AI's Disruptive Impact on the Utility Industry

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Since the emergence of DeepSeek as a prominent player in the AI race, investors of all stripes have begun to question AI-related growth themes. AAM's technology analyst, Garrett Dungee, reviewed the trending topic last month in DeepSeek and the AI Race: CapEx Implications and Market Impact. The report examined the technological questions raised by the emergence of DeepSeek and its potential impact on the adoption of AI. While it remains to be seen if DeepSeek (or any other model) will have the impact as some now fear, it has at least brought into question many assumptions associated with AI. In this light, it is worth revisiting the impact AI is having on the utility industry.

Constantly Evolving Industry Projections

Over the past few years, AI has replaced EVs as the driving force ushering in the dawn of a new age in the utility industry. This represents a significant paradigm shift for an industry that experienced almost no growth over the previous two decades. In fact, over the 15-year period ending in 2023, total electricity generation in the United States increased by only 1.4%. The emergence of ChatGPT in late 2023, and the resulting AI-related growth in data centers, have created a seemingly relentless quest for power. This has dramatically changed the demand outlook for the utility sector, and forecasts for the industry are rapidly evolving.

According to the North American Electric Reliability Corporation (NERC) 2024 Long-Term Reliability Assessment report[1], summer peak demand forecast for the current 10-year assessment period is expected to rise by 132 gigawatts (GW). Just a year earlier, the 2023 report projected an increase of 80 GW. The summer peak load was approximately 745 GW in 2024.

For context, the U.S. has approximately 1,250 GW of generating capacity. At any given moment, there is plenty of power across the country. Problems arise when localized demand exceeds available supply. These tight conditions often last for just a few hours on a few days throughout the year. Although a

1 North American Electric Reliability Corporation 2024 Long-Term Reliability Assessment

significant amount of power is available in the US, we don't always have it exactly where we want it, when we want it. High-profile winter storms or summer heatwaves have the potential to strain the grid and serve as salient reminders of the grid's vulnerability.

PJM Interconnection (PJM) is the largest Regional Transmission Organization (RTO) in the US and is a useful case study in the AI related quest for power. As an RTO, PJM coordinates the movement of wholesale electricity and ensures grid reliability for more than 65 million people. PJM's territory spreads across thirteen states, from Illinois to the East Coast, and includes the world's largest data center cluster in Northern Virginia, as well as data center hotspots in Ohio, New Jersey, and Illinois.

In its 2023 report[2], PJM forecasted a summer peak load of 160,971 megawatts (MW) in 2033, a 10-year increase of 11,912 MW. In the 2024 report[3], the 10-year projection was for a summer peak load of 176,822 MW in 2034, an increase of 25,575 MW. In the latest report[4], published in January 2025, the 10-year forecast was raised substantially to a peak summer load of 209,923 MW in 2035. This is a 10-year increase of 55,779 MW, or an average annual growth rate of 3.1%.

These projections compare to 2024's actual peak load of 152,666 MW, which was reached on July 16th. In its latest report, PJM projects the peak summer load to reach 154,144 MW in 2025. It is worth pointing out that the daily peak load in 2024 was only forecasted to exceed 140,000 MW on 21 days and exceed 130,000 MW on 44 days. The median forecasted daily peak load was approximately 104,000 MW. So a typical day falls significantly short of annual peak load.

Peak load growth rates for individual zones within PJM range from 0.1% to 6.3%, with a median of 0.7%. The wide variety of growth rates across the zones within the PJM territory indicates that rapid data center demand is not uniformly distributed geographically. Unsurprisingly, the zone with the highest growth rate is Dominion, which is already home to the largest data center cluster in the world.

Utility Company Pipelines

At the individual company level, large load pipelines are also showing unprecedented growth. Based on commentary from recent earnings calls, there has been no let-up in demand and companies continue to get inbound requests for connections. Some examples of growing queues include:

- Public Service Enterprise Group (PSEG) has seen its pipeline grow to 4,700 MW, up from just under 400 MW a year ago. This includes inquiries from large load and data center customers. This pipeline includes both mature leads and initial inquiries.
- Southern Company currently has a pipeline of over 50 GW through the 2030s, of which 10 GW are committed projects and 6 GW are under contract. The company projects load growth of approximately 8% from 2025 to 2029. The rapidly changing demand picture is highlighted in the annual Integrated Resource Plan submitted by Southern Company's Georgia Power subsidiary. The 2022 IRP only included 400 MW of load growth and the projection jumped to 6,600 MW in a 2024 update. The 2025 IRP now includes 8,200 MW.

2 PJM 2023 Long-Term Load Forecast Report
3 PJM 2024 Long-Term Load Forecast Report
4 PJM 2025 Long-Term Load Forecast Report

- Dominion is home to the largest data center cluster in the world in Loudoun County, Virginia, and continues to be at the forefront of the data center demand surge. The company's pipeline currently comprises 40.2 GW of projects at various stages of contracting. This is up from just 21 GW as of July 2024.

