DCS DATACENTRE SOLUTIONS

DEVELOPING DIGITAL INFRASTRUCTURE IN A HYBRID WORLD

ISSUE II 2023

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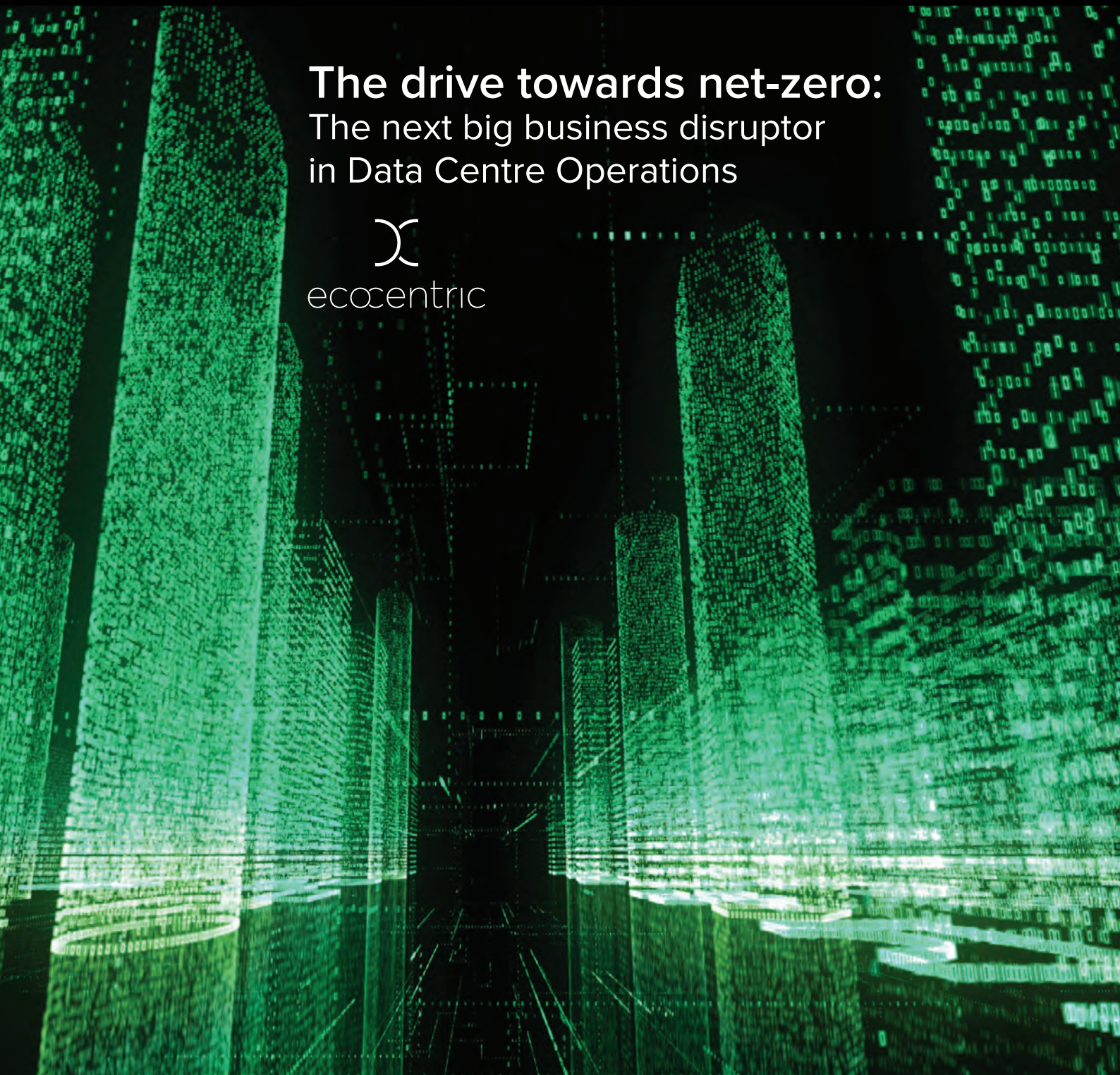

The drive towards net-zero:
The next big business disruptor in Data Centre Operations

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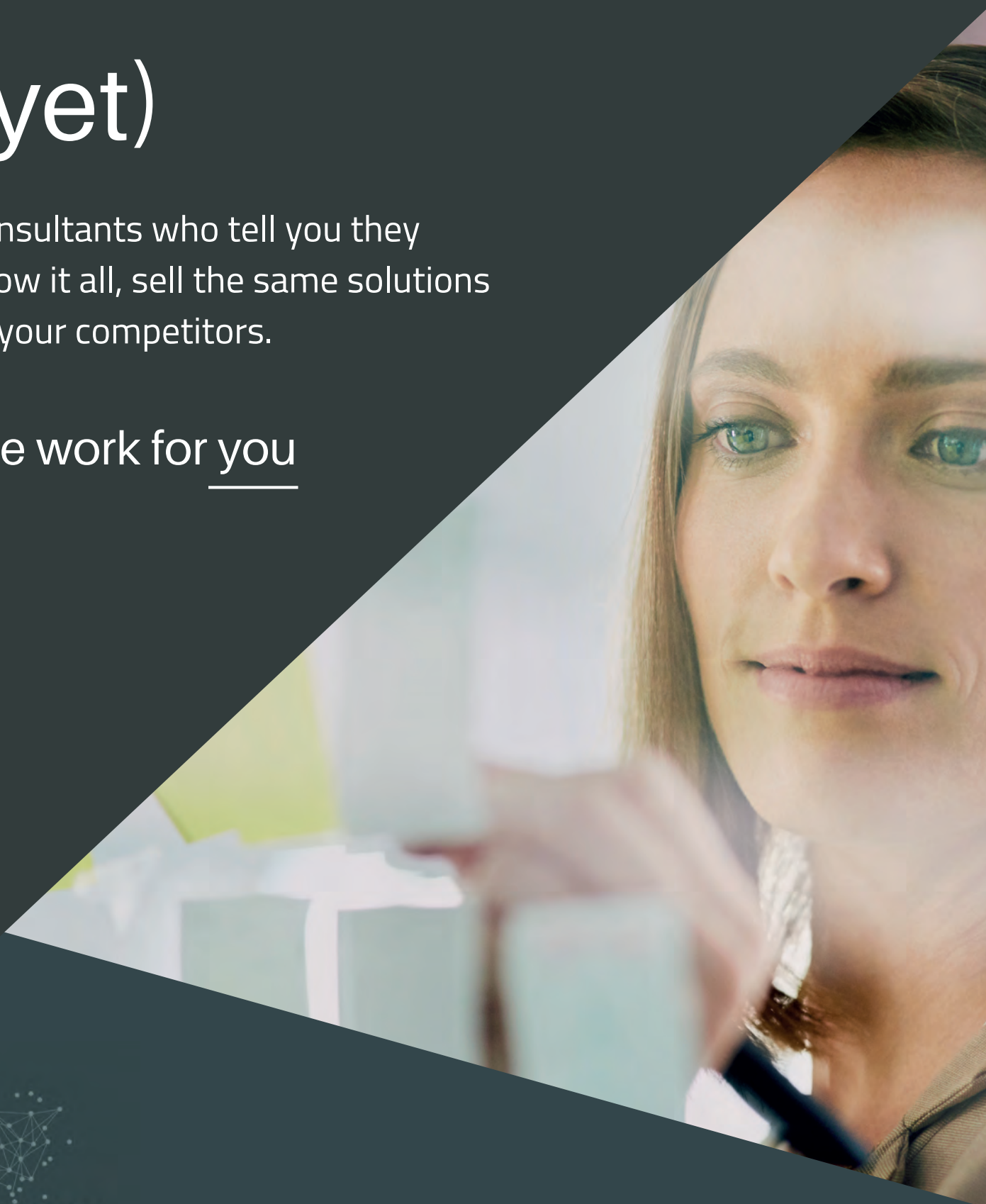

BCS. is a digital built asset consultancy.

VIEWPOINT

By Phil Alsop, Editor

Data centre industry seems to be in good health

FIRST there was the pandemic. Then there was/is the Russia/Ukraine conflict, closely follow ed by the not unrelated energy crisis, which in turn was followed by the not unrelated cost-of-living crisis. And just when we might be hoping that rock bottom had been hit, the demise of the Silicon Valley Bank, closely followed by the not unrelated(?!) demise of Credit Suisse threatens that the ever present spectre of yet another banking-induced financial crisis might soon become a reality. Maybe a recession will go unnoticed against such a background!!

The good news, for now at least, is that the data centre industry would seem to be in very good health, judging by the packed aisles at the recent Data Centre World event. On the first day at least, it would seem that crowd control and stand bouncers were required to manage the sheer numbers of visitors keen to talk data centres. Day two was slightly less hectic, but the overwhelming impression received is that data centre activity is very busy right now. Whether that's in part due to some pent-up demand thanks to Covid finally being released, or just because the digital transformation agendas of so many businesses demand digital infrastructure on a scale far beyond what's currently available, it's not easy to say. One imagines the combination of the two might just be the cause of such activity.

We must also hope that the data centre industry not only continues with its sustainability focus, but also begins to sound more confident over the positive contribution digital infrastructure makes to so many aspects of modern day life. Yes, the amount of energy consumed by data centres is substantial, but how much energy do they prevent from being used, thanks to many of the digital platforms which they underpin? As I've written previously, doing such digital sums – calculating the carbon footprint of activity A v activity B – can be extremely complicated.

However, until the radical changes required to seriously address the climate crisis are sanctioned by governments across the globe (and which tend to boil down to the simple mantra: we must consume far less of everything), the data centre industry can be proud (not arrogant) of its record of enabling so many environmental improvements across society.

To give just one example: in the UK, a data centre company is working with swimming pools across the country (many of which are threatened with closure thanks to a huge rise in their energy bills), to provide waste heat to them. There are many other ways in which the data centre industry is making a positive contribution to the sustainability objective, long may it continue.

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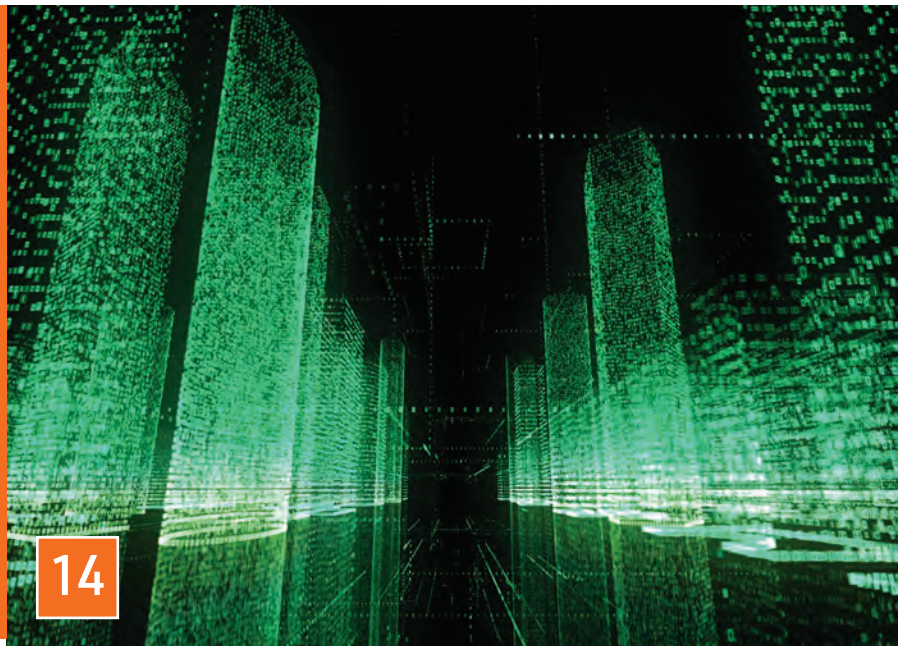

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The data centre challenge behind digital transformation

Digital transformation has reached a turning point. Businesses have now added so many new applications and need so much data consistently available, that accessing sufficient capacity in data centers is becoming a challenge.

CADENCE (Future Facilities is now Cadence) has conducted market research, interviewing over 750 technical practitioners and digital strategists to investigate some of the sector's most pressing trends. This encompasses small, mid-sized and large companies across a range of sectors, including Software/Technology, Financial Services, Government, Manufacturing and Healthcare.

Data Centers: The Heartland of Business Transformation

Digital transformation was inevitable for all businesses, but various factors—most notably the pandemic—accelerated plans for organizations across the board over the last few years. As it is such a critical part of so many businesses' strategies, it is unsurprising that their main reasons can be boiled down to three main points:

- To enable the business to work faster
- To replace analogue with digital
- To modernize infrastructure

However, while this acceleration has helped businesses in every vertical to reach their goals ahead of schedule, one thing they all agree on is that, in comparison to the last 18 months, digital transformation is only going to speed up. And data center leaders need to find a way to avoid continually playing catch up.

Alignment in the IT Industry

The proliferation of apps, as well as compute-intensive features such as machine learning (ML) and big data workloads, has led to cascading pressures for data center professionals. All of which are complicated by many of their customers switching to hybrid working processes.

Combined, this compounds the risks in data centers because of the necessary speed and scale of change required to accommodate them. Despite this, 81% of the IT professionals we asked in our research state that their digital transformation is a help to their business. However, the flipside of this is that 20% of our technical respondents see digital transformation as a non-strategic replacement of tools—essentially, that their digital transformation has not been properly thought out.

How Will Digital Transformation Affect Your Industry?

Digital transformations will impact every member of staff, though in varying ways. However, most felt that digital transformation created more demand for capacity, particularly those at larger organizations.

Manufacturing has been most affected by this need for increased capacity, with 64% of those surveyed mentioning it as a challenge, followed by Financial Services (62%) and Healthcare (61%). Nevertheless, over two-thirds of Manufacturing companies are solving this problem through increased colocation, making them the most aggressive to facilitate transformation using this method. For many businesses, this increased demand, driven by digital transformation, will result in new data center projects.

Are Technical and Transformation Strategies Aligned?

This need for expanded capacity led us to examine the extent to which transformation leaders are considering it within their planning, and then stress testing whether tech professionals concur. Fortunately, the results were largely positive—with 86% of technical professionals agreeing that digital transformation leadership takes data center capacity into consideration.

This was highest among Education (91%), but even the lowest, Government, had over three-quarters agreement (78%). These figures are encouraging, particularly in the face of the new wave of leadership entering digital, technology and transformation functions in recent years.

The expectation was that their wider set of skills might reduce the level of awareness around technology challenges, but it appears this has not been the case.

Data Centre momentum continues in EMEA

2022 saw total capacity across key markets increase by 1020MW.

THE GROWTH of the data centre markets across EMEA continued at pace throughout 2022, despite significant headwinds such as cost inflation and restrictions on power availability according to the latest research by global property adviser Knight Frank, in partnership with DC Byte.

The Knight Frank Data Centre Report focuses on eleven major markets across EMEA – London, Frankfurt, Amsterdam, Paris, Dublin, Madrid, Milan, UAE, Berlin, Copenhagen, and Stockholm, with the report finding that aggregate supply across these markets recorded an substantial increase of close to 1020MW in 2022.

Cloud computing continued to underpin activity. In the established FLAP-D markets (Frankfurt, London, Amsterdam, Paris and Dublin), London registered significant activity in 2022, with 98MW of capacity absorbed in the fourth quarter alone. This uplift was largely due to public cloud securing multi-megawatt deals. Similarly, Paris and Frankfurt now both have over a gigawatt of total IT supply, with the latter nearing 1500MW. In Frankfurt international operators account for the majority of the power committed.

