Driving sustainable data centres

July 2025

Executive summary

As global digitalisation accelerates, the data centre industry finds itself at the nexus of innovation, energy demand, and environmental responsibility. Data centres are among the most resource intensive assets in the built environment – consuming significant electricity and water, generating substantial heat, and increasingly contributing to global emissions. As such, they face mounting pressure from investors, regulators, and end users to demonstrate credible, measurable ESG performance.

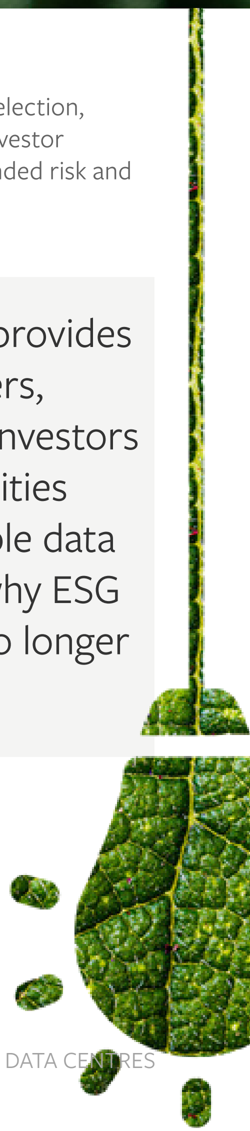
This white paper outlines how data centres can shift from being perceived as environmental liabilities to becoming leaders in sustainable infrastructure.

It explores how forward-looking operators are improving their ESG profiles by investing in advanced energy procurement strategies, closed-loop cooling systems, waste heat recovery, and sustainable construction methods. It also delves into the regulatory landscape shaping the industry – including the EU Taxonomy, SFDR, CSRD, and national energy efficiency mandates – and how proactive compliance not only mitigates risk but can unlock new capital sources through sustainability-linked financing.

A key focus is the integration of ESG metrics into operational and investment decision-making. The paper highlights how data centres are evolving to become not just efficient, but resilient – leveraging tools like real-time performance monitoring, AI-enabled cooling optimisation, and third-party green certifications (e.g. LEED, BREEAM) to future-proof their operations.

Additionally, this paper identifies strategic site selection, regulatory compliance, talent acquisition, and investor transparency as pivotal levers for reducing stranded risk and maintaining long-term competitiveness.

Ultimately, this white paper provides a roadmap for asset managers, operators, and institutional investors to understand the opportunities and imperatives of sustainable data centre development – and why ESG leadership in this sector is no longer optional but essential.



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1. Introduction: sustainable data centres

The demand for sustainable data centres has increased in recent years due to the growing global reliance on digital technologies and the heightened awareness of the industry's environmental impact. This trend is further accelerated by additional factors such as rising energy costs and the need for operational efficiency. Consequently, data centre operators are focusing on environmental, social and governance (ESG) performance to align with the Paris Agreement climate goals and applicable energy efficiency regulations, to meet their customers' sustainability requirements and to promote long-term sustainability.

The high demand for electricity and water raises the question of preferred locations for new developments.

Operators and owners of data centres are facing increasing public attention on their greenhouse gas footprint and have in many cases pledged to cut their Scope 2 and respectively Scope 3 emissions. Of course, the relative location within the global network of data streams plays an important role when deciding on where to build a new data centre, but the availability of low-emission electricity becomes more and more important, too. Data centres do not only require tremendous amounts of electrical power, but this power also needs to be provided at a constant and reliable level, which can be supported but not entirely met by on-site renewable sources like solar or wind. Battery-based energy storage and a smart load management can increase the usable share of renewable energy, but data centres still heavily rely on grid-provided power. Therefore, a high share of renewables in a country's electricity generation implies a relevant factor for such heavy-load industries (of course, electricity price will still play a big role). A widely debated question is currently whether data centres' high appetite for low-emission and constantly delivered electricity might result in an increasing demand for nuclear power. While the demand of electrical power per computational operation has extremely reduced over time, the facilities' computational power has increased at even higher pace resulting in higher total electrical loads. Therefore, the availability of sufficient electrical power has become one of the most important factors for choice of location. After some negative experiences in the past, many developers are no longer relying on weak statements of intent but require a clear and legally binding regulation on guaranteed power availability including the installation of new utilities.

Data centres also face significant risks from climate change, including extreme weather events, power disruptions, and regulatory changes. Adopting sustainable practices not only reduces these risks but also helps create a competitive advantage in the market. No matter how small the reduction of water and electricity demand due to more efficient practices is, the less vulnerable to any shortage a data centre becomes. Similar to the provision of electricity, there is – for traditionally cooled data centres at least – a constant need for cooling water, and locations with existing water scarcity or a growing risk of extreme drought events might not be considered optimal for new data centres. The situation might not be comparable to the cooling requirements of nuclear power, but relying on nuclear energy to run a data centre in regions with significant drought risk can result in a dangerous cumulation of water and energy risk. One need only look at the situation in recent years in France with nuclear plants having to be shut down due to drought-related water scarcity.

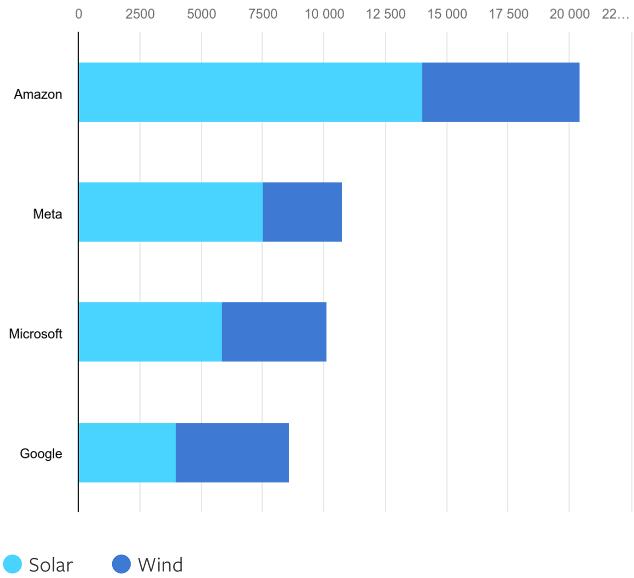
2. ESG performance relevant factors

Incorporating ESG factors plays a crucial role in the sustainable operation of data centres, including reducing energy consumption, managing waste, and engaging with local communities. By implementing energy-efficient solutions and adhering to international guidelines (or exceeding such targets), data centres can improve their ESG performance while reducing operational costs, minimising their environmental impact and becoming more attractive to not only investors but also tenants – many of which have their own sustainability goals and net zero targets.

2.1 Energy efficiency and renewable energy use

Leading information and communication technology (ICT) companies are increasingly investing in renewable energy projects to stabilise energy costs, reduce their carbon footprint, and enhance their brand image. Hyperscale data centre operators, such as Amazon, Microsoft, Meta, and Google, are among the top purchasers of corporate renewable energy Power Purchase Agreements (PPAs). Collectively, they have contracted nearly 50 GW of renewable energy capacity, equivalent to the entire power generation capabilities of Sweden.

