Hunger games: The data centre race for power, land and water

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IN A NUTSHELL

— Data centers are the new power giants, driving a new investment wave in energy grids, hyperscale colocation facilities and commodity markets

— However, scarce land and water, slow permitting, and overloaded utilities are testing grid capacity, threatening climate goals and sparking new battles over energy availability

— For investors, data centres are no longer just a digital theme but also a full-stack infrastructure story offering a range of investment opportunities

Introduction

Over the last decade, data centres (DCs) have shifted from being background infrastructure to a central pillar of the global economy, Hyperscale operators, namely the big cloud and AI players, have led this charge as the number of large hyperscale data centres have nearly doubled from under 600 to around 1,189 by early 2025, representing roughly 44% of global data centre capacity.[1]

The rapid expansion of data centres is therefore emerging as one of the most important shifts in global infrastructure. Their rising energy footprint is reshaping power demand trajectories, particularly in the U.S., parts of Europe and other emerging hotspots. As data-processing intensity accelerates, utilities and grid operators face pressure to deliver reliable electricity at unprecedented scale, while policymakers in certain jurisdictions struggle to reconcile this surge with decarbonisation goals.

However, this growth is constrained by a complex set of bottlenecks that extend far beyond electricity. These include permitting hurdles and land and water availability which are driving where and how quickly new facilities can be built. These challenges are catalysing a new wave of innovation from advanced cooling technologies and on-site generation to smarter grid management. At the same time, the digital economy's footprint is reverberating through global commodity markets as data centre construction and operation are intensifying the demand for commodities such as copper, aluminium, steel and rare earth metals.

For investors, these intersecting forces are creating both challenges and opportunities. Understanding how energy constraints, grid modernisation, materials demand and policy direction are shaping the future of the digital economy will be essential to identify where capital is most at risk and where it stands to benefit from what is likely to be one of the most important infrastructure transformations of the decade. In this paper, we explore these trends by examining the energy footprint of data centres as well as identifying the challenges and the possible investment opportunities that might lie ahead.

[1] Synergy (June 2025). The world's total data center capacity is shifting rapidly to hyperscale operators

1 / The energy footprint of data centres

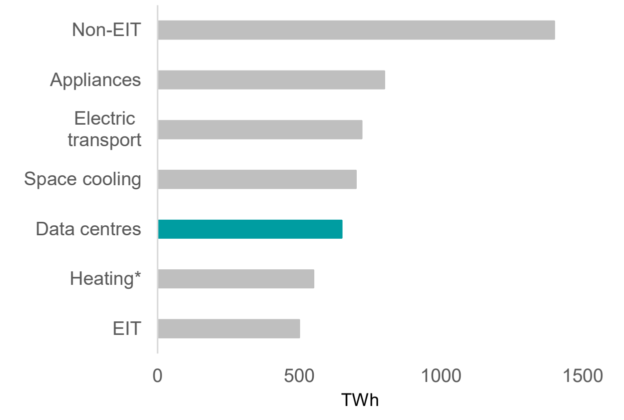
1.1 Wired for power

Over the last decade, global power demand has grown by 2.7% per annum, twice the pace of total energy demand[2] and rising towards 4% over the next few years.[3] This reflects a shift in the energy mix whereby electric vehicles are replacing combustion engines, electric heat pumps are displacing gas boilers and industrial processes which are moving towards electric arc furnaces and eventually green hydrogen production. While the industry, transport and building sectors will remain important sources of power demand, DCs have emerged as an additional source of power demand, Figure 1a.

DCs exist to power the world's digital ecosystem. Their purpose is to store data, hosts apps, run analytics, train AI models and maintain online services. They are designed never to go offline and consequently require reliable power sources and industrial-sized cooling systems. Geographically, DCs are located when three conditions align: affordable and reliable power, robust fibre connectivity, and suitable land or climate conditions. DCs are typically built in clusters and close to urban areas. These include Northern Virginia, the world's largest cluster, Silicon Valley, Dallas, Amsterdam, Dublin, Frankfurt, London, Shanghai, Singapore, Sydney and Tokyo. More recently, countries such as Finland, Norway and Sweden have become attractive due to natural cooling and renewable energy availability. At a global level, the U.S., China and the EU account for around three-quarters of total data center capacity.[4]

