Data Centres

Knight Frank

Taking Stock of Sustainability

November 2025

A data-driven view of how the data centre sector is adapting to energy constraints, decarbonisation goals, and the growth of AI workloads

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Powering the digital economy

Data centres have quickly become the backbone of the modern economy, powering the world's digital infrastructure, from AI models and streaming platforms to healthcare systems and financial networks. Every day, the world generates more than 400 million terabytes (TB) of data, a figure that continues to grow as AI adoption accelerates and global connectivity strengthens. To keep pace, global data centre operational capacity has more than doubled in the past five years, from just over 25GW in 2020 to over 57GW so far in 2025.

This growth has created what many are calling a perfect storm of demand pressures. The scaling of AI workloads, the push for cloud capacity, and the shift towards real-time digital services have collided with existing bottlenecks, most notably energy availability. In several regions, including the UK, grid infrastructure is struggling to keep up. The UK's National Grid, largely designed for a fossil-based, centralised energy era, is now being asked to support a distributed, electrified, high-growth digital economy. In practice, this means long interconnection queues, regional power shortages, and the need for the grid to be substantially upgraded, and in some areas, effectively rebuilt, to enable future digital growth.

Against this context, data centres have come under an intense spotlight, especially from a climate perspective. Long considered as energy-hungry and resource-intensive, data centres have become central in debates relating to decarbonisation, grid capacity, and water use. Often, press coverage frames the industry as a climate liability. The full picture is more complex and, in many ways, more positive than they suggest.

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What is frequently missing from public discourse is a grounded view of how far the industry has progressed and where the most meaningful challenges remain. This paper aims to dissect that progress by offering a data-driven look at the forces reshaping one of the world's most critical infrastructure classes. It looks at how operators, investors, and regulators are responding to rising demand, new compliance pressures, and the need to establish credible pathways to net zero, all while balancing the requirement to provide capacity for ongoing technological innovation.

That innovation is critical for broader decarbonisation goals. Data centres and the broader information, communication and technology (ICT) sector act as key enablers of emissions reductions across industries. In particular, artificial intelligence (AI) has the potential to reduce global emissions by more than 2.5% annually by 2035, based on estimated savings in the power, meat and dairy, and light road vehicle sectors, according to research from the Grantham Research Institute on Climate Change and the Environment and Systemiq. Data centres power the digital infrastructure behind smart grids, buildings, agriculture and logistics, as well as, e-health services, to name a few examples, driving efficiency and decarbonisation across industries.

Reality check

Increasing energy demand, AI-driven growth and rising sustainability pressures have made data centres a target for criticism. But assumptions often overlook how far the sector has come in efficiency, clean power adoption and transparency. This analysis attempts to separate the myths from the reality shaping a critical pillar of the global digital economy.

MYTH 1: THE SECTOR'S POWER MIX IS MOSTLY CARBON-INTENSIVE

REALITY: Data centres are still widely perceived as heavily reliant on fossil fuels, with low-carbon energy playing only a minor role. The sector has made significant progress. By 2024, low-carbon sources[1] supplied 66% of the sector's electricity, up from 50% in 2020[2]. Colocation and service providers are sourcing a greater share of their electricity from low-carbon sources, reaching 66% in 2024. This is only slightly higher than hyperscalers, who have followed a similar upward trend and reached 65% in the same year.

The shift toward renewables reflects both corporate responsibility pressures and the economic benefits of stable, low-cost power, especially in the Nordics, where abundant hydro and wind resources keep electricity prices in Finland and Norway, the EU's lowest, at just under 79.7 €/MWh, according to Eurostat.

