ESG INSIGHTS

ARTIFICIAL INTELLIGENCE: WITH GREAT POWER COMES GREAT RESPONSIBILITY

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KEY TAKEAWAYS

- Digitalisation, cloud computing and the rise of artificial intelligence (AI) are fuelling an expansion of data centres around the world, with the US as the largest market.[1]
- New AI-backed services from big tech companies, such as Microsoft, Meta and Alphabet (Google's parent company), require increasing amounts of computing power, resulting in expanded data centre infrastructure and a growing environmental footprint.
- Sound governance and strong decision-making processes are necessary for big tech companies to reconcile their AI growth with environmental, social and governance (ESG) impacts.

CONFRONTING THE SCALE OF THE CHALLENGE

Advancements in technology over the past decade have given rise to large language models (LLMs) and artificial intelligence. With the commercial launch of products like ChatGPT, AI is becoming more widely available to more people around the world. AI applications are already being tested by companies to manage data and perform analytical and diagnostic tasks.

While AI is recognised as a potential long-term growth trend across many industries, it's still too early to identify all of its use cases and profitable applications. What seems to be clear is that deploying today's AI technologies requires considerable amounts of data and computing power, which is increasing the environmental footprint of digital infrastructure.

As the AI regulatory environment continues to take shape, there are already signs that this power-intensive technology is straining global energy supply and natural resources.[2] Data centres—buildings that house computer systems and hardware—have already surpassed 10% of electricity consumption in five US states and over 20% of all electricity consumption in Ireland, according to the International Energy Agency (IEA).[3]

[1] Taylor, Petroc. "Data Centers Worldwide by Country 2024." *Statista*, 11-Oct-2024.
[2] Stokel-Walker, Chris. "The Generative AI Race Has a Dirty Secret." *Wired*, 10-Feb-2023.
[3] "What the Data Centre and AI Boom Could Mean for the Energy Sector – Analysis." IEA. Nov-29-2024.

From an environmental perspective, this explosion in AI-backed products has broadened the carbon footprint of many leading big technology companies, such as Microsoft. The US-based global software and cloud services giant, which has invested in OpenAI—the company behind ChatGPT—reported that its carbon emissions have increased by nearly 30% since 2020 due to the expansion of its AI data centres network.[4] Meanwhile, Stargate[5], a joint venture between OpenAI, SoftBank, and Oracle, is set to invest $500 billion in data centre infrastructure projects across several US states over the next four years. The project could consume more than 1GW of electricity annually, which is comparable to the electricity consumption of a small American city.[6]

Given the rising environmental footprint associated with AI infrastructure, digital technology companies will likely need to adapt their historical "take, make, use, waste" business model.[7] Investors may be concerned about the rapid expansion of AI infrastructure and its environmental impact. Understanding the hurdles big tech companies face in transitioning to more sustainable business models can provide deeper insight into their long-term growth potential. Analysing the resources and targets these companies set to address this challenge can reveal their capacity for sustainable development.

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DATA CENTRES: THE POWERHOUSES BEHIND AI

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With over 10,000 data centres around the world, nearly half are found in the US.[8] Leading the way is Virginia, which has almost 500 facilities, making it the largest data centre market in the world.[9] These tech hubs are typically strategically located in regions with abundant electricity, robust optic fibre connectivity, favourable climates, and ample water supplies to meet cooling needs. Affordable real estate and government-sponsored perks, such as tax incentives, are also important factors in making these ideal locations.[10]

The data centre market is divided between colocation providers, where companies rent space and facilities and big tech players like Amazon Web Services, Microsoft, Google and Meta. These companies have the resources to build and operate extremely large data centres, known as "hyperscalers," designed to deliver massive amounts of computing power and storage capabilities.

The average data centre spans around 10,000 m^2, equivalent to the size of 1.4 football fields, and hosts roughly 100,000 servers.[11] However, the surge in AI demand is driving the need for even larger data centres, packed with more servers, greater power density, as well as additional

[4] Microsoft. "2024 Environmental Sustainability Report." Microsoft. Accessed 29-Nov-2024.
[5] "Announcing the Stargate Project." OpenAI, 21-Jan-2025.
[6] Chungfat, Melissa. "Impact of Stargate Project on Renewable Energy: A Solar Industry Perspective." *SolarFeeds Magazine*, 25-Jan-2025.
[7] "Digital Economy Report 2024: Shaping an Environmentally Sustainable and Inclusive Digital Future." UN Trade and Development, 11-Jul-2024.
[8] Taylor, Petroc. "Data Centers Worldwide by Country 2024." *Statista*, 11-Oct-2024.
[9] "USA Data Centers." Data Center Map. Accessed 29-Nov-2024.
[10] "Tricks and Traps of Data Center State Tax Incentives" *Tax News*, Accessed 29-Nov-2024.

