

Perspectives

Data centres: Powering the growth of AI and cloud computing

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Executive summary

- **Data centre capacity is rapidly growing.** Global data centre power capacity has grown more than 200% in the past decade, from 26 gigawatts (GW) in 2015 to 81 GW in 2024. Capacity is projected to reach 222 GW by 2030 (a compound annual growth rate (CAGR) of 18%), reflecting fast growing demand for compute-intensive workloads such as artificial intelligence (AI).
- **AI and cloud computing are the key growth drivers.** The increasing power demands of AI, particularly generative AI, and the widespread adoption of cloud computing are driving data centre growth. AI workloads require energy-intensive graphics processing units (GPUs) for training models, while enterprise workloads and data are increasingly moving to cloud given its cost efficiency, scalability, and flexibility.
- **Hyperscalers need more power.** Hyperscalers like Google, Microsoft, and Amazon are actively pursuing renewable energy, especially wind and solar, to meet their net-zero commitments. In addition, they are exploring other alternative energy sources, such as small modular reactors (SMRs) and energy storage solutions, to ensure reliable power supply.

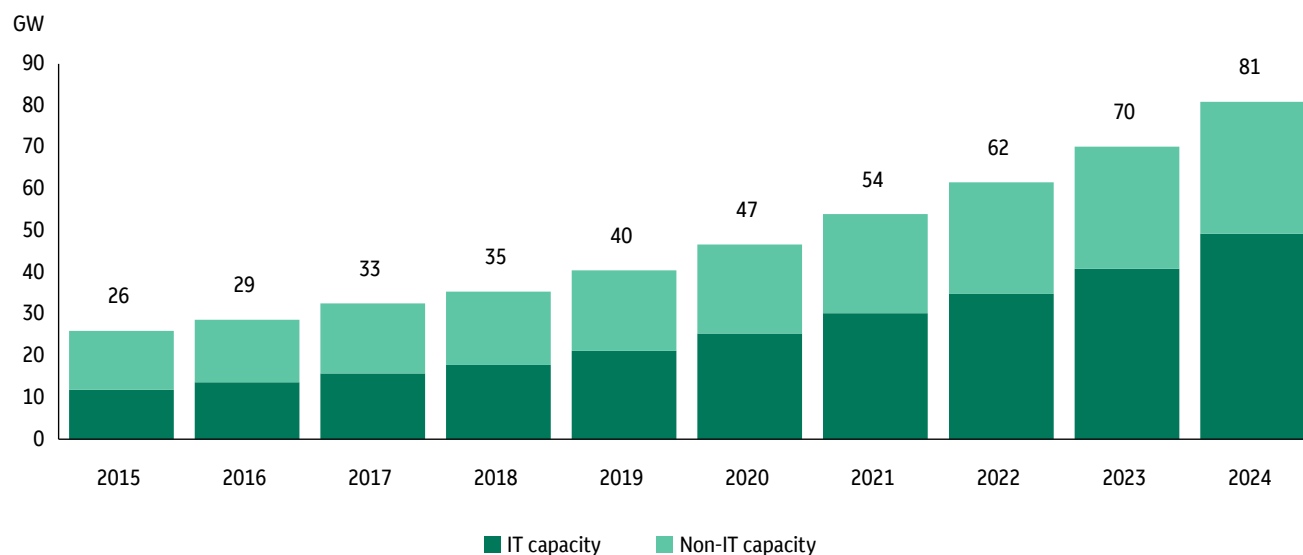
The evolution of data centre capacity: Past growth and outlook to 2030

The data centre market has experienced rapid growth over the past decade. During this period, information technology (IT) capacity – a metric that reflects the power consumed by IT equipment and is commonly used to gauge data centre size – has surged by more than 300% globally, rising from 12 GW in 2015 to 49 GW in 2024.¹

However, IT equipment is not the sole consumer of power within a data centre. Non-IT equipment, particularly cooling systems, also accounts for a significant portion of energy usage. While advancements in power usage effectiveness (PUE) – a ratio of total power consumption to IT equipment power consumption² – have slowed the growth of non-IT power demand, it has still increased substantially alongside the proliferation of data centres. Overall, the total power capacity of data centres expanded from 26 GW in 2015 to 81 GW in 2024, marking a 211% increase or a CAGR of 13% (Figure 1).