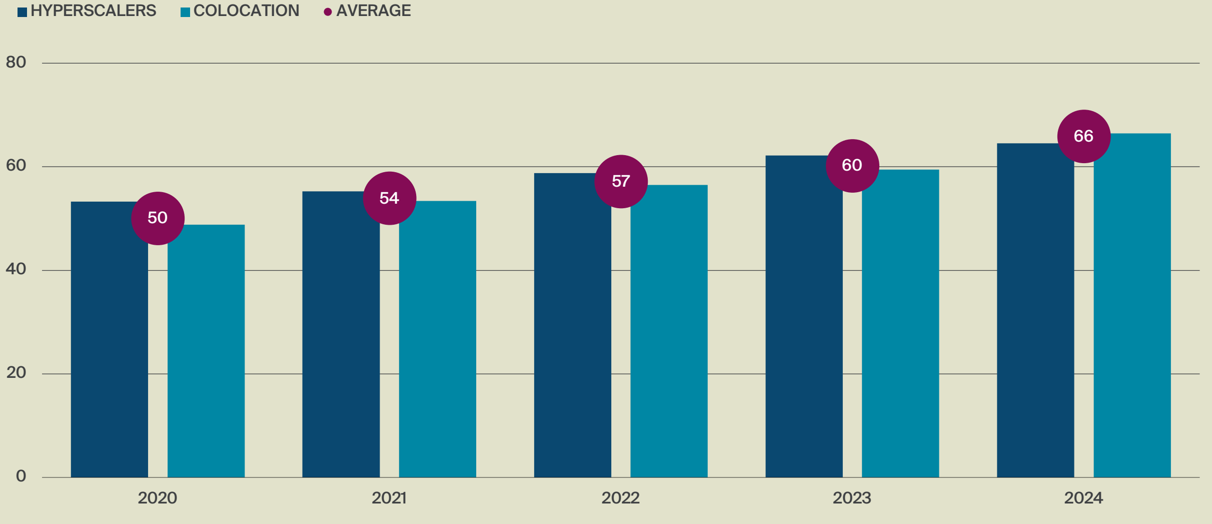
A sign of stronger commitment is that 21 hyperscalers and colocation providers have joined RE100, pledging to match 100% of their electricity demand with renewables. Yet, even the remaining fossil fuel share represents a substantial volume of carbon-intensive power, given the sector's rising energy demand. This equates to roughly 131 TWh per year still reliant on carbon-intensive sources. Closing this gap will be far more challenging than the early gains, requiring advances in equipment efficiency, as well as in procurement, energy storage, and grid decarbonisation.

IEA data on the top 50 data centre markets by operational capacity show many countries are decarbonising their grids. Norway, Sweden, and France already source over 90% of power from renewables, while the fastest growth since 2020 has come in Portugal (+27%), the Netherlands (+23%), Chile (+22%), Germany (+12%), and Poland (+12%). As grids continue to decarbonise, data centres that rely primarily on grid power will see their operational emissions decline, while those that proactively procure clean energy will also benefit from greater energy resilience.

MYTH 2: MORE CAPACITY = MORE CARBON

REALITY: A common misconception with the data centre sector is that expanding capacity inevitably drives higher carbon emissions. However, the data tells a more nuanced story.

Renewables on the rise
Share of electricity from low-carbon sources, %



Source: Knight Frank Research, Company Reports

Between 2020 and 2024, total live supply nearly doubled, increasing from 25.7GW to 50.3GW, a compound annual growth rate (CAGR) of 18%. Over the same period, combined Scope 1 and 2 emissions[3] rose from 83 to 103 $MtCO_2e$, a much lower 6% CAGR . In other words, capacity grew three times faster than emissions. Despite energy consumption rising 17% per year between 2020 and 2024, from 208 to 384 TWh, the sector's carbon intensity[4] fell by around 9% annually, from 398 to 270 gCO_2/kWh. If data centres had maintained 2020 carbon intensity levels, 2024 emissions would have reached 153 $MtCO_2e$. Instead, actual emissions were only 103 $MtCO_2e$, indicating that 49 $MtCO_2e$ were avoided, likely through efficiency improvements, such as advances in server performance, cooling systems, and workload optimisation, as well as a shift toward renewable electricity.

