Personal Power Plants
On-Site Generation for Data Centers

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As you're reading this on your laptop or smartphone, you're almost certainly connected to the internet, which means you're connected to the cloud. "The cloud"—millions of interconnected, remotely accessed physical and virtual computers and their support facilities—stores and provides access to computer hardware, software, and data available to every Apple or Android phone and virtual desktop on the planet. The cloud isn't in the ether somewhere in the sky. It's right here on Earth: in giant, climate-controlled buildings filled with hundreds or thousands of lightning-fast servers running 24/7. Each of these data centers typically has a surface footprint that dwarfs a soccer pitch. Each is connected to a vast network of other data centers, which comprise a complex web of computing and storage infrastructure interlaced with the internet. Data centers guzzle electricity at speeds and quantities that eclipse other industries. And, as of May 2025, there are already over 5400 data centers located in the United States. *See* Cloudscene, *Market Profile: United States of America* (n.d.).

Data centers, which from the outside resemble otherwise-unremarkable warehouses, are central to modern life. Creating and storing electronic data and using the internet require them. So does cloud computing. "Cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the internet ('the cloud') to offer faster innovation, flexible resources, and economies of scale." Microsoft Azure, *What Is Cloud Computing?* (n.d.). There are endless examples of our reliance on data centers and cloud computing, from day-to-day document collaboration at work, to sharing photos from one cell phone to another, to managing complicated enterprises like military combat operations.

As work and life trend toward more sophisticated automation through artificial intelligence (AI), our dependence on this universe of remote computers running virtual software is only reinforced. Critically, without data centers, there would be no AI. And for better or worse, in 2025 and beyond, we cannot live digital lives without AI.

So, to the data-management functions that data centers have traditionally provided, add AI, which ravenously devours electricity as it learns, solves problems, and creates its own neural networks. And don't forget AI's often controversial, but pivotal, role in cryptocurrency mining and trading. It is estimated that annual electricity consumption by crypto miners alone ranged from 0.6% to 2.3% of total U.S. electricity consumption in 2022.

Unsurprisingly, the country's creation and consumption of data over the past decade parallel the growth of data centers and their rapacious energy use. According to the Department of Energy (DOE), total annual data center energy use from 2014 to 2016 remained stable, at about 60 terawatt-hours (TWh). Arman Shehabi et al., *2024 United States Data Center Energy Usage Report*, at 5 (Lawrence Berkeley Nat'l Lab Dec. 2024). That began to shift in 2017 when high-octane graphic processing unit (GPU)–accelerated servers for AI were first installed, driving data center energy consumption to 76 TWh, 2% of the total for the United States, by 2018. *Id.* That's because these GPU servers require four times more power than older servers.

Although new technologies undoubtedly will emerge that could reduce the need for so much electricity, by 2030, accounting for all foreseeable use cases, data centers will likely require between 325 and 580 TWh of electricity. That's between 6.7% and 12% of total U.S. electricity consumption. *Id.* at 6. Even though the United States has 4.22% of the world population, and only 1.87% of the planet's surface land mass, it uses 16% of the world's electricity. U.S. Energy Info. Admin. (EIA), *What Is the United States' Share of World Energy Consumption?* (last updated Apr. 11, 2024). Considering these numbers at scale, it's obvious that data centers, while important to the global economy, are a huge suck on American electricity.

Although certain data centers have the capability to "drop load," or reduce their electricity use, arguably providing demand-response benefits, typically power must be consistently available because computing never stops. Traditionally, data centers have drawn power from public utilities through the grid. Unfortunately, none of the major U.S. electricity grids are equipped to supply enough steady-flow electricity to data centers as they multiply. As explained by Mark Mills from the National Center for Energy Analytics, a single data center now uses more power than a steel mill, and it does so all day, every day, forever. This fact has caused many new data-center projects to stall or fail. *America's AI Moonshot: The Economics of AI, Data Centers, and Power Consumption: Hearing Before the Subcomm. on Econ. Growth, Energy Pol'y & Regul. Affs., H. Comm. on Oversight & Gov't Reform* (testimony of Mark P. Mills, Apr. 1, 2025)

The U.S. electric grid will require significant modernization to meet the needs of increased demand. The grid was designed in the early 20th century to support an American population only a tiny fraction of today's. At the time, science fiction writers were dreaming of technologies like personal computers and AI. Their future is now.