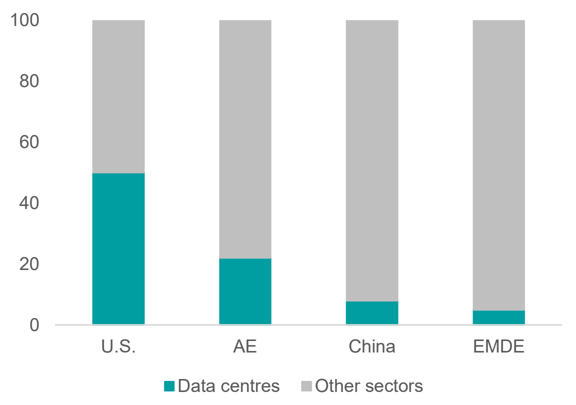
DCs currently account for 1.5% of overall global power demand[5] and with global electricity consumption for DCs projected to more than double by 2030[6], it would imply this share rising to as much as 4% by 2030.[7] However, this still relatively small share of power demand at a global level underestimates the call on power demand at a regional, state and city level. In the U.S., DCs are projected to account for 50% of the growth in U.S. power demand between now and the end of the decade, Figure 1b.[8] This means that DCs share of total U.S. power demand is set to more than double from 4.4% to 10% or more by 2030. In the case of Virginia, North Dakota, Oregon, Wyoming, Nebraska and Iowa, DC power demand is projected to be in excess of 15% of state power consumption by the end of the decade.[9]

Figure 1a: Global power demand growth by sector 2024-2030



* Space and water heating in buildings; EIT=energy-intensive industry
Source: IEA (November 2025). World energy outlook 2025

Figure 1b: Power demand growth by region 2024-2030



AE: advanced economies; EMDE: Emerging market and developing economies
Source: IEA (November 2025). World energy outlook 2025

[2] IEA (March 2025). Global energy review 2025
[3] IEA (February 2025). Growth in electricity demand is set to accelerate in the coming years as power-hungry sectors expand
[4] Voronoi (July 2025). The U.S. holds 44% of global data centre capacity with China and the EU at 22% and 10% respectively. In terms of the number of data centres, the U.S. holds 45.6% of the global total, with China at 3.8%.
[5] IEA (April 2025). Energy and AI
[6] IEA (April 2025). AI is set to drive surging electricity demand from data centres while offering the potential to transform how the energy sector works
[7] McKinsey (August 2025). Scaling bigger, faster, cheaper data centers with smarter designs
[8] IEA (November 2025). World energy outlook 2025
[9] Carbon Credits (June 2024). US Data Center Power Use Will Double by 2030 Because of AI. (Power shares for Virginia and North Dakota are estimated to be in excess of 20% by 2030)

