Principal Real Estate

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How data center developers are powering AI

Demand for power has never been higher—nor supply more constrained. Here's how data center developers are getting the watts they need.

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AUTHORS' NOTE:

In the short time between when we wrote this paper and its publication, the Chinese AI company DeepSeek released a report claiming that its AI model uses 10-40 times less energy than similar U.S. AI technology. Greater energy efficiency is a good thing, of course. But it's not likely to eliminate massive new power requirements, just as virtualization—which dramatically improved servers' computational efficiency—didn't alter data centers' growth trajectory. U.S. companies are not likely to use DeepSeek's models, but if they replicate its more efficient training approach, that may well spur even greater levels of AI adoption that continue to drive data centers' growing power requirements.

AT-A-GLANCE

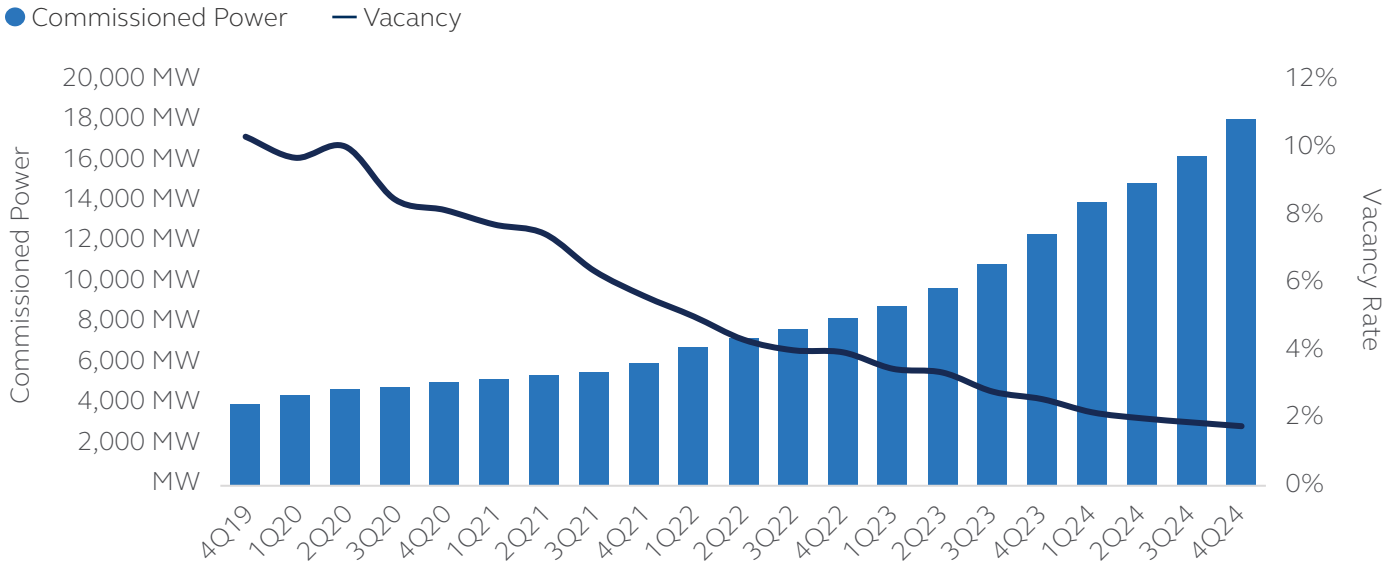
- Already massive, accelerating data center demand is driving unprecedented levels of demand for power capacity—potentially growing at three times the pace of the last 20 years.
- Power supply is constrained by a number of factors, including permitting timelines and equipment supply chains.
- There is a range of ways savvy developers are getting the power they need: on-site generation, co-development of power infrastructure with utilities, proactive land development and power procurement, and (to a lesser extent) moving to new markets.

