DCS
DATACENTRE SOLUTIONS

DEVELOPING DIGITAL INFRASTRUCTURE IN A HYBRID WORLD

ISSUE V 2024

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PREPARING DATA CENTRES FOR A MUCH COOLER, MORE FLUID FUTURE AS AI ADVANCES

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Life Is On Schneider Electric

VIEWPOINT

By Phil Alsop, Editor

SustAInable?

LEST ANYONE is in any doubt as to the likely impact of AI when it comes to sustainability, a recent newspaper report stating that one of the hyperscalers' carbon emissions have actually increased almost 50% over the last five years is clear evidence of the struggle that, potentially at least, lies ahead. The main reason given for this increase is the building and operation of the 'power-hungry' data centres required to support the development and roll-out of AI-related applications.

Looking ahead, there are several possible ways in which the apparent conflict between digitalisation and sustainability can be addressed. These would range from a market or business driven approach where, ultimately, nothing must be allowed to inconvenience the march of technology and the many benefits it brings to society (even if it is destroying the planet along the way!) to the other end of the scale, whereby some kind of a (government-imposed) limit is placed on the development and use of digital solutions.

My own view, for what it's worth, is that any serious plan designed to halt climate change requires a radical re-think of our 21st century lifestyles. The climate change naysayers always point out the huge cost of going green – apparently it will cost the UK, for example, trillions of pounds. The fatal flaw in this argument is the assumption that we will all carry on our lives more or less as they are now, but with green solutions. So, we will carry on using our cars, but they will be electric vehicles – and it will cost us all thousands of pounds to purchase a new, green car. Ah, but if we did away with the need for cars, then I am guessing there would be no cost associated with such a sustainable policy (and it would be a truly sustainable policy, as opposed to the EV solution, which still has some impact on the planet)

In other words, truly green solutions will require radical changes to our lifestyles. Certain political movements want to frighten us all as to the 'nightmare' of 15 minute cities and the significant infringement of our civil liberties required to deliver sustainability in its purest form. But I suspect that the vast majority of us would be quite glad if we could give up the daily commute, for example. Indeed, one small plus from the pandemic, is the idea of working from home/more locally – people seem to enjoy this...And then we might perhaps consider the civil liberties of those who live in areas of the world where floods and heatwaves will mean abandoning their homes...

I appreciate that my comment is moving a long way from data centres and IT, but I do not think that any truly serious sustainability debate can do anything other than take a radical approach – question much of what we today would think of as an essential part of our lives. Travel would be a great example. No one needs to fly abroad for a holiday. And yet the travel sustainability debate thus far is more about how do we make the air industry green, how to develop eco-tourism, as opposed to suggesting that maybe we simply don't need to travel frequently and far for holidays.

I guess the ultimate decision each of us makes as to what sustainability means in our own lives comes down to how serious and urgent we view the threat of climate change. In terms of the UK, I always say that, the minute the River Thames floods large parts of London, then climate change might suddenly become important. Until then, what happens in the provinces to the 'little people' is apparently of little consequence.

In finishing, I am not sure that there are any easy answers to the digital v sustainable debate, but let us hope that the decisions made on our behalf are at least well-considered and implemented, and done without fear or favour.

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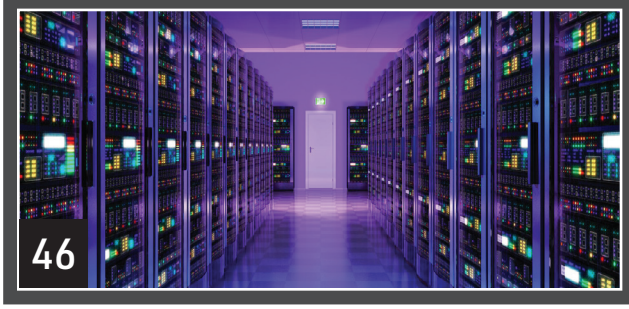

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CIOs must prepare for the fourth industrial revolution

The emerging impact of AI, combatting more sophisticated cyber threats and improving sustainability are the top priorities for CIOs.

HOT ON THE HEELS of the release of Chat GPT-4o and the Google IO conference where lots of AI tools were on show, a recent study has shown that Chief Information Officers (CIOs) are investing in AI tools to ensure they position themselves front and centre in the world's fourth industrial revolution.

Results in the 2024 CIO Report from global technology service provider, Logicalis UK&I, revealed that 85% of CIOs are earmarking budgets solely for AI development and implementation. Undoubtedly, this needs to be a strategic objective for many senior leaders in 2024 as 87% of CIOs reported a substantial demand for AI technology from across their organisations.

Before the calls of 'the robots are taking over' are made, it is worth noting that there is an air of caution amongst many CIOs. 72% said that they are apprehensive about the challenges of regulating AI use internally and 64% of business leaders expressed worries about AI threatening their core business propositions.

Neil Eke, CEO at Logicalis UK&I says, "Our survey shows that CIOs are unequivocally embracing the disruption. Compared to our 2017 report when CIOs were mainly focused on keeping the lights on, their remit in 2024 is far more strategic, forward-thinking, and business-driven. Digital transformation is being replaced with AI innovation as more investment goes towards emerging technologies. With AI becoming the top priority for CIOs in 2024, it's not surprising that many are actively seeking opportunities to incorporate such capabilities into their companies."

The Logicalis CIO Report surveys the views of 1000 CIOs across the globe

and has tracked the strategic influence of the CIO for over a decade. During that time technology leaders have moved from the basement to the boardroom.

Now, in 2024, CIOs have to juggle major disruptive forces. The rise of AI and advancing security threats, global economic uncertainty and the mounting need for climate action, are upending the status quo and bringing a whole new set of leadership challenges.

Cybersecurity findings from the CIO Report include:

- 83% reported experiencing a cyber hack in the last year
- Less than half (43%) felt their business was fully equipped to handle another major security breach
- Malware and ransomware (41%) are the most significant risks to organisations over the next 12 months, with a similar portion reporting data breaches (36%) and phishing attacks (35%) as the two other most significant risks.

It is staggering that 83% of CIOs reported experiencing a cyber hack in the last year and, even more concerning is that almost all of those surveyed experienced business damage as a consequence.
Mike Fry, Security and Cloud Business Unit Director at Logicalis UK&I explains, "Everyone now has easy access to sophisticated AI models, including cybercriminals, which could explain why so many CIOs reported they've experienced a cyber hack recently. There is also a skills gap in the IT industry which is particularly pronounced in the cybersecurity sector, leading to fatigued and overwhelmed IT teams trying to tackle more incidents and alerts."

Fry continues, "As we enter the era of widespread AI use, the use of AI by threat actors will be one of the single biggest threats we face in Security. However, if used correctly, AI also represents the best chance we have at defence.

As a result, organisations should be looking to deploy security systems that leverage AI technology to remain one step ahead. By integrating AI into your Security Operations Centre and deploying AI-enhanced threat detection the technology can help tip the scales in our favour when it really counts."

As if getting to grips with emerging AI and combatting sophisticated cyber hacks wasn't enough, CIOs are also facing growing pressures to limit the environmental impact of their organisations on top of the traditional demands to control costs.

Europe primed for data centre ABS financing as investment soars

2023 was the second-largest investment year in the past decade for investment in data centres globally, with capital reaching $36bn.

GLOBAL INVESTMENT in data centres reached $36bn last year with $22bn invested in the first five months of this year alone, according to analysis by global law firm Linklaters, signalling robust growth in support of the digital economy.

North America leads with significant investment, accounting for 62% of the global total in 2023 and 69% of investments up to April 2024, equating to $15bn invested. Europe's market share has jumped from 6% in 2022 to 20% in 2023, with over $7bn invested in European data centres so far in 2024, giving Europe a 29% market share and highlighting the continent's growing importance in the data centre market. While North America continues to hold a significant portion of activity, Europe stands out as the only region to build a year-over-year increase in transaction volume in 2023.

The rise of asset-backed securitisation

The financing strategy for data centres is evolving. As these centres reach income stabilisation, the transition to ABS offers a more cost-effective means to refinance existing bank debt, showcasing the versatility and appeal of the product in this sector.

The ABS market in the US experienced a resurgence in 2023 with $5.4bn in securities backed by data centre revenues issued, and the first five months of 2024 has already seen issuances totalling $3.7bn. This is a significant rebound following a contraction in 2022 due to elevated funding costs.

Since 2018, data centres across North America have seen issuance of over $21bn in asset-backed securities. This growth trajectory emphasises the sector's appetite for sustained development and the integral role that ABS financing will play at the appropriate phase in the lifecycle of these assets.

As data centre deals mature, expectations are set for a rise in activity in the European ABS sector. Europe's data centre sector has just seen its first ABS issuance at £600m, with the growth in data centre transactions set to make the sector prime for further ABS uptake as owners look to optimise their financing and unlock capital, indicating the early stages of an emerging market with vast potential.

A key difference of the European sector compared to North America is the significant difference between legal jurisdictions across the continent. Pan-European ABS platforms have been successfully executed in other established sectors – this could be replicated for data centres.

Elisabeth Johnson, Structured Finance Partner at Linklaters (London) commented: "Data centres have been the target of significant global investment, with appetite growing substantially within Europe. We're at the edge of witnessing asset-backed securitisations in Europe pick up pace as these ventures mature. This is an exciting time for the industry, where strategic financing structures will pave the way for the next wave of digital infrastructure expansion. Linklaters has successfully structured a large number of complex pan-European ABS structures and is expertly placed with its network of offices in all major European jurisdictions to advise on novel structures."

Patrice Doat, Structured Finance Partner at Linklaters (Paris), added: "Data centres have become an attractive asset class with predictable cash flows, making them ideal candidates for ABS.

France, with its strategic location and strong regulatory framework, offers an attractive environment for such innovative financing structures. With this in mind, it will be essential for firms to navigate the specific legal and regulatory considerations, including compliance with the EU securitisation regulations and French commercial real estate laws, to fully leverage ABS in this sector."

Barbara Lauer, Capital Markets Partner at Linklaters (Frankfurt), observed: "Data centres have seen exponential growth, driven by technological advancements and market trends such as the popularity of AI and the need for cloud-based storage. As the sector matures, ABS has potential to become an additional funding source noting that it will be crucial to apply the knowledge and experience gained on other more esoteric asset classes in structuring such deals in an insolvency remote manner. ABS may be used to enhance liquidity and potentially to lower capital costs."

Linklaters is at the cutting-edge of the digital infrastructure sector and the remit of the team has widened as the market has grown to incorporate a growing number of digital infrastructure assets, including data centres, fibre, towers and satellites.

Report focuses on thermal management challenges and opportunities for I/O modules

Fuelled by heightened demand for the fastest data rates, optical I/O module power requirements push traditional forced-air cooling to operational limits.

MOLEX has published a report that examines thermal management pitfalls and possibilities as data center architects and operators strive to balance high-speed data throughput requirements with the impacts of growing power density and the need for heat dissipation on critical servers and interconnect systems.

Molex's In-Depth Report of Thermal Management Solutions for I/O Modules addresses the limitations of legacy approaches for thermal characterization and management and explores new innovations in server and optical module cooling to better support 112G and 224G connectivity.

"As demand for faster, more efficient data processing and storage continues to rise rapidly, so does the heat generated by the high-performance servers and systems needed to scale generative AI applications and support the transition from 112 Gbps PAM-4 to 224 Gbps PAM-4," said Doug Busch, VP & GM, Enabling Solutions Group, Molex.

"The integration of optical connectivity and optical modules, applied with new cooling technologies, will optimize airflow and thermal management within next-gen data centers. Molex is driving innovations in thermal management across both copper and optical platforms, as well as within our power management products, to help our customers improve system cooling capabilities and enhance energy efficiency within next-gen data centers."

Shift to 224 Gbps PAM-4 shines light on creative liquid cooling

The move to 224 Gbps PAM-4 interconnects between servers and network infrastructure represents a doubling of the per-lane data rate. Power consumption is also surging, with optical modules alone reaching as

high as 40W over long-range coherent links, up from 12W just a few years ago, representing nearly a 4X increase in power density.

In this informative report, Molex explores the latest in air cooling, along with the integration of creative liquid cooling solutions within existing form factors to address increased power and thermal demands on I/O modules. Direct-to-chip liquid cooling, immersion cooling and the role of passive components to enhance active cooling are addressed. The report also delineates cooling methods that may be most effective for accommodating power demands in chips and I/O modules that scale to high levels.

To solve persistent challenges in cooling pluggable I/O modules, Molex features a liquid cooling solution, called the integrated floating pedestal. In this scenario, each pedestal that contacts the module is spring-taut and moves independently, allowing implementation of a single cold plate to different 1xN and 2xN single row and stacked cage configurations.

For example, this solution for a 1x6 QSFP-DD module utilizes six independently moving pedestals which can compensate for varying port stack heights while ensuring seamless thermal contact.

As a result, heat flows directly from the module generating heat to the pedestal over the shortest possible conduction path to minimize thermal resistance and maximize heat transfer efficiency.

Additionally, the Molex report outlines the inherent costs and risks associated with immersion cooling, which offers highly effective thermal cooling that exceeds roughly 50kW per rack but requires a complete overhaul of a data center's architecture.

Molex Drop Down Heat Sink (DDHS) Technology

Beyond liquid cooling, Molex's In-Depth Report of Thermal Management Solutions for I/O Modules details advanced approaches to module design and thermal characterization poised to transform the performance of high-speed network interconnects.

For I/O specifically, new solutions can be integrated into servers and switches for greater levels of heat sinking without compromising reliability. To that end, the report describes an innovative Molex Drop Down Heat Sink (DDHS) solution that maximizes heat transfer capability of a traditional riding heat sink while minimizing metal-to-metal contact, which can create wear-and-tear on components.

Through the DDHS, Molex replaces current riding heat sinks with a solution that eliminates direct contact between the optical module and thermal interface material (TIM) for a simpler and more durable installation without friction or piercing. As a result, Molex's DDHS allows successful TIM implementation for more than 100 insertion cycles. This reliable heat management solution fits within standard module and rackmount form factors while effectively cooling higher power modules and improving overall power efficiency.

AI design shifts slow data centre physical infrastructure market

According to a recently published report from Dell'Oro Group, Data Center Physical Infrastructure (DCPI) revenue growth slowed to a mid-single-digit rate in 1Q 2024, as design shifts accelerated computing infrastructure and AI workloads need time to materialise.

"AS I PREDICTED, DCPI revenue growth slowed in 1Q 2024 as deployments related to AI workloads simply need more time to materialize, and to a lesser extent, a difficult comparison to an unseasonably strong 1Q 2023," said Lucas Beran, Research Director at Dell'Oro Group. "On a positive note, the pipeline for AI-related DCPI deployments continues to grow, as evidenced by vendor backlogs that have eclipsed levels seen during the 2022 supply chain constraints. Fulfillment of this demand is simply a matter of time.

"Many factors are impacting the timing of this DCPI growth related to AI – Vendor manufacturing expansion, data center construction, and power availability all need to align. Furthermore, new data center designs to accommodate rack power densities 3 to 5 times higher than average, to incorporate liquid cooling, and to manage AI training load variability are all new challenges currently being addressed.

As they are overcome, I expect growth to materialize in a very meaningful way," continued Beran.

Additional highlights from the 1Q 2024 Data Center Physical Infrastructure Quarterly Report:

- Eaton, Modine, and Schneider Electric led all vendors in market share gains, while Vertiv lost share.
- Revenue growth was broad based, but North America slightly outpaced all other regions. The China DCPI market was the only region to decline, but is expected to return to growth next quarter.
- Hardware sales growth broadly slowed, with the exception of Facility Power Distribution, which was the only market segment to grow at a double-digit rate, due to increasing power distribution requirements of AI workloads. Thermal Management growth notably slowed as some colocation end-users are still deploying recently shipped equipment.

