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DATACENTRE SOLUTIONS

DEVELOPING DIGITAL INFRASTRUCTURE IN A HYBRID WORLD

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VIEWPOINT

BY PHIL ALSOP, EDITOR

Where next for sustainability?

CLIMATE CHANGE as evidenced by so much, increasing global weather volatility in recent years, and the warming of the planet, would seem to be an accepted trend by a majority across the globe. There has always been an element of push back – but this has been, until recently at least, something of a minority voice. Now, with a climate change sceptic as US president, allied to the rise of a right-wing political wing which seeks to blame the ills of the modern world on a combination of immigrants and wokery – with sustainability very much seen as a part of the latter – the progress which has been made over the past decade or so when it comes to protecting the future of the planet would seem to be in jeopardy.

For now, there may only be a trickle of huge corporations and banks beginning to abandon some of their environmental goals, but it is not difficult to imagine this becoming something of a torrent over the coming months, as social media outlets continue to manipulate millions of people who (apparently) can't think for themselves into calling for the total abandonment of Net Zero targets – the narrative being that it is costing too many jobs and too much money. The justification, as ever, will be that this is democracy in action. Anyone think of some notable occasions in the 20th century where democracy and the will of the people to be governed by certain individuals and in certain ways didn't work out too well?!

It will be fascinating to see how the data centre industry, not unconnected to the finance sector, responds to the sustainability debate over the next few years. At one level, it is already set on a course of sustainability, with much excellent work having already been completed. At another, it is still relatively early days, and the sector has always struggled somewhat with the idea that it can both underpin the ongoing global, digital explosion and be sustainable. Suddenly, there's the opportunity to come down firmly on the side of digital 'progress' and simply shrug corporate shoulders at the power consumption this requires.

I'll make two observations before finishing.

Those seeking to pin the blame of crumbling societies on immigrants and political correctness, might do well to contemplate the many negative impacts that IT (in the wrong hands if you will) has had on societies across the world. No government on the planet has yet got to grips with how to effectively tax a virtual, IT-fuelled organisation as compared to a bricks and mortar business – and all are reeling from the massive hole this has left in their countries' finances; not to mention the re-shaping of the places where we live thanks to the growth of online alternatives to the high street.

Secondly, a possible silver lining in the current direction of political travel. If more and more countries do become more nationalistic and inward looking this will, ultimately, be good for the planet. After all, far less movement of folks and goods across the planet – back to the largely national supply chains of decades ago and travel seen as a luxury – is definitely far more sustainable than today's current globalisation model.

I remember reading both 1984 and Brave New World as a teenager – definitely fiction for someone growing up in the 70s and 80s. Now, perhaps, both these titles should be in the non-fiction, history section of the library (always assuming there's still a library nearby!)?

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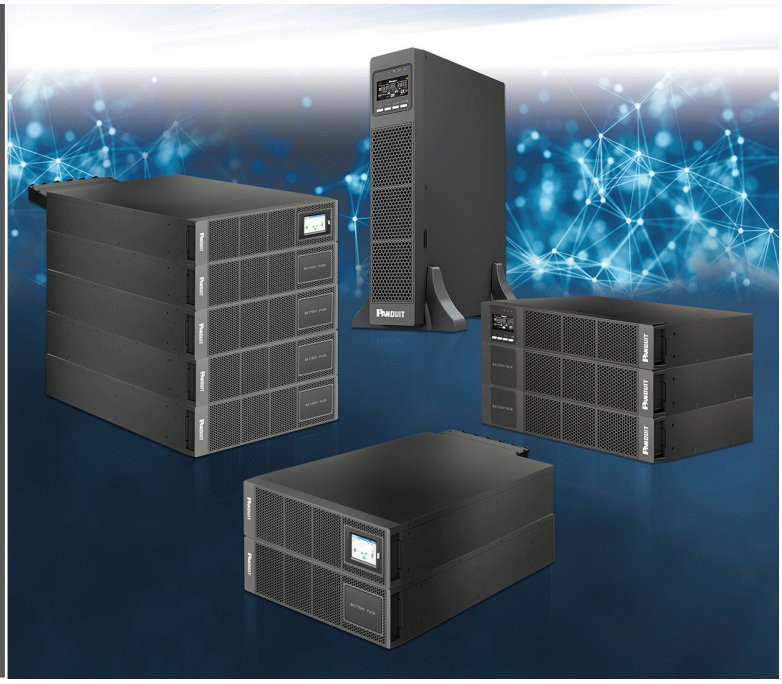

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Global data centre demand surges despite supply and power constraints

JLL's new 2025 Global Data Center Outlook explores the relationship between AI, sustainability and investment demand.

ARTIFICIAL INTELLIGENCE applications are rapidly expanding across industries, and the global data center industry plays a critical role in AI adoption and advancement. To meet the exponential data center demand, the sector will grow at a phenomenal pace in 2025. JLL's 2025 Global Data Center Outlook explores how AI is not only driving demand but the development of more powerful and efficient data center infrastructure that balances computing power and sustainability.

Across the hyperscale and colocation segments, an estimated 10 GW is projected to break ground globally in 2025, while 7 GW will likely reach completion. Based on this current pace of under construction and planned developments, the global data center market will likely expand at a baseline 15% CAGR through 2027 – with the potential to reach 20%. Rapid expansion brings challenges, including demand outstripping supply and electricity development constraints in some markets. The industry also faces numerous opportunities such as the immergence of new technologies.

"The pace of AI innovation is not slowing down, and the data center industry must continue to adapt," said Jonathan Kinsey, JLL EMEA Lead and Global Chair, Data Centre Solutions. "AI's transformative power demands have already reshaped our world, yet its most significant and enduring effect may lie in how we rise to meet the substantial energy demands required to fuel this technological revolution. The results will fundamentally reshape data center design and operation."

Next-generation AI requires higher rack density and advanced cooling technology

At the core of the AI revolution is the rapid advancement in semi-conductor technology. Over the past two years, GPUs have become substantially more powerful, leading to higher rack densities ranging from 40 kW to 130 kW per rack, with future chips projected to reach an astounding 250 kW per rack.

GPU innovation presents a significant hurdle: managing the heat generated by densely packed, energy-intensive GPUs. The necessity to keep this tech cooled and load variability stable, combined with new power usage effectiveness (PUE) regulations, will shift thermal management strategies toward liquid cooling as the standard for new data center developments. In the future, immersion cooling will become a common solution as GPUs surge past 150 kW.

Most new data centers are being designed to house a combination of both AI and traditional workloads. Though a significant driver, even optimistic adoption scenarios suggest that AI will represent less than 50% of data center demand in 2030, with traditional, lower-intensity workloads like data storage and cloud-based applications comprising most of the demand. "While not every data center is or will be a specialized AI facility, all data centers – new and existing – can benefit from more energy efficient operations and improved technology integration," said Andrew Green, JLL Regional Data Center Practice Lead, Asia Pacific. "Data center operators must contend with the demand for massive power needs while satisfying the need for more energy efficient facilities. AI is transforming data center management through predictive maintenance applications, which optimize energy usage, lead to longer lifespans for equipment and result in less down time."

Developers seek alternative energy solutions amid power transmission bottlenecks

Forecasts suggest that global data center energy demand could double over the next five years. While data centers consume large quantities of power, they are one component of the complex global power challenge. Furthermore, data centers are expected to represent only about 2% of global electricity consumption in 2025. A variety of other factors like increasing EV adoption, machinery electrification and rising power consumption in developing countries also contribute to growing power demand.

Power shortages to restrict 40% of AI Data Centres by 2027

AI and generative AI (GenAI) are driving rapid increases in electricity consumption, with data centre forecasts over the next two years reaching as high as 160% growth, according to Gartner, Inc. As a result, Gartner predicts 40% of existing AI data centres will be operationally constrained by power availability by 2027.

"THE EXPLOSIVE growth of new hyperscale data centres to implement GenAI is creating an insatiable demand for power that will exceed the ability of utility providers to expand their capacity fast enough," said Bob Johnson, VP Analyst at Gartner.

"In turn, this threatens to disrupt energy availability and lead to shortages, which will limit the growth of new data centres for GenAI and other uses from 2026." Gartner estimates the power required for data centres to run incremental AI-optimised servers will reach 500 terawatt-hours (TWh) per year in 2027, which is 2.6 times the level in 2023
.
"New larger data centres are being planned to handle the huge amounts of data needed to train and implement the rapidly expanding large language models (LLMs) that underpin GenAI applications,"

said Johnson. "However, short-term power shortages are likely to continue for years as new power transmission, distribution and generation capacity could take years to come online and won't alleviate current problems."
In the near future, the number of new data centres and the growth of GenAI will be governed by the availability of power to run them. Gartner recommends organisations determine the risks potential power shortages will have on all products and services.

Electricity prices will increase

The inevitable result of impending power shortages is an increase in the price of power, which will also increase the costs of operating LLMs, according to Gartner.

"Significant power users are working with major producers to secure long-term guaranteed sources of power independent of other grid demands," said Johnson. "In the meantime, the cost of power to operate data centres will increase significantly as operators use economic leverage to secure needed power. These costs will be passed on to AI/GenAI product and service providers as well."

Gartner recommends organisations evaluate future plans anticipating higher power costs and negotiate long-term contracts for data centre services at reasonable rates for power. Organisations should also factor significant cost increases when developing plans for new products and services, while also looking for alternative approaches that require less power.

Sustainability Goals Will Suffer Zero-carbon sustainability goals will also be negatively affected by short-term solutions to provide more power, as surging demand is forcing suppliers to increase production by any means possible. In some cases, this means keeping fossil fuel plants that had been scheduled for retirement in operation beyond their scheduled shutdown. "The reality is that increased data centre use will lead to increased CO2 emissions to generate the needed power in the short-term," said Johnson.

"This, in turn, will make it more difficult for data centre operators and their customers to meet aggressive sustainability goals relating to CO2 emissions."

Data centres require 24/7 power availability, which renewable power such as wind or solar cannot provide without some form of alternative supply during periods when not generating power, according to Gartner.

Reliable 24/7 power can only be generated by either hydroelectric, fossil fuel or nuclear power plants. In the long-term, new technologies for improved battery storage (e.g. sodium ion batteries) or clean power (e.g. small nuclear reactors) will become available and help achieve sustainability goals.

Data Centres across Europe struggle to meet decarbonisation goals amid growing energy demands

CFP Energy's survey shows that 90% of data centres in the UK, France, and Germany have decarbonisation strategies, but only 52% of French operators are meeting targets, compared to 70% in Germany and 78% in the UK.

AS GLOBAL demand for data processing surges and with it, an increase in energy demand and carbon emissions from data centres, operators across the UK, France and Germany are battling to achieve decarbonisation targets.

A survey published by CFP Energy sheds light on the energy transition efforts of data centres in Europe, with a range of other key industries featured. While most data centre operators have taken steps toward decarbonisation, significant barriers threaten progress, with the rapid growth of artificial intelligence (AI) intensifying energy usage and complicating sustainability goals.

The full report: *'Decarbonising the Future: Navigating ETS Reforms and Net Zero Solutions',* highlights similar challenges across aviation, manufacturing, shipping and construction sectors.

Decarbonisation strategies show mixed progress across countries, CFP Energy survey finds 90% of all data centres surveyed have a decarbonisation strategy, with the UK leading at 94%, followed by Germany (90%) and France (86%). However, success in hitting targets reveals a sharper divide. Only 52% of French operators report meeting their decarbonisation goals, compared to 70% in Germany and a notable 78% in the UK.

The adoption of green solutions for energy transition varies widely across nations

Green Certificates are most popular in France (71%) and Germany (60%), while the UK lags at 50%. Biofuels see the highest uptake in the UK (56%), compared to 43% in France and only 20% in Germany. Power

Purchase Agreements (PPAs) are widely embraced in Germany (70%) but less so in France (57%) and the UK (50%). Voluntary Carbon Offsets lead in Germany (80%), followed by 67% in the UK and 43% in France.

Data centres in Europe face key hurdles in decarbonising, with multiple challenges highlighted by respondents

69% cite a lack of suitable technology, hindering the adoption of renewable energy or energy-efficient systems. 61% identify funding limitations as a barrier, with high upfront costs delaying green investments. 63% point to regulatory complexity as a challenge, particularly for cross-border operations. Knowledge gaps also exacerbate difficulties, especially for smaller data centres struggling to design and implement effective decarbonisation strategies.

AI: Fueling expansion and exacerbating energy pressures in data centres

AI is reshaping the industry, driving unprecedented growth in computing power demand. While AI adoption is critical for innovation, its energy-intensive nature is pushing data centres to their limits. While AI has the potential to accelerate the energy transition through predictive systems and efficiency optimisation, its current implementation often exacerbates the strain on energy resources.

The survey highlights an urgent need for collaboration across governments, industry stakeholders, and technology providers to address these barriers. Streamlined regulatory frameworks, enhanced funding mechanisms, and technological innovation will be critical to ensure data centres can meet rising energy demands sustainably.

George Brown, Head of Content at CFP Energy, shared his concerns
"Data centres operate at the cutting edge of the technology sector, many of which are operated by the largest tech firms on the planet. And yet they are becoming a major issue for businesses to manage from an energy consumption and carbon emissions perspective.

As more applications of AI and new technology such as self-driving cars get online, the demand for data will continue its exponential growth."
CFP Energy urges industry leaders to act decisively, leveraging insights from this survey to shape policies and partnerships that accelerate the energy transition.

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Execs expect outages

PagerDuty has released a study that reveals service disruptions remain a critical concern for IT and business executives, with 88% of respondents saying they believe another major incident will occur in the next 12 months.

PAGERDUTY surveyed 1,000 IT and business executives who were director level and above, from the U.S., U.K., Australia and Japan. The study's findings illustrate how critical it is for companies to implement efficient processes and strategies for preventing major incidents and mitigating damages, while maintaining customer trust.

The PagerDuty study found that the 2024 July global IT outage was a learning experience for organizations. In today's digitally connected world, IT outages can be caused by everything from cyberattacks to human error.

86% of executives surveyed now realize that they have been prioritizing security at the expense of readiness for service disruptions, causing changes within the company.

The reality is that a focus on preventing service disruptions, which can often be security-related, is imperative for organizations today. Preparedness in terms of people, process and culture is key to ensuring disruptions are minimized to limit revenue and reputational harm.

83% of business and IT executives admitted that the July global IT outage caught them off guard , exposing gaps in their preparedness for service disruptions. 89% of executives in the U.K., 84% in the U.S,, 80% in Japan and 77% in Australia admit to being surprised by the disruptions.

Nearly half of IT executives (47%) believe that insufficient incident management planning will exacerbate the impact of major IT outages on their organizations , a concern shared by 41% of business executives, if approaches to service disruption are not prioritized. "The PagerDuty study shows that executives around the globe are shifting their leadership priorities with

major incidents in mind, with 100% of those surveyed reporting a heightened focus on preparing for future service disruptions at their companies," said Eric Johnson, chief information officer at PagerDuty.

"CEOs and their boards are now focused on this issue, and with the accelerated pace of AI and other advanced technologies being deployed, companies cannot afford to delay critical technology infrastructure updates."

Additionally, 55% of executives surveyed have observed a mindset shift towards continually evaluating and improving preparedness instead of a one-time move into investments in new systems or protocols that are now complete (45%).

Other key findings from the survey data include:

- A strong majority of executives surveyed in the U.K. (91%), U.S. (89%), Australia (88%) and Japan (78%) believe that it's not a matter of "if" but "when" these service disruptions happen.
- While some organizations were prepared for the digital disruption, others were not. Of those that were not fully prepared, 37% of executives said the July global IT outage resulted in lost revenue or an inability to process sales transactions and delayed response times by 39% to customer or internal requests.
- Organizations that experienced multiple service outages due to the July global IT disruption suffered communication breakdowns between departments (38%), delays in workflow and projects put on hold (35%). Overall, 39% of executives saw an impact on decision-making.
- Nearly half in the U.S. (48%), Australia (48%), and the U.K. (47%), along with a majority in Japan (53%) believe that limited access to real-time data tools will further hinder their organizations during an outage, if approaches to service disruption are not prioritized.

For many who experienced disruptions during service incidents, the July global IT outage meant a return to the old ways of doing things, as 44% saw increased reliance on manual processes or workarounds following the incident, showing just how much organizations rely on digital tools.

Data centres drive IT market surge

The surging demand for cloud computing, increased data volumes, and the widespread use of AI technologies have helped the data centers market not only to recover from the 2023 slowdown but to hit record highs.

ACCORDING to data presented by AltIndex.com, global spending on data centers is forecasted to grow by 15% and hit $367 billion in 2025, the biggest increase among all IT industry segments.

15% Surge Makes 2025 One of the Top 5 Years for Data Centers in a Decade
The data center market has seen explosive growth in the past ten years. From a once-niche piece of IT infrastructure, it has evolved into a massive revenue driver for tech giants and the talk of the investment world.

Today, Nvidia, a global supplier of parts for modern cloud storage and processing data centers, is the world`s largest tech company, outpacing even the tech giants Apple and Microsoft.

At the same time, Amazon Web Services generate roughly 20% of the ecommerce giant`s revenue, showcasing the huge role data centers have in its business. The surging use of AI technologies has only fueled the market growth, helping it to hit record highs.

According to Gartner, global spending on data centers has skyrocketed by 34% and hit over $318 billion this year. This shows a strong recovery after the 2023 slowdown, which saw 3% year-over-year growth and $236 billion in total spending. Gartner expects the double-digit growth to continue in 2025, with global spending on data centers jumping by another 15% and reaching over $367 billion.

Moreover, this places 2025 among the top five years for data centers in a decade. Besides a 34% surge in 2024, the market saw just as impressive growth of 20% and 16% in 2022 and 2018, respectively.

The data center boom is even more impressive compared to other IT industry segments, most of which will grow much slower. For instance, global spending on software will increase by 14% and hit over $1.2 trillion next year. The IT services segment is forecasted to see 9% growth and $1.7 trillion in revenue, while IT devices and communication services follow with a 9.5% and 4% annual increase, respectively.

Data centers spending more than doubled in a decade
Although it has become quite common for companies to spend hundreds of billions of dollars on data centers each year and to regularly increase their budgets for services in this segment of the IT industry, the ten-year difference in total spending is still shocking. The Gartner data shows global spending on data centers has more than doubled since 2015, when it amounted to roughly $171 billion.

Most of that growth came from only two markets, the United States and China, the world`s largest data center spenders. According to Statista Market Insights survey, the US market generated around $100 billion, or roughly 30% of total market revenue in 2024. This figure is expected to grow by 25% and hit $125 billion by 2028. The Chinese market will see even bigger growth, surging by 33% and reaching a $93 billion value by 2028. Other top markets, Japan, Germany, and the United Kingdom, will see similar growth rates, with their revenues growing by 32%, 27%, and 31%, respectively.

Less than a fifth of IT professionals say cloud infrastructure meets their needs

ACCORDING to new data from SolarWinds, less than one in five (18%) IT professionals believe their present cloud infrastructure satisfies their business needs, indicating a large disconnect between expectations and reality when it comes to cloud adoption.