Figure 1:

Global data centre power capacity is exploding, growing at a 13% CAGR over the past 10 years



Source: Bloomberg New Energy Finance (BNEF), "Data Center Market Overview", June 2025.

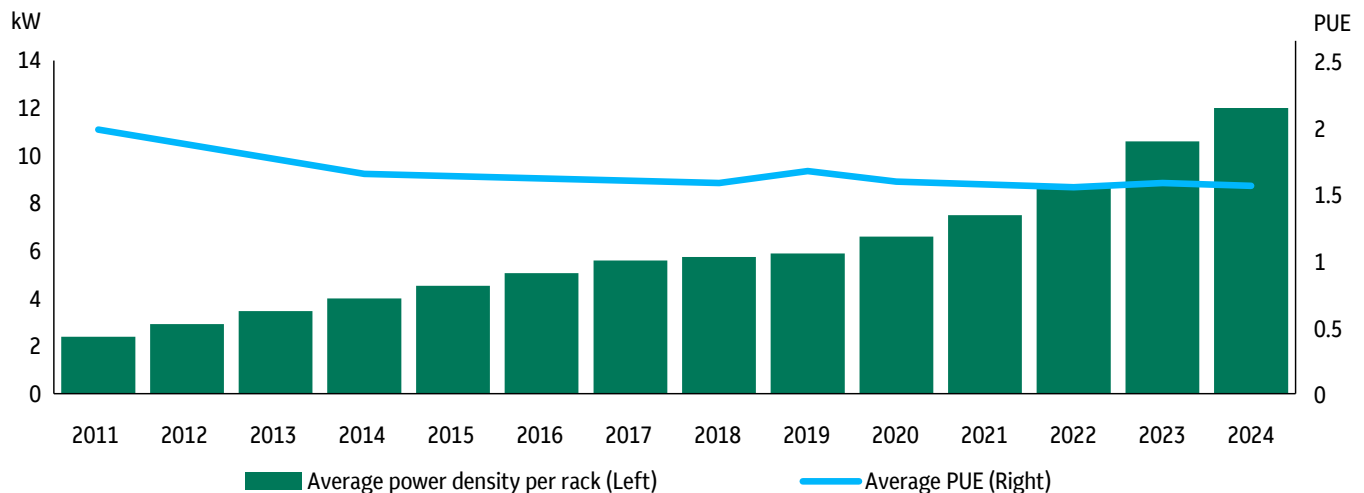
It is not just that the global fleet of data centres is expanding, but individual data centres are also evolving to accommodate the growing demand for compute-intensive workloads such as AI, internet of things (IoT), cryptocurrencies, and augmented/virtual reality. These workloads are driving the adoption of high-density racks. In 2011, the average power density per rack – the electrical power consumed by IT equipment within a single fully populated server rack – was just 2.4 kilowatts (kW). In 2024, this figure is estimated to have increased fivefold to 12 kW. On the other hand, during the past five years, the average PUE has remained relatively stagnant, hovering between 1.55 and 1.6 (Figure 2). With rack densities continuing to rise, a stagnant PUE implies that the overall power capacity of data centres is expected to grow at a comparable rate.

1. BNEF, "Data Center Market Overview", June 2025.

2. A PUE of 1.0 represents the theoretical ideal, where all power is consumed solely by IT systems. This, however, remains an unachievable standard in practice.

Figure 2:

Average power density per rack increased fivefold while average PUE has remained relatively stagnant since 2011