Looking ahead, we forecast double-digit revenue growth for the 2024 DCPI market after a small upward revision. We expect this to be weighted towards the second half of the year as physical infrastructure deployments related to AI workloads begin to materialise.

Data center switch sales decline

ACCORDING to a recently published report from Dell'Oro Group, spending on Ethernet data center switches declined in 1Q 2024, marking the first decline since 4Q 2020.

While Ethernet data center switches are gaining ground in AI back-end networks used to connect accelerated servers, this footprint expansion was not enough to offset the decline in spending in the broader front-end network, used to connect general-purpose servers.

"In line with our expectations, backlog normalization, inventory digestion, and spending optimization caused a decline in Ethernet data center switch sales in the first quarter of the year," said Sameh Boujelbene, Vice President at Dell'Oro Group. "The decline was broad-based across Cloud Service Providers (SPs) as well as Enterprise segments, though certain accounts performed better than others depending on where they are in the digestion cycle.

Despite overall spending softness in the front-end network, spending in AI back-end networks continues to grow exponentially. While Ethernet was able to capture an increasing share of AI infrastructure spending, this growth couldn't offset the decline in the front-end network," added Boujelbene.

The decline was broad-based across almost all major branded vendors, with the exception of Arista and Huawei. White-Box vendors also saw a revenue increase, driven by spending recovery from several large Cloud SPs, including Google and Amazon in the U.S. and Alibaba, Tencent, and ByteDance in China.

Europe lags behind North America in AI race

New research reveals North America leads in AI-driven product innovation but Europe seeks to make up gap with user-first approach.

EUROPEAN product professionals are much less likely to be developing AI features than their North American counterparts, shows new research from Pendo, the all-in-one product experience platform. The People Behind the Product Survey, which collected data from over 300 product leaders across Europe and North America, found that 58% of North American businesses are implementing AI features in their products, compared to just under a third (34%) of businesses in Europe. User engagement remains an issue, though, with just 15% of product leaders across both North America and Europe reporting that users are embracing AI features.

When it comes to improving user experience and uptake of AI features, though, Europe may have an edge over North America: nearly two-thirds of European businesses say they've increased the size of their user experience and research teams in the past 12 months, compared to only 27% of those based in North America. This suggests European companies are placing user experience at the heart of their strategy to catch-up to North American AI innovation.

"AI has streamlined so many product processes, but to bridge the gap and begin successfully implementing AI features into our end-user products, we need to first understand what their needs are," said Francesca Buckland, vice president of product management at Clarivate, a leading global provider of transformative intelligence. "Taking a user-led approach to developing and implementing AI features is critical for ultimately seeing widespread user adoption."

While many businesses continue to seek new ways to improve user engagement for their AI features, the research reveals that AI is already being embraced by product managers to support their own day-to-day tasks. Over two thirds (69%) of European, and 62% of North American-based product managers say that they have embraced AI to help with their daily tasks, highlighting a disparity in their comfort level between using AI personally and building it into the products they provide to end users.

"Today's product professionals realise the massive opportunity for AI to increase their own productivity, but fear and regulation still control the narrative around AI in many organisations, especially in Europe," said Todd Olson, CEO and co-founder of Pendo. "It's time to recognise the commercial potential of AI - with AI in our products, we can positively impact end user experiences and ensure our companies remain competitive in the future."

The research reveals that almost all product professionals use third-party large language models, with the vast majority (71% of North American-based and 65% of European-based product professionals) using OpenAI's ChatGPT.

Innovation using bespoke large language models remains uncommon, with just 17% of North American and 5% of European product managers currently building AI features using their businesses' self-trained models.

When it comes to improving user experience and uptake of AI features, though, Europe may have an edge over North America: nearly two-thirds of European businesses say they've increased the size of their user experience and research teams in the past 12 months, compared to only 27% of those based in North America

Downtime costs companies $400 billion annually

Splunk, in collaboration with Oxford Economics, has released a new global report "The Hidden Costs of Downtime", which highlights the direct and hidden costs of unplanned downtime.

THE SURVEY calculated the total cost of downtime for Global 20001 companies to be $400B annually, or 9 percent of profits, when digital environments fail unexpectedly. The analysis revealed the consequences of downtime go beyond immediate financial costs and take a lasting toll on a company's shareholder value, brand reputation, innovation velocity and customer trust.

Unplanned downtime — any service degradation or outage of a business system — can range from a frustrating inconvenience to a life-threatening scenario for customers. The report surveyed 2,000 executives from the largest companies worldwide (Global 2000) and showed downtime causes both direct and hidden costs as defined below:

- Direct costs are clear and measurable to a company. Examples of direct costs are lost revenue, regulatory fines, missed SLA penalties and overtime wages.
- Hidden costs are harder to measure and take longer to have an impact, but can be just as detrimental. Examples of hidden costs include diminished shareholder value, stagnant developer productivity, delayed time-to-market, tarnished brand reputation and more.

The report also highlighted the origins of downtime — 56 percent of downtime incidents are due to security incidents such as phishing attacks, while 44 percent stem from application or infrastructure issues like software failures. Human error is the number one cause of downtime and the biggest offender for both scenarios.

However, there are practices that can help reduce downtime occurrences and lessen the impacts of direct and hidden costs. The research revealed an elite group of companies — the top 10 percent — are more resilient than the majority of respondents, suffering less downtime, having lower total direct costs and experiencing minimal impacts from hidden costs. These organizations are defined as resilience leaders3 and their shared strategies and traits provide a blueprint for bouncing back faster. Resilience leaders are also more mature in their adoption of generative AI, expanding their use of embedded generative AI features in existing tools at four times the rate of other organizations.

The combined direct and hidden costs
The repercussions of downtime are not limited to a single department or cost category. To provide a multifaceted view, the report surveyed Chief Financial Officers (CFOs) and Chief Marketing Officers (CMOs), as well as security, ITOps and engineering professionals to quantify the cost of downtime across several dimensions.

Key findings on the impacts of downtime include:
Revenue loss is the number one cost. Due to downtime, lost revenue was calculated as $49M annually, and it can take 75 days for that revenue to recover. The second largest cost is regulatory fines, averaging at $22M per year. Missed SLA penalties come in third at $16M.

Diminishes shareholder value. Organizations can expect their stock price to drop by as much as 9 percent after a single incident, and on average, it takes an average of 79 days to recover.

Drains budgets due to cyberattacks. When experiencing a ransomware attack, 67 percent of surveyed CFOs advised their CEO and board of directors to pay up, either directly to the perpetrator, through insurance, a third party or all three. The combination of ransomware and extortion payouts cost $19M annually.

Curbs innovation velocity. 74 percent of technology executives surveyed experienced delayed time-to-market, and 64 percent experienced stagnant developer productivity, as a result of downtime. Any service degradation often results in teams shifting from high-value work to applying software patches and participating in postmortems.

Sinks lifetime value and customer confidence. Downtime can dilute customer loyalty and damage public perception. 41 percent of tech executives in the report admit customers are often or always the first to detect downtime. In addition, 40 percent of Chief Marketing Officers (CMOs) reveal that downtime impacts customer lifetime value (CLV), and another 40 percent say it damages reseller and/or partner relationships.

Globally, the average cost of downtime per year is more costly for U.S. companies ($256M) than their global counterparts due to various factors including regulatory policies and digital infrastructure. The cost of downtime in Europe reaches $198M, and $187M in the Asia-Pacific region (APAC).

Organizations in Europe — where workforce oversight and cyber regulation are stricter — pay more in overtime wages ($12M) and to recover from backups ($9M). Geography also shapes how quickly an organization recovers financially post-incident. Europe and APAC hold the longest recovery times, while companies in Africa and the Middle East recover the fastest.

Resilience leaders bounce back faster
Resilience leaders, or companies that recover faster from downtime, share common traits and strategies that provide a blueprint for digital resilience. They also invest more strategically, rather than simply investing more.

Cloud continues to enable innovation in tough economic climate

When it comes to embracing AI, meeting ESG demands and becoming a more efficient organisation, cloud remains a trusted constant.

NEW RESEARCH from the Cloud Industry Forum (CIF) has found that 100% of organisations are now accessing cloud-based services to meet their needs, with the most common motivation being its potential to offer greater flexibility of IT spend, and its ability to make them more agile as a business.

The data, taken from CIF's latest research white paper, Tough times, but innovation springs internal, also examined the continued prominence of artificial intelligence in fuelling innovation, and the continued importance placed on ESG efforts. Key findings from the research included:

- The preferred cloud-based services were AWS (used by 57% of respondents), Azure (51%) and IBM (51%). 39% of organisations reported using Google Cloud, 28% Oracle and 18% Salesforce.
- 33% of respondents highlighted cloud's potential to offer greater flexibility of IT spend, while 32% of organisations noted better agility.
- 96% of organisations believe that AI will be at least somewhat important to their organisation in the next five years, an increase from 86% in 2023.
- Further to this, 42% of respondents reported that they consider AI among their most important IT projects, ahead of other considerations such as security and IT sustainability.
- 94% of organisations are either planning to or are already using generative AI, with 62% saying it is already in use across at least some parts of the business.
- 40% of respondents reported that IT sustainability is an important project for their organisation, underlining the sustained relevance of ESG-related initiatives.
- 78% expressed that they plan to reach net zero by at least 2040, and 87% plan to do so by 2050.

David Terrar, CEO of the Cloud Industry Forum, said: "Cloud has long been a regular feature in any modern companies' tech stack, and this year's research exemplifies how this remains the case as businesses across industries manage a challenging economic climate. With cloud services more or less ubiquitous now, attention should turn to where businesses can maximise its potential, particularly in crucial areas such as AI and ESG. Thanks to its inherent flexibility, cloud can help companies navigate these challenges with confidence.

"Our research also indicates that AI's rapid rise has continued over the last 12 months and shows little sign of slowing. In fact, many of those surveyed highlighted AI as one of their most important projects, outranking other key considerations like security and cloud migration. Nearly all of the respondents said that AI is a part of their plans, but two thirds of them are already using it, likely representing the fastest adoption of new enterprise technology ever. "Cloud naturally has a key role to play in the further adoption of AI, offering the agility to enable businesses to experiment with AI and reap its rewards. In response, cloud service providers are already integrating AI into their offerings and leveraging its capabilities where possible.

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Preparing data centres for a much cooler, more fluid future as AI advances

Data centre operators know they must constantly adapt to the changing needs of their clients. With the relentless advance of AI applications, the demand for high-capacity computing is set to grow significantly. The high processing speeds and energy demands of this technology present increased pressure on cooling systems, necessitating new, more robust approaches.

BY OZGUR DUZGUNOGLU, DESIGN AND ENGINEERING DIRECTOR, TELEHOUSE EUROPE

MOST SENIOR PEOPLE within the IT world, regardless of industry, know compute requirements are set to increase substantially as AI and edge computing gain greater adoption. Recent Telehouse research revealed that 89% of IT decision-makers anticipate they will need high-performance, high-density computing systems by 2030. AI workloads are not currently large but could expand quickly, requiring low latency, high-bandwidth connectivity from data centres.

From the outset, data centres have always incorporated cooling mechanisms. Traditionally, the favoured technique has been air cooling, a method that relies on the simple physics of circulating cold air around operational hardware to mitigate the heat produced. But the modern workloads we witness, particularly those spearheaded by AI, are stretching the capacities of air cooling to their very limits.

With natural boundaries to heat transfer capabilities, air cooling technology could hinder the rollout of newer, more energy-intensive, heat-generating services to meet the new demand. This could cap the total volume of AI workloads a data centre can handle unless there is a change to a more efficient cooling technology. This is where liquid cooling technology comes into play.

The inherent limitations of air cooling systems in terms of heat transfer efficiency pose significant challenges. As we look to the near-future, ever-increasing computing power is likely to side-line air cooling. Operators will need to think very seriously about liquid cooling technology.

Although the current demand for liquid cooling remains low & steadyit is poised to assume a central role in the future of digital infrastructure.

With intensifying pressure for cooling systems to be sustainable and eco-friendly, liquid cooling is on the brink of becoming the industry standard. Data centre providers need to ready themselves now for what is an impending shift.

Understanding liquid cooling

Two primary forms of liquid cooling are set to dominate the data centre sector. First, conductive liquid cooling harnesses the potential of liquids to directly extract heat from processor components. This system uses heat sinks attached straight to heat-generating units like central processors. These are then connected via tubes, facilitating fluid circulation and ensuring efficient heat removal.

Conversely, immersive liquid cooling necessitates the complete submersion of servers in a purpose-designed, non-conductive fluid. This enables the heat to be effectively dissipated into the liquid medium. However, this approach requires specific modifications to the servers to guarantee safe immersion. Adopting liquid cooling brings a plethora of benefits to the table. It allows for the augmentation of rack densities, with some reaching an impressive 100KW per rack. This capability enables innovation-driven clients to implement power-hungry workloads vital for their growth. Furthermore, these cooling methods typically have a lower energy consumption, mitigating operators' worries about rising energy costs.

The reduced energy consumption translates into reduction in an improved PUE (power usage effectiveness) rating and reduction in the overall carbon footprint. Additional advantages include freeing up data centre space due to the removal of CRAH/CRAC units and a reduction in noise levels with the elimination of fans.

Yet, the transition to liquid cooling is not without hurdles. The introduction brings its own set of complexities, especially during the design and installation phases. Potential leaks pose significant threats, leading to catastrophic hardware destruction or data loss. The quality of water used in the building's cooling system requires rigorous monitoring, and the financial implications of potential damage and maintenance should not be underestimated. A comprehensive approach, involving specialised equipment, must be considered during the planning phase by the design team.

