Challenges and Opportunities for Energy in the Era of Data Centers

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The United States has seen explosive data center growth in the past few years, chiefly driven by the rapid development and expansion of artificial intelligence (AI) technology. This growth has generated discussions about the impacts of data centers on the energy sector and how best to manage them. This issue brief explores the effects of data centers, hyperscale developers' energy and water investments, utility agreements, state and local policies regarding such projects, and impending federal actions.

Impacts of the Data Center End User

The energy-intensive computing powers of AI data centers are a contributor to rising energy demand nationwide. For example, the median Gemini prompt uses 0.24 Wh of electricity. Data centers' power demand has increased more than 400% in the past ten years and 150% in the past five years alone. According to a new study released by the National Electrical Manufacturers Association, U.S. electricity demand is projected to increase by 55% through 2050, and data center energy consumption is projected to increase 300% over the next 10 years, accounting for up to 15% of electricity use by 2030.

The surge in energy demand has imposed costs on ratepayers, although the primary driver of price increases remains structural features of the power system. For example, in the PJM interconnection, data centers accounted for a $9.3 billion price increase in the 2025-26 capacity market. The average residential electric bill is expected to rise by $18 per month in Maryland and $16 per month in Ohio. While rate increases are highest in PJM, similar trends can be observed throughout the country. Nationwide, residential electric prices jumped an average of 7.1% in 2025, more than double the inflation rate.

Such significant increases in energy consumption also affect carbon emissions. Google estimates the greenhouse gas emissions associated with the median Gemini prompt to be 0.03 g of CO2 per unit of electricity, showing the potential for increased emissions as growth continues.

Data centers also typically draw on vast quantities of water to cool servers, as running intensive AI workloads generates substantial heat. Google estimates that each Gemini prompt consumes around five drops of water. Even with efficient cooling, a single hyperscale data center of approximately 130 MW can use 171 million liters of water annually.

What Does This Mean?

Data centers' resource consumption has notably affected communities and the grid. Secondary impacts of data centers can be observed in these areas and more:

Project Siting: The average data center land transaction has grown to 224 acres, showing that developers seek locations with large plots of land available. Developers also seek out land with flat topography and proximity to water sources, fiber lines, and reliable electrical infrastructure. Due to these criteria, data center projects are often built in suburban areas. For example, there are currently 231 data centers in the Dallas-Fort Worth area of Texas, mostly in suburbs or nearby cities.

Power Procurement: Data centers draw on various types of power sources, both via traditional grid interconnection and behind-the-meter agreements. (See the *Agreements with Utility Providers* section for more information.) In 2024, natural gas was the biggest generation source for data centers in the United States, at over 40%. Renewables provided another 24%, nuclear power provided 20%, and coal made up the final 15% of generation.

Decarbonization: U.S. data centers are projected to produce 24-44 mmt of CO2 annually through the end of the decade. In 2025, U.S. CO2 emissions increased by 115 mmt and are expected to decrease by 67 mmt through 2027, or an average of 33.5 mmt per year.

Energy and Water Management: To keep up with data center demand, utilities are building new natural gas plants and expanding renewable capacity. Coal plants originally expected to retire are remaining online. However, the quantity of generation projects needed has led to project backlogs and stalled permits. Data centers are straining communities' water supply, as over 97% of the water consumed by major data center operators is drawn from municipal drinking water systems.

Data Center Solutions

Investments in Energy, Carbon, and Water Management

Many data center developers are investing in resource management techniques to reduce their energy and water consumption and their carbon emissions. Investments include:

Advanced cooling technologies: Microsoft is leveraging new zero-water evaporation liquid cooling technology, which recycles water through a closed loop instead of relying on a fresh water supply. As of August 2024, all new Microsoft data center designs use this technology. This has helped the company achieve a 25% reduction in water-use intensity for its data centers.

Heat reuse measures: Gneuton, a new data center company, has developed a thermal distillation technology utilizing excess heat from gas turbines, which can improve facilities' energy efficiency.

Investments in Energy, Carbon, and Water Management (Cont.)

Energy efficiency: In addition to developers' efforts, industry has worked to develop standards for data centers. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the National Electrical Manufacturers Association (NEMA), and the Pacific Northwest National Laboratory (PNNL) released a scalable framework for energy-efficient data centers in June 2026. Recommended measures include utilizing energy storage to draw energy at off-peak times and predictive analytics to forecast demand and grid conditions. The framework is intended to help facilities better navigate electrical demand issues while reducing energy uncertainty.

Carbon capture and storage: Data center developers are seeking to balance power growth and emissions reduction goals using carbon capture, utilization, and storage (CCUS) technologies. Google signed a deal to purchase electricity for its data centers from a planned 400 MW natural gas plant in Illinois, which will capture around 90% of the plant's CO2 emissions. Other developers have announced similar initiatives. A report from Bloom Energy projects that by 2030, nearly one third of U.S. data center sites using onsite power will incorporate CCUS.