In the summer of 2024, in what is deemed "Data Center Alley" south of Washington, D.C., 60 data centers were forced to abruptly switch to on-site backup power generation due to voltage fluctuations in the grid. The backups prevented catastrophic shutdowns. Tim McLaughlin, *Big Tech's Data Center Boom Poses New Risk to US Grid Operators*, Reuters (Mar. 19, 2025). It appears that the incident may have been triggered by a surge-protector failure connected to a 230-kilovolt transmission line. NERC, *Incident Review: Considering Simultaneous Voltage-Sensitive Load Reductions* (Jan. 8, 2025). Regulators called the incident a "near miss." That's because if a large, 300-megawatt (MW) data center went dark, it would be like unplugging 10 million laptops at once. Power surges and grid-scale power outages could follow. And if an outage lasts long enough, some data centers could "out-run" their back-up capacities—essentially like a car running out of gas in the fast lane of an interstate. Power deficiencies and outages cause significant financial losses, reputational damage, operational disruption, and, in severe cases, the loss of unsaved data. Simply put, our online lives have created a need for more power, but the infrastructure to provide it doesn't exist.

Off the Grid

This threat is profound: Data center failures could lead to real-world disasters (and not just missing your next networked videogame session with your virtual friends). Think hospitals, universities, public utilities, water providers, and the grids themselves. Each is bound in some way to the power of the internet. So, many data center owners are pivoting. Presently, many large data centers use onsite power sources at small scales for backup purposes. However, in recent months, many data center companies have retooled the concept entirely—and announced larger projects, conjoining new data centers with full-scale power plants "colocated" on the same real estate. *See, e.g.*, Press Release, Energy Abundance Dev. Corp., Energy Abundance Announces Data City, Texas–The World's Largest Behind-the-Meter Data Center Hub Powered by 100% 24/7 Green Energy (Mar. 20, 2025).

As Mills noted during the AI Moonshoot hearing, modernization of the grid and opportunities to colocate private power with data centers will be key to what insiders view as a coming "data-center revolution."

Data center owners are investing headlong in nontraditional power-supply options. "Behind-the-meter" power sources are off-the-grid and on-site. This is electricity produced and controlled by non-utility generators and used only by the data center. And it is expected that colocation will energize roughly 30% of all data centers by 2030. Bloom Energy, *2025 Data Center Power Report: From Gridlock to Growth: How Power Bottlenecks Are Reshaping Data Center Strategies*, at 5 (Jan. 2025). But building your own power plant is neither an easy nor a quick fix.

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Building on-site power-generation infrastructure takes time, and projects have encountered regulatory and infrastructural challenges, as well as mixed social reactions and political environments. The Biden administration and various nongovernmental organizations pressured big-tech data companies to prioritize "net-zero" carbon goals; environmental, social, and governance (ESG) criteria; and renewable-energy sources: solar, wind, and battery storage. The Trump administration, by contrast, through its "Unleashing American Energy" Executive Order—part of the administration's focus on "American Energy Dominance"—will change the landscape, possibly fostering opportunities for fossil fuel–based on-site generation. Exec. Order 14,154, Unleashing American Energy, 90 Fed. Reg. 8353 (Jan. 29, 2025). The Trump administration is also committed to AI and energy deregulation. Under the Trump administration, the AI universe—and the data centers that enable it—is poised to expand quickly alongside Americans' hunger for screentime, online gaming, streaming, video calls, virtual offices, and AI-based solutions to every imaginable problem. In President Trump's first week in office, he announced a $500 billion investment in AI infrastructure—the so-called Stargate collaboration—a promising push forward for AI and blockchain industries with U.S. leadership. Donald Bryson, *AI's Growing Energy Demands: How States Can Keep the Lights On*, RealClearEnergy (Feb. 3, 2025).

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Notably, although AI is becoming ubiquitous in business and society, AI's power needs have *not* grown in lockstep. Instead, according to the Western Electricity Coordinating Council (WECC), even though cloud computing has expanded by over 2,600% since 2008, its energy use has increased by only 10%. Ryan Quint et al., WECC, *An Assessment of Large Load Interconnection Risks in the Western Interconnection*, at 35 (Feb. 2025). This is due to significant power-efficiency innovations implemented by the largest data-center operators like Google, Meta, and Amazon. Additionally, AI uses different amounts of energy depending on its task. Training AI takes more energy than running it, so as AI becomes smarter and needs less training, it becomes more energy efficient. And AI platforms and the servers that run them use much less computing power now than even six months ago—simply due to advances in AI tech. That—and the fact that AI now is able to "learn" from what is called "synthetic" data, rather than the "whole internet," as the original versions of ChatGPT did—even training AIs now requires much less power. All of that said, as more AI data centers come online and do more work of increasing variety and complexity, the simple addition of so many AI platforms will require significant amounts of electricity. So, even as innovation creates efficiencies, data-center power demand continues to grow. That's simply because the number of users and applications (AI included) will only increase.