Planning for implementation

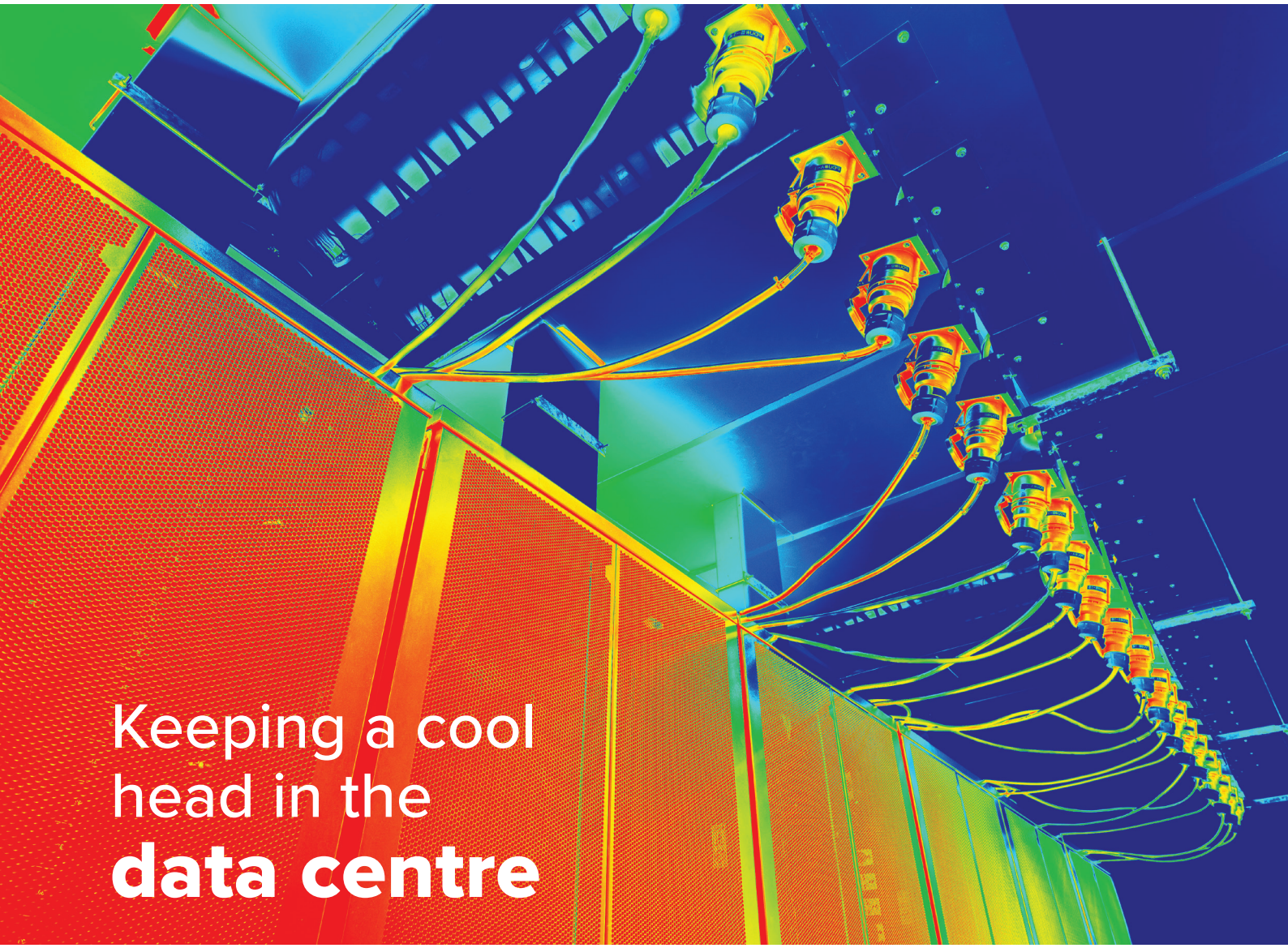
Given this level of investment, how should operators position themselves in anticipation of the rising demand for liquid cooling? A robust and diverse supply chain is crucial. Diversifying suppliers can act as a safeguard against potential component shortages. Additionally, fostering close ties with customers is essential. Through transparent dialogue, operators can gather insights about expected workload trajectories, ensuring all parties are on the same wavelength. AI is also set to become one of the cutting-edge technologies within this process. Operators will lean heavily on advanced systems to manage data centre functions and power consumption. AI will monitor building temperatures and recommend optimisation tactics. As the demand curve rises, the layouts of data centres will undergo a series of transformations, seamlessly incorporating liquid cooling solutions.

Anticipating the liquid future

While some operators may currently be satisfied with their well-established set-ups, especially if their customers are not crying out for demand-intensive workloads, such equilibrium is likely to be fleeting. An increasing number of organisations of all types will soon rely on high-density computing services, aiming to offer more advanced and competitive solutions to their customers.

Given the surging demand generated by AI applications for significant computational power, operators need to be one step ahead. Liquid cooling stands as the most effective means to meet these heavy heat-reduction demands. Companies need to start open dialogues with digital infrastructure providers about their anticipated needs so they ensure that the supply is in sync with demand. Everyone should be looking ahead to the next ten years.

Liquid cooling's appeal is multifaceted, not restricted to its efficiency alone. By closely collaborating with suppliers and establishing a harmonious relationship with the broader supply chain, operators can guarantee the on-time acquisition of essential components. Continued open communication with customers will be utterly essential, so operators have insight into their changing objectives and are able to plan with confidence, meeting sustainability goals in the process. Looking ahead, tools powered by AI will be invaluable, enabling operators to consistently monitor ambient temperatures and proactively implement liquid cooling solutions without compromising on emissions and energy efficiency targets. The clarion call is clear – the time to prepare for liquid cooling has arrived.



Keeping a cool head in the **data centre**

As the data centre heats up, the case for liquid cooling systems grows ever stronger.

BY MUSTAFA KESKIN, APPLICATIONS SOLUTIONS MANAGER, CORNING OPTICAL COMMUNICATIONS

WHEN I LAST VISITED a data centre, in 2023, I first had to sign multiple documents, including non-disclosure-agreement (NDA) papers and health and safety protocols, which we were required to comply with at all times. Eventually, I received access cards to visit the data hall of my customer and was greeted by... noise, lots of noise. In the data hall was a concerto of fans trying to cool down servers, network switches, power distribution units and air handling devices.

A typical data centre has a noise level of 70-80 dB, but this can sometimes reach up to 90 dB levels. To put this in perspective; typical human conversation takes place at 60 dB; vacuum cleaner creates noise at 75 dB; an alarm clock makes noise around 80 dB; exposure to continued noise level above 85dB can cause permanent hearing loss.

Data centres can get really hot because electrical energy used by servers, storage devices, networking hardware, and various other equipment is converted into thermal energy. That's why data centres require effective cooling systems and methods to manage temperature, ensuring the proper functioning and durability of their equipment. These systems transport heat energy from indoor IT spaces to the outdoor environment.

For years, air has been the primary medium for transferring heat. To disperse thermal energy, cool air must flow past every key component. This is achieved using high-performance fans and large heatsinks, which are the main sources of noise

inside data centres. Cool air is first pumped through floor vents into the "cold aisle" of the data centre. It then channels through server racks, transferring heat to the "hot aisle." Finally, heated air is drawn into ceiling vents and chilled by computer room air conditioning (CRAC) units, renewing the cycle.

With power requirements for server racks more recently increasing rapidly from 5-7 kW per rack to up to 50 kW, and in some instances, over 100 kW per server rack, the amount of heat generated by the IT equipment has also increased.

Traditional air-based cooling solutions cannot cope with this new reality due to the simple fact of the low heat transfer capacity of air molecules. Is there a solution that can?

The industry warms to liquid cooling

Liquid-based heat transfer agents are fast emerging as a viable solution across the industry. For example, water has 1000 times more cooling capacity than air because water molecules are closer together. However, we cannot simply circulate water inside our servers or IT equipment as we do air, due to water's conductive nature. But we can circulate water inside insulated pipes and around heat-generating Central Processing Units (CPU) and Graphics Processing Units (GPU) components using insulated heat-conducting plates. This method has been the most widely deployed solution recently.

This kind of liquid cooling requires server racks equipped with vertical and horizontal liquid cooling manifolds, as well as servers and network switches that use liquid cooling plates instead of heat sinks. These will be connected to the coolant distribution unit using a sealed piping network.

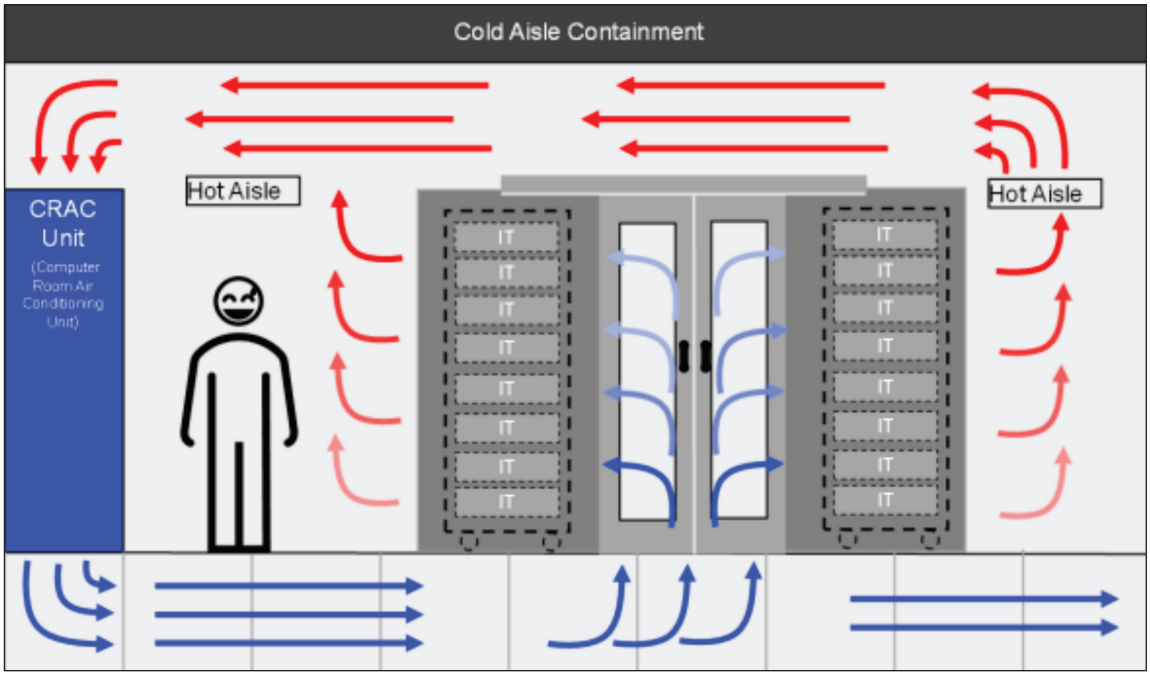
If we look inside a liquid-cooled server rack, we will see a lot of pipes and manifolds, which do not exist in air cooled ones. You may be wondering what a manifold is. Essentially, it is a larger pipe that branches into several openings, which are then connected to the smaller pipes coming from the servers. In Figure 2 you can see the schematic depiction of this new cooling technology.

We know that liquids are better than air in terms of heat transfer, so can we use this information to develop better cooling solutions? The industry came up with immersion cooling solutions in two flavors: single phase immersion cooling (1PIC) and two-phase immersion cooling (2PIC).

In 1PIC solution, servers are installed vertically in coolant bath of a hydrocarbon-based dielectric fluid that's similar to mineral oil (Figure 3).

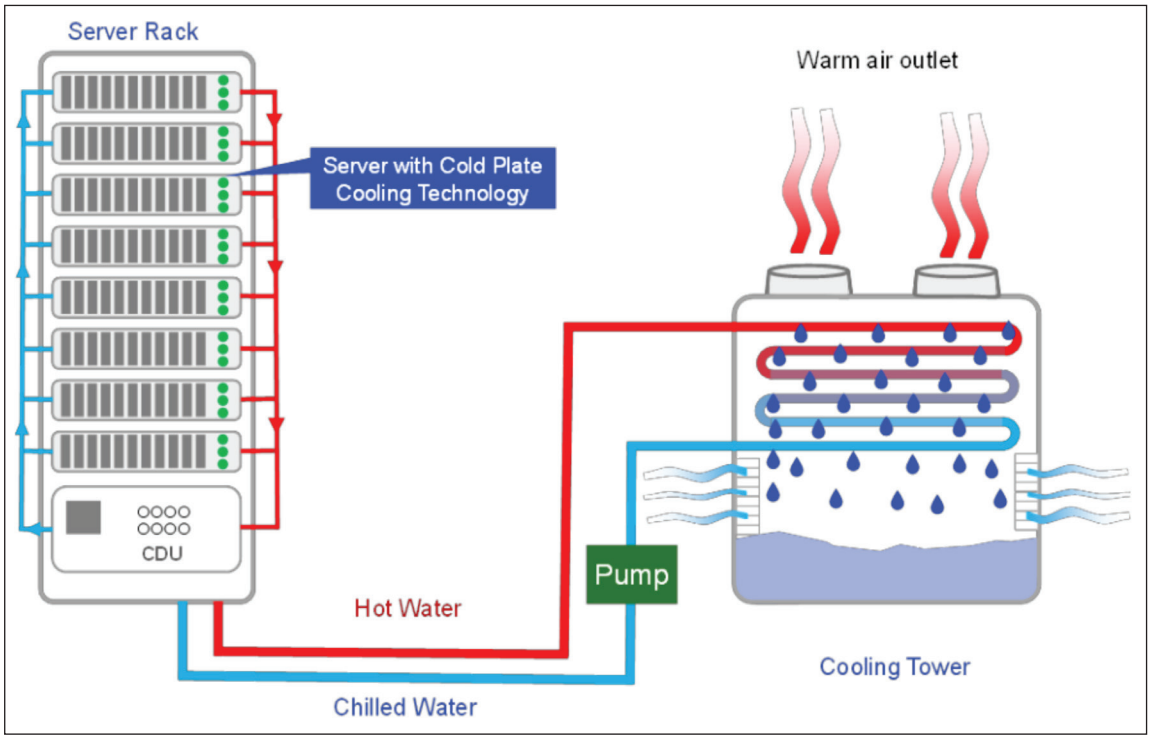
The coolant transfers heat through direct contact with server components. Heated coolant then exits the top of the rack and is circulated through a Coolant Distribution Unit connected to a warm water loop which is connected to an outside cooling system. This type of cooling solution requires usage of immersion ready servers. Immersion cooling tank solutions do also require a connection to an external pump and cooling tower solution which will circulate the returned hot water from the system and transfer the heat to the outside of the data centre.

In 2PIC systems, servers are sealed inside a bath of specially engineered fluorocarbon-based liquid which has a low boiling point (often below 50°C) (Figure 4). Heat from the servers boils the surrounding fluid. The boiling of the liquid causes a phase change (from liquid to gas), hence it is named two-phase immersion cooling. The vapor is then condensed back to the liquid form when they



➤ Figure 1 shows the schematic depiction of this cycle.

Figure 2



reach the cooled condenser coils. The condensed liquid drips back into the bath of fluid to be recircled through the system.

Long story short, if we look inside a liquid-cooled rack, we will see very little space remaining for structured cabling patch panels from cooling pipes and manifolds. In the case of immersion cooling solutions, it is better to keep optical connectivity components outside of the cooling tanks.

So, where can we mount our passive optical connectivity panels in our data centres if we want to use these new cooling solutions for our ever-heating server systems?

At Corning, we have developed various 2U and 4U overhead mounting brackets suitable for wire trays and ladder racks to mount Corning EDGE and EDGE8 hardware where there is limited or no space within your server or network racks. One can mount the necessary optical patch panels in these overhead mounting trays and establish server connectivity by using short jumpers coming down to the server systems.

Regarding immersion cooling systems, it is also important to use cables that won't degrade over time due to extended exposure to the liquids used inside these tanks.

They say liquid cooling can help reduce the electricity cost for an entire data centre by up to 40% and up to 55%, and a reduction in the data centre's server noise levels would also be a bonus. So far, I haven't visited a data centre facility that has implemented liquid cooling across the board, so I can't confirm these numbers from personal experience. What's clear, is that as the data centre heats up, the case for liquid cooling systems grows ever stronger.