Agreements With Energy Providers

Data centers are pursuing several types of agreements with utilities and generation providers, including solutions for supplying their own power. Solutions include:

Bring your own power: In some cases, developers agree to fund generation and transmission infrastructure projects for utilities. Meta will fund the $11 billion construction of 10 natural gas plants, adding 7.5 GW of capacity to power its Louisiana campus. Meta is also funding 240 miles of new transmission lines connecting South Louisiana to other parts of the utility's region.

Power purchase agreements (PPAs): Many hyperscale developers are opting to sign long-term utility-scale power purchase agreements (PPAs) rather than funding the infrastructure themselves. These agreements typically supply facilities with renewable energy. For instance, Google signed a 15-year PPA for 1 GW of solar capacity to supply its Texas data centers with power.

Colocation: Alternatively, developers have begun pursuing generation colocation projects. Emerson is providing control system solutions for one such project in collaboration with a confidential developer. The hyperscale campus will be fully grid-independent by utilizing energy storage and an onsite microgrid. Bloom Energy will install up to 2.45 GW of fuel cell capacity to fully power an Oracle data center in New Mexico. Such agreements allow facilities to provide their own power, alleviating grid stress and sometimes allowing for a behind-the-meter agreement with the utility rather than a standard interconnection rate.

Demand response: Utilities and data centers are also signing agreements to utilize demand response mechanisms, which can preserve stability during peak times or grid events. Google signed agreements with utilities in Tennessee and Indiana stating that its facilities would shift non-urgent tasks during periods of grid strain.

Agreements With Energy Providers (Cont.)

Large load tariffs: Utilities can design large load tariffs to mitigate data center-induced price hikes, and if approved, data centers must comply. Utilities are revising rate structures specifically for hyperscale customers to shield ratepayers. As of May 2026, 30 states have at least one utility that has introduced or been approved for such tariffs. For example, Virginia's Dominion Energy created a new rate class for customers with a load of 25 MW or higher. The large load tariff also requires these customers to pay $1.5 million per MW in collateral, among other constraints. Measures such as these are intended to protect grid infrastructure and capacity while benefiting data centers and traditional ratepayers alike.

State and Local Data Center Policy Actions

Many states and localities have imposed restrictions or guidance on future data center projects.

Limiting tax breaks: Illinois and Ohio initially offered tax breaks to attract data centers but have now halted those incentives. Pennsylvania did not suspend incentives but created a list of best practices data centers must follow to receive state support, including investing $250 million in a community benefit plan and sourcing 10% of electric capacity from renewables.

Energy taxes: Virginia lawmakers reached a deal via a budget agreement which will impose an energy tax on data centers. Data centers will pay $0.011 per KWh of electricity consumed per month for the next two years, capped at $600 million per year. This measure is estimated to cost the data center industry $1.2 billion.

Regulation: Some states have advanced measures directing state agencies and utilities to regulate data centers. In Texas, ERCOT has proposed a rule to the state's public utility commission to allow the grid operator to approve new projects in batches, which it says could allow better allocation of power. Also in Texas, Senate Bill 6 requires new large loads over 75 MW to curtail power on demand during grid emergencies. The governors of Utah and Wyoming both signed executive orders directing state agencies to ensure that data centers do not increase utility bills or water consumption.

Local moratoriums: So far, the greatest pushback against data center expansion has occurred at the local level. Aurora, Illinois imposed a 90-day moratorium on data centers, during which it developed and passed new regulations. These include: a transparent public process, clear water and energy plans and usage limits, and a requirement that either 25% of peak load be from renewables or 50% of peak load be from batteries. Similarly, Texas' Hill County passed a one-year moratorium – but is already receiving lawsuit threats over it.

Federal Actions

Given the rapid expansion of data centers and the flurry of state actions surrounding them, the federal government is becoming involved.

Show Cause Orders: In June 2026, FERC issued show cause orders to the six regional grid operators under its jurisdiction, directing them to develop their own data center interconnection rules in line with their region's needs. These orders identify five categories of reform to be addressed, such as providing new transmission services for large loads and accommodating colocation and behind-the-meter generation. States will still have authority over the terms of retail sales to large load and siting and construction decisions.

Ratepayer protection pledge: The White House issued a voluntary ratepayer protection pledge in March 2026, which directs new data centers to pay for their own power generation. Seven major tech companies have signed it. Congress is currently considering a proposed ratepayer protection act that would codify aspects of the voluntary pledge.

For more information on this topic:

AI Data Center Energy Performance Framework – ASHRAE, NEMA, and PNNL

Environmental Impact and Net-Zero Pathways for Sustainable Artificial Intelligence Servers in the USA – Nature Sustainability

FERC Launches Aggressive Targeted Action to Speed Large Load Interconnection – FERC

Ratepayer Protection Act Proposed Text – Congress.gov

What We Know About Energy Use at U.S. Data Centers Amid the AI Boom – Pew Research Center

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