As Cloud adoption has grown across mainland Europe, the geographic expansion of Hyperscale operations was particularly noteworthy in 2022, with this growth strategy simultaneously underpinning heightened activity in secondary locations across EMEA. Berlin has established as the second largest data centre market in Germany, with 147MW of live IT power added in the past year. In Italy, Milan registered growth of 94MW in 2022 – a 155% increase over 12 months. Whilst in Madrid, development activity is rising as a result of Google, Microsoft and AWS all confirming new cloud regions in Spain. Google has now also revealed plans to develop cloud regions in the UAE and in Kuwait and Apple more recently announcing the development of a second facility in Viborg, Denmark.

Ben Stirk, Partner and Co-Head of Global Data Centres at Knight Frank said: “Although the past year has posed some significant challenges for the data centre industry, including political instability, disrupted supply chains, rising energy bills and skills shortages, the fundamentals, societal and organisational digital transformation, have continued to accelerate. Consequently, the data centre landscape across EMEA continues to evolve rapidly as operators compete to secure land, develop new sites and increase market coverage.We can expect expansion across EMEA to continue at pace in 2023, with the potential scalability of the emerging markets perhaps offering the greatest opportunities for new development.” Stephen Beard, Partner and Co-Head of Global Data Centres at Knight Frank, added: “The strong performance of last year in fairly depressed wider economic conditions and future outlook of the sector will certainly have sparked further investor interest.

While cap rates have increased across all commercial property sectors in 2022 largely as a result of rising interest rates, cap rates on data centres have not been impacted as heavily, but that shift in pricing may well now present the opportunity that ‘new to the market’ investors have been holding for.

At Knight Frank, our transaction and valuation teams are expecting a busy 2023.”

Cloud computing continued to underpin activity. In the established FLAP-D markets (Frankfurt, London, Amsterdam, Paris and Dublin), London registered significant activity in 2022, with 98MW of capacity absorbed in the fourth quarter alone

EUDCA publishes whole life carbon assessment white paper

The European Data Centre Association (EUDCA) has published a new white paper entitled "Whole Life Carbon Assessments for Data Centres", immediately available for download from the organisation's website.

THE NEW publication says that as energy efficiency measures are potentially reaching their limits, with many data centre operators addressing operational carbon through power purchase agreements, on-site renewable energy technologies and taking into consideration the decarbonisation of grids, the next challenge will be achieving net zero embodied carbon.

These emissions are emitted into the atmosphere during the manufacture, construction, maintenance, and end of life stages of a data centre's lifecycle and cannot be reversed.

"The actual volume of carbon emissions caused by data centres continues to be a matter of debate," said Andrew Harrison, chair of the EUDCA Technical Committee.

"Whilst it's important we understand that number, we cannot escape the fact that demand for data is growing and if nothing changes, the result will be an even greater contribution to global emissions and climate change. The industry therefore needs to focus on radically reducing total lifecycle emissions associated with data centres - Whole Life Carbon Assessments are key to unlocking greater understanding to help guide decision making."

The benefits of Whole Life Carbon Assessments (WLCA) within the data centre industry are clear and there is growing understanding of their importance – especially by those who have employed specialist sustainability teams.

However, implementation may present challenges; for example, there can be disparity with project delivery teams who could make the greatest impact by harmonising design and construction decisions. Education, continuing to spread awareness and upskilling are key to addressing this.

A key element of WLCAs is defining the boundaries of the assessment. Given the current maturity of the data centre industry in conducting these assessments, there is still a grey area with many assessments excluding the MEP systems and externals from their scope.

According to outputs from assessments which have carried out, the MEP systems are a huge component of the overall embodied carbon emissions of a data centre and should therefore be considered as a prominent factor within the WLCA.

The 19-page white paper explains the relevance of WLCAs, what they consist of and some of the methodologies and reporting frameworks that currently exist. It provides an example of a typical data centre compared to other building types and how WLCA can offer value to data centre operators at a time when there is a growing focus on decarbonization and embodied carbon.

Finally, it highlights some of the challenges the data centre industry faces in relation to WLCA and recommendations on how to tackle these.

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Angel BUSINESS COMMUNICATIONS

Accelerated computing to push DC physical infrastructure market to $35 billion

According to a recently published report from Dell'Oro Group, data center physical infrastructure (DCPI) revenues are forecast to grow at an 8 percent compound annual growth rate (CAGR) from 2022 to 2027, to above $35 billion.

MACROECONOMIC uncertainty and lingering supply chain constraints are currently short-term headwinds, however, long-term growth is forecast to remain resilient supported by sustainability-minded cloud and colocation data center expansions and on-premises enterprise modernization.

"Next generation processors and accelerators, from the likes of AMD, Intel, and NVIDIA, are rapidly changing the power and thermal management requirements for data center physical infrastructure," said Lucas Beran, Principal Analyst at Dell'Oro Group. "The Thermal Design Power (TDP) of these semiconductor components continues to rise, with TDPs of 350W and 400W for the latest generation of CPUs, and up to 700W for GPUs. And product roadmaps show further increases from here. This is ultimately leading to higher rack power densities, with architectural changes in backup power, power distribution, and thermal management required.

"At the same time, data center sustainability has risen to the top of decision making, planning, and design criteria in the industry. This has opened the door for a significant technology transition during this forecast period – the transition from air to liquid-based thermal management. The two primary technologies, direct liquid cooling and immersion cooling (single-phase and two-phase), are forecast to grow significantly and reach $1.7 billion, or 24 percent, of thermal management revenue by 2027," continued Beran.

Additional highlights from the Data Center Physical Infrastructure 5-Year January 2023 Forecast Report:

- DCPI revenue growth is forecast to remain resilient in 2023, growing 9 percent, supported by historically high DCPI vendor backlogs.
- Asia Pacific (Excluding China) is forecast to grow at the fastest CAGR during the forecast period, followed by EMEA and China.
- Data Center Thermal Management is forecast to grow at the fastest rate of any market segment during the forecast period, surpassing $7 billion in vendor revenues in 2027.
- The Service Providers (Top 10 Cloud, Rest-of-Cloud, Colocation, and Telco) customer segment is forecast to grow at a double-digit CAGR during the forecast period, while the Enterprise customer segment (Large Enterprise, Rest-of-Enterprise) is forecast to grow at a much lower rate.

Data Center Thermal Management is forecast to grow at the fastest rate of any market segment during the forecast period, surpassing $7 billion in vendor revenues in 2027

Data centre CAPEX to reach $400 billion by 2027

ACCORDING to a recently published report from Dell'Oro Group, global data center capex is on track to reach $400 billion by 2027.

WE PREDICT hybrid cloud will generate data center market growth opportunities for both the hyperscale and enterprise markets

"While the cloud hyperscalers will account for half the data center infrastructure spending by 2027, significant opportunities exist on-premises," said Baron Fung, Research Director at Dell'Oro Group.

"Enterprises will continuously optimize their IT deployments, balancing workloads in the multi-cloud with those on-premises. New applications will also demand infrastructure at the edge leading to the emergence of a new ecosystem.

Furthermore, upcoming advances in new server architectures, accelerated computing, and sustainability will enable greater efficiencies in the data centers of the future," explained Fung. Additional highlights from the January 2023 Data Center IT Capex 5-Year Forecast Report:

- Worldwide data center capex is forecast to grow 11 percent by 2027.
- Macroeconomic factors may hinder near-term data center investments, although forthcoming data center architectures will stimulate long-term growth.
- Edge computing is forecast to comprise 8 percent of total data center infrastructure spending by 2027.

Public cloud means multicloud?

New research found that IT leaders use multiple cloud providers to benefit from reduced costs and more control over their data.

MULTICLOUD is the new reality in enterprise technology according to a study from 451 Research, part of S&P Global Market Intelligence, commissioned by Oracle Cloud Infrastructure. The study collected information from 1,500 respondents at enterprises—organizations with more than 1,000 full-time employees in North America or more than 500 in other regions—about how they use the cloud within their organization and found that almost every cloud journey is now becoming a multicloud journey. Read the full report here.

In recent years, cloud has become nearly synonymous with IT as enterprises seek increased business agility and improved operational efficiency from the technology they use. While these trends have existed for some time, more than 90 percent of respondents agreed that the COVID-19 pandemic has been a strong driver of greater interest and investment in cloud technology. As organizations faced new challenges such as increased levels of remote work and collaboration with new business partners and suppliers, they adopted a multicloud strategy to gain the flexibility and scalability they needed for this new reality.

“The ‘one-stop-shop’ mentality has died when it comes to the cloud. Instead, multicloud is the reality of enterprise technology environments as these organizations seek to get the right mix of solutions and capabilities they need to operate effectively,” said Melanie Posey, research director, Cloud & Managed Services Transformation at 451 Research.

“Multicloud is here to stay, and enterprises are choosing this model for the benefits it provides for a range of different business and operational requirements, like business agility or access to best-of-breed technology.” Key findings from the study include:

Almost every cloud journey is multicloud

- 98 percent of enterprises surveyed are using or plan to use at least two cloud infrastructure providers and 31 percent are using four or more.
- 96 percent reported they are using or plan to use at least two cloud application providers (Software-as-a-Service), with 45 percent using cloud applications from five or more providers.
- This multicloud strategy allows IT departments to meet the specific technology needs of different teams across the organization.

Data sovereignty and cost optimization are driving demand for multicloud strategies

- The top two drivers of multicloud strategies in enterprises are data sovereignty (41 percent) and cost optimization (40 percent).
- Other drivers of multicloud strategies include business agility and innovation (30 percent), best of breed cloud services and applications (25 percent) and cloud vendor lock-in concerns (25 percent).
- Multicloud strategies give enterprises more control over where and how their data is stored and used, while also ensuring businesses can control the costs of their cloud operations by adjusting which services they use from different providers.

Enterprise organizations are proactively planning multicloud strategies for the future

- Data redundancy (54 percent) is the most anticipated future use case, followed by data mobility (49 percent) and cost optimization across public clouds (42 percent).
- IT departments also plan to use multicloud strategies for risk mitigation for the entire IT environment (40 percent) and geographic expansion or global service delivery (38 percent).
- The fact that IT departments are planning multicloud strategies shows that they see multicloud as a way to get ahead of their technology needs, instead of simply a tactic to react to crises.

“Multicloud is here, whether enterprises are ready for it or not. Business mergers can turn even the most stable of IT strategies into a multicloud environment overnight,” said Leo Leung, vice president, OCI and Oracle Technology. “Whether IT teams are starting their multicloud plans from scratch or already have an implementation in place but want to add best-of-breed cloud services, OCI’s distributed cloud can help. With the recent introduction of MySQL HeatWave on AWS and Oracle Database Service for Microsoft Azure, customers have even more capabilities to help their multicloud strategies succeed.”

83% of CIOs must do more with less in 2023

SoftwareOne Holding has unveiled the findings of CIO Pulse: 2023 budgets & priorities.

THE STUDY, which recently surveyed 600 C-suite and IT decision-makers in the UK and USA examines how the current global economy is impacting IT priorities, revealing that despite 93% of CIOs expecting IT budgets to increase in 2023, 83% say they are under pressure to make their budgets stretch further than ever before – with a key focus on improved cloud cost management and tackling the reduction of mounting technical debt.

The survey found that 72% of CIOs admit they are behind in their digital transformation because of this technical debt, which is of particular concern as 92% of CIOs are expected to deliver digital transformation initiatives that act as revenue generators this year.

38% said the accumulation of this debt is largely because of rushed cloud migrations during the pandemic, with 31% failing to optimise their workloads before commencing the migration process.

A further 38% revealed that their organisation miscalculated the cloud budget when provisioning, which resulted in significant cloud overspend. Many organisations also still have multiple on-premises IT legacy systems and 51% of CIOs state that the complexity of legacy IT is one of the top three challenges they currently face.

Craig Thomson, Senior Vice President of Cloud and Application Services at SoftwareOne: “Businesses are dealing with an uncertain economic environment, which makes planning big IT transformations a challenge. Yet organisations need to move to the cloud and modernise legacy applications to remain competitive.

We’re seeing a real need for a combination of innovation with optimisation. Our clients are looking for pragmatic step-by-step transformation initiatives, rather than wholesale megalithic projects that can be hard to get approved when budgets are under pressure.”
The survey findings reflect this. 45% of CIOs surveyed believe having improved transparency and control of cloud costs would help them extract greater value from their cloud investments and therefore improve company buy-in. 80% plan to increase their investment in FinOps to achieve this and 39% say they will use cloud native tools to reduce licensing costs. Despite budget pressures, 82% will increase their investment in application modernisation. Security remains a priority, with 92% increasing investment in this space.

Dan Ortman, Global Practice Lead FinOps at SoftwareOne: “The next year is going to be a challenging one for businesses worldwide. The increased agility that comes with cloud computing will allow companies to better respond to these unexpected market changes. Adopting FinOps practices will help them optimise not just their spend but the processes, accountability and transparency required to get maximum value from their cloud investment. Once legacy IT is migrated and modernised, and cloud is optimised, any savings can be reinvested into innovative projects that help the IT team to achieve more with less.”

Bold leadership elevates CIOs to the boardroom

CIOs have stepped into the role of digital evangelist and strategic advisor, according to the 2023 Global CIO Survey from Logicalis, a global technology service provider. The study questioned 1000 technology leaders and explores how the role of the CIO is evolving.

This year’s survey, The Meteoric Rise of the CIO, demonstrates a monumental shift in the role of the CIO from tech implementor to business leader.

Today’s tech leaders are actively involved in creating business strategy - 41% have some level of responsibility for business strategy while 81% say they are spending more time on innovation. They are using their technology expertise to deliver innovative solutions that drive value and competitive advantage. Over three quarters (77%) are now spending more time selling ideas into the board. “CIOs are playing a leading role in orchestrating transformation and are stepping up in response to the changing industry dynamics.” says Robert Bailkoski, CEO at Logicalis. “Yet, CIOs are faced with challenges to navigate including a potential recession and talent shortages. In addition to this, they are experiencing increased pressure to deliver digital-based outcomes for their organisations, giving them more exposure to their Boards and requiring a different way of operating.”

Orchestrating transformation on the journey towards a digital-first future means CIOs are forging a new path. The four critical areas of focus for CIOs identified in this year’s report include:

- Innovation
- Strategy - 8
- Digital Transformation
- Reimagining service partnerships.

Business leaders do no trust climate claims

Three quarters of business leaders do not believe their peers' ESG reporting, according to a new study, showing that a lack of industry trust and verifiable data is driving scepticism.

MOST BUSINESS LEADERS (76%) in major industries doubt their peers' Environmental, Social and Governance (ESG) reporting, according to a new study by Inmarsat.

The findings come from a new global, independent research report Accelerating sustainable action through IoTcommissioned by the company. It explores the views of over 1,000 senior technology and ESG decision-makers across agriculture, mining, transport, utilities and oil & gas firms. The survey asked professionals about their perceptions on ESG and whether they believed data provided by 'Internet of Things' (IoT) solutions could help improve reporting transparency. Respondents also report concerns about their peers' ESG priorities, with 80% saying their competitors are more focused on perception rather than achieving tangible sustainability outcomes.

However, despite scepticism about the motivations of their peers, most business leaders have faith in their own initiatives: with 81% convinced their company is more sustainable than their competitors.

Lack of data driving lack of trust

The results suggest that a lack of verifiable hard data – and the willingness to share it – is undermining trust and slowing progress on business sustainability.

Positively, however, many believe data collected via IoT solutions is critical to building trust (81%) and improving ESG outcomes overall (82%).

Four in five respondents plan to increase their use of IoT solutions over the next 12 months to measure and understand the impact of their sustainability initiatives more accurately. A similar proportion reported they are already seeing return on investment from IoT tools used to improve sustainability (78%).

While the majority (83%) agree they could be doing more to effectively leverage IoT solutions to produce ESG data, engrained resistance to data sharing creates an additional barrier to progress. Only 47% said they would be comfortable sharing all their ESG data with third parties to improve industry reporting and benchmarking over the next 1-3 years, reinforcing that improving trust will be key to achieving better outcomes.

Satellite connectivity key for IOT

With big data at the heart of IoT effectiveness, nine in ten (91%) agree that satellite connectivity is the key to harnessing the full potential of IoT solutions focused on improving sustainability.