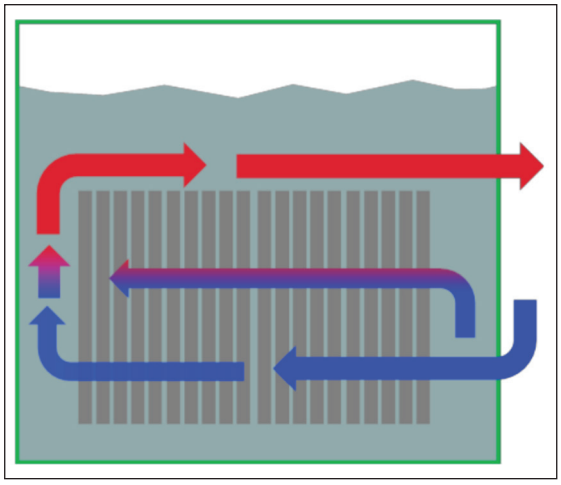


Figure 3

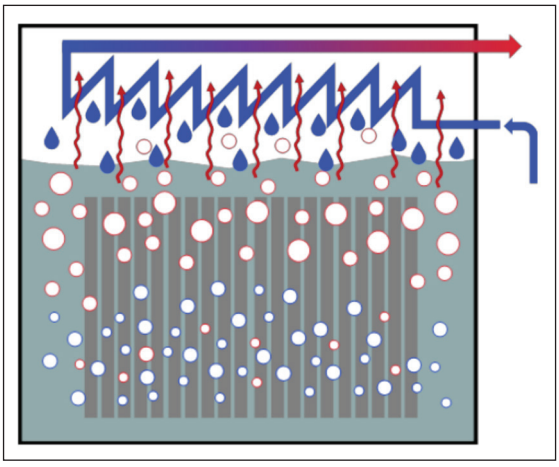


Figure 4

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Data center cooling:
it's time for sustainable solutions

Amid the climate crisis, one of the most pressing issues facing data center operators is how to cool their facilities in an environmentally sustainable manner. The challenge of efficient cooling is further exacerbated by the increasing adoption of AI and advanced computing technologies. These powerful systems generate higher temperatures, placing even greater demands on data center cooling infrastructure.

BY ULRIK VADSTRUP, REGIONAL EUROPE SEGMENT SALES MANAGER HVAC AND ANNE FRANZAS, GLOBAL PRODUCT MANAGER, CIRCULARITY, ABB MOTION

OPERATORS are now faced with evaluating the merits of different cooling technologies and approaches to minimize their energy usage and carbon footprints. Among the options are electronically commutated (EC) fans versus separate motor-drive ventilation systems for air cooling. Sustainability, reparability, reliability, and longevity are all essential considerations during this evaluation process.

This is more than a choice of equipment; it's an investment in a greener future.

Rethinking sustainability

Sustainability must be woven into the fabric of data center operations. It plays a crucial, but sometimes overlooked, role in the debate between EC fans and separate motor-drive systems. While EC fans may be able to offer an edge in simplicity of installation in some cases, we need to think bigger — beyond just the initial setup.

A long-term, sustainable approach is about creating a loop where every part of a product's lifecycle, from production to end-of-life management, conserves our planet's resources – including by using less energy. Separate motor-drive systems may initially cost more – and take more time to install – but they stand the test of time, make more efficient use of energy, and align with environmentally-friendly disposal practices, unlike their EC counterparts. What's more, some EC fans' rely on rare earth metals, which poses sustainability challenges. These metals are difficult to source sustainably and even harder to recover at the end of the fan's life. Separate motor-drive systems, used in heating, ventilation and air-conditioning (HVAC) systems for decades, have proven to be long-lasting and most importantly, repairable. These factors are significant in boosting the motor-driven system's sustainability credentials.

A lifelong perspective

The real environmental impact of cooling systems spans their entire existence. The lower operational energy use offered by EC fans is just one part of this story. Motor-drive systems, while historically viewed as less efficient, now offer comparable energy-saving capabilities, especially with recent advancements in motor and fan technology.

However, their most substantial advantage lies in their longevity and greater capability for recycling and repair, which EC fans generally lack.

In terms of lasting service, separate motor-drive systems significantly outperform EC fans. The average lifespan of an EC fan can be as short as four years, while motor-drive systems can last for well over two decades. This means that over time, the latter will require fewer replacements, generate less waste, and incur fewer costs — both financial and ecological. The benefits of such a choice add up, particularly when considered across the sprawling landscape of numerous data center units.

Additionally, the ease of maintenance — an often-overlooked aspect — plays a vital role. EC fans, when they fail, commonly need to be replaced entirely. Repairing or recycling them isn't a simple task due to their integrated design. Separate motor-drive systems, in contrast, offer the simplicity of exchanging parts or repairing them as needed, reducing the overall carbon footprint and embodying a practical application of circular economy principles.

User-friendly and earth-friendly

Turning to the technical side, separate motor-drive systems can now outperform EC fans in terms of efficiency through innovations like Synchronous Reluctance motors (SynRM). This is particularly important under partial load conditions, which are common in data centers. Efficient operations mean lower energy costs and a reduced environmental impact over time.

But it's not just usage efficiency that's a concern; user-friendliness is equally important. Facilities managers note that the ease of integrating these motor-driven systems into existing frameworks, coupled with their reliability, make them a good choice. Moreover, the possibility of remote maintenance and firmware updates further solidifies their positioning as a technologically advanced yet ecologically sound choice.

In practical terms, opting for motor-drive systems over EC fans is deeply connected to everyday human experiences. Take as an example a data center's maintenance director who confronted a significant failure rate with EC fans. This high failure frequency not only disrupted continuous operations but also incurred steep costs in time and money. With motor-drive systems' enhanced durability and ease of remote servicing, technicians are spared such frequent disruptions, showcasing the meaningful advantages of these systems beyond mere efficiency numbers.

However, we must resist seeing this through a binary lens of EC fans versus motor-drive systems and instead appreciate the context and nuances. Each system offers unique benefits, but the thorough assessment of data center needs, sustainability goals, and the total cost over a system's life tells a compelling story. It's about using a mix of innovation, strategic planning, and operational insight to find a balance that suits both the digital and natural world.

Beyond the specifications, numbers, and efficiency charts lies a simple truth: the decisions we make for data center operations ripple outward, affecting more than just the servers they cool

Simplicity in action

Beyond the specifications, numbers, and efficiency charts lies a simple truth: the decisions we make for data center operations ripple outward, affecting more than just the servers they cool. They dictate our relationship with the environment and influence the carbon footprint we leave for future generations. Selecting a cooling system that matches our sustainability aspirations requires a serious commitment to natural resource preservation. It calls for technologies that are easily maintainable, broadly recyclable, and ultimately, operate on a principle of minimal waste.

In conclusion, the choice of cooling technology within data centers captures a microcosm of the broader sustainability challenge. It's a balance between short-term operational effectiveness and long-term environmental responsibility. As we steer towards a digitally dependent future, it's imperative that we anchor our technological choices to sustainable foundations that support our planet just as much as they support our data.

The evidence suggests that while EC fans brought about an energy efficiency revolution at their inception, it's the motor-drive systems that are now leading the charge for environmental and operational sustainability in data centers. In the strive for a greener tomorrow, every switch to a motor-drive system tightens the loop in the circular economy and pushes the industry toward a more responsible and resilient existence.

How power and cooling adjustments can drive sustainable data centres

Dat¬a centers consumed two percent of global el¬ectricity usage in 2022– 460 terawatt-hours. Computing power and cooling were the two most energy-intensive processes. The infrastructure including servers, water, electricity, cooling systems–and other required systems to make these buildings productive in the U.S. generated 2% of greenhouse gas emissions as of 2023.

BY MICHAEL SKURLA, CHIEF PRODUCT OFFICER OF RADIX IOT

DATA CENTRES are the backbone of the global information infrastructure of our ever-increasing data processing and storage demands worldwide. Scrutiny of their soaring power and water usage has led to most data center operators adopting carbon footprint-reducing initiatives as part of their larger Corporate Social Responsibility (CSR).

In embracing sustainable data center operations practices to help reduce the environmental impact, operators have also safeguarded against potential legal and reputational repercussions to ensure they adhere to evolving and strict local and global environmental regulations. To gain stakeholder loyalty, sustainable data center practices, as in all industry sectors, have become a global moral, and evolving regulatory issue.

Technologies for sustainable data centres

Though location plays a large factor in utility resources and associated costs; using technologies that boost sustainability has become front and center. Data center owners and operators first and foremost need monitoring and facilities analytics to control energy management as energy costs continue to peak. According to the U.S. Department of Energy, commercial facilities in the U.S. account for 18% of total U.S. energy consumption–with an annual energy expenditure of $190 billion and CO_2 emissions of nearly 826 million metric tons.

Any level of energy spending reduction in a data center can trigger significant cost savings. Keeping in mind that the average data center cooling system consumes nearly 40% of the total power, chilled water plants continue to be data centres' largest energy hogs.

Integrating DCIM Platform technologies can help augment sustainable operations while providing data center operators with real-time access to:

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Data centres have never been short on operational data, but most rely heavily on manual investigation of various building automation technologies to make critical choices. This includes everything from cooling towers to chillers, pumps, and basic sensing devices. A modern DCIM allows these various operational data sources to become one, wholistic solution allowing for a single point of truth for real-time monitoring and management without the effort of manually sifting through data from different systems.

Best of all operators can make fact-based, data-driven business decisions and alterations to their portfolio of data centres to introduce sustainability measures over time and see the outcomes. Even minor data-driven tweaks have resulted in a 20 percent energy cost savings–the larger the data center, the higher the savings gained.

Modern DCIM platforms also allow for “unmanned” smaller, edge facilities in far-off and hard- to-reach areas to be remotely automated, triaged, and managed; lowering the need for expensive truck-rolls to investigate problems or even just check on locations.

Maintaining Sustainable Datacenter Operations
Efficient energy management is the cornerstone of sustainable data centres. Leveraging DCIM IoT platforms yields cost savings, enhances business efficiency, and aids in fulfilling corporate environmental, social, and governance (ESG) objectives.

Embracing evolving data center technologies necessitates the integration of energy-efficient hardware and advanced cooling systems, but it is not about simply replacing systems. Optimization is key, and vastly more economical in the short term than replacement equipment, yet without a DCIM that can adapt to inevitable differences in build designs and generations of equipment – it is very difficult to benchmark results. Hence, an effective, as well as flexible (and ideally manufacturer-agnostic) DCIM should be the first step in any ESG program.

Beyond technology initiatives like The Green Grid initiative foster industry collaboration and standardization. USGBC also offers LEED for Data Centres which is a specialized rating system tailored to the requirements of high-density computing infrastructure, notably server racks utilized for data storage and processing.

This unique sustainability benchmark and certification considers the substantial cooling demand of the data center market aiming to enhance overall efficiency and sustainability while creating a focus on Power Usage Effectiveness (PUE) and transitioning to renewable energy sources to further minimize environmental footprints.

Regardless of whether a structured program works for your business, or more ad-hoc solutions are a better investment; two things are very clear:

#1 Data is key to any sustainability program to allow for rational investment that can be proven.

#2 Regardless of where you are in the world, if you are in the data center business, sustainability is coming for you, and you can start to invest now or scramble later when inevitability the rules will change.

EDGE DATACENTER PROJECT OF THE YEAR: SMART TEXTILE TRANSITION 5.0

SMS Engineering has designed and developed a smart IOT EDGE for SMART TEXTILE TRANSITION 5.0 to support Digital Transformation, Environment, and People of a major Fashion Brand. This investment has been made with the aim of integrating new technologies into their production, including Internet of Things (IoT), cloud computing and analytics, artificial intelligence and machine learning, cybersecurity platform, backup and energy efficiency sustainability across the entire IT network. Thanks to this important Edge project, the client company is now able to manage and optimize all aspects of the production processes from design to production and supply chain for the new factory 5.0.

The new IOT EDGE for TRANSITION 5.0 allows real-time data processing and insights to make smarter and faster decisions about their business with the highest level of security and sustainability for energy consumption. This smart EDGE infrastructure increases the efficiency and profitability of the entire production activity. With the aim of ensuring maximum resilience, local management in total data security, SMS Engineering has implemented a LAN and WAN Fault Tolerance Network to ensure data flow from the CLOUD to the Edge with the highest standards of Cybersecurity protection and Business Continuity available today.

Thanks to the implementation of IOT Edge SMART TEXTILE TRANSITION 5.0, treatment activity takes place near the physical location of the user processing the data or the data source, in order to reduce latency and save bandwidth.

The project was developed starting from a Risk Assessment that highlighted all vulnerabilities of all local, central and remote systems connected to the corporate network and it was immediately necessary to implement an end-to-end architecture on all levels, from physical to application, pervasively across the entire network.

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Can data centres **heat homes?**

Using residual heat from data centres to power large-scale district heating networks is more than just a theoretical concept.

BY MALCOLM HOWE, PARTNER, CRITICAL SYSTEMS, CUNDALL

THE UK GOVERNMENT is committed to achieving net zero carbon emissions by 2050 in line with the COP21 Paris Agreement. One key objective in this regard is to decarbonise the UK housing sector, which is responsible for about 14 percent of the country's carbon emissions mainly through using fossil fuels for heating.

There have been discussions about phasing out gas-fired boilers in new constructions. In fact, there are proposals to ban the sale of domestic gas boilers altogether. Initially, this ban was supposed to be implemented by 2025, but it has since been extended to 2035 to give homeowners more time to switch to low-carbon alternatives. Therefore, finding affordable and sustainable alternatives to traditional gas-fired boilers has become a top priority.

A potential solution is available in the form of data centres. According to the Environmental Investigation Agency (EIA), data centres consume around 1.0-1.5% of global electricity, primarily to power IT equipment. This results in a significant amount of heat generation, which cooling systems then need to remove. However, rather than treating this residual heat as a wasteful byproduct, it should be viewed as a valuable resource that can be captured and reused.

Waste, or valuable product?

Using residual heat in district heating networks presents multiple advantages for various stakeholders, particularly in light of evolving sustainability targets and the need to transition away from traditional heating systems. For data centre operators, harnessing residual heat may generate attractive reductions in operational expenditure and improvements in Power Usage Effectiveness (PUE and Water Usage Effectiveness (WUE), by reducing the load on heat rejection plant. Additionally, monetising residual heat through partnerships with Energy Service Companies (ESCOs) offers an alternative income stream that would mitigate operating costs. The sustainability benefits are significant as partial shutdown of cooling infrastructure would reduce the data centre's energy consumption and carbon footprint.

However, the true environmental benefit lies in lower external carbon emissions from district heating network users, who would otherwise need to rely upon burning fossil fuels to heat their homes. To maximise this impact, data centre operators should be encouraged to advocate the potential benefits to Municipalities and Planning Authorities. This would strengthen the facility's environmental credentials and potentially support the planning approval process.

For the ESCOs, data centres emerge as a dependable and abundant heat source, catering to customer needs while reducing carbon emissions. Using low-grade residual heat from data centres as a primary source for heat pumps enables ESCOs to deliver hot water to their networks without the need for centralised boiler plant. With data centres increasingly transitioning to renewable energy sources, the residual heat becomes carbon neutral.

Promoting adoption

Data centres and district heating systems offer numerous benefits, but their integration could be

From the data centre operator's perspective, investing in expensive infrastructure to harvest residual heat only makes sense if this leads to worthwhile savings in operational expenditure, in the form of reduced power and water consumption

improved. The Nordics and the Netherlands have notable examples, but the UK needs to catch up. The constraints appear to be economic, rather than technical.

Firstly, the main challenge in collecting and using residual heat from data centres is the need for established external infrastructure. Although planning authorities advocate for heat reclamation, the absence of a coherent plan for heat network development presents a significant obstacle.

While planning policy often requires developers to facilitate connections to future heating networks, this needs to align with relevant infrastructure development plans. The current disjointed approach means that compliance with regulatory obligations becomes a means to achieving planning permission, with little expectation that the connections will ever be used.

Secondly, from the data centre operator's perspective, investing in expensive infrastructure to harvest residual heat only makes sense if this leads to worthwhile savings in operational expenditure, in the form of reduced power and water consumption.

However, this may be undermined by misalignment of load profiles. Whilst demand from heating network peaks in winter and declines in summer, data centres operate inversely, using energy intensive mechanical cooling during periods of warm weather, but reverting to efficient 'free cooling' strategies during the winter. Hence, exporting residual heat during colder months may result in only marginal improvement in energy efficiency.

