DCS
# DATACENTRE SOLUTIONS
DEVELOPING DIGITAL INFRASTRUCTURE IN A HYBRID WORLD

ISSUE II 2025

AN ANGEL BUSINESS COMMUNICATIONS PUBLICATION

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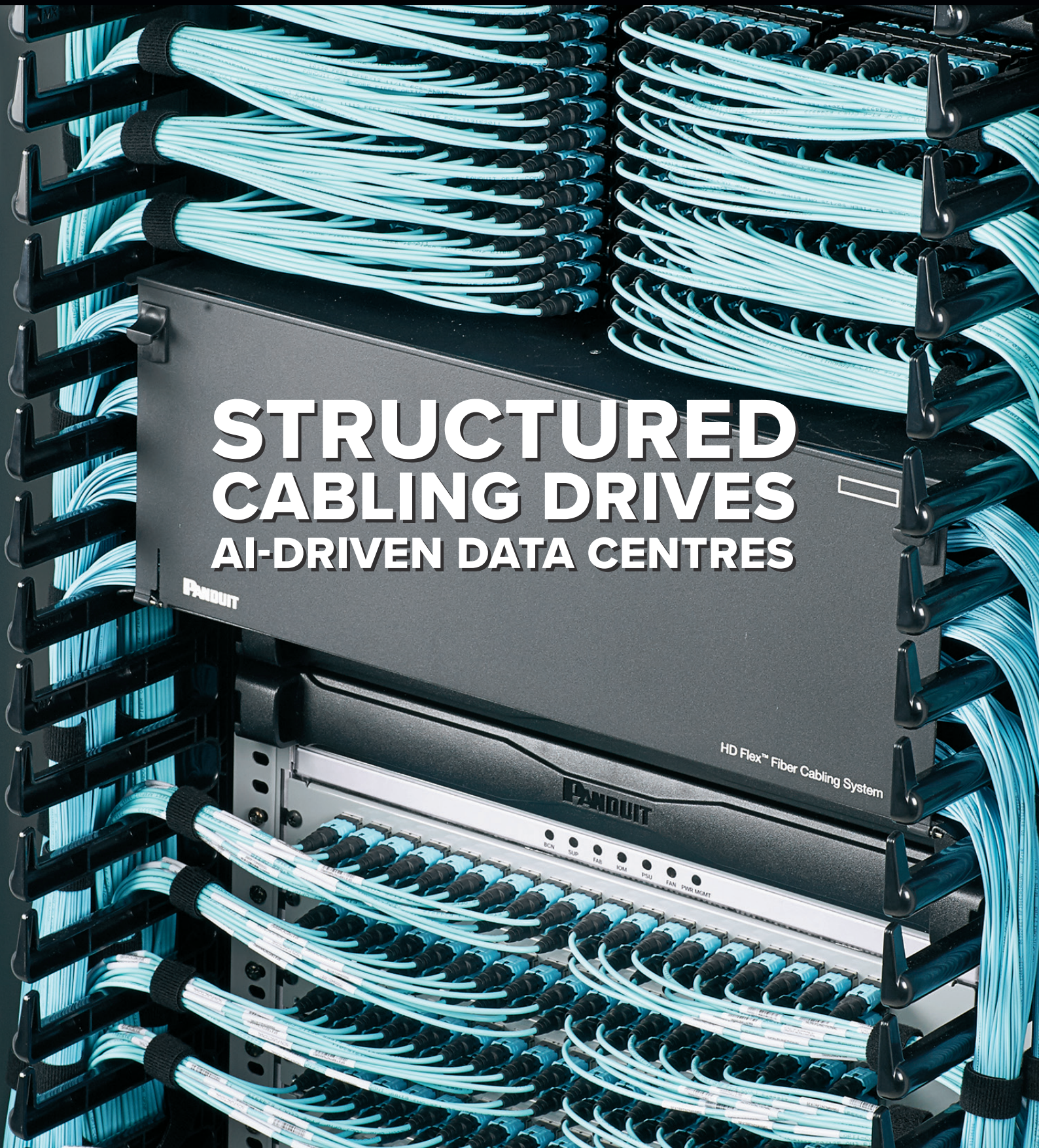


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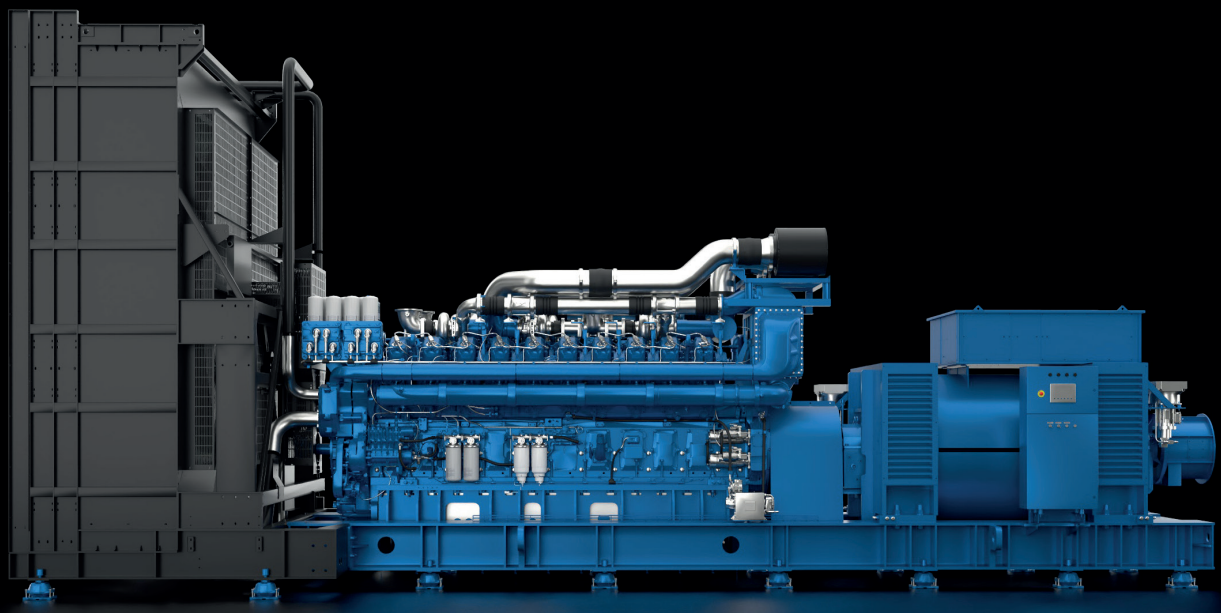

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# VIEWPOINT

BY PHIL ALSOP
EDITOR

## What price uptime?

THE RECENT fire at Heathrow Airport is an unfortunate but timely reminder of the importance of a reliable and resilient power supply for mission critical infrastructure. As of now, there seems to be a fair amount of uncertainty as to why the substation outage caused such major disruption – in other words, why was there apparently no plan in place for an alternative power supply to continue to provide electricity to the airport?

For data centre owners and operators, the Heathrow meltdown may well serve as a timely reminder to check their business continuity and disaster recovery plans, to ensure that there are no dangerous, single points of failure or indeed any potential vulnerabilities that might be exposed in the (unlikely) event of an unpredictable series of interlinked incidents which, combined, have no respect for apparently robust resiliency measures.

Many years ago, working at the time in the storage networking industry, I used to drive along the A4 on a regular basis and encounter all manner of roadworks. Back then, the cause of this disruption was the laying of cable (whereas now the roadworks are invariably down to crumbling road surfaces and potholes!). Talking to colleagues, we bemoaned the delays, but also joked that, if terrorists really wanted to paralyse the country, then a couple of cable-related explosions, plus maybe the destruction of a few motorway bridges, would do the job far more effectively than 'random' attacks in cities.

Fast forward to today, and it would appear that undersea cables (as opposed to land-based ones) are indeed being targeted by bad actors and who knows how and where other critical national infrastructure across the developed world might be targeted to case maximum impact.

Set against the increasing activity of human-caused disruption, we already have a background of climate volatility and increasingly frequent extreme weather events.

I still chuckle, although maybe I shouldn't, bearing in mind the potentially catastrophic consequences, that two of Europe's major data centre hubs are Amsterdam – approximately two metres below sea level – and London, where the Thames Barrier is all that stands in the way of extreme high tides wreaking havoc to Docklands...

Migrating data centres away from such locations is unthinkable...then again, for how much longer can we continue to rely on received wisdom when it comes to the potential consequences of doing nothing?

Back to airports to finish. The beauty of night time London viewed from a plane as it makes its way up the Thames before heading to Heathrow is breathtaking, and then I spoil it all by thinking what would happen if the plane fell out of the sky and wiped out a few of the streets below. You can be fairly certain that questions would be asked as to just who thought it was such a good idea for so many planes to fly over a MAjor city so routinely.

Sorry if all this sounds a bit bleak, but maybe it is time to question long-held assumptions and beliefs. Your data centre may not be quite as resilient as you thought.

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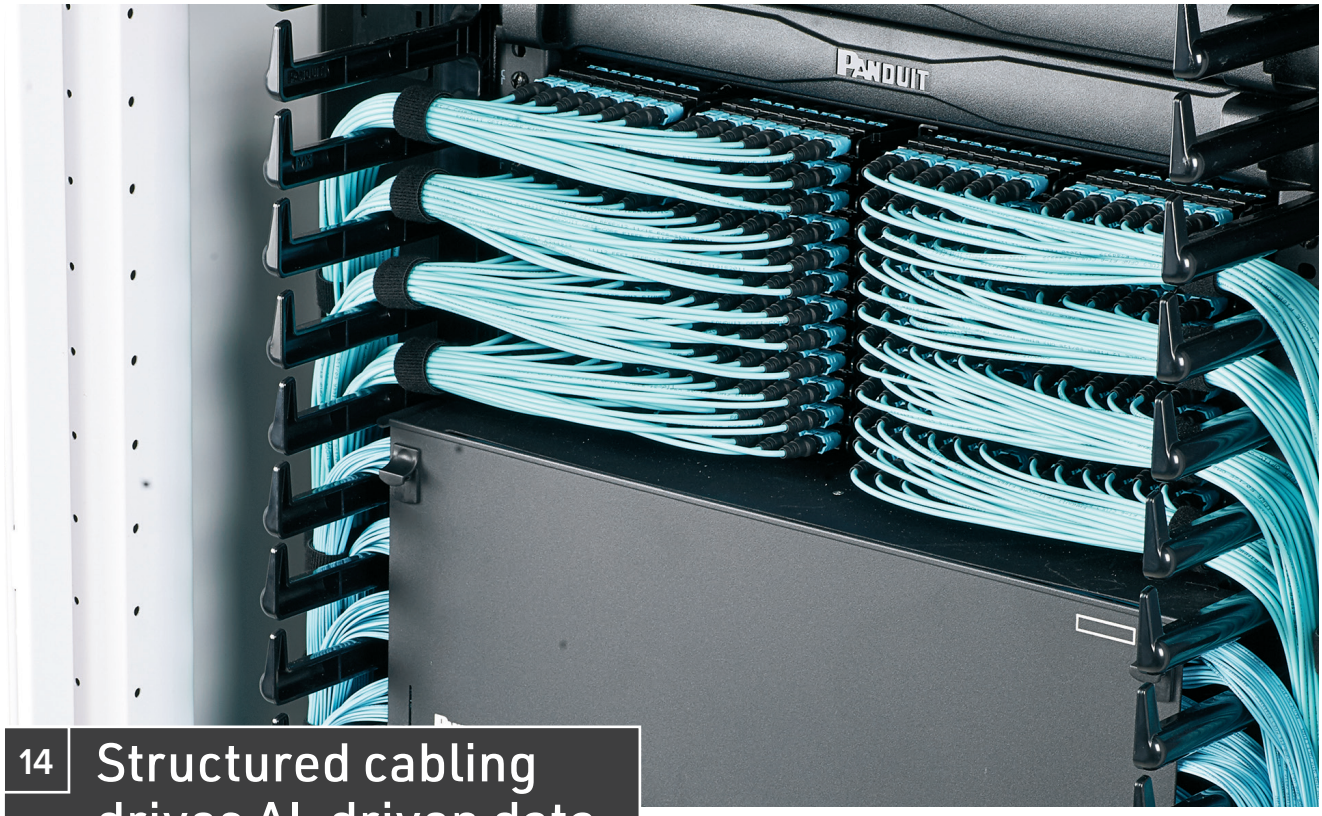


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Angel BUSINESS COMMUNICATIONS

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ISSN 2756-1143 (Online)

# Digital twins - a data centre 'game changer'

The data center industry is on the brink of rapid transformation, driven by emerging technologies that promise to reshape its future.

TO ASSESS the current ability of the data center industry to capitalize on the technologies that could transform it, Cadence's latest report, drawing on insights from 400 IT, facility, and business leaders worldwide, reveals how data centers are evolving and what changes are essential for future success. The report found that:

- 86% of decision-makers say that failing to innovate data centers would lead to serious or moderate consequences
- Three quarters (74%) say data centers are under increased pressure from AI-driven demands
- 88% say they're actively working to enhance energy efficiency, but only three-in-ten (31%) believe that they're doing enough
- 70% say the national power grid is being stretched to its limits, and there won't be enough energy to go around if we don't use renewable sources in data centers
- A quarter (26%) state that they'd never use liquid cooling

The report uncovered how opportunities for data center innovation are lost through reluctance and a lack of preparedness to incorporate transformative technology and solutions. 80% of decision-makers say their organization has the capabilities to capitalize on the technologies that could transform their data center.

However, this confidence doesn't necessarily translate into advanced technologies and approaches actually being used. A sizeable majority (73%) say they use artificial intelligence and machine learning (AI/ML). However, fewer are using renewable energy sources (63%), liquid cooling (45%), and digital twins (42%).

## Innovation obstacles

86% of decision-makers say that failing to innovate data centers would lead to serious or moderate consequences.

However, transformation is easier said than done. Data centers face various challenges when implementing innovation, with 42% of decision-makers citing the cost of implementing new technologies as the biggest barrier.

Other obstacles include a lack of skilled staff (35%), incompatibility with legacy systems (31%), and uncertainty about future technologies (30%). Additionally, 33% are hesitant to invest due to unclear ROI. All of which underscores the complexities of driving innovation.

## AI challenges and opportunities

The challenges continue as 74% of decision-makers agree that data centers are under increased pressure from AI-driven demands. This is arguably driving the uptake of high-density servers, which 59% report they are now using.

Despite the complications created by AI, it is also being harnessed as an innovative tool within data centers themselves for fault detection (60%), natural language assistants (56%), demand forecasting (54%), and automating capacity management (50%). However, adoption isn't always effortless, leading some to pull back. For example, 10% of decision-makers say they were using AI but aren't anymore.

Despite this, findings suggest future AI plans are on the horizon. Notably, while 73% of all respondents agree that the use of AI within data centers is still in its infancy, three-quarters (75%) believe that in the future, it'll be possible to use AI to run data centers in place of human operators, indicating an expansive future for the technology.

More immediately, 50% of respondents plan to use AI for energy management, highlighting its potential to drive efficiency and sustainability.

## Digital twins help address innovation challenges

73% of decision-makers believe digital twins are a game changer for driving technological innovation in data centers. This figure rises to 81% among those already using digital twins, underscoring their proven value in practice. These benefits may be why 21% of decision-makers not currently using digital twins plan to introduce them in the next 12 months.

# Data centres are fundamental to European competitiveness, but challenges remain

Providing a critical role in Europe's digital infrastructure, data centres are the foundation of digital economies, but face challenges in power availability, sustainability, and regulatory compliance.

DATA CENTRES are fundamental within the competitive international landscape, serving as crucial components of Europe's digital infrastructure, housing the IT equipment necessary for storing and processing data, and enabling the digital services that underpin European economies and society.

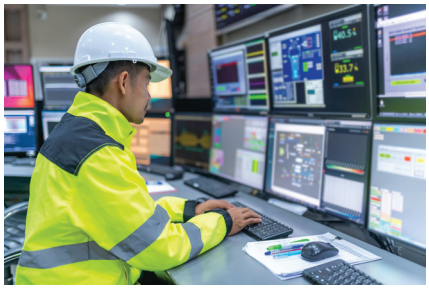
However, there are distinct challenges for the market as three quarters of data centre operators consider access to power as their biggest challenge in the next three years.