Top corporate off-takers of renewable energy PPAs, 2010-2022



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International Energy Agency (IEA), Top corporate off-takers, 2010-2022
https://www.iea.org/data-and-statistics/charts/top-corporate-off-takers-2010-2022-2

But how do we measure the energy efficiency of a data centre? Traditional KPIs from the real estate industry will determine the efficiency of an individual building by measuring its energy consumption during a given period (usually 1 year) per floor area. There can be some further adjustment due to climate, weather, vacancy, occupation or, in the hospitality sector, room nights, but these approaches are hardly applicable to data centres. Modern data centres consume much more energy per square metre than before, but they are also able to process a disproportionately higher amount of data. One of the most common efficiency measures is Power Usage Effectiveness (PUE), which measures the amount of energy used for computational purpose in relation to a data centre's total energy consumption. An ideal PUE value gets close to 1 with almost all energy used for a data centre's actual purpose, computation, as opposed to power conversion or cooling. There are many different KPIs available to measure data centre efficiency and one main point of criticism for a sole application of PUE is that it only considers how much energy you put into a data centre but not their actual output of work. Closely related to PUE, but focusing on a data centre's carbon footprint, the Carbon Usage Effectiveness (CUE) measure quantifies the carbon emissions in relation to a facility's total energy consumption and therefore considers the emission factor of grid electricity used as well as on-site renewable generation.[1] In addition, rankings like Green500 relate the computational performance of the TOP500 supercomputer systems to the electrical power they consume, showcasing efficiency among energy-intensive applications such as generative AI, scientific research and media streaming.[2] EuroHPC's supercomputer JEDI currently heads the Green500 list with 72.73 GFLOPS/watt (GFLOPS = 1 billion floating point operations per second).[3]

2.2 Water consumption and energy-efficient cooling systems

Water consumption is a critical concern when it comes to the environmental impact of data centres. According to NPR, a mid-sized data centre uses 300,000 gallons (approximately 1.14 million litres) of water daily for cooling purposes, which is roughly equivalent to the water use in 100,000 homes. This significant water consumption is primarily due to the need to dissipate the heat generated by IT equipment in data centres.

The World Economic Forum states that the average 1 megawatt (MW) data centre consumes around 25.5 million litres of water annually for cooling alone.[4] Deloitte suggests that artificial intelligence (AI) data centres will consume over 1.7 trillion gallons (approximately 6.4 trillion litres) of freshwater (potable water) by 2027, while a hyperscale data centre alone will require around 50 million gallons (approximately 189 million litres) a year.[5] Most of a data centre's water demand is caused by cooling. Some data centre operators have sought to mitigate against the availability of water by investing in closed-loop cooling methods. For example, Prime Data Centers utilises a fully closed system to provide a near-zero Water Usage Effectiveness (WUE) score.[6] The closed-loop system reduces the wastewater produced by some of its sites. Others such as Amazon Web Services (AWS) and Google have focused on investing in water replenishment projects to ensure local communities are not affected by a lack of available potable water.[7]

As data centres are expanding their workloads, liquid cooling becomes more essential for heat management of high-density racks. As JLL UK mentions, liquid cooling has become an industry standard for AI and crypto-mining-focused facilities as it boasts more effective cooling.[8] According to their report, AI is a significant driver of projected data centre growth and is set to represent just under 50% of data centre demand by 2030. The digital ecosystem, specifically cryptocurrency mining, is also driving the need for data centres. Iris Energy (IREN) has constructed 5 data centres in remote locations in the US, where renewable energy is in plentiful supply, to focus on crypto-mining operations. These facilities are purpose-built for high-consumption applications in AI and mining. According to IREN, remote locations are often selected for data processing facilities due to 2 main factors: lower infrastructure costs and reduced reliance on high-speed grid connections. These facilities primarily focus on data processing tasks that don't require low latency, making their distance from urban centres less critical. These facilities use air cooling rather than liquid because of the lack of available water in these remote locations.[9] Some operators such as AWS have rolled out purified wastewater cooling systems across 20 of their sites to address the lack of available potable water for managing temperatures in their server rooms. By using non-potable water such as reclaimed wastewater, the operator is working towards being 'water positive' by 2030.[10]

2.2.1 Direct water consumption in data centres

Many data centres rely on water-based cooling systems, such as evaporative cooling or cooling towers, to maintain optimal temperatures for their IT equipment. These systems directly consume water on-site, contributing to the substantial water usage associated with data centre operations. In regions facing water scarcity or high competition for water resources, this level of consumption may pose significant environmental and social challenges.

Data centre operators use the WUE metric to quantify how efficiently a data centre uses water, which is measured in litres of water per kilowatt-hour of energy (L/kWh). It compares the amount of water used for cooling IT equipment with the amount of energy used to power IT equipment.

2.2.2 Indirect water consumption and electricity production

In addition to direct water consumption, data centres also contribute to indirect water usage through their electricity consumption. Power generation for data centres often involves water-intensive processes, such as cooling in thermal power plants. By reducing their electricity consumption, data centres can indirectly lower their overall water footprint.

Adopting a modular design approach can allow data centres to scale capacity as needed, reducing energy waste and improving overall efficiency.

2.2.3 Opportunities for reducing water consumption in data centres

There are several strategies that data centres can implement to reduce their water consumption and minimise their environmental impact:

- Adopting energy-efficient technologies: By investing in energy-efficient IT equipment and infrastructure, data centres can lower their electricity consumption and indirectly reduce their water usage
- Utilising alternative cooling methods: Data centres can explore alternative cooling solutions that require little to no water, such as air-cooled systems, liquid immersion cooling, or free cooling, which utilises outside air to cool the equipment. However, at least in the US, there is a move toward more high-density design, which makes air cooling of any sort more difficult
- Implementing water conservation measures: Data centres can adopt water-saving practices, such as capturing and reusing rainwater or condensation, to supplement their cooling system's water supply. This approach can help reduce their reliance on freshwater sources
- Monitoring and optimising water usage: By continuously monitoring and analysing water consumption data, data centres can identify inefficiencies and implement targeted improvements to reduce their water usage

Efficient cooling systems are critical for reducing energy consumption in data centres. The 2016 EU Heating and Cooling Strategy presented an initial assessment of energy consumption and fuel mix in primary end-use sectors for heating and cooling. The strategy outlined actions and tools to ensure the heating and cooling sector's contribution to the EU's goal of achieving climate neutrality by 2050. These actions were implemented in the Clean Energy for All Europeans package, adopted in 2019, focusing on enhancing renewable energy and energy efficiency while adopting an integrated approach to the energy system.

The EU's renewable energy targets are closely linked to its energy efficiency targets and measures. As more energy is conserved, it becomes easier for EU countries and the EU as a whole to meet their renewable energy goals. Renewable heat sources, such as ambient and geothermal energy primarily utilised through heat pumps and solar thermal systems, generate low-temperature heat (up to 200°C). These sources operate most efficiently in highly energy-efficient, well-insulated buildings or low-temperature process heat applications (e.g. breweries and food drying).

Decarbonisation of the heating and cooling sector is one of the three key focus areas in the renovation wave strategy.

2.3 Waste heat recovery

Waste heat recovery is another essential aspect of improving energy efficiency in data centres. By capturing and reusing the excess heat generated by data centre operations, facilities can reduce their overall energy consumption and carbon emissions. Implementing waste heat recovery systems, such as heat exchangers or absorption chillers, can help data centres utilise excess heat for other purposes, such as district heating or cooling.

Regarding the reuse of thermal output/waste heat from data centres, new laws have already been introduced in certain jurisdictions. For example, in Germany, according to the German Energy Efficiency Act that came into force at the end of 2023, new data centres that start operation as of 1 July 2026 are in principle required to use a minimum of 10% reused energy (15% as of 1 July 2027 and 20% as of 1 July 2028). Operators of (new and existing) data centres are also required to avoid/reduce waste heat in accordance with the latest available technology.