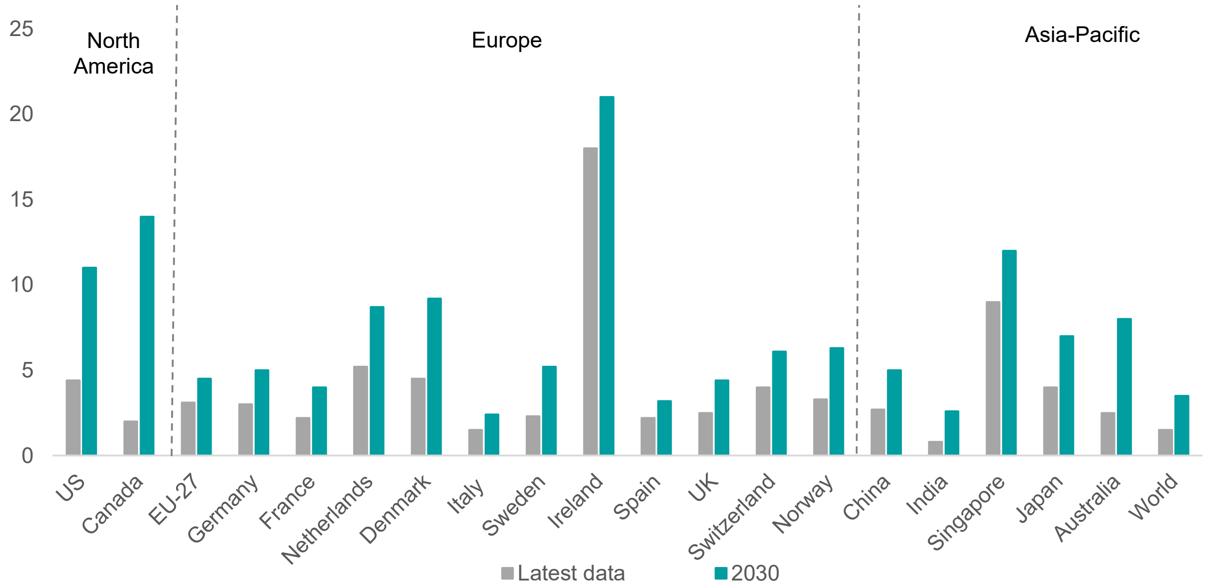
In Europe[10], DC power demand as a share of total power demand currently stands at an estimated 3.1% and this is forecast to rise to 4.5% by 2030.[11] Like the U.S. this headline figure disguises DC power demand hotspots such as Ireland where DC power demand currently accounts for 18% of national power demand. In terms of market concentration, 45% of data centers in Europe are in Germany, the UK and France.

In Asia-Pacific, DCs are clustered in a few centres and their electricity needs are rising rapidly. The largest clusters are in northeast Asia and specifically China (Beijing-Tianjin, Shanghai, Guangzhou/Shenzhen), and Japan around Tokyo and Osaka. In southeast Asia, Singapore is the most mature hub with DC power demand accounting for 9% of the city-state's total power consumption.[12]

Projections for 2030 reveal that DCs will become an even greater share of total power consumption particularly in the U.S., Canada, Netherlands, Denmark, Ireland, Singapore and Australia, Figure 2.

Understanding the energy footprint of DCs today and tomorrow reveals not just the magnitude of their impact, but also the challenges of the systems supporting them. In the next section, we turn to the obstacles, including technical, environmental and geopolitical that could define how fast this growth can continue.

Figure 2: Current and projected data centre power demand as a share of national power demand by country



Source: ICIS (May 2025). Data centres: Hungry for power

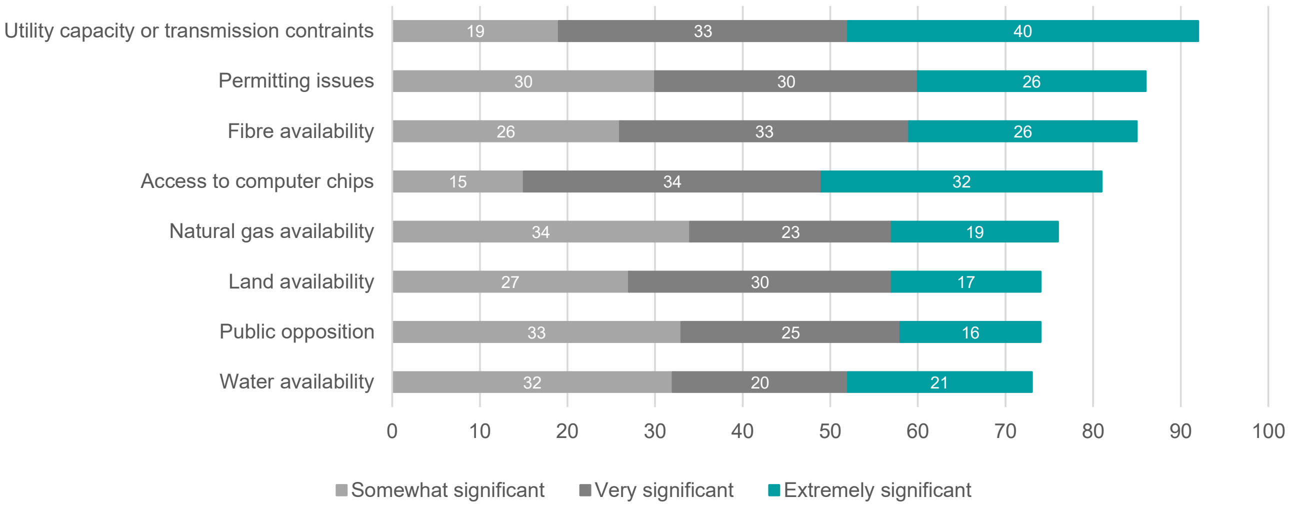
[10] Europe is defined as the EU27, UK, Switzerland and Norway
[11] ICIS (May 2025). Data centres: Hungry for power
[12] IEA (March 2025). Data centres energy use: critical review of models and results

