentivize flexibility by offering rapid interconnection, as opposed to a focus on financial $/kW. Pacific Gas and Electric and Portland General Electric have introduced programs to allow customers to connect to the grid before full-service capacity upgrades are completed, using flexibility to bridge the gap (PG&E 2026; Ciampoli 2025). These programs have started with MW-scale loads. On the customer side, “bring your own” models help streamline grid connection by enabling customers to provide their own capacity, including generation, storage, and demand-side flexibility – and capacity obtained from other utility customers. For example, one company is seeking to aggregate flexible demand across many customers into a “virtual power plant” as capacity for hyperscalers (Voltus 2025).

Industry Motivations

Ultimately, the extent to which data centers incorporate flexibility into their design and operations will depend on its value to their business model. Often this value is measured in a reduction of regulatory barriers, community resistance, and time to market and revenue generation.

The large, highly capitalized firms that own and/or operate AI factories rely on getting facilities built, energized, and profitable as soon as possible. With IT equipment typically accounting for upwards of three-quarters of data center costs, AI hyperscalers seek to expedite a return on that investment. Protecting capital assets and guarding against lost production are key motivators for integrating greater cooling capacity, fast switches, and distributed storage—features that enable demand flexibility. By comparison, traditional incentives from the power sector such as demand flexibility credits or reduced electricity charges, are less compelling.

In addition to expediting interconnection processes to get AI facilities online faster, two other factors may induce the industry to consider demand flexibility. First, utility requirements and statutory and regulatory mandates (such as SB6 in Texas) are emerging that require facilities to curb demand upon request and/or use their own generation during grid emergencies. Second, public acceptance has emerged as a key criterion in getting data centers sited and approved. By one count, public opposition has blocked or delayed more than $100 billion in data center projects since 2023 (Data Center Watch 2025). Consequently, the industry routinely seeks to build community goodwill and soften opposition, investing in economic development initiatives and other emoluments for host communities. Touting demand flexibility capabilities could enhance these efforts, as they can improve grid reliability, ease pressure on wholesale prices, and reduce costs for utility customers.

Accelerating AI Data Center Flexibility

Industry and researchers alike have mobilized to tackle the technical, market, and business challenges facing data center grid integration, and nascent strategies address the fundamental needs of data center demand flexibility. These include interconnection contractual models to assure grid reliability; education to inform public discourse; optimized utility tariff designs and programs; guidance for flexing data center compute and cooling loads, alongside development of controls, communications, and simulation tools; and clarifying the value proposition for data centers to provide load flexibility.

Cutting across all of these needs are general enablers for the AI industry, such as national goal-setting and technical assessments of demand flexibility potential to inform broader investment, education, and workforce development efforts.

Much current work is being driven by the data center industry. For example, recent publications describe Google's exploration of computational flexibility with utilities in Tennessee, Indiana, Michigan, and Nebraska (Terrell 2025; Mehra and Hasegawa 2023) and EmeraldAI's demonstration in APS territory (Colangelo et al. 2025). Verrus is developing facilities for hyperscalers with flexibility built-in as a central capability, and has published how it approaches operational 'energy productivity' (Verrus 2025).

Examples of efforts from the research community include:

DC Flex, a collaborative field-deployment program demonstrating data center load flexibility, including compute shifting, HVAC optimization, and backup power strategies across nine demonstration sites (EPRI 2026).

REFLEX, a program focused on setting national load flexibility targets, developing control/communication technology packages, value proposition research, and technology demonstrations; it covers all industrial sectors, including data centers (LBNL 2026).

The Project on Grid Integration, a collaborative to develop technical, policy, and operational tools to modernize the U.S. electric grid while managing the demand surge from hyperscale data centers (Harvard Kennedy School 2026).

A project at the Duke University Nicholas Institute explores practical pathways to align reliability and affordability by assessing system-wide impacts of large load additions and identifying policy and market reforms (Duke University 2026).

Additionally, several broader industry organizations—such as the Peak Load Management Alliance (PLMA 2026), Consortium for Energy Efficiency (CEE 2026), and Smart Electric Power Alliance (SEPA 2026)—have added data center flexibility as a focus area among their ongoing working groups and initiatives.

Historically, innovation in demand-side energy and utility programs has been realized over much longer time horizons than is seen in the fast-moving data centers industry. Given the urgency that the industry faces, agile partnerships that can pivot with shifting market dynamics will be essential for success.

Conclusion

Rapid AI data center deployments at scale can impact grid reliability and energy costs—and, in parallel, pose important questions around public acceptance and technological competitiveness. But just as importantly, AI data centers and AI itself present significant opportunities to bolster and even transform grid operations. In many ways, large data centers are ideal customers to help utilities maximize power availability for themselves and other customers, as new infrastructure is put into place. Their digital workloads and onsite energy assets and networked infrastructure, if orchestrated with care, can open up a variety of flexibility strategies to reduce both grid strain and energy costs. These opportunities involve compromises, however. Demand flexibility requires technological and operational change, at a moment when time is of the essence.

No single solution, including demand flexibility, offers a panacea for the steepest demand growth the U.S. electricity industry has seen for many decades. Nor is demand flexibility a credible substitute when bulk power is clearly needed for the long term, and is sparking a search for all-of-the above solutions inclusive of self-generation and novel nuclear power systems. But flexible operations can absolutely bridge uncertainties around supply, timing, and markets, and can meaningfully contribute to a more robust and resilient U.S. power system.

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