The research, based on a survey of 272 global IT professionals, shows that despite the cloud's promises of scalability and cost savings, the reality is mixed for many IT teams: only a quarter of those surveyed (25%) feel their organisation's approach to the cloud is carefully considered and successful, while 23% admit their hybrid cloud strategy has created an overly complex IT environment. Despite this, less than a quarter (22%) of respondents have invested in external IT services to help with cloud migration strategy.

In response to these cloud challenges, more than one in ten (16%) respondents have already repatriated workloads back to on-premises. Meanwhile, a further 12% acknowledge that poorly planned cloud transitions have already resulted in long-term financial impacts on their organisations. This goes to show that rushed cloud migrations can lead to costly fixes or reversals.

The data also indicates a lack of trust in cloud security, with nearly half (46%) of IT pros still storing their most sensitive data on-premises due to persistent security worries. However, the findings do highlight a continued focus on cloud strategies with the aim of reducing costs. In fact, nearly a third (29%) of respondents say they are prioritising cloud migration to cut operational costs.

Market challenges rise by over a third as data centres battle mounting pressure

Annual research from Keysource uncovers operational transitions, existing challenges and future opportunities for IT and data sectors.

NINE in 10 (88%) UK data centres face increasing challenges due to growing market pressure, a 37% increase on last year's report. That's according to an independent Censuswide study commissioned by data centre solution provider Keysource for the seventh annual iteration of its 'State of the Industry' report.

More than 200 UK senior decision-makers within IT and data centre sectors were polled, and the results were compared with findings from previous years.

The relentless demand for faster delivery leaves data centres battling with greater risk (50%), poorer quality (29%) and increased costs (33%) in day-to-day operations. Under this pressure, over three-quarters (78%) of managers admit being required to overestimate their capacity, contributing to unnecessary wastage. Adding to the pressure, two thirds (66%) of data centres expect their infrastructure to change over the next four years.

"The increased power requirements of widespread AI use are catalysing a focus on heightened power capability, speed, and resilience for data centres. The dynamic of data centres overestimating capacity, while unsurprising given the high demand, is resulting in costly waste and needs addressing. Data centre decision makers must take advantage of innovative optimisation techniques, from location, initial build or stack configuration through to more effective cooling methods. The opportunity is there for those seeking more accurate capacity estimations and the efficiency this brings" stated Jon Healy, COO at Keysource.

Alongside market challenges, 40% of respondents affirm they do not possess the necessary skills required for modern demand, with four in 10 reporting a lack of available talent as the most significant blocker to solving the current skills gap.

"The IT and Data sector depends heavily on a skilled, mature workforce, and so it faces age-related biases that affect recruitment from both younger and older generations simultaneously", adds Rich Clifford, Director of Solutions at Keysource. "As the skills gap shows no sign of slowing, and future demands threaten to widen it further, the sector must recognise the value of tapping into talent across all age groups. Failing to invest in younger talent or to upskill older generations, impacts the accessibility to talent, drives hiring competition, and perpetuates the reliance on outsourcing."

Financial decisions toward climate positive progress remain divisive. While over half (55%) of data centre and IT teams have access to separate 'green' funds - up from 50% in 2023 - 40% of organisations still do not separate their budgets.

Sustainability remains a leading factor on the sector's agenda. The industry's drive towards enhanced sustainability is closely aligned with regulatory reporting under the Energy Efficiency Directive (EED).

Over three quarters (78%) of decision-makers believe they have the necessary data and tools to meet these reporting requirements. However, while many organisations feel prepared to meet their targets, only 40% rate their strategies as fit for purpose. When it comes to net-zero investment, Jon Healy concludes,

"The disparity in progress - whether perceived or actual – alongside the wide range of practices being adopted by different organisations, paints a picture of fragmentation. While an optimistic outlook is a strong indicator of net-zero's rising prioritisation, also evidenced by increasing rates of dedicated green funds, there is a need for greater standardisation across the sector. Data centres must move quickly to provide concrete evidence of sustainability progress, unifying efforts to invest in the innovations that can provide the most immediate impact".


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Optimise, optimise, optimise

To meet the energy challenge for data centres we need to apply circular principles – this is how we can do it.

BY TIM FOSTER, HEAD OF ENERGY SERVICES, CONRAD ENERGY

DATA CENTRES have a pivotal role to play in the future of global economies, including in the UK where the government is enthusiastically encouraging investors to build more. However, whilst building more data centres will be vital to unlock the promises offered by the digital economy, to accommodate them the total capacity of the UK grid will need to increase.

Indeed, the UK grid is already straining at the seams to deliver the volume of energy that the UK requires, whilst simultaneously attempting to connect new renewable power sources to the grid. All of which is to say that whilst the government might welcome the construction of new data centres, those tasked with keeping the lights on across the UK might be more sanguine about the prospect – particularly as the energy demands of data centres are expected to skyrocket as the use of AI becomes more commonplace.

However, whilst this problem is growing, the solution to it is also emerging at a similar rate. Renewable energy assets are being built in increasing numbers and with greater capacity to generate energy. A single onshore wind turbine installed today, for instance, can now generate over 4MW of energy, more than twice that of turbines installed 5 years ago. These advances in renewable energy will be crucial for powering the data centres of the future.

Unlocking the benefits of the digital economy sustainably

Given that renewable energy will have the key role to play in decarbonising the UK electricity industry, the challenge is to ensure that data centres are clearly drawing energy from renewable sources. That process will happen organically in part as the share of renewable energy across the National Grid continues to grow. But with the grid battling connection delays as well as capacity limits, a wait-and-see approach won't suffice.

Instead, it will be essential to build renewable energy assets alongside new data centres or to build new data centres close to where renewable assets are already located – in other words to use 'behind-the-meter' energy. This will enable data centres to be plugged directly into renewable assets, limiting their demands on the grid and – given the high energy costs that would otherwise be incurred by operating the data centre – offering significant financial benefits at the same time.

Every data centre will come to different decisions about the combination and nature of renewable energy sources that is right for its particular location, budget, and energy needs. This will require data centre operators to work with energy sector experts to map out these requirements and to assess the available options in order to draw up a bespoke plan

Examples of this can include using solar panels on the roof of a data centre or a wind turbine located in a nearby field. Amongst the advantages of behind-the-meter energy are predictability of cost and supply, both of which are particularly valuable for data centres (and indeed other energy intensive businesses) at a time of considerable fluctuation in the energy markets.

The costs of behind-the-meter energy are also lower than energy bought directly from the grid, meaning that the initial capex costs of installing renewable assets will effectively pay for itself in savings over time. Data centres will also have the option to sell excess energy to the grid and to take advantage of a range of tax credit schemes designed to encourage the installation of renewable energy. For data centre businesses that aren't in a position to make the upfront investment to install renewable assets, there is also the possibility of working with companies that provide fully funded renewable installations.

These installations are backed by a Power Purchase Agreement (PPA), whereby the data centre agrees to purchase the energy generated by the on- or near-site assets at an agreed upon price for an agreed upon duration. PPAs are also an option for data centres that aren't in position to install assets on or near-site. In this case, Corporate Power Purchase Agreements (CPPAs) see the data centre agree a long-term contract with an energy provider to purchase renewable energy generated at separate sites located elsewhere in the UK at a pre-agreed rate.

This offers numerous advantages, including guarantees on cost and supply stability as well as that the energy being purchased is generated by renewable sources. Indeed, innovative technologies now enable purchasers to track the amount of energy they are consuming to the outputs of renewable assets, providing transparent time-based energy matching.

Optimise, optimise, optimise

Although data centre operators have a range of different options to choose from when it comes to purchasing or generating energy, it is also essential that they make the most of that energy. In other words, it should be a key priority to make data centres run as efficiently and cost-effectively as possible.

An example of how data centre operators can go about this optimisation of operations is by accessing the data that will be provided through either a CPPA or behind-the-meter assets. This data can be used by power generation specialists to assess the optimal times for certain processes to be run. For those used to the historical principle that the cheapest time to run energy intensive processes is at night, the results may be surprising.

For data centres using large amounts of solar energy, rather than scheduling operations at night, it may be most cost-effective to shift these to the daytime when they are generating or sleeving maximum solar power. The possibility of negative energy prices on particularly windy or sunny days should also be taken into account by data centre operators when making energy purchase plans. Taking account of such factors is essential if data centres are to operate at optimum energy cost performance.

Every data centre will come to different decisions about the combination and nature of renewable energy sources that is right for its particular location, budget, and energy needs. This will require data centre operators to work with energy sector experts to map out these requirements and to assess the available options in order to draw up a bespoke plan. But given the potential savings on offer, the initial effort required to integrate renewable energy into operations should be amply rewarded for data centres – with such integration offering practical and financial benefits as well as ensuring that data centre operations are put on a sustainable footing.

How can we reduce data centres' emissions through AI?

Companies are facing a Catch 22 when it comes to the need to invest in new forms of AI, whilst continuing to hit increasingly stringent sustainability targets.

BY MAXIME VERMEIR, SENIOR DIRECTOR FOR AI STRATEGY AT ABBYY

RESEARCH from Morgan Stanley notes that as data centres expand due to the increasing demand for AI and cloud infrastructure, they are likely to produce around 2.5 billion metric tonnes of carbon dioxide-equivalent emissions globally through the end of the decade. To put it another way, training a single AI model can consume as much electricity as 100 homes for one year.

So, where does this leave business leaders who are trying to balance the need for innovation, while complying with environmentally friendly practices?

Optimise AI for renewable energy

Data centre operators aim to manage costs and ensure reliable performance by maintaining steady energy consumption. However, they currently rely on electricity grids and renewable energy sources, which can be inconsistent depending on the weather. We're still in a position where they may need to use fossil fuels during energy shortages, if they don't have sufficient pumped storage.

There are AI tools that can overcome these challenges by optimizing energy use. For example, the technology can predict the availability of solar energy by using weather data and predictive analysis. Predictive analytics like this could allow data centres to shift workloads according to renewable energy generation peaks, eventually enabling them to reduce their dependence on fossil fuels.

While AI is undoubtedly having an environmental impact, for many in the industry the benefits of the technology will outweigh the risks in combating the climate crisis. With the rise of energy-efficient algorithms and groundbreaking cooling systems, AI can be used as a powerful ally in the fight against climate change.

Utilise new AI technologies

AI is already playing a key role in redesigning sustainability programs, and it has the potential to significantly enhance energy efficiency. By optimizing operations and eliminating unnecessary processes, AI could lead to a substantial reduction in overall energy consumption over time. One way it is doing this is through digital twin technology. There are many variations of digital twins, and

depending on the type, the technology may cost as little as £50,000 to over £766,000 to deploy.

Digital twins are able to create a virtual replica of data centre infrastructure, which can then be used to generate real-time insights to improve efficiency. By automating tasks such as cooling adjustments, they reduce human error and reduce the amount of energy used.

Pivot to purpose-built AI

Finally, using specialized or purpose-built AI such as small language models (SLMs) can significantly reduce energy consumption. Advanced platforms such as generative AI and large language models (LLMs) have come under scrutiny for their high energy usage, stemming from the massive stores of data that must be navigated to yield results.

Instead, enterprises have begun to pivot to purpose-built AI specialized for narrower tasks and goals. These solutions are tailored to improve accuracy in real-world scenarios. For example, ABBYY trains its machine learning and natural language processing (NLP) models to read and understand documents that run through enterprise systems just like a human. With pre-trained AI skills to process highly specific document types with 95% accuracy, organizations can save trees by eliminating the use of paper while also reducing the amount of carbon emitted through cumbersome document management processes.

The future of AI will be determined by regulation

AI regulation is still in its early stages, and some aspects are yet to be fully refined. The EU's AI Act, which aims to regulate the use of AI systems based on their risk levels, came into force in July this year. It requires AI systems to prioritise transparency and safety, which could encourage responsible AI development and usage. However, how effective it ends up being will depend on how well it is implemented.

AI regulation is still in its early stages, and some aspects are yet to be fully refined. The EU's AI Act, which aims to regulate the use of AI systems based on their risk levels, came into force in July this year. It requires AI systems to prioritise transparency and safety, which could encourage responsible AI development and usage

Currently, regulations lean towards the data security and privacy side, often neglecting the environmental impacts of AI. While security concerns are clearly vital to address, it's important to consider the broader implications of AI on the environment as well.

To my mind, better defined national, regional and international frameworks are needed for energy consumption, especially in view of the role of the energy sector in the global economy and its importance for climate goals.

As more regulations are proposed and come into play, the fact remains that it's important to get the balance right between regulation on one hand, and allowing businesses enough creative freedom to make advances in AI on the other.

With a lack of legislation in the sustainability arena, it's up to business leaders to take the initiative and ensure transparency and accountability for sustainability credentials are upheld when implementing AI. Companies willing to embrace this challenge can not only gain substantial economic advantages but also establish a new standard for sustainable innovation.

Navigating power challenges in the data centre era

The rapid growth of data centres and IT-driven enterprises has created an escalating demand for resilient power infrastructures. This demand is intensified by the global transition to renewable energy sources, which are inherently intermittent

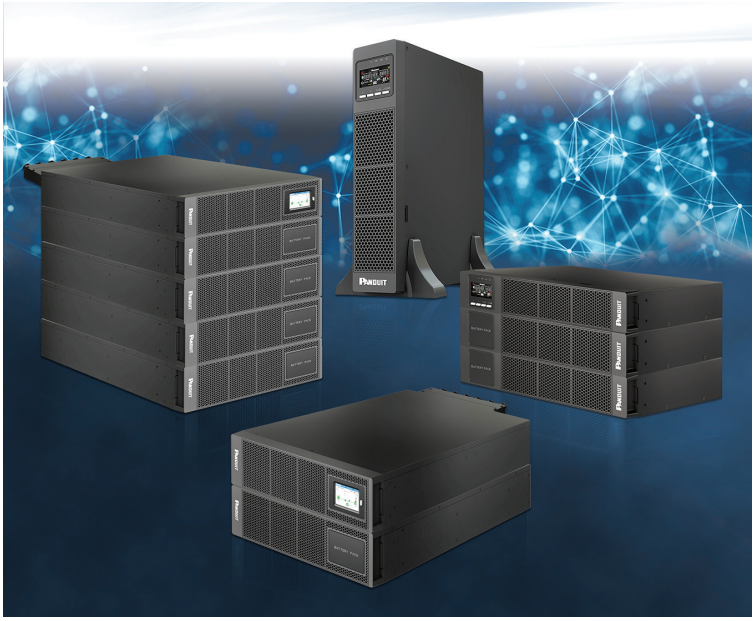
BY MICHAEL AKINLA, BUSINESS MANAGER EUROPE NORTH, PANDUIT

AGAINST this backdrop, data centre operators face mounting pressure to deploy integrated Uninterruptible Power Supply (UPS) systems as a safeguard against power disruptions. A comprehensive approach to UPS implementation is no longer optional, it is critical for maintaining operational continuity, customer trust, and financial stability.

Reliable power solutions

Power outages are an enduring challenge for IT-dependent businesses. According to the Uptime Institute, a significant percentage of data centres have experienced outages in the past three years, underscoring the vulnerability of even advanced infrastructures. These disruptions can cause severe repercussions, ranging from data loss and extended downtime to reputational damage and financial penalties.

The stakes are particularly high in industries like finance, where even a brief disruption can lead to substantial monetary losses. In such environments, UPS systems serve as the linchpin for uninterrupted operations, bridging the gap between utility power failure and the activation of backup generators. For hyperscale data centres, this window may span just 1-2 minutes, whereas financial institutions might require 10-15 minutes of runtime to ensure data integrity and process continuity.



➤ Panduit's ranges of Li-ion and VRLA UPS

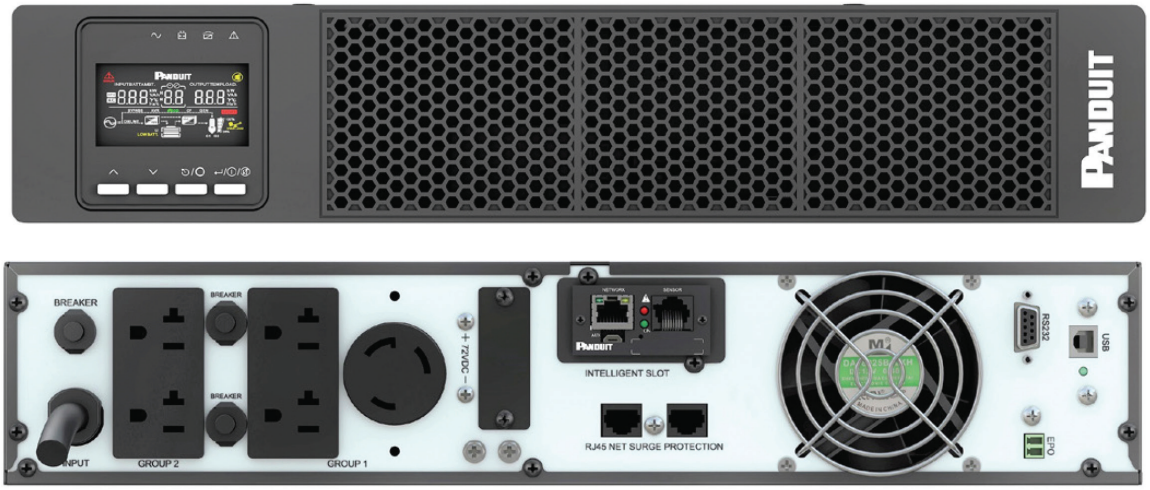
The global UPS market is projected to reach $13 billion in 2025, driven by advancements in technology and growing demands for efficiency and reliability. In some scenarios traditional Valve-Regulated Lead-Acid (VRLA) batteries have given way to more advanced lithium-ion (Li-ion) alternatives. Li-ion batteries offer a variety of benefits, including smaller footprints, reduced weight, longer lifecycles, and enhanced energy density. These attributes make them ideal for edge computing and high-density environments, where space and energy efficiency are paramount.

Moreover, modularity has emerged as a key innovation in UPS design. Modern systems feature hot-swappable components, enabling seamless maintenance and scalability without disrupting operations. Intelligent battery management systems further enhance reliability by continuously monitoring battery health and environmental conditions. These systems help optimize performance, extend battery life, and reduce the risk of unexpected failures.

Customizing UPS for diverse applications

Selecting the right UPS system requires a nuanced understanding of the specific needs of the IT environment. Factors such as risk tolerance, the resilience of applications, and the availability of backup generators influence the choice of UPS configurations. For instance:

- **Hyperscale Data Centres:** Typically require UPS support for 1-2 minutes to transition to generator power.
- **Colocation Sites:** Demand runtimes of approximately 5 minutes to manage varied client needs.



➤ Panduit's UPS offer a range of connectivity and power options

- **Financial Institutions:** Require 10-15 minutes of runtime to safeguard mission-critical data and processes, as even brief downtimes can result in significant financial losses and reputational damage.

These differing requirements can substantially change the power density required especially with such different uptime requirements of the bridging power. Over provisioning UPS capacity can lead to unnecessary capital expenditures, while under provisioning increases vulnerability to outages. A balanced approach must ensure cost-efficiency and operational reliability are central to overall data centre power provision.

Today's UPS are not standalone systems, they are integral components of a larger ecosystem. Advanced UPS models integrate seamlessly with Data Centre Infrastructure Management (DCIM) platforms, providing real-time insights into power usage, environmental conditions, and potential vulnerabilities. Cloud-based monitoring further enhances visibility, enabling IT teams to manage power systems remotely and proactively address issues before they escalate.