3. Risk management and resilience in data centres: challenges and opportunities

With the growing demand for data storage and processing, it is essential for organisations to ensure that their data centres are resilient, adaptable, and sustainable. This chapter will discuss the role of ESG factors in risk management and resilience for data centres, with a focus on site selection, energy-efficient infrastructure, and disaster recovery planning.

The Sustainability Accounting Standards Board[11] has identified several environmental risks that are material to the data centre industry. It has introduced mandatory reporting requirements on data centre operators focusing on the energy and sustainability of each facility.

Environmental risks such as flooding, wildfires and extreme weather events are also becoming increasingly prevalent due to the effects of climate change.[12] People are witnessing ‘once in a lifetime’ events at a higher frequency than before.[13] Data centres are not immune. Historically high temperatures, storms, earthquakes, floods and fires all affect the operability of data centres.

3.1 Infrastructure

As data centres continue to grow, sustainable design strategies are becoming increasingly important to minimise their environmental impact. Several opportunities exist to integrate green infrastructure, optimise renewable energy and enhance sustainability in data centre construction.

Data centres can incorporate green infrastructure to help mitigate their environmental impact. Green roofs and living walls, for example, can help improve air quality and enhance biodiversity. They also provide natural insulation and cooling opportunities, which in turn reduce energy consumption as, on average, 40% of a data centre's power consumption is generated by traditional cooling systems.[14] In addition, green walls can help sequester carbon dioxide from the atmosphere, providing data centres with an opportunity to offset carbon emissions generated elsewhere in their operations, such as the use of refrigerants in cooling.

Opportunities also lie in rainwater harvesting solutions to increase sustainability and water resilience in data centres by utilising passive, non-potable water sources. Rainwater can be stored on-site and can ensure data centres conserve freshwater resources, promoting resilience in urban areas by reducing their reliance on potable sources.[15] As water usage is becoming an increasingly monitored metric, as a Natixis investor survey has found, utilising passive water sources can be looked at favourably by investors.[16]

Using recycled building materials is another opportunity for sustainable data centres. Recycled steel, low-carbon concrete and recycled plastics can significantly reduce the carbon footprint of the data centre during construction. Meta has focused on reducing the carbon footprint of its data centres by utilising low-carbon concrete, which lowers its carbon intensity by up to 20%.[17]

3.2 Site selection

3.2.1 Physical risk

Whilst data centre operators have invested in their facilities' physical infrastructure to fortify against physical damage caused by extreme weather events, Uptime Institute's survey indicates that extreme weather events are still a concern for the data centre industry.[18] According to their 2024 report, almost half of data centre operators have experienced an extreme weather event that threatened their operations, with around 10% suffering an outage at some point within the last three years. Uptime's surveys have consistently shown over the last few years that these events, exacerbated by climate change, will continue to increase outage risks.[19]

To address these challenges, many data centre providers are prioritising infrastructure redundancy as a critical strategy to ensure resilience and minimise downtime during extreme weather events. Infrastructure redundancy involves building systems with duplicate components and pathways, allowing operations to continue even if one part of the system fails. By incorporating redundancy into their designs, providers can better protect their facilities and maintain uninterrupted service during increasingly unpredictable conditions.

Infrastructure redundancy varies by location and by provider. For example, in hurricane hotspots such as Miami, Equinix have ensured their Miami data centre operations are concurrently maintainable by building their MI1 facility with 7-inch-thick (18-centimetre-thick) walls to withstand a Category 5 storm and housing its critical infrastructure 32 feet (9.8 metres) above sea level.[20] Other operators have invested in multi-layered redundancy designs such as flood-resistant designs, on-site generators, uninterruptible power supply (UPS) units and weather protocols.[21] In the US, much of the large-scale renewable infrastructure (i.e. solar and wind) tends to be in the south (also called the Sunbelt), where ambient temperature is very high and thus requires additional cooling due to the environment.

Water scarcity is another concern. A recent report by TechUK highlights how water stress can affect liquid evaporative cooling systems used by the UK's data centre sector.[22] According to the report, the 168 data centres located in the Greater London area are exposed to water stress risks due to the lack of potable water, especially during the summer months.[23] In 2022 and 2023, Thames Water disclosed plans to restrict peak time availability of water and increase supply costs to data centres in Greater London due to concerns over water availability and the effects on its infrastructure.[24] In comparison, data centres located in more water abundant areas such as the Cotswolds and the Peak District have a reduced risk of water stress.

Choosing the appropriate location for a data centre is a critical aspect of risk management and resilience. By considering ESG factors in site selection, organisations can mitigate risks related to natural disasters, regulatory changes, and issues with community engagement. Factors to consider when selecting a site include:

- Proximity to natural disaster-prone areas: Avoiding locations that are susceptible to flooding, earthquakes or other natural disasters can minimise the risk of operational disruptions and infrastructure damage.
- Access to renewable energy sources: Prioritising sites with access to renewable energy sources, such as solar or wind power, can help reduce the environmental impact of the data centre and contribute to long-term sustainability.
- Community engagement: Engaging with local communities and addressing their concerns can help prevent social backlash and foster a positive relationship between the data centre and its surrounding community.

3.2.2 Permits and entitlements

Data centres face challenges related to local regulations and site selections. This is especially onerous for data centres that may fall under multiple zoning classifications due to the lack of characterisation.[25] Whilst data centres are a unique type of infrastructure, they are still required to comply with local development regulations, including permitting and entitlements.[26] A challenge arises where there is a lack of direct code provisions for data centres within the domestic regulatory framework.

This challenge is prevalent in areas where data centres are less established. As a result, developers can bypass potentially ambiguous classifications by seeking customised approval processes or exemptions and variances to municipal codes if there is a distinct lack of suitable provisions, citing the benefit to wider community goals and economic growth of the local area as well as potential power grid upgrades.[27]

Whilst possible, this process takes time. Land development review alone can take between 6 to 18 months with several stages of review depending on the jurisdiction's efficiency and local interest in the development. Permitting adds further delays, taking an additional 4 months in the UK alone.[28]

The level of permitting required depends on the installed emergency backup generators' thermal input. For the largest data centre emergency generators or on-site generation plants exceeding 50 MW of thermal input, a bespoke installation permit is necessary. This permit requires extensive consideration as to the potential environmental impacts, including air quality, water, land and groundwater, energy efficiency and waste generation.[29] Once applied for, the permit ensures the use of the generator will not significantly detriment the surrounding environment for the lifetime of the facility. If a contamination occurs, the permit is surrendered, and the operator is obligated to restore conditions to their baseline state.

Site selections can pose a challenge to data centre operators, as hotspot areas such as Virginia and Dublin are facing planning challenges from local authorities due to concerns over unprecedented levels of power and water consumption. The state of Virginia houses around 512 data centre facilities and handles around 70% of global internet traffic.[30] The Joint Legislative Audit and Review Commission (JLARC) found that almost all of Virginia's projected electricity demands over the next 5 years can be attributed to data centres if growth is left unconstrained.[31]

In 2024, Dublin ceased all new development of data centres around the city until 2028 due to fears of grid constraints.[32] These fears are not unfounded. Recent analysis from the International Energy Agency (IEA) has suggested that, by 2026, data centres in Ireland will account for 32% of the country's total power consumption.[33] As of 2024, Ireland houses 82 centres, with a further 14 under construction and 40 in the process of being approved.[34]

When it comes to sustainable data centres, the sophistication of renewable energy infrastructure varies by location. It is therefore important for operators to consider the level of domestic support and investment in renewable energy before planning construction. For example, data centre operator EcoDataCenter chose to locate its operations in Sweden's northern forest to gain 100% renewable energy power from nearby hydroelectric power plants.[35]

3.2.3 Talent acquisition

The rapid growth of data centres means there is a severe shortage of professionals in this market, both on the management side and on the day-to-day technical support side.

