# AI-driven data centre boom sparks urgent push for smarter energy solutions



Data centre operators are grappling with a confluence of challenges as surging demand for artificial intelligence (AI) and the internet of things (IoT) fuels unprecedented growth in energy consumption. According to Massimo Muzzì from ABB Electrification, managing this growth efficiently and sustainably is critical to avoiding wasted resources, overcapacity and spiralling costs. Operators face not only the operational complexities of securing reliable power and maintaining infrastructure but also the environmental scrutiny stemming from data centres’ substantial energy and water use, alongside their heat emissions. The pressure to reduce environmental impact while ensuring cost-effective 24/7 operation has propelled smart electrification solutions into the spotlight.

The International Energy Agency projects that global electricity consumption by data centres will more than double by 2030, with AI the primary driver. AI workloads demand far greater computing power than traditional cloud operations, intensifying pressure on power grids and data centre infrastructure. To meet this challenge, the latest innovations in substation technology, power protection and monitoring are being deployed to enhance efficiency and sustainability. For example, uninterruptible power supplies integrated with battery storage can stabilise power networks by tapping into reserve energy, while localised microgrids incorporating solar panels and batteries offer opportunities for self-generation and energy optimisation.

Digital transformation within data centres is equally integral to addressing these challenges. Advanced energy monitoring and asset intelligence tools provide granular visibility of component performance and overall network efficiency, enabling predictive maintenance and reducing downtime risks. The adoption of smart devices further empowers operators with actionable insights to optimise energy use and cut operational costs. Modular, prefabricated infrastructure solutions also enable rapid yet controlled capacity scaling, reducing deployment times significantly.

The interplay between hardware and software is fundamental to sophisticated energy management in modern data centres. AI-powered software solutions can dynamically allocate workloads to energy-efficient servers, modulate cooling systems based on real-time conditions and leverage historical data to forecast demand patterns. Sensors embedded within the facility feed critical inputs to these intelligent systems, fostering operational adaptability that balances energy consumption with reliability.

Looking ahead, microgrids and decentralised energy systems are set to become even more pivotal. Their scalable nature, combined with integrated energy management and smart software, ensures minimised energy waste and maximised sustainability. Innovations like AI and 5G will further enhance microgrid intelligence, optimising energy flow and improving grid interaction. AI’s role will extend beyond workload management to underpin smart building automation, advanced monitoring and electrical power control systems, contributing to overall performance resilience and efficiency.

Despite these advancements, misconceptions persist within the industry. Some operators fear that data centre energy demand will surpass the capabilities of existing infrastructure or become prohibitively expensive and environmentally damaging. However, the current trajectory of electrification technologies and sophisticated power management tools suggests otherwise. These systems are not only keeping pace with demand but are designed for scalability, cost reduction and extended asset life.

On a broader scale, the rapid expansion of data centres presents complex challenges for national power grids. In the US, for example, data centre electricity demand is projected to reach between 6.7% and 12% of total power consumption by 2028. This surge is prompting record capital investments from energy companies into power plants and transmission infrastructure, with utility spending expected to peak above $220 billion by 2027. While such investments are necessary for grid stability and expansion, concerns loom around potential cost pass-through to consumers, with regional energy prices possibly rising 15% to 40%. Utilities are exploring special tariffs and infrastructure cost-sharing with data centre operators to mitigate these effects.

Emerging innovative solutions are redefining how data centres interact with power grids. Nvidia, in partnership with prominent figures in technology and finance, is backing Emerald AI—a startup developing software that dynamically aligns AI computational workloads with regional electricity grid demands. Demonstrations have shown this approach can reduce peak-time energy use by around 25%, transforming data centres into flexible assets that support grid stability rather than burdensome power consumers. By integrating such technology with AI hardware, operators can swiftly adjust workloads in response to grid conditions, aiding renewable energy integration and reducing strain on power systems. This model, akin to a “virtual power plant,” promises to accelerate AI infrastructure deployment while easing energy supply constraints.