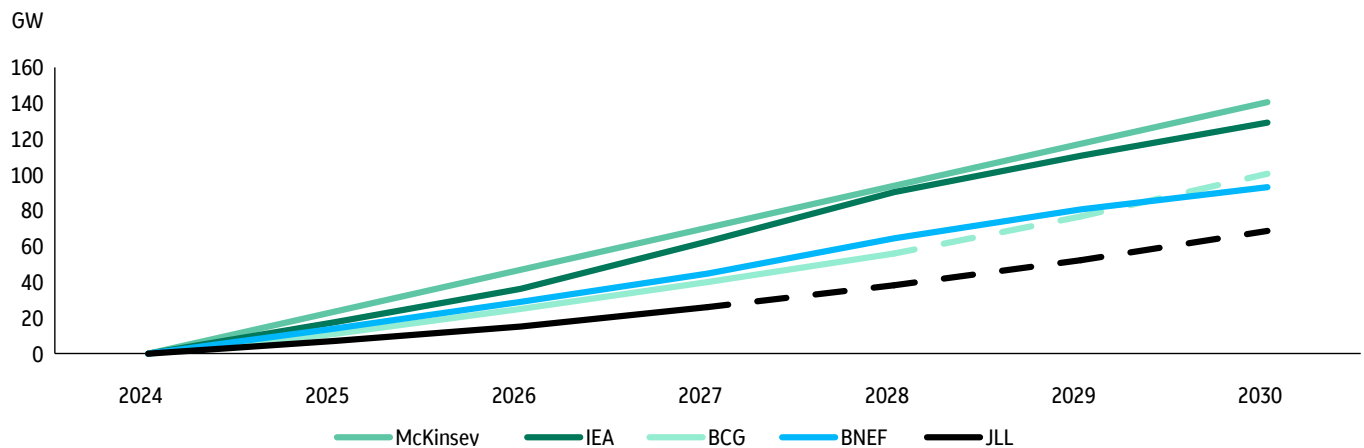
Sources: Uptime Institute, "Rack Density is Rising", December 2020; Omdia, "Data Center Racks Market Analysis - 2023", December 2023; Uptime Institute, "Uptime Institute Global Data Center Survey 2024", July 2024; Macquarie Asset Management analysis.

Looking ahead, global data centre capacity is expected to continue expanding rapidly through 2030, although growth projections vary significantly by forecasters (Figure 3). From 2025 through 2030, capacity additions are forecasted to be between 69 GW and 141 GW, reflecting an 85% to 174% growth relative to global capacity in 2024.

The range of projections stems not only from differing assumptions around data centre demand growth but also from methodological differences. Some forecasters use a top-down approach, aggregating project pipelines and permitting data to estimate near-term capacity additions, while other forecasters base projections on server shipments. The former approach offers higher visibility over the near term but may underestimate longer-term growth, while the latter provides insights into latent demand but potentially underestimating external constraints such as grid connection. Overall, these divergent forecasts highlight not only the sector's vast growth potential but also the considerable uncertainty around how quickly supply chains, regulatory frameworks, and energy systems can scale to meet demand.

Figure 3:

Global data centre capacity is forecasted to grow between 69 GW and 141 GW from 2025 through 2030



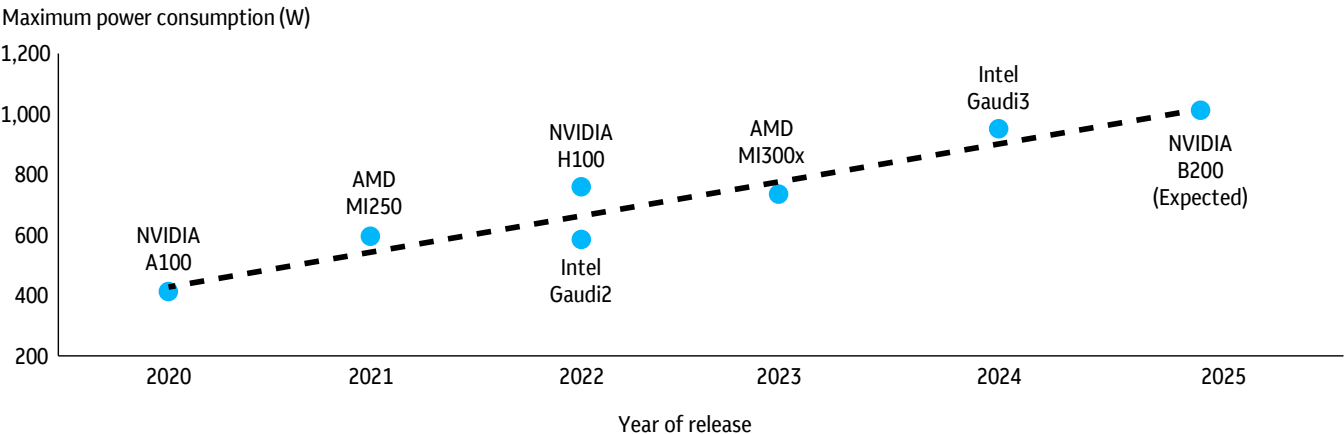
Sources: BNEF, "New Energy Outlook 2025", May 2025; International Energy Agency (IEA), "Global data centre capacity additions in the Base Case and capacity at risk of connection delay due to grid constraints, 2025-2030", April 2025; JLL, "2025 Global Data Center Outlook", January 2025; Boston Consulting Group (BCG), "Breaking Barriers to Data Center Growth", January 2025; McKinsey & Company, "AI power: Expanding data center capacity to meet growing demand", October 2024; Macquarie Asset Management analysis. Dotted lines represent capacity additions extrapolated with the assumption of the same CAGR as the forecasted period; the derived values do not imply endorsement by the original data providers.