MYTH 3: ELECTRICITY DEMAND CROWDS OUT OTHER SECTORS

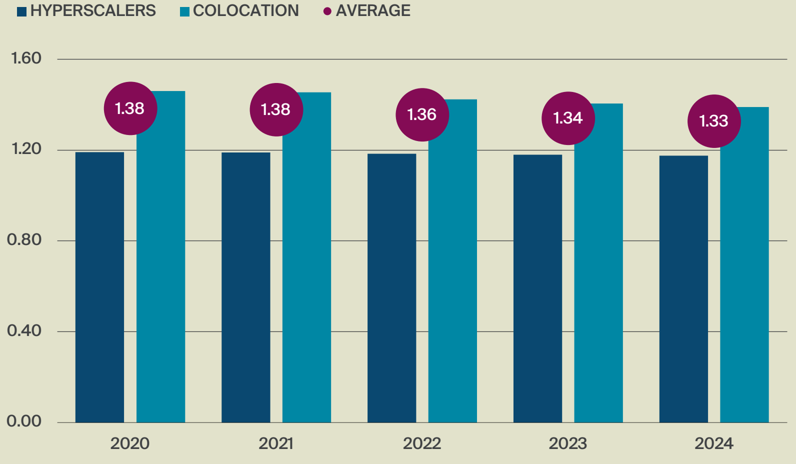
REALITY: Total energy consumption in the global data centre market has risen sharply since 2020, increasing from 208 TWh to 384 TWh in 2024, a four-year CAGR of around 17%. Growth has been driven primarily by colocation and service providers, whose electricity demand expanded to reach 197 TWh in 2024, overtaking hyperscalers, whose demand reached 187 TWh, in total consumption.

Even with the accelerated expansion, data centres still represent a relatively small share of global power use, with global electricity demand rising from 0.8% in 2020 to 1.2% in 2024. The IEA projects that total data centre energy use could reach around 945 TWh by 2030, implying an annual growth rate of about 16% through to the end of the decade.

As data centre demand grows, power availability has become a limiting factor to scaling. In many major markets, long grid-connection backlogs make securing sufficient capacity the key bottleneck for new development. Developers are now looking further ahead to secure suitable sites and are increasingly considering secondary markets. Operators are also beginning to colocate data centres close to renewable generation sources. This approach can accelerate project timelines by reducing dependence on congested transmission infrastructure. It can also lower long-term operating costs by enabling access to power at the source rather than purchasing electricity from the grid.

PUE gains

Annual average PUE for hyperscalers and colocation providers, kWh/IT



Source: Knight Frank Research, Company Reports

MYTH 4: PUE GAINS ARE OVER

REALITY: Annual average Power Usage Effectiveness (PUE)[5] improved from 1.39 in 2020 to 1.33 in 2024. Hyperscalers remain the benchmark, sustaining low PUE levels around 1.17, while colocation and service providers have narrowed the gap, improving from 1.46 to 1.39 over the same period. While incremental, these gains are significant given the rise in compute demand and overall energy use. For example, a 20GW data centre facility that once required 27.8GW of total power at a PUE of 1.39 would now need only 26.6GW at 1.33.

But there is also a growing debate about how much further PUE can drive efficiency improvements. Many data centres are now operating close to the practical limits of current air-based and mechanical cooling, and compute densities are rising to levels that these systems can no longer support. This is prompting the adoption of new thermal management technologies. Direct-to-chip liquid cooling and immersion systems are now being designed into next-generation facilities, although deployment remains in its early stages. These technologies have the potential to reset the efficiency curve, enabling operators to manage higher thermal loads and achieve improvements beyond what is possible with air-based systems alone.