Legal Challenges and Advancements

Colocating power and load, despite its obvious benefit, can be difficult. Building a power plant and plugging a data center into it is a simple concept. But the regulatory hurdles alone, both state and federal, can be tremendous barriers to behind-the-meter generation.

Many states are unfriendly to independent power producers, hoping to directly serve private enterprise. Protective of public utilities' monopoly service territories, some states and their public utility commissions have been reluctant to exempt independent power producers serving a single retail customer from regulation as a public utility. As a result, this forces data centers to either own the generation, something certain companies are reluctant to do, or enter into equipment-lease agreements with their power suppliers to avoid public utility status and the risk of infringing on the incumbent utility's monopoly service territory. Of course, a public utility can agree that a retail customer in its service territory can be served by an alternative power supplier, but this has been something public utilities have been reluctant to do. As a result, this gives state-backed monopolies massive control over the fate of data centers' plans for on-site generation. And when the incumbent public utility is not capable of serving the new data center in a timely manner, this leaves data centers at a crossroads, often leading them in search of friendlier state policies.

In contrast, some states see data centers as economic opportunities and a chance to capitalize on grid revitalization. For example, Colorado's SB 25-280, the Data Center Development & Grid Modernization Act, offers tax and utility incentives to data-center developers who break ground within five years and use at least 50% renewable energy. The bill also rewards grid improvements, especially in rural areas. SB 25-280 also incentivizes grid development and specifically encourages data center owners to become eligible for an income tax credit in an amount equal to 10% of the amount of any grid-enhancement and modernization investment they make, and an additional 5% if those improvements are made in a rural area.

Although data center owners find support in some states, those states are not necessarily safe harbors. That's because the federal government has not made things easy for colocated data-center generation. Any Federal Energy Regulatory Commission (FERC)-regulated public utility must comply with its FERC-approved generator-interconnection procedures. And where the utility wants to enter into a nonconforming interconnection agreement, FERC must approve it. Thus, to the extent that a data center's on-site power is directly interconnected with a FERC-regulated public utility, FERC has tremendous authority over the data center's power supply.

Recently, for example, the Commission rejected a proposal to amend an existing interconnection service agreement (ISA) among PJM, Susquehanna Nuclear, and the interconnected transmission owners to increase the amount of colocated load (for a data center) under the interconnection agreement. *PJM Interconnection, L.L.C.*, Dkt. Nos. ER24-2172-000, ER24-2172-001, 189 FERC ¶ 61,078 (Nov. 1, 2024). FERC found that PJM had not demonstrated that the proposed nonconforming provisions in the Amended ISA were necessary deviations from the pro forma ISA due to specific reliability concerns, novel legal issues, or other unique factors. Talen Energy appealed FERC's order to the Fifth Circuit Court of Appeals following FERC's denial of a rehearing request.

Because the Trump administration is prioritizing deregulation of American energy—at least for fossil fuels—that may affect FERC's regulatory positions, likely loosening them. Although the details are unclear, there is no doubt that the federal government is openly shifting course. The Department of Energy, for example, wants to site data centers on federal land. In April, the agency announced 16 potential federal sites that it says would be "uniquely positioned for rapid data center construction," including easy access to energy infrastructure or the ability to fast-track permitting. Press Release, U.S. Dep't of Energy, DOE Identifies 16 Federal Sites Across the Country for Data Center and AI Infrastructure Development (Apr. 3, 2025). The Department also specifically identified nuclear energy for fast-track permitting, marking a bold turn toward nukes. Additionally, DOE hopes to colocate AI and other research facilities on data-center sites. All these projects will be subject to federal permitting processes under NEPA and other statutes, of course, and they are sure to face significant legal challenges.

Energy-Source Limitations

Colocated data-center power plants, hypothetically at least, could generate electricity from any currently available—and scalable—electricity source, from solar to nuclear to natural gas. Aside from the changing political landscape under the Trump administration, which has forced many companies to rearrange their energy preferences, there are pure technological considerations too. Solar and wind are intermittent sources and battery technology hasn't solved that yet. In any event, turbines, panels, and related equipment require space—extra real estate in which data center or power generator owners might not want to invest. Some companies have explored using hydrogen fuel cells, but those technologies are still nascent. Others are looking at small, modular, nuclear reactors (SMR). Those are also unproven at scale.