According to Uptime Institute's 2023 Global Data Centre Survey, almost 2.3 million professionals are needed to operate global data centres by the end of 2025.[36] 58% of data centre operators surveyed are having difficulty in finding qualified candidates and 55% have difficulty in retaining staff with a further 40% losing staff to competitors.[37]

Data centres are a unique asset type, with professionals from construction, IT, communications, management, engineering and now sustainability. Multi-disciplined professionals are required in this space, both on the management side and the technical side, to ensure energy efficiency, efficient cooling, and maintain uptime.[38]

As the sector has suffered for the past few years from talent poaching,[39] some large operators are tackling the problem by creating a central programme management office (PgMO) across their collection of sites.[40] Whilst this does not address the need for adequate salaries in the market, it can facilitate a coordinated management effort across global sites. This ensures that the most skilled people are able to oversee operations and related issues in the collective.

Others have joined with collaborative initiatives such as TechUK's Skills Group[41] and the National Data Centre Academy (NDCA)[42] to provide a knowledge forum and to facilitate professional development in the sector. Within these are environmental and sustainability focused programs such as the Certified Data Centre Environmental Sustainability Specialist (CDESS) Program.[43] This is especially important following the EU's Corporate Sustainability Reporting Directive (CSRD), which adds another element of complexity and oversight to data centre operations and management.

3.3 Energy procurement

Data centres have an almost constant base load with power peaks primarily driven by cooling requirements.[44] Given their high energy demands, major technology companies such as Microsoft and Google have committed to achieving full renewable energy use in their operations by 2025[45] and 2030.[46] Apple has already done so since 2014, powering its 2.8 TWh facilities entirely with renewable energy.[47]

A key challenge for sustainable data centres is energy procurement. Data centre servers operate 24/7 and require a UPS to ensure operational resilience and uptime.[48] According to McKinsey, the global annual data centre power consumption will rise to 171-219 GW by 2030, driven by AI and the digital economy.[49] Current data centre demand requires around 60 GW of annual power.[50]

Currently, the renewable energy landscape is insufficient to support green-powered data centres.[51] While investments in renewable energy assets have continued to grow to reach $1.2 trillion,[52] with solar and wind maintaining preference over hydroelectric, tidal and geothermal power projects, the growth remains inadequate to meet power demands. The market is expected to reach a compound annual growth rate of 8.5%-9.7% from 2024 to 2033, whereas the data centre industry is growing at 19%-22%.[53]

Although on-site renewable energy generation is attractive to investors as it ensures the data centre is immune to renewable intermittency issues,[54] it would only account for 10%-20% of a facility's total energy needs. Solar photovoltaic (PV) panels are the preferred choice due to their affordability and ease of installation. However, variable energy generation and land ownership constraints pose challenges to their ability to be utilised effectively to meet demand.[55]

Despite these barriers, data centres are expected to play a growing role in the corporate clean energy shift. North American data centres are projected to lead this shift, procuring an estimated 41 GW of solar and wind energy by 2030[56] by acquiring renewable energy PPAs.[57] However, smaller data centre providers may struggle to secure these purchase agreements due to their position in the market and negotiation powers.[58]

3.4 Heat and water management

As data centre capacity continues to rise at this rapid annual rate[59], heat and water management remains both a challenge and an opportunity for innovation. Cooling systems are a necessity to maintain operational temperature levels and can account for around 40% of a facility's total power consumption,[60] significantly increasing operational costs and environmental impact.

However, developments in liquid cooling technologies means fully closed-loop cooling systems, as used by Prime Data Centers, can be utilised.[61] These systems recycle water indefinitely, with Prime Data Centers, stating their solution uses less than 1% of the water consumed by traditional adiabatic and evaporative systems while achieving an almost zero WUE score.[62]

Heat is a byproduct of data centre operations yet presents a key opportunity for sustainability through waste heat recovery initiatives. In Sweden and Denmark, data centre operators have successfully integrated waste heat into district heating networks, providing energy-efficient heating to local communities.[63] In regions with mandatory Scope 1, 2 and 3 emission policies, such as Europe and North America, incorporating waste heat recycling can be a competitive advantage in securing planning approvals and investment.

Nordic countries like Denmark incentivise sustainable data centre practices through R&D relief. Utilising the Tax Credit Scheme in Denmark by investing in sustainable innovative practices such as cooling systems could provide data centre operators with additional liquidity to support their growth.[64]

4. The impact of certifications on sustainable data centres

Data centres often already comply with various International Organization for Standardization (ISO) standards, such as ISO 9000 for quality management, ISO 14000 for environmental management and ISO 27001 for information security management. Various additional certifications, such as LEED and BREEAM, can play a significant role in driving sustainable practices in the data centre industry. By adhering to the standards set by these certifications, data centres can improve their environmental performance, reduce operational risks, and enhance their reputation among stakeholders.

4.1 LEED certification

Leadership in Energy and Environmental Design (LEED) is a globally recognised certification that evaluates the sustainability performance of buildings, including data centres. Key benefits of LEED certification for data centres include:

- Enhanced energy efficiency: LEED-certified data centres implement best practices in energy management, resulting in lower energy consumption and operating costs.
- Reduced environmental impact: By adhering to LEED standards, data centres can minimise their environmental footprint, including greenhouse gas emissions, water consumption, and waste generation.
- Improved indoor air quality: LEED requirements ensure that data centres maintain optimal indoor air quality, contributing to a healthier work environment for employees.
- Utilisation of sustainable and locally sourced building materials: LEED certification encourages the use of environmentally friendly and locally sourced materials, reducing the environmental impact of construction and supporting local economies.

4.2 BREEAM certification

Building Research Establishment Environmental Assessment Method (BREEAM) is another globally recognised certification that assesses the sustainability performance of buildings. BREEAM-certified data centres can:

- Demonstrate their commitment to sustainable practices and reduced environmental impact by meeting BREEAM's stringent criteria.
- Achieve higher levels of energy efficiency, resulting in reduced energy consumption and lower operating costs.
- Promote water conservation measures and minimise waste generation, contributing to more responsible resource management.
- Integrate with local ecosystems to reduce environmental impact, such as incorporating green spaces and biodiversity enhancements.

4.3 The impact of ESG reporting / CSR

ESG reporting as a form of corporate social responsibility (CSR) has a significant impact on sustainable data centres by promoting transparency, driving the adoption of sustainable practices, and influencing stakeholder decisions. Here are some ways in which CSR, including ESG reporting, affects sustainable data centres:

4.3.1 Increased transparency and accountability

CSR, through ESG reporting, enables sustainable data centres to demonstrate their commitment to environmental, social and governance issues. By disclosing their performance in these areas, data centres can showcase their efforts in reducing environmental impact, promoting employee well-being, and adhering to ethical governance practices. This increased transparency holds them accountable for their actions and helps build trust with stakeholders, including investors, customers and regulators.