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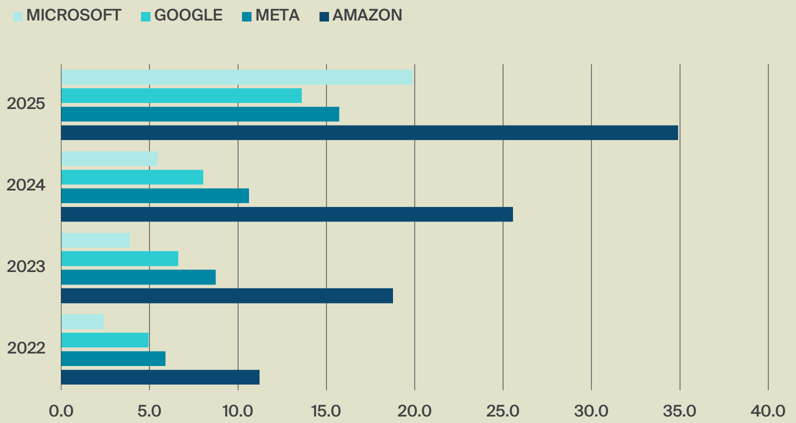
> "Since 2022, hyperscalers have significantly expanded their clean power procurement, with cumulative contracted capacity rising from around 24GW to more than 84GW by 2025"

Procurement leaderboard

Estimated cumulative contracted clean energy capacity for selected hyperscalers, GW



Source: Knight Frank Research, S&P Global

MYTH 5: PPAS DON'T ADD REAL CLEAN ENERGY GENERATION

REALITY: Since 2022, hyperscalers have significantly expanded their clean power procurement, with cumulative contracted capacity rising from around 24GW to more than 84GW by 2025. 2025 alone already reflects roughly 1.5x the capacity contracted in the previous year. Amazon accounts for the largest share, increasing from 11.2GW in 2022 to 34.9GW in 2025, while Microsoft has also rapidly scaled commitments, reaching almost 20GW by 2025, alongside Meta (15.7GW) and Google (13.6GW).

PPAs are typically signed for projects with delivery dates in the future and represent financial contracts that guarantee developers a long-term revenue stream. This certainty enables projects to secure financing, break ground, and get built. By underwriting new clean generation, PPAs give developers and investors a direct lever to expand capacity sustainably while locking in long-term price stability.

MYTH 6: COOLING PUTS UNSUSTAINABLE PRESSURE ON LOCAL RESOURCES

REALITY: There is no denying the challenges around water consumption. Cooling continues to place pressure on local resources, particularly in regions already facing water scarcity. Our analysis[6] found that globally, 41% of operational capacity, equivalent to 23.1GW, is located in areas experiencing high levels of water stress. The pipeline suggests this challenge is set to continue. Around 37% of capacity currently under construction or committed is also located in high water-stress regions, with the highest proportions in EMEA (45%) and APAC (44%).

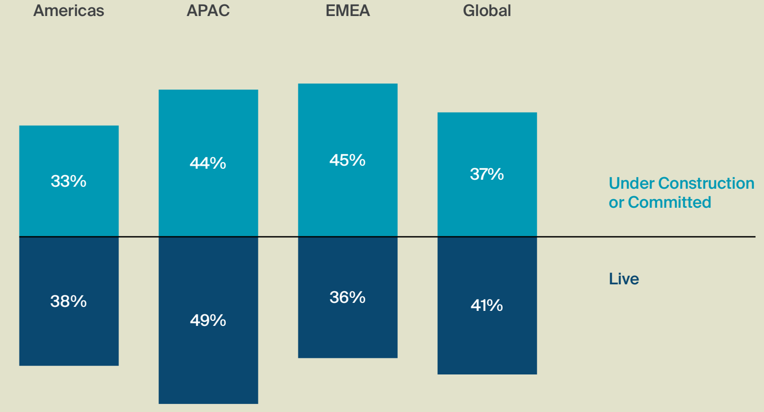
Our estimates suggest that the global data centre market consumed around 242 million cubic metres of water in 2024, growing at an average rate of 8% per year since 2020. Hyperscalers accounted for most of this demand, with water use rising 7% annually, while colocation and service providers grew even faster at 13% per year, nearly doubling their consumption. To put this in perspective, global water use totals roughly 4 trillion cubic metres per year, meaning data centres account for less than 0.01% of global water consumption. However, efficiency is improving. Annual Average Water Usage