2 / Challenges to data centre development

2.1 DC projects face a complex web of constraints

Even as digital-service demand accelerates, turning planned capacity into operational infrastructure has become increasingly complex. Across many markets, DC projects face a web of constraints from land and water availability, to permitting and access to computer chips. In a survey[13] of North American data centre executives conducted at the beginning of this year, 92% ranked lack of utility generation or transmission capacity as the biggest source of DC project delay followed by permitting issues and fibre availability, Figure 3. In this section, we examine these challenges and why the growth in DCs needs more coordinated planning between operators, grid authorities and policymakers.

Figure 3: Survey findings[1] of the major sources of delays in data centre projects



[1] Survey conducted in the first two months of 2025 polling 149 respondents from North American data centers
Source: Schneider Electric, AlphaStruxure and Data Center Frontier (April 2025)

2.2 Power demand and grid infrastructure

In certain regions, the power requirements of DCs are growing much faster than overall electricity demand, which are creating issues such as grid capacity bottlenecks and connection queues. For example, Loudoun County in Northern Virginia hosts the world's largest concentration of DCs and Dominion Energy has stated it faces unprecedented load growth and the need for massive grid and transmission upgrades.[14] In Dublin, Ireland, since 2021 new DCs seeking a connection have been required to provide on-site generation or storage to match their load, and the system operator has effectively imposed a moratorium on new connections in the region until around 2028. In the Amsterdam-Haarlemmermeer area, the Dutch government has restricted new hyperscale DCs to only a few designated municipalities, explicitly linking this to pressure on energy infrastructure and power capacity.

Addressing transmission and distribution constraints is not simply a question of additional capital expenditure on new transmission lines. Conventional reinforcements such as new high-voltage corridors, substations and uprated circuits face permitting, siting and construction timelines since AI-heavy DCs take anywhere between 18-36 months to be permitted and built, while new generation and transmission to support them takes anywhere from five to ten years. This mismatch is therefore increasing the risk of potential blackouts or winter power shortages. For example, NERC[15] in the U.S. as well as grid operators in Ireland and the Nordics are warning that DC growth, on top of the electrification of other key sectors, is pushing grid systems closer to the edge during peak load conditions.

[13] Schneider Electric, AlphaStruxure and Data Center Frontier (April 2025). Before AI, after AI energy crunch survey
[14] Dominion Energy (October 2024). Dominion Energy releases comprehensive long-term plan to meet growing power demand with reliable, affordable and increasingly clean electricity
[15] North American Electric Reliability Corporation

These challenges are amplified by the age and historical design of many power grid systems, particularly in the U.S. and Europe where 50% of energy grids are more than 20 years old.[16] Operators face simultaneous pressures to replace ageing equipment, integrate large volumes of variable renewable generation, and support accelerating electrification. A further constraint for DC development is the need for renewable and conventional power generation to accommodate around-the-clock demand. Addressing this constraint typically requires a multi-pronged approach such as the introduction of small modular reactors (SMRs) and long-duration storage or long-term power purchase power agreements that underwrite investment in additional generation.

However, the IEA estimates that around 20% of planned DC projects globally could be at risk of delays. This is relevant risk factor in the U.S. since 50% of DCs under development in the country are in pre-existing large clusters.[17] This is likely to divert DC development in regions offering more abundant power availability, which appears to be already happening with Texas and Georgia emerging as faster DC growth markets compared to Virginia, the largest DC market in the U.S.[18] Even so, research[19] suggests that by 2028 the U.S.'s peak electricity supply may fall short of anticipated peak demand and so posing a serious risk of widespread energy shortfalls.