Internationally, the landscape varies. In Malaysia, new tiered electricity tariffs have sharply increased power costs for data centres, threatening the country’s competitiveness as a digital infrastructure hub. Operators face annual cost hikes potentially reaching $20 million, with uncertainties around future fuel surcharges exacerbating investment hesitancy. Such shifts are prompting a search for alternative energy sources and could redirect investments toward neighbouring countries with more favourable conditions.

Government policies are also evolving to address the power demands of AI-driven data centres. In the US, the administration has introduced executive proposals to expedite grid connections, streamline permitting, provide federal land for data centres and reform regulations to support traditional and nuclear power facilities. These measures are designed to sustain rapid AI infrastructure growth and maintain national competitiveness in the global technology race.

The trajectory towards intensive AI-driven data centre growth brings undeniable challenges in energy demand, infrastructure capacity and environmental impact. Yet, through the convergence of smart electrification technologies—encompassing microgrids, AI-powered energy analytics and integrated hardware-software systems—there exists a promising path to meet these demands sustainably and cost-effectively. Innovations such as those spearheaded by startups, utility investments and supportive policy frameworks collectively position the industry to navigate this transformative era. The UK, alongside global counterparts, has the potential to lead in harnessing these advancements, fostering an environment for responsible AI innovation grounded in energy efficiency and resilience.