Effectiveness (WUE)[7] has decreased by nearly 3% per year since 2020. Hyperscalers reduced their WUE from 0.96 to 0.93 L/kWh, while colocation providers improved from 0.93 to 0.81 L/kWh. That said, reporting remains inconsistent, only 21 of the 35 companies analysed disclosed WUE data, including just four of the major hyperscalers.

These gains reflect the widespread adoption of advanced, water-efficient cooling technologies, particularly closed-loop and air-cooled systems, which significantly reduce reliance on fresh water. Many facilities are also increasing the use of recycled and non-potable water. Innovation in water-efficient and waterless cooling is becoming a key differentiator for growth, investment, and community acceptance. Equally important is the strategic siting of new data centres in regions with lower water stress, ensuring that expansion does not intensify competition for local resources.

Water dependency

Proportion of data centres located in areas experiencing high or extreme water stress



Source: Knight Frank Research, World Resources Institute

MYTH 7: THE INDUSTRY CREATES FEW LOCAL JOBS

REALITY: While the number of onsite employees created by a data centre is relatively limited, the broader employment and economic contributions of the sector are substantial. On average, each megawatt of operational capacity supports approximately 1.7 direct jobs, equating to more than 84,000 operational employees in 2024, with forecasts indicating an increase to over 111,000 by 2026. When construction activity is included, the total employment impact expands to over 702,000 jobs, projected to reach around 930,000 by the end of 2026, according to our estimates.

Research by PwC and McKinsey & Co highlights that there are broader impacts with the sector supporting jobs indirectly (i.e. employment supported through supply chains) at a rate 3.5 to 6 times higher than direct employment. This multiplier translates to an estimated 3.3 million jobs supported across the wider economy, even under conservative assumptions. Beyond this, the sector's presence is likely to stimulate longer-term regional development by attracting investment in energy infrastructure and fibre networks.

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From regulation to reputation

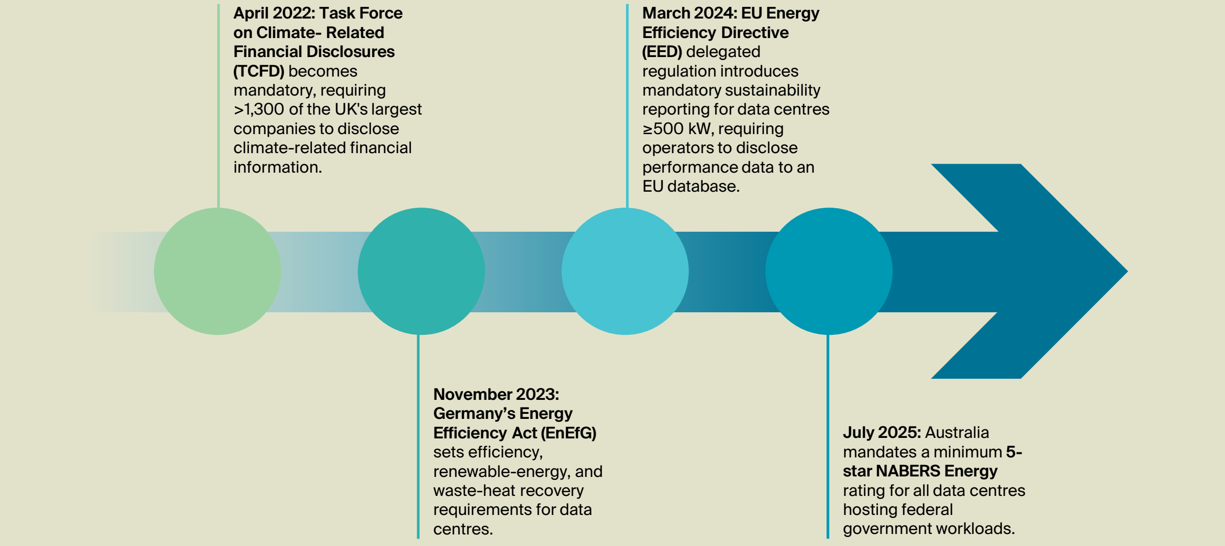
From climate disclosure mandates to new energy and water regulations, the operating environment for data centres is fast-moving, becoming more complex, and regionally fragmented. For investors, this landscape presents both risk and opportunity. Broadly, the sustainability agenda falls into two categories. What is required are the non-negotiables operators must meet to build, connect and operate, increasingly written into law or permitting. What is strategic are the voluntary frameworks that go beyond regulation but are fast becoming markers of competitive advantage and investor confidence, with some investors even demanding them.