on-site energy and cooling systems. To keep pace, data centre operators—including big tech—are prioritising new builds, as retrofitting existing structures can be complex and expensive. Estimates suggest that by 2030 new builds will comprise 80% of the data centre market.[12] The global market for data centre projects is expected to reach $409 billion by 2030, with a projected compound annual growth rate of 5.1% from 2023 to 2030.[13]

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DECODING THE ENERGY RIDDLE

As AI adoption spreads, energy consumption will likely rise, putting increased pressure on grid planners. The IEA estimates that the rapid expansion of data centres could more than double their overall energy consumption from 460 terawatt-hours (TWh) in 2024—comparable to France's overall energy consumption in 2022—to over 1,000TWh by 2026.[14] Data centres, cryptocurrencies and AI collectively account for about 2% of the current electricity demand.[15] Depending on technological advances, the base case suggests data centres will then account for less than 10% of total electricity demand growth at the global level between 2023 and 2030.[16] However, this impact is unlikely to be uniform everywhere around the world. Some concentrated data centre markets, like the US, may eventually face challenges in matching electricity demand with supply.

Grid planners in the US are already working to expand generation and transmission capacities to accommodate increased energy needs. However, given regulatory requirements and planning timelines, near-term power generation will likely struggle to keep up with the spike in demand. While regulatory shifts under US President Trump's administration could alleviate some of this pressure, technical constraints will remain. Several big tech companies, including Microsoft, have already started investing in power stations and localised energy systems, known as microgrids. In September 2024, Microsoft struck a deal to reopen Pennsylvania's Three Mile Island nuclear power plant to supply energy to nearby data centres.[17] In any case, AI infrastructure will continue to depend upon local power grids, which will ultimately determine the type of energy that powers data centres.

Despite progress in renewable energy, the anticipated increase in renewable power generation is still unlikely to meet the growing electricity demand of AI data centres. Natural gas is likely to remain the primary power source for US data centres.[18] As a result, big tech companies are expected to continue investing in renewable energy credits and offsets to align their operations with climate commitments.

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[11] Dgtl Infra. "Cities and Regions with the Highest Concentration of Data Centers." Institutional Real Estate, Inc., 23-Feb-2023.
[12] Comgest analyst discussion during Gerson Lehrman Group expert call.
[13] "Datacenters Business Research Report 2024: Global Market to Reach $409.1 Billion by 2030 - Expansion of AI and IoT Spurs Need for Advanced Datacenter Infrastructure - ResearchAndMarkets.com." *Business Wire*, 11-Oct-2024.
[14] "Digital Economy Report 2024." UN Trade and Development, 19-Dec-2023.
[15] "Electricity 2024 – Analysis and Forecast to 2026." International Energy Agency, May 2024.
[16] "World Energy Outlook 2024." International Energy Agency, 16-Oct-2024.
[17] Smyth, Jamie, and Myles McCormick. "Microsoft in Deal for Three Mile Island Nuclear Power to Meet AI Demand." *Financial Times*, 20-Sept-2024.
[18] Dublin, Kenneth. "EIA Projects Renewables Share of U.S. Electricity Generation Mix Will Double by 2050 - U.S. Energy Information Administration (EIA)." U.S. Energy Information Administration, 8-Feb-2021. Natural gas is projected to account for approximately one-third of US electricity generation between 2020 and 2050.

Google, Meta, Microsoft and other companies have established the Symbiosis Coalition, pledging to contract up to 20 million tonnes of nature-based carbon removal credits by 2030.[19] As AI-related emissions rise, big tech companies are also actively entering into renewable power purchase agreements to reduce their carbon footprint.[20] From an environmental perspective, aligning with global climate ambitions requires that these mechanisms be used only alongside robust and ambitious carbon reduction and energy efficiency programmes. Additionally, all offsetting projects should undergo a rigorous verification and disclosure process.

Improving energy efficiency to mitigate data centres' environmental footprint can also lead to cost optimisation. Energy is a major expense for data centres, with electricity accounting for 45% to 60% of total operating costs.[21] The majority of this electricity—over 80%—is used by IT equipment and cooling systems. In January, Chinese AI company DeepSeek surprised the market by releasing its R1 model, which claimed to use fewer resources than US models like OpenAI's ChatGPT. Despite industry-wide efficiency gains—like DeepSeek's new model—AI infrastructure continues to grow in absolute terms supported by all market players including the big tech companies.

In this context, optimising AI loads and implementing energy efficiency measures, such as power-capping hardware, makes sense for tech companies from both an environmental and financial perspective. Adjusting the size of AI models and how they are trained could also further enhance energy efficiency. For instance, Alphabet has experimented with shifting non-urgent tasks, such as adding new words to Google Translate or processing YouTube videos, to reduce electricity consumption.[22]

FROM ENERGY TO WATER AND BIODIVERSITY

— Large data centres can consume between one to five million gallons of water a day—equivalent to the daily consumption of a mid-sized American town with a population between 10,000 and 50,000 people.