AI is a key driver for data centre electricity demand growth

A key contributor to the growth of data centre power capacity in recent years has been the increasing power draw of AI, especially generative AI. Its growing role in global industries has fuelled a surge in computational power requirements, leading to rising energy consumption by data centres. Major graphics chip makers such as NVIDIA, Advanced Micro Devices, Inc. (AMD), and Intel have been rolling out new AI GPUs, and as each generation of GPUs increases in computational power and speed, it also consumes more power per chip. For example, NVIDIA's H100 GPU, popular for AI training, has a thermal design power (TDP) of 700 watts (W), almost double that of its predecessor. Its new B200 GPU – expected to be shipped later this year – even reportedly has a TDP of 1,000W (Figure 4).

As a result of both the higher power requirement of new GPUs and the increasing number of GPUs required, training AI models have become substantially more energy intensive in recent years: OpenAI's GPT-3 – trained with about 1,024 A100 GPUs over 34 days – used 1,287 megawatt hours (MWh) of electricity, while GPT-4, reportedly trained using up to 25,000 H100 GPUs over 100 days, consumed over 62,000 MWh, nearly 50 times more electricity than GPT-3.³

Figure 4:
Power consumption per chip is increasing over time

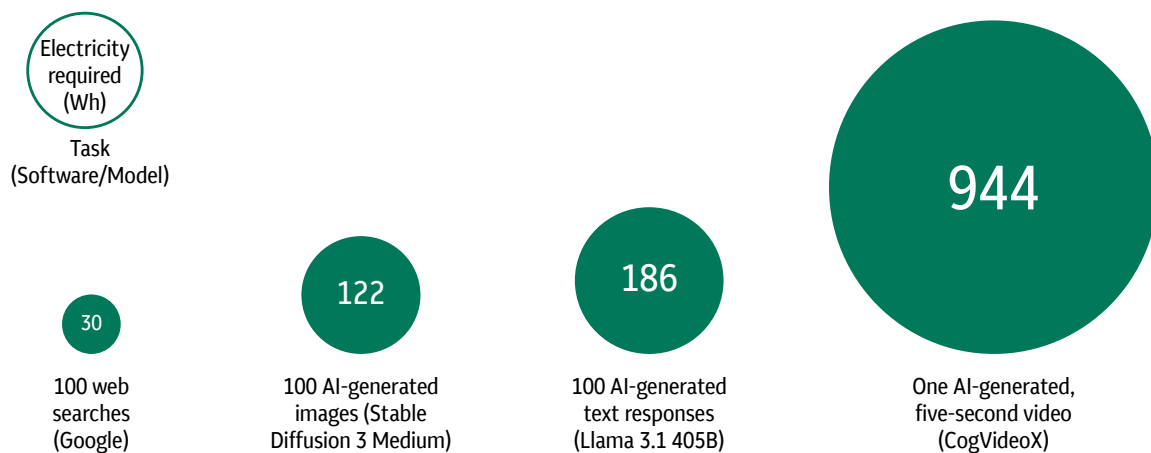


Sources: AnandTech, "NVIDIA Blackwell Architecture and B200/B100 Accelerators Announced: Going Bigger With Smaller Data", March 2024; Forbes, "AI Power Consumption: Rapidly Becoming Mission-Critical", June 2024; SemiAnalysis, "Nvidia Blackwell Perf TCO Analysis – B100 vs B200 vs GB200 NVL72", April 2024.