These are findings from a new report from the European Data Centre Association (EUDCA) entitled "State of European Data Centres 2025". The report aims to enhance an understanding of the European data centre market's fundamentals, opportunities, and challenges, while contributing valuable insights to foster the sustainable development of the industry in Europe.

"The digital economies of Europe could not have been built without the foundation of digital infrastructure comprising a network of more than 9,000 data centres.

To remain competitive globally and to support the continuing wave of technological development and digital transformation, the data centre industry must ensure continued focus on efficiency and sustainability while driving innovation," said Michael Winterson, Secretary General, EUDCA.

Data centres significantly contribute to Europe's socio-economic landscape, finds the report. In 2023, colocation data centres alone accounted for €30 billion in GDP, with forecasts predicting €83.8 billion by 2030, alongside the creation of thousands of direct and indirect jobs.



## Energy use and sustainability

To meet sustainability challenges, three quarters already employ environmental or energy management systems, half use residual heat coupling, and almost half (47%) employ IT equipment recycling practices.

Sustainability is a guiding principle for data centres in Europe, and widespread support and adoption of voluntary measures such as the Climate Neutral Data Centre Pact (CNDCP) demonstrate not just commitment but the will to go beyond compliance.

Markets and growth The market is expanding rapidly, with demand outstripping supply and attracting billions of euros in investments. This growth boosts GDP, creates jobs, and supports digital sovereignty. Major centres of activity include Frankfurt, London, Amsterdam, Paris, and Dublin (FLAP-D), with intense activity in emerging hubs in the Nordics and Southern Europe.

The report finds the industry faces challenges related to power availability, sustainability, and regulatory compliance as new reporting obligations came recently into effect. However, these challenges also present opportunities for innovation in energy efficiency, flexibility, and heat reuse. The sector's continued growth will necessitate ongoing investments in sustainability to minimise environmental impact. The European data centre market is poised for significant growth, driven by digitalisation, cloud adoption, and AI advancements. Addressing key challenges such as power constraints, regulatory compliance, technical skills shortages, and sustainability pressures will be crucial to maintaining this growth. Continued investment in green technologies, streamlined regulatory frameworks, and workforce development will be essential to ensure Europe's competitiveness in the global digital economy.

## Global AI adoption to surge 20%

AI adoption has skyrocketed over the past years as businesses and individuals increasingly integrate AI-powered tools into everyday life. In 2020, less than 116 million people used AI daily, a figure that nearly tripled to 314 million last year. But the momentum is far from slowing down, with projections showing tens of millions of new users embracing AI this year.

According to data presented by AltIndex.com, global AI adoption is expected to jump by another 20% and hit 378 million users in 2025.

Nearly 65 Million New Users in 2025 Alone, the Highest Annual Increase Yet In just five years, artificial intelligence has transformed from a futuristic concept into a mainstream technology revolutionizing industries and changing daily life. From healthcare and retail to manufacturing, stock trading, and social media, companies increasingly turn to AI to enhance efficiency, decision-making, and user experience. As AI technology becomes an essential tool, its user base is reaching record highs.

Just five years ago, the global AI market counted roughly 116 million users, according to a Statista Market Insights survey. B

# Data Centres investing In nuclear, fuel cells, and Li-ion batteries

The unprecedented growth in AI has seen power demand for data centers skyrocket.

DATA CENTER hyperscalers want new grid capacity added using electricity generation methods that align with their ambitious sustainability goals. Amazon, Microsoft, Meta, and Google are already established as leading corporate wind and solar power buyers globally. Such funding has enabled new wind/solar projects to reach a level of maturity where they are now competitive with fossil fuels.

IDTechEx's "Sustainability for Data Centers 2025-2035: Green Technologies, Market Forecasts, and Players" report found that emerging energy solutions such as small modular nuclear reactors, hydrogen and fuel cells, enhanced geothermal systems, and grid-scale Li-ion batteries are now seeing increased investment from the data center space. With momentum building for increased focus on hourly time-based energy matching when accounting for power-based scope 2 CO2 emissions, carbon-free energy sources without the intermittent nature of wind/solar are needed. While these emerging energy technologies are currently more expensive than fossil fuels, sending demand side signals for higher capacity factor carbon-free energy generation and/or energy storage is the next step for grid decarbonization.

Most new solar/wind installations nowadays have an LCOE (levelized cost of electricity) below fossil fuels, but this wasn't the case only a decade ago. For data center hyperscalers with money to spend on future-proofing operations sustainably, there are reasons to be confident that investing in early-stage carbon-free energy solutions now can lead to decreased energy costs in the long term. IDTechEx forecasts that by 2035, the global data center sector will have saved US$150 billion by using low-carbon energy sources compared to a fossil fuel scenario (taking 2024 as the baseline). Some emerging energy technologies expected to play an increasingly important role are explored below.


Small modular nuclear reactors
In 2024, data centers triggered a resurgence in interest for nuclear power solutions. These approaches ranged from reopening decommissioned large-scale nuclear plants to nuclear fusion ambitions, to support for small modular reactors.

Small modular reactors (SMRs) promise cost reductions and shorter construction times relative to their conventional counterparts by taking advantage of assembly line production. However, wider adoption will require technical and regulatory developments, including development in fuel supply chains and international licensing standardization.

### Hydrogen and fuel cells

Renewable energy can be converted into hydrogen using electrolyzers and stored for long periods. Fuel cells are advanced energy systems that convert this hydrogen gas back into electricity through a chemical reaction with oxygen. Because solid oxide fuel cells have a long operating lifetime and fuel flexibility, they are well-suited to the continuous power generation required for data centers. Some data centers are already utilizing these solid oxide fuel cells running on natural gas, with plans to transition to low-carbon hydrogen once economic and infrastructure can make this commercially feasible.

### Enhanced geothermal

The number of sites suitable for conventional geothermal power plants worldwide is quite limited. However, developing enhanced geothermal technologies could greatly increase the number of viable locations. Both Google and Meta support upcoming enhanced geothermal installations that aim to demonstrate commercial viability, deploying technologies from startups such as Sage Geosystems and Fervo Energy.

### Grid-scale Li-ion batteries

Battery energy storage would increase the number of hours per day that data centers can be powered by solar/wind energy. Over the past decade, Li-ion batteries have become an increasingly important stationary energy storage technology suitable for grid-scale applications. When scaling up these technologies, players are prioritizing different performance characteristics such as storage duration or energy density.

# Dell'Oro Group raises market forecast for liquid cooling and rack power distribution

According to a recently published report from Dell'Oro Group, it has raised its forecast of the Data Center Liquid Cooling and Rack Power Distribution segments of the Data Center Physical Infrastructure (DCPI) market. We are now predicting DCPI market revenues to increase at a 14 percent CAGR from 2024 to 2029, to $61 billion

"WE RAISED our outlook as a result of three factors," said Tam Dell'Oro, Founder of Dell'Oro Group. "First, actual results through 2024 exceeded our predictions, second, shipments of accelerated computing (and high-end GPUs), designed to handle AI workloads exceeded our prior forecast and we have learned that demand – which remains robust – is spreading from Tier 1 to Tier 2 Cloud Service Providers. Third, governments and Tier 1 Telecom Operators are becoming involved in enabling data center expansion, which means this is a long-term trend. DCPI deployments are a prerequisite to support AI workloads. "The proliferation of accelerated computing to support AI and ML workloads has emerged as a major DCPI market driver which is significantly increasing data center power and thermal management requirements.

For example, the average rack power density today is around 15 kW/rack, but AI workloads will require 60 – 120 kW/rack to support accelerated servers in close proximity.

While this jump in rack power density will trigger innovation and product development on the power distribution side, a bigger change is unfolding in thermal management – the transition from air to liquid cooling," added Dell'Oro.

Additional highlights from the Data Center Physical Infrastructure 5-Year January 2025 Forecast Report:

- Forecast strong growth in 2025 and 2026, as Tier 1 and some Tier 2 Service Providers deploy "at-scale" accelerated computing and the DCPI infrastructure to support it.
- Asia Pacific (excluding China), North America and Europe, the Middle East, and Africa (EMEA) are forecast to grow at the fastest CAGRs during the forecast period.
- Although the Top 10 Cloud SPs will build purpose-built facilities for AI inferencing, Colocation (wholesale and retail) to play a bigger role in building AI inferencing facilities over the long term.

# Data centre capex to surpass $1 trillion by 2029

"WE PROJECT that data center infrastructure spending could surpass $1 trillion annually within five years. While AI spending has yet to meet desired returns and efficiency improvements, long-term growth remains assured, driven by hyperscalers' multi-year capex cycles and government initiatives such as the $500 billion Stargate Project," said Baron Fung, Senior Research Director at Dell'Oro Group. "Although recent advancements in AI model training efficiency from DeepSeek have been disruptive, innovations have been in progress for some time to drive greater efficiencies and lower the total cost of ownership in building and operating AI data centers. Key areas of focus include advancements in accelerated computing through GPUs and custom accelerators, LLM optimizations, and next-generation rack-scale and

network infrastructure—all crucial to enabling sustainable growth from both a cost and power perspective," Fung explained.

Additional highlights from the Data Center IT Capex 5-Year January 2025 Forecast Report:

Worldwide data center capex is forecast for a CAGR of 21 percent by 2029. Accelerated servers for AI training and domain-specific workloads could represent nearly half of data center infrastructure spending by 2029. While the Top 4 US-based cloud service providers (SPs)—Amazon, Google, Meta, and Microsoft—will account for nearly half of global data center capex in 2025, select Tier 2 cloud SPs are poised to increase capex significantly over the next several years.

# Knight Frank unveils 2025 Global Data Centre Forecast

Knight Frank, the leading global real estate consultancy, has released its Global Data Centres – Forecast Report 2025, with insights on the sector's key market trends, the impact of technological advancements, and the challenges shaping the sector worldwide.

THE REPORT identifies artificial intelligence (AI), hybrid cloud adoption, and the relentless demand for data as the primary forces propelling growth in the global data centre market. As enterprises seek scalable, high-performance computing solutions, data centre operators are responding with rapid expansion and innovation to meet bespoke customer needs.

Power availability, sustainability imperatives, and regulatory complexities are becoming increasingly influential in shaping investment decisions.

While demand continues to outstrip supply, the market is witnessing strong investment activity, particularly in Tier 2 and Tier 3 cities, which offer alternative locations with more accessible land and power infrastructure.

**Regional insights**

**EMEA:** Major data centre hubs such as London, Frankfurt, Amsterdam, Paris, and Dublin (FLAP-D) remain critical, but developers are expanding into emerging markets including Lille, Düsseldorf, North England, Lisbon, and Bilbao. Power constraints and regulatory pressures are key concerns.

**APAC:** The region is set for aggressive expansion, with strong investor interest in both primary and secondary markets.

High-profile acquisitions, such as Blackstone's purchase of AirTrunk, underscore the sector's appeal. Cities like Melbourne, Chennai, and Osaka are emerging as key locations alongside established hubs in Sydney, Mumbai, and Tokyo. Unlike EMEA, where power constraints and regulatory hurdles are dominant challenges, APAC markets face unique obstacles such as fragmented regulatory frameworks, land scarcity, and infrastructure limitations. However, the region's rapid AI adoption and increasing cloud demand position it as a crucial growth driver for global data centre expansion.

North America: Home to nearly half of global live IT capacity, North America continues to dominate the sector. AI-driven demand is tightening vacancy rates, driving up rental costs, and accelerating the development of new powered-shell facilities.

**Sustainability and the future of data centres**

Sustainability has transitioned from a priority to an imperative. Data centre operators are adopting renewable energy solutions, advanced cooling technologies, and efficient infrastructure designs to align with global climate goals. Regulatory frameworks are also evolving, introducing stricter environmental and cybersecurity requirements.

Stephen Beard, Global Head of Data Centres Development & Investment at Knight Frank, commented: "The data centre market is at a pivotal moment, experiencing unprecedented demand driven by AI, cloud computing, and digital transformation. While challenges such as power availability and regulatory complexities persist, the opportunity for investment, innovation, and sustainable expansion has never been greater. Knight Frank's global platform, combined with our deep market insights, positions us uniquely to guide investors and operators through this evolving landscape."

The data centre market is at a pivotal moment, experiencing unprecedented demand driven by AI, cloud computing, and digital transformation. While challenges such as power availability and regulatory complexities persist, the opportunity for investment, innovation, and sustainable expansion has never been greater

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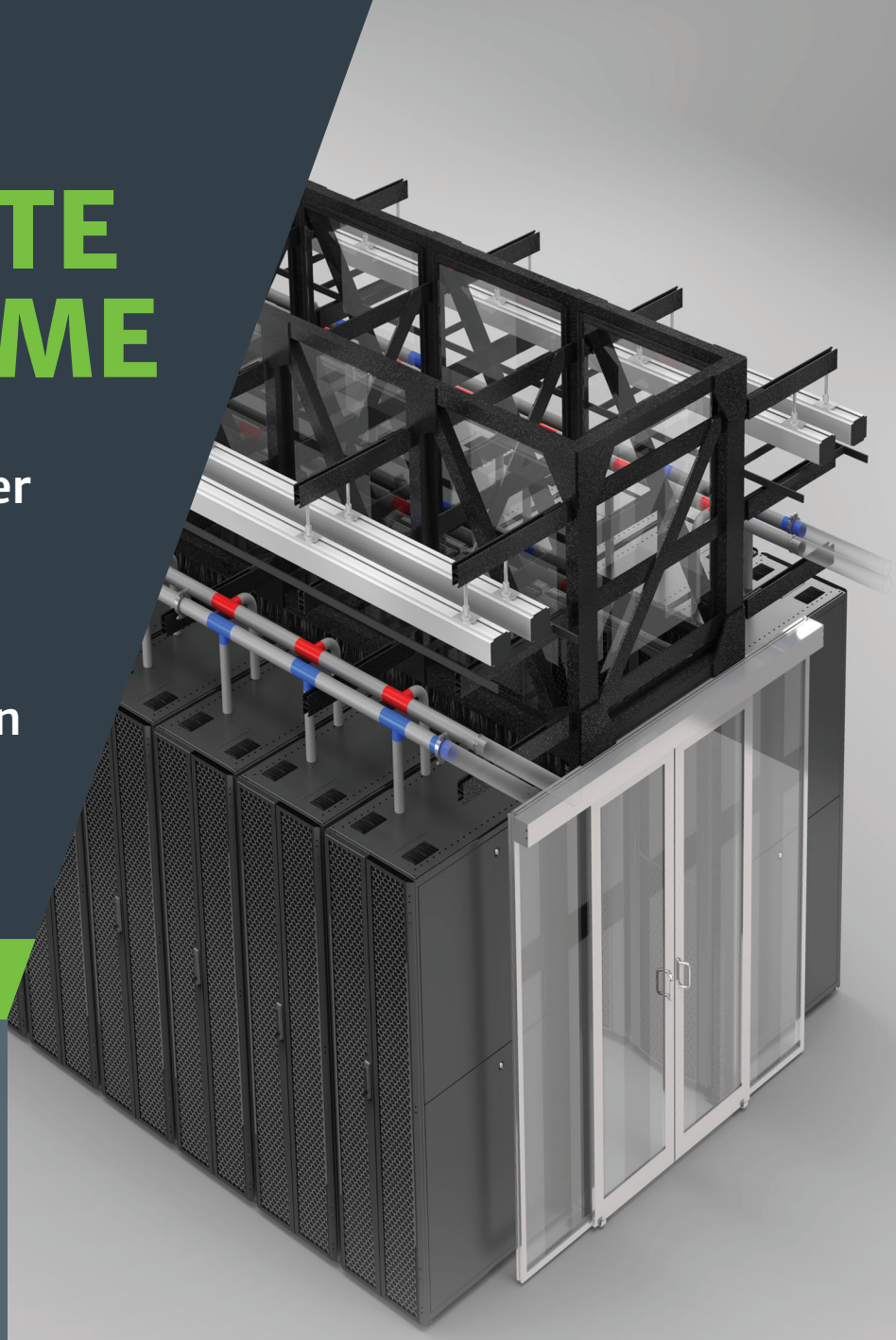

SUBZERO ENGINEERING

# Global data centre energy consumption to exceed 2000 TWh in 2035

By 2035, IDTechEx forecasts that the continued growth of artificial intelligence will result in over 2000 TWh of energy being consumed by data centers.