2.3 Energy consumption and carbon footprint

DCs and specifically AI introduce a new layer of complexity to decarbonize the global economy. Over the medium-term, AI has the potential to support the climate agenda in areas such as grid optimization, energy efficiency and fostering innovation. However, the use of large machine learning models currently requires immense computational power. These rely largely on electricity girds still dominated by fossil fuels. This is likely to continue particularly in areas where wind and solar conditions are the most reliable. This fossil fuel dependency is giving new life to coal fired power plants, particularly in the U.S., where coal plant retirements are being postponed to help support the growth in power demand driven by DCs.[20]

This puts hyperscalers such as Microsoft in a challenging position since the growth in DCs is driving up their emissions while their 2030 climate pledges require steep cuts.[21] Microsoft's own reporting shows total CO_2 emissions are 23.4% higher than in 2020,[22] even as it buys record volumes of renewable power. In terms of the Magnificent 7,[23] their aggregated total CO_2 emissions in 2024 were somewhere between 100-150MtCO_2. This would imply their emissions account for somewhere between 1-2% of total U.S. emissions depending on how scope 3 emissions are allocated geographically. Whether or not the aggregated emissions of the Magnificent 7 rise or fall over the coming years will likely be a function of whether their electricity and supply chain operations decarbonise faster than their DCs power demand grows.

2.4 Water usage and cooling challenges

DCs generate large amounts of heat and are therefore voracious consumers of water for cooling purposes. The IEA estimates[24] that global water consumption for data centres is currently around 560 billion litres per year, and this could rise to around 1200 billion litres per year by 2030. Another analysis focusing on U.S. water demand estimated that direct water use by DCs located in the U.S. in 2023 was 17 billion gallons (equivalent to 64 billion litres) and this could potentially double or even quadruple by 2028 as AI workloads grow.[25] This rising demand for water threatens to exacerbate water stress in certain locations. For example, independent mapping of U.S. DC locations[26] suggests that 52% of Microsoft's facilities sit in regions classified as having high or extreme water scarcity. This is leading to restrictions on new builds, for example in Malaysia[27], and the potential relocation of DCs to water-rich regions such as the U.S. Great Lakes.[28]

[16] IEA (October 2023). Electricity grids and secure energy transitions
[17] IEA (April 2025). Energy & AI
[18] ZeroHedge (October 2025). 5 states leading US data center boom
[19] Schneider Electric (November 2025). America's power grid is at an inflection point. Can it keep up with the AI revolution?
[20] Count on coal (August 2025). Planned coal plant retirements crash into energy reality
[21] In June 2020, Microsoft announced in would be carbon negative by 2030
[22] Microsoft (May 2025). 2025 Environmental Sustainability Report
[23] Magnificent 7 refers to the group of seven major technology stocks of Alphabet, Amazon, Apple, Broadcom, Meta platforms, Microsoft and NVIDIA
[24] IEA (April 2025). Energy & AI
[25] Pew Research Center (October 2025). What we know about energy use at U.S. data centers amid the AI boom
[26] Business Insider (June 2025). How data centres are deepening the water crisis
[27] New Straits Times (November 2025). Johor tightens approvals for data centres
[28] Planet Detroit (November 2025). Data centers in Michigan: what you need to know