This undermines the business case for investment in heat reclaim infrastructure.

Thirdly, the energy supply companies that operate the heating networks also face challenges. Their business case for investment in heat pumps and pipework will assume that the infrastructure will be fully utilised. Uncertainties regarding operational factors in the data centre that are beyond their control, such as IT load growth and periodic maintenance shutdowns, may hinder their commitment.

Even if these uncertainties are resolved, determining the energy cost poses another challenge. Data centre operators aim to sell heat at prices covering infrastructure costs, while ESCOs seek competitive prices to ensure profitability. Agreeing on a mutually acceptable cost remains pivotal for fostering collaborative partnerships.

Exploring solutions

The UK Government needs to intervene and learn from successful models implemented in other countries to encourage construction of district heating network infrastructure to avoid falling behind other nations.

Planning policy should be revisited to allow data centres to be located nearer to urban centres. This would support Edge applications and bring them closer to where heating network users work and live, reducing infrastructure costs and pumping energy.

Although this move might be opposed in some quarters, such attitudes could be overcome if data centres came to be seen as an essential part of an urban infrastructure, providing low-grade, low-carbon heat to support local communities.

The solution to address the issue of load mismatch requires a large-scale approach. Developing extensive networks serving diverse commercial and domestic users would smooth out demand profiles.

This approach allows ESCOs to capitalise on multiple heat sources based on season, unit costs, and heat availability.

Offering grants and tax incentives to cover the new infrastructure costs could make planning conditions that mandate data centres to connect to district heating networks a reality.

Government support would bolster the business case for data centre operators and ESCOs. Introducing tax breaks on energy costs would incentivise data centre operators to contribute residual heat, complemented by subsidies for ESCOs to harness and distribute this heat. The imperative of reducing operating temperatures for decarbonising heat networks cannot be overstated. Currently, many district heating networks operate within the medium temperature range, which necessitates the use of fossil fuels as a primary heat source.

Decarbonisation will require the adoption of alternative solutions such as ammonia heat pumps combined with low-grade heat sources. This will mean lower operating temperatures, and perhaps increased pumping power consumption, but the overall carbon reduction would be significant.

Blueprint for success

Cundall has firsthand experience effectively utilising residual heat, as demonstrated in Odense, Denmark. Working closely with the client and local ESCO, Fjernvarme Fyn, we were responsible for the design of a hyperscale facility that will eventually export up to 45MW of residual heat into the local district heating network.

Fjernvarme Fyn's extensive heat network serves 65,000 metred connections, connecting various heat sources and user types to smooth out load demand profiles. The data centre is integrated into the district heating network through multi-stage ammonia heat pumps housed in a dedicated energy sector.

The heat pumps capture low-grade residual heat from the data centre, increasing the district heating network's temperature by 70-75^{0}C. Upon completion, it is expected to provide 165,000MWh of heat annually. This heat is entirely carbon emissions-free due to the data centre's reliance on renewable energy sources.

To replicate this in the UK will require significant investment and political will over several years. But using residual heat from data centres to power large-scale district heating networks is more than just a theoretical concept, as the Odense scheme demonstrates. If replicated in the UK, such schemes could make a substantial contribution to achieving the nation's 2050 net zero carbon targets.

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Revolutionising data centre sustainability

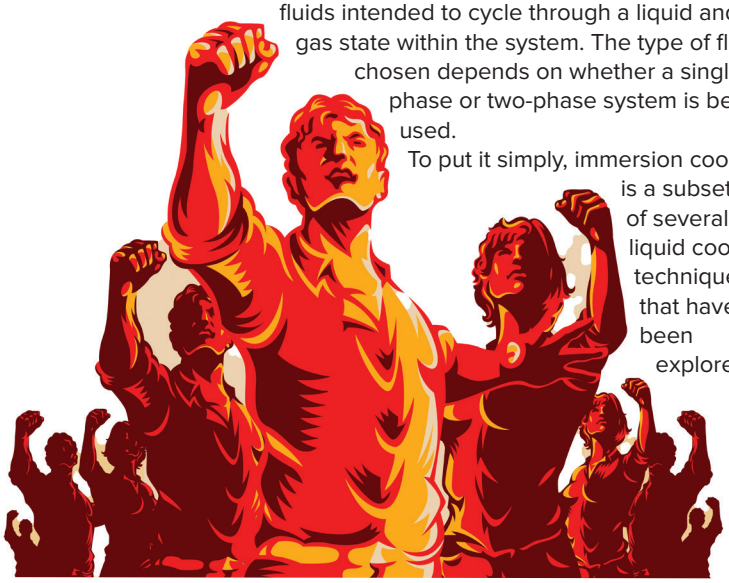
The power of liquid immersion cooling technology.

BY CHRIS CARREIRO, CTO, PARK PLACE TECHNOLOGIES

IMMERSION COOLING is a type of liquid cooling used to moderate data center equipment temperature by submerging it in a cooling fluid. Server immersion cooling helps to dissipate heat and keep components like CPUs performing optimally. Immersion cooling systems prove to be more efficient than traditional data center cooling methods (like computer room air conditioning, or CRAC) due to the increased thermal conductivity of most liquids compared to air.

Because 1-1.5% of electricity use across the globe is attributable to data centers, companies have been innovating to find a liquid cooling solution that can reduce that energy demand. Dielectric fluid immersion cooling is one solution that could increase CPU density in data centers while consuming less energy. Dielectric liquid cooling depends on the use of a thermally conductive but not electrically conductive fluid that will not disrupt the function of electrical components like servers. Examples of dielectric fluids include mineral oil hydrocarbons, synthetic fluorocarbons, and silicone fluids.

Immersion cooling technology can rely on dielectric fluids purpose-chosen to remain in a liquid state, or fluids intended to cycle through a liquid and gas state within the system. The type of fluid chosen depends on whether a single-phase or two-phase system is being used.



To put it simply, immersion cooling is a subset of several liquid cooling techniques that have been explored.

Other types of liquid cooling include direct-to-chip (DTC), rear-door server rack cooling, waterborne data center cooling, and evaporative cooling.

With immersion cooling, whole data center components are directly submerged into a specially designed tank. In contrast, water-cooled server racks look very similar to traditional rack-mount servers, but they are networked with waterblocks and tubing that circulates fluid to help dissipate heat.

The “phases” in single-phase and two-phase immersion are a reference to states of matter, and not physical stages in the system. The physical footprints of these two immersion cooling tanks are not drastically different, but their cooling cycles and contained fluids set them apart.

In single-phase immersion cooling, heat from the immersed server components is transferred directly to the surrounding fluid. However, the dielectric fluid does not undergo a “phase change” from a liquid to a gas. Instead, the fluid is cycled out of the immersion tank by a coolant pump that runs through a heat exchanger and is returned to the immersion tank at a lower temperature where it continues this heat transfer cycle.

In two-phase immersion cooling, heat from immersed server components causes the special immersion fluid to boil. The resulting steam heats a condenser coil in the top of the sealed chamber. The coolant in the condenser coil is cycled out of the chamber to a heat rejection mechanism (cooling tower, etc.). Then, the coolant is sent back to the sealed chamber at a lower temperature, ready to continue the heat transfer cycle.

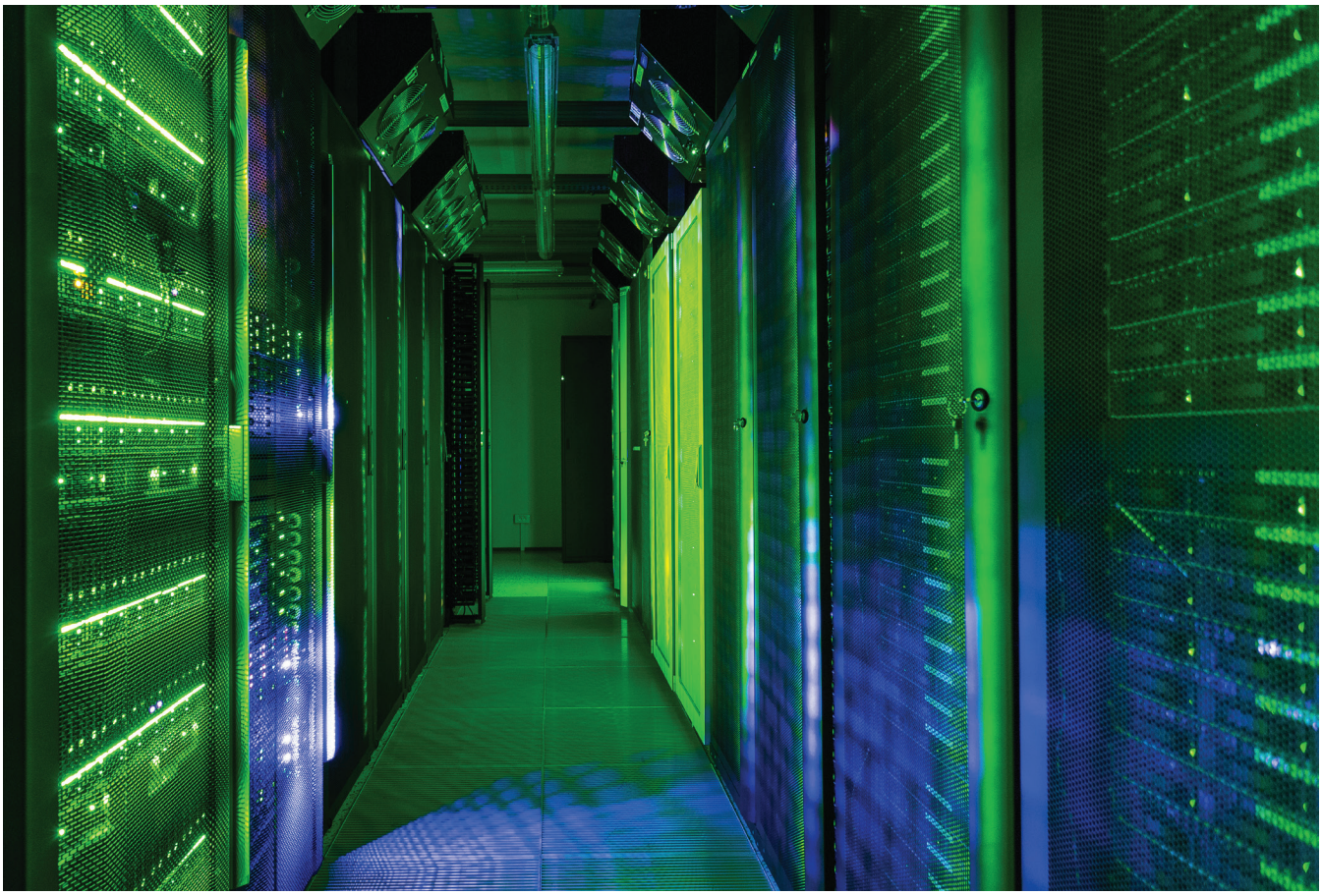
Because of the steam from the phase change in two-phase liquid immersion cooling, the chamber must be sealed during operation. This means that performing maintenance requires a cooling and unsealing process that costs valuable operation time (which can cost as much as $5,600 per minute). The average power usage effectiveness ratio (PUE) within a data center can be measured by

dividing total energy consumed by energy used by computing equipment. This means that as PUE gets closer to 1, efficiency is improving. According to The Register, PUE for a traditional data center in 2022 was approximately 1.58, while single-phase immersion was able to bring this number down to the 1.05 to 1.10 range.

Not only does immersion cooling improve the energy efficiency of data centers, but it can save valuable space as well. According to a 2023 research article, immersion cooling only requires about one-third of the space to that of an air-cooled configuration.

One of the main contributors to this efficiency is the improved rack power density from not having to allow for air flow within servers. CRAC, one of the main traditional cooling methods for data centers, is reliant on the use of fans. This means that traditional data centers are very loud. Immersion cooling server configurations don't rely on fans and air flow for cooling. Because of their liquid cooling function, immersion cooling has proven to reduce data center noise.

Launching a liquid cooling solution comes with a list of challenges, like preparing existing hardware for immersion, training maintenance staff (or finding qualified third-party maintainers) on the repair process for immersed gear, and managing vendors for the tanks, dielectric fluid, and more. But the ROI and sustainability benefits make liquid cooling an exciting part of future data center planning.



Developing a strategic approach to IT sustainability

Navigating the complexities of datacentre sustainability is crucial for organisations striving to meet their Net Zero commitments. By embracing greener cloud solutions, fostering strategic partnerships, and actively managing environmental impacts, IT professionals can position themselves as leaders in the evolving landscape of ESG-driven business practices.

BY DAVID WALKER, FIELD CTO, EUROPE, AT YUGABYTE.

THE UN CLIMATE SUMMIT (COP28) in Dubai, in December 2023, recognised that if humanity is to limit temperature rises to 1.5C above pre-industrial levels, there is a need for deep, rapid, and sustained fossil fuel reductions.

From a business perspective, this means that IT executives need to prepare (more than ever) for an imminent wave of inquiries related to their organisation's Net Zero commitment. This is a critical business and IT challenge that demands a proactive stance. IT professionals need more than a quick answer, they also need to show a comprehensive strategy, supported by tangible metrics showcasing sustainability progress.

Why datacentres are a HOT topic

The current datacentre scrutiny poses a challenge that extends beyond the immediate horizon – one intertwined with the overarching goal of achieving a Net Zero commitment.

This issue demands a measurable strategy and a compelling response to the question: "What is IT doing to propel the organisation towards Net Zero?"

The problem is that datacentres—including the ones your Cloud Service Providers (CSPs) partners are delivering your multi-cloud on – don't have a great 'Green' reputation. Despite their indispensable role

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in modern IT infrastructure, they have a lacklustre profile when it comes to environmental credibility.

Even before the current era of environmental awareness, datacentres faced excess heat and burgeoning power cost challenges. To optimise for low latency, the IT industry strategically situated data facilities—referred to as 'data hotels' and 'colocation services'—in proximity to urban centres, where corporations often cluster. While repurposing brownfield sites for this purpose is commendable, it puts considerable strain on power networks.

This leads to a situation where any environmental benefits are offset by increased power consumption. These are not new challenges. Managing the excess heat generated by the myriad of IT devices housed within datacentres is an ongoing struggle.

Innovative solutions like leveraging ambient air and local water for non-carbon-generating free cooling, as well as the implementation of hot and cold aisle configurations, have been employed. Yet, regardless of these measures, the reality is that datacentres demand electricity, and IT devices generate heat.

As appealing as the concept of on-site zero-carbon power might be, it is impractical to move all datacentres to environmentally pristine locations. So, although IT professionals may want to win sustainable awards, the IT industry is unlikely to receive such accolades in the near future. This presents a tough challenge, particularly when facing inquiries about Net Zero commitments from business leaders seeking more than just a status quo response. And, when you pose the same question to your IT software suppliers, a mere acknowledgment of the status quo is equally unsatisfactory.

This is why more strategic IT software suppliers can be a better fit here, and part of the solution to those challenging green questions.

Multi-Cloud can be your green ally

Cloud, especially multi-cloud solutions, offer a greener alternative to traditional on-premises setups. While acknowledging that the cloud isn't flawless, it is inherently more power-efficient than running numerous machines on-site. Public cloud vendors, leveraging economies of scale and energy-efficient build principles, are making significant strides in sustainability. For instance, Amazon's Graviton3 processors claim a 60% reduction in energy consumption compared to traditional X86 chips. And Google Cloud claims its facilities are 1.5 times more efficient than a typical enterprise datacentre.

Therefore, if you are using cloud and want to know how your service provider is reducing their carbon impact and optimising their internal operations, you may already have a good Green IT answer.