THE EXPECTED increase in CO2 emissions from powering these new data centers creates a dual challenge for both governments with net-zero targets and tech giants with internal carbon neutrality pledges alike: how can the unprecedented rise of AI be supported without causing major harm to the environment?

The new report published by IDTechEx, "Sustainability for Data Centers 2025-2035: Green Technologies, Market Forecasts, and Players", characterizes green data center technologies, players, and markets, focusing on cost and commercial viability. With coverage across solutions for reducing scope 2 emissions (renewable power generation and energy efficiency on the data center componentry level) and scope 3 emissions (carbon credits, green concrete, and decarbonized IT manufacturing), spanning over 170 companies, it provides comprehensive market intelligence for the data center space. Market forecasts until 2035 are included, covering global data center CO2 emissions, power and electricity consumption, and savings from carbon free energy usage.

## Decarbonized power generation

Rapid growth in the data center construction is starting to stretch grid capacity to its limits in some regions. To expand in a way aligned with sustainability goals, data center hyperscalers are increasingly playing a more active role in bringing new renewable energy projects online beyond standard power purchasing agreements (PPAs) and renewable energy certificates (RECs). For example, early microgrid projects exploring on-site off-grid power generation for data centers are emerging.

Wind and solar power have long been favored by data center players


due to a low LCOE (levelized cost of electricity) that is often below fossil fuel alternatives. However, the intermittency of these renewables means fossil fuel power generation is still needed for many hours per day. There is building momentum to change the way scope 2 power emissions are accounted for under the GHG Protocol to favor hourly time-based energy matching so that demand side signals can be sent for emerging low-carbon energy technologies to better facilitate the continuous power demand of data centers.

The new IDTechEx report, *"Sustainability for Data Centers 2025-2035: Green Technologies, Market Forecasts, and Players",* examines such technologies, including hydrogen fuel cells, enhanced geothermal energy, small modular nuclear reactors, and grid-scale Li-ion batteries. Key players and case studies in the data center space are identified, and the economic/technical factors that determine which emerging energy solutions hold the most promise for green data centers over the next ten years are discussed.

## Improving energy efficiency

Existing policies surrounding data center decarbonization, such as the EU Energy Efficiency Directive, relate to the energy efficiency (PUE – power use efficiency) of data centers. If less power can be consumed per data center through improved thermal efficiency, electrical efficiency, and IT efficiency, the environmental impact is minimized. Therefore, from purpose-built chips, memory modules, to cooling components and AC/DC converters, data center players are racing to enhance energy efficiency.

As the data center sector transfers over from traditional air cooling to direct-to-chip liquid cooling, bringing reductions in greenhouse gas emissions, water usage, and energy consumption, tradeoffs in other metrics, such as cost and complexity, must be considered.

## Reducing Scope 3 emissions

Typically, scope 3 emissions represent the majority of CO2 emissions from data centers. Key factors contributing to scope 3 emissions include upstream manufacturing/assembly of servers and networking equipment used in data centers and emissions related to data center construction. In 2023, Microsoft's Scope 3 emissions were 30.9% higher than in 2020, which was attributed to the embodied carbon in building materials, as well as hardware components such as semiconductors, servers, and racks.

Because Scope 3 emissions are indirect emissions in a company's value chain that are not caused by the company itself, it can be hard for data center players to tackle scope 3 emissions. IDTechEx explores three different ways for companies to reduce scope 3 emissions in its new Sustainability for Data Centers report: (1) Purchasing carbon credits (specifically carbon removal credits) to counteract hard-to-avoid CO2 emissions, (2) Using low-carbon materials in data center construction (green concrete, green steel, and timber) either physically or through attribute purchases (book and claim), and (3) Choosing IT hardware with lower embodied/manufacturing carbon over the lifetime of a data center.

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# Structured cabling drives AI-driven data centres

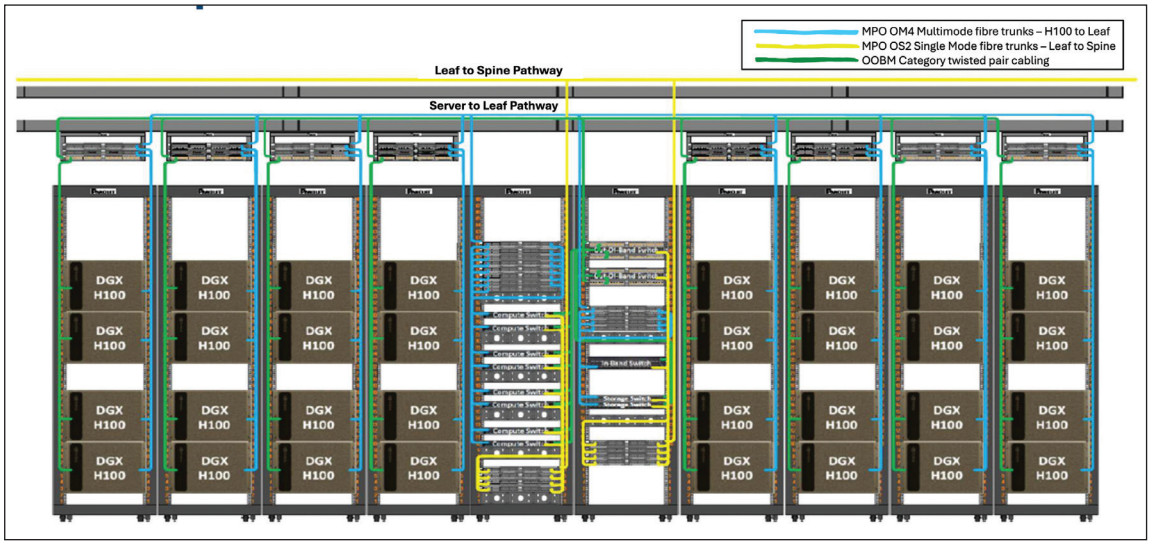
Artificial Intelligence (AI) training and inference sessions are driving data centre operators' requirements towards increasingly higher network data speeds; through 400Gb/s, beyond 800Gb/s, towards 1.6Tb/s, and today's high specification fibre cable can handle speeds comfortably in those ranges.

**BY MICHAEL AKINLA, MANAGER, NORTH EUROPE, PANDUIT**

STRUCTURED CABLING is the foundation for ensuring scalability, efficiency, and performance for AI workloads. The exponential increase in data transmission demands has led to significant shifts in cabling design, transitioning from traditional low-density connections to high-density, scalable, and efficient infrastructures. This article explores the impact of AI workloads on structured cabling and highlights various considerations for maximising performance, reliability, and return on investment. AI-driven networks require vast computational power and seamless high-speed data transmission.

As a result, the traditional network architectures are evolving to meet these increased demands. Traditional duplex LC connections, which utilise two fibres per link, are being replaced by MPO-based connectivity. AI GPU based servers use eight fibre MPO-08 and as detailed in IEEE 802.3df aggregated 800G data rates over 8 duplex lanes (16 fibre) for multimode (MM) 800GBASE-SR8 and single mode (SM) 800GBASE-DR8 channels and not two fibre duplex LC like traditional servers. This effectively quadruples the number of fibres at a minimum when the current 8 fibre MPO's are deployed in AI Pods within a data centre, and with AI generally needing very high numbers of servers, the overall density of fibres can be as much as 8x more using conservative estimates than in traditional data centres.

This transition also facilitates the already prevalent move to parallel optics infrastructures and together with the massive increase in fibre utilisation by as stated a factor of eight. This shift is necessary to accommodate the bandwidth growth required for AI,




➤ SuperPod with overhead distribution racks.

| | Structured Cabling | Point to Point Cabling |
|---|---|---|
| Low Latency | Good<br>Fiber connectors do not affect Latency | Good<br>Fewer components |
| High Cable Density | Good<br>Can consolidate multiple cables into few higher count trunks reducing pathway usage by up to 70% | Poor<br>Higher number of cables = more congestion |
| Ease of Installation | Good<br>Simpler to run Permanent Link before cabinets are installed and add jumpers later | Medium<br>Only one cable from Server to Switch, but difficult to debug / rework |
| Slack Cable Management | Good<br>Panels offer space for slack and Jumpers are simple to estimate length = less slack | Poor<br>Difficult to correctly measure length = more slack |

➤ Panduit labs have tested structured links for AI to ensure link performance.

but it also introduces new challenges related to fibre density and management.

The rapid adoption of 400Gb/s and 800Gb/s network speeds requires significantly more fibre links. AI clusters rely on APC multi-fibre MPO connections for server to leaf links, and your more traditional single-mode MPO connections for leaf to spine links, which means fibre volumes have increased exponentially. Without a structured approach, data centres risk excessive cable congestion, increasing difficulty in maintenance and reducing airflow optimisation.

AI workloads operate within clustered architectures, often requiring shorter cabling runs, with a large percentage of AI networks built in <50m SuperPods. This means the concern over propagation latency due to the additional connection points that structured cabling introduces is not a concern, as light propagation delay over such distances (<50m per SuperPod) remains below 250 nanoseconds, which is negligible compared to switching and signal processing delays.

The misconception that structured cabling introduces excessive latency compared to direct point-to-point cabling is being countered with strong evidence that latency from structured cabling is minimal. Moreover, most delays in AI networks arise from forward error correction (FEC) and buffering at the switch level, not from the additional fibre connectors which only introduce optical loss. One of the concerns against structured cabling in AI networks is the added connector loss that may cause channel performance risk. This argument should be discussed by pointing out that when working with transceivers fully compliant with Ethernet channel specs which allocate connectivity losses of 1.5 dB for MMF channels and about 2.5dB for SMF channels. The concern can be addressed even when looking at proprietary designs, there is extensive testing that shows when keeping connector losses within the mentioned limits and observing good installation and cleaning practices with links will comply with IEEE 802.3df. Thus, a well-designed structured cabling infrastructure does not negatively impact latency-sensitive AI workloads.

### Implementing structured cabling in AI workloads

To maximise return on investment, optimise longevity, and ensure seamless operation, structured cabling systems must be designed with the following criteria in mind.

### Scalability and modularity

Data centres must implement modular patch panels and high-density MPO cabling to allow for seamless upgrades as network speeds increase. A structured approach allows for better management of fibre expansion without requiring frequent overhauls.

### Optimised cable pathways and management

High-density cabling can lead to congestion in pathways, negatively impacting airflow and serviceability. Structured cabling mitigates these risks by consolidating multiple fibre runs into high-count trunks. This approach significantly reduces the physical footprint of fibre pathways, with estimates showing a reduction of up to 70% in pathway utilisation when structured cabling is deployed.

### Reliability and reduced network downtime

Structured cabling improves maintainability and minimises risks associated with excessive cable slack, improper bend radii's, and disorganised cable management. Implementing structured pathways ensures that connections are well-documented, labelled, and accessible, which simplifies troubleshooting and reduces mean time to repair (MTTR).

### Futureproofing with high-density connectivity

The transition to high-speed networking requires


➤ Panduit Fibre Connectivity

infrastructure that supports evolving standards. The shift towards 16-fibre MPO connectors for 800Gb/s deployments allows for network scalability while maintaining compatibility with existing 400Gb/s systems. Investing in structured cabling that accommodates future higher-density connectors ensures a seamless migration path for increasing bandwidth needs.

### Energy efficiency and sustainability

As AI workloads consume significant amounts of power, structured cabling can contribute to power efficiency through the adoption of multimode fibre. Multimode transceivers consume up to 15% less power than their single-mode counterparts, making them an attractive option for AI workloads operating within shorter reach distances.

## Structured cabling vs point-to-point cabling in AI networks

While some organisations still rely on direct point-to-point cabling for their high-speed AI networks, this approach introduces several challenges:

### Increased fibre management complexity

Point-to-point cabling can create a chaotic infrastructure with excessive slack, making moves, adds, and changes difficult.

### Limited scalability

Expanding point-to-point networks requires additional fibre runs, which leads to congestion and inefficient space utilisation.

### Higher operational costs

The difficulty of maintaining and troubleshooting point-to-point systems increases operational expenses over time.

By contrast, structured cabling provides a well-organised, scalable, and maintainable network infrastructure that is better suited for AI-driven environments.

Good installation practices and complying to industry standards, such as IEEE802.3df for 800Gb/s over multimode fibre, provide guidelines that help maintain network integrity and facilitate future upgrades, while also ensure compatibility and performance consistency as well as longevity and reliability of the cabling infrastructure. Factors such as mapping and documenting the physical infrastructure are critical especially as network speeds get progressively faster. Complete and accurate records must be kept from day one to create a data base that can be used to audit current installations and are invaluable when changes need to be made.

## The roadmap to 1.6Tb/s and beyond

The future of structured cabling is evolving in line with industry trends. As networking standards advance towards 1.6Tb/s and beyond, structured cabling solutions must adapt. Emerging technologies such as co-packaged optics (CPO) and next-generation small form-factor connectors, such as MDC, are expected to further optimise fibre management in AI workloads.

Additionally, enhanced modulation techniques such as PAM-4 will enable higher transmission rates over existing fibre infrastructure, reducing the need for frequent cabling replacements.

AI-driven workloads demand high-speed, high-density network infrastructures, making structured cabling essential for modern data centres. The transition from LC to MPO, increasing fibre density, and the need for scalable, efficient network architectures highlight the importance of a structured approach.

By implementing best practices in structured cabling, organisations can optimise network performance, minimise latency concerns, reduce pathway congestion, and ensure a future-proof infrastructure.

With AI workloads continuing to expand their effect on our daily lives, a structured cabling approach is not just beneficial, it is a necessity for ensuring seamless operation, scalability, and long-term reliability in high-performance data centres.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# Data centres will be at the epicentre of a new AI ‘ramp up’ but there will be many challenges

The UK government recently announced what it called its ‘AI Opportunities Action Plan’ which recommended ways to grow the UK’s artificial intelligence sector, drive adoption of AI across the economy to boost growth and improve products and services.

**BY BEN PRITCHARD, CEO, AVK-SEG**

THE GOVERNMENT also revealed plans to set up a number of ‘AI Growth Zones’ with the aim of unlocking investment in AI-enabled data centres and support infrastructure by improving access to power and facilitating planning.

This all sounds very promising but what do these announcements mean for the energy industry and how can data centre developers and operators optimise their power/energy solutions to facilitate the proliferation of high-density AI workloads? At first glance, the challenges seem immense, although not insurmountable.

Before we get into the detail, we need to understand exactly what these government initiatives consist of.

## ‘Ramping up’ AI adoption

The AI Opportunities Action Plan has been described by the UK government’s Department for Science, Innovation and Technology as “a roadmap to capture the opportunities of AI to enhance growth and productivity and create tangible benefits for UK citizens”. Put another way, the aim is to “ramp up” AI adoption across the UK to boost economic growth, provide jobs for the future and improve people’s everyday lives. AI must be harnessed to enhance healthcare and education, improve how citizens interact with their government and increase the prevalence of AI in people’s working lives to open up new opportunities.

Pointing out that the UK is the world’s third largest AI market, the government says the plan is based

around three core goals – invest in the foundations of AI, position the UK as the best state partner to those building frontier AI and push hard on cross-economy AI adoption. The government says: "The public sector should rapidly pilot and scale AI products and services and encourage the private sector to do the same."

The plan, then, is to build a secure and sustainable AI Infrastructure within the UK, which involves having access to sufficient computational power. This means data centres capable of housing the large and complex computers that are required for AI model training, inference and real-time inference.

Tied in with this opportunities programme is the creation of AI Growth Zones (AIGZs) that are designed to facilitate the accelerated build-out of AI data centres. For example, AIGZs could benefit from a streamlined planning process that is focused on delivering clean power. At the same time, the government is looking at other ways of boosting this build-out, including making AI data centres eligible for relief schemes that incentivise investment.