Massive data center demand is driving huge new power requirements

Exponential growth in demand for data center capacity continues to accelerate—the U.S. colocation data center market doubled in size from 2020 to 2024, and that doesn't account for all the capacity brought online by hyperscalers themselves. AI could drive demand even faster; Dell CEO Michael Dell predicts that AI will drive a 100x increase in data center demand over the next 10 years.

Demand is rising so much faster than supply that vacancy rates in major data center markets are at their lowest levels ever—below 3% nationwide.

EXHIBIT 1: Data center supply is growing, but not as fast as demand

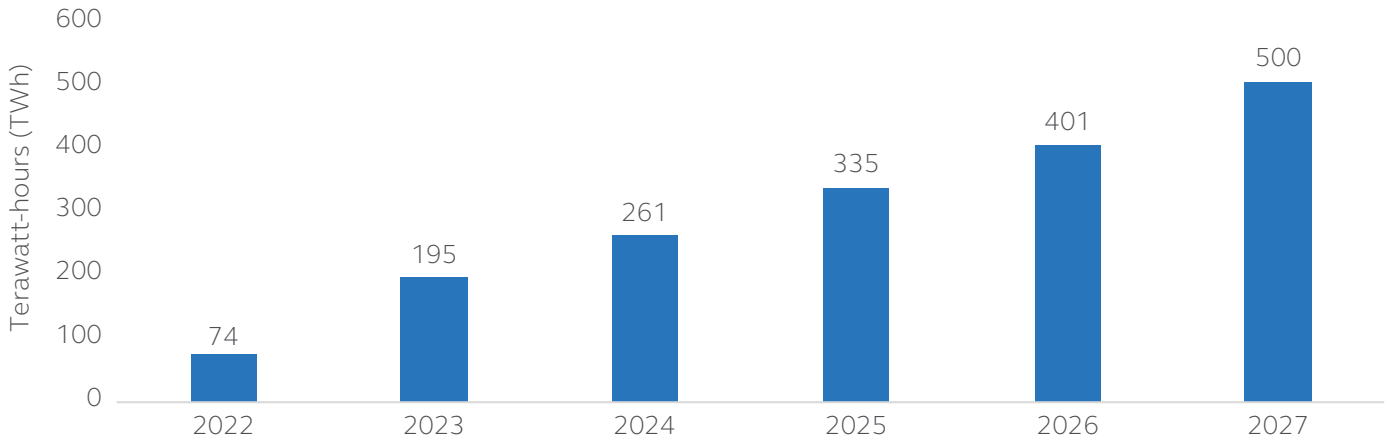


Source: datacenterHawk, 31 December 2024

As we've written before, the primary task of a data center is to securely house, power, and cool the IT equipment on which virtually every aspect of modern life depends. Challenges abound: land is constrained in some markets, and data center operators are having to adopt new cooling strategies to support AI. But power is the predominant gating factor in data center developers' ability to support growing demand.

Data center power demand was already growing rapidly, but generative AI has driven it to unprecedented rates. That is in part because these AI models are incredibly power-intensive—before generative AI, computational requirements grew about 8x every two years, now it's 256x. Another factor is how widespread generative AI has become, with applications like ChatGPT making it accessible to anyone with an internet connection.

EXHIBIT 2: Power requirements for data centers to run newly added AI servers growing 47% per year



Source: Gartner, 12 November 2024

In aggregate, demand for power in the U.S. could grow 15.8% over the next five years, according to a December 2024 report by the power sector analyst firm Grid Strategies.[1] (The official forecast is 8.2%, but new updates suggest much higher growth.) Data centers are the primary driver, though manufacturing and electrification are also adding significant new demand.