Currently, just over a third of respondents (36%) rely on satellite networks for IoT connectivity. However, satellite is set to become the most popular method of connectivity over the next decade, with half expecting to use it within this timeframe. IoT-enabled data is not the only way satellite technology can help improve environmental outcomes. Inmarsat's recent 'Can Space Help Save the Planet?' report revealed that the world could reach Net Zero by 2040 – ten years ahead of schedule – by accelerating the adoption of space and satellite technologies.

Networks such as Inmarsat ELERA are central to this, providing ultra-reliable global connectivity which allows data sharing in industries like agriculture, electrical utilities, mining, oil and gas, and transport.

Jat Brainch, Chief Commercial and Product Officer, Inmarsat said: "You cannot manage what you cannot measure, so it is heartening to see so many organisations looking to IoT to assess and improve ESG reporting. "To demonstrate progress, however, businesses must overcome their reluctance to share useful data and have the confidence to publish meaningful insights. Otherwise, they risk undermining genuine collaboration on sustainability and overshadowing the real progress being made.

There is no quick fix, but creating methodical benchmarks based on actionable data, and sharing the results, will play a critical role in re-establishing trustworthy ESG reporting.

"IoT is nothing without connectivity. Yet terrestrial coverage often cannot reach the remote locations where our most valuable data points frequently originate. By using satellites to close that connectivity gap, organisations can access data to make the right decisions right away. We need to make the most of that opportunity if we are to achieve Net Zero quickly."

David Hill, Executive Director, IoT Community, said: "Connected IoT solutions are the key to sourcing, analysing and sharing aggregate ESG data in a compliant and secure way. The same way we use wearable devices to measure our personal health, businesses should rely on IoT solutions more to monitor progress, reduce costs, improve safety and maximise sustainability. Robust data will back up their ESG claims and can be used for reporting across all areas of their operations, particularly in remote locations with challenging conditions. "To achieve true success, we must shift our mindset with regards to data sharing and connectivity. Once businesses become comfortable sharing their ESG insights to improve broader industry reporting and benchmarking and prioritise satellite connectivity as a key enabler, will we start to see real progress on sustainability."

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The drive towards net-zero:
The next big business disruptor in data centre operations

The global drive towards a net-zero future and the targets that have been committed to, is creating another wave of disruption that will dominate industry over the coming decades. Businesses will be forced not only by governments, but more importantly by their customers, to become sustainable.

BY ANTON MENKVELD ECOCENTRIC ENERGY

WITH DEMAND for data centre capacity set to increase dramatically, combined with the urgent need to address climate change, sustainability in data centre operations is no longer nice to have. It is fast becoming a requirement to stay in business. Data centre operators will face significant and growing pressure, not only from governments, but from their own customers and stakeholders, to prove real and tangible progress in becoming sustainable.

According to a recent survey (1) of more than 800 data centre service providers globally, 43% of multi-tenant data centres already have a comprehensive sustainability program. This number is expected to grow significantly as 2030 net-zero targets loom closer.

According to the survey, the following key factors are driving sustainability in the data centre industry: Customer demand, business value and government regulation.

Customer demand

Nearly all respondents to the survey listed customer demand as driving their commitment and investment in sustainability. This represents an existential threat to data centres choosing not to start the journey towards sustainability.

Many data centre customers now have public sustainability targets for themselves and their entire supply chain. Apple for example: “our goal is to reach carbon neutrality across our entire footprint by 2030 — including our supply chain and the energy

required to use our products. To do this, we're committed to transitioning our entire supply chain to 100 per cent renewable energy, while also ensuring that our suppliers' facilities are as energy-efficient as possible." - Apple Supplier Responsibility Website (2) Since the sustainability of a service provider directly impacts the sustainability credentials of customers, customers demand more transparency on their sustainability goals and performance.

To add to the threat of losing customers, many software savvy customers even require real-time access to asset carbon footprint data, through online portals and application programming interfaces (API). Sophisticated technology solutions are thus required to adequately address the sustainability demands of data centre customers.

Business value

The drive to net-zero represents a major disruption in the business landscape and can be compared to the rise of the Internet or smartphones. Sustainability will dominate business agenda for the next few decades and forward thinking businesses will thrive while others get left behind.

Major disruptions like these always present opportunities to businesses willing to take a different approach. The fact that survey respondents list business value as the number two driver for sustainability projects, shows the business value that can be gained from investment in sustainability.

Marketing and brand value

Strong customer demand inevitably dictates a company's overall marketing and branding message. Becoming sustainable and marketing a company as such will have an overwhelmingly positive impact on the company's reputation and brand value. Sustainable companies are seen as promoting transparency and in doing so greatly increasing brand trust.

The substantial brand value of marketing a company's sustainability efforts is clear from the many companies that now make this central to their branding message:
https://group.accor.com/en/commitment
https://www.iag.com.au/safer-communities/our-esg-performance
https://www.nextdc.com/about-us/environmental-sustainability
https://www.apple.com/au/environment/

Cost reduction

Maintenance & energy efficiency through intelligent asset monitoring
Improved monitoring of energy consuming assets will result in early fault detection, which not only reduces system downtime, but ensures that equipment uses energy optimally. This is especially true for faulty cooling equipment that might still be providing adequate cooling, but at the cost of much higher energy consumption.

Improved energy efficiency resulting from improved maintenance and operating practices could further result in reduced energy requirements. Not only does this reduce direct energy costs, but could result in the delay or avoidance of capacity expanding capital investment.

Artificial Intelligence (AI) will play a significant role in the intelligent monitoring of asset condition and performance. AI's ability to process vast amounts of data and highlight inefficiencies and equipment most in need of maintenance will allow companies to expand their operations with less reliance on staff.

Investment in innovation and new technologies
New technologies that improve energy efficiency are constantly developed and improved. Investment in technology such as innovative cooling systems and high-efficiency uninterruptible power supply (UPS) technology, can make a substantial difference to the overall efficiency of a data centre.

With rapidly rising energy costs, investment in renewable energy sources such as solar and wind can have very reasonable payback times and result in significant cost savings and carbon footprint reductions.

The drive to net-zero represents a major disruption in the business landscape and can be compared to the rise of the Internet or smartphones. Sustainability will dominate business agenda for the next few decades and forward thinking businesses will thrive while others get left behind.

Continuous equipment monitoring can assist in identifying the most urgent assets to replace and further set a baseline to verify and validate improvements and return on investment (ROI) once new equipment has been installed.

Employee Satisfaction and Retention
Today's workforce value sustainability and inclusivity highly and companies that genuinely embrace these values will increase employee satisfaction and reduce the cost related to employee turnover.

Government regulation and reporting requirements

Many governments around the world have well publicised sustainability targets and lawmakers are

increasingly acting to reduce the environmental impact of industry through regulation. The fast growing and high consuming data centre industry is directly in their crosshairs.

Data centre operators that don't comply with these regulations will face penalties and even revocation of operating licences. In addition to punitive measures, regulation will introduce significant ESG (Environmental, Social and Governance) reporting requirements.

European Union
In the EU, the Corporate Sustainability Reporting Directive (CSRD) came into effect in January 2023. This requires a broader set of large and listed companies to provide sustainability reporting, according to the European Sustainability Reporting Standards (ESRS). This forms part of the European Green Deal which strives for Europe to be the first climate neutral continent. In response to the goals set out in the European Green Deal, leading data centre operators have formed the Climate Neutral Data Centre Pact. This pact is a self-regulatory initiative committed to achieving the ambitious greenhouse gas reductions of the climate law, and leveraging technology and digitalization to -achieve the goal of making Europe climate neutral by 2050.

United Kingdom
Environmental, Social and Governance (ESG) reporting requirements have also been strengthened in the UK, with various new and updated laws being phased in from 2023. The Companies Act of 2006 was expanded in 2022 to align with requirements from the Task Force on Climate-Related Financial Disclosure (TCFD).

Large companies must also disclose the UK energy use and carbon emissions through the Streamlined Energy and Carbon Reporting (SECR). From 2023, the Sustainability Disclosure Requirements (SDR) will be introduced, becoming mandatory by 2025.

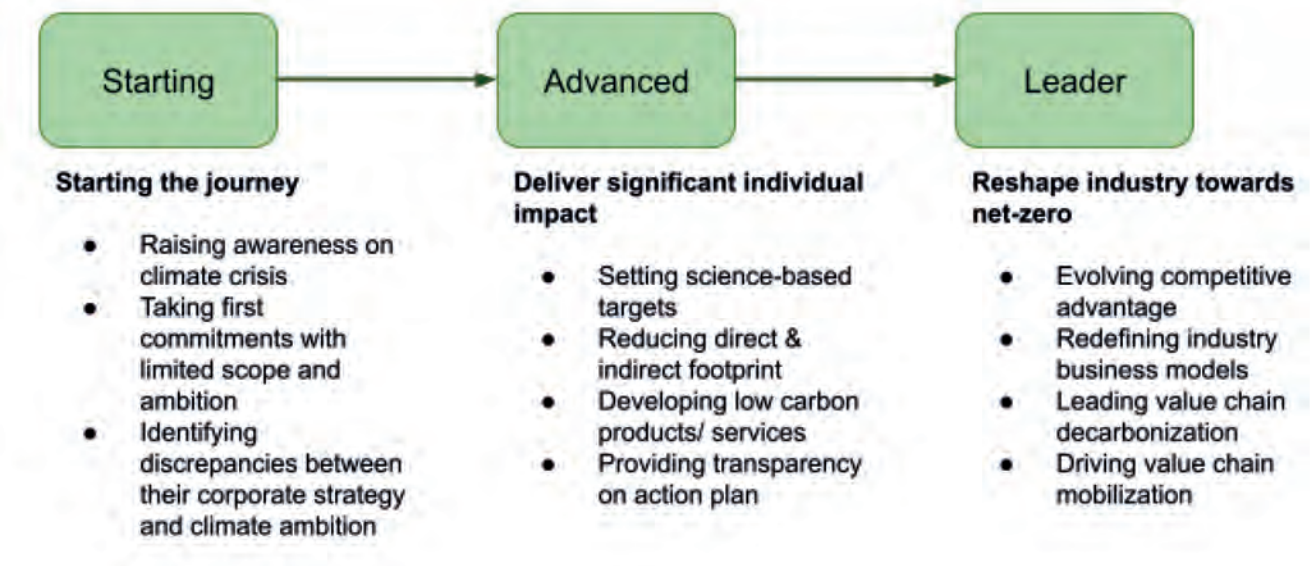
Australia
In Australia, ESG reporting is currently voluntary. Nevertheless, as noted by the 2022 Australian Council of Superannuation Investors (ACSI) annual report, many corporations in Australia, including the majority of ASX200 companies, are already doing sustainability and ESG reporting. The Australian government is likely to phase in mandatory reporting from 2024, as indicated by the government consultation paper released in January 2023. The expectation is that this will include large listed businesses and possibly also large private businesses.

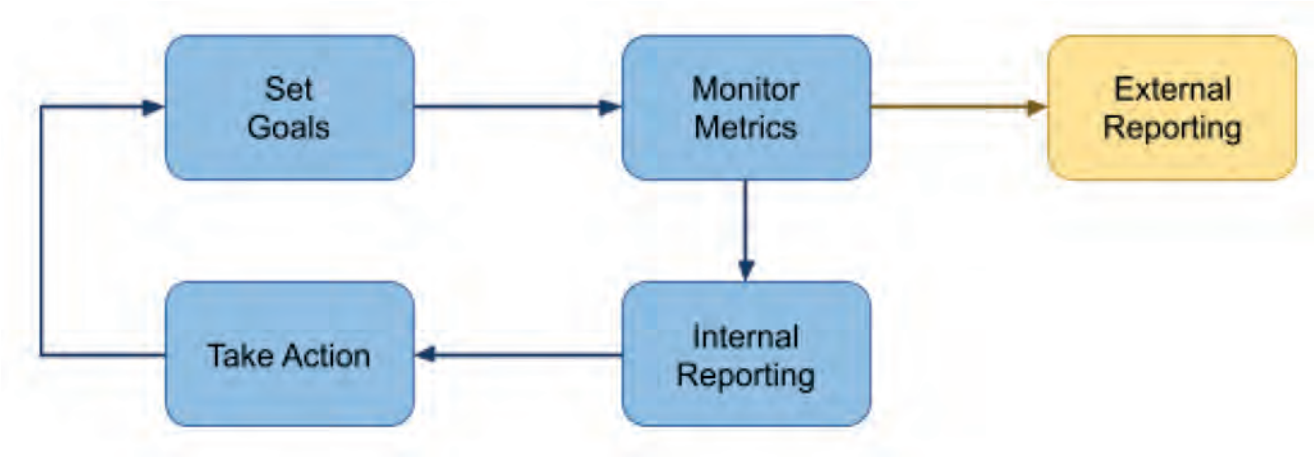
The road to a net-zero future

In their paper (3) "The road to a resilient, net-zero carbon future", the World Business Council for Sustainable Development has defined three main stages in the journey towards a sustainable future: As with all journeys, knowing where you are and keeping track of your progress is essential. Irrespective of where a business finds itself along the path to net-zero, data will underpin all sustainability efforts.

Quality data will drive sustainability

The old adage of 'if you measure it, you can manage it' is especially true for sustainability. Governments have realised this and are putting the burden of gathering and reporting data on businesses. It is widely accepted that technology will play a major part in achieving sustainability goals. Big data and AI are expected to deliver most of the solutions needed and this requires data, detailed quality data. Quality data means that data is accurate and up-to-date. It is further easy to access, search and filter and is available in multiple formats that allows further analysis and integration with other systems. Since data is such a valuable resource, it also





requires the highest levels of security to avoid unauthorised manipulation and theft.

Data in different formats, stored on local devices, media or paper and required manual effort to access, will not provide what is needed to drive sustainability.

Data Centres embarking on the journey towards sustainability must have the ability to continuously measure and report not only internally for continuous improvement purposes, but also externally for customer engagement and regulatory compliance.

The following diagram shows a typical continuous improvement cycle:

Accurate granular data that tracks individual energy sources and loads, is vital to drive this process. Technology that can reliably acquire, securely store and report this data is essential to enable this process. Innovative technology such as Numen makes it simple to install (or retrofit) the hardware that produces the data needed to drive the sustainability journey.

Since energy is just a part of the overall sustainability landscape, any energy data system must be able to be integrated into other systems that can track other aspects of sustainability such as waste management, water usage etc. and produce all the required reports automatically.

How can ecocentric help?

Ecocentric Energy's flagship product, Numen, provides a proprietary hardware and software platform that can support data centre operators in all stages of the sustainable journey.

- Accurate data acquisition system that is easy to install or retrofit
- Real time monitoring and reporting on important metrics
- Equipment level monitoring for fine grained measurement
- AI-based data analysis platform with a growing library of algorithms that produce actionable insights that results in energy and cost savings
- Equipment condition monitoring algorithms for improved energy and maintenance efficiency
- Secure cloud data storage
- Easy integration with other systems
- Web-based portal providing instant access to all historical and current data and reports
- Automating alerts and reports

Automated ESG Reporting

The cost and burden of ESG reporting can not be overstated. This is evidenced by the fact that the large audit and consulting firms (4) have all geared up to provide this service to industry, in conjunction with their current financial reporting services. Automating as much of the data acquisition and reporting as possible will not only save money, time and effort, it also allows data centre operators to make timely changes to their operations to rectify any issues, rather than wait for an annual audit to highlight these issues.

To assist with automating ESG reporting, Numen can produce the following key ESG metrics in real-time:

Energy Visibility

The ability to access current and historical data easily and quickly provides operators with much desired visibility on their energy consumption, more generally the overall performance of the facility. Numen provides a simple web-based interface that can be accessed from anywhere. The Numen console provides multiple reporting and data visualisations tools that provide a deep understanding of performance of electrical systems. The console further provides a way to do root cause analysis of failures in an effort to avoid similar failures in the future. Significant events can be bookmarked in the data and easily referred to for future analysis.