Additionally, intelligent power distribution units (iPDUs) in data centre racks and cabinets complement UPS functionality by offering enhanced communication and control capabilities. Features such as programmable outlets, temperature adjustment algorithms, and smart load-shedding ensure optimal resource utilization and operational efficiency. Sustainability is becoming a central consideration for data centre operators. Today's UPS systems are designed to meet stringent energy efficiency and environmental standards, such as ENERGY STAR® compliance. The shift toward Li-ion batteries also contributes to sustainability goals, as these batteries require less frequent replacement and have a lower environmental impact compared to VRLA alternatives.

Challenges and opportunities ahead

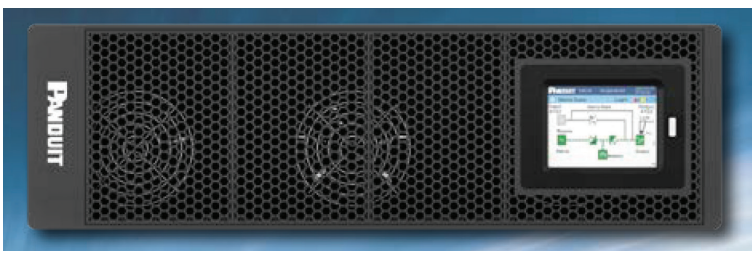
The relentless pace of technological innovation presents both challenges and opportunities for UPS implementation. As IT equipment becomes denser and more power-intensive, the demand for robust and scalable UPS solutions will only grow. Operators must stay ahead of these trends by investing in systems that combine high efficiency, adaptability, and intelligent monitoring.

For example, Panduit's UPS portfolio exemplifies the next generation of power protection, offering solutions tailored to diverse applications. From compact 1-3 kVA systems for edge computing to 20 kVA configurations for large-scale enterprises, these systems address a wide spectrum of operational needs. Features like double conversion pure sinewave technology, unity power factor, and cloud monitoring readiness ensure that businesses are equipped to handle future challenges.

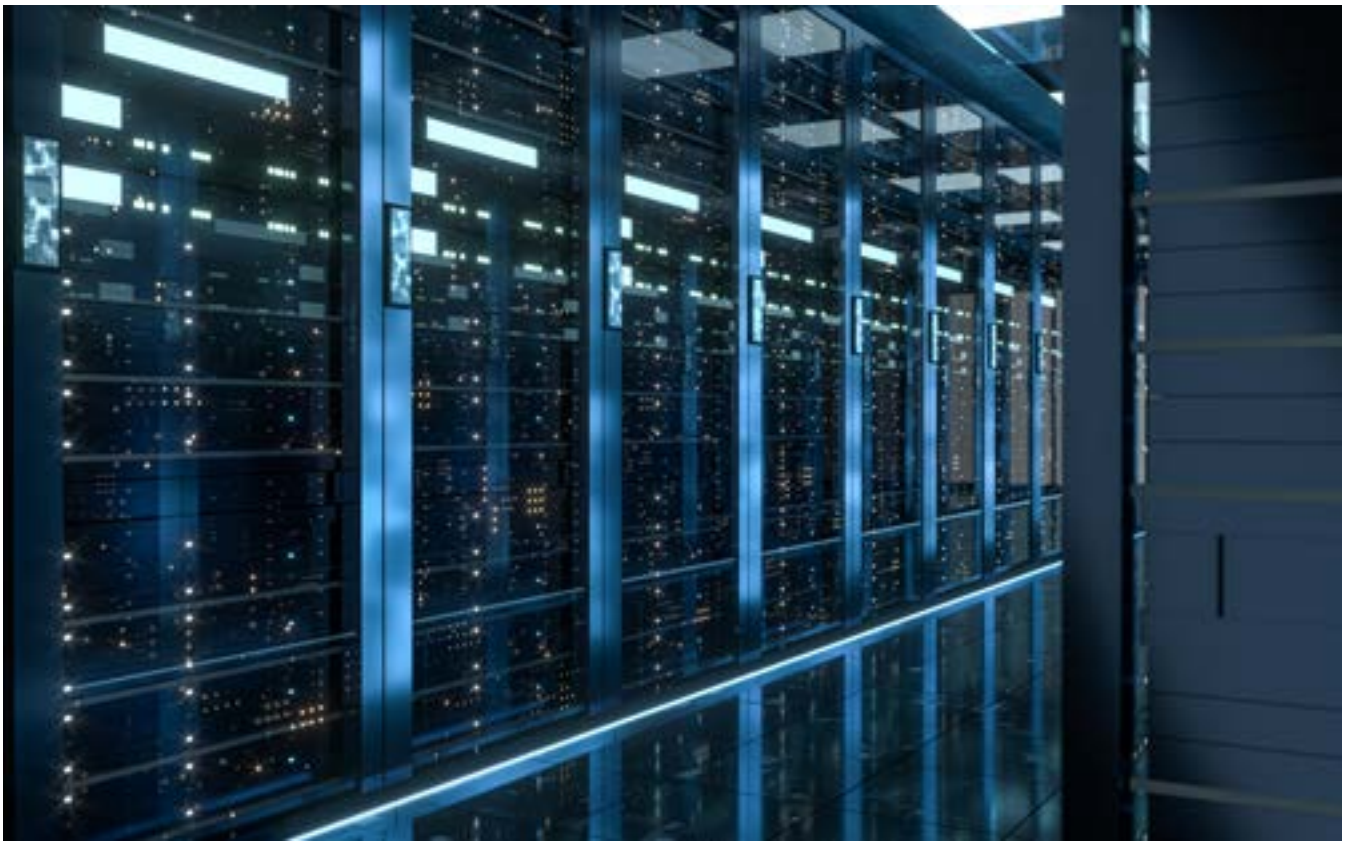
Conclusion

In an era where uninterrupted power is a non-negotiable requirement, integrated UPS solutions are indispensable for data centre operators. Beyond merely providing backup power, these systems are critical for maintaining business continuity, safeguarding data integrity, and ensuring customer satisfaction. By embracing innovations such as Li-ion batteries, modular designs, and cloud-based management, operators can build resilient and future-proof infrastructures.

The pressure to implement robust power management strategies will only intensify as global energy demands rise and the transition to renewables accelerates. For data centres, the integration of UPS into a holistic energy strategy is not just a technical requirement, it is a strategic imperative for longer term success.



➤ Panduit's SteadySine™ On-Line Double Conversion UPS



Meeting denser data centre workloads in the age of AI

Prefabricated aisle containment systems ideal for the support of escalated processing power.

BY BRIAN PATE, DATA CENTER SPECIALIST, ATKORE INTERNATIONAL

IN THE ever-evolving data center landscape, the need for massive processing, computing, and storage power is continually escalating. The advancement of Generative AI, Machine Learning (ML), High Performance Computing (HPC), and Hyperscale Cloud architectures has ushered in an era of unprecedented data demands—innovative and adaptive data center technology solutions are a necessity across an array of areas, including management of interior cabling and infrastructure design.

As data centers strive to handle the immense real-time processing needs associated with AI, denser workloads are driving electrical and mechanical requirements to an unprecedented level. This inherently means denser cabling configurations, with heavier busducts, cable trays, fiber guides, and ladder racking cable management requirements needed to transmit increased volumes of processing, storage, and computer power.

Freestanding, floor-supported aisle containment systems are a robust solution for heavier data center workloads. When a large majority of system materials are prefabricated offsite, increased electrical and mechanical workloads can be accommodated, deployments can be escalated, and onsite risk can be reduced during install.

Designed and built to withstand the increased loads of today's data center cabling infrastructures, prefabricated or "prefab" aisle containment systems are composed of modular components that can be quickly assembled to create secure aisle containment pathways that can accommodate a variety of sizes and configurations. The optimization of material usage within these systems can create unique configurations that allow easier access to cabling infrastructure (whether aisles are hot or cold), increasing speed of deployment and aiding in the installation process to ensure a project is on budget and on schedule.

The Benefits of Prefab Aisle Containment Systems
By taking advantage of prefab aisle containment systems, data centers with large-scale AI-based applications can offer enhanced design and setup flexibility, improve accessibility via removeable panels, and optimize cooling efficiency and overall performance.

The benefits of freestanding, floor-supported aisle containment systems include a rapid deployment process, flexibility for densification of physical infrastructure, production at scale, cost savings, and improved quality control when materials come directly from the manufacturer, all while keeping sustainability top of mind. Floor-supported aisle containment systems offer a variety of assembly, scalability, flexibility, cooling, safety, and upfront cost advantages:

Enhanced flexibility & scalability

Modular in nature, aisle containment systems are custom-designed and then configured onsite to meet the exact needs of a data center's physical layout.

A floor-supported containment architecture also provides the flexibility needed to adapt to evolving electrical conveyance setups. As AI continues to drive more densification- cabling configurations, fiberguide and busduct can be reconfigured with height-adjustable outriggers or cantilever arms. The modularity of these systems allows for scalability and ongoing growth as the needs of a hybrid ecosystem expand—plus the ability to add material components and supports without disrupting the live environment.

Optimised cooling & airflow

Aisle containment systems optimize data center airflow by helping efficiently direct both hot and cool air streams. Efficient airflow management is inherently designed into floor-supported aisle containment systems, contributing to both improved cooling efficiency and reduced energy consumption. In this regard, aisle containment systems can also contribute to sustainability efforts and help reduce a data center's carbon footprint.

Lower installation costs

The installation of a floor-supported aisle containment system may involve fewer labor-intensive tasks when deployed onsite, with fewer loose frame connections, components, and attachment hardware to assemble, which translates to a streamlined workflow and a highly repeatable "assembly line"-like deployment.

The prefabricated nature of aisle containment systems allows for some level of prekitting or preassembly, which can reduce onsite assembly through simplification of containment components. And since offsite manufacturing is the main production vehicle for aisle containment systems, the manufacturer can drive a lot of the solution in a controlled environment, making way for consistent quality standards—which can translate to reduced production costs.

Increased workflow & project safety

Utilizing cantilever arms or outriggers affixed to the containment system electrical conveyance and busduct can be accessed from a variety of locations, making the cabling installation process more streamlined, reducing trade congestion and improving operational continuity. Floor-supported aisle containment systems also further reduce project complexity due to the fact that they require less hardware, bolts, and bracketry than traditional architecture, which is advantageous to installing parties and allows for rapid deployment.

Freestanding, floor-supported aisle containment systems also contribute to a safer working environment both during installation and in day-to-day data center operation. Utilizing offsite manufacturing and prefabrication, the solution arrives to the site kitted, with fewer materials to stick-build, which equates to less onsite working congestion. The robust nature of floor-supported aisle containment systems lends itself to engineering flexibility that can withstand heavy electrical and mechanical infrastructure loads and allows for future proofing to accommodate densities.

Aisle containment systems are typically deployed with twin wall polycarbonate paneling that has smoke- and flame-resistant characteristics. Typically, this provides a cost-conscious approach with the ability to thermally insulate and safely remove the hot air from the environment. This contributes to energy efficiency and reduces cooling costs by preventing the mixing of hot and cold air. Additionally, its flame-retardant properties and low smoke emission characteristics make it a safe material, compliant with fire life safety standards. These attributes collectively contribute to containment efficiency, safety, and reliability during data center operation.

Reduced design costs

With floor-supported aisle containment systems, design costs can be lower when a standardized level of materials and components are used—while floor layouts change from project to project, the overall design approach is set around a pre-engineered set of criteria following industry standards. The modular nature of prefabricated cable systems streamlines the design process as system engineers can start their design with a selection of predesigned modules, easily configuring them to the exact needs of the data center environment.

Prefab aisle containment systems usually undergo testing, ensuring compliance with building codes and industry standards. This level of pre-engineering and testing can decrease the time and resources needed for upfront design and limit multiple recasts before deployment.

With a variety of AI-based applications, Machine Learning (ML), High Performance Computing (HPC), and advanced cloud technologies evolving by the day, data centers and their critical environments need to keep up with the densification of server, storage, and networking infrastructures. Data centers consume energy and produce volumes of heat. An airflow strategy is critical for the maximization of cooling efficiencies onsite. The careful integration of cabling and electrical infrastructure integrated with aisle containment configurations can elevate operational performance. The built-in scalability of prefab aisle containment systems also helps save money as containment sections can be easily added or reconfigured.

Engineered before they arrive onsite—cutting back on lead times and reducing schedule delays—freestanding aisle containment systems are designed based on structure height, aisle width, and aisle height, and can feature any number of outrigger or cantilever arms as well as single swing or dual sliding door systems. Offsite manufacturing of containment systems can provide a consistent level of quality and material standards that allow for rapid integration of electrical components such as busduct, cable tray, wire basket, lighting, AC and DC cabling, and fiber infrastructure.

Data centers are critical to the processing, storage, and transmission of data around the world. Prefab and offsite manufacturing of floor-supported aisle containment systems aids today's largest and most advanced data center operators and assists in optimizing their infrastructure, increasing cooling efficiencies, lowering operational expenses, and enhancing profitability while the industry at large remains poised for global leaps forward in AI, ML, and inference along with cloud and HPC technology.

Uninterruptible Power Supply

Delivering Reliable Power Protection and Backup Power Efficiently

Quality & Reliability

Verified and validated using robust premium components

High Efficiency

Up to 98% in ECO mode and 98.5% efficiency in line-interactive therefore reducing energy waste and the cost of operation

Intelligent Battery Management

Intelligent algorithm provides fast charging for the battery while maximizing its lifespan

Integrated Wifi

Provides wireless network connectivity as well as direct connectivity for quick and easy configuration and activation for large deployments

Uninterruptible Power Supply

Green Design

Meets Green initiatives and reduces environmental impact

Secure Remote Monitoring

Intelligent network card with PEN certification best industry security practice and intelligent swinghandle integration

Lithium Batteries

5× Energy Density in 1/3 space, 3× Lifespan & Faster Charging than VRLA

Programmable Outlet Group

Smartload shed features with agentless shutdown saving more energy and extending the runtime for critical load

For more information, visit
https://mkt.panduit.com/UK-UPS.html

Powering AI innovation while preserving sustainability in data centres

The rise of artificial intelligence is transforming how we work and live. From medical diagnosis to financial forecasting, AI is bringing automation, efficiency, and advanced analytics to a vast array of industries. However, this progress comes at a serious cost – the immense energy consumption required to power these advanced processes. According to a recent study, generative AI may require up to 33x more energy than task-specific software.

BY JAD JEBARA, CEO OF HYPERVIEW

ACROSS industries we can expect to see this energy consumption increase as the UK AI market increases. Indeed, according to the International Trade Administration, the UK AI market is worth more than £16.8 billion and is expected to grow to £801.6 billion by 2035. It's imperative data centre operators begin to identify and implement key strategies to support navigating the growing AI boom.

By strategically addressing these factors, data centres can facilitate AI innovation while also ensuring sustainable and efficient operations. The first step operators should take is identifying where data centre energy is used the most – but how? Data driven insights for targeted efficiency gains Traditionally, tackling energy waste in data centres has been a guessing game. However, modern data centre management innovations that have emerged in recent years offer a more precise approach. These platforms continuously monitor resource utilisation, power consumption, and even environmental conditions within the facility. This real-time data empowers operators to identify inefficiencies, such as overtaxed cooling systems.

With this knowledge in hand, operators can strategically target the necessary areas for improvement - leading to significant energy savings while driving sustainability efforts. Another beneficial use case includes analysing data so operators can identify hotspots within the data centre and optimise cooling systems to focus on areas that require it. Similarly, detailed power usage effectiveness (PUE) reports can highlight inefficient servers that can be replaced with more energy-efficient models.
By acting on accurate, real-time data analytics, data centre operators can make targeted decisions – and investments - that maximise energy efficiency while facilitating the increased power demands of AI.

Optimising resource utilisation

The power required to train and run AI models can be substantial. Traditional data centres often

operate with underutilised resources, using energy unnecessarily. To achieve optimal resource utilisation, data centres need to develop and implement a comprehensive strategy based on data. This includes capacity planning, real-time monitoring, asset management, environmental control, and real-time data analytics.

By deploying these strategies, data centres can significantly reduce idle processing power, translating into lower energy consumption. This optimisation not only benefits the environment, but also frees up resources for more demanding AI workloads, boosting efficiency and cost effectiveness.

Embracing sustainable power sources

When addressing long-term sustainability efforts, data centres need to think ahead to making the switch to renewable energy sources. This means the data centre will need to work with companies that generate electricity from renewable sources, or invest in on-site renewable energy generation technologies, like solar panels. These approaches can significantly reduce reliance on energy derived from fossil fuels and minimise the environmental impact of increased AI operations. Furthermore, exploring alternative cooling solutions is another important step data centre operators can take.

Traditional air conditioning systems are energy intensive. Implementing liquid cooling technologies, which transfer heat more efficiently, can lead to substantial energy savings. Additionally, utilising innovative cooling techniques, such as outside air economiser for free cooling during colder periods, can further decrease reliance on energy-hungry cooling systems.

A sustainable future with AI

The rise of artificial intelligence is undeniable, and data centres will undoubtedly play a critical role in its advancement. However, data centres must ensure this progress doesn't come at the cost of environmental damage. By leveraging data insights, embracing renewable energy sources, and implementing innovative cooling solutions, data centres can push help push the AI revolution to the next level, while remaining sustainable.

The time to act is now. Data centre operators must prioritise energy efficiency as they plan for the future by investing in data centre management platforms, embracing continuous monitoring, and collaborating with technology partners who offer sustainable solutions. By taking these steps, operators can future-proof their data centres - contributing to a greener tomorrow while ensuring the power of AI is harnessed responsibly.

Leveraging AI for sustainable data centres

Discovering the path to greener technology.

BY ANDY CONNOR, CHANNEL DIRECTOR EMEA FOR SUBZERO ENGINEERING

THE DIGITAL AGE has meant that demand for data processing has soared in recent years, placing data centers front and central to the internet and cloud computing infrastructure.

Recent research from Goldman Sachs Research has estimated that while data centers currently consume between 1 and 2% of the world's overall power, this demand is expected to grow by 160% by the end of the decade. And it is this unprecedented energy demand that can incur significant environmental costs, with 2022 to 2030 carbon emissions predicted to double!

The upsurge of AI must take responsibility for its role in increased energy consumption. According to the International Energy Agency, a Google search requires just 0.3 watt-hours of electricity, compared with a mighty 2.9 watt-hours for a single ChatGPT query. In this article, we look at both the part AI plays in technology's demand for power, and conversely its huge potential in advancing sustainability efforts.

AI's role in advancing sustainability

By balancing the power and cooling requirements of data centers with the need for efficiency, AI algorithms can predict, monitor, and adjust power consumption in real time, optimizing server utilization, cooling systems, or other infrastructure by reducing energy wastage from idle or underutilized equipment. This approach can pay huge dividends, resulting in notable energy savings and improved operational efficiency.

Cooling contributes to a significant energy expenditure in data centers. Modeling using Computational Fluid Dynamics (CFD), uses AI insights to manage cooling systems by adjusting

temperature and airflow based on real-time data and predictive analytics without compromising performance.