2.5 Supply chain and geopolitical risk

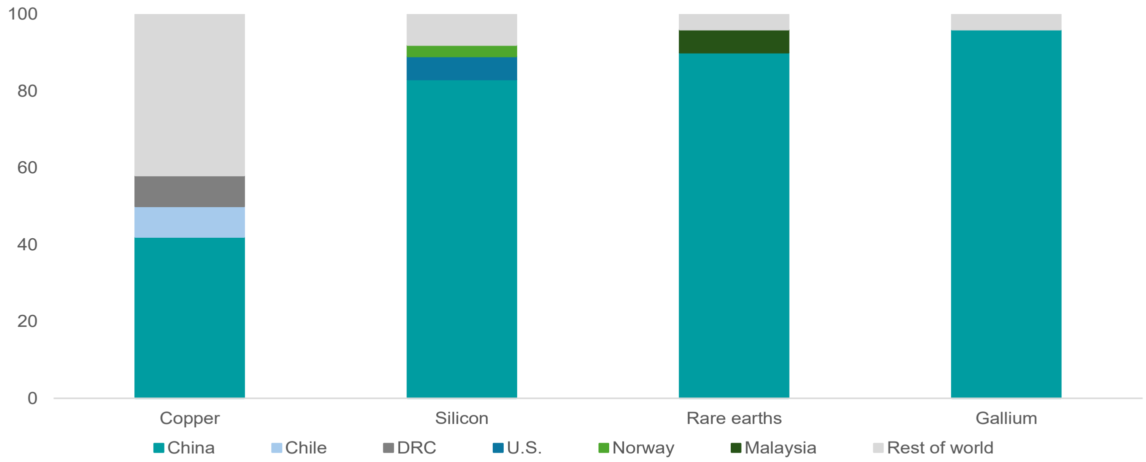
Beneath the surface of the DC build-out lies a deeper, more structural investment story, one rooted not in semiconductors or software, but in the commodity markets that underpin physical infrastructure. As DC power appetite accelerates and grid upgrades take hold, the next phase of the DC cycle will be defined by access to key commodities such as copper, steel, aluminium and rare earths. For investors, this creates a new landscape of bottlenecks and opportunities.

From DC construction to grid upgrades, DCs are adding a new and persistent source of structural copper demand at a time when copper supply growth is already weak. This reflects declining ore grades in Chile and Peru and new mine developments facing permitting timelines of seven to ten years.

Across the transmission, distribution and power generation sectors, steel and aluminium are also important enablers for DC infrastructure. From the expansion of high-voltage transmission networks alongside high voltage towers, substations and cooling infrastructure, these are steel-heavy, while aluminium will be used for overhead conductors and transmission conductors.

While aluminum, copper and steel are part of the physical infrastructure to support the building and running of DCs, critical minerals such as rare earths, gallium and silicon are enabling materials required inside key components. For example, silicon is the base material for CPUs, GPUs and AI accelerators. Rare earths enable permanent magnets to be used in high-efficiency cooling fans as well as in precision sensors. While gallium has importance in power electronics and high-speed communications and consequently supporting more efficient DCs. The challenge is that the production and processing of these critical minerals are highly concentrated. For rare earths, China accounts for approximately 70% of global mine output and about 90% of processing capacity.[29] China also produces over 95% of the world's gallium and has also imposed export controls illustrating the potential supply risks, Figure 4.[30]

Figure 4: Share of commodity refined production relevant for data center expansion by country in 2024 (%)



Source: IEA (April 2025) Energy and AII

[29] Mining technology (January 2025). China currently controls over 69% of global rare earth production
[30] CISI (July 2025). Beyond Rare Earths: China's Growing Threat to Gallium Supply Chains