4.3.2 Encouragement of sustainable practices

CSR encourages data centres to adopt and continuously improve their sustainable practices. Regular reporting on ESG performance pushes data centres to set targets for energy efficiency, renewable energy usage, water conservation, and waste reduction. This helps the industry move towards more eco-friendly practices, reduce its environmental footprint, and contribute to global sustainability goals.

4.3.3 Enhanced reputation and competitiveness

Sustainable data centres that engage in CSR, including ESG reporting, can enhance their reputation and competitiveness in the market. Companies and investors are increasingly seeking data centre providers that prioritise sustainability and demonstrate strong ESG performance. By reporting on their ESG initiatives, data centres can distinguish themselves from competitors and attract new business from environmentally conscious clients.

4.3.4 Improved risk management and resilience

CSR can help sustainable data centres identify potential risks and improve their overall resilience. By disclosing and analysing their ESG performance, data centres can uncover areas that require improvement, implement risk mitigation strategies, and monitor their progress over time. Addressing these risks can result in more resilient and sustainable operations in the long run.

4.3.5 Meeting regulatory requirements and industry standards

In some jurisdictions and industries, companies are required to disclose their ESG performance as part of their CSR, and adhering to industry standards, such as LEED or BREEAM, may require public reporting on sustainability initiatives. By engaging in CSR, including ESG reporting, sustainable data centres ensure compliance with these requirements and demonstrate their commitment to meeting industry standards.

European lenders are required, pursuant to the Non-Financial Reporting Directive[65] (NFRD), to disclose information on the way they operate and manage social and environmental challenges. European lenders are also required to make sustainability-related disclosures in respect of financial products pursuant to the Sustainable Finance Disclosure Regulation (SFDR)[66]. In this context, the Loan Market Association (LMA), together with the Asia Pacific Loan Market Association (APLMA) and the Loan Syndications and Trading Association (LSTA), have developed sustainability-linked loan principles. Sustainability-linked loans (SLLs) aim to support a borrower's efforts in improving its sustainability profile over the term of the loan.[67] These loans align the terms to the borrower's performance, measured using one or more sustainability Key Performance Indicators (KPIs), which can be internal or external.[68]

Margin ratchets are included as incentives for borrowers to meet sustainability targets. These mechanisms adjust interest rates based on sustainability performance in 2 ways: a step-down or a step-up. A step-down reduces interest rates as a reward for meeting sustainability targets, encouraging borrowers to prioritise sustainability. Conversely, a step-up increases interest rates when targets are not achieved, imposing a financial consequence for insufficient sustainability efforts.[69] SLLs typically have interest rates that vary based on the borrower's success in meeting predefined sustainability KPIs. Borrowers and lenders usually select 2-3 quantitative sustainability KPIs and agree on future targets to be achieved within the loan's duration.[70] Borrowers often work with independent third-party advisors to verify their performance against the KPIs. This adds credibility and transparency to the process, providing assurance to lenders and reassuring investors that their funds are genuinely contributing to sustainability improvements.

The regulatory landscape of sustainable disclosures as it applies to data centres is changing as a result of a series of European Union level directives such as the Energy Efficiency Directive (EU) 2023/1791 and the Delegated Regulation (EU) 2024/1364, which have implemented stricter reporting requirements on data centre operators for energy use, water use and emissions footprint. To be able to accurately track and measure these metrics, sustainable data centres need robust and well-designed systems which allow for real-time energy and carbon tracking.[71]

An example in the U.S. is Arizona, which has strict water use regulation. New data centre developments must obtain approval for their water use, and an efficient design and consumption tracking are both essential.

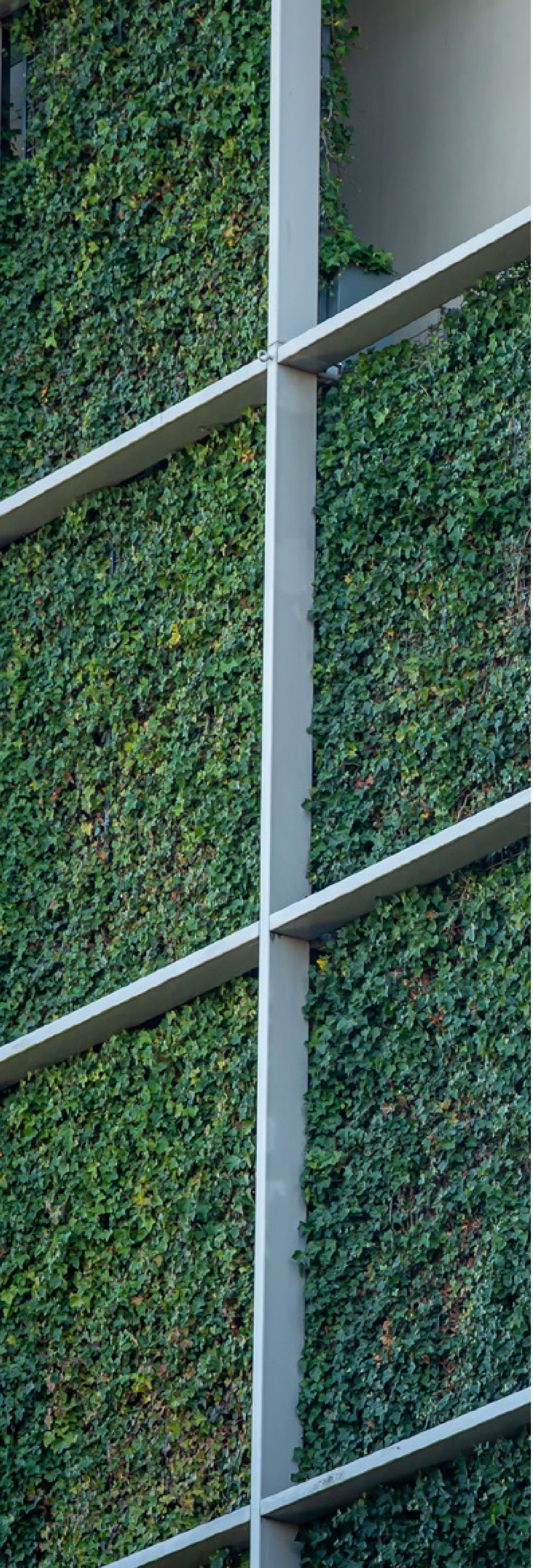
In addition, investors are applying additional pressures on data centre operators to provide transparency as to their sustainability disclosures and to improve their sustainable strategies.

For example, BlackRock, which holds over $70 billion in data centre assets as of the end of 2024, has pushed for sustainability commitments from data centre operators.[72] According to Reuters, fund managers as a whole are pushing operators for more information on their PPAs and their duration, AI power consumption, geographic distribution, and Scope 3 emissions.[73] As many asset managers are required to disclose the Scope 1, 2 and 3 emissions of their portfolio holdings under CSRD[74] and SFDR,[75] data centres are under pressure to satisfy investor needs but, at the same time, adhere to their own reporting standards.

5. The importance of middle- and back-office management, requirements to monitor key metrics and deliver reporting

Data centres are subject to a wide range of sustainability reporting requirements. As a result, middle-office professionals need to ensure that they have an effective management system in place that monitors key metrics such as PUE, WUE, and CUE. These have to be within acceptable levels as defined by ISO/IEC 30134. By adhering to sustainable reporting requirements, middle offices can foster investor confidence in the sector and maintain capital flows.

Back offices can utilise both proprietary and third-party software, like AI to monitor and assess critical areas such as energy consumption and water usage. By leveraging AI technology, back offices can enhance energy efficiency through optimisation and predictive analytics. This section will discuss key considerations of middle and back offices in sustainable data centres.