## 500MW AI infrastructure cluster by 2030

The UK government wants to build strategic partnerships with AI developers to work on shared AI and AI-enabled priorities. More specifically, the government is looking to work with data centre developers and energy solutions firms to establish at least a 500MW AI infrastructure cluster by 2030. Officials are particularly interested in strategic proposals that go beyond data centre developments to contribute to the UK's broader AI ecosystem, including research, innovation, skills development and energy solutions.

The government wants key players within the AI sector to:

- Set out a clear pathway to 500MW+ capacity, including rough timelines and key development milestones
- Identify what support is needed from government to unlock development
- Indicate any partnership opportunities with local authorities and/or ways in which an AI Growth Zone proposal would support the UK's wider AI ecosystem beyond providing greater computing power

At the same time, local authorities are going to be tasked with offering:

- Sites with large existing power connections (100MW+)
- Deindustrialised areas with land and infrastructure suitable for redevelopment
- Locations near land suitable for hosting low carbon power generation and storage
- Regions with an existing tech or industrial base that could benefit from AI infrastructure and support the formation of a wider innovation hub

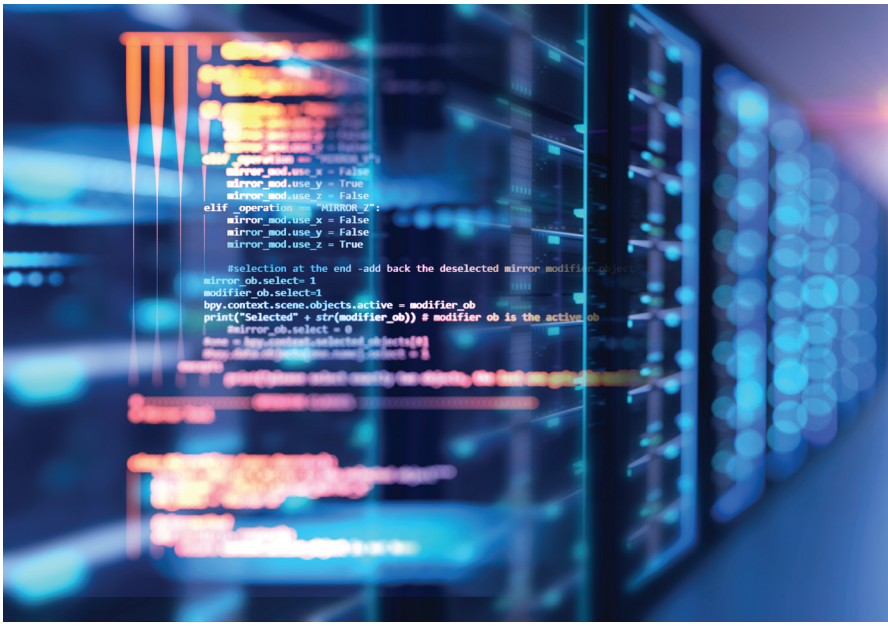
> By being "technology agnostic", AVK is able to focus on delivering the optimal power solution through the application of the very latest technology, backed by the expertise and experience of such impressive and long-standing partners as Wärtsilä and Rolls-Royce Power Systems

## The energy implications of AI expansion

So far so good, but what do all these plans mean for data centre producers and operators and how do they impact the energy sector in general? It's clear that such ambitious plans for an AI-driven future demand careful management of energy resources combined with intelligent infrastructure development.

As we know from experience, AI models require high-density computing which leads to an inevitable increase in demand for energy. It follows then that AI Growth Zones are likely to accelerate the demand for scalable and sustainable power solutions and this development is especially rife with challenges and likely risks. Apart from the ever-present potential problem of rising energy costs, there are the obvious grid constraints that a massive expansion of data centres could expose. Capacity is already a problem on some existing power grids and the UK government's AI drive will undoubtedly test limitations.

Also, sustainable power sources within the AI-powered industries will need to be reliable (and let's not forget that even sustainable power solutions can sometimes have environmental impacts). Shifts in



government policies and regulations can affect the viability and funding of sustainable power projects, so there will be a significant challenge for stakeholders to keep up-to-date with regulatory changes and ensure continued compliance. Finally, investing in future-proof technologies is equally important but can also incur unforeseen and even significant costs.

## How can data centres optimise their power solutions?

This drive to AI and sustainable development highlights the importance of data centre developers and operators having resilient and flexible energy strategies in place.

To this end, AVK offers a range of sustainable power solutions that reduce reliance on traditional power sources and ensure uptime and reliability. These include full prime microgrids. Offering a resilient and flexible power supply, microgrids can integrate renewable energy sources and provide backup power during outages. Other solutions include renewables, standby options, hydrogen-powered backup and battery storage. Storage solutions can enable energy loads to be managed more effectively, with excess energy stored when demand is low for release during more peak periods. In addition, to flag up inefficiencies and opportunities for improvement, AVK specialises in the implementation of advanced energy management systems (EMSs) that enable users to monitor and control their energy usage in real-time.

By being "technology agnostic", AVK is able to focus on delivering the optimal power solution through the application of the very latest technology, backed by the expertise and experience of such impressive and long-standing partners as Wärtsilä and Rolls-Royce Power Systems. Through these collaborations, AVK is used to working with customers on their future roadmaps. That's why the company is committed to future-proofing its products and developing solutions that are not short-term sticking plasters but instead are designed around long-term sustainability goals. AVK's commitment to minimising the environmental impact of installations also stretches to the company investing in local production and supply chains.

In short, data centres are able to manage energy consumption better while lowering operational costs through effective load management. Strategies for energy efficiency can include advanced cooling technologies such as free, liquid and adiabatic. Also, server virtualisation, consolidation and optimisation can lead to lower numbers of servers being required.

## Conclusion

The premise behind the UK government's initiative on increasing the adoption of artificial intelligence through its action plan and AI Growth Zones is promising but the market has to be ready. The reality is that this new strategy is going to create a number of new challenges for data centre developers and operators who will need to be sure they are putting the best solutions available into practice while always complying with the very latest requirements. AVK stands ready to work with key players to ensure these energy challenges are met head-on in a practical, sustainable and affordable way.

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# Are colocation data centers the right partner for universities to meet their sustainability goals?

Higher education in the United Kingdom is facing funding pressures. Frozen domestic fee caps, rising operational costs and potential decreases in international student fees are putting universities under significant budgeting constraints.

**BY IAN FERGUSON, REGIONAL DIRECTOR FOR EMEA, ICEOTOPE**

ACCORDING to the Office for Students, 40% of higher education providers in England were projected to operate at a deficit by the end of last term, a concerning trend that underscores the sector's financial vulnerability.

At the same time many universities are turning to artificial intelligence to support groundbreaking research across healthcare, environmental science, cybersecurity and more. Budget constraints are impacting essential infrastructure upgrades and equipment renewals required for their high-performance computing infrastructure. IT departments are being forced to stretch their existing resources, some of which have been in use for over a decade, and in some cases look for alternative sources of compute.
Colocation data centers can help. These facilities rent space to businesses, universities and other organisations to house servers and IT infrastructure and provide power, cooling, security, and connectivity. They can be an effective and sustainable solution for universities challenged with managing their growing IT infrastructure needs. One advantage colocation data centers can offer is an alignment to a university's sustainability goals.

Universities are increasingly committed to reducing their carbon footprints and promoting sustainable practices. In 2023, the QS Sustainability Rankings were launched to measure a higher education institution's ability to tackle environmental, social and governance challenges highlighting the importance of this issue. Colocation data center providers can contribute to these efforts by offering efficient energy management and cooling solutions, like liquid cooling, that significantly reduce the environmental impact compared to traditional on-campus data centers.

Colocation also offers universities flexible options for managing their IT workloads. Depending on workload demands, universities can take advantage of "compute as a service" types of models where the compute infrastructure is owned and managed by a colocation provider and the university pays for the service as needed. This allows universities to cost-effectively scale their computing power without the upfront investment in hardware, something particularly attractive when institutions are faced with budget constraints. Universities can also opt to host their own infrastructure within a colocation facility. This gives them more control over their IT environment while still benefiting from the enhanced power and cooling capabilities of the data center. The operator can allocate dedicated space for university equipment and expand capacity as needed. This flexibility is crucial for universities facing challenges in upgrading their on-campus labs due to financial or logistical constraints as they can maintain their research and educational activities without costly upgrades to their own facilities.

Colocation data centers can be a versatile and sustainable solution for universities looking to enhance their IT capabilities. Universities can benefit from the advanced infrastructure, like liquid cooling, and sustainability features offered by these facilities. As universities continue to navigate budgetary pressures and the need for sustainable growth, colocation data centers will play an increasingly important role in supporting their mission to advance education and research in a cost-effective and environmentally responsible manner.

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# AI and GPU data centres: Navigating the networking challenge

The rise of artificial intelligence (AI) and its integration into industries has increasingly become a focal point worldwide. AI for IT operations (AI Ops), a practice that leverages AI to optimise and automate network management tasks, is widely expected to revolutionise network operations. However, to be effective, it requires a flexible, software-defined network control plane paired with secure remote access for provisioning, orchestration, management, and remediation.

**BY ALAN STEWART-BROWN, VP EMEA AT OPENGEAR**

TO DELIVER to its full potential, AI relies on immense computational power, much of which is delivered through modern data centres. These data centres, equipped with advanced graphics processing units (GPUs), have become the backbone of AI innovation. Powered by Moore's Law, GPUs have been critical in supporting the growing demands of AI workloads. According to MarketsandMarkets, the global data centre GPU market size was valued at US $14.3 billion in 2023, and it is estimated to reach US $63 billion by 2028, growing at a compound annual growth rate of 34.6 during the forecast period from 2023 to 2028.

## The elephant in the data centre: Networking bottlenecks

GPUs have revolutionised AI development due to their ability to process vast amounts of data simultaneously. This parallel processing is ideal for the complex computations required by deep learning and large language models like GPT.

Yet as these models grow in complexity and size, they generate "elephant flows" – substantial data chunks that strain traditional ethernet networks. This leads to congestion and increased latency, creating bottlenecks that hamper performance. Ethernet, while ubiquitous and cost-effective, wasn't originally designed to handle such voluminous and high-speed data transfers.

This networking bottleneck has ignited a debate within the data centre community: Should the industry continue to rely on traditional ethernet networks, or explore alternative solutions better suited for AI workloads? Some argue that enhanced

ethernet technologies, such as remote direct memory access (RDMA) over converged ethernet (RoCE), offer low-latency data transfer capabilities that can mitigate these issues. Others believe that entirely new networking paradigms may be necessary to meet the demands of AI-driven data centres.

Amid this technological tug-of-war, network management within GPU data centres faces its own challenges. Traditional network switches typically include console management ports for straightforward configuration, but many newer, high-speed switches lack these ports, relying instead on ethernet management interfaces. This discrepancy necessitates a re-evaluation of management strategies to ensure seamless operation regardless of the underlying networking technology.

## Adapting network management for AI's future

Independent overlay management networks emerge as a viable solution, providing a unified management layer that interfaces with both ethernet and serial connections. This approach ensures data centre operators maintain robust control over their networks, enabling secure remote access for provisioning, orchestration, management, and remediation tasks. By decoupling the management plane from the data plane, these overlay networks offer the flexibility and resilience required in the evolving landscape of GPU data centres.

However, as networks grow in complexity, relying solely on in-band management can be risky. This is where out of band management becomes crucial, providing a dedicated pathway that operates independently of the primary network infrastructure.

In the event of network failures or disruptions caused by heavy AI data loads, out of band access allows administrators to remotely manage and troubleshoot devices without relying on the main network. This ensures minimal downtime and maintains operational continuity, critical when dealing with AI workloads where any interruption can lead to significant productivity losses.

Integrating out of band management solutions enhances resilience, ensuring continuous operations even under strain. This dedicated channel allows swift issue resolution, safeguarding AI application performance and reliability.

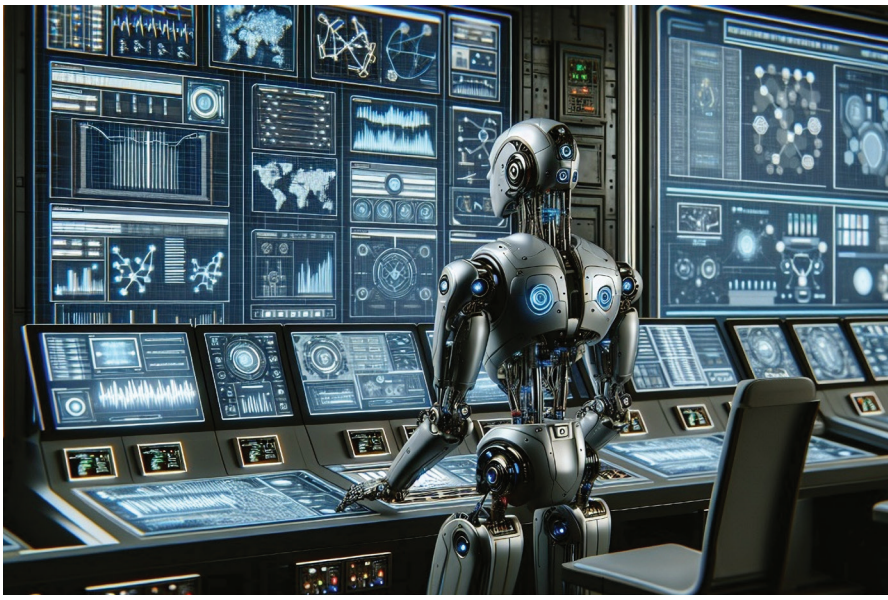
The broader challenge lies not just in selecting specific networking technologies but in designing infrastructure capable of meeting the ever-increasing demands of AI workloads. Data centres must prioritise flexibility, scalability, and security in their network designs. Embracing software-defined networking (SDN) creates a flexible control plane that dynamically adjusts to shifting workloads and network conditions. This adaptability is crucial for handling the unpredictable nature of AI data flows.

As edge computing and IoT devices generate more data at the network's periphery, data centres must extend capabilities beyond centralised locations. This expansion highlights the need for resilient infrastructure and cost-effective edge deployments. Implementing robust network management solutions across distributed environments ensures data integrity and availability, regardless of where data is generated or consumed. Without these measures, including both in-band and out-of-band management, the vast volumes of data risk being underutilised, limiting their potential to produce actionable insights and meaningful change.

Navigating the networking challenge in AI-powered data centres requires a commitment to innovation and agility. Organisations must remain open to adopting new technologies that enhance network performance and management. Integrating AI into operations can improve efficiency and reduce the likelihood of human error. This proactive approach enables businesses to pre-emptively address issues before they escalate into significant problems.

Yet there is no one-size-fits-all solution. The choice of networking infrastructure may vary based on specific use cases, budget constraints, and scalability requirements. What remains constant is the need for a robust, flexible network management strategy that accommodates current demands and future growth.

In this rapidly evolving landscape, robust network management remains essential for ensuring performance, scalability, and security in AI-powered data centres. Strategic use of out of band management, combined with innovative technologies, enables data centres to handle the growing demands of AI workloads while maintaining operational continuity. By adopting flexible and resilient infrastructure, organisations can unlock AI's full potential, driving innovation and thriving in an increasingly data-driven world.



# How AI is transforming the facilities management industry

Artificial intelligence (AI) is reshaping the facilities management (FM) industry at breakneck pace. Once stereotyped as a highly traditional industry, FM companies are turning their attention to advanced technologies to create smarter, efficient, and more sustainable built environments.

**BY DAVID DE SANTIAGO, GROUP AI & DIGITAL SERVICES DIRECTOR AT OCS**

THIS SHIFT is happening on a global level; according to a Gartner report, 70% of facilities managers have already elevated digital transformation to a core strategic position. From integrating generative AI language models to implementing multi-agent systems, FM is moving away from manual, reactive practices and becoming a leader in transformative technologies.

While many large FM companies have already adopted tech-first strategies, the future belongs to those that can harness these technologies to benefit their workforce, customers, and the environments they manage. Innovations such as smart buildings, satellite technology, and digital twinning are not only transforming service delivery but also positioning FM as an exciting space for IT, technology, and AI professionals.