Regulatory Safeguards

Across the country, regulatory bodies are seeking ways to facilitate data center growth while also protecting existing ratepayers and mitigating the risk of stranded asset costs should AI demand fall short of aggressive projections. There is a growing concern that not all the demand in the queues is genuine and that many of the requests are merely placeholders necessitated by the lengthy lead time in securing additional power. While it is difficult to determine the exact amount of redundancy, it is generally accepted that some potential customers hold positions in multiple load request queues. This makes sense given the uncertainties surrounding power availability. It is possible that many of these requests may not be needed, or at least not immediately, and developers are just trying to maintain some degree of flexibility.

While there are regulatory developments all across the country, Senate Bill 6 in Texas has become one of the more closely watched proceedings. The bill has passed the Senate and has been sent to the House. While details are still being ironed out through the amendment process, a basic framework is emerging that reflects not only the concerns of Texas legislators but also regulatory bodies across the country. Some features of SB6 include:

- Upfront charges for new large loads interconnecting to the grid.
- The disclosure of other requests the large load customer has made, both in Texas and outside.
- Requires new large load customers to install equipment that allows the load to be curtailed periods of stress.
- Requires the PUCT (Public Utility Commission of Texas) to study whether the current methodology (Four Coincident Peak) for calculating transmission cost allocation is still fair and appropriate.
- Directs the PUCT to establish standards that encourage business development while maintaining grid reliability and guarding against stranded asset risk.

While there is likely to be changes in the details before a final version is passed, the intention of the legislation is clear. SB6 is intended to be a comprehensive bill that protects current retail customers by establishing guidelines and protocols for large loads attempting to connect to Texas's transmission system. The final version is likely to be watered down, but it still serves as an example of the regulatory debate that is going on in jurisdictions across the country.

Alternative Solutions

The most obvious solution to the explosion in data center power demand is an increase in generation capacity, and this will certainly continue. Certain forms of baseload generation, such gas and nuclear, take a significant amount of time to develop. According to the largest domestic developer of power, NextEra Energy, it would take until 2030 for new unplanned natural gas plants to be built, and new nuclear plants have an even longer timeline. There is a valid concern, though, that long term demand growth may not match the current trajectory. This creates the possibility of stranded asset costs if demand falls short of expectations. Wind and solar can be deployed much faster but come with the drawback of being intermittent. For these reasons, alternative solutions to more generation are likely needed to help address tight power markets.

- **Technological Improvements:** While there are some questions about DeepSeek's claims, it does highlight the likelihood of improvements in efficiency. It is reasonable to assume that a variety of technologies will contribute to this goal. In addition to more efficient AI models, there are also advancements aimed at making data center equipment more efficient. In fact, it is reasonable to suggest that AI itself could be a significant contributor to this problem.

- **Transmission Expansion:** The data center demand spikes are not uniform across the country and there are still pockets of excess supply of electricity. There are numerous transmission projects across the country awaiting approval, and many are designed to connect growing demand to available supply. As just one example, Dominion is working on two 500 KV lines that will bring an additional 6 gigawatts of capacity to Eastern Loudoun County.

- **Demand response:** Demand response refers to a variety of demand-side management programs that curtail usage during periods of peak demand. With periods of stress limited to a few relatively brief instances throughout the year, these programs can be an effective tool for addressing tight reserve margins. In a recent report[5], researchers at Duke University determined that at a curtailment rate of just 0.25%, 76 GW of new load could be added to the system without only minimal capacity expansion. Further, at a curtailment rate of 1.0%, 126 GW could be added. Demand response programs have been used for decades to curtail load during periods of demand spikes but have become an increasingly attractive option as reserve margins have tightened and power prices have increased.

Conclusion

Data centers currently have a seemingly insatiable need for power and pipelines of large load requests have exploded. There is no doubt that the onset of AI has awakened an industry that has seen relatively subdued growth over the past two decades. The question is, is AI a challenge or an opportunity? The answer is likely both. Growing demand provides an opportunity to make investments in infrastructure while spreading the cost over a wider base. The challenge will be to make these investments without burdening existing ratepayers and compromising the reliability of the grid. The industry has been balancing the often competing goals of reliability and affordability, and now accelerating growth is adding complexity to this balancing act.

5 Norris, T. H., T. Profeta, D. Patino-Echeverri, and A. Cowie-Haskell. 2025. Rethinking Load Growth: Assessing the Potential for Integration of Large Flexible Loads in US Power Systems. NI R 25-01. Durham, NC: Nicholas Institute for Energy, Environment & Sustainability, Duke University. https://nicholasinstitute.duke.edu/publications/rethinking-load-growth

While there are no immediate signs of slowing demand for power, reasonable questions are being raised about longer-term demand. This is particularly important for the utility industry, as investment decisions are made with very long payback periods, often spanning decades into the future. Making investment decisions based on a sudden surge in AI-related demand runs the risk of creating stranded asset costs if demand ultimately fails to meet expectations. The good news is that the risk is not going unnoticed by regulators, and companies continue to look for ways to protect ratepayers from potentially overly optimistic forecasts.

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