AI's hunger for power is matched only by its thirst for water. The introduction of high-power-density graphic processing unit (GPU) chips—essential for AI and high-performance computing workloads—has increased heat generation within data centres, further intensifying the need for effective cooling solutions. There are signs that this rising demand is already straining local watersheds near data centres.[23] According to J.P. Morgan and environmental consultancy ERM, large data centres can consume between one to five million gallons of water a day—equivalent to the daily consumption of a mid-sized American town with a population between 10,000 and 50,000 people.[24]

Traditional data centres typically use a combination of air and water cooling, but the higher power density of AI data centres requires more advanced solutions. Direct-to-chip liquid cooling provides better heat

[19] "Symbiosis Coalition | Meet the Coalition." Symbiosis Coalition | Nature-Based Carbon Removals. Accessed 17-Jan-2025.
[20] Tauschinski, Jana, Camilla Hodgson, and Kenza Bryan. "Big Tech's Bid to Rewrite the Rules on Net Zero." *Financial Times*, 14-Aug-2024.
[21] Shirer, Michael. "AI-Driven Growth in Datacenter Energy Consumption, Predicts Surge in Datacenter Facility Spending amid Rising Electricity Costs." IDC, 24-Sept-2024.
[22] Mehra, Varun, and Raiden Hasegawa. "Using Demand Response to Reduce Data Center Power Consumption." Google, 4-Oct-2023.
[23] There are estimations that 20% of the water used by US data centres is drawn from stressed watersheds. The US National Integrated Drought Information System tracks groundwater supply trends.
[24] "The Future of Water Resilience in the U.S." ERM Sustainability Institute, 28-Oct-2024.

dissipation than traditional cooling methods, enabling servers to operate at optimal performance levels and reduce energy consumption. However, this method does not always guarantee lower water consumption. Since it uses less electricity than blowing fans, water is often employed in cooling systems for heat release through evaporation. Balancing energy and water consumption will be a key challenge for big tech companies as they expand their data centre operations.

Enhancing IT systems efficiency and implementing heat reuse methods could significantly improve water consumption management. With rising energy prices, companies may be incentivised to explore solutions like heat recovery systems, which repurpose excess heat from data centres for local heating or industrial processes. Developing alternatives to water evaporation in cooling systems will be another critical step in addressing the water problem. Microsoft recently announced that their newest data centre designs include precise temperature cooling avoiding evaporation.[25] According to the company, "the result has been a nominal increase in our annual energy usage compared to our evaporative data centre designs across [our] global fleet…"[26] Further innovations, including targeted cooling, will still be necessary in the future to conserve both water and energy.

Beyond water use, building and construction materials pose potential environmental risks for data centre operators. A variety of carbon-intensive materials—including steel, concrete, timber, and aluminium—are used in data centre construction, with cement being particularly challenging to decarbonise.[27] Building data centres can contribute to pollution, land transformation, deforestation and other environmental risks that impact local ecosystems and biodiversity.

Companies are experimenting with new methods to reduce their reliance on natural resources when constructing new data centres. For example, Meta[28] and Amazon[29] have been testing alternative cement solutions, while Microsoft[30] is seeking to invest in circular solutions aimed at reusing critical and rare materials from used IT equipment. The challenge lies in meeting essential technical requirements while also reducing the emissions associated with data centre construction.

LEADERSHIP AND CULTURE MATTER

— **Aligning AI growth and sustainability goals through the development of effective governance and internal cross-functional expertise will be key.**

To keep growing, solidify their competitive edge and reduce environmental and financial costs, big tech companies should adopt a holistic approach to sustainable AI development. Aligning AI growth and sustainability goals through the development of effective governance and internal cross-functional expertise will be key. As of today, no big tech company has published a comprehensive action plan for addressing

[25] Walsh, Noelle. "Sustainable by Design: Transforming Datacenter Water Efficiency." The Microsoft Cloud Blog, 27-Dec-2024.
[26] Solomon, Steve. "Sustainable by Design: Next-Generation Datacenters Consume Zero Water for Cooling." The Microsoft Cloud Blog, 27-Dec-2024.
[27] Apel, Fabian, Johanna Hoyt, Francisco Marques, Sebastian Reiter, and Patrick Schulze. "Cementing your lead: The cement industry in the net-zero transition." McKinsey & Company, 6-Oct-2023.
[28] Meta. "Advancing Low Carbon Concrete in Our Data Centers." Meta, 19-Dec-2024.
[29] Walker, Chris. "How AWS Is Using More Lower-Carbon Materials to Build Data Centers." AWS, 17-Oct-2023.
[30] "Microsoft Makes Strategic Investment in Cyclic Materials to Accelerate Climate Tech Innovation." Cyclic Materials, 16-Jul-2024.