Partnering for success

Illustrating the effectiveness of a sustainable approach is Temenos, a global financial services and banking sector Independent Software Vendor (ISV). It has been incorporating green practices into its cloud-native architecture since 2011. A Yugabyte strategic partner, Temenos recently extended its commitment to environmental responsibility by ensuring that each new solution will have a lower environmental impact than its predecessor. The latest version of Temenos Banking Cloud demonstrates a remarkable 32% carbon efficiency improvement at runtime. The company has also developed a carbon emissions calculator to provide customers with detailed insights into the environmental impact of utilising Temenos Banking Cloud services.

The CIO's role in energy efficiency

As sustainability continues to gain prominence, Chief Information Officers (CIOs) are expected to report on energy efficiency Key Performance Indicators (KPIs). While cloud solutions contribute to efficiency, there is a risk of wasteful practices, such as unnecessary scaling and excessive machine cycles. Organisations must actively monitor and manage their cloud usage, taking accountability for environmental costs rather than relying solely on hyperscalers to bear the Net Zero burden.

Understanding the ESG impact

It is important to recognise that datacentre decisions directly influence the environmental aspect of the broader Environmental, Social, and Corporate Governance (ESG) framework. Businesses need to proactively gather and present data to internal and external stakeholders, including customers, to showcase the positive strides they are taking toward sustainability. Embracing a holistic approach to ESG through informed datacentre choices is pivotal for achieving comprehensive corporate responsibility.

Navigating the complexities of datacentre sustainability is crucial for organisations striving to meet their Net Zero commitments. By embracing greener cloud solutions, fostering strategic partnerships, and actively managing environmental impacts, IT professionals can position themselves as leaders in the evolving landscape of ESG-driven business practices.

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Mechanical energy storage:

sustainability and suitability comparisons

2023 is the year energy storage became a big decarbonisation and sustainability talking point for industry. As every country's grid system transition ripples through to industry, the need to find ways to locally store energy for emergency back up that is low carbon, sustainable and efficient is a growing priority.

BY PILLER – ACTIVE POWER

THE CONTEXT is that everyone expects more locally based power generation in the form of microgrids.

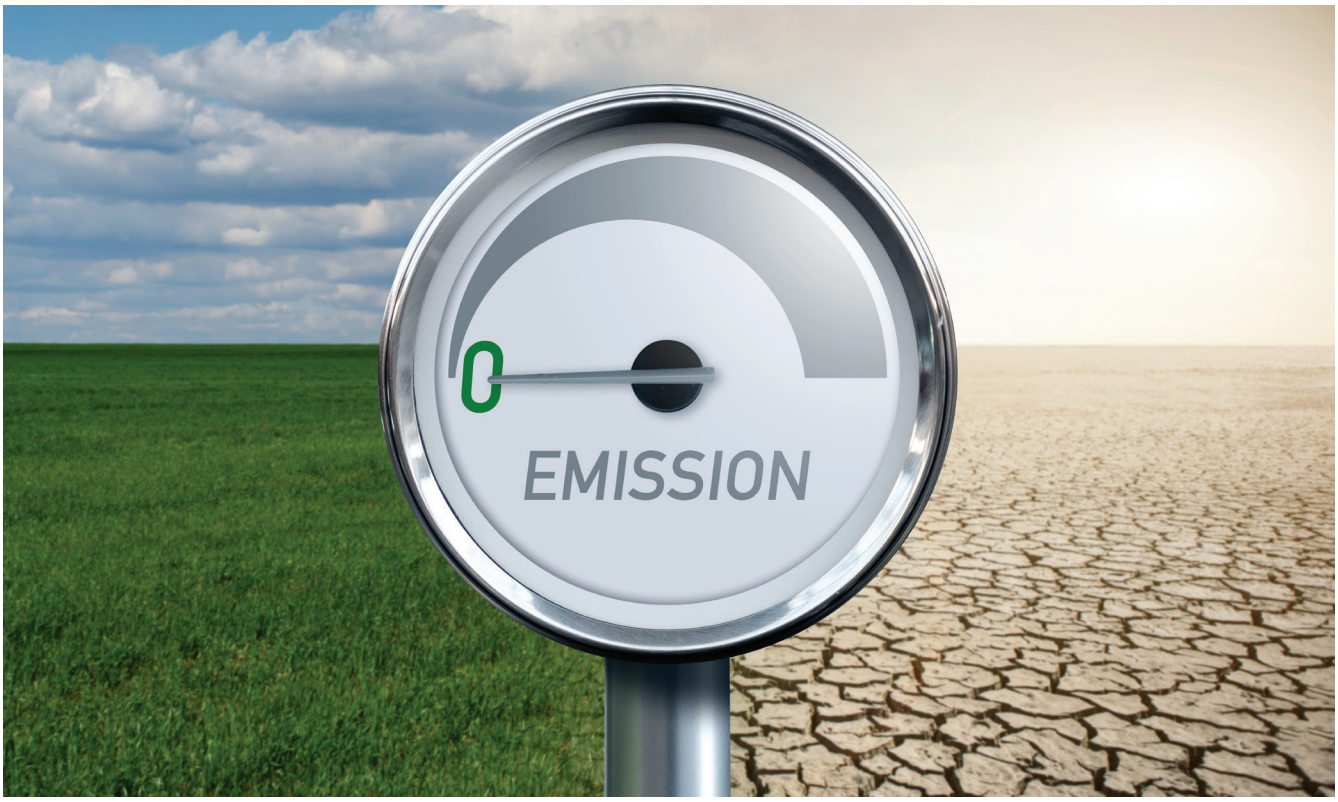
Alongside this, engineers expect the new norm to be more coupling and decoupling from grid power and greater reliance on on-site power generation. Local energy storage for short ride through will be used more regularly. That means more charging and discharging.

The choice then becomes one of opting for chemical battery storage or mechanical storage. However, batteries come with significant challenges and mechanical options are limited.

When comparing the different mechanical energy storage options what are the pros and cons?

Kinetic

Flywheel kinetic energy storage involves stored energy in the form of a mass spinning at high speed. The energy is stored and later released on demand as electrical power. In motor mode, the flywheel charges up using power from the grid and stores



energy. When short-term backup power is required, the flywheel becomes a generator: inertia allows the rotor to continue spinning and the kinetic energy is converted to electricity.

A Flywheel kinetic energy storage system responds quickly to high power instant demands, has low maintenance costs, is efficient, with high power density, and has reliability that is exceptionally high when compared to other existing forms of energy storage. Flywheels that store energy by spinning at high speeds are often used in applications such as Uninterruptable Power Supply (UPS) where the need for rapid energy discharge or absorption is essential. Kinetic energy storage systems are highly efficient with minimal energy losses during operation. Flywheels are not used to provide power over long periods, but are ideal for continuous stabilizing of power and delivering high quality power rapidly, at MW+ scale for shorter periods.

Kinetic energy storage systems are built using mechanical components such as heavy flywheels which spin on bearings enclosed safely within a housing. The materials used in these components have environmental and resource implications. However, when viewed from cradle to grave the embodied carbon footprint cost is far outweighed in the long term by low carbon operation over decades. At end-of-life kinetic flywheels are almost 100% recyclable with no harmful chemicals contained within the system.

Liquid Air Energy Storage (LAES)

Liquid Air Energy Storage (LAES) technology converts electricity into cold liquefied air or other cryogenic liquids. During periods of high energy demand, the stored liquid air is evaporated and expanded which drives a turbine to generate electricity.

LAES systems have three stages: charging, storage, and discharging. The charging phase includes compression, cooling, and liquefaction, whereas the discharging phase includes evaporation, heating, and expansion

According to the European Association for the Storage of Energy the components of a LAES system include Compressors (integral to the liquefaction unit) driven by an electric motor; Liquefaction unit; Insulated liquefied air-tanks; Evaporation unit; Air expander; Gas turbine (Optional) Electric generator Cold Storage (Optional) Heat Storage (Optional). LAES systems are normally considered as large scale – 100s of MWs – with claims as a sustainable solution centred around reducing reliance on fossil fuels for energy storage and encouraging the integrating of renewable energy sources into the grid.

Research into LAES for smaller industrial deployment and use with UPSs are ongoing. However, their suitability is unproven. As LAES energy requires a process to liquefy and later re-gasify the air this process occasionally results in energy loss and reduces its efficiency. The cooling process during liquefaction consumes a significant amount of energy and the equipment used may cause environmental harm.

Compressed Air Energy Storage (CAES)

Compressed Air Energy Storage (CAES) is another energy storage method usually spoken about in terms of large scale compressing of air into large underground reservoirs or above ground tanks. When electricity is needed the compressed air is expanded through a turbine to generate electricity. Large CAES requires suitable geological formations to store compressed air.

However, when looking at small scale CAES systems efficiency and storage become major issues. Even at large scale the compression and expansion processes results in energy losses which reduces overall system efficiency. If using storage tanks for smaller scale deployments as the tanks get bigger the density drops and along with it, energy efficiency.

Gravity energy storage

Pumped hydro is the best know gravity energy storage method. Storing energy by raising and lowering heavy objects, such as large masses of water. When energy is abundant these heavy objects are lifted to higher elevations which stores potential energy. The main challenge with gravity energy storage is finding suitable geographical locations for the construction of pumped hydro facilities which even then are capital intensive and have environmental and ecological impacts.

For industrial applications companies are developing solutions that involve digging shafts or building towers in which heavy objects drop to produce the required power on demand. These methods involve significant construction projects.

Conclusion

Advances, research and development into all forms of mechanical storage are a welcome addition to the energy transition landscape.

AEnergy storage differentiates for every application - each have sustainability pros and cons.

For example, when there is a requirement for long term storage with discharge times of hours or days then large-scale construction projects of gravity, liquid or compressed air energy storage infrastructure may be justified. However, such projects can come at a high environment cost.

Today the only mechanical energy storage solution for industrial applications must be low carbon, provide sustainable operation and doesn't involve significant construction projects or complex systems involving a multitude of interconnected components (pipes, pumps, compressors, storage tanks) and their unavoidable carbon cost, is kinetic flywheels.

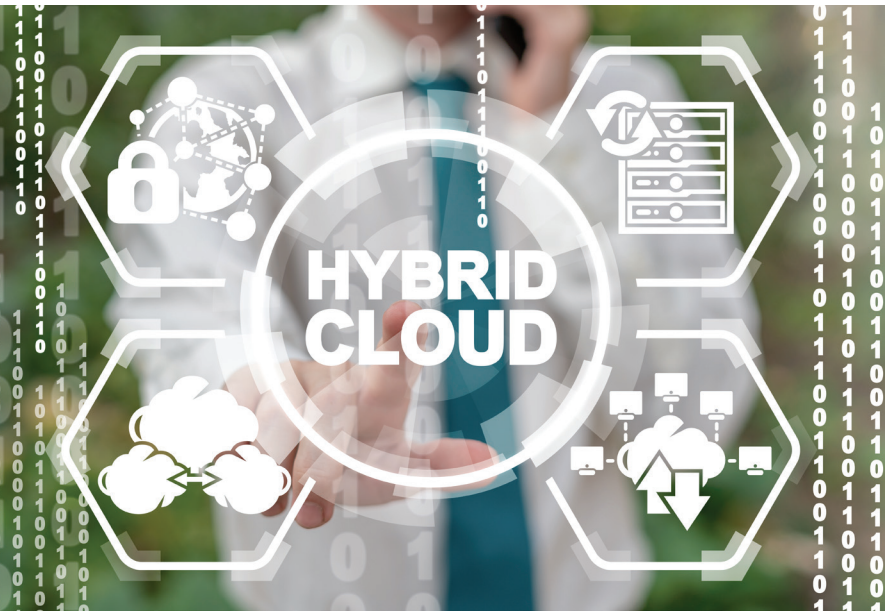
Banking on a hybrid cloud

Reaping the rewards of AI-powered services is putting the quality of fintech IT infrastructure to the test

BY ARPEN TUCKER, SNR. BUSINESS DEVELOPMENT MANAGER, UK, VANTAGE DATA CENTERS

FINTECH'S are well aware of the criticality of their IT systems to deliver competitive advantage and growth. Getting it right means the agility to respond quickly to customer demands while reacting to new market opportunities with timely new products. The result, more business and greater customer loyalty through the delivery of a highly tailored customer experience in tune with their immediate and future needs.

It's no surprise therefore that many fintech businesses are turning to new developments in artificial intelligence (AI) and machine learning (ML). To not only improve operational efficiencies but also for processing and analysing far more data than ever before, allowing super-accurate decision making based on razor-sharp AI-based intel. Furthermore, ML enables a new weapon for combatting fraud, with powerful biometrics which analyse users' physical and cognitive behaviour.



However, all of the immediate benefits and future possibilities offered by AI demand unprecedented compute power and a more robust IT Infrastructure. Equally, the handling of huge volumes of sensitive financial data requires specialised, highly compliant IT. Ongoing regulatory updates, such as those related to e-money, anti-money laundering, and capital requirements, require fintech firms to be agile in adapting their IT systems to comply with changing laws.

There are other risks too. Not least, fire, flood, power outages or the fallout from a physical or cyberattack - all can take vital systems offline resulting in loss of business opportunities, customers, reputational damage and even the potential of hefty fines.

With so much at stake, fintech companies must regularly evaluate whether it is affordable or indeed best practice to keep all their IT systems on-premises. An alternative is outsourcing IT servers and equipment into third party 'colocation' data centres. Backed by service level agreements, these can provide the critical infrastructure, security and round-the-clock support services necessary for keeping systems continuously available. Leveraging the cloud as well as, or instead, is a further option. But in the rush to cloud enabled services, don't forget these still depend on the reliability, connectivity and security of someone's data centre(s) somewhere.

Best of both worlds

A best of both worlds' solution could be a hybrid cloud, combining public and private clouds under one umbrella, including where required, legacy systems.

On a pay as you go basis, this allows a fintech company to manage and scale variable workloads in the public cloud and leverage the latest AI/ML tools and technologies available to innovate and

experiment with new product offerings. Apart from the time to market benefits, capital expenditure can be devoted to private cloud infrastructure for supporting workloads that can be seamlessly accessed from the on-prem or colocation data centre. Such an optimised approach allows continued control and ownership of sensitive information – a prerequisite for fintech firms – while also addressing the growing challenge of having sufficient compute resources consistently available.

There are further advantages to taking the hybrid route. Fintech businesses will be able to seamlessly integrate and analyse public data sets and private financial data to derive valuable insights and enhance their AI-driven financial services. Moreover, critical data and applications can be replicated across both on-prem and public cloud environments, reducing the risk of downtime due to hardware failures or unforeseen events.

Changing IT infrastructure requirements

In practice, however, whether on-prem or third party, the data centres supporting these hybrid cloud environments will need to be equipped with fit for purpose IT infrastructure, suitable cooling and sufficient power to scale and manage the increasing draw of high-density racks. They will also need highly skilled engineering personnel on hand as hybrid clouds are complex and cannot be built, tested and managed successfully without suitable facilities and training. High levels of physical and cyber security are also going to be of more importance than ever.

But, above all, the hybrid cloud must meet user and customer expectations for application responsiveness and predictability which means placing compute resources closer to end-users and vital data sources. This brings latency and the cost of connectivity into focus both of which are critical in fintech. However, with the considerable amounts of data moving back and forth between the public and private cloud environments, few on-prem data centres will be able to afford to run the dedicated network links necessary for assuring the consistent performance of workloads that may have variable resource needs. While Microsoft, for example, offers ExpressRoute as a low latency dedicated connection, it is only available as a direct 'trunk' connection to certain colocation, public cloud and connectivity operators. These can connect directly with ExpressRoute at core data centre speeds and so largely eliminate latency issues and ensure bandwidth is optimised.