Continuous condition monitoring

AI-driven condition and performance monitoring systems are far superior to human operators. In all industries the task of monitoring the operation of

equipment is being moved from human operators to AI data analysis systems. This brings significant cost savings in personnel cost as well as improvements in operation and maintenance efficiency.

Numen offers an AI-driven device condition monitoring system that is capable of monitoring individual electrical devices with just a clip-on current transformer installed in a switchboard. The fact that no sensors are installed on plant equipment greatly simplifies installation.

In short, having continuous monitoring reduces the need for on-site staff and provides peace of mind that operations are running smoothly.

Platform-as-a-Service

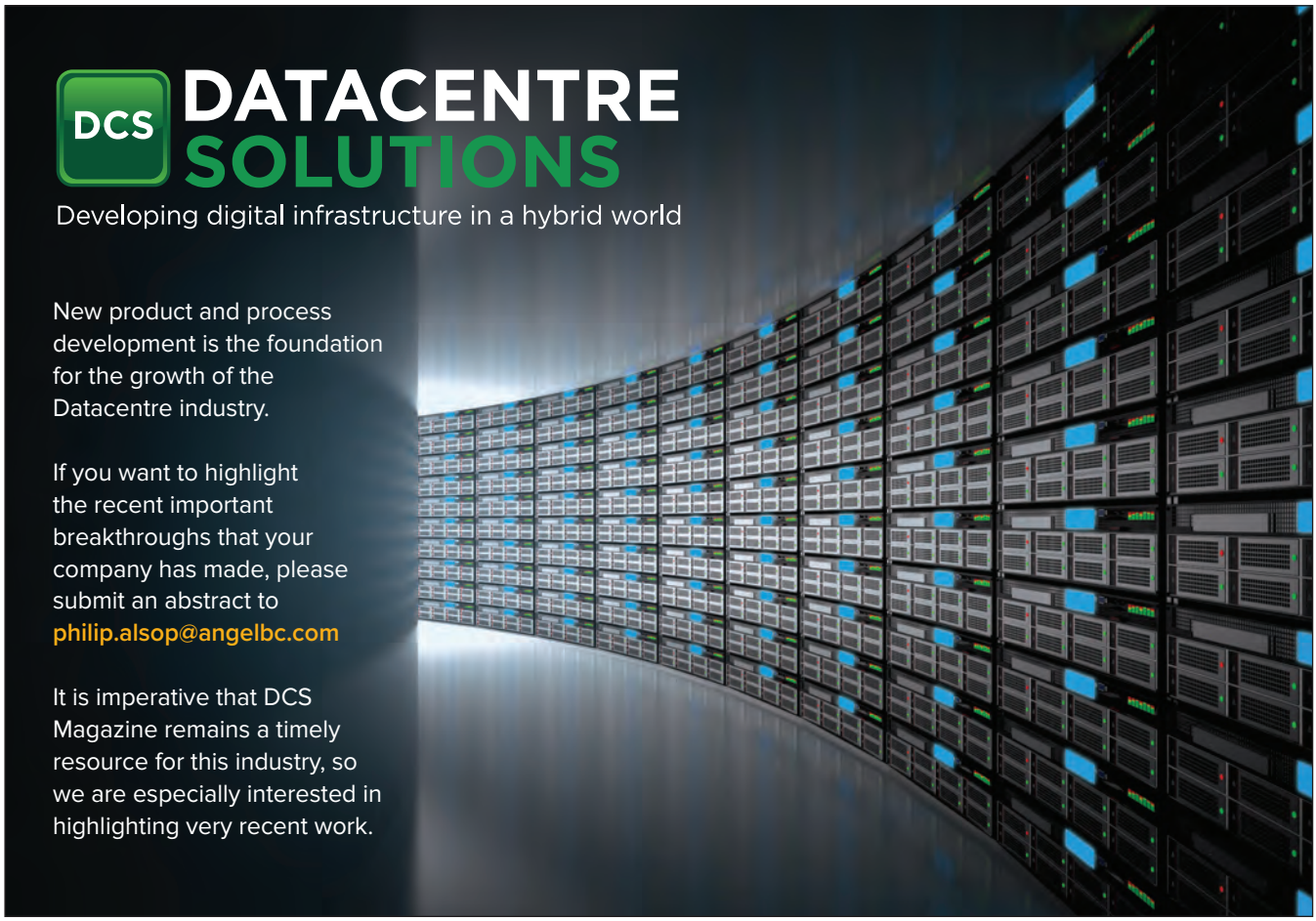
In this day and age, businesses are no longer looking to make capital purchases of monitoring equipment and having to maintain the equipment themselves. Hardware and software quickly becomes out of date and unreliable over time. Smart businesses are looking for managed services that can guarantee the operation of the monitoring system itself and rely on the output from these systems, rather than worry about hardware and software.

Numen operates on a 'Data acquisition and analysis platform as a service' business model. Under this model, Numen takes care and guarantees the operation of the monitoring hardware, data transmission, storage, backups, analysis and notifications. Systems are continuously monitored and upgraded as part of the ongoing engagement. Numen removes the headache of wondering if the data is correct and if the sensors are working.

Numen provides the peace of mind that accurate data and monitoring is always available.

FURTHER READING

- https://resources.enterprisetalk.com/ebook/Schneider-486-EN-1.pdf
- (2) https://www.apple.com/au/supplier-responsibility/
- (3) https://www.wbcsd.org/contentwbc/download/9499/144264/1
- (4) https://www.pwc.com/gx/en/services/audit-assurance/corporate-reporting/esg-reporting.html



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The challenging state of the industry

This year's Keysource State of the Industry Report, which gathers the views and insights from over 250 IT Directors in UK & Europe showed that decision makers in the sector are continuing to face a number of challenges.

BY JON HEALY, OPERATIONS DIRECTOR AT KEYSOURCE

IN LAST YEAR'S SURVEY we reported on investment in the sector as double that of the previous year and this year's activity suggests a similar trend driven by continued digitalisation, IT transformation and data growth. Advances in technologies and their applications continue the demand for highly available and flexible hosting services.

The impact of this ongoing demand for the IT decision makers we surveyed is creating a range of competing issues including security, sustainability, supply chain and skills shortages. However, this is against a backdrop of other operational challenges, particularly as IT location has become more of a consideration in the last 12 months – an increase on last year. This is being driven by geographical or edge demand and a need to access cloud services. We have seen this at Keysource when working with our customers to undertake IT transformation we are often implementing hybrid hosting models to best flex with application and user requirements.

It is also worth noting that this is echoed by our respondents whose attitude to the cloud is changing with less than half (43%) continuing to adopt cloud first strategy and a quarter finding it difficult to use the cloud for everything. In our previous survey over 86% thought one solution could meet all of their needs so there is a realisation that one size does not fit all and whilst the cloud is still a game changer it is not utopia. Concerns were also raised about cloud capacity following Microsoft's announcement in July that it is experiencing capacity shortages. At Keysource we commonly see application latency limits determine requirements for cloud on-ramp or express route services driving location and, for global organisations with a distributed footprint, inter-site connectivity becomes a major influence providing an easy platform to provide service resilience. The cost of services, now heavily influenced by local power costs, is a key secondary driver.

However, according to our survey 78% of respondents believe that their existing investments are preventing IT transformation – a figure similar to last year suggesting little or no progress in this area. Are organisations failing to understand the money savings change could bring as they are focused on the investment and/or don't want to admit they may have got it wrong? Or are they unaware of the options available to them?

It may be that in many cases this needs a complex business case which takes time to define dependencies and needs multiple stakeholders to navigate it. For example, given the high capital cost to build a data centre, where the asset is typically written down over a period of 10 years or more, writing off the value early, completely removing an asset from the books, can have an impact for the business and often introduces other considerations and other stakeholders.

For third party managed services or colocation contracts, having relatively long contract terms of 5 or 10 years hasn't been uncommon. As such, any transformation will need to factor in how best to leverage these commitments or justify the return for implementing alternatives, whilst potentially paying the penalty of early termination.

In conclusion, we are operating in a world with a rapidly expanding social and economic consumption which relies on processing, data and transfer to be both secure and sustainable, alongside a skills shortage and severe supply chain issues. As an industry we are used to change and challenges but this might be our greatest one yet.

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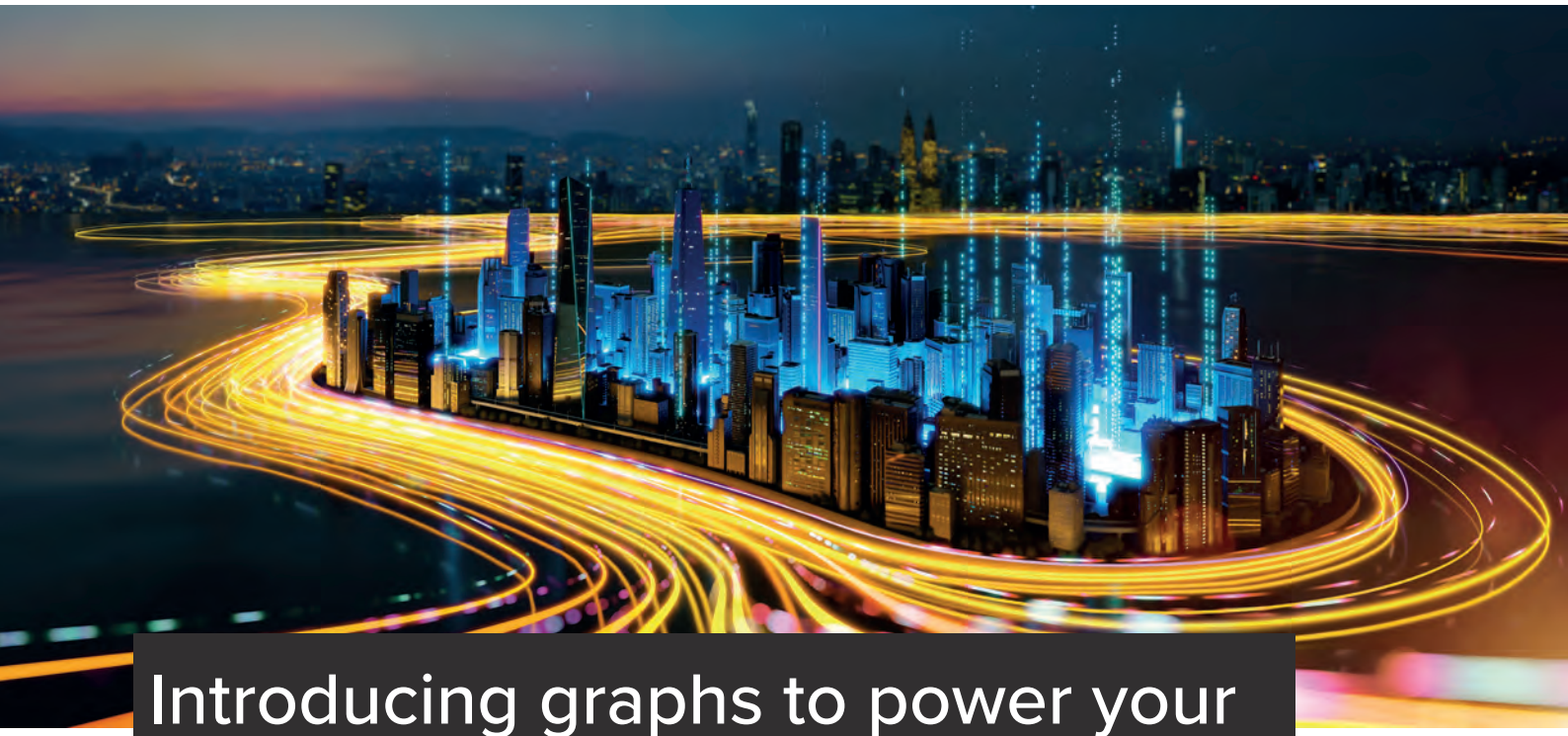


Introducing graphs to power your infrastructure, drive sustainability, and speed up innovation

Looking at how graph database technology could be a boon in supporting data centre managers.

BY JIM WEBBER, SCIENTIST AT GRAPH DATABASE LEADER Neo4j

A GRAPH DATABASE has been designed as a more agile and flexible alternative to traditional databases that rely on tables or documents. Data is stored in the same manner in which you sketch out ideas on a whiteboard, enabling users to easily process complex sets of connections and gain insights into what's happening.

Despite its apparent simplicity, a graph database is powerful and capable of handling large amounts of data. Many enterprises are leveraging this technology to fuel their intelligent applications and gain an edge in the market. For instance, graph databases are being used to detect fraud, track products through supply chains, and conduct sophisticated impact analyses on networks.Top of FormBottom of Form

Monitoring, automation and sustainability

Graph databases are rapidly gaining popularity for their ability to effectively manage dependencies and automate microservice monitoring across different platforms in the data centre. They also offer a cost-effective solution for improving scalability and optimizing performance. Furthermore, graph databases are proving to be environmentally friendly, contributing to sustainability initiatives. Their design takes up less server space, resulting in lower energy consumption compared to traditional databases. This not only benefits the environment but it also helps organizations reduce their carbon footprint and operate more sustainably.

A prime example of the challenges that can arise with data modeling can be seen in Adobe Behance, an online platform designed to showcase creative skills. Behance suffered from bloating issues with the architecture necessitating 48 Cassandra instances, 50 terabytes of data, and very high-powered machines to power the activity feed. Much of this was caused by the fanout strategy used for the activity feed. For every user, there had to be a corresponding row in Cassandra, similar to any

relational database. It's worth noting that this issue was not related to Cassandra itself, but rather a data modeling problem that could have been addressed with a more efficient data architecture.

To address the complexity, storage, and infrastructure costs associated with their activity feed, the team at Adobe Behance realized that they needed a more flexible solution. Initially, they attempted to run Cassandra on fewer servers, but this failed to meet the platform's user requirements.

Ultimately, Adobe Behance decided to switch to a more adaptable solution, graph database technology, to power the activity feed and support five new features. This solution contained approximately ten times the amount of data as the previous Cassandra architecture, but the native graph's flexibility and scalability allowed it to be deployed in production at scale. This decision enabled Adobe Behance to reduce complexity, lower costs, and improve performance, all while maintaining the features that users required. The full production version runs on just three servers for the same workload, with a huge drop in data storage, and with substantially improved functionality. In effect, a factor of 40 reduction in hardware, which has a direct positive impact on the carbon footprint.

"We cut our data store from 50 terabytes of data to 50 gigabytes producing lots of cost savings on infrastructure" explains David Fox, systems engineer at Adobe. "Our user-facing features became even more compelling because we had this new data we could easily surface and easily manage".

Before switching to a graph platform, Adobe Behance faced challenges with populating a user's activity on the fly when they signed up. However, with the implementation of graph technology this process became much more streamlined. Adobe Behance was able to connect users directly to the data stored in the database, improving overall performance.

The flexibility that comes with graph technology has allowed Adobe to innovate after the initial implementation. Adobe, for example, wanted to be able to allow users to filter projects just from people they follow. This was impossible with Cassandra because it could not query data to produce the required view. Adobe Behance was able to deliver this feature to users in just one week, leveraging the power of graph technology to provide a more user-friendly experience.

Graphs: managing infrastructure while promoting experimentation and flexibility

The move to a graph platform has led to reduced infrastructure costs for Adobe, Fox adds. Graphs have also made life easier for the team in terms of operational management and administration. As well as reducing infrastructure costs, the move to a graph platform has allowed Adobe to develop and iterate quickly.

"It has encouraged innovation because product development realises that we have this data that is already available in Neo4j and that we don't have to run a long process to migrate or figure out how to get it end-usable," explains Fox.