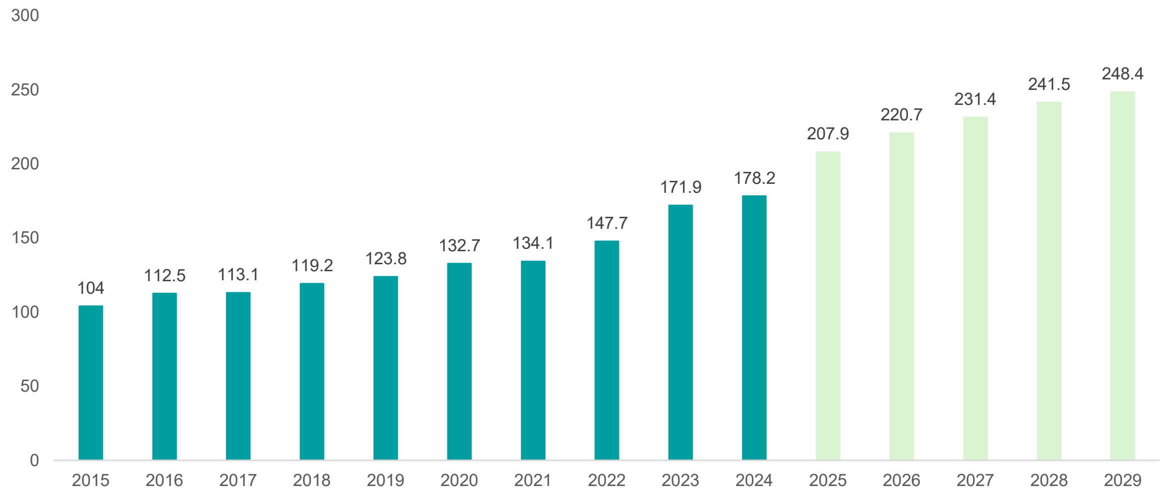
3 / Opportunities for investors

3.1 Regulated utilities

Energy grids have become enabling infrastructure to accommodate electrification and the rising power demand requirements of DCs. This unprecedented power demand is forecast to lead to a surge in the investment needs of utilities particularly those in the U.S. According to industry estimates,[31] utilities will spend as much on capex in the next five years as they did in the entire previous ten-year period, Figure 5. This offers investors a range of options to ride this capex wave, including exposure to regulated utilities and grid owners to those with low-carbon generation with long-term tech offtakes.

Investors also need to position investments where there is a supportive regulatory and permitting environment. To solve for short-term gird congestion and bottlenecks, system operators and policymakers are turning to a portfolio of measures to make the existing grid go further. This might include grid-enhancing technologies, flexible and phased connection agreements, on-site generation and storage, and stronger locational guidance to steer new projects towards areas with available capacity. Over the longer-term, integrated planning of DC clusters and network expansion, alongside reforms to interconnection queues and regulatory frameworks will be critical to align digital infrastructure growth with the inherently slower pace of transmission investment.

Figure 5: U.S. investor-owned electric utilities capital expenditures 2015-2029



Source: EEI financial analysis department, EEI member company reports (September 2025)

3.2 Data centre REITs

Data centre REITs have become a mainstream way for public market investors to gain exposure to digital infrastructure. The sector offers some appealing characteristics such as multi-year demand from hyperscalers, long leases and resilient occupancy. A distinctive part of this market lies in sustainability, which is core part of a hyperscaler's business model. This has led to incentive schemes for energy efficient or green DCs. These schemes provide support contingent on meeting performance criteria such as high renewable shares or compliance with green building standards.

Examples of incentives schemes include tax allowances and accelerated depreciation for energy-saving equipment. Another option is targeted grants and certification schemes for "green" DCs as has happened in Singapore.[32] This has meant that energy-efficient, renewables-backed DCs are becoming the 'premium' end of the REIT universe. This opportunity is not without risks given the sector's sensitivity to interest rates, its reliance on a concentrated set of technology tenants and power-supply bottlenecks. A possibly more prudent approach might be exposure to multi-tenant colocations (MRDC) operators, especially those with diverse customer bases and strong interconnection ecosystems. This could provide a more but tactical way to play the DC theme as the demand profile of MRDCs should be less tied to hyperscaler capex cycles.

[31] EEI financial analysis department, EEI member company reports (September 2025)
[32] IMDA (2025). The Green Data Centre (DC) Roadmap

3.3 DC enablers

DC enablers are the technologies, infrastructure and services that make DCs operate. While DC REITs provide physical real estate exposure, the enablers supply the power, cooling and resilience required to run DCs. On the power side, developers are increasingly turning to micro-grids, on-site generation and storage to bypass grid bottlenecks and secure a reliable power supply. At the same time, liquid cooling and power-distribution equipment manufacturers stand to benefit from the shift from air to liquid cooling for high density AI clusters.

Further out, investors could also target emerging clean power solutions that are increasingly being pitched to large DC campuses. These include small modular reactors, advanced geothermal and next generation gas turbines. While these are at early-stage development, these could, with a favourable regulatory and permitting environment, become important suppliers of low carbon power to hyperscalers.

3.4 Technology and hardware

The growth in DCs also delivers investment opportunities in the components, systems and architectures that make AI computation fast, efficient and scalable. Hardware and technology can therefore me viewed as the enabling machinery of the AI era which sit upstream of cloud platforms and downstream of utilities and real estate. This investment theme is creating a structural tailwind for companies supplying the specialised hardware that enables high-performance AI computation. At the heart of this are advanced compute systems such as GPUs. Meanwhile the energy demands of DCs is accelerating the adoption of high-efficiency power electronics. In addition, there is also a growing role for robotics and automation that keep hyperscale environments stable, optimised and cost-efficient.