## AI application in FM

FM companies traditionally deliver a wide range of services categorised into “soft services” and “hard services.” Soft services, such as cleaning, catering, and security, focus on making buildings safer and more comfortable for people, while hard services, such as HVAC, plumbing, and maintenance, focus on a building’s physical infrastructure. Historically, these areas have operated in silos, each with distinct methodologies and goals. However, technology is now blurring the lines between soft and hard services. With the integration of IoT sensors, computer vision, and AI-powered platforms, the synergies between these two domains are becoming increasingly apparent. For example, environmental monitoring technologies that track air quality (a hard service) can now directly impact safety and comfort (a soft service). This convergence is influencing FM providers to rethink the value they deliver to customers by offering holistic, integrated solutions that enhance the lifecycle of the building while simultaneously improving user experience.

## Multi-agent systems

Generative AI has quickly become mainstream, with many people treating it like the next version of the internet. Yet a significant challenge for FM companies is leveraging this technology to enhance job roles, workplaces, and the broader industry. The concept of multi-agent AI systems—where large language models collaborate with smaller, domain-specific AIs—addresses this challenge by providing nuanced, contextual solutions. In FM, this shift is enabling the adoption of innovative service models that are commonplace in the tech industry. For instance, the emergence of the “Facility Success Manager” role, powered by AI, exemplifies how FM is borrowing from technology-driven industries. Armed with insights from IoT sensors, historical data, and real-time analytics, a Facility Success Manager can contextualise information and provide tailored recommendations for a building’s unique needs. This role goes beyond predictive maintenance to encompass personalised services, such as optimising energy consumption while improving occupant comfort, thereby reimagining the relationship between technology and human oversight.

## Satellite technology

Advancements in satellite technology are also bringing new perspectives to FM—both figuratively and literally. High-resolution satellite imagery combined with AI-driven analysis has enabled FM companies to detect heat loss, monitor infrastructure projects, and map building usage with exceptional accuracy. However, the potential of this approach extends beyond satellites alone. The convergence of various technologies, such as near-infrared imaging, IoT sensors, blockchain, and hyperspectral cameras, is revolutionising how FM services are delivered. For example, motion-detecting IoT sensors integrated with computer vision can optimise workspace utilisation and predict traffic patterns within buildings. Blockchain

technology ensures tamper-proof data logs, enhancing transparency and trust in critical areas like compliance. These developments enable FM companies to evolve into strategic consultants for building functionality, offering data-driven insights that extend far beyond the traditional scope of hard and soft services.

A striking example of this convergence is the transformation of security systems. Cameras, traditionally used for surveillance, are now capable of doubling as retail shelf analytics tools, providing valuable insights into stock levels and customer behaviour. Similarly, hyperspectral imaging, once reserved for industrial use, can detect microplastics in water systems, advancing sustainability efforts. These innovations highlight how FM companies are redefining their role, not just as service providers but as pioneers of integrated, technology-driven solutions that enhance the value and functionality of built environments.

## Blockchain and augmented reality

The potential of AI extends even further as it intersects with emerging technologies like blockchain and augmented reality (AR). Blockchain is increasingly being used to streamline FM contracts and ensure transparency in procurement processes. For instance, blockchain technology can authenticate energy credits traded under sustainability initiatives, while AI analyses consumption patterns to recommend improvements. Augmented reality, on the other hand, is transforming how FM teams approach maintenance and training. By overlaying building schematics onto physical spaces, AR allows technicians to troubleshoot issues remotely, reducing downtime and improving efficiency. Extended reality (XR) is also gaining traction as a tool for immersive facility tours and workforce training, helping FM professionals upskill in real time.

## Looking ahead

As AI adoption accelerates, the FM industry is poised to evolve dramatically over the next five to ten years. Proactive asset management, powered by predictive analytics, will become the norm, enabling FM teams to address potential issues before they arise. Digital twins will play a pivotal role in this shift, allowing FM companies to simulate the impact of environmental changes on building performance and recommend preventive measures. Fully automated workspaces, equipped with IoT sensors and AI integration, will adapt in real time to occupant needs, optimising everything from lighting to catering operations. Beyond this, FM companies are expanding their service scope to encompass areas like employee well-being and workplace productivity, measuring and enhancing factors such as stress levels, collaboration patterns, and satisfaction through AI-driven insights.

An example of this future is already taking shape through pilot projects. Leading FM companies are

exploring AR-driven live maintenance guidance combined with AI diagnostics to enhance repair accuracy. Another use case is the application of hyperspectral imaging being used to detect environmental contaminants in real time, contributing to safer and more sustainable buildings. These initiatives illustrate how FM companies are transitioning from reactive service providers to proactive innovators, fundamentally changing how built environments are managed and interacted with.

While these advancements are transformative, they also raise important questions about responsible AI deployment and workforce readiness. AI is not about replacing jobs; it is about augmentation. The role of technology is to empower the workforce, equipping them with tools to perform their roles more effectively. For example, a Facility Success Manager enhanced by AI can manage more complex systems while maintaining a human-centric approach to building management. Economic data underscores this potential: McKinsey Global estimates that AI could create up to 50 million new jobs by 2030, emphasising the importance of continuous learning and adaptation. Ethical considerations, particularly around data privacy and emotional AI, also demand attention as FM companies embrace these technologies.

Frameworks such as the European Union's AI Act provide essential guidelines for ensuring responsible development and deployment. Looking ahead, it is clear that AI will continue to redefine FM. The convergence of digital twinning, multi-agent paradigms, and emerging technologies will reshape how built environments are managed, moving the industry toward a future marked by adaptability, innovation, and sustainability. FM companies that approach this transformation with both ambition and responsibility will not only thrive but also set new benchmarks for excellence in service delivery. As the AI revolution unfolds, the potential to create smarter, more sustainable built environments is boundless. For FM, this is not just an evolution—it is a reinvention.

# Bringing back DCs to the communities that they serve

No one knows yet what the next generation of data centres will be like, but one thing is for sure, they will be fully integrated within the communities that they serve. There is no other way for the industry to continue to grow, and steer away from the incoming storm of regulation.

**BY ALEX MARIAGE, REGIONAL DIRECTOR AT BCS**

IN RECENT MONTHS the buzz around green data centre initiatives has increased with discussions around subjects such as district heating solutions, solar power and green roofs. So far, the hype outweighs the actions of our sector, and we find ourselves at a crossroads once again - with one route being proactive, investing in new technologies, self-generation and looking at innovative storage solutions to reach climate neutral targets. The other route is having legislation and regulations dictated to the industry and having to react to the imposition of energy, water and emission targets that we have no influence over. The recent German energy efficiency law is a good example of the kind of regulation we can expect and whilst it is still too recent to assess its impact, we anticipate that many jurisdictions will follow Germany's lead.

## The data centre dichotomy

The challenge that we, as a society face, is that data centres play a vital role in supporting our digital infrastructures supporting governments, economies, defence, and healthcare and the communities that they serve. The other side of the equation is that data centres use lot of energy and create significant heat, and this is the basis for much of the regulatory concern. In many cases data centres are competing for the resources that they draw with the communities where they are based, putting increasing pressure on utilities, driving up energy costs and increasing pollution from non-renewable energy sources.

It is therefore understandable that if operators do not take the initiative to find solutions by themselves, Governments will start to dictate specifically how data centres are supposed to be built and operated in terms of energy efficiency and stipulate mandatory green initiatives. We must change or be changed.

Whilst there are clearly challenges, particularly around cost, I believe this is an opportunity for operators to try to integrate more with the communities that they are supposed to serve.

However, to make that happen we as an industry will need to make significant changes in areas other than just our designs such as our culture and our communication.

## A well-kept secret

For many years the data centre sector has hidden in the shadows – of little interest to anyone that wasn't directly involved. For many it was still assumed that it was a few servers in the back telecoms room and its sheer size and importance shrouded in secrecy. However, a number of factors including high profile data leaks; the proliferation of streaming services; and the arrival of AI have forced the sector into the spotlight.

For example, in the UK, the Government has announced that data centres will be designated as Critical National Infrastructure (CNI) alongside energy and water systems. With this increased profile comes greater scrutiny in areas such as sustainability. And whilst the communication departments from many of the developers have done a great job in advertising the green initiatives that their respective organizations work on it is fair to say that these efforts haven't matched the equivalent growth of the industry.

Secrecy is of course a key aspect of data centre operations in order to support the protection of the data they hold. However, operators have got accustomed to the comfort this brings but this has started to change and in recent months we are seeing 'green activists' that have started to demonstrate outside data conventions and shareholder meetings to protest about 'vampire data centres' and their effect on the planet. This is a real risk, and it is no longer a matter of if, but when these types of activists will start to target data centres directly especially as they become aware of the energy usage and carbon emissions.

## Getting the message out

It is therefore vital that the industry take the lead in implementing sustainable designs and solutions and communicating them to a wide audience. A good start will be to follow the lead of the German Authorities in their recent legislation – not just because no one has a choice anyway but embrace the principles; and come to the realisation that no one wants windowless, dark-grey, secret buildings any longer in their communities. They want modern buildings that can provide heat to entire neighbourhoods and help reduce energy bills. They want to see trailblazing initiatives where buildings heat greenhouses where community members get the opportunity to grow their own food. They want an integrated approach.

## Transformative leaders needed

Sadly, more of these types of initiatives are needed and in fact we need to transform our approach and completely rethink data centre projects from the inception. The first questions will have to be - what place does this data centre have in the community and will the building be an integral and valued part of it. Leaders and forward thinkers will need to step up and take the initiative. No one knows yet what the next generation of data centres will be like, but one thing is for sure, they will be fully integrated within the communities that they serve. There is no other way for the industry to continue to grow, and steer away from the incoming storm of regulation.

# Enterprise data centres in the AI age

As enterprises deepen their investment in AI-driven (artificial intelligence) workloads and high-performance computing (HPC), data centre strategies must evolve.

**BY PETER MILES, VP OF SALES VIRTUS DATA CENTRES**

THE DISCUSSION is not just about choosing between public cloud and private infrastructure but about refining the right mix of solutions to meet increasing performance, security and cost pressures. IT leaders are rethinking infrastructure strategies to ensure they can support the scale and speed required by AI and data-intensive applications while maintaining operational control and regulatory compliance.

## AI's growing demands and infrastructure implications

AI workloads demand far greater computational power than traditional enterprise applications, requiring high-density processing, high-speed storage and low-latency networking. Many organisations initially turned to hyperscale cloud providers for AI capabilities, leveraging their scalable compute instances. However, as AI projects move from experimentation to production at scale, enterprises are encountering new challenges - soaring cloud costs, complex security considerations and an increasing need for predictable performance.

For AI training and inference workloads that require sustained, high-performance computing, colocation and private infrastructure often present a more cost-efficient alternative. AI models need uninterrupted access to vast datasets, and enterprises are realising that keeping critical workloads closer to their data sources, rather than constantly moving them in and out of the cloud, reduces cost and latency.

Additionally, as AI applications expand into industries such as healthcare, finance and manufacturing, the need for real-time decision-making is accelerating. This has increased demand for edge computing capabilities that bring AI processing closer to the point of data generation, ensuring lower latency and higher efficiency.

## The cost of scale: Managing AI workloads beyond the cloud

Cloud computing transformed IT economics by shifting enterprises from CapEx-heavy investments to OpEx-based consumption models. But as enterprises scale AI applications, the limitations of hyperscale pricing structures are becoming apparent.

High egress costs, unpredictable price fluctuations, and the overhead of continuously running GPU-intensive (graphics processing unit) workloads in the cloud can make long-term AI deployments financially unsustainable.

In response, organisations are segmenting workloads based on cost, performance and compliance needs. Many are adopting hybrid models, leveraging colocation or private cloud for sustained, high-compute AI workloads while using public cloud resources for burst capacity and distributed applications. Strategic workload placement is becoming essential - not as a reaction to cost pressures but as a way to align infrastructure with business priorities.

## The role of colocation in enterprise AI and HPC

Modern colocation facilities are no longer just space-and-power providers. They have evolved into critical enablers of hybrid cloud strategies, offering low-latency interconnection to hyperscalers while providing enterprises with dedicated infrastructure for high-performance workloads.

Key factors driving colocation adoption include:

- **AI and GPU Processing –** The demand for AI-ready infrastructure has led colocation providers to build facilities optimised for high-density GPU deployments, liquid cooling and enhanced power availability.
- **Direct Cloud Interconnectivity –** Enterprises are leveraging colocation hubs to establish high-speed, direct links between private infrastructure and hyperscale cloud environments, reducing latency and cloud transfer costs.
- **Data Sovereignty and Compliance –** Many industries face strict regulatory requirements for data locality. Colocation allows enterprises to maintain control over sensitive data while ensuring compliance with jurisdictional regulations.
- **Security Considerations –** By leveraging colocation as part of a hybrid strategy, businesses can build customised security postures that combine the agility of cloud services with the control of private environments.

## Performance, scalability and security considerations

As enterprises expand AI-driven initiatives, they are prioritising not only where workloads run but also how infrastructure adapts to dynamic requirements. AI models depend on more than just compute power - they require fast access to storage, proximity to datasets and scalable networking.

High-bandwidth, low-latency environments are critical, which is why many enterprises are moving towards colocation solutions that offer high-speed interconnects to cloud platforms. Security is another key concern, as AI workflows often involve proprietary models and confidential datasets. Many enterprises are using colocation to establish controlled environments that integrate seamlessly into their broader security frameworks, ensuring strict access control, encryption and monitoring.

Scalability remains a challenge for enterprises running AI workloads. Unlike traditional business applications, AI models require an adaptable infrastructure capable of scaling up or down as demand fluctuates. Colocation data centres with modular expansion capabilities allow enterprises to deploy and scale AI clusters more efficiently, avoiding unnecessary expenditure on underutilised cloud resources.

## The future of enterprise data centre strategy

As enterprises continue to refine their infrastructure strategies, several key trends will shape the next phase of data centre evolution:

- **AI-Specific Data Centres –** Purpose-built facilities optimised for AI workloads, featuring high-power densities, liquid cooling solutions and dedicated networking capabilities, will become increasingly common.
- **Sustainable AI Infrastructure –** The growing energy demands of AI are pushing organisations to explore renewable energy sources, power-efficient architectures and smarter workload scheduling to manage electricity consumption.
- **Workload Portability and Flexibility –** Enterprises will prioritise infrastructure solutions that allow workloads to move seamlessly between private, colocation and cloud environments as needs evolve.
- **Edge and Distributed AI Models –** As AI becomes more embedded in operational workflows, enterprises will look to edge data centres to decentralise processing and improve response times in latency-sensitive applications.

## Preparing for an AI-Driven future

The rigid infrastructure strategies of the past are being replaced by adaptive, workload-driven models. Enterprises that integrate hybrid infrastructure - balancing public cloud, colocation and private environments - will be best positioned to scale AI initiatives efficiently while maintaining cost control, performance, and security.

The challenge for IT leaders is no longer about choosing a single infrastructure model but rather about optimising a mix of solutions that align with evolving business and technological demands. Enterprises must embrace flexibility, automation and interconnectivity to build sustainable, AI-ready data centre environments that will drive innovation into the next decade.

As businesses deepen their reliance on AI, success will depend on infrastructure strategies that are adaptable, scalable, and resilient - enabling enterprises to leverage AI not just for immediate gains but as a long-term competitive advantage.

# The challenges of data centre fire safety

The pivotal role of data centres and server rooms and their fundamental contribution to modern life is undeniable. And, with the amount of data stored doubling every 18 months, it is a rate that is only increasing with the ongoing development of AI. The oft-quoted figure of an estimated 90% of data being created in the last two years helps to put this in perspective. It is therefore relatively easy to appreciate just how devasting a data loss can be. The financial consequences for a business can be considerable, as can the potential reputational damage, with business closure in the event of a serious data loss being an all too regular occurrence.

**BY ROBERT YATES, HEAD OF BUILDING PRODUCTS FIRE SAFETY UK, SIEMENS**

A BASIC CONSIDERATION in maintaining the operation of a data centre is protection from fire, with a solid fire safety concept an essential component in any data centre's business continuity strategy.