The project has shown Adobe that rigid data structures create a mindset and a culture of not innovating. "What happened with us is we were just trying to keep our system running and keep our Cassandra cluster functional and we lost the ability for product to say this is something we want to build on top of, this is something we want to give users", concludes Fox. This and other examples show that graphs continue to prove themselves as powerful tools in managing your infrastructure, as well as tackling the IT carbon footprint problem at the same time. Finally, graphs allow developers and operations teams the ability to focus on innovation rather than struggling to achieve tasks that are difficult or impossible with traditional database architectures.

Taking financial services to the edge

Edge computing, cloud, and AI are changing the competitive landscape for financial service organisations. In a highly sophisticated and digitally mature market, speed and efficiency have become paramount to securing an advantage in retaining customers and maximising profits.

BY PASCAL HOLT, DIRECTOR OF MARKETING, ICEOTOPE

FOR TRADITIONAL RETAIL BANKS, edge computing creates opportunities to improve customer service, reduce costs, and ensure regulatory compliance. It also enables banks to personalise their services by processing data quickly and effectively. These real-time analytics translate to bespoke value-added services that provide the customer with exactly what they need.

High frequency trading firms utilise edge computing to maximise profits on high-volume, low-margin trades. Edge computing brings computation and data storage closer to where the data is being generated. Reducing latency issues can help a firm gain a competitive advantage in high-speed order execution.

Defining the edge

The edge is the physical location where things and people connect with the networked digital world and it's changing the way we process data. We are moving towards a more interactive world. Data is no longer merely being pushed towards us on our devices, but rather it's being collected or "pulled" from our interactions with Internet of Things sensors we encounter in our daily lives.

As a result, the data centre is rapidly changing to no longer be the centre of data. The need to handle, manipulate, communicate, store and retrieve data efficiently is moving processing capacity closer to the user than ever before. This phenomenon is known as "data gravity" and draws the physical location of digital infrastructure closer to the data source itself. This creates a new set of challenges – and opportunities – for financial service organisations.

Changing the competitive landscape

Financial firms are not only adopting cloud-based technology to deliver a much better service for their clients, but they are doing so to remain relevant. Artificial intelligence (AI) is one such example. For processing simple, repetitive tasks or extracting insights from large amounts of data, AI applications, in combination with edge computing, have the power to create significant competitive advantages. Management consulting firm, McKinsey & Company, estimates that AI technologies could potentially deliver up to $1 trillion of additional value each year for global banks. They found that AI could "help

boost revenues through increased personalization of services to customers (and employees); lower costs through efficiencies generated by higher automation, reduced errors rates, and better resource utilization; and uncover new and previously unrealized opportunities based on an improved ability to process and generate insights from vast troves of data."

A more personal customer experience

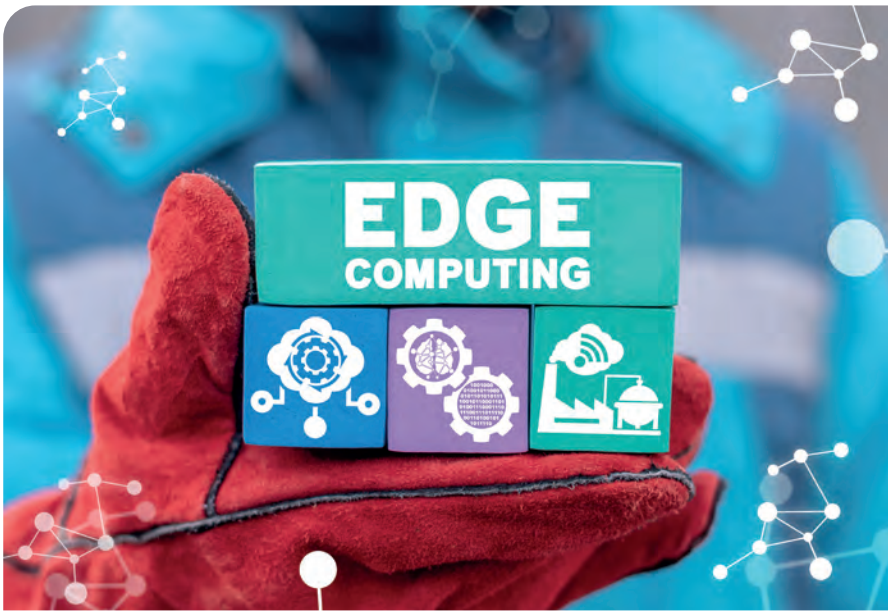
Technologies like AI, machine learning (ML) and natural language processing (NLP) utilise the cloud but require edge computing for processing data closer to where the data is generated. For traditional retail banking firms, that creates an opportunity to improve customer service while reducing costs.

Going back to our "push" vs "pull" discussion, retail banking has historically been very much in the push category. All customers are given the same product information, regardless of whether it is relevant to them or not. With edge computing, the data gathered helps the bank better understand individual financial needs enabling them to customise advertising and product offerings accordingly. HSBC is taking this type of customisation one step further with Pepper, a semi-humanoid robot, operating in several branches in the US. Pepper uses NLP to interact with customers. The data intelligence needed for Pepper to successfully and beneficially engage with human customers also requires real-time, low-latency analysis of large quantities of data. All of which is easily served through edge computing.

While Pepper may be a fun way to engage with customers, there are plenty of other use cases for edge computing in banking and financial services. Security and fraud detection/prevention is critically important as unauthorised financial fraud losses across payment cards, remote banking and cheques totalled £360.8 million in H1 2022, according to UK Finance. There is also a significant regulatory burden on modern banking and edge computing enables real-time monitoring of compliance to those regulations required by law.

Challenges ahead Many banks have net zero targets they are trying to achieve by 2030. The Big Six US banks have announced a variation of carbon neutral and net zero plans in the last two years. In addition, the UN-backed Net Zero Banking Alliance is bringing together more than 100 banks from 40 countries to align their lending and investment portfolios with net-zero emissions by 2050.

From a data centre perspective – whether that be in the cloud, on-premises, in colocation, or at the edge – technology solutions are available today to help achieve these goals. Advanced liquid cooling solutions can achieve a 1.03 PUE or below. Precision immersion liquid cooling, for example, captures >95% of server heat inside the chassis, significantly reducing energy costs and emissions associated



with server cooling. Water consumption is negligible as little to no mechanical chilling is required.

Beyond sustainability, there are some unique considerations for edge computing. IT computing loads are usually required to operate reliably in locations not built specifically for IT equipment. Whether it is indoors around people or in harsh external environments, the equipment needs to be purpose built for edge computing. With precision immersion liquid cooling, the sealed chassis form factor provides the same kind of protected environmentally controlled conditions found in a data centre facility. It is also designed to withstand all types of IT environments with minimal impact on its local surroundings.

Edge computing is just starting to make an impact on the financial services industry. As technology continues to improve customer service and increase competitive advantages, it will become more important than ever for organisations to have the right solutions in place to enable those opportunities. Many of these applications are pushing the limits of existing technologies and opening the door to new alternatives. Now is the time for organisations to take a bold step and embrace these new technologies.

Going back to our "push" vs "pull" discussion, retail banking has historically been very much in the push category. All customers are given the same product information, regardless of whether it is relevant to them or not

Three ways to improve data centre sustainability

Data centers have proactively taken it upon themselves to become leaders in reducing emissions, and are well-positioned to continue meeting the increasingly stringent environmental demands of investors, consumers, and regulatory agencies in the years to come.

BY TIM HYSELL, CEO, ZINCFIVE

IN TODAY'S information and technology-driven economy, data centers are fundamental to maintaining the day-to-day operations that keep businesses, organizations, and governments running. They act as centralized information hubs and enable the storing, processing, and dissemination of data and applications — vital to the operational continuity underpinning contemporary economic growth.

The intense processing power behind data centers inevitably means that they demand significant energy resources and produce heat waste. In fact, data centers are so energy intensive that they account for 2.4% of global electricity usage and 0.5% of greenhouse gas emissions (GHG) in the United States, which contains more data centers than any other country.

The outsized environmental impact of data centers has garnered increasing attention in recent years as businesses face growing pressures from investors, consumers, and regulatory agencies to integrate sustainability into their operations, and the industry is responding.

For many organizations, data centers comprise a significant portion of their overall emissions (either scope 1 or 3, depending on ownership), making the issue quite salient.

The good news is the variety of ways in which data centers can upgrade their facilities to meet evolving pressures, hedge against uncertainty, and become more sustainable, efficient, and highly cost-effective. Effective methods include optimizing airflow dynamics, adopting modular design, and switching to alternative battery technologies like nickel-zinc.

Optimizing cool airflow

The industry-recognized optimization standard for data center infrastructure ("hot aisle/cold aisle") was pioneered in 1992 by IBM's Robert Sullivan — an internationally recognized engineer — and remains a practical way of boosting existing cooling technology without needing additional capital investment. In this specific configuration, cabinets containing processors are placed so that the front of one will never face the back of another, where heat exhaust escapes.

Rearranging a data center in this manner effectively creates alternating rows of cold supply and hot return air, reducing energy usage. It's also important to reinforce the separation of alternating aisles with physical barriers that seal off gaps for air and to clear airflow obstructions — often poorly placed cables — from intake and exhaust openings. Doing so will deliver the highest-quality airflow dynamics, guaranteeing reduced energy costs, improved corporate sustainability metrics, and greater operational reliability.

Another economic — albeit geographically and logistically restrictive — way data centers can optimize their airflow is by making use of free air cooling. As the name suggests, free air cooling is a process whereby external ambient air temperatures are used to cool data centers' processors via heat exchange. The caveat of this cooling method is that it's location-dependent — and many of the most attractive places for data centers to locate (i.e. big tech hubs) don't have the required climatic conditions.

Mountainous and some northern hemisphere regions are especially effective for free air cooling, as they boast low and stable temperatures year-round.

Modular data centers

A recent survey of data center executives revealed that over half have already deployed modular data centers, and 99% plan to in the future. Made from prefabricated units and preconfigured equipment, prefabricated modular data center systems (PMDCs) can be deployed in a much wider array of locations than traditional facilities, and offer multiple benefits: reduced costs, faster construction, greater customization, and easier scaling of the data center's equipment and systems over time.

PMDCs' ability to add and replace components as needed provides several environmental benefits. Since they don't need to be designed on a massive scale on location, they generally have smaller footprints, more efficient power and cooling options, and the ability to easily replace equipment with more climate-friendly alternatives such as nickel-zinc batteries. Some modular data centers can even be built in existing buildings, lowering the construction footprint even further. As the survey shows, data center operators plan to take full advantage of modular designs' financial and environmental benefits in 2023 and beyond.

Sustainable backup batteries

Batteries comprise an integral part of information technology but are often overlooked when it comes to a data center's sustainability directives. Since even a few seconds of data center downtime can disrupt operations around the world, uninterruptible power supply (UPS) systems are essential to maintain uptime during a power outage. These UPS systems must contain backup batteries, which present a key opportunity for contributing to sustainability goals.

For example, because nickel and zinc are four and five times more abundant in the Earth's crust than lead and lithium, and boast more sustainable mining processes, nickel-zinc batteries have six-times the GHG avoidance compared to lithium-ion, and four-

times relative to lead-acid. They also reduce overall water usage, eliminate volatile organic compounds during manufacturing, and are non-flammable.

Additionally, nickel-zinc allows for higher operating temperatures, offering reduced cooling requirements and resulting in energy savings. In many cases, the UPS is rated to operate at up to 104°F (40°C) or higher, but the battery operating temperature limits the ability to increase temperature and reduce cooling costs in that space. Fortunately, nickel-zinc can tolerate higher temperatures, thus providing an opportunity to reduce cooling costs and improve Power Usage Effectiveness (PUE) and sustainability.

Unsurprisingly then, nickel-zinc batteries have achieved the highest climate rating of 9.4/10 according to Boundless Impact Research and Analytics' analysis of environmental and performance-based factors for battery chemistries commonly used in data centers. This is one of a few key reasons why Corscale recently announced that it will make use of nickel-zinc chemistry in its uninterruptible power supply system.

Conclusion

As major consumers of energy around the world, data centers have proactively taken it upon themselves to become leaders in reducing emissions, and are well-positioned to continue meeting the increasingly stringent environmental demands of investors, consumers, and regulatory agencies in the years to come.

Though it's not a silver bullet solution, the positive economics of airflow optimization, modular design, and alternative battery chemistries offer impactful, accessible, and low-risk ways of improving data center sustainability.

As major consumers of energy around the world, data centers have proactively taken it upon themselves to become leaders in reducing emissions, and are well-positioned to continue meeting the increasingly stringent environmental demands of investors, consumers, and regulatory agencies in the years to come

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Climate crisis: How data centre operators can keep their cool

There is no time to waste when it comes to coping with climate pressures.

BY CINDY RYBORZ, MARKETING MANAGER DC EMEA, CORNING OPTICAL COMMUNICATIONS

2022 was a year in which record temperatures were documented across the world but you'd be forgiven for missing some of the wide-ranging impacts. This included a notable effect on the data centre market, with centres from both Google Cloud and Oracle shutting down due to cooling failures during an extreme UK heatwave.

For data centre operators, unfortunately, this threat is only going to become more severe. Not only as a result of the deepening impact of climate change but also because of the energy consumption of data centres as well as the need to meet rising bandwidth demand. As data centres evolve to manage increased speeds such as 400 or 800G, they will need to deploy higher speed transceivers that generally use more power. And, considering what we know of pluggable transceivers, higher speed equals more heat dissemination and so even more cooling needed at the back of it.

These data rates may seem a long way off for some, but with the pressures of climate change that are here right now, becoming more resilient to soaring temperatures is simply a non-negotiable for data centre operators. Let's take a look at some of the ways in which that can be achieved.

Smart choice of location

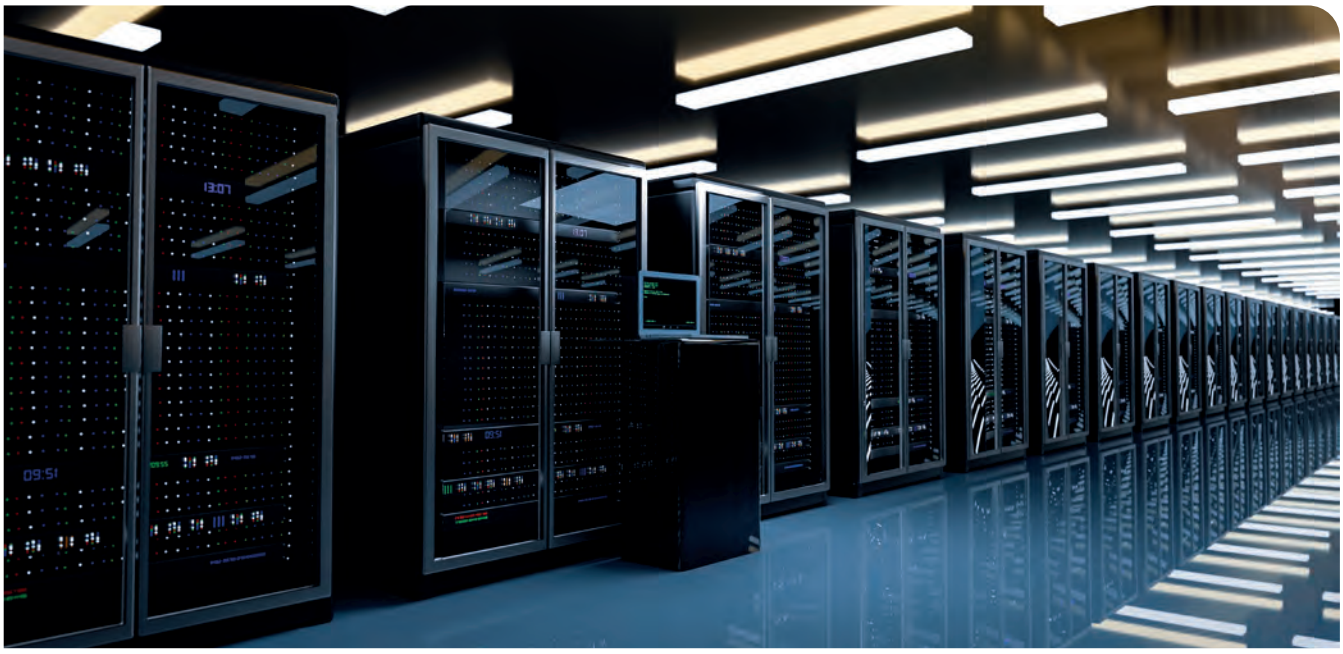
If looking to relocate or perhaps invest in a new or additional data centre, then exactly where you decide to do it can be impactful. It's particularly key to avoid building at locations where the energy grid is already struggling to support and the risk of outages already exists. While this won't be an option for every deployment, it's interesting to see some of the more extreme examples of how the surrounding environment can be utilised for natural cooling.