Delivery of new power constrained by lack of transmission capacity

Average load growth has been well below 1% per year for the last two decades. A 3% annual growth rate would require six times the planning and construction of new generation and transmission capacity than utilities are used to. Now, "connection requests for hyperscale facilities of 300-1000MW or larger with lead times of 1-3 years are stretching the capacity of local grids to deliver and supply power at that pace."[2]

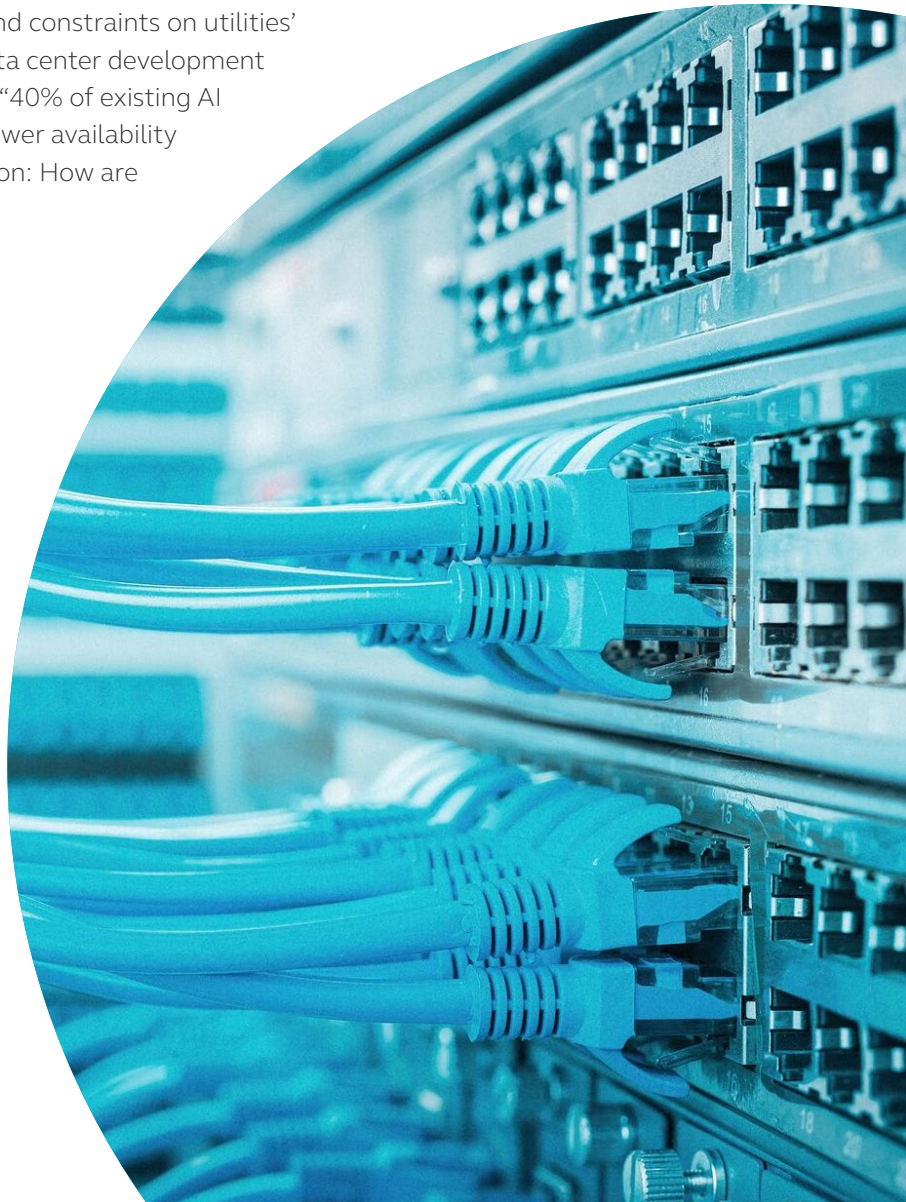
The issue, for now at least, is not a lack of generating capacity. Rather, it's the speed (or lack thereof) with which utilities can build new transmission lines to get the power to the new data centers. Permitting is a significant constraint. According to analysis by Lawrence Berkeley National Laboratory, "the timeline from the initial connection request to having a fully built and operational plant has increased from under two years for projects built in 2000-2007 to more than four years for those built in 2018-2023."[3]

Supply chain delays for critical equipment is another constraint on utilities' ability to fulfill interconnection requests. According to CBRE, "Power delivery timelines will continue to increase in H2 2024 due to a shortage of readily available equipment, such as transformers, switches and generators. Difficulty in procuring critical equipment will lead to power delivery delays of up to four years."[4]

What's a data center developer to do?