5.1 Energy procurement and management

Middle offices in sustainable data centres play an important role in optimising energy procurement and management, ensuring alignment with sustainability goals while maintaining operational efficiency. They are required to analyse energy consumption patterns and negotiate contracts to ensure a sufficient source of renewable energy to meet capacity demands.[76]

To achieve 100% renewable energy operations, data centre management should consider bilateral agreements such as renewable energy PPAs. These long-term contracts, usually between 10-25 years, provide a consistent supply of clean energy from sources such as solar and wind farms.[77] However, relying on a single source of renewable energy is insufficient. Management needs to diversify their portfolio of PPAs to include not just solar and wind but also tidal and hydroelectric power generation. This approach enhances reliability and stability, as solar and wind energy can be intermittent. PPAs also offer stable pricing and enable direct investment in renewable energy projects, which is increasingly important given the political disruptions to supply chains and inflationary effects on commodities.[78] As a McKinsey report suggests, renewable energy developers face challenges in meeting energy demands following constraints on key materials needed to scale wind and solar farms, such as steel.[79]

Leading data centre operators like Microsoft, Amazon, and Google have achieved 'green' status through direct investments in renewable energy projects, long-term PPAs, and on-site solar and wind generation.

However, renewable energy alone cannot meet the continuous power demands of data centres as both wind and solar energy generation are variable.[80] Investment in renewable energy infrastructure is critical to sustaining sector growth and ensuring greater availability of clean energy in the coming years. For example, Google has invested in large-scale renewable energy generation parks following its target to have all of its data centres powered by renewable energy by 2030. To do this they have partnered with Intersect Power, an independent power producer, and TPG Rise Climate to design and build energy plants next to data centre locations to power their sites. This $20 billion clean energy partnership will create a co-located energy project, which will see new data centre builds powered by the renewable energy generated from the project.[81]

According to Schroders Green Coat, between 2012 and 2023, power demand from data centres experienced a compound annual growth rate (CAGR) of 14%, whilst electricity generation grew by 2.5% over the same period. As noted earlier, the IEA warns that data centres in Ireland are set to consume 32% of total electricity by 2026, up from 17% in 2022.[82]

Virtual Power Purchase Agreements (VPPAs) should also be considered. These allow data centres to support renewable energy projects without consuming the energy. Through Renewable Energy Certificates (RECs), operators can offset carbon emissions from their power use and contribute to the development of renewable energy infrastructure. S&P Global has suggested wind and solar energy can only meet around 40% of global data centre demands of 150 to 250 TWh per year by 2030.[83] Schroders Green Coat's own analysis suggests demand from data centres could require an additional 100 GW of new wind and solar projects by 2035. Resulting in a further $120 billion in capital expenditure to meet demands.[84]

Another way management can ensure efficient energy procurement of renewable energy is through green tariffs. Whilst these are less effective than PPAs, because they do not ensure stable pricing, operators such as Meta have utilised them to support their fully renewable generated sites in the US. According to Meta, utilising green tariffs from renewable energy providers supports generation projects to ensure their energy needs are met.[85]

To maximise renewable energy utilisation, middle offices can consider shifting data loads geographically to sites with greater renewable energy availability. For example, Google has relocated some of its data centre operations to areas with more accessible renewable energy.[86] A notable case is Cirrus Nexus, which moved its operations from the Netherlands to California within a day to ensure a continuous 24/7 supply of solar power for its servers. This approach optimises renewable energy use and reduces reliance on fossil fuels or small modular reactors (SMRs).

While there are currently no national thermal output reuse requirements in the United States, California has required waste heat recapture for data centres under the 2022 Building Efficient Standards (Title 24 of the California Building Standards Code). As California can often serve as a bellwether for future environmental regulation, developers would be well-advised to consider integrating thermal recapture technology and design in new developments. Middle offices play an important role in ensuring that data centres meet sustainability reporting requirements. Following the introduction in May 2024 of the European Commission Delegates Regulation 2024/1364, which is based on the Energy Efficiency Directive (EED), operators of data centres are required to report on 24 performance indicators and information as to their energy and sustainability, information and communication technology, and data traffic[87]. These KPIs, set out under Annex II of the regulation, require data centre operators, with an installed information technology power demand of at least 500 kW, to monitor and measure these indicators and self-report on an annual basis to their EU member state or the European database. This is an attempt to monitor and establish a unified methodology to assess the sustainability of data centre operations across the European Union.[88]

Middle offices must also ensure compliance with sustainable disclosure regulations, including SFDR and the EU Taxonomy. To achieve this, they should consider adopting environmental management systems (EMS), which monitor heat, water usage, and energy efficiency. These systems, often implemented via software, align with sustainable principles and enhance resource management. It should be noted, under UK permitting legislations, a permit can only be given to a data centre operator if there is an EMS already in place.[89]

They should also consider fostering investor confidence in their sustainable claims by achieving third-party standards such as the ISO 14001[90] or LEED.[91] Centre renewable energy usage, water efficiency and waste management are requirements for classification. ISO 14001, in particular, provides a framework for minimising environmental impact and improving the effectiveness of risk management. According to the BSI Group, ISO 14001 fosters a culture of continual improvement by providing a structure for internal audits to see where they experience weakness in their approach to managing their environmental impact across the lifetime of the facility. It ensures a data centre is proactive in managing its impacts.[92]

Some data centres have emerged as benchmark examples of best practices in sustainability by fully aligning with the EU Taxonomy for Sustainable Activities. One such example is Maincube's FRA02 data centre in Frankfurt, which undergoes third-party sustainability audits by Northshore to verify its environmental claims.[93]

For data centres looking to enhance transparency and credibility, independent verification through frameworks like LEED and ISO 14001 is essential. Middle office teams should prioritise external sustainability audits to ensure the accuracy of environmental disclosures, maintain regulatory compliance, and build investor confidence.

Investor sentiment also underscores the growing importance of sustainability metrics. According to a Natixis investor survey, 13.6% of asset managers consider WUE a desirable KPI for monitoring environmental impact, with nearly two-thirds of respondents identifying water consumption as a critical concern for institutional investors and sustainable finance stakeholders.[94]

To establish high levels of efficiency, data centre operators may target the highly coveted Uptime Institute's Tier IV Standard, which focuses on operational resilience and redundancy. While Tier IV is not a direct measure of sustainability, achieving this certification demonstrates that sustainability-focused data centres can also meet the highest operational standards. This reassures investors that efficiency and sustainability are not mutually exclusive.

Beyond operational resilience, data centres must adhere to key EU sustainability regulations, including the CSRD, SFDR and EED. Compliance with these frameworks ensures transparent and standardised sustainability reporting, making environmental performance measurable and comparable across the industry. To be compliant with SFDR, middle offices must track, assess and report key sustainability metrics such as energy consumption, carbon emissions, water usage and waste management. Middle offices are also required to collaborate with risk management teams to identify and evaluate environmental risks that affect the long-term viability of the facility.[95]

In addition to regulatory requirements, voluntary sustainability initiatives such as the Science Based Targets Initiative (SBTi), Carbon Disclosure Project (CDP) and Global Reporting Initiative (GRI) further enhance accountability, climate resilience, and ESG transparency. These frameworks encourage data centres to identify, manage and mitigate environmental risks effectively while aligning with global decarbonisation goals.