This allows data center operators and engineers to achieve improved energy efficiency, by enhancing cooling performance, proactively addressing issues to minimize downtime, and delivering optimal resource utilization. This enables informed decisions to be made in the reduction of energy consumption and improvement of overall efficiency.

Going forward, we expect to see CFD used extensively with the integration of machine learning (ML) and AI ITE and hybrid cooling designs, with a continued priority on energy efficiency and sustainability.

As an exercise, we have kept track of the savings we have achieved for our customers through careful and considered optimization of their data center environments. The numbers are impressive. Since 2015 our customers have saved just under 9.1 billion kilowatt hours, reduced water consumption by 4.3 billion gallons, and have a total carbon reduction figure of more than 8.6 million tons - the equivalent of planting 47 million trees.

Along the way, we've also been able to help customers achieve an estimated 25% energy cost reduction and reduced the PUE (Power Usage Effectiveness) figure by an average of 0.3.

AI's role in renewable energy sources

Adopting AI and other emerging technologies must not come at the expense of environmental impact. The integration of renewable energy sources into data center operations therefore, remains pivotal in obtaining true sustainability credibility. Using free environmental energy sources, such as solar, wind, or water provides a sustainable means for power with AI further reducing the carbon footprint by predicting production from the source and aligning it with the facility's demands. As an example, AI plays a critical role in monitoring and managing Microsoft's Project Natick's underwater data centers ensuring they operate efficiently, sustainably, and reliably.

There are, and will always be regional challenges, such as high temperatures, water scarcity, or high dust surroundings that can impact sustainability. AI can mitigate these challenges by predictive modeling, but there is an additional need to invest in research and development to advance renewable technologies. Furthermore, by sharing these innovations with the broader industry, this leadership can help drive the adoption and influence of sustainable solutions across the tech sector.

Integrating sustainability into AI development Strategies Without Compromising Innovation

Many hyperscalers are considering their infrastructure today for tomorrow's technologies. They want to know that if by upgrading from a standard data center to an AI high-performance data center would it result in having to rip everything out, restarting their business from the ground up? They want to know if they can install a hyperscale area in their current facility or, in the event they need to put in piping for water cooling, that the infrastructure is primed and optimized for hyperscaling challenges.

When talking to our customers we ask them what they want to achieve, when they want to achieve it, and how we can help them engineer a solution that will work for them now and going forward. Are there alternative materials that are closer to sustainability values? How can we work better to make something that will be around for 10 or 20 years? We also discuss the type of materials being used. We're working closely with other companies where we can produce a product that's viable against steel. It's more efficient and more sustainable. You can transfer it, it's lighter and these things make a difference.

Is the hyperscaler running its own data center? Or are they taking space in a CoLo? If they're in a CoLo, there's a responsibility on all sides to achieve sustainability goals. Often customers taking space in a CoLo don't care how efficient that data center is. They just want to make sure their SLAs are met. The CoLos are up against it because they need to provide the metrics of whoever's taking the estate. But, as legislation comes in, the efficiency of the data center will remain the focus.

The future of AI and sustainable data centers

If you were looking at a true 100% AI infrastructure data center, the likelihood is that it won't exist just yet. There will always be areas within the industry that will need high-performance compute processing power, but most facilities are likely to be powering what they do now; our phones, apps, laptops, and smart homes.

While new-build data centers can make themselves reasonably sustainable and efficient, legacy data centers have their work cut out. And that's where new containment systems ready for AI technologies, such as on-chip cooling, can enable companies to upgrade to more sustainable cooling solutions, without the need to completely rebuild.

AI is another step in the evolution of digital transformation. We can either allow it to consume more power or leverage it to enhance operational efficiency, integrate renewable energy sources, and drive substantial and purposeful change.

Organizations will continue to embrace AI-driven solutions but it is in the optimization of the technology, that can pave the way for greener and more energy-efficient infrastructure, benefiting both business and the planet.

Scaling the future

AI's role in data centre operations and scalability

BY RAMZI CHARIF, VP TECHNICAL OPERATIONS, EMEA, VIRTUS DATA CENTRES

WITH the digital economy expanding at an unprecedented rate, the data centre providers are under growing pressure to scale operations quickly, efficiently and sustainably. As a result, cloud services and AI-driven applications are leading to increasing demands for data storage and processing, making traditional infrastructure inefficient and costly. As well as being the cause for some of these issues, AI is also a tool that can help meet these challenges, not only by optimising current operations but by fundamentally reshaping how data centres can grow and adapt to cope with future demands.

AI-enhanced operations: Setting the foundation for scalability

Before addressing the scalability challenge, it's crucial to understand the operational role that AI is already playing in today's data centres. In traditional environments, much of the day-to-day monitoring and resource management is done manually or through fixed schedules. This model can leads to inefficiencies as adjustments are made reactively, rather than proactively.

AI-driven systems provide an entirely different approach by automating routine processes like real-time monitoring, energy management and workload distribution. For example, AI platforms continuously collect data from various sensors spread throughout the facility, from temperature and humidity monitors to power consumption trackers. The system processes this data instantly, enabling it to make real-time adjustments, such as rebalancing workloads or altering cooling settings to avoid performance issues.

This constant optimisation is critical in laying the groundwork for scalability. With AI handling the smaller, repetitive tasks, data centre operators are free to focus on high-level strategies for growth. Additionally, AI ensures that as facilities expand, they can maintain efficiency and reliability across more complex operations.

The challenge: Managing resources as demand grows

As data centres scale, managing resources effectively becomes increasingly complex. Traditionally, expanding operations meant adding more servers, storage units or even building new facilities - methods that quickly lead to inefficiencies and rising costs. AI offers a smarter alternative by intelligently managing resources and automating much of the scaling process.

AI's dynamic resource management capabilities ensure that workloads are distributed evenly across servers, preventing overload on certain machines while others sit idle. This balance maximises the performance of existing infrastructure, allowing data centres to scale up without necessarily increasing their physical footprint. For example, if AI detects a spike in demand, it can automatically allocate additional resources to the servers that need them most, ensuring that performance remains consistent even during periods of high activity.

As AI continues to evolve, its role in managing multi-site operations will also grow. By leveraging AI, data centres with multiple locations can coordinate resource-sharing across sites, ensuring that each facility is used optimally, rather than building new infrastructure to handle temporary spikes in demand.

AI-driven cooling: Efficient energy use at scale

Energy management, particularly cooling, is one of the most significant challenges for data centres. Cooling systems are responsible for up to 40% of a data centre's total energy consumption, and as operations grow, this percentage can increase if systems are not managed efficiently. AI-driven cooling solutions provide a vital tool for maintaining energy efficiency even as data centres expand.

Rather than relying on fixed cooling schedules, AI systems dynamically adjust cooling strategies in real-time, based on current workloads and environmental conditions. For example, if AI detects that certain servers are under heavy load while others are operating at lower capacity, it can redirect cooling resources to the areas where they are needed most. This targeted approach ensures that cooling is applied efficiently, reducing energy waste and preventing overcooling.

AI's predictive capabilities also mean it can anticipate cooling needs based on historical data and environmental factors. If a spike in workload is expected, AI can pre-emptively adjust cooling levels to maintain system stability without overloading the system. As data centres scale, these AI-driven cooling strategies ensure that energy consumption remains controlled, keeping costs down and supporting sustainability goals.

Predictive maintenance: Reducing Downtime as operations scale

As data centres grow in size and complexity, maintaining the infrastructure becomes more challenging. Traditional maintenance practices rely on scheduled checks, but these can be inefficient, leading to either unnecessary downtime or missed early warning signs of equipment failure. AI's predictive maintenance tools are transforming how data centres manage their infrastructure, allowing for a more efficient and proactive approach.

AI systems analyse performance data from critical infrastructure - such as servers, cooling units and power systems - and use it to predict when failures are likely to occur. This data-driven approach enables operators to schedule maintenance only when it is necessary, rather than adhering to rigid timelines. For instance, if AI detects that a cooling unit is beginning to operate outside of its optimal parameters, it can alert the maintenance team before a breakdown occurs, avoiding both unnecessary downtime and expensive repairs.

Predictive maintenance also has the advantage of extending the lifespan of equipment. By identifying and addressing potential issues early, AI systems help components to be kept in good condition for longer, reducing the frequency of replacements and keeping operational costs down. As data centres scale, this proactive approach to maintenance becomes even more valuable, preventing disruptions that could affect larger and more complex operations.

Securing data centres at scale: AI's role in cybersecurity

The larger and more distributed a data centre becomes, the more vulnerable it is to cyber threats. As data centres scale, their attack surface grows, making them more attractive targets for hackers and cybercriminals. Traditional security measures, which often rely on fixed rules and manual oversight, struggle to keep up with the evolving nature of these threats. AI offers a more adaptive and responsive solution to this challenge.

AI-driven security systems continuously monitor network traffic and access patterns in real-time, detecting any unusual activity that might indicate a potential breach. By analysing this data, AI can identify and respond to threats far faster than a human-operated system could. For example, if AI detects a sudden spike in data transfers or an unauthorised login attempt, it can immediately isolate the affected area, preventing the attack from spreading.

Additionally, AI's machine learning capabilities enable it to evolve with each new threat, improving its accuracy and response times over time. As data centres scale and the complexity of their operations increases, AI's role in ensuring security will be essential, providing real-time protection against increasingly sophisticated cyberattacks.

The future of data centre scalability: AI as the driving force

AI's role in data centre scalability is only set to grow as demand for digital services increases. By automating key processes like resource management, energy use, predictive maintenance, and security, AI enables data centres to scale efficiently without sacrificing performance or reliability. Moreover, as AI technology continues to evolve, its ability to support distributed networks - such as edge data centres - will become increasingly important, ensuring that data centres remain agile and adaptable in the face of new challenges.

For operators, investing in AI is no longer just an option; it is becoming a necessity. The ability to scale operations seamlessly, while maintaining efficiency and minimising costs, will define the future of the data centre industry. Those who embrace AI now will be best positioned to meet the growing demands of tomorrow's digital landscape.

How to figure out your realistic IT infrastructure scaling needs

Scaling effectively is the key to a successful business. But for many non-technical people, getting a grasp on infrastructure scalability is a complex task. Surprisingly, even the most seasoned professionals in technical roles often grapple with the nuances of scalability, leading to costly missteps.

BY ISAAC DOUGLAS, CRO AT GLOBAL IAAS HOSTING PLATFORM SERVERS.COM

SCALABILITY is more than avoiding downtime or managing costs. It's the key to sustainable business growth; without a good grasp of your scalability needs, your business could face unexpected outages or overspend on infrastructure. It isn't a simple check box activity either - even the most well-established businesses continue to navigate infrastructure challenges as a strategic and ever-evolving exercise.

What is infrastructure scalability?

Infrastructure scalability is the ability to handle increased or decreased demand for resources without compromising on performance. In simple terms, a highly scalable system can seamlessly manage traffic spikes, whether it's due to a surge in online shoppers during Black Friday or millions of gamers logging on for a new game release.

When it comes to managing scalability, businesses need to have a clear sense of their demand spikes and these businesses typically fall into two categories: those with predictable scaling requirements, and those with unpredictable requirements.

Those with a clear idea of when demand will spike can plan ahead, provisioning additional bare metal

servers and/or virtual machines as needed. For example, any retail business will know that traffic will spike during Black Friday, enabling adequate prep time. These predictable events eliminate the need for auto scaling so dedicated servers are the most suitable - and straightforward - option.

Conversely, businesses with unpredictable demand spikes need to be prepared for volatility at any given time, making the use of a fixed number of dedicated servers a potentially risky move. It would only take one big spike to render a website or service slow or even unavailable to customers, opening a business up to a whole number of secondary challenges ranging from unsatisfied customers to lost revenue. Major streaming platforms like Netflix, which experience unpredictable surges in demand, need cloud auto scaling solutions that can instantly adjust to - and keep pace with - real-time demand.

Figuring out your scaling requirements

For any business unsure of its scalability requirements, there are two key stages to gaining a better insight. The first stage is understanding your business model, and the second is taking a thorough look at how your business can scale within its current set up.

It's difficult to determine how any new business is going to scale right off the bat, so a good first option is to adopt some sort of cloud or hybrid infrastructure until your scaling patterns become clearer.

For B2C businesses, demand is usually volatile. It's hard to predict an unexpected celebrity endorsement that blows up traffic, and unfortunately, there's no crystal ball that gives us sight of the next viral trend. B2C businesses need to be on top of holidays, internet trends, seasonal events and more, and technical teams should closely collaborate with marketing teams to determine when these spikes may occur. And, given that scaling needs are not 100% predictable as a result, adopting hybrid infrastructure is probably the safest option. That means deploying a mix of bare metal hosting to accommodate steady resource requirements, alongside access to the cloud for emergency scaling as and when needed.

For B2B businesses, scaling is a little more straightforward as scaling events tend to be less volatile. That said, collaborating closely with the sales team to understand pipelines and forecasts is still essential. One large enterprise deal alone could require multiple additional servers, making quick provisioning in the form of cloud or an agile bare metal provider a must-have.

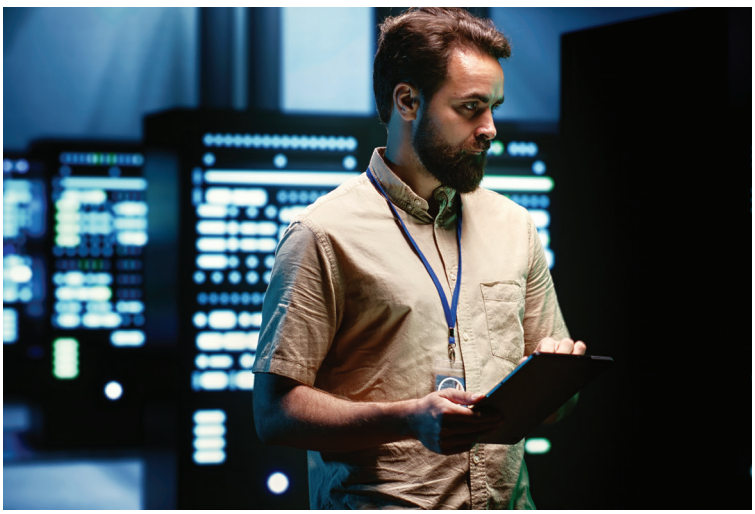
Regardless of business type, how can an organization scale within its current set up? If your business is operational, it's easy to look at existing data to understand your scaling behavior. It's surprising how many infrastructure as a service (IaaS) users don't take advantage of their existing data to make decisions. Rising service bills indicate continuous growth and the need for rapid provisioning, suggesting that a hybrid infrastructure approach could be optimal. Conversely, steady or declining bills could suggest stable or decreasing demand, making bare metal hosting a cost-effective choice. Occasional spikes in costs point to a need for flexible scaling solutions, favoring a hybrid approach.

For any business unsure of its scalability requirements, there are two key stages to gaining a better insight. The first stage is understanding your business model, and the second is taking a thorough look at how your business can scale within its current set up

A solution to fit your needs

Navigating the huge variety of infrastructure options on offer requires a clear understanding of your scalability needs. Whether you're a CTO under pressure to cut costs, or a startup founder facing uncertain demand, it's essential to move beyond the superficial question of costs and engage deeply with what your business needs in order to thrive.

The moral of the story? Don't just approach an infrastructure provider to request a quote, but instead start the conversation with an informed background of what you may need and why. If you're serious about finding a solution that meets your performance, cost and scalability needs, understanding your scaling patterns and how they translate to your infrastructure requirements is one of the best investments you'll make.



How can data centre managers handle explosive growth driven by AI and ML?

Growing focus on generative Artificial Intelligence (AI) and Machine Learning (ML) has brought AI into the forefront of public conversation, but the capabilities of AI are vast.

BY MARC CAIOLA – NVENT VICE PRESIDENT OF GLOBAL DATA SOLUTIONS

TODAY, we see large enterprises launching their own AI solutions and figuring out how to successfully integrate AI into business is top of mind for management. Supply chain management, research and analysis, and product marketing are just a few examples of how AI will be adopted to drive value for businesses and customers. AI will also see increased adoption in the healthcare, eMobility and energy generation and power industries as technology improves and key stakeholders grow more comfortable with its adoption.

All these factors are driving an increase in demand for the AI industry, which is expected to grow significantly in the coming decade.

New technology means new demands

As data center managers know, it takes an extreme amount of data processing to deliver the results that users of AI and ML applications have come to expect and these applications are driven by high-performance chips on the cutting edge of IT development.

These advanced chips use a lot of power to run and produce more heat than less sophisticated applications. Data center managers have to deal with these high heat loads while still being able to scale their operations to meet demand. Scaling capabilities cannot always depend on more physical space—data center managers and engineers often have to solve the technical problem of fitting more and hotter servers into the same spaces. They also have to maintain 24/7 uptime: the needs of AI applications will not pause for a data center renovation.

Additionally, the industry is facing increased scrutiny over power use, so data center managers need to be especially conscious about how they are using electricity. Sustainability has always been a conversation in the data center industry, but this increased attention will create even more conversation around PUE and power management.

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A shift in cooling approach

Next-generation chips and other AI infrastructure need more than traditional cooling methods to keep them from overheating. Data centers may implement solutions that remove extra heat by increasing air volume or reducing air inlet temperatures, which can be inefficient and costly to run. When air cooling systems have to work harder to maintain optimal temperatures, facilities can also face equipment breakdowns, unexpected shutdowns and increased energy costs.

For many data centers, using liquid cooling technologies can offer better performance while reducing energy use and helping data centers operate more sustainably. For the most advanced applications, liquid cooling is the only possible option. By using liquid cooling technologies in the right way, data center managers can greatly improve Power Usage Effectiveness (PUE), even in applications where they are using next-generation IT.

Liquid cooling can help data centers increase capacity while maintaining efficient space and energy use. It also can offer a favorable return on investment and lower the total cost of ownership for data center facilities. Liquid cooling systems provide an effective solution for achieving required temperature parameters and reducing the energy consumption of cooling systems. Liquid provides a much greater heat transfer capacity than air. This helps liquid cooling increase power usage effectiveness, managing heat loads effectively, reducing energy costs and contributing to environmental sustainability.

Solutions at scale

Liquid cooling does not have to be a comprehensive solution. Data centers can choose to cool a single rack or a few racks that run AI and machine learning applications without having to build entire data halls that are liquid cooled and support many racks of equipment that use high performance computing solutions.

However, when applying these partial solutions, it is vital to understand future business plans. Using specific cooling solutions for a particular problem is useful, but because of cost, energy efficiency and other factors, a solution for one problem may not work for another. As with all data center projects, different challenges need different solutions, and a universal approach rarely works.

With the growth in demand for high performance computing driven by the expansion of AI, data center managers need to have a plan in place to scale their cooling solutions. This may mean planning next generation data centers to be fully liquid cooled or exploring hybrid liquid to air solutions such as rear door cooling or direct-to-chip CDUs that bring liquid cooling to the rack and chip level while operating within air-cooled infrastructure.