Business continuity is a fundamental tenet in the world of the data centre. With companies so reliant on their information systems to run their operations, any downtime can have significant and wide-ranging repercussions. A reliable infrastructure for data centre operations is therefore crucial, not only for the data centre itself but also for the customers that it serves. Integrity and functionality of the hosted computer environment are prime considerations in this process for a service in which such a high level of availability (business continuity) needs to be achieved.

## Single source option

The importance of business continuity is perhaps best illustrated by the requirement for a Tier 4 data centre to be fully fault tolerant and have an uptime of 99.995%. In terms of fire safety, this means that a detection, alarm and extinguishing system needs to be designed to keep the business functioning, even if a fire does occur. As such, early detection plays an integral part: the earlier a fire can be detected, the earlier the operators can be notified of the event and the earlier the required technical and organisational measures can be initiated.

Fundamental to this early response in the event of a fire is the interface between detection, alarming, control and extinguishing. Communication between the different elements is essential for the effectiveness of the complete system. This is a strong argument for adopting an integrated fire safety system from a single source.

## Aspirating smoke detection

The heavy power loads that are a characteristic of data centres need to be considered in establishing an effective fire safety system. Such loads or a defective component in equipment can quickly lead to overheating or a short circuit. Electrical fires will

often start slowly with a long period of overheating and smouldering before flames even occur. To detect overheating and avoid the onset of flames, very early smoke detection is required. If smoke is greatly diluted by high ventilation, aspirating smoke detection (ASD) will provide the earliest possible warning even when the smoke is undetectable by the human eye. Air samples are continuously taken at the danger spots, usually in the circular airflow as well as among the server racks, and carried to the sampling device. As soon as smoke particles are detected by the air sampler, a pre-alarm or an alarm is triggered, depending on the smoke concentration level. The response characteristic is determined according to the application. Sensitivity ranges from normal to high, allowing even a minimal smoke concentration to be identified unequivocally at an early stage.

Aspirating systems can be up to a thousand times more sensitive than a standard point detection system. By combining this level of sensitivity with an environmental learning capability, it is possible for such a system to provide and maintain the optimum operating level and keep unwanted or 'false' alarms to an absolute minimum. Aspirating systems also usually have the capability to monitor their own integrity and, in the event of the system's ability to detect smoke being compromised for any reason, an alert is raised.

Shutting down equipment at the earliest indication of fire will stop even corrosive combustion gases from developing further. In a "gentle" shutdown, intelligent server management is activated to divert valuable data to neighbouring server racks. This can only be achieved by combining an appropriate software/ hardware environment with the earliest possible fire detection. The final shutdown of power only takes place once the transfer of data is complete.

If such a "gentle" shutdown is considered too risky, an alternative method – aspirating smoke detection with verification by point-type detectors – may be used. In this system, the cooling system is shut down after pre-alarm while the point-type detectors verify the presence of combustion and trigger the extinguishing system.

ASD systems are available which operate through a dual wavelength technology to verify that particles aspirated in very low concentrations are actually smoke from a fire. Full integration of the device into the fire safety or management system ensures the safest operation possible because all the ASD warnings and possible maintenance messages are available at the management level to allow corrective measures to be taken. Recent developments have seen the introduction of newer generations of ASD technologies which mean that a single device can now cover an impressive area of up to 6,700 m2.. Even for Class A installations with the highest sensitivity requirements, up to 2,000 m2 of detection coverage is achievable with a single detector. This makes the technology ideally suited to applications typified by their large open areas, data centres being a prime example.

## Preventing damage to HDDs

One of the fundamental considerations in designing an extinguishing system for a data centre application is to ensure that the chosen agent extinguishes the fire without harming sensitive electronic equipment. Water should therefore be avoided at all times. Furthermore, the agent must be environmentally friendly, safe for people working in the protected area, and cause no harm to the HDDs in operation.

Even though dry extinguishing systems are the best choice to protect data centres, the latest technological findings show that in very rare cases computers and HDDs can face problems after the extinguishing process has been triggered. These problems may range from automatic shutdown of an HDD with no damage after restart to more severe disturbances. Research has shown that the main cause of these problems was the high noise level caused by the discharge of the agent during the extinguishing process.

To address this issue, silent extinguishing technologies have been developed specifically for data centres and server rooms. This enables reliable protection of IT operations and minimises the risk of business interruptions following a fire extinguishing system discharge.

## Experience and expertise

The value of the global data centre market was estimated at $187.35 billion in 2020 with growth projections suggesting it will reach $517.17 billion by 2030. Given the fundamental role that data centres play in modern business and life in general, minimising disruption has to be a prime concern. To ensure the highest possible fire safety, it is important to control the interfaces and use the latest scientific findings for the best solution. Having a complete fire safety system from a single supplier with extensive experience in data centre applications can provide the optimum solution in terms of detection, alarming, control and extinguishing.

# Sustainable power - solving the energy challenges of AI

The AI revolution is well underway, but it brings with it challenges for data centre energy consumption, power availability, and carbon emissions. By utilising innovative technologies, data centres can provide the foundations for a greener future, powered by AI.

**BY MARK YEELES, VP, SECURE POWER DIVISION, SCHNEIDER ELECTRIC UK&I**

TODAY, many of the macro trends accelerating data centre adoption are being driven by increasingly compute intensive applications. Generative artificial intelligence (GenAI) and AI workloads, large scale data analytics, and accelerated computing are all impacting demand for physical space, connectivity, power and cooling.

In certain geographies such as Dublin and London this has already led to constraints, and now, both government and industry are working to solve the challenges.

## Energy demand

There is no simple answer to the complex issues surrounding power. However, a careful strategy built around the most advanced and energy efficient equipment, AI-enhanced remote monitoring and predictive analytics, and underpinned by innovative energy systems will not only ensure continued, uninterruptible power, but provide a sustainable foundation for the data centres and grids of the future.

According to the IEA, electricity consumption from data centres, AI and cryptocurrency processing could double by 2026, and data centres are currently said to account for around 1% of global electricity consumption. In larger economies such as the US, China, and the EU, data centres account for around 2-4% of total electricity consumption, and in Ireland it could be over 20%. This level of growth has had a measurable impact on emissions too, with some hyperscalers experiencing a carbon footprint increase of 30% due to indirect emissions from data centres.

## Geographical impact

Once seen as a centre for data centre excellence, growth and development, Dublin is in a challenging position. A combination of pressure on the national energy grid and ambitious renewable energy targets has effectively halted new data centre connections since 2021. Whilst the consultation process led by the Commission for the Regulation of Utilities (CRU) is ongoing, what's clear is that greater collaboration between government and

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industry is needed to solve both the data centre, energy and sustainability challenges facing the country. Similarly in London, a recent report has found that there are up to 400GW of grid requests that may be effectively holding up data centre developments, the strong majority of which (70%) may never see approval. The UK National Grid CEO John Pettigrew has said that «bold action» is needed to create a network able to cope with growing demand from AI.

## A new approach to energy generation

Despite an apparent similarity of situations, the two geographies are taking very different approaches. In Dublin the constraints on energy availability has led the CRU to propose strict new rules for energy generation, where new facilities connecting to the grid will be required to provide generation and/or storage capacity to match their requested demand. Additionally, these new distributed energy systems would be required to participate in the electricity market, improving the resiliency and reliability of the grid, while reporting on their annual consumption of renewable energy and their associated $CO_2$ emissions.

In the UK, encouraged by the measures set out in the UK Government's AI Opportunities Action Plan, operators are beginning to buildout in a host of new locations, including the North of England. In Greater Manchester, for example, Kao Data has been working with local government to bring its £350 million facility to life, while Microsoft's £100 million facility in Leeds brings with it new significant advantages for the Northwest. In Wales, Vantage's multi-billion pound Bridgeport development may also become one of Europe's largest data centre campuses and the company plans to invest over £12 billion in data centres across the UK – creating over 11,500 jobs in the process.

Many of these facilities are likely to deploy renewable energy sources (RES), while using innovative energy infrastructure such as battery energy storage systems (BESS), high-density Uninterruptible Power Supplies (UPS) and distributed energy resources to accelerate both their infrastructure deployments, while overcoming energy constraints.

## Energy independence

Due to widespread issues of energy constraints, data centre operators are increasingly planning for greater energy independence. Instead of having the ability to operate for just a few hours the event of a power outage, they're now looking to technology to enable extended periods of self-sufficiency.

This is supported, in part, by the development of new UPS equipment to provide battery backup and advanced power protection. The latest technologies, for example, feature ultra-compact, pioneering high-density designs, and fault-tolerant architecture that can maximise availability, while delivering up to 99% energy efficiency. The ultimate expression of this growing need for energy independence can be found in microgrids - small-scale power systems that operate independently of the grid and generate electricity for a host of use-cases including university campuses, hospitals, industrial manufacturing systems and data centres.

Additionally, microgrids can work in conjunction with traditional power grids, or function autonomously, delivering power from distributed energy resources (DERs) such as solar panels, wind turbines, fuel cells and energy storage systems to exactly where it's needed. Furthermore, they can provide additional grid support by providing energy balancing capabilities due to the variability and intermittency of large scale RES.

## Small Modular Reactors (SMRs)

With energy challenges continuing apace, some operators are exploring nuclear power generation. Amazon, Google, and Microsoft, for example, have all engaged in direct partnerships to either situate infrastructure near to these systems, or have made commitments to consume energy from existing nuclear power sources. Another direct avenue for the nuclear path, however, is the development of small modular reactors (SMRs). Based on decades of experience with applications as submarines and icebreakers, there are now around 80 development projects around the world looking, generating capacities of 300MW per system up-to around 500MW.

This new generation of SMRs are based around technologies that are safer and produce less waste, while enjoying a high degree of recyclability in the fuels used. Designs employing technologies such as molten salt, Thorium cycle, and other non-traditional approaches mean safer, more reliable reactors, and are seen as ideal for high demand data centres, and as a basis for microgrids – reducing energy losses, and virtually eliminating the emissions associated with power generation. Further, all of these innovative energy solutions are being combined with AI-enhanced management systems and predictive analytics built on decades of experience in managing complex networks. As such, they allow data centre operators to meet the challenging demand of the AI boom, with high-density and sustainable power solutions, while supporting national grids to develop and bring on more renewable energy in time.

With innovative technologies now providing a vehicle for greater energy independence, the data centres of the future can provide a platform for the responsible and sustainable growth of AI, while playing a critical role in advancing the UK and Ireland's digital economies. Further, by harnessing the power of the ecosystem, data centres can be a catalyst for the green transition, and act as a fourth utility that accelerates the development of renewable energy.

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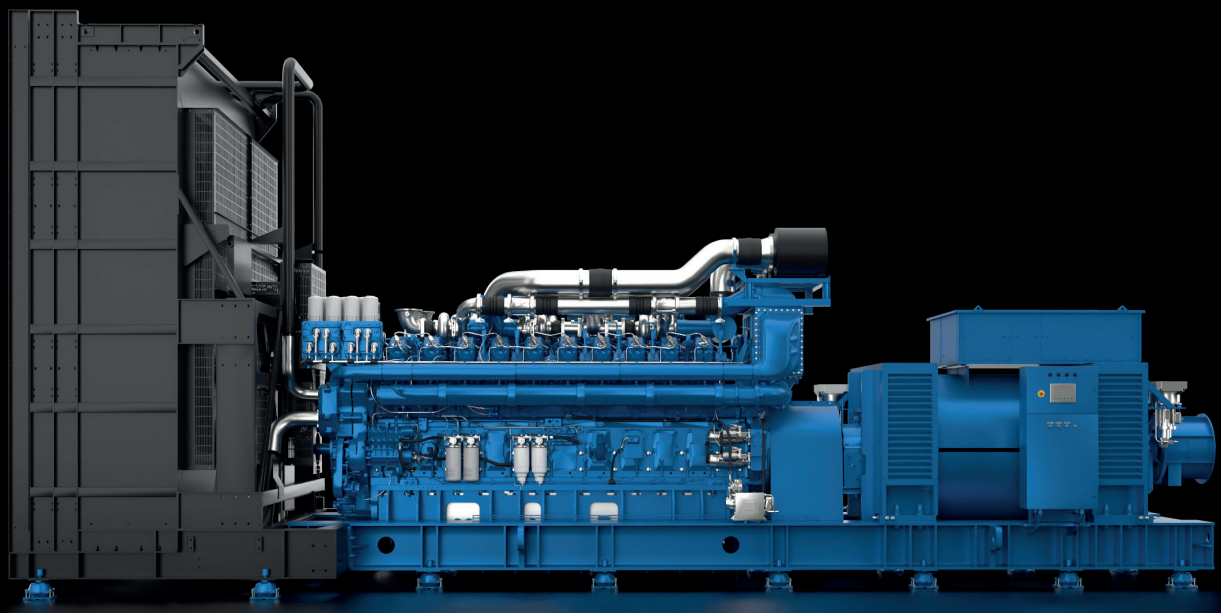

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# Thermal imaging for data centres

Data center maintenance teams have a big share in safeguarding the critical resource that customers and businesses depend upon. Fortunately, they have one secret weapon that enables them to spot issues in an early stage before they turn into big problems: FLIR thermal imaging.

**BY FLIR**

THE DATA CENTER MARKET has seen a massive growth in recent years. Spurred by a growing adoption of cloud technologies, AI, IoT, 5G and big data, new data centers are being built across all continents at fast pace.

Whether they are in-house data centers for some of the largest and most influential companies, or built by specialized vendors offering infrastructure services, data centers fulfill a critical role in maintaining the continuity of a business. Downtime of a data center can have an enormous economic impact and needs to be avoided at all costs. In addition to financial loss, reputational damage can be equally impactful, especially when the data center is supporting customer-facing services.

Guaranteeing uptime has become increasingly complex for data centers. With so much mechanical, electrical and electronic infrastructure under one roof, overheating is a major concern, not only because the infrastructure is not using the energy efficiently, but also because overheating can cause a complete shutdown of servers, impacting users around the world, or even data or equipment loss. One of the most reported incidents is the 2013 overheating of a Microsoft data center operating some of its cloud services, including Outlook, which led to services being lost for 16 hours.

## Maintenance inspections with thermal imaging cameras

The maintenance of a data center today involves much more than IT operations. Power distribution systems and cooling infrastructure are also essential for keeping the data center up and running, and for preventing mechanical or electrical failures and resulting outages.

Many systems that are critical for the data center's operation heat up before they fail.

Temperature is an important indicator of energy consumption and equipment operation, which is why infrared thermography (thermal imaging) is an ideal tool to inspect power consumption, electrical installations, cooling equipment and computing hardware.

Periodic inspections with a thermal imaging camera have become indispensable in predictive and preventive maintenance programs. Thermal cameras help maintenance staff to detect problems in electrical switchgear, motors, HVAC infrastructure, uninterruptible power supplies (UPS), power distribution units (PDU), batteries

➤ Right: FLIR Exx-Series

and generator equipment and all electrical devices that feed the server systems, before these problems turn into serious failures or downtime.

With cloud computing becoming the new normal, and as data centers are growing to great scales, the need for higher computing density and power efficiency is growing as well. Data center owners are seeking ways to increase their capacity, but they also want to reduce costs and energy. Thermal imaging can give them important information on how to optimize energy and space requirements, without causing overheating.

In short, regular inspections with thermal imaging cameras can help maintenance staff to:

- Find and fix hidden problems before they turn into unplanned downtime.
- Reduce the chance of component degradation going unnoticed due to overloaded circuits or loose connections.
- Prevent equipment breakdowns
- Optimize energy management and space allocation

## What is thermal imaging?

A thermal camera is a non-contact device that detects infrared energy (heat) and converts it into a visual image. Infrared radiation lies between the visible and microwave portions of the electromagnetic spectrum.

Any object that has a temperature above absolute zero (-273.15 degrees Celsius or 0 Kelvin) emits radiation in the infrared region. Even objects that we think of as being very cold, such as ice cubes, emit infrared radiation. Thermal cameras turn this invisible energy into something that can be seen on a screen and measured.