WHAT IS REQUIRED

The introduction of the International Sustainability Standards Board (ISSB) framework, building on the former Task Force on Climate-related Financial Disclosures (TCFD), marks a step towards mandatory climate reporting. From 2024, jurisdictions such as the UK, Canada, Japan and Singapore are requiring companies, including data centre operators, to disclose climate-related financial risks and opportunities in line with ISSB standards. For operators, this means reporting on Scope 1-3 emissions, renewable energy use, climate resilience, and transition strategies. The EU has the Corporate Sustainability Reporting Directive (CSRD) which is broadly aligned to TCFD, with those companies falling under scope likely to be those with >1,000 employees and >€450m turnover. While no national level requirement in the US, data centre operators in California will soon be required to share estimated water use as part of the permitting process. In addition to reporting and disclosures, operators also face tightening regional standards, including:

- Under the revised EU Energy Efficiency Directive (EED), data centres with an IT load above 500 kW must report performance data, including PUE, water use and renewable energy share to a public database. National implementations, such as Germany's Energy Efficiency Act (EnEfG), go further, setting waste heat reuse requirements for new facilities. Targets are phased, with new data centres required to achieve an Energy Reuse Factor (ERF) of 10% in 2026, rising to 15% in 2027 and 20% in 2028.
- New developments in the UK are now subject to the Biodiversity Net Gain (BNG) requirement under the Environment Act 2021. From 2024, most major data centre

Growing number of regulations and standards, with more in the pipeline



Source: Knight Frank Research

- projects must demonstrate a minimum 10% net increase in biodiversity value compared to the pre-development baseline.
- From July this year, companies providing data centre services to the Australian federal government will be required to have a five-star NABERS rating for their facilities or achieve a PUE of 1.4 or lower.

At the same time, planning and grid-connection policies are tightening in power-constrained markets. In countries such as Ireland and the Netherlands, new planning approvals are increasingly tied to grid capacity and renewable integration, effectively limiting new developments unless they can demonstrate energy efficiency or heat recovery benefits.

WHAT IS STRATEGIC

What is strategic is alignment with industry-led commitments such as the Climate Neutral Data Centre Pact (CNDCP), which sets voluntary targets for 2030 on renewable energy, efficiency and heat reuse. While not legally binding, it is increasingly viewed as a baseline indicator of sector reputation and leadership. This also includes frameworks such as RE100 and established green building standards. The RE100 initiative brings together companies committed to 100% renewable electricity. Members such as EdgeConneX, KDDI Telehouse, and Iron Mountain now account for almost 6 TWh of annual demand globally.

