

AI's Energy Appetite: can the world's grids keep up?

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The rapid ascent of artificial intelligence has been nothing short of revolutionary. AI systems are reshaping everything from healthcare to finance, promising to accelerate productivity and innovation at an unprecedented scale. Yet, this digital transformation is built on an increasingly



fragile physical foundation: the availability of reliable and affordable energy. As machine learning models expand in size and complexity, the energy required to train and operate them is beginning to rival that of small nations. The central question, therefore, is no longer whether AI will change the world, but whether the world's energy systems can withstand the strain of that change.

Energy and climate costs

According to the European Central Bank's (ECB) recent bulletin, global electricity consumption linked to AI-related data centres already stands at around 20 TWh per year, a figure expected to grow sharply by 2026. For context, that is approximately the power requirement of 20 million homes for a year. The current growth in energy needs is such that AI will account for a significant share of total data-centre demand across Europe and North America. The MIT Technology Review has noted that this intensifying energy footprint risks outpacing efficiency gains, meaning that even as chips become faster, total power draw continues to rise.

The proliferation of data centres is now altering the geography of energy demand itself. AI firms are flocking to regions with cheap or stable electricity, from the hydro-rich provinces of Scandinavia to the gas-driven grids of the US Midwest. These shifts can (and no doubt will) overload local systems and drive-up consumer prices, especially in markets already struggling with energy affordability. In the developing world, where grids are weaker and investment capacity is limited, the expansion of AI infrastructure risks deepening inequalities. The global race for AI leadership is, therefore, becoming inseparable from the race for energy security.

Geopolitics

This confluence of energy and power, both electrical and geopolitical, is already shaping the emerging hierarchy of nations. Countries that combine AI capacity with abundant, resilient energy supplies are poised to dominate the next phase of technological competition. Those that do not face a double vulnerability: dependence on imported energy and exposure to foreign technology platforms. For example, Europe's drive for digital sovereignty is constrained by its reliance on imported fossil fuels and its desire for critical materials for energy transition technologies. Meanwhile, the US, despite its dominance in AI research, faces internal strains as data-centre construction collides with outdated grid infrastructure and local resistance.

In contrast, China and Saudi Arabia are pursuing a deliberate synthesis of AI ambition and energy strategy. Beijing's large-scale investment in energy capacity, alongside its control of strategic minerals used in computing and batteries, places it in a better position to weather the global competition for both data and power. Saudi Arabia's Vision 2030 explicitly links digital transformation with energy diversification, as it attempts to turn petrodollars into a foundation for data-driven growth. The geopolitical picture is clear: energy-rich or energy-secured states will hold the upper hand in the next phase of AI development.

Yet, this is not a straightforward advantage. As governments demand for low-carbon energy soars, even these nations face constraints. The surge in AI data-centre construction threatens to divert electricity from industrial or domestic use, prompting social and political tensions. In Europe, the ECB warns that without timely investment in generation and transmission, AI diffusion could exacerbate existing supply bottlenecks and inflationary pressures. One such bottleneck often overlooked is that the world may be entering an era where energy scarcity, rather than computing capacity, becomes the limiting factor for digital progress.

In this context, the desperate race for energy could reshape alliances and rivalries. Nations with surplus renewable capacity (think Iceland, Norway and Canada) may find themselves courted by technology giants seeking clean power for training clusters if the push for renewable energy continues, despite the technology struggling to produce high enough capacity as stable supply. Meanwhile, regions lacking the necessary stable supply could experience new forms of digital dependency, forced to lease computing capacity or import AI services from energy-secure powers. This would mirror earlier patterns of dependency seen during the oil era but inverted. Instead of hydrocarbons fuelling industry, electricity will fuel intelligence. Control over that electricity, its sources, transmission lines and critical raw materials, will become a new axis of geopolitical leverage.

The cost

The social costs will also be unevenly distributed. Consumers in energy-constrained markets may shoulder higher prices as data-centre demand competes with households and industry for limited capacity. Taxpayers may underwrite grid upgrades and subsidies designed to attract foreign AI investment, while local communities bear the environmental footprint of construction and water use for cooling. Governments that rush to brand themselves as AI leaders without ensuring energy resilience, risk eroding both economic stability and national credibility.

Balancing AI progress with energy security therefore demands strategic foresight. Energy and technology policy must no longer exist in separate silos. Governments should treat AI adoption as an infrastructure challenge, one that requires rigorous forecasting and close co-ordination between digital and energy ministries. The ECB has emphasised that addressing energy constraints early is essential if AI diffusion is to be sustainable. That means aligning data-centre growth with new energy generation and investing in grid modernisation.

For advanced economies, this will involve difficult trade-offs between competitiveness and sustainability. For emerging markets, the question will be whether to prioritise digital development or energy sovereignty. In both cases, the path forward will hinge on the ability to synchronise technological ambition with physical reality.

Conclusion

The promise of AI is vast, but it cannot exist in a vacuum. Its algorithms run not on abstract ideas, but on electrons, water and minerals. Nations that forget this will discover that technological power without energy security is not sovereignty. The coming decade will reveal whether humanity can build a digital future that the planet's grids can sustain or whether the pursuit of intelligence will outstrip the capacity to power it. In this contest, as in every previous industrial revolution, the decisive question remains unchanged: who controls the energy and at what cost?

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