## The benefits of thermal imaging

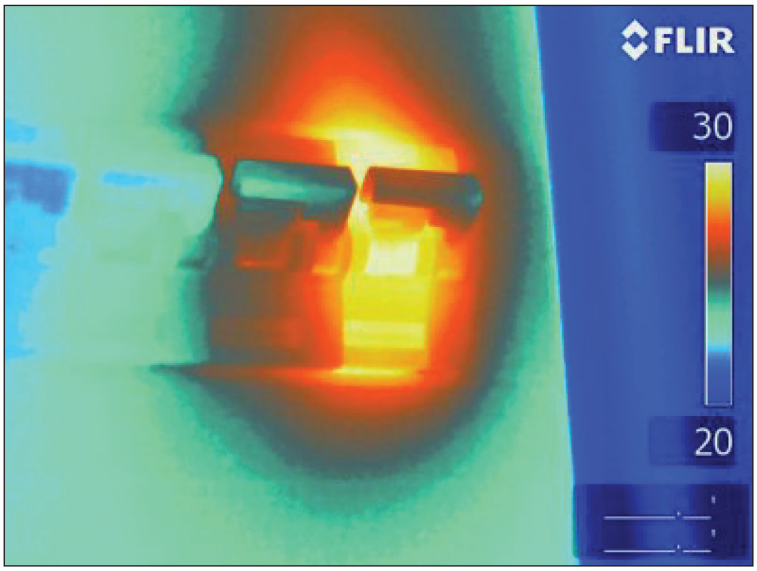
Why would you choose a FLIR thermal imaging camera? Sure, there are other technologies available to help you measure temperatures – infrared thermometers or thermocouples to name only two. But no other tool is as powerful and efficient as a FLIR thermal imaging camera.

## See the whole picture

Unlike IR thermometers or thermocouples, thermal imaging cameras enable you to scan large areas for hot spots or temperature differences. Without a thermal camera, it's easy to miss critical parts like air leakages, areas with insufficient insulation or water intrusion. A thermal imaging camera can scan entire electrical installations, buildings, heating or HVAC installations. It never misses a potential problem area no matter how small this might be. They also allow you to compare temperatures of components in the same environment more easily.

## Save time and costs

Maintenance of data center installations can be labor-intensive. Because they can easily see larger surfaces, thermal imaging cameras can be the solution to reduce maintenance time speed up inspection rounds, and still see all impending failures, before they turn into costly defects.




➤ Overheated circuit breaker

## Inspect without shutting down

Thermal imaging is a non-contact technology. This is a safe method, because maintenance personnel can keep a distance without having to touch hot items. But it also means that inspections can easily be carried out while the equipment is still running or under load. There's no need to foresee costly downtime. Some inspections, for example rotary UPS systems, can only be done during operation, which makes the thermal imaging camera an ideal tool for online inspections.

## Report like a pro

Thermal imaging cameras allow users to make professional, more insightful reports of their inspections that also look great for management and customers. Users can compare current inspections with historical data and discover trends. Features like templates, batch processing, image editing and route planning further enhance the use-friendliness of today's reporting solutions.

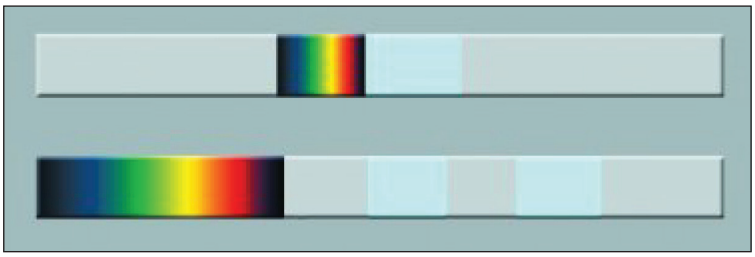
## Thermal imaging applications

Thermal imaging is the perfect technology to tackle the wide range of maintenance and inspection jobs for data centers.

## Electrical and mechanical systems

Thermal imaging cameras can be used to inspect a variety of electrical or power generation-related systems. Heat is an important indicator for defects in electrical installations. When current passes through a resistive element, it generates heat.

Over time, the resistance of electrical connections can increase, due to loosening and corrosion for instance. The corresponding rise in temperature can cause components to fail, resulting in unplanned outages.



➤ The themal spectrum

Electrical systems can also suffer from load imbalances and increases in impedance to current. Thermal inspections can quickly locate hot spots, determine the severity of the problem, and help establish the time frame in which the equipment should be repaired.

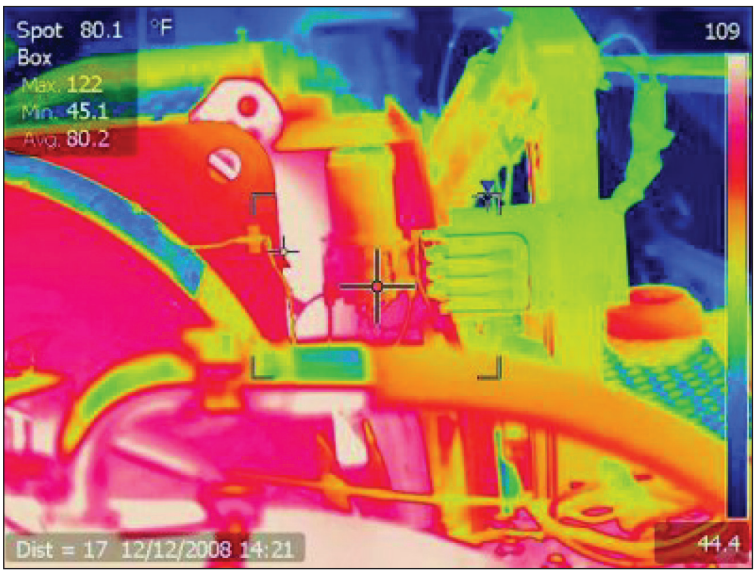
**Thermal imaging cameras will help you to spot issues with:**

- Overheated connections
- Overloaded or imbalanced circuits
- Damaged switches
- Faulty fuses
- Power supplies
- Battery systems
- Generator systems
- Uninterruptible Power Supplies (UPS)
- Transformers
- Electrical panels
- Resistive load banks

## HVAC and cooling systems

To run smoothly and efficiently, data centers need perfectly air-cooled conditions. Data centers are typically making use of a hot aisle/cold aisle layout principle. Server racks are lined up in aisles with the front sides facing each other.

The cold aisles get cold air directly from the Computer Room Air-Conditioning (CRAC) unit from the bottom of the raised floor. The cool air cools down the servers on the racks. Meanwhile, the backs of the servers vent out hot air in the hot aisle, which then returns to the CRAC unit.




➤ thermal imaging wind turbine transmission survey performed at a 50-meter height

Thermal imaging has become increasingly important to verify the proper hot aisle/cold aisle operation, especially because data centers today are condensing more servers into their racks. Thermal cameras will enable users to see problems such as misaligned ductwork and electrical faults, and then make decisions about corrective actions.

**HVAC inspection with a thermal imaging camera can help to:**

- Monitor server rack temperature distribution patterns
- Locate misrouted and leaking ducts
- See electrical or mechanical CRAC unit defects
- Confirm the source of energy losses
- Find missing insulation
- Discover AC condensate leaks
- Find internal server fans which are inoperable or damaged

## Renewable energy

increasingly improving their use of renewable energy sources, including solar and wind power. These renewable power sources enable data centers to reduce their environmental impact, whilst meeting long-term sustainability goals.

## Solar power

The solar panel, the most important part of a solar system, must be reliable and capable of producing electricity for years on end. Unfortunately, solar panels are susceptible to wear. Maintenance professionals therefore use thermal imagers to inspect solar panels installed on rooftops or in solar parks to quickly pinpoint solar panel problems down to cell level.

Anomalies can clearly be seen on a crisp thermal image and - unlike most other methods – thermal imaging cameras can be used to scan installed solar panels during normal operation. Thermal imaging cameras also allow users to scan large areas within a short time frame.

## Wind power

Wind turbine components are susceptible to wear and can break down. That's why preventive maintenance and periodic inspections are so important. Thermal imaging is the only technology that allows users to inspect all electrical and mechanical components of the wind turbine and the surrounding electrical system, so they can detect a problem before a breakdown occurs.

## Fire protection

Although data center fires are relatively rare, they can have a devastating impact. Data centers may be equipped with fire alarms and firefighting systems, but once a fire starts, asset damage is almost certain. Fixed thermal imaging cameras can identify


# Power protection

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hot spots before they ignite and provide an early warning response to avoid a full-on destructive fire before assets are harmed or safety is compromised.

## Physical security

Thermal cameras not only detect hot spots or temperature differences. They also help protect a physical perimeter against unwanted intruders or trespassers. As data centers operate 24/7, they need effective solutions to help them monitor the premises and detect threats around the clock.

Thermal security cameras that offer high contrast, high resolution and long detection ranges are ideal for data center deployments. Unlike standard video cameras, thermal cameras can see in most adverse weather conditions– such as light rain, fog, smoke, or total darkness.

When integrated with video analytics, thermal cameras can distinguish between a human or vehicle. When paired with radar, customers gain redundancy and reduce the likelihood of a false positive. By combining thermal cameras with HD visible cameras, remote operators can review thermal and visible video streams of the scene for improved alarm verification and intruder identification.

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# Ending the industry's reliance on generators

The UK government recently stated that data centres are to be classified as critical national infrastructure alongside those like the NHS and power grid. This means they will get additional government support in the case of a major incident. To improve resiliency, data centres have often relied upon generators. However, this does not mean they are necessary for every data centre build. In fact, many data centres can reach industry reliability and availability standards without a single generator on campus.

**BY JAMIE CAMERON, ASSOCIATE DIRECTOR, CUNDALL**

DAs STATED by Uptime Institute, an unbiased advisory whose mission is to report on the technical requirements for resilience in data centres: On-site power production should be considered the primary power source. Local utility power should be seen as an economical alternative only.

Because of this and the desire from major data centre developers for a standardised reference design, we've seen many operators believe that they need full generator backup for every project. If, instead, they were to consider sites on a case-by-case basis, they would realise they could hit their resiliency benchmarks while improving their bottom line and sustainability targets for some developments.

The industry has largely set itself the target of net zero carbon. While many changes are happening across the full scope of data centre design, an

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important issue that is being overlooked is the need for generators. It's time to reevaluate the status quo of data centre design, and that means asking: Do we need generators for our data centre?

## Utility supplies and data centres

Data centre operators target a standard reliability metric, '5 9s', which refers to an uptime of 99.999%; this is calculated by looking at the average time it takes equipment to fail (Mean Time to Failure) and the average time it takes to repair (Mean Time to Repair).

Data centre campuses have grown from 10MW IT to 100MW IT to 1000MW IT and above scales. Particularly with machine learning and artificial intelligence development, these sites are becoming connected to the grid at higher voltage levels. This significantly changes the reliability of the utility networks supplying these campuses.

Typical distribution network connections operate between 11-33kV and are usually fed from the same substation; as such, when you get a utility fault, it would usually take out both your A and B utility supplies. This should not be mistaken with transmission networks, which instead operate at a much higher voltage of 132kV or above. Additionally, they have a much higher level of resilience with multiple supply routes, which allows the transmission grid operator to carry out remote switching and resupply sites via alternative routes.

To understand reliability, developers must look at their data. When this information is available from the utility, data centre developers can evaluate the predicted system's reliability by reviewing the historical performance of upstream networks and substations. This includes the mean time between failures (MTBF) and mean time to repair (MTTR) and inputting this real-life data into their data centre reliability calculations. In reviewing the electrical system holistically, you are better able to determine if generator backup capacity is even needed.

The Energy Networks Association (ENA) engineering recommendation P2 Security of Supply recognises the increased resilience of connecting to the network at higher voltages. We are currently seeing proposals for the large data centre campuses that would fall into Class E, referring to connections over 300MW and up to 1500MW capacity. Under the ENA P2 guidelines, the first circuit outage should be restored immediately, and a second circuit outage should be restored immediately to two-thirds of the capacity. It should be noted that immediately is defined as within 60 seconds to allow for switching of the grid.

## Progression through reduction

For progression to occur and for our industry to meet the commitments of the COP21 Paris Agreement, we must adopt a reductionist mentality. First comes dismantling the belief that generators are necessary for every data centre site. The end-tenants must lead this change as it is their leasing agreements which enforce full generator backup.

Changing the perception of these tenants by showing them the data will be the first step to achieving change in the industry however, for this the utility companies must be more transparent with their network resilience as well.

A way of solving this is for end-customers to increase the scope of their site selection process, which includes reviewing the grid capacity and adjacency of major transmission substations. This is where the higher reliability of the connections can be provided, as well as reviewing the historical reliability data for these substations. Considering the grid first gives operators the opportunity to make more strategic decisions about location. They can choose data centre locations close to major substations, which enables resiliency to be provided through the grid rather than backup generators.

After this, the industry can take a broader look at what resiliency means. At this point, operators reviewing a site for data centre construction rarely look beyond resilience at a site level. Taking a step back to look at their data centre network as a whole means they can see where several discrete sites connect at different parts of the grid. Through this lens, they can provide redundancy through their IT infrastructure and enable generator backup only for vital network traffic. This would mean that if one site goes down, the network traffic can then be diverted to other data centres connected to either discrete parts of the grid or separate grids entirely. They still achieve resiliency and remove their reliance on generators alone.

Introducing generators to a site costs the operator financially, the designer in complexity, and the environment the embodied carbon stemming from the production and emissions during routine testing. In my own experience, I have worked on data centre sites in which over 50 generators have never been switched on beyond routine testing and maintenance. This is incredibly inefficient. At the same time, some data centre operators have smartly selected sites with highly resilient utility connections that mitigate the need for generators by achieving '5 9s' availability without them.

We have seen real-life data dispel the myth that generators are a necessity. Yet, the industry still chooses to mandate full generator backup throughout the leasing agreements. Despite being able to find other sites better suited to their projects and reaping the benefits of cost savings and better sustainability metrics, belief in generators is being maintained. It is a fact that generators will still be a must for a lot of projects, however, it is only when operators look at their projects individually that they determine the best solution for them. It's time to break the industry's perceived reliance on generators and adopt a better mindset.

# INTELLIGENT COOLING FOR CRITICAL ENVIRONMENTS


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# DCA Update

## By Steve Hone, CEO The DCA – Data Centre Alliance

DATA CENTRE WORLD 2025 is over for another year. What a fantastic event!
The DCA were delighted to be Event Partners again this year, as we have been since the very first event 15 year ago.

The DCA team were involved in many aspects of the show, from initial planning meetings, judging awards, chairing theatres and hosting DCA Panel Sessions. Many of our team and members representatives actively participated in other panel sessions throughout the conference.
The DCA team all agreed that it had been one of the busiest and most productive industry events we'd been to in recent years.
DC EVENTS 2025
The DC event diary for 2025 is crammed. Here are some of the events listed for April alone:

- Data Centre Nation, Milan
- The Data Centre and Critical Infra Expo, Dublin
- Smart Green Building Expo, Dublin
- DTX Manchester
- Platform Frontiers Markets, Athens
- DCA 10X10 – St Pauls, London
- OCP EMEA Summit, Dublin
- Datacenter Forum, Helsinki

To see details of these events and the rest of 2025 CLICK HERE

**DATA CENTRE SOLUTIONS – ISSUE 02**
Issue 02 of Data Centre Solutions has a number of topics of focus including Ai & Automation and Co-location.
The DCA feature is comprised of articles from DCA Partners. I'd like to thank all the contributors for providing their contributions.

- Dr. Stu Redshaw, CTO & Innovation Officer at EkkoSense has some serious thoughts on AI and the engineering required to support this technology.
- Evie Treanor, Manager at BCS (Business Critical Solutions) highlights DeepSeek - a new Ai model that claims a lower power usage.
- Andy Kellow, Product Manager for Colocation at Pulsant Data Centres brings us his views on the state of colocation in 2025. Could there be Ai fatigue already?

If you'd like to find out more about The DCA and how we support the sector and those working in it drop me an email, steveh@dcauk.org

Best regards,
Steve

# A new four horsemen? The state of colocation in 2025

## By Andy Kellow, Product Manager for Colocation - Pulsant

THE COLOCATION sector continues to face four, specific industry issues that – taken together – could reshape the industry.