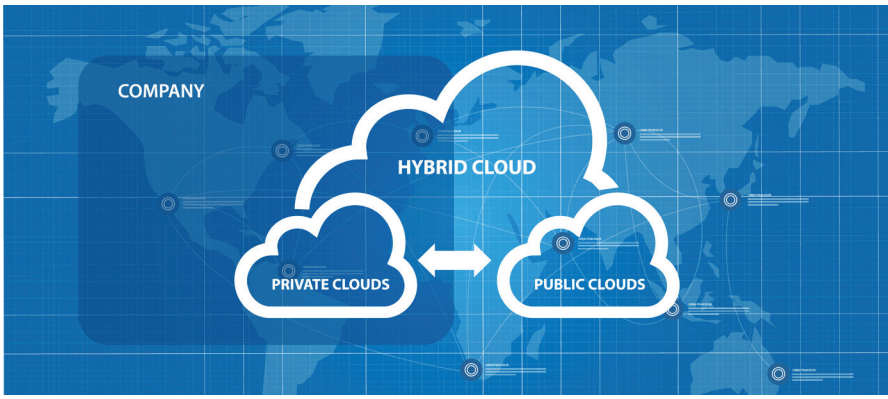
But for those on-prem or colocation data centres not directly connected, the only alternative is to find an equivalent fast and predictable connection from their facility to an ExpressRoute partner end point. As such, organisations using ExpressRoute for their own private data centre will still have to deal with any latency and speed issues in the 'last mile' between their facility and their chosen ExpressRoute point of presence. This is the case even where connectivity providers are offering ExpressRoute to a private or colocation facility as they are layering their own connectivity from the edge of their network and the ExpressRoute core to the edge of the user network.

the hybrid cloud must meet user and customer expectations for application responsiveness and predictability which means placing compute resources closer to end-users and vital data sources

In addition, if an organisation is planning on using a colocation facility for hosting some or all the hybrid cloud environment but keeping legacy workloads operating in its own data centre, the colocation must offer a range of diverse connectivity options. Multiple connections running in and out of the facility will assure maximum performance and resilience.

In summary, with fintech's growing adoption of AI and ML based applications, the dilemma of where and how to maintain IT infrastructure is coming under increasing scrutiny. As they strive for greater agility without compromising the control and security of sensitive, stringently regulated financial information, many firms will turn to best of both worlds' hybrid cloud solutions.

In turn, the quality of on-prem or third-party colocation data centres at the heart of these complex environments will require careful evaluation in terms of their forwards power availability and cooling solutions, on-site engineering expertise, and proximity to public cloud provider networks for ensuring predictable, low latency and seamless interconnection of public, private and legacy workloads.



Stick to good cable-labelling practices

Once you start looking around, there's a bewildering choice of cable labels to choose from, encompassing various types, sizes, and materials. And that's not where it ends, you also need to think about the right labelling tool, such as a reliable commercial-grade label printer.

BY ROBERT VINES, COUNTRY MANAGER FOR THE UK, IRELAND AND NORDICS, TSC PRINTRONIX AUTO ID

YOU CAN'T LOOK at any news outlets without seeing someone speculating about the potential of artificial intelligence (AI) or maybe its legal or sustainability ramifications. Generative AI such as ChatGPT and Google's Bard are fast gaining traction, which, in turn, is driving an increased demand for data centres.

And with the rising demand comes a need for more energy to power them as well as keep them cool, with one study suggesting the AI industry could consume as much electricity as the whole of the Netherlands by 2027. In addition to the increased energy requirements comes the challenge of ensuring the cabling networks that interconnect these crucial business systems are running at maximum efficiency.

Organising and labelling cables should be standard practice in any business. Failing to properly label individual cables can not only cause costly operational interruptions and unnecessary downtime but also take longer for problems to be identified.

Good processes and practices help keep you safe from outages

Data centre outages are caused by anything from cyber-attacks to natural disasters but it's human error, rather than equipment failures or architecture, that is the most common culprit.

The Uptime Institute claims that three quarters* (75%) of all data centre outages could be attributed to human error, be they inefficient layouts, no labelling, insufficient training, or scant maintenance. Inadequate cable management can also jeopardise operational safety as it obstructs airflow to racks, traps dust, and leads to cable overheating.

Accurate and timely cable labelling is important because it enables you to:

- Comply with industry standards and regulations or meet customer specifications.
- Follow the ANSI/TIA-606-B standard for administering telecommunications cabling infrastructure
- Troubleshoot and rectify issues quickly thereby minimising safety risks and any downtime
- Conduct maintenance and repairs efficiently and effectively
- Record hardware assets better

Preparing for network expansion

Many UK businesses have probably managed fine up until now with their own server and renting cloud space but an increasing number are seeing the need for their own data centres. In this instance, the IT team might prioritise network design and cable structure over in-cabinet wiring.

However, how the cabling is bundled and segregated is every bit as important for compliance and operational reasons as the health and safety (H&S) aspect. A spaghetti of cables hanging from a cabinet poses a real trip hazard!

That said, the networking industry is fairly well practiced in ensuring cables are easy to identify, inspect and replace. Colour-coding of cables is commonplace to determine cable function and connection type, and labels at each end of the cable further aid identification. But comprehensive labelling offers further benefits:

- **Efficiency:** being able to quickly identify what hardware is connected where saves time in routine maintenance and repair jobs, in audits of assets and in troubleshooting outages.
- **Meeting standards:** enables businesses to comply with industry regulations and alert people to safety risks like dangerous areas.
- **Accurate records:** minimises the risk of errors in troubleshooting and clarifies the function of each cable to those who neither planned nor installed the data centre.
- **Neat:** not only does it look more professional it also makes for better organisation

Choosing a labelling solution

Once you start looking around, there's a bewildering choice of cable labels to choose from, encompassing various types, sizes, and materials. And that's not where it ends, you also need to think about the right labelling tool, such as a reliable commercial-grade label printer.

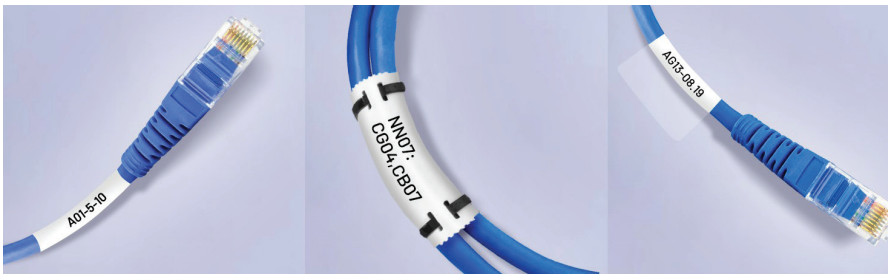
Ideally, you want a device that is versatile enough to print, with exceptional quality, speed and precision, across a variety of media types. To ensure print quality, you must also select the right printer based on such consideration as frequency of label printing, label size, and materials used.

When it comes to cable labelling, the top three cable labels are:

- Printable polyolefin heat-shrink labels that come in different diameter sizes, ranging from 1/8-in, 1/4-in, and 3/16-in up to 7/8-in.
- Self-laminating labels crafted from clear polyester or vinyl material, featuring a small white printable area.
- Cable and wire tags, usually made of durable polyethylene, available in heights of 1/4-in, 1/2-in, and 3/4-in, with widths ranging from about 1/2 inch to 3 inches.

When considering media variations, it is vital to also think about selecting the appropriate ribbon to ensure it works with the selected media type.
Future-proof your cable labelling

Given the diverse label media available, and the amount of information you might want to include on them, it pays to choose a printer with the capability to overcome both current and future label printing challenges. The TSC Printronix Auto ID TH Series of desktop barcode printers are available for 4-inch and 2-inch applications, offering direct thermal and transfer thermal print methods and are particularly recommended for cable label printing. Its key features include:



- **Heavy-duty cycle support:** can print up to 7,000† labels per day.
- **Wide media width support with minimum 5 mm print height:** both the 4-inch and 2-inch versions can handle media widths of 15 mm to 120 mm and 15 mm to 60 mm, respectively, making them ideal for cable labelling. A unique narrow media adaptor can also handle 10mm wide media, which will ft most heat-shrink tubes.
- **Exceptional precision and print quality:** a combination of high precision performance and a media damper to stabilise media during printing guarantees top-notch print quality for narrow and small labels. Moreover, the heater line and thermal print head (TPH) pressure can be adjusted to accommodate thicker labels, while the 10 mm wide adaptor securely holds the media for seamless printing.
- **User-friendly operations:** Each TH Series Printer boasts three shortcut buttons that can be customised to perform frequently used functions. For instance, a shortcut for media calibration proves invaluable when working with different media types.
- **Auto-switch printer language emulation:** out of the box plug-and-play, no need to modify label templates, ensuring a smooth transition.

The TH Series, like the DH Series, of barcode printers is TSC Printronix Auto ID's most versatile and future-proof range of devices yet. They can print on diverse media including fabric, card and linerless and it is this last medium that additionally offers H&S benefits.

The peel-off backing sheet from more traditional labels is not recyclable and the waste material presents a real slip hazard on cluttered commercial or industrial premises floors, especially high-volume shipping areas, for example, where litter from label liners can be significant. Another advantage of linerless that is that labels can be printed to any length so more information can be included such as cable function, location or any other criteria.

Bring order and professionalism to your cable management with the TH Series of desktop barcode printers.

*Source: https://infraon.io/blog/common-data-center-outage-problems/

† The print volume is based on printing 4-in x 6-in and 2-in x 6-in labels at a print resolution of 203 dpi.

DCA news and updates

BY STEVE HONE, CEO, THE DCA

THIS MONTH Data Centre Solutions editorial theme has a number of topics Edge, 5G and Energy Efficiency. The DCA have chosen to focus on Energy Efficiency. We have three articles from DCA Partners. I'd like to thank EnerSys, Carbon 3IT and Enel X (along with Digital Realty) for taking the time to write these articles which I hope you will find them interesting.

Michael Sagar, Direct of Marketing Energy Systems, Enersys provides an informative piece titled – 'Unlocking the Potential: Data Center Energy Storage's Dual Function in Backup and Grid Balancing'. Michael's article explores how data centre energy storage can play a dual role in backup and grid balancing, not only ensuring customer data integrity but also facilitating the clean energy transition, lowering the overall carbon footprint.

John Booth, MD Carbon3IT & Chair DCA Energy Efficiency SIG has spent time considering AI and Data Centres - 'Beware the AI'ds of March (The Ides of March)' – John points out that AI is THE dominant topic at most of the data centres events he's attended recently. His observation - AI, is taking over all rational thought and perhaps we should all take a deep breath, and consider what we are doing...

John Byrne, Managing Director – Ireland, Enel X, and Evan Barker, Manager - Facilities Engineering, Digital Realty have collaborated, producing an article that relates to how leveraging the flexibility of data centre UPS through Enel X and Digital Realty's award-winning collaboration avoids over 30,000 tonnes of CO2 emissions and supports Ireland's renewable energy transition. 'Grid-interactive UPS – How data centres can actively enable Ireland's renewable energy transition'.

The DCA's - Data Centre Transformation 2024
22 October 2024 at The IET, Birmingham

The event comprises of panel sessions, workshops and updates from Government and Industry Experts. The conference programme starts at 10.00am and finishes at 17.00pm, followed by informal networking drinks and The DCA Dinner. All DCA Members and Partners are welcome at DCT along anyone else who has an interest in the Data Centre Industry.

Don't miss this fantastic one-day event!
Click here to register for Data Centre Transformation 2024!

To find out more information about The DCA click here or email us mss@dca-global.org

Unlocking the potential: Data center energy storage's dual function in backup and grid balancing

By Michael Sagar, Director of Marketing, Energy Systems - EnerSys®

IN THE NEAR FUTURE, the global energy landscape is poised to shift dramatically, with a reduced reliance on fossil fuels. The COP27 UN Climate Change conference saw nearly 200 countries reaffirm their commitment to limit global temperature to rise to 1.5°C (2.7°F) above pre-industrial levels.

However, the world is perilously off course to keep this limit within reach and a bleak report published by the UN Climate Change shows current pledges put us on track for a 2.5°C (4.5°F) rise by the end of the century. With the seriousness of the environmental threats the world faces, there is a heightened emphasis on replacing fossil-fuel generated electricity with renewable energy sources like wind and solar power. However, the intermittent nature of these sources poses a significant challenge when it comes to integrating them into the existing power grid infrastructure.

This article explores how data center energy storage can play a dual role in backup and grid balancing, not only ensuring customer data integrity but also facilitating the clean energy transition, thereby lowering the overall carbon footprint.

Emerging trends in the energy sector

Accelerating solar and wind generation site additions are driving the growth in renewable energy supply. According to the International Environment Agency (IEA) 2022 was a record year for renewable capacity additions and is expected to jump by a third in 2023.

Nevertheless, this activity needs to ramp up sharply to align with the Net Zero Emissions by 2050 (NZE) Scenario. In the run-up to COP28 taking place at the end of 2023, the IEA is preparing its 'Tracking Clean Energy Progress 2023' report, which supports the first global review of the Paris Agreement.

Challenges in renewable energy generation

Unlike traditional power stations, which can readily scale up generation to meet demand, renewable sources like solar and wind are inherently variable and depend on local environmental conditions. This unpredictability, coupled with daily and seasonal fluctuations, poses challenges for maintaining a stable grid when demand surges. As the energy landscape shifts towards greater reliance on intermittent renewables, strategies should be developed to augment power output when necessary to ensure grid stability.

Ensuring grid stability

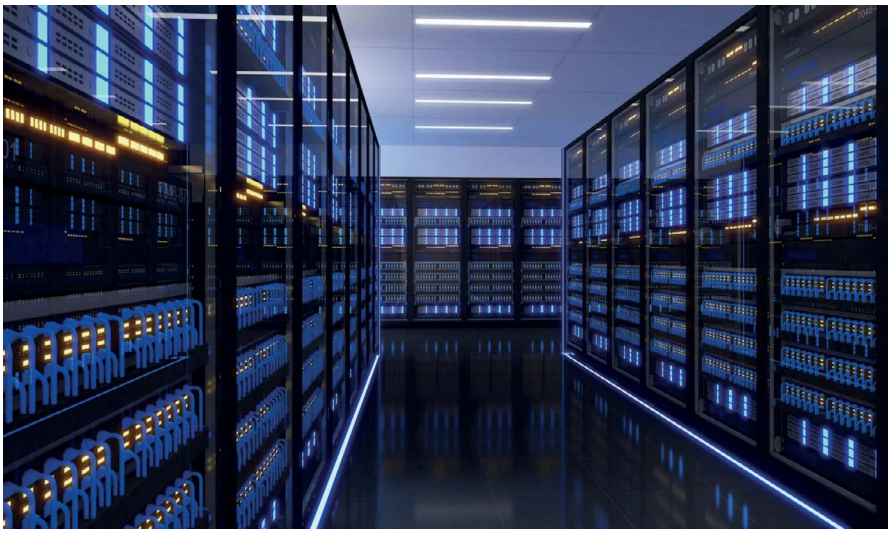
Grid stability hinges on maintaining a consistent grid frequency, which varies between regions (e.g., 60Hz in the US and 50Hz in the EU). Even small deviations from the standard frequency can lead to power outages. Grid balancing technology is crucial for maintaining the optimal frequency by tapping into stored energy reserves during peak demand and charging these reserves when there is excess energy available.