3. Electric Power Research Institute, "Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption", May 2024.

Furthermore, as AI models have advanced in their ability to generate more complex and higher-quality outputs, ranging from text to photorealistic video, their energy demands have also risen accordingly. While generating an image or a text response using an AI model requires 1-2 watt-hours (Wh), producing a five-second video segment can consume as much as 944Wh – a power requirement more than 3,000 times greater than that of a Google web search. This underscores the exponential growth in energy intensity associated with increasingly sophisticated AI application (Figure 5).

Figure 5:
The electricity required to create a five-second AI-generated video can power more than 3,000 Google web searches



Sources: MIT Technology Review, "Climate change and energy: We did the math on AI's energy footprint. Here's the story you haven't heard", May 2025; IEA, "Electricity 2024", January 2024.

Data centre electricity demand will keep trending upward despite energy efficiency improvements

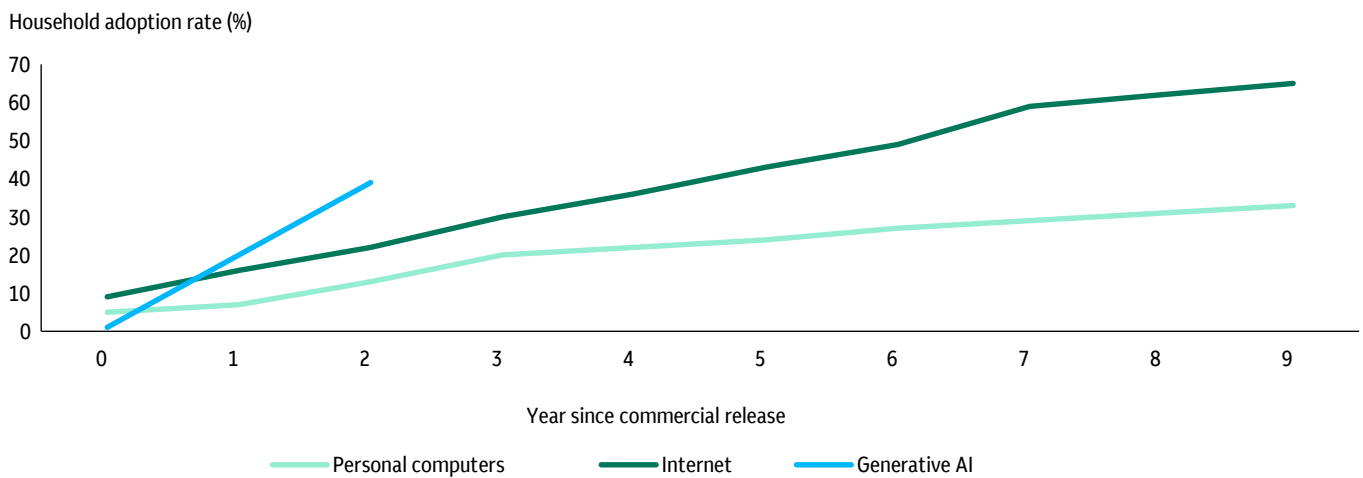
Earlier this year, DeepSeek-V3 sparked market discussion on the trajectory of data centre electricity demand. DeepSeek claims that training its AI model only took 3.7 days with a cluster of 2,048 NVIDIA H800 GPUs, which are essentially a less powerful version of the popular H100.⁴ If DeepSeek's claim is true, it implies that training AI could be much less energy intensive than previous data suggested. But even without DeepSeek, ongoing technological advances are expected to boost AI and data centre energy efficiency. For example, Google's specialized AI chips, Tensor Processing Units (TPUs), are believed to be faster and more energy efficient than GPUs for specific AI tasks.⁵ In addition, advances in cooling systems and AI-based workload management can also help to reduce the electricity consumed per unit of computing.

4. DeepSeek-AI, "DeepSeek-V3 Technical Report", December 2024.

5. Wevolver, "TPU vs GPU in AI: A Comprehensive Guide to Their Roles and Impact on Artificial Intelligence", March 2024.

Nonetheless, the overall trajectory of data centre electricity demand will most likely remain upward despite energy-efficiency improvements. This is because increased efficiency drives down costs, making AI more accessible and accelerating AI adoption. In fact, in the US, consumers adopt generative AI much quicker than they did for internet and personal computers (Figure 6). As the household adoption rate of AI continues to grow and AI becomes more deeply embedded in enterprise applications, its total electricity demand is likely to continue expanding.