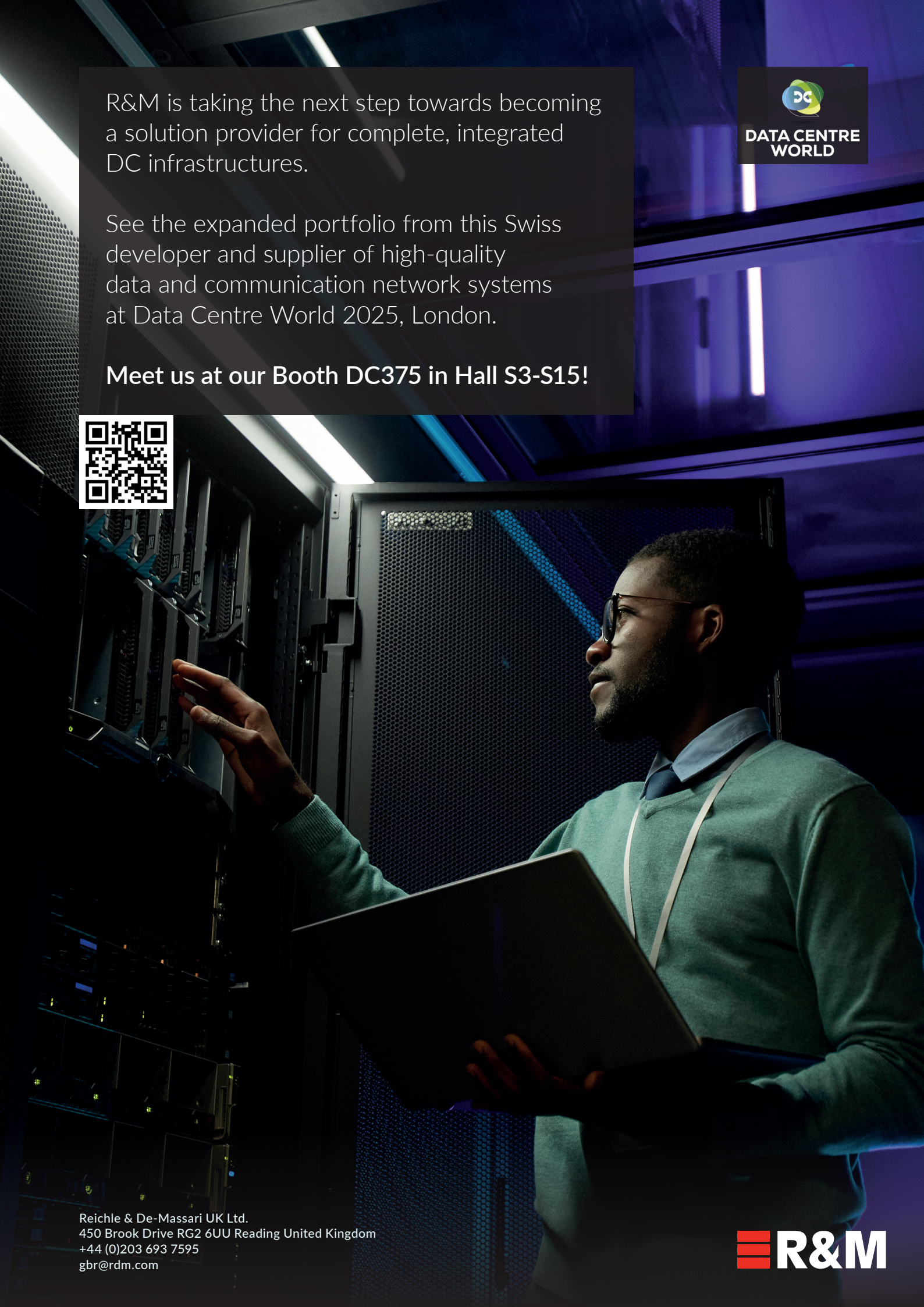
The biggest advantage that planning for the future and understanding IT workloads will bring is the realization that almost all potential cooling solutions can be built out in combinations, allowing data center managers to match their power and cooling capabilities with shifting demands. The key to sustainable growth is a variety of flexible options for supporting the next-generation equipment. Liquid cooling technologies help drive that flexibility.

Power management for AI

Power distribution is another critical technology for managing AI and ML workloads. Smart power distribution units (PDUs) are equipped with technology to distribute and monitor power usage to multiple devices within a data center and provide alerts in the event of power surges or other issues. The remote monitoring and control capabilities of smart PDUs can increase energy efficiency and reduce the risk of downtime. Input metering, for instance, allows power coming into a PDU to be remotely monitored, reducing the risk of overloading PDUs and causing breakers to trip. This monitoring can also help ensure that PDUs are not getting too close to breaker levels, allowing data center operators to remotely mitigate potential issues before they occur.

Some PDUs also are equipped with outlet metering, where monitoring and control technology is applied not only to the PDU level but at the level of each individual outlet/power connection on the PDU. This technology can help operators better understand specific device power usage and compare efficiencies between different technologies. It can also identify underutilized or “zombie” equipment that is not in use, but still drawing significant power. Being able to remotely identify this equipment and turn it off allows data center managers to make sure they only are using the power that they need.

The opportunity for the data center industry brought about by the growth of AI and ML comes with challenges. By leveraging the right cooling and power technologies, data center managers can improve performance, drive sustainability and scale operations appropriately to meet the growing needs of their customers.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Understanding UPS efficiency in data centres

In modern data centres, maintaining continuous and reliable power is critical. Uninterruptible Power Supply (UPS) systems ensure power is available without interruption during outages, fluctuations, or other power disturbances. However, beyond providing backup power, the efficiency of a UPS system plays a crucial role in energy consumption, cost management, and overall operational performance. This article will explore UPS efficiency, how it's calculated, the factors influencing it, and the practical benefits for operators managing large data centre facilities.

BY ALFREDO MARFISI, MARKETING MANAGER 3PH UPS AT LEGRAND

UPS EFFICIENCY refers to the ratio of energy delivered to the load compared to the energy absorbed by the UPS from the mains grid or batteries. Simply put, it measures how effectively the UPS system converts input energy into usable power for connected equipment. Efficiency is typically represented as a percentage, with a higher percentage indicating a more efficient system.

For data centres, efficiency is critical. These facilities run large-scale IT operations and require constant energy to support servers, storage systems, and other computing resources. Any inefficiency in power conversion directly results in higher energy costs and increased operational overhead.

Therefore, optimizing UPS efficiency is essential for managing power costs and ensuring the reliable protection of sensitive IT equipment.

How Is UPS efficiency calculated?

Calculating UPS efficiency is straightforward. It's the ratio of output power to input power, expressed as a percentage:

- **Output Power:** The actual power delivered to the connected load.
- **Input Power:** The power drawn by the UPS from the utility source or battery.

This calculation is typically performed using a high precision wattmeter connected to the UPS system's input and output points. It's important to note that UPS efficiency can vary depending on whether the system is drawing power from the mains (utility source) or its batteries. During regular operation (on mains), part of the input energy is used to charge the batteries.

However, manufacturers often exclude this energy from efficiency calculations since the charging phase is temporary, and the system operates most of the time with fully charged batteries, making the energy they absorb negligible.

Key factors influencing UPS efficiency

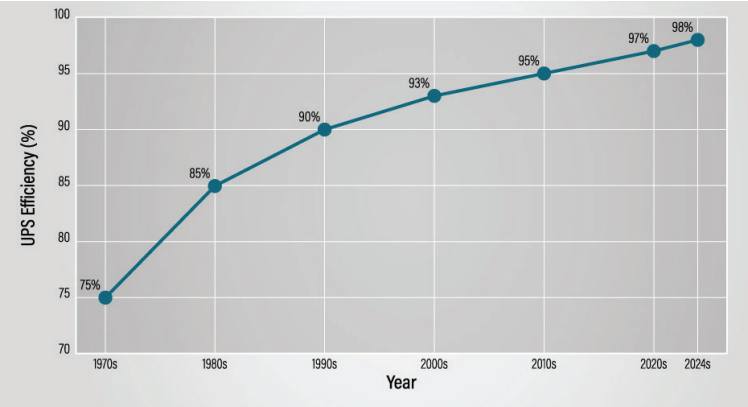
Several factors can affect the efficiency of a UPS system. Understanding these variables can help data centre operators optimize performance:

- **Load Level and Type:** UPS systems typically operate more efficiently at higher loads. Partial or low loads decrease efficiency, resulting in higher power losses.
- **Power Factor:** A higher power factor (near unity) means more of the power drawn is effectively used by the load. Power factor correction technologies in modern UPS systems help improve efficiency.
- **Temperature:** Environmental factors, particularly high temperatures, can degrade internal components like capacitors and fans, reducing overall efficiency.
- **Component Aging:** Over time, key UPS components such as batteries, fans, and capacitors wear down, negatively affecting efficiency. Regular maintenance is essential to replace aging parts before performance significantly declines.

UPS topologies and their efficiency comparisons

UPS systems come in different topologies, each with distinct efficiency characteristics:

- **Off-Line (VFD):** This is the simplest UPS topology, where the load is directly connected to the mains power during normal operation. It provides high efficiency but minimal protection against power disturbances. When mains power fails, the UPS switches to battery mode to provide backup power.
- **Line-Interactive (VI):** This topology adds an automatic voltage regulator (AVR) to stabilize voltage variations. It is more efficient than off-line systems during normal operation and offers better protection against power disturbances, though it doesn't protect against frequency variations.
- **Online Double-Conversion (VFI):** The most advanced UPS topology, continuously converting incoming AC power to DC and back to AC to supply the load. While offering the highest protection, it is less efficient due to the continuous running of two power converters. However, it is ideal for data centres that prioritise power quality and uptime.



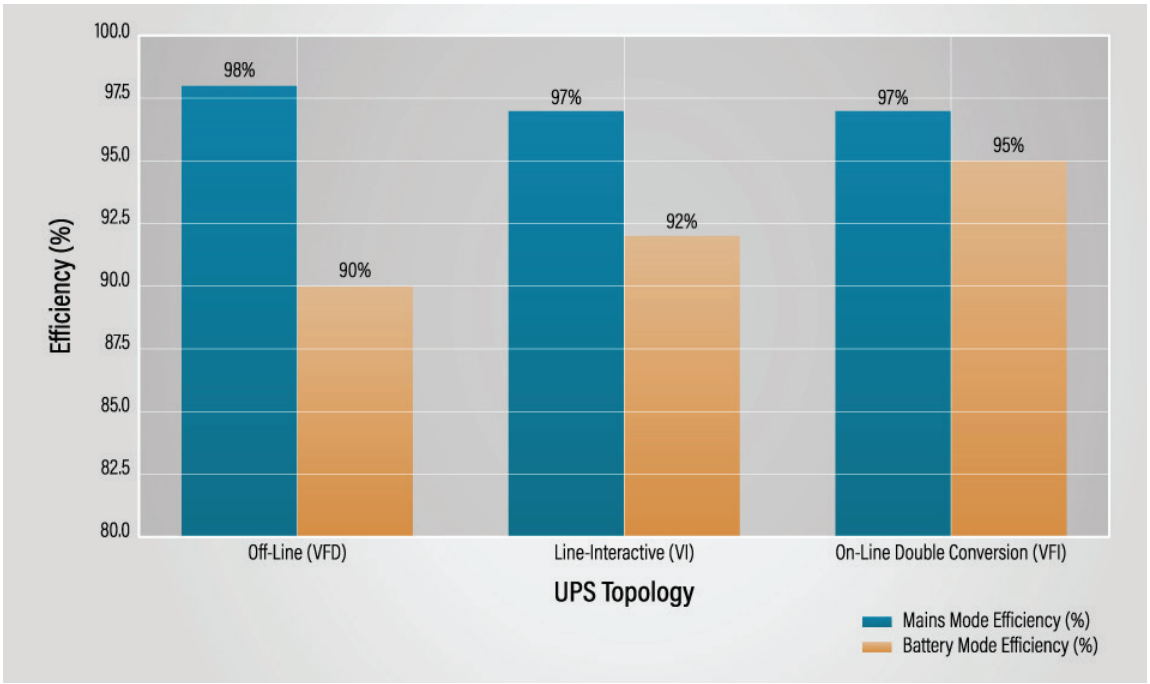
Historical improvement of UPS efficiency (1970s-2020s)

Advances in UPS technology: Silicon carbide and modular designs

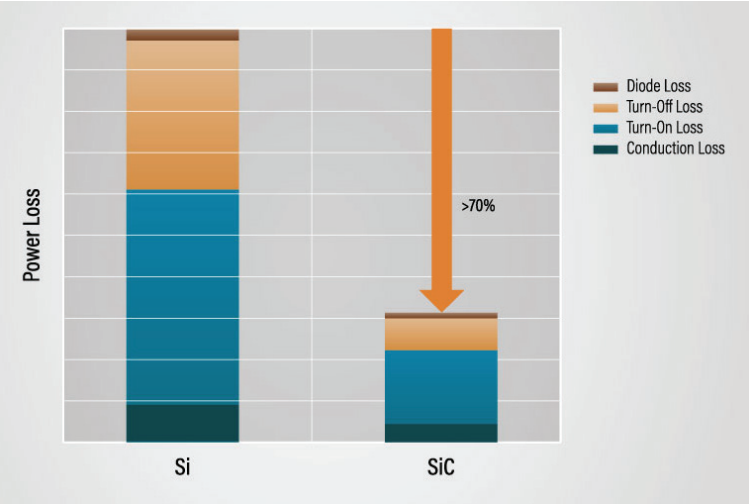
Recent advancements in UPS design have driven efficiency improvements. One significant innovation is the use of Silicon Carbide (SiC) components in power converters.

Compared to traditional Silicon (Si) components, SiC offers superior efficiency, faster switching speeds, and better thermal conductivity. This allows UPS systems to operate at higher power densities with lower losses, resulting in smaller, more efficient systems capable of delivering the same or higher performance levels.

Modular designs are also gaining popularity, enabling operators to scale power capacity more effectively and improve system redundancy.



Comparison of UPS efficiency levels in main and battery modes



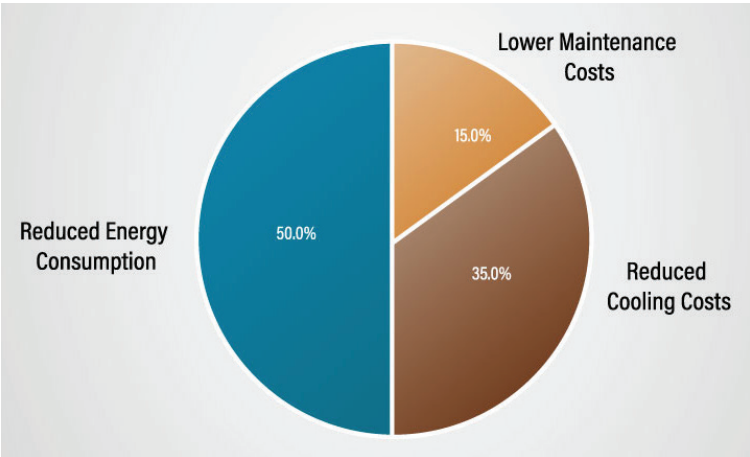
➤ Scheme power loss

Modular UPS systems can be optimized for varying load conditions, ensuring peak efficiency regardless of load levels.

Practical benefits of high-efficiency UPS systems

The efficiency of a UPS system has significant practical implications for data centres, particularly in terms of operational costs and environmental impact:

- **Energy Cost Savings:** Data centres are energy-intensive, and even small improvements in UPS efficiency can lead to substantial cost savings. A 1-1.5% increase in efficiency can significantly reduce energy consumption over time, especially in large-scale facilities where UPS systems may be rated in megawatts.
- **Reduced Cooling Requirements:** Inefficient UPS systems generate excess heat, which must be dissipated using additional cooling systems. Improving efficiency not only saves on direct energy costs but also reduces the cooling load, driving down operational expenses further.
- **Lower Carbon Footprint:** Improving UPS efficiency helps meet sustainability goals by reducing overall energy consumption. This, in turn, lowers the facility's carbon footprint, as less electricity is drawn from the grid, reducing greenhouse gas emissions.



➤ Cost savings breakdown due to high-efficiency UPS systems in data centres

UPS efficiency and data centre reliability

An often-overlooked benefit of higher UPS efficiency is its contribution to reliability. Efficient systems generate less heat, reducing stress on internal components and minimizing the risk of overheating. This extends the lifespan of critical equipment, lowers the risk of thermal shutdowns, and improves overall system stability.

Additionally, UPS systems with advanced monitoring and diagnostic capabilities can detect potential issues before they lead to failures, enhancing uptime.

Future trends in UPS technology and efficiency

Looking ahead, UPS technology will likely place greater emphasis on efficiency and longer lifespans through the integration of advanced battery technologies, such as lithium-ion and solid-state batteries. Additionally, advancements in AI and machine learning are expected to play a major role in optimizing energy usage, predictive maintenance, and system diagnostics. These technologies will enable UPS systems to self-optimize based on real-time load conditions and environmental factors, consistently ensuring peak efficiency.

Furthermore, the growing demand for high-performance computing (HPC) and artificial intelligence (AI) workloads is pushing the boundaries of UPS design. Data centres will increasingly seek UPS systems offering superior power quality, scalability, and reliability to support these advanced applications.

Conclusion: Choosing the right UPS for your data centre

For data centre operators, selecting the right UPS system is a critical decision that impacts both operational costs and reliability. Prioritizing high-efficiency systems with advanced features like AI-driven power management and modular scalability can help operators achieve their performance and sustainability goals.

As UPS technology continues to evolve, data centres will need to adopt the latest innovations to ensure long-term efficiency and reliability. By investing in high-efficiency UPS systems, data centre operators can reduce energy consumption, lower their carbon footprint, and ensure continuous power protection for critical IT infrastructure.

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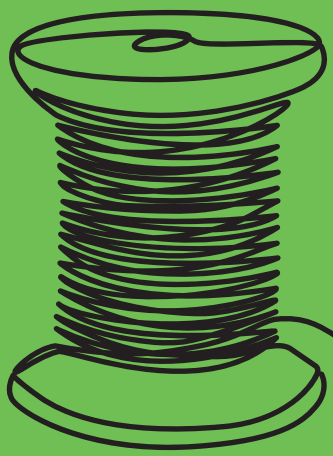

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Why physical security is not enough to protect data centres

With data centres now deemed as critical infrastructure, organisations must evolve beyond traditional security to combat sophisticated cyber threats.

BY JON MORT, CTO, THE ADAPTAVIST GROUP

THE UK government recently granted data centres Critical National Infrastructure (CNI) status, recognising their vital role in powering the British economy and underpinning other essential public services such as healthcare and finance. Data centres join the CNI lineup alongside industries like energy, water, transport, and health, and are now entitled to financial support from the government in the event of critical incidents.

Although all industries with CNI status share common characteristics, data centres face unique, compounded security challenges. Traditional CNI industries like water or transport mainly focus on physical risks, such as infrastructure damage, but data centres are uniquely susceptible to both physical and severe cyber-attacks.

What separates data centres is that, while they still face physical security challenges (equipment failure, flooding or fires can lead to significant outages and millions in losses), they are also highly susceptible to cyber-attacks. Unlike industries where physical risks dominate, data centres are critical digital hubs, amplifying the damage potential of cyber-attacks across multiple sectors.

Physical security measures, though necessary, are only the first line of defence in what should be a multi-layered digital defence system. Think of a data centre like a modern bank. While vault doors and security cameras are essential, the greatest threats are not limited to physical break-ins and threats; they wield code.