That is not to say that nuclear as a broader concept is not in the running. Data center owners, including Meta, are pursuing that option. Meta has been flirting with nuclear as a behind-the-meter option. *See* Liam Denning, *Meta Flirts with Nuclear for AI. It's Still Married to Gas.*, Bloomberg (Dec. 4, 2024). The benefits are obvious. Nuclear energy is carbon-free and has no intermittency issues. Although public skepticism and fear of meltdowns and other failures remain, it's possible that SMR technology, which is widely viewed as safe, could dispel those fears, especially over time. *Id.* (discussing the Kairos Power reactors for Alphabet). Even so, nuclear projects are wildly expensive, costing, in Meta's estimation of its own projects, upwards of $30 billion, and they're unlikely to come online until after 2030. *Id.* Although nuclear is still out of reach, the United States has recently moved to reform its antiquated nuclear policies. The Inflation Reduction Act, the bipartisan 2022 law, supports development or redevelopment of existing nuclear plants and newer, smaller, advanced reactors, as well as high-assay, low-enriched uranium and hydrogen production. *See* World Nuclear Ass'n, *Nuclear Power in the USA* (Aug. 27, 2024). But until U.S. nuclear-policy reforms manifest as actual projects, and until costs come down, nuclear remains off the table.

That means that many colocated power plants are likely to run on fossil fuels. On-site natural-gas power plants are the most-viable option: They're reliable and dispatchable, and permitting is a straightforward and well-understood process. Natural gas colocation projects could come online very soon. In Columbus, Ohio, a number of natural gas–powered plants have been proposed, with ongoing community engagement and plans to break ground as early as late 2025, potentially powering up in mid-2026. Kevin Clark, *Onsite Gas Plants Proposed for Data Centers in Ohio*, Power Eng'g (Mar. 27, 2025). These proposed gas plants have generation capacities between 120 MW and 200 MW each and will be the primary power generators for the data centers connected to them. Although natural gas has numerous detractors (from environmentalists to purveyors of clean-energy tech), it might be the best power option in the short term. Because U.S. electric grids can't support the continuing proliferation of data centers, owners and operators are likely to embrace an all-of-the-above approach to colocation.

Social and Political Implications

Putting aside legal and technical considerations, data centers are stirring conversation from the Oval Office to the local ballot box. On-site power generation has not yet become a kitchen-table issue, but the impacts of data centers, especially locally, are tangible.

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On one hand, data centers require skilled construction, engineering, maintenance, and operations workers, boosting local economies. *See* Uptime Inst., *The People Challenge: Global Data Center Staffing Forecast 2021–2025* (Jan. 1, 2021). "The number of people working in data centers grew from 306,000 to 501,000 between 2016 and 2023," according to the U.S. Bureau of Labor Statistics. *See* Andrew Foote & Caelan Wilkie-Rogers, *Employment in Data Centers Increased by More Than 60% from 2016 to 2023 but Growth Was Uneven Across the United States*, U.S.

Census Bureau (Jan. 6, 2025). And they fill economic niches in suburban and rural communities. On the other hand, data centers create environmental issues. Their forecasted reliance on fossil fuels will add to the impacts of global warming. And local externalities, especially when adding colocated power generation, include noise pollution, increased traffic, and localized air emissions.

Another issue, at least in April 2025, that could pose financial and supply-chain problems for data centers is tariffs. President Trump's tariffs, aside from being imposed, retracted, and imposed again, are sweeping and generalized. Important to data centers, a 125% tariff on all Chinese imports and a potential 25% tariff on all Mexican imports strike at two of the largest sources of U.S. computer equipment. Mark Niquette, *supra*. Huge cloud-computing companies like Amazon might simply absorb resulting price fluctuations. But as component prices—whether for computer or power infrastructure—increase, smaller data center companies could be squeezed, undermining plans to colocate power.

Data Centers Are Essential and Regulators Should Treat Them That Way

As AI-driven workloads drive exponential increases in data center energy consumption, regulatory and infrastructural challenges continue to hinder a transition toward energy independence for data center owners. U.S. federal and state governments are divided over whether to promote and how to regulate colocated power projects. Political pressure from utilities, environmental groups, and tech companies will influence these decisions. But there is no question that governments must prioritize sustainability, efficiency, and resilience to ensure that the next generation of data centers can operate seamlessly, untethered from the country's dangerously inadequate and antiquated electricity grids. The stakes aren't just digital. Life in this 21st century literally depends on it.

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