The combination of massive power requirements and constraints on utilities' ability to deliver new capacity quickly makes the data center development process more difficult, and longer. Gartner predicts "40% of existing AI data centers will be operationally constrained by power availability by 2027."[5] For many investors, this begs the question: How are data center developers meeting demand?

There are a range of ways savvy data center developers—hyperscalers themselves, as well as third-party providers—are getting the power they need: through on-site generation, co-development of power infrastructure with utilities, proactive land development and power procurement, and (to a lesser extent) by looking to new markets.



(1) The report's load growth estimates are based on annual planning reports submitted to the Federal Energy Regulatory Commission by electric balancing authorities, and updated with additional data from utilities and planning regions. Source: Grid Strategies, Strategic Industries Surging: Driving US Power Demand, December 2024.

(2) U.S. Department of Energy, Recommendations on Powering Artificial Intelligence and Data Center Infrastructure, 30 July 2024.

(3) Lawrence Berkeley National Laboratory, Grid connection backlog grows by 30% in 2023, 10 Apr 2024.

(4) CBRE, North America Data Center Trends H1 2024, 19 Aug 2024.

(5) Gartner, Rapid Growth in Energy Consumption For GenAI Will Exceed Power Utilities' Capacity, 12 Nov 2024.

On-site generation

On-site power generation is behind the meter, meaning it doesn't require utility interconnection. On-site generation with natural gas is a common temporary solution developers employ while waiting for interconnection to the grid. The upside of natural gas as a temporary solution is its reliable, well-managed distribution network and relative abundance. That it is a fossil fuel—a backward step on the path to decarbonization—is a significant downside.

On-site generation with renewables (solar, wind, and fuel cells powered by biogas or hydrogen, combined with battery storage) is typically a permanent solution. But it requires another resource in increasingly short supply: land. For example, Apple's data center campus in Maiden, North Carolina, features 58 megawatts (MWs) of solar panels and 10 MWs of biogas fuel cells; each 20 MW solar farm spans about 100 acres.

Behind-the-meter nuclear generation is growing in popularity, spurred in part by tax credits the Inflation Reduction Act set aside for existing nuclear plants. For example, AWS bought a data center campus in Pennsylvania from Talen Energy, signing a long-term agreement to purchase power via a direct connection from the Susquehanna nuclear power plant. A request to expand the deal from 300 MW to 480 MW was denied by the Federal Energy Regulatory Commission (FERC), though Talen said it would appeal.[6]

On-site generation with small modular nuclear reactors, SMRs, is widely considered the 'holy grail' of the data center power solutions. It could be temporary or it could be a permanent solution requiring grid interconnection only for redundancy. But SMRs are likely a decade away from widespread adoption. A recent deal between Google and Kairos Power plans for 500 MW of power to come online by 2035; it's not clear whether the plants will be behind the meter or connected to the grid.

Co-development

While on-site generation is a common short-term strategy, co-development is a more likely long-term approach for data center developers to get the new power capacity they need. As power demands continue to grow and if generating capacity becomes constrained, these kinds of projects will represent essential new sources of generation.

Of course, a co-developed project also takes time to build and may face permitting and supply chain constraints. But co-development can give data center developers more control over timelines, and ease the capital burden on utilities. Most utilities' balance sheets are sound, but their ability to use debt funding or issue new equity for these massive capital projects is limited by various factors, including rating agency constraints and shareholder interests. In 2024, utilities increasingly leaned on credit supportive hybrid debt instruments as an attractive source of funding following favorable rating agency updates. We expect high levels of issuance to continue as utilities make these significant capital investments.