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## Bibliography

1. <https://datacentrereview.com/2025/07/qa-can-smart-electrification-keep-ai-hungry-data-centres-from-crashing-the-grid/> - Please view link - unable to able to access data
2. <https://www.reuters.com/business/energy/dash-data-centers-creates-revenue-risks-power-developers-2025-07-01/> - The rapid expansion of U.S. data centers, driven by increasing demand for AI and digital services, is significantly raising power consumption forecasts, though projections vary widely, creating financial risks for power developers. The U.S. Department of Energy estimates data center electricity demand could reach 6.7%-12% of national power use by 2028, up from 4.4% in 2023. Developers rely on accurate forecasts to secure long-term power purchase agreements (PPAs) for revenue stability. However, the swift pace of data center development is challenging traditional planning processes. Texas and Northern Virginia are hotspots due to low energy costs and infrastructure availability. ERCOT, Texas’ grid operator, forecasts peak demand to potentially reach 218 GW by 2031. In response, power developers are adopting advanced forecasting tools and financial instruments, including synthetic PPAs and tolling agreements, to manage price volatility and hedge risks. The situation is further complicated by delays in grid connections and evolving federal policies under President Trump, which affect tariffs and tax credit schemes. These dynamics underscore a critical period of uncertainty and adaptation for U.S. power and energy infrastructure.
3. <https://www.ft.com/content/051f2361-de09-4744-814f-0de4b9b6c0d0> - US energy companies are investing record amounts in power plants and transmission infrastructure to meet the surging electricity demand driven by data center growth. Utility capital expenditures are expected to reach $212.1 billion in 2025, a 22.3% increase from the previous year and 129% higher than a decade ago, with forecasts peaking at $228.1 billion in 2027. This surge is largely fueled by the energy-intensive needs of AI-supporting data centers. However, there are concerns that these costs might be transferred to consumers, potentially raising energy bills and prompting pushback from regulators and the public. Residential prices could rise 15-40% depending on the region. To mitigate this, some energy providers are creating special tariffs or requiring data center operators to fund related infrastructure directly. Additionally, infrastructure development faces challenges in forecasting demand and fairly allocating costs, particularly when upgrades are needed far from data center locations. Despite these complexities, some experts assert that increased power grid utilization could help maintain energy asset viability. Private developers are also playing a significant role, though they face unique funding challenges.
4. <https://www.axios.com/newsletters/axios-generate-7badc110-55bd-11f0-8ecd-cd0eb51333d9> - Nvidia, in partnership with key tech and finance figures including John Kerry and Fei-Fei Li, is backing a new startup called Emerald AI, which aims to revolutionize how data centers manage energy use. By integrating software that adjusts AI workloads based on regional electricity grid needs, Emerald AI helps reduce strain on power systems and supports renewable energy integration. A field test in Phoenix demonstrated a 25% reduction in energy use during peak times. This innovation allows data centers to become dynamic energy assets rather than liabilities, potentially speeding AI infrastructure deployment by easing power availability constraints. Emerald AI plans larger tests and commercial deployment by early 2026.
5. <https://www.reuters.com/sustainability/boards-policy-regulation/malaysia-data-centres-battle-higher-power-costs-unclear-pricing-2025-07-01/> - Data centre operators in Malaysia are facing significant cost reassessments due to unexpectedly high power tariff increases, potentially raising electricity charges by 10% to 14% for high-consumption users. This new pricing system, effective July 1, 2025, introduces tiered rates based on voltage levels, placing many major data centres in the highest-cost category. The changes threaten Malaysia’s competitiveness as a data centre hub, previously bolstered by low electricity prices and a stable grid that attracted investments from companies such as Microsoft and Google. Larger facilities could see annual cost increases of up to $20 million, excluding future fuel surcharges, which will now be updated monthly. Industry leaders warn the lack of clarity and the magnitude of the increase may cause investors to delay or reconsider Malaysian projects, potentially shifting focus to regional competitors like Vietnam and Thailand. Equinix and others are already exploring alternative energy sources to mitigate the impact. The Malaysian government, justifying the hikes as vital for social spending, may need to re-evaluate its strategy to maintain the country's appeal for digital infrastructure investment amid a forecasted tripling in regional data centre power demand by 2027.
6. <https://www.axios.com/2025/07/01/nvidia-startup-data-center-power> - Nvidia, alongside Radical Ventures, AMPLO, and other investors, is backing a new startup, Emerald AI, which aims to revolutionize data center energy use. Emerging from stealth with a $24.5 million seed round, Emerald AI has developed software that aligns AI computation loads with regional electricity grid demands. This innovation addresses increasing pressure on power grids due to surging AI applications, allowing hyperscale data centers to become assets to the energy infrastructure rather than burdens. In a field test conducted in Phoenix with Oracle, Nvidia, the Electric Power Research Institute, and Salt River Project, the software demonstrated its ability to dynamically shift workloads in real time. By integrating Nvidia chips with their control systems, data centers can quickly adjust operations to help stabilize the grid. Emerald AI's vision, described by leader Sivaram, is to create a "virtual power plant" model where large-scale AI computing supports and enhances existing energy systems. A larger Phoenix pilot and additional national demonstrations are planned over the next six months to further showcase this paradigm shift in energy and data center management.
7. <https://www.reuters.com/legal/government/trump-plans-executive-orders-power-ai-growth-race-with-china-2025-06-27/> - The Trump administration is preparing a series of executive actions to accelerate the expansion of artificial intelligence (AI) in the U.S., largely to compete with China in technological advancement. These measures aim to address the increasing energy demands of AI by facilitating faster grid connection for power projects, offering federal land for building AI data centers, and streamlining permitting processes, such as implementing a nationwide Clean Water Act permit. The administration plans to release an AI Action Plan, due by July 23, and has proposed making that date "AI Action Day" to boost public attention. The build-out of large-scale AI infrastructure, such as data centers, is driving unprecedented electricity demand, expected to grow fivefold by 2029 and thirtyfold by 2035, according to industry reports. Regulatory reforms are also intended to clear obstacles for traditional and nuclear energy sources to keep pace with AI’s power requirements. Trump has positioned AI leadership as a national priority, reflecting efforts including partnerships with companies like OpenAI, SoftBank, Oracle, and Amazon, which recently announced a $20 billion investment in Pennsylvania data centers.