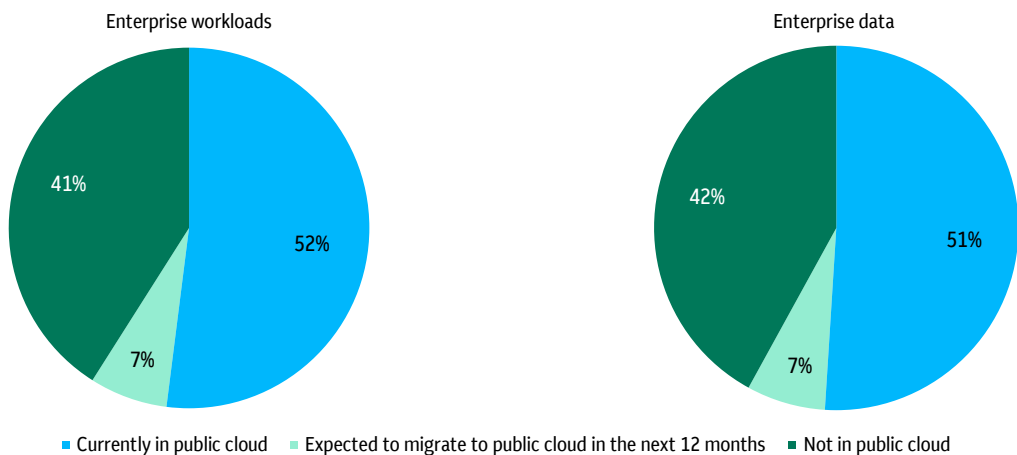
Figure 6:
US consumers adopt generative AI much quicker than they did for internet and personal computers



Source: IEA, “Household adoption rates of digital technologies in the United States”, October 2024.

Beyond AI, cloud computing is another driver of data centre growth. Unlike AI workloads, which are concentrated in specific applications, cloud computing supports a vast range of enterprise IT needs, from storage to real-time analytics. Just over half of enterprise workloads (applications and services) and data are in the public cloud today, with an additional 7% expected to migrate in the next 12 months (Figure 7). Indeed, non-AI workloads are projected to still account for 55% of data centre power demand by 2028.⁶ The steady growth of cloud adoption ensures that even if AI efficiency gains slow the pace of electricity demand growth, the broader expansion of cloud computing will sustain a strong upward trend in data centre energy consumption.

Figure 7:
Enterprise workloads and data in public cloud, 2025



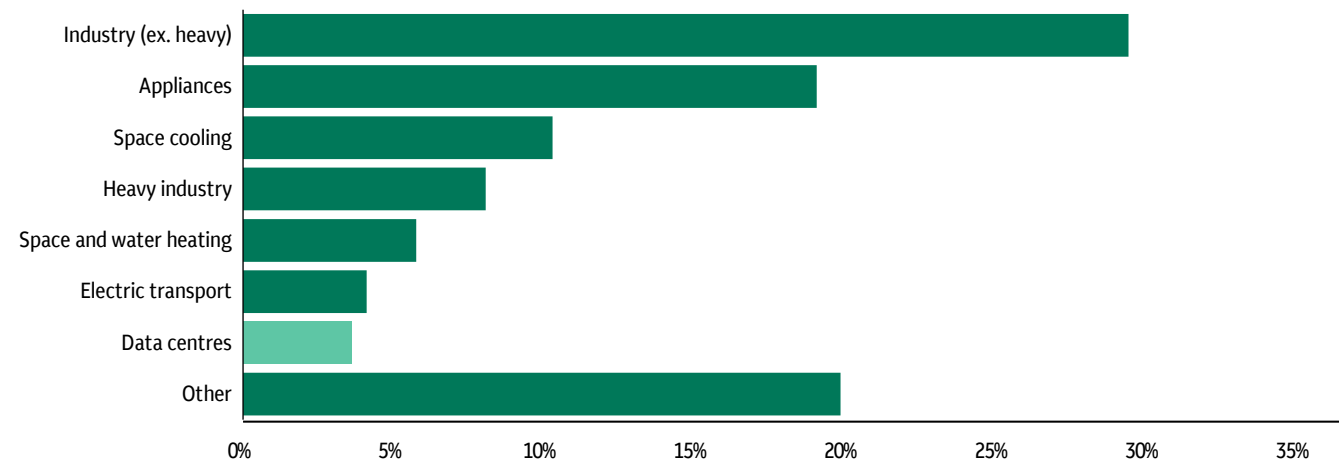
Source: Flexera, “State of the Cloud Report 2025”, March 2025.