Taking a cyber-first approach to security

Recent incidents like the NHS ransomware attack have shown how quickly cyber threats can spread throughout highly interconnected systems, highlighting the need for cyber resilience among services powered by data centres. However, to achieve this new approaches are required. Ransomware, malware, DDoS, and other attacks add layers of complexity to the risk landscape in CNI industries. For data centres, which underpin many of these critical services, the increased use of AI, intricate software ecosystems, and cloud infrastructure further compound this risk, making advanced, multi-layered defences essential.

Protecting data centres from these new and evolving cyber risks requires a shift from reactive

defence to proactive, preventative action. As the UK government promotes economic growth and the proliferation of data centres, developing guidelines to meet the expanding complexity of digital infrastructure and the greater risk of cyberattacks is critical. Security must be integrated from start to finish, from design and development to deployment and operation. This is the only way to ensure risks are identified and reduced before they become breaches, guaranteeing a more secure and resilient digital ecosystem.

Meeting the challenges of complexity

The growth of AI-driven software and cloud-based infrastructure has exposed the UK's businesses and national infrastructure to a wider array of vulnerabilities. Cybercriminals increasingly exploit software, networks, and human behaviour weaknesses to penetrate systems and disrupt critical services, making these interconnected systems increasingly challenging to secure. This makes regular vulnerability assessments essential for uncovering and preventing attacks. Assessing both hardware and software configurations in addition to third-party dependencies can help organisations pinpoint potential weaknesses before they can be exploited.

With human error becoming a common factor in cybersecurity breaches, prioritising employee training and strengthening internal procedures is also essential. Organisations must equip their staff with the skills to recognise threats like phishing attacks, which can significantly improve the overall security of data centres. Given that many breaches are linked to preventable mistakes in processes, a strong focus on education can help avoid similar issues. Moreover, encouraging a culture where employees feel empowered to report concerns and take initiative, regardless of their role in the company, fosters a more secure and comfortable environment. This kind of open communication enhances not only security but the organisation's ability to address problems swiftly and effectively.

Next steps for essential data protection

Security certifications play a pivotal role in establishing trust and maintaining high-security standards. Obtaining these certifications forces organisations to implement rigorous procedures, ensuring adherence to best practices that strengthen data centre security.

Documentation is a key aspect of this process, ensuring policies, protocols, and incident responses are well-documented and accessible. Such thorough documentation not only standardises operations but also serves as a critical tool during post-incident analysis, helping to minimise damage and speed up recovery efforts in the event of a breach.

Cross-sector collaboration between governments and industries is essential for developing robust practices that safeguard both physical assets and the digital services supported by data centres. Governmental regulatory guidance should emphasise improving operational resilience, ensuring IT systems are well-prepared to withstand cyber threats.

Future-focused cybersecurity

As cyber threats become increasingly sophisticated, organisations must take a future-focused approach to securing data centres. Moving beyond the physical realm, there needs to be increased focus on securing interconnected systems, including cloud platforms, software, and AI applications. This can only be achieved through a holistic cybersecurity framework that considers regular assessments, comprehensive training, and collaboration with both private and public sectors. To ensure resilience in the digital age, data centres must adapt to evolving threats and continuously improve their cybersecurity stance and strategy.

The top trends impacting infrastructure and operations for 2025

Gartner, Inc. has highlighted the six trends that will have a significant impact on infrastructure and operations (I&O) for 2025. Gartner analysts presented the findings during the recent Gartner IT Infrastructure, Operations & Cloud Strategies Conference.

"THESE TRENDS give the opportunity for I&O leaders to identify future skills requirements and seek insights to help meet implementation requirements," said Jeffrey Hewitt, Vice President Analyst at Gartner. "They will provide the differentiation needed for enterprises to gain the optimal benefits from their I&O operations in 2025."

Trend No. 1: Revirtualization/devirtualization

The recent license changes for certain vendor-based solutions have forced many I&O teams to re-evaluate their virtualization choices with some moving more to public cloud, some turning to distributed cloud and some moving to private cloud. This involves multiple options beyond just changing hypervisors.

"I&O leaders must inventory all current virtualization implementations and any related interdependencies," said Hewitt. "Evaluate alternative paths including hypervisors, hyperconvergence, distributed cloud, containerization, private cloud and devirtualization. Identify existing I&O skills and how those need to evolve to support top choices."

Trend No. 2: Security Behavior and Culture Programs

As the sophistication and variety of attacks increases, security programs must evolve to address behavior and culture to optimize their effectiveness. Security behavior and culture programs (SBCPs) are enterprisewide approaches to minimize cybersecurity incidents associated with employee behavior.

SBCP programs result in improved employee adoption of security controls and reductions in behavior not considered secure. They enable I&O to help support the more effective use of cybersecurity resources by employees.

Trend No. 3: Cyberstorage

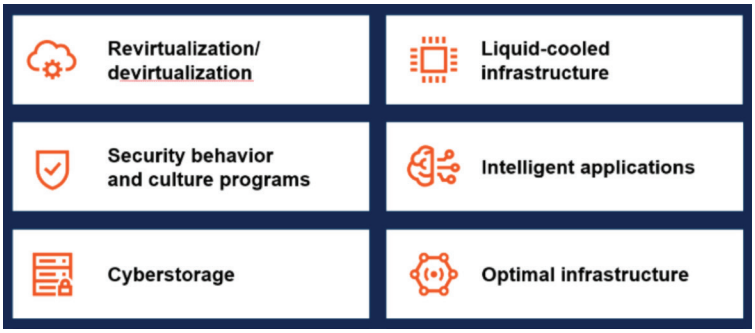
Cyberstorage solutions utilize a data harbor made up of data that is fragmented and distributed across multiple storage locations. The fragmented data can be instantly reassembled for use when needed. Cyberstorage can be a dedicated solution with comprehensive features, a platform-native service offering with integrated solutions, or a collection of stand-alone products that augment storage vendors with cyberprotection capabilities.

"For cyberstorage to be successful, I&O leaders should identify the risks of costly and disruptive storage threats, combined with increasing regulatory and insurance expenses to build a business case for cyberstorage adoption," said Hewitt.

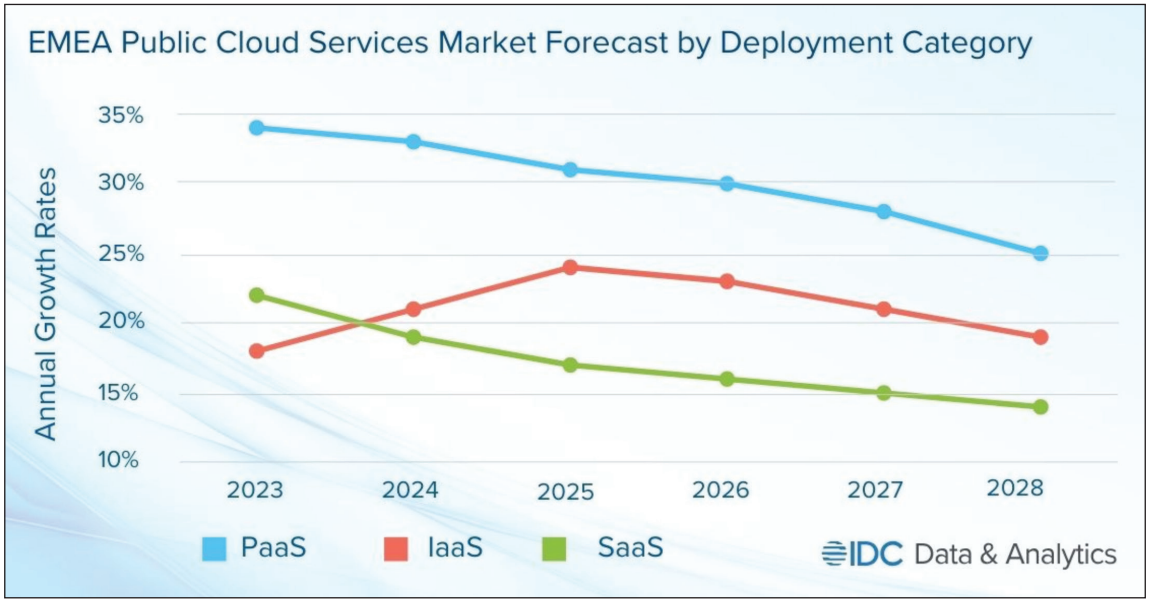
Trend No. 4: Liquid-cooled Infrastructure

Liquid-cooled infrastructure consists of rear-door heat exchange, immersion and direct-to-chip. It enables I&O to support new chip generations, density and AI requirements, while also providing I&O opportunities to flexibly place infrastructure to support edge use cases.

"Liquid cooling has evolved to move from cooling the broader data center environment to getting closer and even within the infrastructure," said Hewitt. "Liquid-cooled infrastructure remains niche



➤ Figure 1: Gartner Top I&O Trends for 2025. Source: Gartner (December 2024)



Source: IDC's Worldwide Semiannual Public Cloud Services Tracker, November 2024

today in terms of use cases but will become more predominant as next generations of GPUs and CPUs increase in power consumption and heat production."

Trend No. 5: Intelligent Applications

Generative AI has revealed applications' potential to operate intelligently, which has created the expectation for intelligent applications. Intelligent applications adapt to their user's context and intent, thereby reducing digital friction. It can interoperate in pursuit of their own, as well as their users' intents, by marshaling the appropriate interfaces to external APIs and connected data.

Ultimately, intelligent applications reduce required intervention and interactions on the part of I&O. It also optimizes processes and utilization while reducing resource overhead.

Trend No. 6: Optimal Infrastructure

Optimal infrastructure is when I&O teams place a highly significant emphasis on the best infrastructure choices for a given use case across a range of deployment styles. This approach utilizes a business-based focus so that executives outside of IT can understand why infrastructure choices are made from their perspectives.

"These choices are ultimately aligned with platform engineering adoption," said Hewitt. "They allow I&O to align infrastructure choices with the business objectives of the overall organization. They also facilitate the support and approval of business unit leaders and C-level executives."

EMEA Public Cloud Services market poised for rapid growth

The Europe, Middle East, and Africa (EMEA) public cloud services (PCS) market, including infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS), is projected to generate $203.0 billion in revenue for 2024. That's according to the latest Worldwide Semiannual Public Cloud Services Tracker from International Data Corporation (IDC), which forecasts that the EMEA PCS market will reach $415.1 billion in 2028, representing a compound annual growth rate (CAGR) of 20.0% for the 2023–2028 period.

SaaS, encompassing both SaaS – Applications and SaaS – System Infrastructure Software (SIS), continues to be the largest cloud deployment category, and is projected to make up 64.4% of the total PCS market in 2024. Due to its size and maturity, SaaS is experiencing the slowest rate of growth among the different cloud deployment models. In contrast, PaaS is the fastest-growing segment, with a projected CAGR of 29.3% for 2023–2028 forecast period, followed by IaaS with a CAGR of 21.6%.

The increased adoption of AI, particularly generative AI (GenAI), combined with ongoing investments in cloud datacenters by global cloud service providers across EMEA, is driving the overall demand for public cloud services. Both end users and technology providers are investing in AI-ready infrastructures and platforms.

Global tech companies will continue to invest in GenAI, embedding more features and functionalities into their existing portfolios. This will create additional opportunities for growth in the IaaS and PaaS markets, boosting adoption of such services across the EMEA region.

"As enterprises adopt GenAI to gain a competitive advantage, the need for scalable, on-demand infrastructure continues to rise," says Manish Ranjan, research director for software and cloud at IDC EMEA. "High-performing compute resources, such as GPUs and other accelerated computing, are essential for running AI/GenAI workloads.

Storage spending in AI infrastructure has been driven by the need to manage large datasets required for training AI models, as well as storage of training, checkpoints and repositories of data for inference phases. This category reported a 36% year-over-year growth rate in 1H24 with 56% of the spending coming from cloud deployments

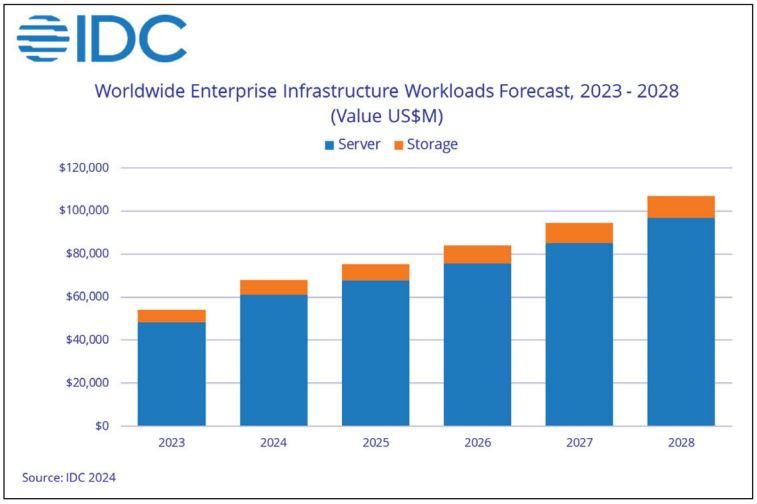
Public cloud service providers are becoming the primary entry point, offering the necessary infrastructure to support GenAI initiatives without significant up-front investments."

From a sub-regional perspective, Western Europe dominates the EMEA market, accounting for over 80% of its revenue, followed by the Middle East and Africa (MEA) and Central and Eastern Europe (CEE). Germany, the U.K., France, and Italy remain the key destinations for cloud investments.

However, global hyperscalers like Google, AWS, Microsoft, and Oracle are aggressively expanding their cloud regions in Finland, Greece, Denmark, the Netherlands, Belgium, Austria, and Spain, boosting cloud adoption across Europe. Similarly, MEA, the fastest-growing sub-region for IaaS, is a hotspot for global cloud providers, with AWS, Microsoft, Google, Oracle, and Alibaba establishing cloud regions in Saudi Arabia, the UAE, South Africa, Qatar, and Bahrain, and planning expansions in Kuwait, Morocco, Kenya, and other tier 2 markets.

AI spending to surpass $100 billion in next five years

The global Artificial Intelligence (AI) infrastructure market is on track for unprecedented growth, poised to surpass $100 billion USD in spending by 2028, according to the latest findings from the International Data Corporation (IDC) Worldwide Semiannual Artificial Intelligence Infrastructure Tracker. Organizations increased spending on compute and storage hardware infrastructure for AI deployments by 37% year-over-year in the first half of 2024, reaching $31.8 billion.



The AI infrastructure market has sustained double-digit growth for nine consecutive half-years, driven primarily by investment in servers for AI deployments. In 1H24, servers accounted for 89% of the total spending, growing 37% compared to the same period last year.

AI Infrastructure deployed in cloud and shared environments accounts for 65% of the total server spending in AI in 1H24, as hyperscalers, cloud service providers and digital service providers expand their infrastructure capabilities. Traditional enterprises, by contrast, have largely lagged behind in adopting on-premises AI infrastructure.

Servers with an embedded accelerator are the preferred infrastructure for AI platforms accounting for 58% of the total server AI infrastructure spending -- growing 63% in the first half of the year 2024. IDC projects that accelerated servers will exceed 60% of the server AI infrastructure spending by 2028, growing at a 19% 5-year CAGR rate.

Storage spending in AI infrastructure has been driven by the need to manage large datasets required for training AI models, as well as storage of training, checkpoints and repositories of data for inference phases.

This category reported a 36% year-over-year growth rate in 1H24 with 56% of the spending coming from cloud deployments. The United States leads the global AI infrastructure market, accounting for almost half of the total spending in 1H24, followed by PRC (23%), APJ (16%), and EMEA (10%).

Over the next five years, IDC expects the APJ region to grow at the fastest CAGR (20%) followed by the USA (16%), EMEA (13%) and PRC (11%). By 2028,IDC forecast AI Infrastructure spending to reach $107Bn with servers deployed in cloud environments at 75% of the market total and accelerated servers around 56% of the total market spending.

"IDC expects AI adoption to continue growing at a remarkable pace as hyperscalers, CSPs, private companies, and governments around the world are increasingly prioritizing AI. Growing concerns around energy consumption for AI infrastructure will become a factor in datacenters looking for alternatives to optimize their architectures and minimize energy use" said Lidice Fernandez , Group Vice President, Worldwide Enterprise Infrastructure Trackers.

Scaling up and scaling out in AI data centres

Explore the evolving AI data centre landscape and gain critical insights into efficient scale-up and scale-out techniques. Grow your understanding of innovative approaches to advanced hardware and infrastructure planning in meeting the growing demands of AI applications.

AFL's latest AI thought leadership white paper is now available. Gain unparalleled insights into the technical building blocks essential for efficient scale-up and scale-out strategies. The highly detailed document offers fresh perspectives on key industry developments, underscoring not only the imperative for continuous scaling innovation, but highlighting the critical need for greater collaboration across AI hardware development and modular infrastructure planning.

Take the opportunity to gain the competitive edge and stay one step ahead in the rapidly evolving AI landscape – let's look at the topics covered and what you'll learn.

Introduction to AI and machine learning

The white paper begins with an in-depth overview of essential terminology such as Artificial Intelligence (AI), Machine Learning (ML), and Large Language Models (LLMs), tailored for all levels of expertise. For example, AI encompasses the machines and software designed to execute tasks typically requiring human intelligence.

ML involves training algorithms to derive meaning from prompts and generate human-like responses. Deep Learning (DL) – utilizing Artificial Neural Networks (ANN) – involves a multi-stage learning process necessary to identify intricate patterns within data. Finally, LLMs represent specialized DL models focused on language processing.

The paper also establishes how separate training and inference stages create models for precise, logical decision-making that replicates human intelligence. Depending on model complexity and computational resources, training timeframes can span weeks or months. Inference leverages trained models to analyze new data, generate responses, and refine outputs for enhanced accuracy.

By covering the fundamental concepts central to AI models and AI data centres, the paper seeks to equip readers with the necessary foundational knowledge required to appreciate the advanced scaling techniques covered later in the paper.

Scaling AI infrastructure: scale-up and scale-out strategies

Explore cutting-edge strategies for scaling up and scaling out in high-performance AI data centres. Gain a practical and nuanced understanding of scaling, encompassing chip development and infrastructure expansion. Discover how scaling up enhances individual node capabilities, while scaling out involves adding more nodes and distributing complex workloads to enhance performance. Both approaches are crucial for meeting the escalating computational demands of advanced AI applications.

The white paper also presents the critical requirements for the high-bandwidth, low-latency

networking essential for synchronous AI model training – understand the architectural necessities of very large systems designed to manage massive computational workloads efficiently.

Advances in AI hardware and models

Advances in computational hardware, optimization techniques, and data availability has driven the evolution of AI models, from simple algorithms to complex architectures with unprecedented capabilities. Innovation in semiconductor technology, chiplets, and packaging is crucial for scaling AI infrastructure efficiently. Such hardware advancements support the development of more powerful processors, capable of with high-bandwidth networking.

For example, smaller process nodes and advanced packaging techniques enhance overall performance, while chiplets enable scalable, efficient integration of different, sophisticated, customizable system functionalities.

The white paper also takes time to consider the wider implications and areas of development surrounding the central theme of scaling advanced AI technologies. Such topics include power consumption and heat generation. Understand the challenges of power supply and thermal management and explore the advanced cooling technologies required to manage the issue effectively.