To meet these sustainability targets, data centre operators should consider engaging specialist consultants to develop robust environmental strategies that comply with both current and future reporting requirements.[96]

5.2 Back-office: operational risk monitoring

Back-office teams play an important role in ensuring sustainability and operational resilience of the data centre. Operational risk monitoring, using dedicated software, AI and third-party risk monitors, is an essential task for these teams.

By leveraging monitoring tools which utilise AI, data centre teams can ensure comprehensive detection of anomalies and potential risks such as power outages and server overheating and damaged systems. These technologies can significantly reduce the likelihood of human error and enable operators to predict and mitigate emerging risks in real-time. Predictive analytics helps operators assess the total impact of critical infrastructure failures due to factors like unmanaged temperatures, environmental events such as flooding and earthquakes, and poor maintenance.[97]

Advanced risk-monitoring tools can significantly enhance resource efficiency in data centres by leveraging real-time analytics to optimise server loads through distribution and environmental conditions. With AI-driven software, cooling mechanisms can be precisely adjusted, directing airflow or liquid cooling to where they are needed. Preventing overcooling the entire facility and contributing to waste. This level of control can reduce the risk of overheating incidents by up to 30%, which in turn improves energy efficiency and water consumption.[98]

By adopting intelligent cooling strategies, data centres can achieve a PUE of 1.2 or lower, compared to the industry average of 1.57. Additionally, optimised cooling can reduce WUE to below 0.2 L/kWh, significantly improving sustainability. Targeted cooling strategies can also extend hardware lifespan by up to 40%, reducing the frequency of equipment failures and lowering operational costs.[99] For instance, Axiado's AI-driven Dynamic Thermal Management solution, has been reported to cut cooling costs by 50%, translating to more than $7 million annual operating cost savings and an 11% reduction in emissions.[100]

When setting up a fund for data centres, managers must carefully address the middle- and back-office functions to ensure seamless integration with sustainability goals, whether this is done in-house or through a specialised fund administrator.

5.3 The relevance of green leases

A green lease is a lease agreement that is intended to ensure a leased property is used and managed in a manner that fosters sustainability, which the tenant and the landlord mutually undertake to conserve natural resources and energy with regard to the leased property. This is underlined usually by a documentation requirement, which is especially important for regulated landlords/owners to meet requirements of ESG-related regulation. The parties usually agree to share with each other all data and relevant information they have or may obtain in the future in relation to the building and the premises in respect of: electricity consumption, gas consumption, the consumption of any other type of energy source, water consumption, waste generation, management and recycling, maintenance of production or distribution equipment used in connection with any of the energy sources used, water and/or waste management.

Careful handling of energy is one of the most important aspects of a green lease. By agreeing the respective regulations, the parties undertake to handle energy with care and to use renewable energy sources. Whereas in usual buildings the parties would agree that all electrical power purchased for the leased property shall be sourced solely from renewable energy sources, this is especially challenging when it comes to the energy consumption of data centres. However, the parties could agree, depending on availability in the data centre location, to purchase at least a certain percentage from renewable resources.

Contractual obligations under such lease provisions force the operator to meet agreed standards, thereby fostering the attractivity and reliability of the asset for meeting investors' standards and regulatory requirements.

6. The future of sustainable data centres

The future of sustainable data centres depends on the optimisation of renewable energy, resilience against climate risks and transparency on resource consumption.

The green data centre market is projected to grow from $81 billion in 2024 to over $308 billion by 2032.[101] Operators must establish sustainable strategies in their design and resource management but also implement circular economy protocols to ensure long-term viability while minimising environmental impact.

The high capacity demands of AI and digital assets are beginning to reshape the data centre industry with specialist 'AI factories' being developed. These are being designed with sustainability in mind with operators such as IREN, fully utilising hydropower and solar energy across their operations in North America.[102]

6.1 Private and public markets

Data centres are becoming an established asset class, with investors from both public and private markets. According to Linklaters, within the first 5 months of 2024, over $22 billion was invested in data centres, and $36 billion was invested over the whole of 2023.[103]

Analysis carried out by Linklaters has found that real estate fund managers are actively seeking exposure to data centres. According to their report, there are more than 50 real estate funds with combined total assets under management of over $50 billion, which are seeking exposure to data centres. 40% of this capital is set to be invested directly in data centres.[104] According to ULI/PwC's annual Emerging Trends in Real Estate report, data centres rank at the top for investment and development prospects across all regions globally.[105]

Institutional investors are also moving into this space. During late autumn 2024, the Canadian Pension Plan Investment Board (CPP) made a series of acquisitions and joint ventures through its private credit platform. The first saw CPP acquire a 12% stake in AirTrunk, an Australian hyperscale data centre developer with assets over $16.1 billion, in partnership with Blackstone.[106] The second was a joint venture with data centre operator Equinix and Singapore's Sovereign Wealth Fund GIC to expand data centre operations in the US.[107] And the third with Pacific Asset Management to develop a hyperscale data centre in South Korea with an initial seed commitment of C$285 million.[108]

Investors' interest in hyperscale data centres is driving the push for decarbonisation.[109] Asset managers, pension funds and other institutional investors are all subject to sustainable reporting requirements such as the EU's SFDR[110] and have also committed to Net Zero initiatives, requiring them to accurately report and mitigate Scope 1, 2 and 3 emissions within their portfolios. They require transparency from their portfolio companies.

As previously reported, fund managers as a whole are pushing operators for more information on their PPAs and their duration, AI-power consumption, geographic distribution and Scope 3 emissions.[111] One-third of investors manage SFDR Article 8 and Article 9 funds with exposure to data centres, according to Natixis[112]. Articles 8 and 9 of the SFDR have robust ESG disclosures, including energy efficiency, renewable energy use and water consumption metrics.[113]

6.2 Verification of sustainability metrics

Sustainability disclosures are mandated, with many adopting the European Commission's EU-wide standards, however data centres should be proactive in their disclosures to ensure they stay ahead of forecast regulations. Operators should also seek to provide context to their KPI disclosures to provide better indicators as to their impact on the environment and sustainability. This would then create an industry standard of best practices, which in turn would promote sustainability within the sector. Whilst the European Commission Delegates Regulation 2024/1364, is working to achieve this, it is only required for those operating within the European Union.[114]

The EU Energy Efficiency Directive (EED)[115] requires operators to report their renewable energy consumption and water usage through PUE and WUE metrics. However, there is no standardised method for collecting and generating this data.[116] As a result, the metrics disclosed are arguably inaccurate and not indicative of sustainability. Water usage, for example, only measures water used for cooling as a singular source however data centres often utilise both potable and non-potable water sources. As a result, the effect on water sources such as rivers or domestic infrastructure is not accounted for.[117]

In addition, there are variances in how these metrics are calculated. The ISO/IEC 30134-9 standard sets out multiple ways to report WUE, ranging from basic to advanced. Very few operators choose to use the advanced standard because it requires utility providers to reliably measure embedded water in power consumption, which incurs additional costs. Further variances transpire as context for the WUE metric is not required.[118] Therefore, in the case of multiple data centres, it is unclear whether the metric applies to every site within the operator's portfolio, which would include air-cooled as well as liquid-cooled operations, or just the largest. Without sufficient context, the scale of data centre impacts on water scarcity are not fully actualised.[119]

The variance in methodologies and the lack of standardisation within the sector leads to erroneous accounting for sustainability metrics. The Guardian analysis in September 2024 uncovered major under valuations of greenhouse gas emissions disclosed by the major data centre operators: Google, Microsoft, Meta and Apple. According to the analysis, the emissions reported between 2020 and 2022 were likely to be 662% higher than what was officially disclosed.[120] To ensure investors meet their Scope 1, 2 and 3 emissions, data centres must provide transparency as to their carbon footprint.