6. BGG, “Breaking Barriers to Data Center Growth”, January 2025.

We need more power generation to fulfil growing data centre demand

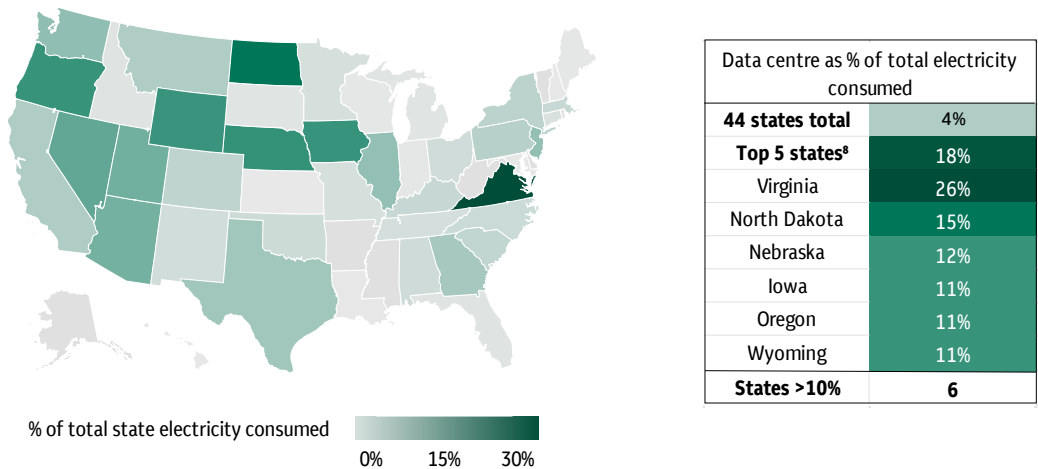
The rapid expansion of AI and cloud computing is driving a surge in electricity demand, with data centres emerging as a key growth driver alongside industries such as manufacturing, space cooling, and electric transport (Figure 8). Although data centres have contributed just 4% to global electricity demand growth over the past decade, this headline figure conceals significant geographic disparities. For instance, in the US, data centres account for 4% of total electricity consumption across 44 states with significant data centre activity. However, in six states, they contribute more than 10% of total electricity consumption, including Virginia, where they now represent nearly 30% of the total (Figure 9). This underscores the considerable strain data centres can place on local energy supplies.

Figure 8:
Data centres contributed to 4% of global electricity consumption 2014-2024



Source: IEA, “Energy and AI”, April 2025.

Figure 9:
In the US, data centres consumed 4% of total electricity across 44 states⁷ but exceeded 10% in six states in 2023



Source: Electric Power Research Institute (EPRI), “Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption”, May 2024.

7. EPRI’s analysis only includes states that had significant data centre load in 2023. States excluded are Alaska, Arkansas, Delaware, Mississippi, Vermont, and West Virginia.
8. Top five states with highest data centre electricity use as percentage of statewide usage. The top five states in 2023 were Virginia, North Dakota, Nebraska, Iowa, and Oregon.