The paper seeks to add balance to the commentary on the strategies for training large AI models with the substantial requirement for massive amounts of energy, raising concerns about sustainability – explore the advanced cooling technologies (e.g., direct liquid cooling and immersion cooling) essential to the future of efficient, more sustainable AI data centre operations.

Future trends and innovations in AI

The white paper offers the opportunity to stay ahead of the rapidly evolving technology curve, providing pertinent commentary on emerging industry trends. These trends include segmented models, less frequent synchronization, and extended distributed systems.

You will gain an in-depth understanding of the present and future need for medium and long-haul links in Data Centre Interconnect (DCI), which help support and maintain stable connectivity between geographically distributed facilities. By developing an appreciation of the trends in these areas, readers will better understand the importance of scalable networking solutions and the need for continuous innovation in AI infrastructure.

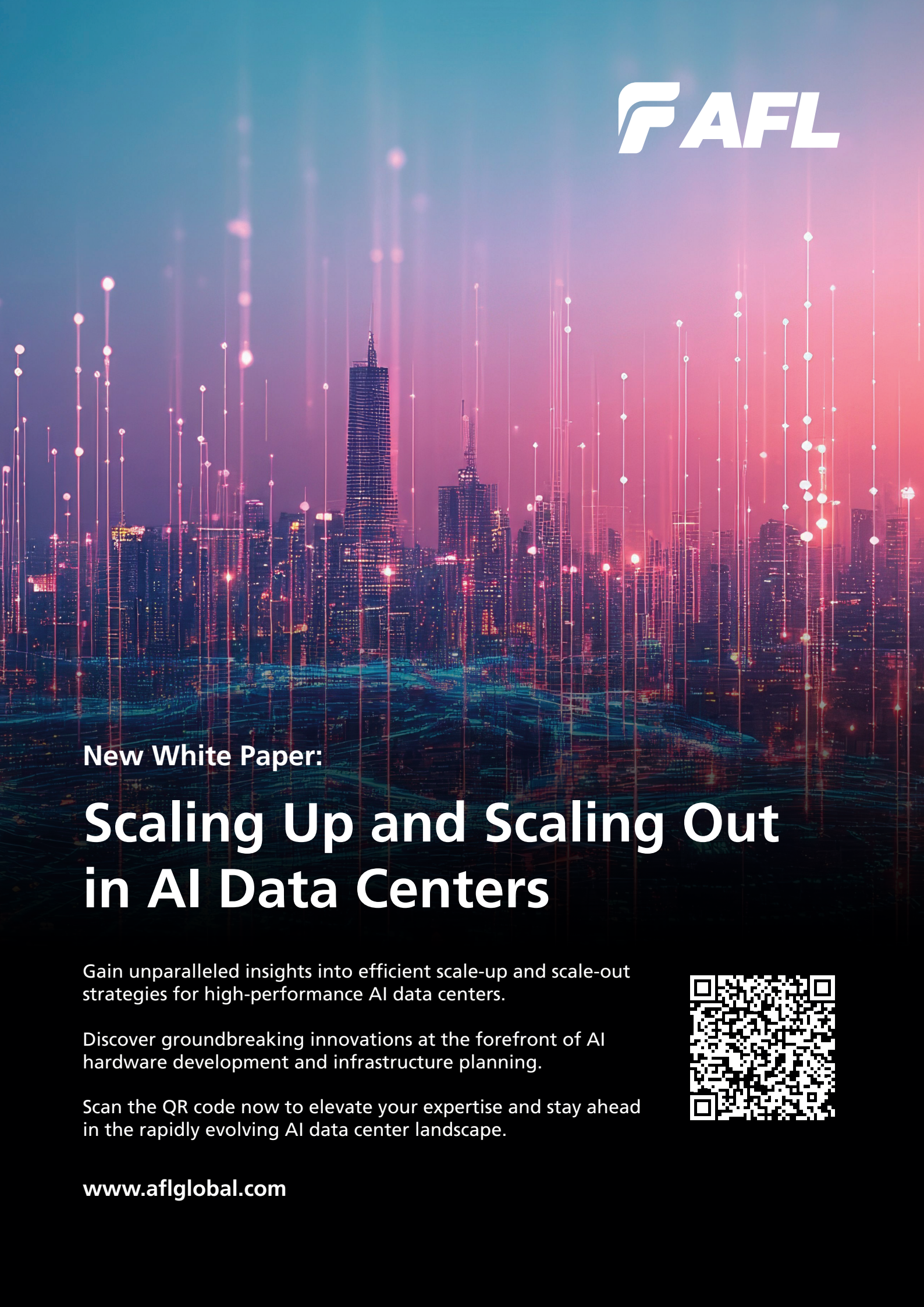
The paper also explores how global interest in AI technologies drives intense competition among major players and startups alike. Investment from tech giants and venture capitalists fuel industry innovation, expediting the emergence of new AI models with new capabilities – see how the competitive landscape is linked to the proliferation of publicly available LLMs, democratizing access to advanced AI capabilities.

AI superclusters

The largest AI facilities require massive computational power and efficient scaling strategies – explore the challenges of super scaling and learn more about segmented models, synchronous training limits, and geographically distributed training.

The paper discusses how medium (up to 40km) and long-haul links (80km and beyond) are crucial DCI solutions, ensuring seamless communication and high-speed, reliable data transfers between geographically dispersed facilities. However, to support the future of geographically distributed AI data centres, these links will require significant upgrades.

The largest AI facilities require massive computational power and efficient scaling strategies – explore the challenges of super scaling and learn more about segmented models, synchronous training limits, and geographically distributed training



New White Paper:

Scaling Up and Scaling Out in AI Data Centers

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One of our core strengths lies in our comprehensive in-house tooling and manufacturing capabilities. With 14 manufacturing facilities globally, we deliver precision-engineered solutions that meet the highest industry standards. Our tooling teams work collaboratively with you, ensuring your designs are optimised for performance and durability, while our R&D teams conduct rigorous testing, such as IP sealing (for water and dust), salt spray corrosion testing, and environmental durability assessments. We test to IP specifications directly in our labs, ensuring your components withstand the toughest conditions.

Through strategic acquisitions, Essentra has strengthened its manufacturing capabilities to better serve the data centre industry and beyond. The acquisition of Hengzhu, a leading Chinese manufacturer of locks, latches, hinges, and handles, enhances our ability to provide precision-engineered solutions for markets like electric power and telecoms. Similarly, the acquisition of Turkey's Mesan, a top manufacturer of high-quality hardware, expands our global reach and product range. These investments enable us to deliver to our customers wherever they are in the world.

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Making the most of integrated modular datacentres

Integrated Modular Data Centre, or (IMDCs), are pre-engineered, prefabricated data centre solutions that combine modular design with integrated components, including IT, power, cooling, and infrastructure.

BY CARSTEN LUDWIG, MARKET MANAGER DATA CENTER, R&M

THESE DCs are typically delivered as ready-to-deploy units or easily assembled modules, enabling rapid, cost-effective deployment and scalability, and performance enhancement, catering to the evolving needs of data centres. Different form factors and concepts are available, catering to a wide variety of requirements, from Containerized DCs in standard shipping containers to complete Micro DCs designed for edge computing.

IMDCs cater to various markets, each with specific requirements based on their operational needs, IMDCs scalability demands, and environmental factors. Several requirements are common across all markets: fast deployment, low PUE, renewable energy integration, easy scalability, rugged construction to withstand environmental challenges, advanced networking options including fibre and 5G readiness, and Integrated systems for remote management and AI-driven optimization.

However, differences exist between markets and applications, too. For IT and Cloud Service Providers and telco operators, the focus is mainly on scalability, as well as high-speed, high-density, low latency computing and storage. In industrial, there's a need for IoT and industrial automation, as well as local data processing for real-time analytics. In Power, monitoring and managing smart grids and renewable energy installations and remote operation in harsh environments are key. For media and streaming firms, high-speed data processing for video streaming and editing are key.

The significant growth of the IMDC market, which is expected to continue for the foreseeable future, is being driven by the need for flexible, scalable, cost-efficient solutions. These are required to support a booming demand for computing power, fuelled by the expansion of edge computing, 5G networks, and digital transformation. As businesses adopt IoT, AI, and real-time analytics, the need for low-latency solutions has driven deployment of IMDCs closer to end-users.

Benefits

Perhaps the most important thing when specifying a Modular Integrated solution is ensuring it is

perfectly aligned with your business goals and related KPIs. Modular designs allow operators to build fast and scale up or down based on demand, reducing overprovisioning, and optimizing capital investment. IMDCs can be deployed in weeks rather than months or years. Leveraging prefabrication and standardized components means construction and operational costs are often lower. Many IMDCs incorporate advanced cooling systems and energy-efficient designs to meet sustainability goals.

Infrastructure units should be delivered preconfigured, tested, ready to install, and guaranteed to fit and work together so operations can commence smoothly. This simplifies planning, customizing, installation, MACs, and maintenance, and ensures a quick return on investment. Ideally, modular infrastructure solutions should integrate network connectivity, rack designs, housing, power, cable management, and DCIM, with a Digital Twin as part of the package right from the start.

Key considerations and solutions in different phases

Design

IMDCs present challenges in balancing functionality, efficiency, and compliance. A key issue is navigating the trade-off between customization - pre-designed modules don't always meet unique customer requirements - and standardization to leverage cost-effectiveness. Space optimisation plays a pivotal role. Furthermore, adherence to global and regional standards, such as ISO 27001 and TIA-942, and commitment to sustainability and energy efficiency, is vital for ensuring compliance. Edge topologies require comprehensive integration expertise, extending from connector to site solution. 'Edge' generally means dealing with unusual locations, in harsh environments, combining multiple systems for hyper-fast data transmission in a very small footprint.

To address these challenges, organizations can rely on advanced software and modelling for simulation and design optimization and invest in comprehensive planning and collaboration with experienced modular DC providers. Selecting the right modules can optimize use of physical space, supporting high-density server racks, cabling, and potential future expansions. Integrating UPS and redundancy measures can ensure reliable power distribution. Precise planning for advanced cooling methods such as liquid or in-row cooling address high-density deployments through effective thermal management without sacrificing energy efficiency.

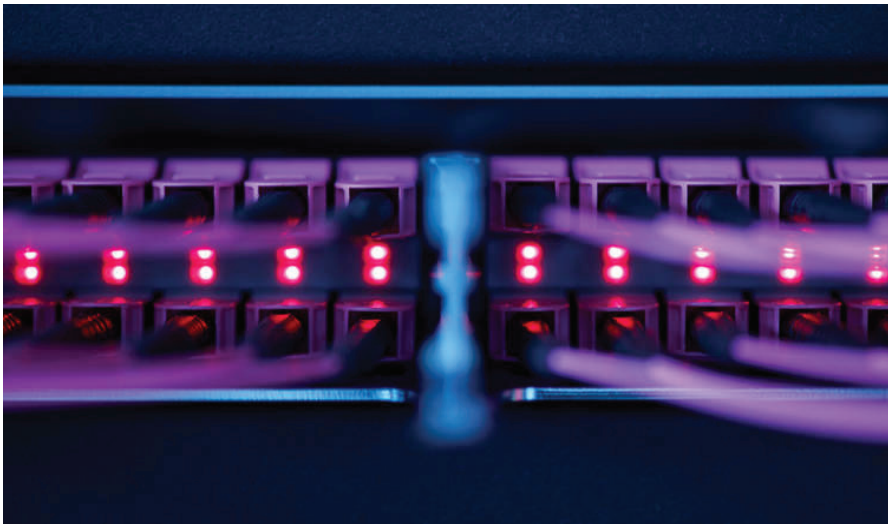
Implementation

One primary concern is ensuring seamless integration of modular components with existing infrastructure, such as power systems, cooling mechanisms, and network architectures. This requires meticulous planning and execution. Delivering and assembling prefabricated modules can be a challenge in urban environments with

constrained space or remote locations with limited accessibility. The complexity of interconnecting modules—especially with precise cable routing to maintain low latency and high-speed connections – requires advanced engineering and coordination.

Practical solutions include leveraging standardized components to the highest degree possible for faster deployment and better integration, while introducing customized or bespoke solutions where they add the greatest value. Using advanced rack systems and cabinets engineered to accommodate high-density cabling and equipment ensures efficient space utilization and streamlined cable, power, and cooling management. Integrating cabling systems directly into the floor can facilitate implementation of flexible zone distribution cabling. You can theoretically support up to 288 fibre optic or copper connections within a single unit, freeing up rack space for active components and facilitating upgrades to higher performance networks. Well thought-out maintenance and serviceability designs allow easy access to components for repair or upgrades without impacting adjacent modules or overall operations.

It's essential that Hardware and Software solutions are fully integrated and that whoever provides them also takes care of setting them up in a way that makes the most sense for specific user requirements and infrastructure.



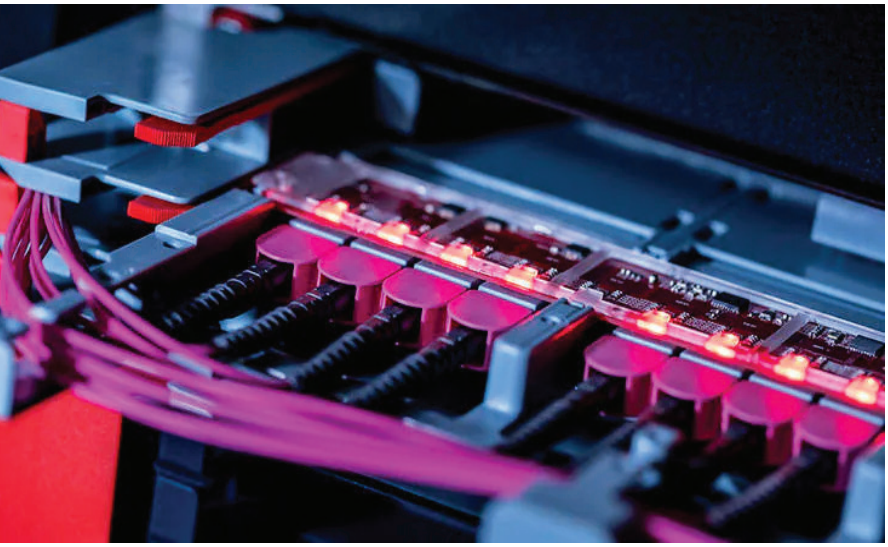
Implementing predictive maintenance and real-time monitoring systems can enhance reliability and reduce operational costs. Data-driven insights can be used to plan capacity, avoiding overprovisioning or underutilization. Advanced DCIM provides a unified interface to monitor and manage power, cooling, network, and IT assets across all modular units, each with its own infrastructure, ensuring operational stability

Operation

Monitoring and management require robust systems to oversee power, cooling, and IT performance, ensuring seamless control despite the distributed nature of modular setups. Furthermore, upgrading infrastructure to accommodate growth must be executed without substantial downtime or disruption. Achieving sustainability goals and regulatory compliance poses challenges, especially in modular deployments across diverse climates, necessitating renewable energy integration and carbon reduction to meet environmental commitments. Energy efficiency necessitates low PUE across fluctuating loads in different modules. Finally, physical and virtual security is paramount, requiring measures to prevent unauthorised access and ensure robust cybersecurity.

Implementing predictive maintenance and real-time monitoring systems can enhance reliability and reduce operational costs. Data-driven insights can be used to plan capacity, avoiding overprovisioning or underutilization. Advanced DCIM provides a unified interface to monitor and manage power, cooling, network, and IT assets across all modular units, each with its own infrastructure, ensuring operational stability. Tracking and optimizing energy consumption in this way enables operators to reduce PUE and boost energy efficiency.

Insights into cooling performance makes it easier to maintain optimal thermal conditions, reduce energy waste, and reduce operational costs. Used correctly,



DCIM also enables better allocation of space, power, and cooling resources, and can adapt to increased workloads. Seamless integration of new modules is facilitated by automatic detection and management. Predictive analytics can detect potential failures or inefficiencies before they cause downtime, while failover mechanisms and redundancy planning can help maintain uptime in modular environments.

A truly integrated approach

IMDCs meet the need for scalability, rapid deployment, and cost efficiency in an increasingly digital world. When designing, implementing, and operating MI-DCs, a truly integrated approach looks at everything from space management, adaptability to technological advancements, engineering, customizing, manufacturing, installation, fire and security, connectivity, cabling, rack equipment, housing, power, airflow, configuration of DCIM software, quality control, project management, and logistics.

When specifying and building a modular solution, dealing with multiple suppliers is practically unavoidable. It makes sense to have one single representative manage all parties and ensure consistency, compatibility and interoperability of processes and products. It's important that every discipline involved works very closely together and exchanges information in a highly structured, standardized manner. Each individual competence area is currently highly specialized and rapidly developing. Customization, for example, is too complicated to be carried out by anyone but experts who understand all the dependencies and variables.

By working with a 'rainbow team' consisting of experts from all relevant disciplines and appointing one single point of contact, the modular solution can be optimized, regardless of the number of variations and product types, and resulting complexity.

A truly comprehensive approach addresses the unique requirements of, for example, branch offices, optimizing connectivity and data processing at the edge while leveraging advanced containment systems to enhance cooling efficiency and energy savings. Such modularity allows for incremental scaling as needs grow, reducing CAPEX and OPEX enabling rapid deployment and future-proofing, while ensuring ongoing alignment with KPIs and targets.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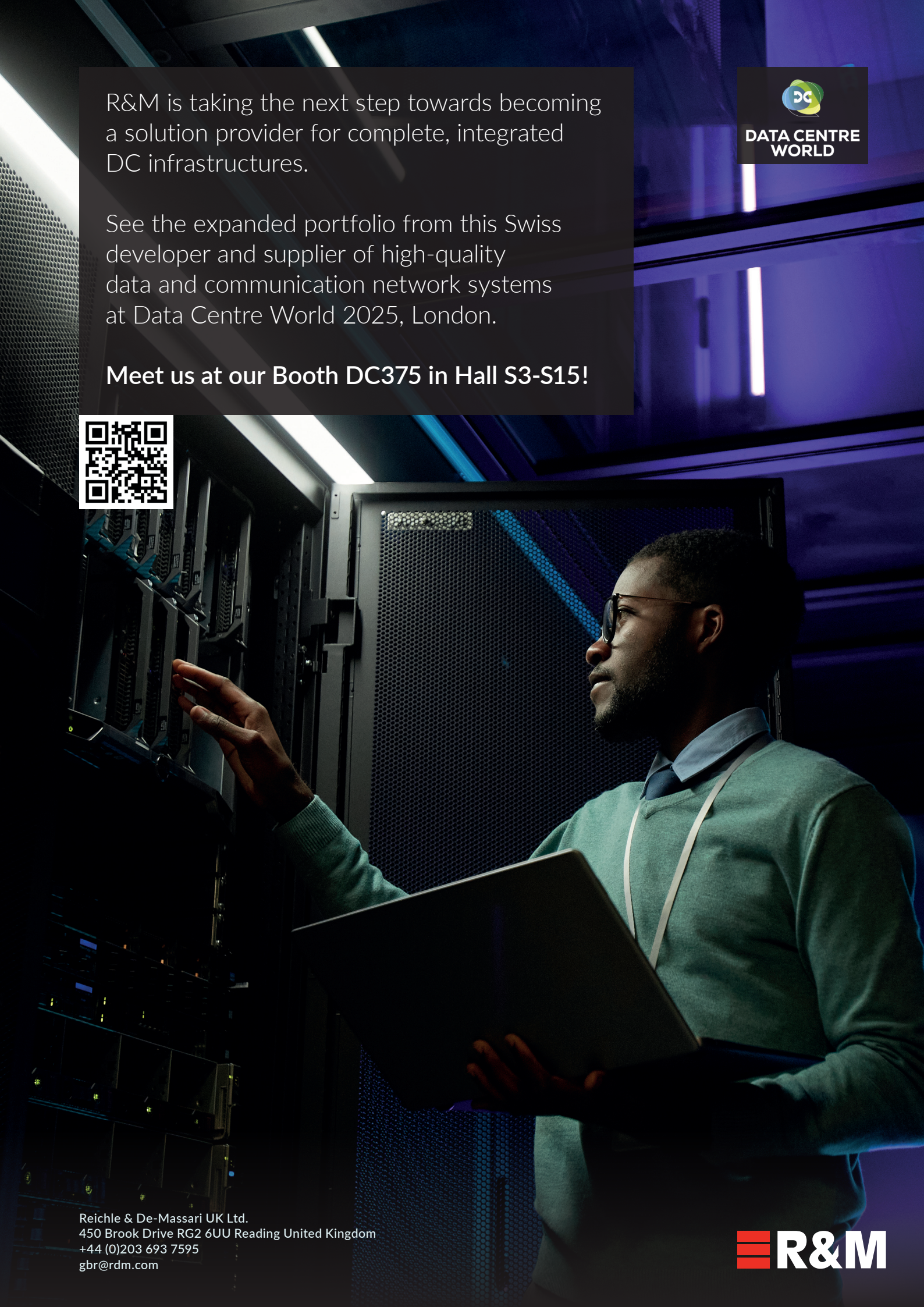
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The DCA Update

By Steve Hone, CEO The DCA

WELL, HERE WE ARE IN 2025! Seems hardly a moment since we stepped into 2024! Time really does seem to be moving at high speed!