A few years ago, one of our customers, Green Mountain, built a data centre inside a mountain on an island in a remote Norwegian fjord. The 21,000 square metre facility with six mountain halls and several dedicated customer rooms utilises 100 percent renewable hydroelectric power and the efficient cooling of the adjacent fjord to provide a power usage effectiveness (PUE) of less than 1.2 – well below the industry average at the time.

Facebook even has a data centre in Luleå, the North Pole that utilises the region's sub-zero air and sea temperatures and has a PUE of just 1.07. At the opposite end of the scale, some operators have built data centres in desert environments, such as eBay in Phoenix. Clever cooling systems and the benefits of the dry desert air make these locations surprisingly effective – and safe from any potential natural disasters such as flooding.

Achieving higher density

There is of course also a number of smaller, more accessible approaches that can be taken by data centre operators to support cooling. Things like choosing the right products to enable better air flow and minimising cooling, as well



as selecting equipment with higher port density to maximise the energy usage of racks.
Higher density can be achieved with Very Small Form Factor connectivity (VSFF), as an example. MDC and SN connector formats promise the possibility of connecting directly from one high-speed transceiver to another transceiver, simplifying the insertion of individual connectors into various switches, breaking out from 400G to 4x100G. In addition, up to three MDC or SN duplex connectors fit into the footprint of an LC duplex, which provides an enormous density advantage.

For operators struggling with reduced space in server racks, implementing LC duplex connectivity with LC to MDC patch cords and compatible hardware is an effective approach. And it's one that can be used for active equipment or to add connectivity for further customers generating additional revenue streams.

This approach will not only allow the LC duplex footprint to be retained at the transceiver end but the port density with MDC in modules or cassettes of the same size can also be increased by up to 3x – imagine the possibility of having 432 instead of 144 fibres in one rack-unit.

When it comes to enabling better air flow, take Altice Portugal for example. The telco was struggling with increased cable density as part of its growing network which led to hotspots inside its server racks. Add climate change to the equation and these areas would become even hotter and have a devastating impact on operations if not resolved. Fortunately, when the team upgraded from a duplex system to a 12-fibre based structured cabling system, the hotspot issues were no longer a concern and the data centre also benefited from improved efficiency and flexibility while being futureproofed for further upgrades.

Port breakout applications

In addition to optimising cabling infrastructure, port breakout applications can positively influence the power consumption of network components and transceivers too. The power consumption of a 100G duplex transceiver for a QSFP-DD is about 4.5 watts, while a 400G parallel optical transceiver operated in breakout mode as four ports with 100G each consumes only three watts per port. This equates to savings of up to 30 percent, notwithstanding the additional savings in air conditioning and switch chassis power consumption and their contribution to space savings.

With port breakout applications, data centre operators can also triple the port capacity of a switch card operating in a 10G or 25G network and no conversion modules or harnesses are required, meaning no need for any extra connector pairs that can impact insertion loss.

Prevention better than cure

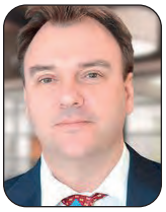
Of course, there are many thermal management tools and solutions out there for data centres, from hot and cold aisle layouts to pumped refrigerants, liquid cooling and edge and cloud technology. The question is – do they go far enough to deal with climate change? There are further cooling technologies on the horizon that utilise artificial intelligence and robot sensors, so it is true that innovation in this space is ongoing.

Unfortunately though, there is no time to waste when it comes to coping with climate pressures. Particularly when that is combined with increasing demand for higher bandwidths. Data centre operators simply can't afford to wait for a heat-related outage before taking action. As the saying goes – prevention is always better than the cure and there are big and small changes that data centre operators can be making now to increase contribution.

Fuel cell use in data centres: How much do you know?

Despite the evidence of numerous data centres piloting fuel cells, as well as predictions for strong growth of the technology in data centre applications, actual use remains low.

BY ED ANSETT, FOUNDER AND CHAIRMAN, I3 SOLUTIONS GROUP



THE INDUSTRY needs a greater understanding of fuel cells to drive wider adoption of a technology which could accelerate the effectiveness of the sector's GHG Abatement efforts.

The potential of fuel cells is one answer to cutting the greenhouse gas emissions associated with powering data centres was a recurring conversation topic across the industry in 2022. It looks like a debate which is also set to continue in 2023.

However, the year 2022 may yet turn out to have been pivotal for hydrogen fuel cell for backup power and even primary data centre power uses. Across the world, there was positive news about hydrogen fuel cells as a cleaner alternative, such as that provided by Microsoft.

As part of its data centre advanced development strategy, the technology giant ran a proof of concept in Latham, New York, where dual 40ft containers housing proton exchange membrane (PEM) fuel cell technology ran at 3MW capacity to provide emission free power for around 10,000 data centre servers. The story is fully documented in Microsoft's case study.

In September, it was reported that Equinix and the National University of Singapore are to test hydrogen fuel cells as a power source for data centres in the city-state. According to an article published by DatacenterDynamics, the plan is to run a comparison between hydrogen fuel cells and "fuel flexible" linear generators, which can run on hydrogen, or else shift to other renewable fuels such as biogas when necessary. In February 2022, The Register reported that Dutch Data centre business NorthC was to replace its backup power generators at the company's facility in Groningen to run on green hydrogen, claiming it was a European first for

data centre design. The 500KW fuel cell module will run on hydrogen created by renewable power. Recent analysis by Emergen Research, a market research and strategic consulting company, says "the fuel cell market size reached USD 4.26 Billion in 2021 and is expected to register a CAGR of 22.8%." The company cites growing demand for fuel cells for backup power in data centres as one of the key factors driving growth.

In addition to their high efficiency, low carbon footprint and ability to provide reliable power, hydrogen fuel cells also appeal because they can help data centres save money by reducing the amount of energy wasted during the power generation process, say Emergen. More details of their Fuel Cells Market Report can be found on the Emergen website.

Gaining an objective view of Fuel cell applicability in data centre applications

The above examples provide a flavour of the news coverage and broader discussion around fuel cells. For those in the data centre industry who wish to explore the potential of fuel cell use, i3 Solutions Group has produced a white paper entitled: "Assessment of Fuel Cells Application in Data Centres for Greenhouse Gas Abatement Benefits." This publication provides a high-level perspective on the application benefits of and challenges to fuel cell use for data centre backup and primary power. It provides a simple description of fuel cells by operation and type, as well as detailing the different fuel cell types suitable for use in data centres. Details of primary and backup power configurations are also provided.

"Assessment of Fuel Cells Application in Data Centres for Greenhouse Gas Abatement Benefits" explains the sustainability benefits of fuel cell technology in terms of emissions abatement, reduced transmission losses and potential for heat reuse. It also includes a comparison of the Sustainability Performance Indicators of some Fuel Cells versus traditional Gas Turbines and Combined Cycle Gas Turbines (CCGT), with Natural Gas as the common fuel.

From potential to production

Whilst the white paper indicates there are many clear sustainability advantages to be gained by using fuel cells for data centres, actual adoption today remains low. This may in part be due to perceptions held by the industry about fuel cells, from concerns about reliability and availability, to those regarding fuel supply and the cost of ownership.

However, fuel cells are projected to achieve cost parity with diesel generators in data centres, partly driven by the higher adoption of fuel cells for transportation applications. More widespread use in other sectors will help inform and educate regarding fuel cell technology, driving improvements to the technology, and providing the economies of scale associated with higher volumes such as reductions in the cost of key components and manufacturing. To further reduce carbon emissions and GHG abatements, pure hydrogen fuel cells have been developed. And as per the examples detailed above, hydrogen fuel cells are being piloted and tested as replacements for diesel generator backup power in data centres.

However, if fuel cells are truly to move from potential to production in data centre industry, overcoming the challenges identified in "Assessment of Fuel Cells Application in Data Centres for Greenhouse Gas Abatement Benefits" could be key to the more widespread use of fuel cells for further GHG abatements throughout the sector.

Four questions to ask your cooling solution provider

There are several competing cooling technologies on the market, but to find the most sustainable solution, you need to look beyond efficiency and ask the right questions of your cooling solution provider.

BY CARL TURBITT, HVAC DRIVES UK SALES MANAGER, ABB

IN 2021 it was estimated the world's estimated energy consumption was 20,000 TWh. Of this, data centres consu-med just under 200 TWh – one percent of all energy usage. Data centres alone account for 2.7 percent of the EU's total energy consumption. These figures are set to rise significantly in the coming years as more facilities come on-line. Indeed, it's reported that energy demand for data centres is predicted to increase by nearly eight times by 2030, feasibly putting it on a similar level to the aviation industry in terms of fuel emissions. This is clearly un-sustainable.

Around 40 percent of energy consumed by a data centre is used for cooling. Fans and chillers are responsible for around a third of this consumption, making them a prime candidate for efficiency improvements. Not only could this significantly lower the carbon footprint of the data centre industry, which has already outgrown that of many countries, but also it could make a substantial difference to operating costs.

For cooling fans in air handling units (AHUs), there are two main competing technologies: electronically commu-tated (EC) fans, and motor + standalone variable speed drive (VSD) arrangements. An EC fan is a self-contained as-sembly comprised of an electric motor, VSD, and fan, all integrated into one

package, while a motor and VSD are in-stalled and maintained as two separate devices.The two options are arguably very similar, with the drive providing precise control over the motor's speed based on actual demand. As such, both technologies can significantly reduce energy usage compared to a fan running without any form of speed control.

Fans, along with pumps, are typically variable torque applications, and take advantage of affinity laws. In practice this means that reducing the speed of a fan by 20 percent, corresponds to a 50 percent reduction in energy con-sumption. Both EC fans and motor-drive packages can both achieve energy savings in this way.

When looking for an effective data centre cooling solution, it can be tempting to go with the cheapest upfront op-tion, which may well be an EC fan. However, to look at price alone is to miss the wider picture. Moreover, what a fan manufacturer tells you about the efficiency of their product may not be the whole story. Here are four questions you should ask your cooling provider before you specify.

What's the whole life cost?

EC fans are often cheaper based on upfront cost or capital expenditure (CAPEX) alone. However, when we also consider operating expenditure (OPEX), and therefore the Total Cost of Ownership (TCO) over the lifetime of the asset, the proposition changes somewhat. In an EC fan, the motor and drive elements are an integrated solution, which can create problems with heat dissipation. While having one self-contained device may seem convenient on the face of it, this can actually lead to the breakdown of electronic devices within the variable speed drive and the insulation of the motor, which are typically the most common points of failure. With a motor-drive package, both motor and drive can be situated separately, resulting in less heat accumulation, resulting in a longer lasting sustainable solution, and lower failure rates.

> In a motor-drive package, if either the motor or drive fails, it can typically be replaced off the shelf with a similar product from any major manufacturer, as many drives and motors from different vendors can be used interchange-ably. This potentially means less downtime, and greater choice

Another aspect to consider is the load profile, or how the fan is actually run on a day-to-day basis. EC fans can deli-ver good efficiency levels at peak loads, but in reality 99% of all fan applications – including data centre cooling sys-tems – rarely run at peak loads, and only then in worst case scenarios. Conversely, a motor-drive arrangement tends to perform better at partial loads, which is typically how it will operate for the vast majority of the time. Ultimately this means you will have to replace your motor and/or drive much less often, creating a more sustainable solution with lower whole life cost.

How easy is it to replace?

We have already established that due to heat dissipation, EC fans can be more susceptible to failures, and therefore require replacement more frequently. However, replacing an EC fan can also create problems. EC fans are typically custom-made to order for a specific application to a particular size, and as such will not always be sized to traditio-nal IEC dimensions. In the event of a failure, this means they must be replaced with a array of the exact same dimen-sions, and with a similar output. Sourcing such a replacement can be a challenge, particularly against the backdrop of long lead times and supply chain delays.

In a motor-drive package, if either the motor or drive fails, it can typically be replaced off the shelf with a similar product from any major manufacturer, as many drives and motors from different vendors can be used interchange-ably. This potentially means less downtime, and greater choice.

How sustainable is it?

The majority of AHUs, particularly in data centres, are large and require multi-fan arrays. EC fans are only available as multi-fan arrays, but this might not be as convenient as it seems. Each fan in the array will have its own drive (or a combination of commutation electronics), irrespective of how many motors or drives are actually required. A se-parate VSD can in fact control multiple fan motors simultaneously, saving large amounts of space.

A motor-drive package can also deliver much more power compared to an EC fan. EC fans are only capable of delivering up to 5.5 kW each, and so any cooling system will require lots of them to reach required airflow levels. Because of this, EC fans are often overspecified, and require additional overload protection per unit as well as communications gate-ways in order to be controlled over protocols such as BACnet and modbus adding additional cost and test points.

A motor-drive arrangement on the other hand can go up to 250 kW without breaking a sweat, providing more power with less complexity, and fewer devices to have to maintain and/or replace when the time comes. There are also multiple options available, including single drive and motor, multiple drives and motors, or a combination of both to best suit the application.

What's the harmonic situation?

Harmonics are not a widely understood concept outside of electrical engineering, yet they can be a big issue for data centres. Harmonics are disruptions to the voltage and current waveforms caused by introducing non-linear loads to the grid.

The majority of electronics that have a power supply will generate harmonics to some extent, but often only in very small amounts. However, when you have a building full of these devices, the level of harmonics on the grid can quickly accumulate.

Excessive harmonics results in nuisance trips and malfunctioning equipment, as well as reducing system efficiency. It also generates heat, which can lead to premature equipment failure, as well as creating more work for the cooling system itself. Like many electronic devices, both EC fans and VSDs generate harmonics.

However, while modern VSDs have built-in mitigations, EC fans may not dependent on the offering. This is an important question to ask when requesting a solution, as it is not something that you would want to leave to chance. It may also require the use of additional har-monic filters at an additional cost later down the line. ABB's Ultra-Low Harmonic (ULH) VSDs on the other hand use active front end (AFE) technology to not only ensure optimal performance where harmonics are present on the grid, but also mitigate them at source, reducing harmonic content by up to 90 percent compared to conventional VSDs.

In summary

EC fans certainly have their place. For small single cell applications operating at peak loads they can provide an effi-cient cooling solution. However, for facilities like data centres, which require vast amounts of cooling, they may not be able to provide everything you need for an effective, reliable and sustainable solution. When you consider what you really need from your cooling system, a separate motor-drive package can often be the more cost-effective and sustainable option, with reduced whole life cycle costs.