Data centers as potential grid balancers

Data center operators typically possess substantial energy storage capacity, often underutilized. In some areas, operators are exploring ways to repurpose this capacity for grid balancing. By reallocating battery units from Uninterruptible Power Supply (UPS) systems, data centers can contribute to grid stability and potentially generate additional revenue.

Developing a grid-balancing strategy

Data center operators considering grid balancing must carefully weigh their options. They can choose to take full control of the process, engaging with electricity distribution companies, making the necessary investments, and overseeing maintenance. Alternatively, they may opt to delegate the grid balancing work to the electricity service provider, which would capture most of the revenue. Hybrid approaches that strike a balance between risk and revenue are also viable. However, data center operators must prioritize the continuity of their core functions. Any strategy for grid balancing should not compromise backup power supply responsibilities, as service interruptions can have catastrophic consequences.



➤ Data center operators have, historically, been unable to adopt grid balancing

Selecting the right battery chemistry

Grid balancing activities require a robust energy storage reserve, but data center operators should consider the Total Cost of Ownership (TCO) and management expenses against potential revenue. Traditional lead-acid batteries were insufficient for the task, but advancements in battery technology have made grid balancing feasible. Batteries with strong charge/recharge durability and suitability for high cyclic requirements are vital for grid balancing. Advanced technology lead-acid batteries, with their elevated energy density, charge cycle endurance, and cost-effectiveness, are a popular choice enabling data center operators to actively participate in the concerted effort to

➤ EnerSys® TPPL battery technology stacks deployed within a data center

maximize grid resilience. EnerSys® has been driving innovation in lead-acid battery technology. The company's advanced thin plate pure lead (TPPL) battery technology significantly boosts lead-acid performance, extends lifespan, and offers high cyclic capabilities, making it ideal for grid balancing. These batteries can operate efficiently at higher temperatures, reducing cooling costs and environmental impact.

However, elevated operating temperatures will reduce the battery's service life, leading to earlier replacement. It is important, therefore, for an operator to fully consider the implications and speak with experts before exploring this option.

Grid balancing for a sustainable energy future

As the transition to renewable energy accelerates, maintaining a stable grid is paramount. Data center operators can have a crucial role to play in grid balancing. By selecting the right battery chemistry and partnering with reliable vendors like EnerSys®, operators can seize the opportunities presented by grid balancing. With appropriate guidance, operators can make informed decisions about the potential capital and operational costs versus revenue. This strategic approach will empower data centers to contribute to grid stability and maximize their energy storage assets while optimizing their operations.

Beware the AI'ds of March (The Ides of March)

By John Booth, DCA Energy Efficiency SIG & MD Carbon3IT

THE IDES IS THE DAY on the Roman calendar to indicate roughly the midpoint of the month it is usually the 15th, the Ides of March became famous as the date of Julius Caesar was assinated in 44BC. According to Plutarch, a seer had warned that harm would come to Caesar on the Ides of March. Enroute to the Senate, Caesar has passed the seer and joked "well, the Ides of March are come", implying that the prohecy had not been fulfilled, to which the seer relied, "Aye, they are come, but they are not yet gone"

"Julius Caesar was assassinated by a group of senators on the Ides of March (15 March) of 44 BC during a meeting of the Senate at the Curia of Pompey of the Theatre of Pompey in Rome where the senators stabbed Caesar 23 times. They claimed to be acting over fears that Caesar's unprecedented concentration of power during his dictatorship was undermining the Roman Republic. At least 60 to 70 senators were party to the conspiracy, led by Marcus Junius Brutus, Gaius Cassius Longinus, and Decimus Junius Brutus Albinus."
Source: Wikepedia, accessed 7th May 2024 https://en.wikipedia.org/wiki/Assassination_of_Julius_Caesar

You may wonder where I am going with this, but AI and its impact on the data centre sector appears to me to be "an unprecendented concentration of power" it, AI, is taking over all rational thought and perhaps we should all take a deep breath, and consider what we are doing...

The dominant topic at the recent data centres events that I've attended is AI.

It is top of a list compiled by Simmons and Simmons https://www.simmons-simmons.com/en/publications/cluuzeox800hyuatcw3kkq0xs/top-10-issues-in-data-centres published on the 11th April 2024, the "The Impact of AI on Data Centres" and has links to number 3 on the list "Balancing Net Zero with human need" and 4 Critical Infrastructures for powering data centres, as well as 8 "Supply chain challenges" and 9 "Lack of Skilled labour in the industry".

But, are we sure about AI?

Personally, I'm not convinced that AI will turn out to be the pancea that some are saying, yes, its good for healthcare and for analysis of geo-data which can be used to determine where and what we should consider for adaptation and mitigation of climate change, I'll even go so far as to say that it can eliminate errors and optimise production lines, but you could do that with sigma six and kaizen methods. The darker side of AI is fake news, outright disinformation and deep fakes, and I am not convinced that enough is being done from a legislative or self-regulatory point of view to address these issues.

From a data centre perspective, it appears to be "technology for technology's sake", AI chips use more power and thus require more cooling, a recent conversation revealed that one of the major players in the space have advised a power/cooling global manufacturer to prepare for 500kw racks.

Its clear that legacy data centres will not and cannot provide the infratructure to support this path, meaning that AI will have to be located in "state of the art" data centres, which will take at least 3 years to build, even if we had a design ready to go, which we dont, so perhaps longer. Add to that the lack of power in the traditional data centre hubs and the question really is, where are we going to put them, and thats to assume that we'll be able to obtain the vast amounts of power required. One area could be the Nordics, to take advantage of renewable energy and a suitable climate, but if we were to deploy at

scale, what could happen to the micro-climate, could we be accelerating global warming by locating heat producing data centres in the very areas that are at risk from climate change?

Nukes?

Some AI'ers have even cited the use of Nuclear power to address the power problems, primarily the use of Small Modular Reactors (SMR's) located within the data centre itself! It might happen in the US, but I doubt very much it will happen in the EU/UK for a host of reasons, the first is cost, access to fuels, cost, security, additional infrastructure adding to the cost, NIMBYism, Nuclear Free cities policies, cost, and timescales, the decision for SMRs in the UK will not be taken until 2029 and realistically the first working reactor some time after, an example is Hinkley Point C, projections indicate double the original cost and over 4 years later to start generating.

Issues

Over the weekend, (5 May 2024) there was a press report covering the disgruntlement of locals adjacent to a large hyperscale build in Waltham Forest on the outskirts of London, true, this was more to do with the construction of the data centre rather than the operation, but we are already seeing local communities moaning about new builds in Ireland, Netherlands, US, with moratoriums in place in Dublin, Amsterdam, Singapore and others. We're already under fire for building featureless boxes, that create low level noise pollution, consume vast quantities of energy, land and water, dont provide many jobs and now we want to add the use of nuclear energy to the list and build a lot more of them around the world.

It clear to see that we will have resistance to building in the future.

Regulations

Returning to the Simmons & Simmons list, the 2nd topic was "Regulatory compliance in the drive to Net Zero", alarmed by the explosive forecasted growth as far back as 2008 (well before AI was even a thing) in data centres, the EU created the EU Code of Conduct for Data Centres (Energy Efficiency) to try and optimise existing facilities, reduce energy consumption and generally pave the way for a more energy efficient and sustainable data centre sector.

This was always envisaged as pre-cursor to more formal regulation, to prepare the industry for what was coming down the road, and that regulation landed in March with the publication of the Energy Efficiency Directive and a delegated act targetting data centres, the 2024 C 1639 which you can download from this link http://data.europa.eu/eli/reg_del/2024/1364/oj. In essence, data centres will have to report a shed load of operational data including PUE, REF, ERF and WUE for the 2023 reporting year by the 15th September 2024, and data for the 2024 reporting year by the 15th May

2025. From recent events and conversations, it appears that the existing data centre sector will struggle to even collect the raw data they will need to use to calculate, let alone report this data to the EU

Radical Rethink

What of the cost of AI? This is the cost of the build-out in terms of data centres, grid infrastucture, hardware, software etc, I tried to find out, but the range was too vast for sensible contemplation, it will be in the trillions when everything is accounted for, if we continue to use a 20th century design and build strategy.

We have an opportuity to use just a portion of the obscene amount mooted for AI to really conduct some serious research and development for a "radical redesign" for the real data centre of the future, one that meets the true definition of "sustainability" to satisfy the needs of today without compromising the needs of future generations. Research for instance, into Graphene, a substance that could reduce energy consumption from chips, and emit less heat, thus reducing cooling requirements, surely this is a better use of resources and cash?

So, beware the AI'ds of March...

Some AI'ers have even cited the use of Nuclear power to address the power problems, primarily the use of Small Modular Reactors (SMR's) located within the data centre itself! It might happen in the US, but I doubt very much it will happen in the EU/UK for a host of reasons

Grid-interactive UPS – How data centres can actively enable Ireland's renewable energy transition

By John Byrne, Managing Director - Ireland at Enel X, and Evan Barker, Manager - Facilities Engineering at Digital Realty

ELECTRICITY GRIDS of the future will depend on the evolving relationship model between user, technology and local regulations. This evolution unlocks a massive opportunity for businesses of all types, but especially data centres, to use their energy storage assets in new ways that add commercial value, resilience, and improved sustainability – for their organisation and for the grid.

Grid stability – a growing challenge

Ireland has emerged as a major hub for data centre activity, attracting both domestic and international companies. The sector is an important source of income for the country, with revenue projected to reach US$1,198m in 2024.

At the same time, the sector is coming under criticism for its heavy use of electricity – consuming up to 18% of the country's electricity in 2022. Capacity constraints in the grid have caused so much concern that there has effectively been a moratorium on the connection of new data centres in the Dublin area until 2028.

This is coupled with Ireland's Climate Action Plan's ambitious target for 80% of the country's electricity to come from renewable sources by 2030. Ireland is well on the way to meeting this target with over 35% of its power currently generated from renewable sources.

Renewable energy sources are more sporadic than traditional carbon fuelled power sources. Integrating them makes the grid less stable. Variations in power production cause small shifts in the balance between supply and demand on the grid that can be seen as frequency fluctuations.
Ireland's secure and sustainable electricity policy

EirGrid, the electricity Transmission System Operator (TSO) in Ireland, has designed its "Delivering a Secure, Sustainable Electricity System" (DS3) with the specific aim of creating the right conditions to safely and securely add more renewable energy to the Irish power system – without having to rely on traditional power stations for backup.

DS3 works by balancing the frequency of the grid as it fluctuates in response to variations in the quantity of renewable energy generation. If the frequency of the grid can be maintained at 50 Hz, more carbon-free electrons from renewable generation can be added to the power transmission lines feeding businesses and homes around the country.

Frequency response programs, including DS3, require standby energy assets that can react to grid signals within seconds or even milliseconds. This is where data centres come in. Battery energy storage systems (BESS) are a highly versatile form of storage found in the Uninterruptable Power Systems (UPS) of most data centres. The main purpose of the UPS is to provide power conditioning and backup electricity for the servers.

UPS systems – a fast acting remedy

With response times below 0.5 seconds, UPS systems are fast enough to prevent data centres from losing power during an outage. Data centre-scale UPS systems typically store enough energy for a few minutes of backup power. After providing backup power, UPS systems can recharge their batteries from the grid.

The availability required by the data centre determines the capacity of the battery and generator installation to ensure that the facility keeps the IT load going, no matter what. This results in often unused capacity that, with the right tools, can be made available to the grid to help it recover from an outage or even prevent one occurring.

A collaboration between Enel X and the global data centre, colocation, and interconnection solutions provider, Digital Realty, is pioneering this approach in Europe. Together, Enel X and Digital realty are making it possible to use a data centre's UPS to stabilise the grid, in what is known as grid-interactive UPS.

Enel X installed hardware at Digital Realty's data centres to both meter the UPS and send power requests to the UPS during times of grid disturbance. These devices have been designed and built to meet the requirements set out by the TSO. Grid compliance testing ensured that the system worked as expected following its installation. In order to provide frequency balancing support to the electricity grid, the data centre batteries had to meet essential criteria:

- 20 millisecond event data
- GPS time synchronisation of +/- 2ms
- 1 second real-time data
- 5 second data latency
- Response time <2 seconds

How data centres can reduce grid stress and costs

Digital Realty is now using batteries on its installed UPS systems to give back to and support the grid

through dynamic frequency balancing services. Whenever minute fluctuations in grid frequency occur, its UPS batteries are enacted to remove load from the grid in sub-2-seconds. This supports the constraint on the grid and allows the frequency to reset to its normal operating frequency of 50 Hz, and avoids the need for taxpayers' money being used to have power plants on standby.

The project is setting a scalable precedent, paving the way for data centres and other large energy consumers to use their UPS to bolster the electricity grid they depend on, and effectively become an intrinsic part of Ireland's electricity system – actively facilitating the country's transition to renewable energy.

Core to meeting these requirements is a dynamic controller developed by Enel X, in collaboration with IoT technology company, EpiSensor. The solution tracks millisecond-by-millisecond grid frequency variations and, during moments of grid frequency instability, increases or decreases battery output to the required level; helping to restore balance to the grid. It is a process that varies battery levels by a small amount while the data centre continues to run on grid power, ensuring that there is no risk to business continuity. You can think of it like a dimmer switch that can be adjusted to meet the needs of the grid in near real time.

By creating a solution that was compliant with Eirgrid's strict programme rules, the data centre batteries can provide frequency balancing support to the electricity grid. This turns a largely idle asset into an active facilitator that helps to create the grid necessary to achieve renewable targets.

Introducing grid-interactive UPS means that data centres could shift from being huge consumers of energy into being a critical part of the wider electrical distribution system.

A triple win – for data centres, the grid and the environment

There are benefits to the data centres through this approach in addition to becoming good grid citizens. As well as supporting the grid through frequency balancing services, the grid-interactive UPS can help data centre operators become more energy aware and use their UPS to support with demand management programs with the local grid – also known as 'peak shaving. In this way, data centres can lower their energy consumption by switching to on-site power generation or using stored capacity in batteries. This helps to avoid grid outages and reduce overall energy cost, with a positive impact on a facility's Total Cost of Operation (TCO) – which is primarily led by the cost of energy.

A study by Baringa considers that if all data centres utilised their UPS as grid-interactive UPS, the need for peaking power plants that rely on fossil fuels, would be negated; saving 1.5 million tonnes of CO2 annually for the Irish power sector. For context, this is equivalent to 2.47% of total CO2 emissions in Ireland in 2022, or the annual carbon emissions of more than 700,000 private cars on Irish roads. Without the need to burn fossil fuels to provide these frequency balancing services, the cost passed on to end consumers for electricity could also be reduced with estimated savings of 270 million euro per year.

This innovative use of battery assets by Enel X and Digital Realty demonstrates how data centres can play a key role in supporting electricity grid stability during periods of exceptionally high demand or supply shortages.

Rising to a global challenge

The joint frequency response program in Ireland leverages the success achieved by a longstanding Enel X - Digital Reality collaboration in Asia Pacific; starting back in 2018 with two data centres in Sydney.

As other countries transition to a greater reliance on renewable energy, they are encountering a similar situation to the one in Ireland. In the UK and Europe recent grid modifications and code changes have been introduced to accommodate more variable renewable energy.

Such reforms are enabling the innovative use of data centre battery assets to support electricity grid stability – as homes and businesses around the world make the transition to net zero.

SDC AWARDS 2024

SAVE THE DATE 28.11 2024

Leonardo Royal City London

NOMINATIONS CLOSE: **30.08**
SHORTLIST ANNOUNCEMENT: **27.09**
VOTING OPEN: **30.09**
VOTING CLOSE: **01.11**
CEREMONY: **28.11**

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