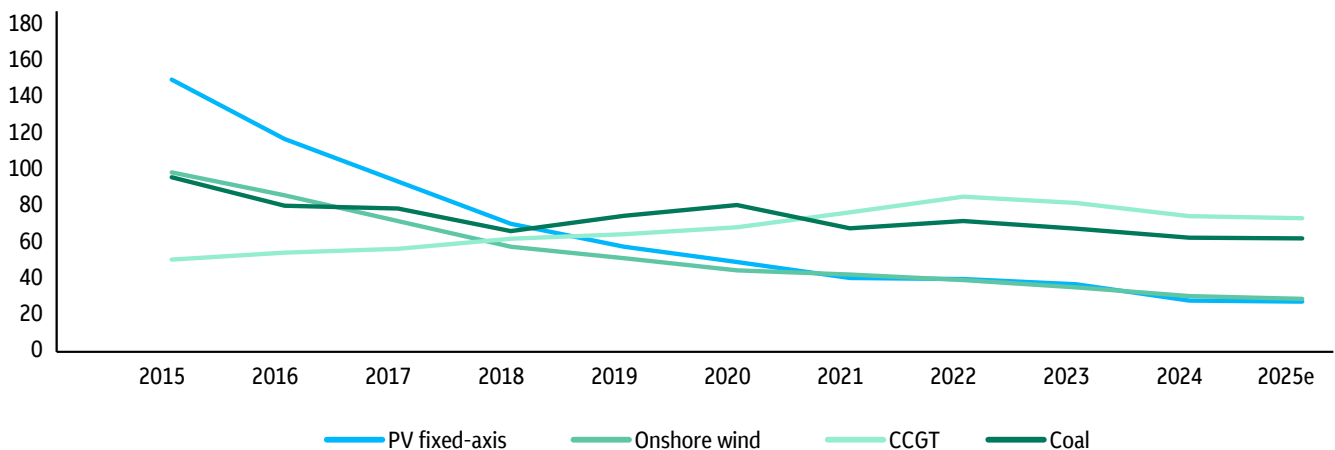
Hyperscalers⁹ like Google, Microsoft, Meta, and Amazon are actively pursuing power to sustain their growing fleets of data centres. These companies, among the largest global buyers of renewable energy, have made ambitious net-zero commitments. By July 2025, they accounted for more than 40% of all corporate renewable power purchase agreements (PPAs), representing over 110 GW of contracted capacity – equivalent to UK's entire power generation capacity.¹⁰

In many markets, wind and solar now offer the lowest levelized cost of electricity (LCOE), making them not only cleaner but often the most economical choices (Figure 10). However, integrating intermittent renewables into the energy-intensive operations of AI and cloud computing presents challenges. These workloads require continuous, stable electricity, necessitating investments in energy storage solutions such as grid-scale lithium-ion batteries, pumped hydro storage, and green hydrogen to bridge the gap between supply and demand.

Figure 10:

Wind and solar have lower LCOEs compared with combined cycle gas turbine (CCGT) and coal

\$/MWh (2024 real)



Source: BNEF, "2025 LCOE: Data Viewer Tool", February 2025.

More importantly, wind and solar power generation capacity is not growing fast enough to meet the surging power requirements of hyperscalers. Consequently, these companies are diversifying their energy strategies. Alongside long-term renewable contracts, they are exploring alternative sources like nuclear and, in some cases, natural gas with carbon offsets to ensure stable baseload supply. For instance, Google Kairos Power announced plans to build up to seven SMRs providing up to 500 MW of power by 2035, while Amazon and X-energy targets to deploy more than 5 GW of SMR capacity by 2039.¹¹ The priority is simple: secure as much reliable power as possible.

The increasing energy demand of data centres also exposes the limitations of current grid infrastructure. Enhancing grid flexibility and resilience through smart grid upgrades has become an attractive investment avenue. Modernizing transmission systems is critical to accommodating the scale and reliability required by hyperscalers, ensuring that the grid can support both renewable integration and the continuous power needs of AI-driven workloads.

In summary, the race to secure reliable and sustainable power for data centres is driving a transformation in energy strategies. While wind and solar remain compelling renewable energy sources, meeting the escalating demands of the digital economy will also necessitate significant investments in energy storage, grid modernization, and diversified energy solutions. Despite advancements in efficiency, power demand is expected to grow substantially due to the rapid expansion of data centres. For infrastructure investors, this presents a broad spectrum of opportunities – from grid and transmission upgrades to utility-scale renewables, energy storage, and tailored on-site power solutions. These opportunities are particularly pronounced in regions with a high concentration of data centres, where existing energy infrastructure is already under pressure.

9. A hyperscaler is a technology company that operates large data centers and computing infrastructure.

10. BNEF, "Power Purchase Agreements (PPA)", accessed 22 July 2025; Department for Energy Security & Net Zero, United Kingdom, "Clean Power 2030 Action Plan: A new era of clean electricity – main report", April 2025.

11. Data Center Frontier, "Google and Amazon Make Major Inroads with SMRs to Bring Nuclear Energy to Data Centers", October 2024.

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