Among built-environment standards, BREEAM has become a benchmark for development across the UK and is increasingly viewed as a baseline requirement for colocation facilities. Current data shows that 42 data centres have achieved a formal BREEAM rating, roughly 14% of operational and pipeline projects. Of these, five were rated Outstanding, 21 as Excellent, 14 as Very Good and two as Good, with almost 80% of these being colocation sites. Certification under BREEAM typically signals strong performance in areas such as energy efficiency, water management and environmental resilience. Elsewhere, LEED certification remains more prevalent, particularly in North America and Asia, with almost 150 data centres certified in each region, and an additional 50 across Europe.

MARKET VIEW

A forward look

WORDS: CHRISTOPHER JONES – HEAD OF POWER PROCUREMENT & MEP CONSULTANCY

The continued growth in the 'Cloud', along with the advent of AI, is currently driving significant growth in the sector. This growth also coincides with a push towards net zero targets in many countries, which requires significant investment in transmission and distribution networks to replace aging infrastructure and also connect new generation assets, and has resulted in significant grid connection queues, delaying data centre projects.

Electrical transmission networks comprised primarily of renewable generation also places constraints on capacity not seen previously. To avoid the use of inefficient short-term fossil fuel generation during periods of high demand and low renewable output, the transmission sector is investigating the introduction of additional policy levers, such as Demand Side Response, in order to meet net zero obligations.

These changes are now driving significant change within the data centre sector. The scale of data centre campuses, along with increasing power densities within data halls, has pushed beyond the design topologies commonly used over the past 10-15 years. New, innovative cooling approaches such as on-chip and immersion cooling support these higher densities and should improve annualised PUE due to the increased availability of free cooling throughout the year in many regions.

The lack of electrical capacity in existing tier 1 markets, and the size of new campuses, is now driving developments outside of existing development zones. This shift is providing access to renewable energy sources that were historically inaccessible. Integrating renewable generation into a data centre campus directly, via a behind-the-meter microgrid potentially have significant benefits. A direct renewable connection negates the need to use the transmission network, as is common with PPAs, which can significantly reduce the cost of power consumed. A microgrid combining generation and storage also allows developers to take advantage of fluctuating energy pricing and participate in demand side response, without relying on fossil fuel standby generation, potentially saving hundreds of millions of dollars, pounds, or euros per year in energy costs on large developments.

I believe that all of the above presents a generational change and opportunity for data centres. Let's hope the sector can fully embrace these innovations and continue to decarbonise whilst building much needed capacity.

[1] Low-carbon sources include renewable energy (such as wind, solar, hydro) and other non-fossil options with reduced carbon emissions (such as nuclear).
[2] This analysis covers 35 of the largest and fastest-growing data centre hyperscalers and colocation providers globally. In some cases, data has been extrapolated to represent the total data centre market.
[3] Scope 1 emissions refer to direct greenhouse gas (GHG) emissions from sources that are owned or controlled by an organisation. Scope 2 emissions are indirect GHG emissions associated with the generation of purchased electricity, steam, heat, or cooling consumed by the organisation.
[4] Carbon intensity was calculated as the sum of Scope 1 and Scope 2 emissions per unit of energy consumed by each operator.
[5] Power Usage Effectiveness (PUE) is the industry standard metric for measuring data centre energy efficiency. It is calculated by dividing the total facility energy consumption by the energy used by IT equipment. A PUE of 1.0 represents perfect efficiency, where all consumed power is used directly for computing.
[6] Data centre locations were mapped to Baseline Water Stress data from the World Resources Institute's Water Risk Atlas.
[7] Water Usage Effectiveness (WUE) is the industry standard metric for measuring data centre water efficiency. It is calculated by dividing the total amount of water used by the data centre facility by the energy consumed by IT equipment. A lower WUE value indicates greater efficiency, meaning less water is required to support the data centre's operations relative to its computing output.

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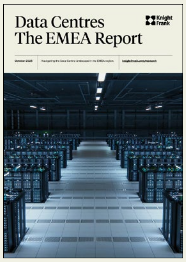

The EMEA Report

The APAC Report

Global Data Centres Report

Data Centres Global Forecast Report

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