In this issue of Data Centre Solutions there are a number of topics of focus – Sustainability, Safety & Security, DC IT. All vitally important to Data Centres.

We have some interesting articles from DCA Partners. A big thank you to all the contributors! ***Astrid Wynne, Head of Public Sector and Sustainability at Techbuyer, Chair of The DCA Sustainability SIG,*** provides us with her view on the changeable situation of Net Zero – 'In the land war between the ESG movement and the anti-ESG coalition, the former could be losing ground.'

Giles Gibson, a veteran of the data centre industry who works on innovation and renewable energy projects explains 'Why PUE is an obsolete metric' – 'We need to rethink our approach as an industry. We can't keep shaving a few points off the PUE score, consuming vast amounts of grid power, and hoping the carbon reduction and energy crisis will just pass us by.'

Finally, ***Andy Lewis, Design Manager at Weatherite,*** highlights the innovations shaping the future of HVAC systems in data centres – 'The future of data centre cooling lies in the seamless integration of diverse technologies to create hybrid solutions that are both efficient and sustainable.'

Meet The DCA in 2025!

The DCA are present at all the key Data Centre events that take place throughout the year. We've produced a comprehensive event calendar and are delighted to be supporting over 40 events!

Support varies – The DCA might consult on conference programmes, judge awards, chair & host sessions at conferences, our representative / Partners speak on panels and most importantly we ensure you know about events by promoting them.

When attending events, The DCA actively looks for opportunities for our Members and Partners, promoting collaborative projects and making introductions.

Here is a list of the events you'll find us at in Q1

- DDCA Kick Start Conference, Netherlands
- Data Centre Expo - Data Centres Track (Day 2), London
- Platform UK, London
- Communico Networking Event, London
- Data Cloud Energy & ESG Europe 2025, Brussels
- Mixing IT Networking Event, London
- Data Centre World, Tech Show, London
- Infrastructure Investor - Global Summit, Berlin
- Datacenter Forum, Oslo
- Tech Capital Infra AI Summit, Greece

You can The DCA on Stand DC534 at Data Centre World. If you would like to arrange a meeting with us at DCW or any of these please drop me a message – Steveh@dca-global.org

Find out more about The DCA or email us: info@dca-global.org

Best regards

Steve

ESG backlash – What now for DC sustainability?

By Astrid Wynne, Chair DCA Sustainability SIG

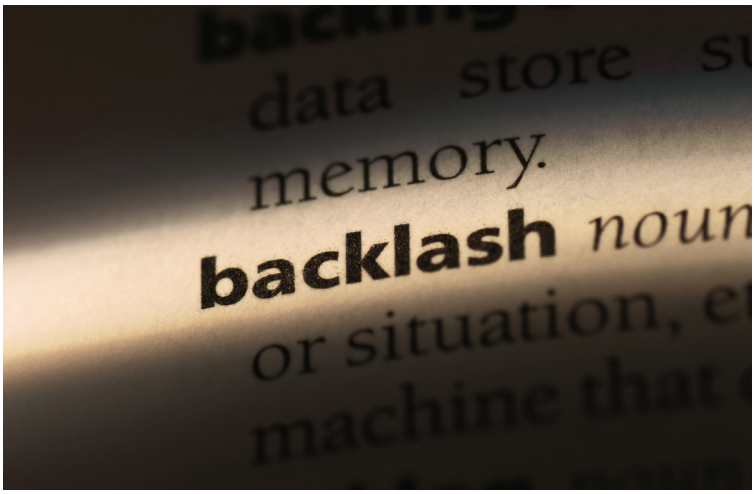
IN THE land war between the ESG movement and the anti-ESG coalition, the former could be losing ground. In January Citigroup and Bank of America backed out of the Net Zero Banking Alliance (NZBA), a UN backed group of banks publicly advancing net zero goals through their investment decisions.

This follows other earlier withdrawals from Goldman Sachs and Wells Fargo and the dissolution of a sister organisation, Net Zero Insurance Alliance. The last of the US banks, JPMorgan, left on 8th January, It has prompted parent organisation, the UN backed Glasgow Financial Alliance for Net Zero (GFANZ), to make some changes. Amongst them, opening up membership to "any financial institution working to mobilize capital and lower the barriers to financing energy transition," rather than having a net zero finance or investment commitment. One wonders if the timing of this has anything to do with Trump's re-election to the US presidency.

US battleground

Tension between the carbon reduction aims of finance bodies and various Republican US states has been continuing for some time. Texas boycotted some heavy financial hitters that had signed up to the Net Zero financial commitments. These included Blackrock, BNP Paribas, Credit Suisse, HSBC with, most recently, NatWest.

Other states took a similar approach: North Dakota prohibited state investment in funds based on social criteria or any other grounds than maximising returns; Kentucky required a public list of financial companies that boycotted energy companies; Arizona prevented the state treasurer from



considering ESG policies for investment. In March 2023, 19 Governors, led by Florida Ron DeSantis announced an alliance against ESG.

The joint statement included the words: "The proliferation of ESG throughout America is a direct threat to the American economy, individual economic freedom, and our way of life, putting investment decisions in the hands of the woke mob to bypass the ballot box." With Trump now entering the Whitehouse, the wind seems to be blowing in this direction.

European shift

At the other end of the dial, EU legislators have introduced legislation on energy efficiency for products and large energy users, circular economy and eco-design. The Corporate Social Reporting Directive and Corporate Social Due Diligence Directive both came into effect this year. The rolling plan will extend to all European SMEs and their supply chain in less than five years. Metrics on pollution, circular economy, water usage, climate and biodiversity as well as metrics on working conditions in the organisation and the supply chain, affected supply chain and stakeholders will all be mandated to appear alongside financials in annual reports.

Governments in the Nordics, Japan, China and Australia are introducing their own spin on the regulations. The risks and opportunity mapping from this legislation is being picked up by stock exchanges and financial frameworks like the International Financial Reporting Standards Foundation. However, even here, there is evidence that the tide is turning away from increased scrutiny on social justice and environmental regeneration.

Free ICT Europe Foundation has been talking to EU legislators on competition, circular economy and economic development for 10 years. Colleagues on the ground in Brussels tell me that there has been a shift since the European elections. With more extremist and nationalist Members of the European Parliament than before, there is less consensus on driving change. There is also a shift towards the issues of sovereignty and economic success over green policies and environmental protection. This will mean a hiatus in ESG advances. However other issues, like Right to Repair can be pivoted to a more business focused approach.

The data centre market

Although data centres are the focus of a large number of investment organisations, particularly as Artificial Intelligence expands, the sector is somewhat insulated from the culture wars around sustainability.

Data centres have been in the crosshairs of bad publicity around energy and water usage for many years. Depending on who you talk to, the sector is responsible for between 2% and 4% of global energy usage and is set to rise by a factor of ten is the next five to ten years as a result of growing AI workloads. This has led to criticism and moratoriums on new developments. It also makes it more difficult to address the skills shortage in the sector.

In 2024, the sector was designated as Critical National Infrastructure (CNI) alongside energy and water systems. Whilst this offers a level of protection to data centres, it also opens the door to increased regulation. In the face of this, the sector is one of the most proactive when it comes to initiatives that demonstrate good practice. The Infrastructure Masons Climate Accord, the Climate Neutral Data Centre Pact, OCP Ready programme and the Data Centre Code of Conduct all include commitments on water usage, carbon reductions, energy efficiency, circular economy, and combined heat and power.

The drivers for this have been as much practical as ethical. There are obvious cost benefits to efficiency gains, particularly as Data Centres have to compete for scarcer resources as time goes on. Energy supply is predicted to be a problem for all as fossil fuel supply diminishes and we rely increasingly on an electric grid for transport and heating.

It is similar for companies serving the data centre eco-system. I work for a company that has specialised in sustainable IT solutions for decades. In practical terms, this means not over-provisioning hardware, offering energy efficient solutions, helping customers make use of IT for as long as possible in their own estates or someone else's.

You can call this approach "sustainable", "resilient", "circular" or "sensible". It all leads to the same result. Whatever happens on the ideological battleground, we are still facing a future where resources are harder to come by and ecosystems are harder to protect. If we want to offer the next generation good opportunities, we will need to prepare for that with today's actions.

Astrid is Head of Public Sector and Sustainability at Techbuyer. She also chairs the sustainability special interest group at the Data Centre Alliance.

Data centres of tomorrow: Exploring the latest HVAC innovations

In this opinion piece, Andy Lewis, Design Manager at Weatherite, explores the cutting-edge HVAC technologies transforming data centre cooling. As data centres grow, efficient and sustainable solutions are crucial. This article highlights the innovations shaping the future of HVAC systems in data centres.

IN THE ERA of digital transformation, data centres have become the beating heart of modern businesses. The rise in computing power and high-density servers has propelled data centres to new heights, demanding unprecedented efficiency, reliability, and sustainability in their cooling solutions. As Design Manager at Weatherite, I am privileged to witness and contribute to the advancements in HVAC technologies that are redefining the landscape of data centre cooling.

The evolution of data centres is marked by a significant increase in power consumption and heat generation. Traditional cooling methods, primarily based on direct and indirect air systems, are reaching their limits. These systems are struggling to cope with the escalating demands without the integration of liquid cooling solutions. At Weatherite, we're pioneering hybrid cooling solutions that seamlessly blend air and liquid cooling technologies to meet the needs of the future.

The case for hybrid cooling solutions

Direct air systems, while efficient, often face challenges in high-density environments. The risk of contaminants and the inability to adequately cool high-specification rooms make these systems less viable as standalone solutions. Indirect cooling, coupled with adiabatic cooling, has emerged as a preferred method for minimising compressor loads and enhancing efficiency. However, the integration of liquid cooling is becoming increasingly embraced.

Liquid cooling, whether through direct-to-chip or immersive methods, offers unparalleled efficiency. Direct-to-chip cooling involves the application of a liquid coolant directly to the server's hottest components, such as CPUs and GPUs. This method ensures precise temperature control and significantly reduces energy consumption. Immersive cooling, on the other hand, submerges entire servers in a thermally conductive dielectric liquid, providing exceptional heat dissipation.

Weatherite's pioneering approach

We're at the forefront of developing innovative hybrid cooling solutions. Our approach combines the best of air and liquid cooling to create systems that are not only efficient but also sustainable. We're currently collaborating with a leading data centre provider to develop our cutting-edge, and scalable concepts in hybrid cooling.

addressing sustainability concerns

This increased usage of data centres brings sustainability concerns to the forefront. Data centres already use 1.5% of global electricity consumption, making providers key players in the hunt for net

zero. Improving energy efficiency presents many challenges to the data centre industry — but also exciting opportunities for innovation.

The average modern data centre uses around 40% of its power for cooling. After all, to provide a secure, high-quality service, processors and other hardware must be kept in optimal conditions.

By adopting advanced cooling technologies, data centres can reduce their energy consumption, operational costs, and carbon footprint. The integration of hybrid cooling solutions can lead to a reduction in power usage effectiveness (PUE), driving both economic and environmental benefits.

The impact of efficient cooling

Efficient cooling solutions are not just a technological advancement; they're a business imperative. According to the Uptime Institute's 2023 Data Centre Industry Survey, PUE remains a critical metric for data centres, with an average of 1.58 across the industry. However, best-in-class facilities are achieving PUEs as low as 1.2, showcasing the potential for significant energy savings.

Liquid cooling offers significant energy savings compared to traditional air cooling methods at very high densities. These improvements not only enhance the sustainability of data centres but also contribute to broader efforts to combat climate change.

Looking ahead

The future of data centre cooling lies in the seamless integration of diverse technologies to create hybrid solutions that are both efficient and sustainable. At Weatherite, we're committed to exploring and implementing the latest innovations to meet the evolving demands of the industry. Our collaboration with data centre providers is a testament to our dedication to pioneering solutions that push the boundaries of what is possible.

A final note

The journey towards the data centres of tomorrow is paved with challenges and opportunities. As we navigate this landscape, the role of advanced HVAC technologies cannot be overstated. By embracing the latest advancements in HVAC technologies, we can build data centres that not only meet the demands of today but also pave the way for a greener, more efficient future.

We're proud to lead the charge in developing hybrid cooling solutions that are efficient, reliable, and sustainable.

Andy Lewis is Design Manager at Weatherite, a HVAC solutions provider. Andy started as a Trainee at Weatherite 24 years ago and has worked his way up through many departments over the years – currently managing the Design & Applications Department.

Why PUE is an obsolete metric

The data centre industry is obsessed with doing the wrong thing better. We spend a small fortune trying to reduce the energy costs of cooling equipment, chasing that elusive PUE figure. Because, let's face it, a low PUE is all that matters, right?

WE'RE IGNORING the elephant in the room– PUE is just one part of the story. What about the rest? Once heat is moved away from the processor, it stops being a problem and turns into an asset. So why do cooling companies brag about how efficiently they can toss away your biggest asset?

I never want to sit through another design meeting where engineers advocate for essentially opening the window and throwing out the most expensive part of running a data centre– energy.

Over its working lifetime, a data centre will likely spend more on energy than any other aspect of its business model.

It's all about the circular energy economy

The future of the DC industry is primarily in energy transfer, with a side hustle in computing. We convert electricity into heat, and guess what? People pay us to do it – a win-win for DC operators.

Energy costs dominate the total cost of ownership for a data centre, far exceeding the capital costs of construction. If we sell that energy to the next user, the total cost of ownership drops dramatically, and financial feasibility improves immensely. At this point, even the bean counters start to pay attention. Google recently announced that their emissions are rising due to AI focus in their data centres. If they joined the energy circular economy, those figures would turn upside down. Customers are chasing low-carbon-footprint hosts for their reporting, making energy-chain participants far more attractive than mere energy consumers.

Grid constraints limit new data centre sites. If our business model included selling heat to nearby customers, a data centre operator would be the darling of any developer, becoming part of a community of businesses that need the data centre's end product—heat. The overall grid load would plummet, opening up many more site opportunities.

=Imagine a future where industrial or residential developments court data centre operators as their local energy suppliers. A circular economy is about transferring a resource from one user to another without losing its value. Everyone wins, including the planet.

Remember when racks consumed a measly 4kW? Now we're looking at 100kW racks and massive floor loadings. Our industry hasn't fully grasped designing out carbon for a building's lifetime. We need to rethink the entire approach.

The DC industry consumes roughly 2-3% of the UK's energy. By 2030, it could be as high as 10% with the drive toward high-density AI data centres. In Ireland the Data Centres now consume more energy than all the housing put together.

Companies like Deep Green show that distributed data centres in smaller buildings, sharing heat with nearby customers, make sense. They plan to locate 500 data centres in local sites like leisure centres, turning waste heat into an asset that can heat swimming pools.

Why isn't this the norm? Embedded thinking has constrained the industry. We gather top-notch specialists to design the same old lower PUE, high-AI-rack data centres. But if we reconceptualized our business as primarily heat producers, the design would change radically.

Imagine a design meeting where generating heat is the primary goal. "Maybe base it around gas-powered boilers?" "Nah, too expensive." Then someone suggests, "What if businesses placed IT equipment in the building to generate the heat for free, or better yet, paid us to do it?" Heads would turn, and posh biscuits would be reached for.

Talking recently to an established DC operator they were happy that their facility had a PUE of 1.6, after all, they said, it is the customer that pays for the power, we just pass on the costs plus a bit. There lies the rub, it is now an industry ripe for a disruptor to undermine the old guard.

Talking to a smart engineer from a major heat pump and cooling company, he mentioned their cooling systems efficiently discard heat, but they also have tech to capture it, reducing total DC energy requirements by over 50%. The barrier to widespread adoption? Entrenched thinking.

Change the focus of the DC design to one of an energy provider and the net power consumption drops dramatically. Throw in immersive cooling, efficient heat exchangers and nearby heat customers it becomes a very different beast. A new metric is born, that of NUE – Net Usage Efficiency. Total power used for the IT and cooling minus total power re-sold. Rather than a PUE of 1.6 it could move towards NUE of 0.5 or so. A DC designed

for these operational costs will easily undercut the inefficient thinking of a PUE of 1.6. Dinosaurs meet your meteorite.

What about existing data centre sites? Limited cooling, power, floor loading, and high energy costs make them uncompetitive with new, energy-efficient, distributed data centres. The industry will split: new sites embedded with their heat customer base and a retrofit industry upgrading legacy sites or repurposing buildings entirely.

Architects like Marchini Curran Associates design low-carbon-footprint data centres, considering the entire lifecycle, including end-of-life recycling. But projects driven primarily by traditional engineers end up with the same old designs.

We need to rethink our approach as an industry. We can't keep shaving a few points off the PUE score, consuming vast amounts of grid power, and hoping the carbon reduction and energy crisis will just pass us by. We need to focus on the NUE score as a prerequisite for a design.

The DCA is leading in ensuring that standards and policy deliver the changes that are necessary, but it can be a slow process. We don't need to wait for the legislation to change and be forced to do the right thing.

In years to come, we'll look back and marvel at our stupidity—building huge dinosaurs that consumed vast quantities of energy, converted it to heat, and then threw it all away. What kind of business model was that? What were we thinking?

Do we want to continue being part of the problem or start being part of the solution?

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