AI's growing environmental footprint. Most track the energy efficiency of their data centres using key performance indicators in line with existing standards and regulations.[31]

To quickly assess key environmental performances of data centers, focusing on just three metrics might be sufficient:

- **Power Usage Effectiveness (PUE)**, which measures total energy consumption against IT equipment energy use.
- **Water Usage Effectiveness (WUE)**, which compares total water usage to IT equipment energy use.
- **Energy Reuse Factor (ERF)**, which indicates the ratio of reused energy, including heat, to total energy consumed in the data centre.

Our research indicates that no company provides a comprehensive report on all three of these metrics collectively. Among the Magnificent Seven[32], ERF is not disclosed. In the case of the other measurements, the Magnificent Seven's average PUE and WUE are in line with industry standards, with PUE close to 1 and WUE less than 0.4.[33]

Figure 1. Magnificent Seven data centre key performance indicators

Magnificent 7" AI & Sustainability*	PUE	WUE in L/kWh	ERF
Performance	Range from 1.09 to 1.2	Range from 0.17 to 0.4	Not disclosed

Source: Amazon, Apple, Meta Platforms, Microsoft, NVIDIA and Tesla corporate sustainability reports.
**Average metrics for operational data centres based on publicly available information.*

Without additional measurements, such as ERF, it's challenging to determine if these companies are fully exploiting efficiency gains. Besides, KPIs alone do not fully capture a company's ability to sustainably manage growing AI data infrastructure. Qualitative factors, such as the coordination of sustainability and AI development strategies among internal leaders and experts, should also be considered.

While ESG objectives are often linked to management compensation, leaders at big tech companies are not always incentivised to achieve sustainability goals alongside AI growth.[34] Meanwhile, the Boards of Directors often lack sufficient sustainability expertise to promote the alignment of sustainability and AI objectives. Assessing the size, experience and collaboration between AI and sustainability teams can reveal the alignment of sustainability goals. Currently, no tech company provides this information or highlights the work of intra-expert teams as a driver of AI-boosted growth. Fostering a culture of cooperation and partnership between internal experts and teams can be seen as crucial for ensuring long-term success.

[31] The U.S. Department of Energy (DOE) promotes energy-efficient practices in data centres through various programs and initiatives. These include recommendations for optimizing cooling systems and managing heat effectively. Starting in 2025, new regulations will be implemented to enhance the efficiency and sustainability of data centres in the US, namely the Energy Act of 2020 as well as the American Innovation and Manufacturing (AIM) Act of 2020.
[32] Includes Alphabet, Amazon, Apple, Meta Platforms, Microsoft, NVIDIA and Tesla.
[33] Kent, Suzette. "Memorandum for Chief Information Officers of Executive Departments and Agencies." Executive Office of the President of the United States - Office of Management and Budget, 25-Jun-2019.
[34] Tonello, Matteo. "ESG Performance Metrics in Executive Compensation Strategies." *The Harvard Law School Forum on Corporate Governance*, 7-Jan-2025.

SUSTAINABLY NAVIGATING TOMORROW'S TECH CHALLENGES

As the world continues to evolve in response to the rapid rise of AI and digitalisation, the technology industry stands at a pivotal crossroads. There are still opportunities for data centre efficiency gains, especially when it comes to calibrating AI models, optimising IT equipment and monitoring energy use. The next step for the industry will be to align AI growth with sustainable practices. This will allow technology leaders to mitigate some of their environmental impacts and unlock competitive advantages and cost savings.

In our opinion, aligning AI innovation and sustainability can reinforce the resiliency of these companies in the face of uncertain future. We believe AI tech leaders can innovate sustainably and deliver stakeholder value by strengthening their corporate foundations in governance, culture, and a forward-thinking approach to challenges.

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Liudmila Strakodonskaya joined Comgest in 2024 and is an ESG Analyst covering the US.

Prior to joining Comgest, Liudmila worked as an ESG Analyst at AXA IM, where she developed thematic research, analysis and shareholder engagement on ESG topics with a specific focus on biodiversity and gender diversity. She represented AXA IM at the Finance for Biodiversity Foundation (FfBF) and co-chaired the FfBF's Impact Assessment Working Group with the goal of building and sharing knowledge on biodiversity metrics among investors. She was also actively involved in the creation of the Nature Action 100 initiative as a member of the launching investor group. Liudmila previously worked at Eleva Capital as an ESG/SRI Analyst in 2019 where she contributed to the development and implementation of the company's ESG strategy. She began her career at EthiFinance in 2016 as a Sustainable Investment Analyst specialising in ESG research and reporting.

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