Whilst perhaps not quite the four horsemen of a data centre apocalypse, grid availability constraints, a difficulty to shake negative perceptions over high power use, technological scepticism (especially around AI) and changes in classification as part of the National Critical Infrastructure (NCI) will redefine the sector.

### Power plays

Last year, geopolitical events sent shockwaves around the world. In tandem, the UK's grid capacity crisis put a strain on access to power. For the data centre sector, the initial effect was unpredictable power costs that had to be either absorbed or reluctantly transferred to clients.

These rising costs challenged financial models. While greater stability is emerging, there is no certainty similar events will not happen again. Global shifts have reshaped supply chains and increased infrastructure costs, prompting a more pragmatic business mindset. For example, renewable energy continued to make solid progress as part of the solution to these challenges. Renewables generated more than 50% of the electricity for four consecutive quarters (Q4 2023 – Q3 2024), averaging 51% during 2024[1].

The outlook here is broadly positive - electricity market stabilisation will improve planning and confidence. This will enable organisations to reassess their digital infrastructure and make better-aligned investments.

When it comes to tackling the negative perceptions that surround the sectors high power use, the publication of regular sustainability reports that detail energy sources, carbon emissions, and efficiency improvements has been front of mind for operators.

This reporting is undergoing a rapid evolution as the differences between power to, and power through the data centre is better understood. Collaboration

between DC operators and co-locating customers will be vital in capitalising on this distinction.

## AI fatigue?

Growing scepticism around emerging tech, particularly AI, despite its promises, raises questions about the future growth of the data centre sector that facilitates it. A recent report revealed that while 56.7% of deployed AI projects achieved ROI in 2021, that figure dropped to 47.3% in 2024.

Elsewhere, a survey of technology professionals and enthusiasts, conducted at AI author Andrew Burgess's recent book launch, found that: "while AI is embraced for its potential benefits, there is a palpable mistrust of big tech companies and a strong call for enhanced regulation."[2]

For AI to succeed, investment in training large language models (LLMs) must translate into practical applications. While tools like ChatGPT are popular, real value lies in monetising models through inferencing and using Retrieval Augmented Generation (RAG). Many applications are in early development but hold significant potential for global impact.

However, it is clear that doubts persist about the true potential of this technology. Only time will tell as to whether this uncertainty will decrease or decelerate data centre investment in the long-term. The shift from theory to real-world application will redefine the UK's digital infrastructure and it feels like we are at a tipping point where practical AI applications will accelerate. This will clarify growth opportunities in the data centre sector.

## What is in a name? Data centres as NCI

2024 saw the data centre sector being classified as National Critical Infrastructure. While this is a positive move overall, it has the potential to influence strategy and operations in a way that may not necessarily help the businesses the industry serves to reach their full potential. The devil is in the detail, and getting this right will be key.

The designation of data centres as critical national infrastructure rightly acknowledges their role as the backbone of the UK's digital economy. Policies must balance security and infrastructure concerns with support for regional regeneration and investment.

Though reclassification aims to enhance business continuity, data centre downtime often stems from an external supplier, partner or client.

Digital resilience is a broader, ecosystem-wide challenge, with data centres acting as just one component in a complex network where shared responsibility is key to minimising operational disruption, so I hope to see greater awareness and collaboration in the future.

## Defining the future of colocation

Despite these challenges, I believe there's clarity ahead, and it will likely come through innovation, strategic adaptation, and evolving technology solutions.

In addition to managing our own stability and risk, I envision the industry taking a more proactive role in educating clients on these critical areas. By guiding clients in strategies for power optimisation, modern technology adoption, and long-term reliability, data centres can become integral to their clients' resilience and innovation.

The regionalisation of data infrastructure will be a key part of this success. Investing in regional data centres offers significant potential to boost local economies and broaden access to technological resources beyond major urban areas.

Many smaller organisations, however, are not prioritising their future digital needs—an approach that could hinder their growth and competitiveness down the line.

Challenges often fuel innovation, and this will pave the way for positive change. Economic recovery, technological advancement, and better operating conditions are within reach as businesses and industries evolve to meet new demands.

Reference

1 See Britain's Electricity Explained: 2024 Review, National Energy System Operator

2 See AI survey reveals scepticism towards Big Tech and strong support for regulation | Digitalisation World

# Deepseek – Is it what the industry is looking for?

## Specialist services provider to the digital built asset industry

### By Evie Treanor, Manager at BCS

AI HAS ALREADY had a major impact on the data centre sector, driving changes to design, resourcing and location. It has also exacerbated concerns about the availability of sustainable power and that failure to find a solution to this may well be a limiting factor, with Amazon chief Andy Jassy warning last year that there was "not enough energy right now" to run new generative AI services.

However, last month saw the entrance of DeepSeek into the market which once again highlights the continuing evolution of this space and the data centre sector's need to adapt and respond. In January, it released its latest model, DeepSeek R1, which it said rivalled technology developed by ChatGPT-maker OpenAI in its capabilities, while costing far less to create. It also claimed that reduced computational demands means it needs less power to run.

So, has the emergence of this Chinese-developed AI model accelerated a shift in how AI is developed, trained, and deployed? Or could this be a geo-political play to challenge the western world and the latest development in the Chinese-US race to see who can dominate the AI landscape? Let's face it, it is unlikely to be a coincidence that the announcement was timed to fall during President Trump's inauguration.

Certainly, it rattled investors, particularly in the US wiping billions of dollars off the stock market with President Donald Trump describing it as a "wake-up call" for the US. However, as Lennart Heim, a tech-policy analyst at Rand pointed out: 'Deepseek's timing 'might be strategic, but their technology is real.'

The financial difference between DeepSeek and its competitors seems compelling. According to a Harvard Business Review analysis, training DeepSeek's V3 model costs an estimated £4.48 million, compared to the £32 to £160 million price tags for AI models developed by OpenAI and other leading firms. This does in theory make it more accessible and may lead to a quicker and broader uptake. Yet despite its cost advantages, DeepSeek does not necessarily perform better. NewsGuard's recent audit found that DeepSeek's chatbot made false claims 30% of the time and failed to provide answers in 53% of cases.

By contrast, the ten leading chatbots had an average false claim rate of 40% but only failed to answer 22% of questions. That said, these reliability concerns may limit DeepSeek's immediate adoption in critical applications but most likely will not affect its broader impact.

For the data centre industry perhaps the biggest positive are the claims that its more efficient approach will mean that the available power obstacles to supporting the AI revolution will not be so great. However, analysts and commentators are split on whether the demand for power will fall as a result - or actually increase as this technology seems more affordable and may become more widespread. This view was echoed by Microsoft CEO Satya Nadella who wrote on X: "The Jevons paradox strikes again! As AI gets more efficient and accessible, we will see its use skyrocket, turning it into a commodity we just can't get enough of."

So, will the innovations made by DeepSeek only encourage greater development as it becomes more integrated into everyday computing resulting in increased energy consumption? Or, if it is proven to significantly boost efficiency could this be the much-needed catalyst for change in our industry? Surely competition is a good thing and may serve as the wake-up call that sparks a transformation and pushes us to embrace new, more effective ways of working.

Certainly, there are changes coming and it is likely that DeepSeek's arrival marks a turning point in AI development, presenting exciting opportunities due to its reduced costs and open-source code, but it will take time to truly understand its lasting impact. One thing that is certain is that our industry will find a way to adapt as it always has, demonstrating our ability to pivot and change in order to deliver the crucial specialist data centre facilities needed to support the growing proliferation of artificial intelligence - whatever it looks like.

At BCS we are aware that this is a fast moving and developing space and are committed to advising our clients on how to best navigate a rapidly changing market and how this may affect the design, cost, construction and handover of data centres moving forward.

# Why AI computing requires serious engineering thinking

With GPU-intensive AI workloads already generating more heat within data centres, operations teams need to think hard about their current infrastructure and how it needs to evolve.

**By Dr. Stu Redshaw, Chief Technology & Innovation Officer, EkkoSense**

TOP OF THE LIST is knowing exactly what's likely to happen from an infrastructure and engineering perspective when you run your AI services at scale. We almost need a crystal ball to ask, "What if?"

At EkkoSense we're already seeing AI-driven heat loads exhibiting significant dynamic variability. It's all very different from the reassuring certainty of traditional enterprise workloads. AI applications load up differently, obviously with very high heat loads, but it's the sheer rate of change that's more notable.

While there's always been a familiar cadence to how traditional data centres run, with AI it's much more dynamic. As AI compute loads kick in, things immediately get much warmer. Suddenly the heat is sitting across the rack tops as extra megawatts hit the room. It's exciting, but it also signals that you're going to need something very different to manage these loads.

## Time for some serious engineering thinking

such as AI clearly set to generate more heat within data centres, operations teams need to think hard about their current infrastructure and how it will need to evolve. As AI compute loads grow dramatically with wider deployment, we'll start to see ultra-high-density AI racks in place. These can potentially require upwards of 100-120 kW of power for equipment that could be worth up to $10 million plus per rack.

This will need to be supported by a smart hybrid cooling approach – most likely some kind of direct liquid cooling to the chip or the chassis, as well as some kind of rear door plate heat exchange technology. Data centre operations teams will also still require some level of air cooling in the room as you'll always get some heat via conduction across the board. Bringing all this together leads to inevitable challenges.

Getting it right first time is critical, and that's why people are placing so much importance on having everything ready and in place. When your AI compute racks arrive, they're priceless, so you'll need to be sure that your infrastructure is 100%, that all the cooling is in place, that you've got all the right back-ups in place. There's a lot of investment needed to ensure that it all works straight out of the box.


## Need for absolute real-time white space visibility

Anything that we can do to help dial down the stress levels for data centre teams is becoming even more important. Top of the list is knowing exactly what's likely to happen from an infrastructure and engineering perspective when you launch your AI services. We're already seeing AI-driven heat loads showing significant dynamic variability – it's all very different from the reassuring certainty of running traditional enterprise workloads.

So, what's needed now is absolute real-time white space visibility. The ability to look across your whole data centre estate and be able to check that the assumptions that you're making on cooling, power and capacity are standing up. There's a huge pressure to get things right, so it's critical that your organisation's IT infrastructure and data centres are ready to support your AI applications, and that you've made all the right choices in terms of preparation.

At EkkoSense we're already seeing the transition towards AI starting to impact data centre infrastructure - both through the sheer volume of compute cycles that developers are now running on AI platforms, as well as infrastructure investment at the many sites that we're busy optimising around the world.

## Derisking AI compute and hybrid cooling deployments

Applying best practice AI-powered optimisation is an important first step in getting your evolving

infrastructure operating as efficiently as it can. Having access to this kind of insight is vital, particularly the ability to understand exactly where you stand in terms of your current cooling, power, and capacity needs. However, given the acceleration towards AI computing, there are also now some more profound engineering What if? questions that CEOs, CFOs, and CIOs need answering, including:

- How can we predict and maintain optimal performance across our full data centre infrastructure?
- Where are the infrastructure capacity bottlenecks for increasing IT loads?
- What spaces can we use for high-density AI loads?
- What would be our best cooling strategy?
- What equipment do we need to replace – and when? How can we optimise our budget?
- What impact could changing environmental conditions have on my estate?

Decisions are needed now, and organisations simply can't afford to get things wrong. These are questions that need very precise answers – and quickly. To address this, we've created EkkoSIM- an entirely new class of data centre simulation and modeling tool that allows businesses to zero in on the right decisions by creating, testing and analysing the results of multiple data centre 'what if?' scenarios.

Due to the accessibility of EkkoSIM's data centre digital twin software, IT and operations teams can accurately analyse and predict the most suitable designs, map metered data against predictive models, and triage those data centre assets that would benefit most from configuration assessments. Critically, this new approach also equips teams with a rapid data centre simulation and modeling capability that supports changes to their IT load so they can understand exactly how any changes in workloads might impact their cooling, power, and capacity infrastructure.

The value of a digital twin approach for automating data centre simulation and modeling is that it provides senior business and IT leadership with the visibility they need at one of the most pivotal points in data centre history. What they get to see is whether it's possible to take their infrastructure forward so that they can bring in the capacity needed to deliver AI compute at scale within their business timeframe. So, when they're asked: 'are we ready for AI?,' they will – for the first time – be able to answer with confidence.

- *"Dr Stuart Redshaw is co-founder of EkkoSense and holds the position of Chief Technology and Innovation Officer. Stuart has a doctorate in heat transfer and thermodynamics from Nottingham University.*

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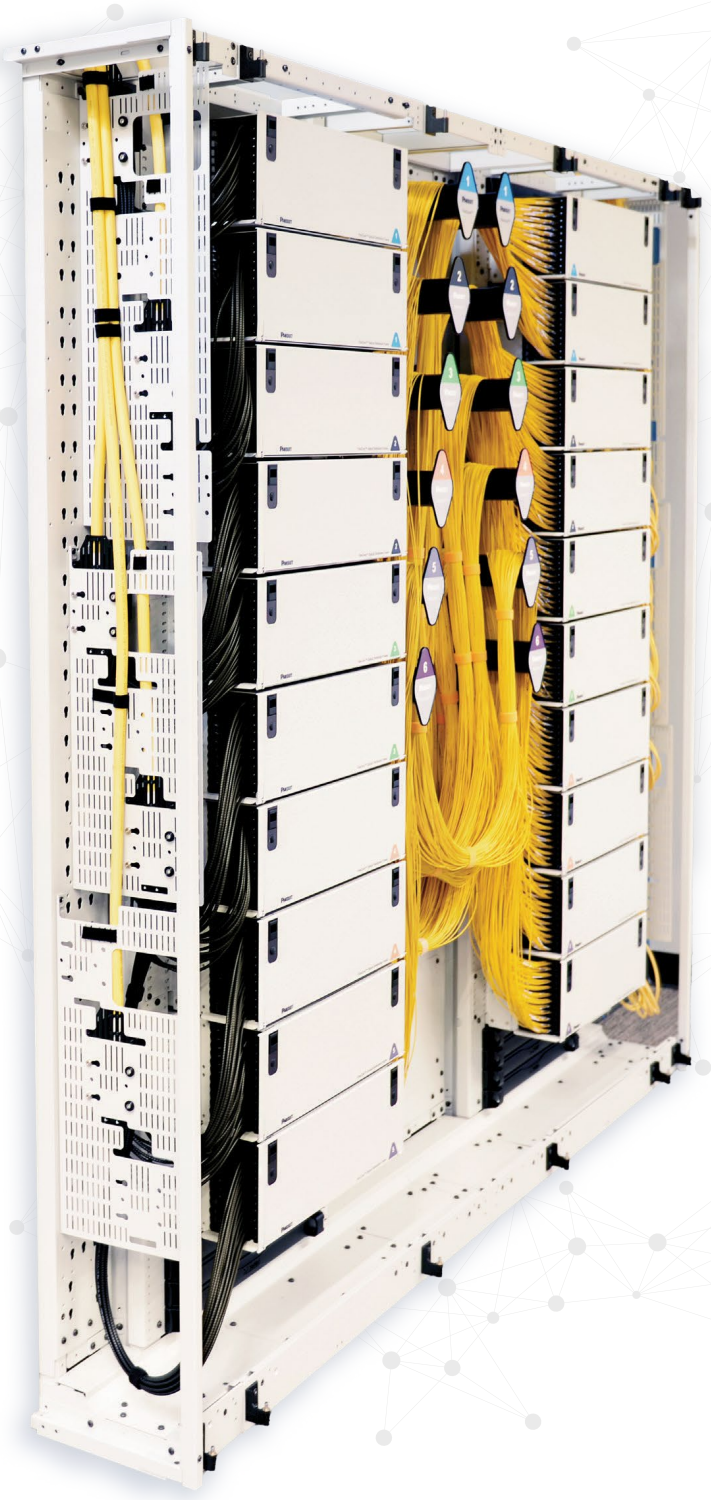

* Assumes 4 double frames (2 double frames in a 'back-to-back' arrangement). Design conditions and configuration specifics apply.

**www.panduit.com/flexcore-odf**

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