6.3 Location

Data centre hubs are changing. Traditional hotspots like London, Frankfurt and Amsterdam have become less viable locations due to land and energy supply constraints. In each region, land is well developed and comes at a premium cost.[121] In highly residential locations, operators can face local interest barriers as well as utility constraints.[122]

Emerging data centre markets have popped up where renewable energy is at a surplus, specifically the Nordic regions. The well-established hydropower, wind and geothermal power infrastructure create a reliable supply of green energy for data centre operators looking to reach fully green classification. Iceland's electricity grid is produced entirely from renewable sources with around 73% from hydropower and 27% from geothermal power.[123] Data centre operators such as EcoDataCenter[124] have already utilised the Nordic regions' support for renewable energy, with their Arctic models within Sweden's northern forest receiving all its power from several hydroelectric power plants nearby.[125]

Another benefit that these new locations have is climate. The cool temperature has significant advantages for maintaining cool rack temperature in the halls. This results in a reduced carbon footprint due to passive cooling methods. By ensuring a cool external temperature, the data centre can reduce its water consumption, as typically facilities consume less water in the winter because internal cooling systems don't need to work as hard to bring the server rooms down to optimal temperatures.[126]

In addition, former industrial and power plant sites are increasingly being considered for data centre projects. This is particularly true for Germany. Due to the phase-out of nuclear energy and coal-fired power generation, the question arises if there will be other use cases for power plant sites in the future. Such sites could be well suited for data centre projects, as they are already well developed, have sufficiently dimensioned grid connections for electricity/gas and often also have access to district heating networks that could be used to utilise waste heat.

6.4 Diversified energy sources to optimise power

Goldman Sachs suggests that data centres will continue with their efforts to decarbonise, driven mainly by sustainable regulations but also the investment industry. The 'Big Tech' companies such as Microsoft, AWS and Google will continue to lead the sector with their use of renewable energy, however it is likely many 'green' data centres will look to nuclear energy to sustain power demands.[127] Small modular reactors (SMRs) are small nuclear power reactors that boast low-carbon energy and have around 90% capacity, compared to around 25% for solar and 35%-40% for wind farms.[128]

Operators such as Equinix, Google and Prometheus have sought SMR-focused PPAs to diversify their energy sources and meet short-term energy demands.[129] AWS in 2024 made three commitments with North American SMR developers to support the construction of nuclear energy projects and supplement their energy procurement from their wind and solar energy projects, which are dependent on climate conditions for generation, through nuclear PPAs.[130] Public acceptance of nuclear energy, the cost and risks of nuclear waste and lack of financing for SMRs limit their usability for data centres to meet their long-term energy demands.[131]

By locating themselves in jurisdictions with well-established renewable energy infrastructure such as Iceland and Finland, data centres can spread their risk of power outages by maintaining a diversified portfolio of different energy sources. According to Natixis' investor survey, two-thirds of investors require a data centre to have some renewable energy use, and 45.5% consider data centres being autonomous in their renewable energy production to be very attractive to avoid intermittency issues and reduce carbon emissions.[132]

6.5 AI and digital assets

The rapid growth of AI and digital assets is reshaping the data centre industry: high-performance computing (HPC) infrastructure often presents additional challenges in power consumption and thermal management. Goldman Sachs estimates AI will increase global data centre demand by more than 160% by 2030.[133] As the environmental effects of this growth come to light, operators are already prioritising sustainability in their strategies. For example, IREN, a Bitcoin mining and AI-focused data centre provider, operates 4 data centres in North America which are powered by 100% renewable energy.[134]

AI-specific data centres have been developed by leading technology companies such as Meta and Nvidia. These are specially constructed high-data-capacity facilities, purpose-built for AI and digital asset generation as traditional data centres do not have sufficient power capacity to support high-density servers.[135] Amazon has announced its commitment to investing over $100 billion in AI-focused data centres by 2035.[136]

In addition, AI and crypto-mining data centres have also heavily invested in advanced cooling systems, typically deploying air-cooling systems, direct-to-chip cooling and immersion cooled systems to manage heat.[137] These systems offer more efficient water use.

Overall, the future of sustainable data centres lies in renewable energy integration, including on-site generation (e.g. from PV), battery storage capacity, and diversified renewable energy PPAs. As global power consumption continues to grow, operators are adopting AI-driven energy optimisation, modular designs to improve cooling efficiency and on-site renewable energy generation. Large tech companies are increasingly targeting full renewable energy utilisation throughout their data centres, with some AI and crypto-mining-focused data centres investing in on-site generation. Data centres are also investing in innovations such as waste heat recovery strategies to heat local buildings; others are utilising wastewater and closed-loop cooling systems to improve their impact on local water systems. Regulators and stakeholders are also pushing for greater accountability in data centre decarbonisation efforts, and green certifications to confirm sustainability claims.

7. IQ-EQ, Norton Rose Fulbright, ULI and BuildingMinds' vision for sustainable data centre management

IQ-EQ, Norton Rose Fulbright, ULI and BuildingMinds believe that a sustainable future for data centres involves the following key components:

- Continued innovation in energy efficiency: As technology advances, sustainable data centres will continue to adopt innovative solutions to minimise energy consumption and maximise efficiency. This includes the implementation of advanced cooling systems, utilisation of renewable energy sources, and the development of cutting-edge infrastructure designs
- Integration of ESG factors into decision-making processes: Companies managing data centres will increasingly incorporate ESG factors into their decision-making processes, ensuring that environmental, social and governance considerations are considered at every stage of operations, from site selection to equipment disposal
- Stronger collaboration between industry stakeholders: The future of sustainable data centres will involve greater collaboration among industry stakeholders, including technology providers, data centre operators, governments and NGOs. This collaboration will foster the sharing of best practices, drive innovation, and promote the adoption of global standards for sustainability

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8. Continued efforts in driving ESG performance, reducing risk, and promoting eco-friendly practices

The future of sustainable data centres will be characterised by ongoing efforts to improve ESG performance, reduce risk, and promote eco-friendly practices. Some of these efforts include:

- Setting and achieving ambitious sustainability targets: Sustainable data centres will establish and work towards ambitious targets for energy efficiency, renewable energy procurement, and carbon emissions reduction. By setting and achieving these targets, data centres can demonstrate their commitment to sustainability and contribute to global climate goals
- Investing in employee training and development: Companies managing sustainable data centres will invest in employee training and development programmes, ensuring that their workforce is equipped with the knowledge and skills needed to implement and maintain eco-friendly practices
- Building resilience through risk management: Sustainable data centres will prioritise risk management and resilience, incorporating ESG factors into their risk assessments and mitigation strategies. This will help minimise operational disruptions and ensure the long-term viability of their operations
- Engaging with local communities and stakeholders: The future of sustainable data centres will involve fostering strong relationships with local communities and stakeholders, addressing their concerns, and working together to promote sustainable development

In conclusion, the future of sustainable data centres relies on continuous efforts to drive ESG performance, reduce risk, and promote eco-friendly practices.

By embracing the vision set forth by IQ-EQ, BuildingMinds, Norton Rose Fulbright and ULI, data centres can adapt to the rapidly changing landscape of technology and sustainability, ensuring a more environmentally responsible and resilient future for the industry.

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