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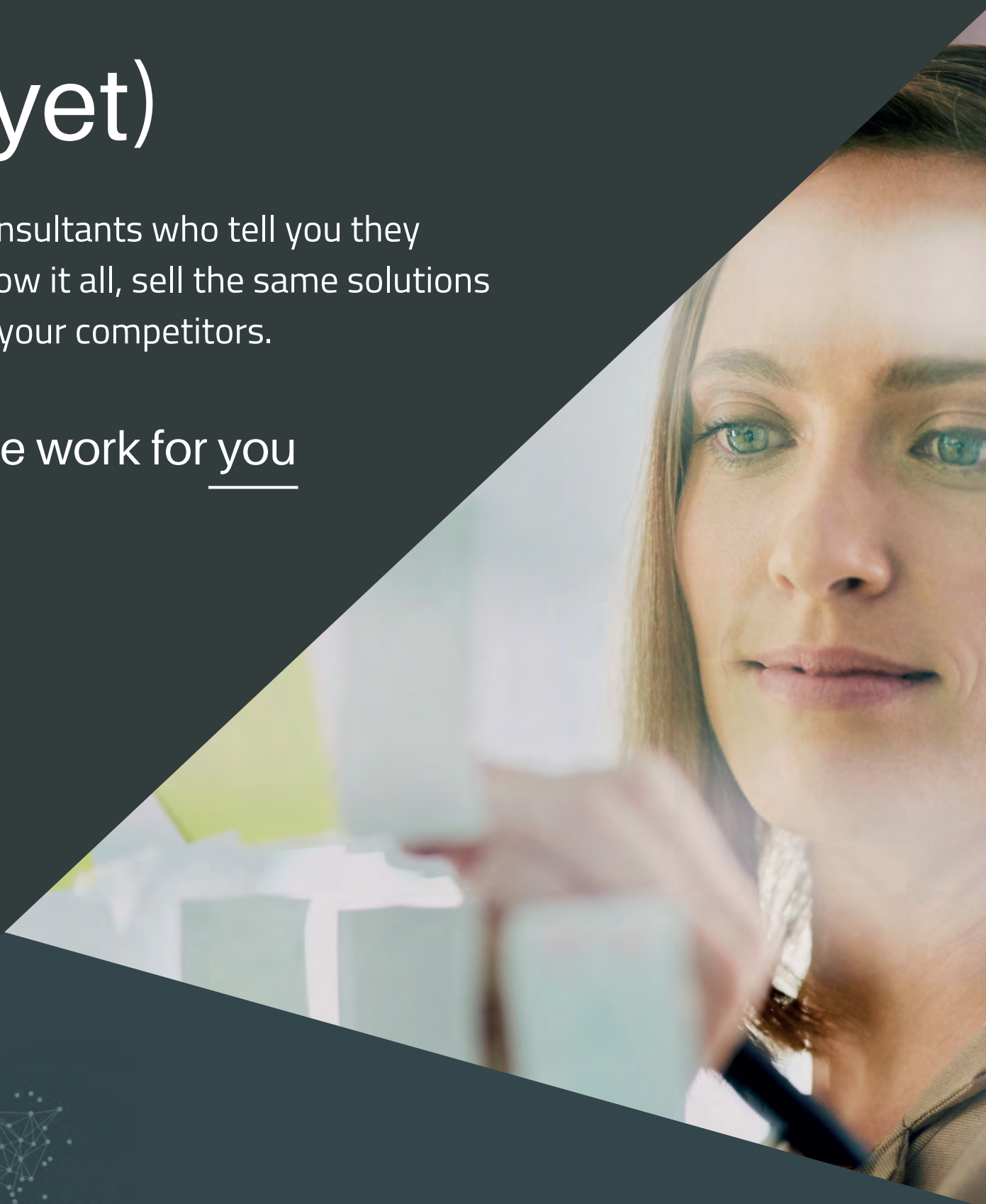

BCS. is a digital built asset consultancy.

What will 2023 bring us?

It looks like 2023 will be an interesting year for our sector with some old and some new challenges and opportunities.

BY JAMES HART, CEO AT BCS

IT SEEMS that despite concerns around recent global events and the subsequent inflationary pressure on power, materials and labour costs, there has been no adverse effect on growth in the data centre sector which continues to remain buoyant. The demand is still growing and shows no sign of stopping – but this brings its own challenges.

Costs will drive standardisation

With further rising inflationary pressures forecast, it seems inevitable that prices will have to rise to cover costs. This is in part due to adverse developments on the gas market, the risk of shortages and the impact on energy costs, especially in the winter of 2022-23.

We are also seeing the need for tight cost management driving standardisation which is ranging from modular components, such as power and cooling modules and skids, to full-fledged prefabricated facilities. I believe that this will become the default approach not just for the enterprise, but also hyperscale and the edge of the network.

Renewables

The geo-political uncertainty has forced governments across EMEA to acknowledge that they can no longer rely on traditional energy sources so the drive for energy autonomy through renewable/green sources will accelerate as there is no choice if economies are to grow.

Replacements for diesel such as HVO will continue at a pace as will investment in alternatives in back-up systems such as hydrogen cells. The increase in high density computing will necessitate liquid cooling systems on high density racks as it is 3000 times more efficient than air; and the recovery of waste heat for the use of community projects/district heating schemes will increasingly become the norm as the whole field of energy storage develops at a pace including grid scale and flow batteries to make the most of renewable energy sources. We will also

see AI and automation will be used in controlling environments to increase efficiencies in power usage.

Self-regulation or regulation

There is no doubt that a positive impact of rising costs is the acceleration of the uptake of alternative power sources and ever more efficient design solutions. The average hyperscale facility consumes 20-50MW annually, theoretically enough electricity to power up to 37,000 homes. Something must change but can the industry be 'trusted' to do this? With ambitious targets to be achieved by 2025 and 2030 under the green deal, it begs the question that if our sector doesn't get ahead of these targets, will the self-regulatory initiative become legislative and regulated? Our sector is at a crossroads with one route being proactive, investing in new technologies, self-generation and looking at innovative storage solutions to reach climate neutral targets. The other route is having legislation and regulation imposed on us and having to react to the imposition of energy, water and emission targets that we have no influence over.

I believe some form of regulation will be inevitable and we are seeing soft regulation on a day-to-day basis through planning, permitting and power availability. The industry will continue to take steps to self-monitor and moderate – including an increasing preference for environmentally-friendly thermal designs, but I fear the year will also see increase in regulatory oversight.

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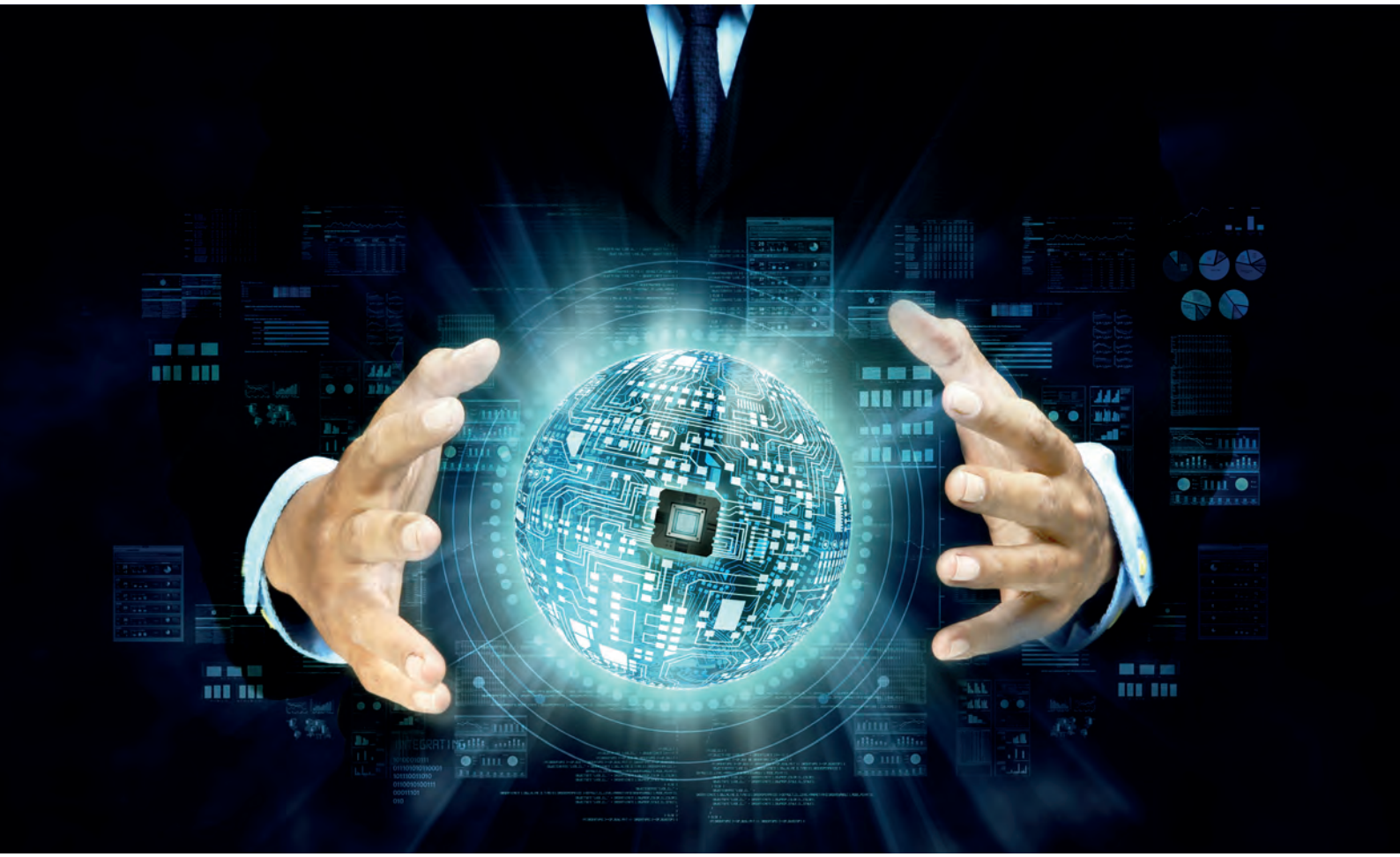

Data centre 2023 predictions: What's next?

The data centre industry is always growing and changing. This brings many challenges and 2023 will be no exception.

BY MATTHEW PULLEN - EVP, MANAGING DIRECTOR EUROPE, CYRUSONE

2022 was another year of incredible growth and progress for the data centre industry, with hyperscale demand in Europe doubling from where it was in 2021. Growth was primarily driven by London and Frankfurt, with London headline signings surpassing 100MW for the first time within the first half of the year alone, according to JLL.

Though the sector continues to grapple with supply chain challenges, rising inflation and the ongoing data skills shortage, it's clear that it has managed to successfully navigate these external factors, with ongoing demand demonstrating the critical nature of data centres to the way we live and work. 2023 will be another landmark year for the data centre industry as it seeks to meet this demand, while continuing to innovate and prioritise sustainability efforts.

Further expansion of data center footprint in 2023

Hyperscale demand will remain strong and, as a result, capacity requirements will continue to grow in the coming year. This will encourage development of larger campuses - and in some cases, Mega Campuses - further outside city centres, with easier access to land and power. It will also see an acceleration of growth in secondary European markets, including Madrid, Milan and Portugal.

Market concerns including extreme weather events, geopolitics impacting energy moratoriums and what data centres represent in societies are influencing where workloads are located. For example, the moratorium in Amsterdam and Dublin has seen an overflow directed to Belgium, Madrid, and Milan.

The digital skills gap will continue to expand, remaining a central issue within the data centre industry, hampering its long-term development and growth. While notable progress has been made in recent years, the sector continues to grow on a steeper curve than the advancements made to-date

This has been the case internationally, with Johor and Batam benefitting from the moratorium in Singapore, or Maryland and Pennsylvania benefitting from overflow in Ashburn, Virginia. Therefore, 2023 could see new markets become relevant with increased market share, as cloud seeks to balance economic, environmental and social priorities. The construction methods for delivering this growth will focus more on offsite manufacturing for speed and repeatability. The hyperscalers will also drive more efficiency in operation of these facilities which will reduce energy waste and reduce the consumption of valuable resources such as water.

Digital Skills gap continues to widen

The digital skills gap will continue to expand, remaining a central issue within the data centre industry, hampering its long-term development and growth. While notable progress has been made in recent years, the sector continues to grow on a steeper curve than the advancements made to-date, with AND Digital's Nature of the UK's Digital Skills Gap report finding 81% of UK managing directors agree that a lack of digital skills is negatively affecting their company.

It's imperative that the data centre industry comes together in a meaningful way to address this gap, identifying additional ways to communicate the value and opportunity that this sector provides and educating on its broader societal impact. This year, we will continue to see more urgency placed around this issue as the industry strives to compete and maintain demand, with many companies widening their net to include recruits in unrelated disciplines who can be trained. It is also vital that efforts are made to implement apprenticeships and similar schemes that provide value and offer the opportunity for long-term career success.

Increased transparency in sustainability reporting

Sustainability will undoubtedly remain a key focus for the industry, with legislation and a standardisation of auditable reporting driving more transparency in the market in the coming year. We are already seeing developments of this in the past month, with signatories of the Climate Neutral Data Centre Pact - including CyrusOne as a founding member - launching an Audit Framework to assess and verify the compliance of data centre operators with the Pact's Self-Regulatory Initiative (SRI) and make data centres climate neutral by 2030.

Consequently, 24/7 carbon-matching will become a requirement with companies having to track their power usage on an hourly basis and match their usage to a carbon free energy source. This will also result in a move away from carbon offsetting and toward PPAs, directly with green energy generators. Consolidation within the Data Centre Industry

We will begin to see significant developments regarding the consolidation of the data centre industry in 2023. While this will present challenges for some, especially smaller players without the ability to scale, this will act as a reset for the industry, allowing the market to normalise once again. Enterprise uptake is growing as businesses and cloud companies realise the benefits of consolidating their operations, with many accelerating their migration to third party providers, viewing digital as mission critical and core spend.

As market pressures continue in 2023, there will be an increased focus to convert capex to opex driving demand for the public cloud and therefore, data centres. The data centre industry is always growing and changing. This brings many challenges and 2023 will be no exception. However, this also encourages innovation and transformation, which makes it a hugely exciting time to be part of this sector. Collaboration within the industry will allow us to navigate these challenges successfully and work together as a collective to identify unique solutions and evolve. This industry has demonstrated its creativity and resiliency and 2023 will be no exception. We look forward to what's next.

The recurring themes for 2023

Forecasting the future of the data centre industry remains challenging as it continues to grow. Gartner reports IT spending in 2023 to increase more than 6% YOY, accelerated by more requirements for software and IT services. As the stakes rise, the sector evolves at an increasingly rapid rate and so we are seeing a new set of themes starting to occur.

BY MARTIN CARROLL, PARTNER, GLOBAL TECHNICAL REALTY

THE SHAPE of organisations is starting to change, in particular with sales teams. The scale, bespoke nature, and time taken to close deals have all increased and the associated skills required have moved to engineering led service teams now responding to customer enquiries and sales processes. Firstly, we forecast the end of the charismatic sales team.
There are also several other themes that GTR forecasts will keep recurring over the next few years.

Death of FLAPD obsession

Since 2015 Europe has witnessed exponential growth in take up. During the next five years, London and Frankfurt will continue to accelerate into their own premier league with the rest of Europe fracturing to provide centres of growth in more diverse cities. Some regions are already reaching oversupply and in smaller markets the supply and demand dynamics are a lot more sensitive - this will require more skill in navigating to achieve return on capital employed.

Energy security climate silver lining

For the European data centre industry increased energy costs will eventually feed into higher cloud computing costs for customers. Key variances in the cost of spot instances available in clouds already differ depending on geographical location of the server driven by a function of build cost of the facility and the cost of powering the server. This will force a new front in driving workloads to areas where power is cheap and stable.

In the medium-term countries will switch to more renewable sources for security of supply. This investment is likely to be state led, but partially funded by big tech to secure renewable supplies for their own use whilst sharing the benefits with local communities which they serve.

Regulation of big tech

Regulatory changes on both sides of the Atlantic may not appear to impact data centre demand, but it very much does. Tech firms may choose to limit the onshoring of content in certain parts of the world where laws are most stringent. GDPR regulation led to a boost in the European data centre industry yet just as easily, over regulation or perceived anti tech bills will push the industry away again.