3.5 Critical minerals and metals

DC expansion relies heavily on minerals and metals embedded in the infrastructure to build and power DCs as well as the enabling materials required inside key components. These create a structural tailwind for miners and processors of these key inputs. For example, investors risk possibly underestimating how much DCs and grid upgrades could contribute to a multi-year copper supply deficit and the potential bullish price and volatility implications. The main beneficiaries of this could be those miners with existing high-quality brownfield expansion options. Investors should therefore look to those markets with existing or potential supply constraints and where long development lead-times exist.

4 / Conclusion

Key findings

1. Data centres (DCs) have become a new growth engine for power demand: DC power demand accounts for 1.5% of overall global power demand and this share is set to rise to between 3-4% by 2030.[33] However, the U.S. is already a DC power demand hotspots accounting for more than 15% of state power demand in Virginia, North Dakota, Oregon, Wyoming, Nebraska and Iowa.[34]
2. DCs are threatening climate goals: Even with rising demand for renewables, hyperscalers are seeing their emissions rise while their 2030 climate pledges require steep cuts.[35] To safeguard power supply, utilities across the U.S. are postponing coal plant retirements.[36]
3. DC projects face a complex web of constraints: Lack of utility generation or transmission capacity, land and water availability, permitting issues are among the biggest sources of DC development constraint. For example, 52% of Microsoft's facilities sit in regions classified as having high or extreme water scarcity.[37]
4. Constraints threaten to delay DC development: In several mature hubs, including Dublin and Singapore, electricity transmission and distribution have already become binding constraints, shaping where and how quickly new DC capacity can be delivered. Policymakers are turning to a portfolio of measures to make the existing grid go further. This might include grid-enhancing technologies, flexible and phased connection agreements, and on-site generation and storage.
5. Access to key commodities has become essential for infrastructure development and component production: DCs are adding a new and persistent source of structural demand for commodities such as aluminum, copper, steel and rare earths.

Investor actions

1. Allocate to utilities where regulatory tailwinds are supporting DC development: Utilities are embarking on strong capex plans. To exploit this trend, investors should consider those utilities where capex plans are focused on transmission, alongside integrated clean energy strategies. Investors should seek out opportunities in those markets where there is a supportive regulatory and permitting environment.
2. Data centre REITs have grown in attractiveness: Investors can benefit from hyperscale-focused REITs with power availability and strong pricing power, particularly relevant in an environment where there may be power scarcity.
3. For more prudent investors, exposure to colocation data centres might appeal: Multi-tenant colocations (MRDC) operators, especially those with diverse customer bases and strong interconnection ecosystems, are a bullish but tactical way to play the data centre theme as their demand profile should be less tied to hyperscaler capex cycles.
4. Understanding regional and site-specific constraints for DC development: Power constraints, water scarcity and physical climate risk vary dramatically by region, creating a potential divergence in value, viability and long-term risk. This means the value of 'location quality' is increasing.
5. Investment opportunities for DC enablers: To address power and water availability issues, investors might be wise to explore exposure to microgrids, on-site solar and storage as well as liquid cooling manufacturers. Additional opportunities might arise in new power technologies, for example in small modular reactors, advanced geothermal and next-generation gas turbines.
6. Increasing attention to physical fundamentals of key commodities: Position for a multi-year copper supply deficit and the potential bullish price and volatility implications. The main beneficiaries of this could be those miners with high-quality brownfield expansion options. Investors should also consider diversified exposure to key enablers such as critical minerals.

[33] IEA (April 2025). Energy and AI; McKinsey (August 2025). Scaling bigger, faster, cheaper data centers with smarter designs
[34] Carbon Credits (June 2024). US Data Center Power Use Will Double by 2030 Because of AI.
[35] Microsoft (May 2025). 2025 Environmental Sustainability Report
[36] Count on coal (August 2025). Planned coal plant retirements crash into energy reality
[37] Business Insider (June 2025). How data centres are deepening the water crisis

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