To date, one of the chief ways that data center developers and utilities have co-developed generating capacity is through power purchase agreements (PPAs). A PPA is a long-term agreement between an energy consumer and an energy supplier that provides the consumer with a guaranteed amount of power and the supplier with a guaranteed price per megawatt-hour.

Recently announced renewable PPAs include two between Meta and the German energy company RWE; County Run Solar in Illinois will provide Meta with 274 MWs and Lafitte Solar in Louisiana will provide 100 MWs. Recently announced co-development projects for nuclear generation include Microsoft's 20-year PPA with Constellation to restart Three Mile Island Unit 1. Microsoft will buy all of the power produced (835 MW), to match the power used by its data centers in the region.

[6] No new developments have been announced as of January 17, 2025.

Proactive land development

Some speculative developers buy up land near power transmission lines, but that doesn't guarantee a grid interconnection. In the past they might have even sought grid interconnection well in advance of demand. But now utilities are taking steps to disincentivize speculative development or overestimation of demand, including by instituting 'take or pay' terms and requiring upfront infrastructure buildout payments.

Savvy data center developers take a proactive, not speculative, approach. They nurture deep relationships with local utilities, communicating and collaborating about upcoming plans. They have sophisticated people, processes, and technologies for selecting the highest-quality, lowest-risk sites to pre-develop. They keep a finger on the pulse of the industry, collaborating with the suppliers driving technology advancements and the customers deploying new capacity to de-risk proactive land development and power procurement.

New markets

Theoretically, power constraints in top markets like Northern Virginia might send developers looking for new markets with plentiful power—and that has happened to some extent. (Meta, for example, is developing a 2 GW data center in Louisiana to train its Llama AI models.) According to CBRE's 2024 Data Center Trends report, "Markets such as Northern Indiana, Idaho, Arkansas and Kansas will continue to draw interest from hyperscalers and developers due to land availability and power availability timelines."[7]

But as we've written previously, most new data center capacity is still in primary markets. Data centers cluster in the locations with the fundamentals that benefit end users (and therefore, developers)—factors like critical mass (the presence of other data centers), connectivity, occupancy cost, and the policy environment. Fundamentals are why Northern Virginia remains the #1 U.S. market, even as power and land are increasingly hard to come by.

Conclusion: Investor considerations

Data center developers face a 'perfect storm': massive (and accelerating) demand for data center capacity, driving unprecedented rates of demand for power, in an environment in which getting power to the data center takes twice as long as before. Not all developers are equally well-equipped to navigate these challenges. For investors, realizing the full return potential requires a keen understanding of which developers are poised to be able to deliver more data center capacity, more quickly than others.

[7] CBRE, North America Data Center Trends H1 2024, 19 Aug 2024.

[8] Principal Real Estate Investors become registered with the SEC in November 1999. Activities noted prior to this date were conducted beginning with the real estate investment management areas of Principal Life Insurance Company and, later, Principal Capital Real Estate Investors, LLC, the predecessor of Principal Global Investors Real Estate.

Principal Real Estate: A partner to navigate the evolving data center sector

Given the highly specialized and niche nature of the data center sector, we believe experience and access are critical to successful execution. As an active commercial real estate investor for more than 60 years—including more than 17 years in the data center sector—we have witnessed the asset class evolve and adapt to the changing needs of data center tenants.[8] We have relationships with many of the top data center developers already successfully navigating this perfect storm.

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Data center properties and will only be attractive to a unique type of tenant. A limited tenant base increases the risk of vacancy. Additionally, a property designed to be a data center property, may be difficult to relet to another type of tenant or convert to another use and will be more likely to become functionally obsolete when compared to other properties. For example, if converted to industrial use, the expected rents would be lower than that projected for data centers. Thus, if operating a data center were to become unprofitable, the liquidation value of properties may be substantially less than would be the case if the properties were readily adaptable to other uses.

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MM14337 | 02/2025 | 4186128 -022026