People skills

The skills shortage continues. In an industry where the customer base becomes more concentrated the skill set required is more engineering led than ever. Facilities Management engineering teams remain in peak demand particularly in hotspot markets of London and Frankfurt and growing markets such as Milan and Tel Aviv. Growth in the industry has outstripped talent which promotes a threat to the quality of company performance in the sector and the quality of development.

Whilst there is still significant grey hair in the global industry to help currently there is a shortage of new entrants at every level. Yes, to training in schools, technical colleges, and Universities but also yes to more apprenticeships and encouraging cross fertilization from pharmaceutical and oil and gas industries that have natural similarities to the data centre sector.

Macro economics

For the industry macroeconomics has hit hard on multiple levels; raw materials and manufacturing cost increases and delays have hit construction costs, impacting rising rents and compression in returns for investors in the sector. Increased debt costs are likely to hit M&A, though the industry waits to see the effect. McKinsey reported 209 data centre deals in 2021 with an aggregate value of $48 billion (40% YoY). The first half of 2022 there were 87 deals with an aggregate value of $24billion. Whilst inflation will start to fall in 2023 financing costs will continue to impact deals and financing of new builds.

Facilities Management engineering teams remain in peak demand particularly in hotspot markets of London and Frankfurt and growing markets such as Milan and Tel Aviv

This is spurning more innovative companies to produce new contract structuring for clients and a more flexible approach to development that has made the industry feel less like tech and more akin to real estate development again.

Sustainability & local communities

Responsible industry wide education programmes for politicians and local government teams and continued industry led initiatives to invest and embrace local communities and use sustainable building practices will continue to be at the heart of new developments success. The industry is already driving efficiency in its facilities as a matter of contracting with its customers, what is more important is the quality of the envelopes being constructed, the energy sources being used and the overall sustainable approach to construction.

Better partners, better world: Four data centre predictions for 2023

At the forefront of the human need for stronger, faster connections, data centres occupy a crossroads in today's interconnected world. With the market set for a value of $200 billion by 2032, the prevalence of data centres in the efficient running of our society is likely to expand too – along with the impact they have on the environment.

BY CHRIS PENNINGTON, DIRECTOR OF ENERGY & SUSTAINABILITY AT IRON MOUNTAIN DATA CENTRES

FROM OPERATIONAL RESILIENCE in the face of global energy scarcity, to a climate-first culture in the boardroom – below are the top four data centre trends of 2023 that industry players must be cognisant of.

Sustainable by design: Building resilient data centres

2022 saw fossil fuel prices rise alongside the frequency of damaging climate episodes, proving the need for investment in carbon free energy for future security. For data centre providers, these events have ensured the need to transition from being a carbon-intensive industry, to a carbon neutral one that is sustainable by design.

The UN's Sustainable Development Goals on future construction states that builders of new data centres must be responsible when it comes to extracting natural resources, aiming to power facilities with 100% carbon free energy. Designers must also transition from single-use design to processes that encapsulate recycling, reuse and remanufacture to avoid landfill.

Energy efficiency is a function of good design and many of the most energy-efficient builds in colocation are committed to the BREEAM green building standards. Signatories, including Iron Mountain, to the Climate Neutral Data Centre Pact, have made clear commitments to achieving low Power Usage Effectiveness (PUE), responsible water usage, and repurposing waste heat. By building sustainability into data centre design, organisations can help ensure long-term resilience when facing volatile supply chains.

The future of data centre power

Data centres are some of the biggest energy buyers in infrastructure and so it is critical that the sector works collaboratively to decarbonize international grids. Many data centre providers are already covering 100% of their electricity consumption with renewable purchases, with some, including Iron Mountain Data Centres, committing to 24/7 renewable energy by matching their energy consumption with local renewables each hour of every day by 2040.

Hydrogen will also play a role in our carbon neutral energy future. Yet with 99% of hydrogen still derived from fossil fuels according to the International Energy Agency (IEA) and on-site energy storage remaining a challenge from a capacity perspective, reliance on backup diesel generators still cannot be phased out completely. Electrolysis powered by renewables can however provide a clean source of hydrogen generation, providing a path to carbon-free green hydrogen. Regulation also has a role to play in this journey by incentivizing proper tracking and certification of where green hydrogen has been sourced.

Prepare for regulatory change

Pushed by increasingly climate-conscious stakeholders, governments are beginning to compel organisations to track their Scope 3 emissions, which Deloitte suggests can account for as much as 70% of a firm's total carbon footprint. In 2022, the U.S. Securities and Exchange Commission (SEC) proposed new amendments requiring many US companies to submit data on their Scope 3 emissions regularly. In the UK and EU, governments are expanding existing programmes to place stricter demands on companies reporting their emissions data.

To tackle Scope 3's carbon impact, reporting will be crucial – you can only manage what you measure. However, reporting has historically been difficult as organisations are not in control of their indirect emissions. As key partners in the supply chain of some of the world's largest businesses, data centres should work transparently with their partners to accurately report on their carbon output and identify areas where reductions can be made within the supply chain.

Empowering customers to evolve

According to the IEA, data centres and data transmission networks are responsible for nearly 1% of all energy-related greenhouse gas (GHG) emissions globally. In recent years, carbon has become a proxy for risk, with businesses now largely unable to stay out of the ESG conversation.

Consequently, traditional customer demand for data centre security through thousands of on-site diesel generators and scalability with fossil fuel solutions no longer appear viable. Instead, the trajectory towards decarbonisation has led some to look to their colocation providers to offer education on how to install their hardware with efficiency in mind, with a focus on space minimisation, avoiding over-cooling and PUE measurement to track progress.

Many customers are also recognising the need to identify improvements in their supply chain and seek IT partners that will help them meet their sustainability goals. Providers are well positioned, therefore, to purchase 100% clean energy at scale, in line with GHG reporting protocols, and provide it to clients as they need it.

As sustainability continues to steer the legislative agenda, it has become clear that for the growing data centre market, adhering to ESG principles is now no longer 'a nice to have' but is good for business. Operators and customers alike should look ahead to future-proof their businesses and build collaborative partnerships as the climate conversation continues.

BASED around a hot industry topic for your company, this 60-minute recorded, moderated zoom roundtable would be a platform for debate and discussion.

MODERATED by an editor, this online event would include 3 speakers, with questions prepared and shared in advance.

THIS ONLINE EVENT would be publicised for 4 weeks pre and 4 weeks post through all our mediums and become a valuable educational asset for your company

Contact: jackie.cannon@angelbc.com

ANGEL EVENTS

DCS DATACENTRE SOLUTIONS
DEVELOPING DIGITAL INFRASTRUCTURE IN A HYBRID WORLD

The DCA - Data centre sustainability SIG

An Introduction from DCA CEO Steve Hone

AS THE Trade Association to the Data Centre sector The DCA understands that it is imperative that key issues affecting the sector have a point of focus. The DCA SIG's (Special Interest Groups) / Working Groups regularly come together over shared interests to discuss issues, resolve problems and make recommendations.

Outcomes result in best practice guides, collaboration between group members, participation in research projects, this includes clarification and guidance for decision and policy makers. Members find these groups are a great way to ensure their opinions and views are considered in a positive and cooperative environment.
The DCA currently facilitates nine Special Interest or Working Groups. DCA members can join any of the groups and contribute find out more here: https://dca-global.org/groups

The DCA Sustainability SIG is chaired by Astrid Wynne, Head of Sustainability at Techbuyer

The purpose of the Sustainability Special Interest Group is to develop best practice in the UK data centre industry with respect to materials usage, energy efficiency, skills development and workforce retention in an operational data centre environment.

The group aims to achieve this through:

- Optimising energy efficiency at use phase
- Expert insight into IT hardware and the effect on energy draw
- Insight into the role of IT load with respect to this, including:
  a. the effect of full utilisation on efficiency as measured by compute power over energy.
  b. the ability of software to dematerialise hardware.
  c. minimising data transfer and storage, potentially leading to a sector Code of Conduct
- An understanding of the importance of Scope 3 emissions (also known as embodied energy) in the hardware, facility and building.
- Circular solutions for the IT hardware and other infrastructure
- Circular solutions for heat, power and IT load
- Use of renewable energy in the sector.
- New technologies that can aid this.
- Existing and upcoming standards relating to this.
- Education of workforce with respect to sustainability insight and practice

The group work very closely with the Energy Efficiency SIG to provide DCA members with an entire overview of data centre energy efficiency and sustainability. To request to join this group please contact the DCA - mss@dca-global.org

DCA sustainability special interest group update

By Astrid Wynne, SIG Chair

IT IS EIGHT MONTHS since the DCA Special Interest Group on Sustainability (SIG) released its best practice whitepaper. It focused on five steps organisations in the sector can take today to improve their sustainability performance in a low cost, high impact way. Our five steps were not the only ones to take – and by no means an exhaustive list – but the direction they represent has been borne out by recent conversations amongst large companies, investors and academics looking at sustainability in the data centre sector.

Work on Greenhouse Gas Emissions

Despite the increased pressure to reduce operational energy usage because of the conflict in Ukraine, the importance of supply chain emissions is being highlighted by those in the industry. Equinix and Infrastructure Masons amongst others have funded a short film on the importance of Scope 3 emissions associated with the use of concrete and steel in the buildings as well as the metals in the equipment they house. “How much faster could we accelerate decarbonization and scope 3 emissions if the digital infrastructure ushering in the 4th Industrial Revolution, worked directly and strategically with their supply chain to revolutionize industrial processes?” the film asks. It makes a strong case for assessing and reducing travel miles as well as extending product lifetimes in order to do this.

Making a Net Zero Pledge was the first of the five actions suggested by our whitepaper, and something we are continuing to articulate to the market this year. The first stage of a net zero plan is to reduce energy usage. Without stepping on the toes of our energy efficiency SIG, we have been looking at this over recent months. One talk discussed the impact of running servers hotter on facility energy draw and an upcoming talk with examine the role of software. The next step is decarbonising energy supply by signing green electricity contracts and also finding alternatives to diesel back-ups. We will be welcoming any organisations that can give an insight into this over the coming months.

We are also hoping that a growing industry awareness of Scope 3 will support movement in the direction of a our second of our five actions, which is to Address environmental impact with Circular Economy. Circular Economy is the process of designing out waste and moving towards a system that is regenerative by design. This can come in the form of combined heat and power, as David Gyulnazaryan articulated beautifully at DCW London last March as well as in an article Intelligent Data Centres in June.

Work on social impacts

Until now, a lot of the social impact assessments would focus on the supply chain – the impact of mining on landscapes and communities and the ethics of sourcing materials from areas with political instability or less than satisfactory health and safety laws. Our sustainability best practice whitepaper addressed this in one of our five steps last year, with our advice to the sector on creating a Code of Conduct.

There is also work being done on social impacts of data centres with studies being conducted by a PhD student at MIT. This study is different and examines the social impact of a data centre on the local community. What effect does low level background noise have on the quality of life of residents? What are the results of having diesel generators kept warm ready to kick into action in the event of electricity failure?

Practical steps towards addressing this would be something like a B Corp Impact Assessment, which was another of the recommendations the Sustainability Best Practice whitepaper. B Corp as an organisation has come under fire recently as some of its members are criticised for plastic pollution and other negative activities. However, the B Impact Assessment is the most widely available, most accessible free of charge resource to address the areas of Governance, Workers, Communities, Environment and Customer relationships.

The circle of life - re-new, re-cycle, re-use, repeat - strategies for a fully sustainable DC

By Simon Harris, Head of Critical Infrastructure at BCS

THE SUSTAINABILITY of data centres is attracting more attention as a matter of concern, as global computing capacity continues to rapidly increase. The European Commission has estimated that by 2030 electricity consumption in data centres will exceed 3% of global energy consumption. In response, industry bodies and individual businesses are committing to initiatives designed to improve the performance of their assets including the areas of energy consumption, carbon impact and water use aligned with their ESG imperatives.

The race for power and space

For the development of new sites the challenge is primarily focussed on the race for space and power that is playing out across Europe with power availability a key consideration for data centre location selection. However, a significant risk exists that rapidly growing demand for information services and compute-intensive applications will begin to outpace the efficiency gains that have historically kept data centre energy use in check. Potential remains for substantial efficiency gains, but investments in next-generation computing, storage, and heat removal technologies will be required to avoid potentially steep energy use growth later this decade, and parallel investments in renewable power sourcing will be required to minimize the climate implications of unavoidable data centre energy use.

Working with what you have

However, the challenges are more complex for the stock of data centres spread throughout Europe around 60% of which are in excess of eighteen years old. Consistent with buildings in other real estate sectors, there is a material and differentiated challenge in dealing with the existing stock of data centres built from the early noughties onwards which are either partially or fully occupied.

By 1st January 2030, The Climate Neutral Data Centre Pact (CNDCP) requires signatories to make a binding commitment to achieve Power Use Effectiveness (PUE) of between 1.3 and 1.4 in sites built up to 2025, reflecting the increased challenges of interventions within operational environments.

Amongst these the older data centres will have often been constructed with PUEs of 2.0 or more. In their current form they could be significantly distant from the required standard and in breach of their owners CNDCP commitments. They will also look increasingly unattractive to tenants pursuing socially responsible energy and carbon agendas. These operational sites will be challenging to upgrade, especially those with high availability requirements. They will require experienced design and construction teams, working closely with operational teams, in order to effect the changes to the engineering infrastructure that are required without service interruption.

Rebuilding is not the best answer

The simplified response to this problem would be to demolish and reconstruct at a convenient point before the deadline through a manged vacation and migration of IT processing. The simplified answer is not necessarily the best answer. The original design and financial plans for these sites were often authored with the structural and architectural elements having a life expectancy of sixty years. There is also a significant embodied carbon penalty to pay in demolition and rebuilding. A substantial amount of the construction work involves the use of energy dense concrete and steel to such an extent that refurbishing an existing facility can save in the order of 70% - 80% of the carbon cost of a new build.

An upgrade and refresh to critical infrastructure could liberate trapped electrical capacity for deployment to serve higher density and growing IT loads, for example through UPS replacement or cooling solution changes. These types of interventions will be more easily accommodated in Tier III facilities having two concurrently maintainable power and cooling paths, although the work will require careful planning and right first time execution. Nevertheless, such a solution overcomes the power availability challenges and

takes the facility down a path towards better PUE performance.

However, the PUE thresholds are not the only challenge embedded the CNDCP. The pact requires data centre electricity demand to be matched by 75% renewable energy or hourly carbon-free energy by the end of 2025 and 100% by end 2030. These requirements are to be delivered in a period when demand for renewable resources will be universally increasing as a result of competing demands from the growth in big data, the decarbonisation of industry, commerce, transport and domestic consumers.

Financial support might be available

The solutions are there which is good news however, none of this is cheap so we advocate that the full project financial picture is considered, inclusive of the tax position. Government tax Incentives in the form of capital allowances are available to support and encourage businesses to undertake capital investment. These incentives are obtained through savings in Corporation Tax. With expenditure on qualifying plant and machinery likely to be substantial, Corporation Tax paying UK based data centre owners should ensure that capital allowance benefits are maximised in order to improve their return on investment. Obtaining the relief is not an automatic process and the tax rules are complex and often misunderstood. As a result, many businesses miss out on the tax relief available to them. Appointing a specialist capital allowances consultant with complex engineering systems experience will deliver tangible benefits.

Conclusion

At BCS we have seen significant improvements to sustainability delivered as part of a general refreshment of assets that are beyond their economic life as we look to renew, re-use, refresh and repeat rather than rebuilding.

As enterprise IT transforms into the third age, an opportunity emerges for CIO's to grasp sustainability

By Mohan Gandhi, Senior Sustainability Consultant, STG Advisors

"SUSTAINABILITY is a data play". I've been banging that drum for a while (issue 3, p61). Enterprise Sustainability is the act of getting the right data into the right hands at the right time to make the right decisions - what I call data fluency.

However, data fluency requires an enterprise to be somewhat IT mature. How else does one create, combine, deliver and act on the necessary data? Only when an enterprise becomes IT mature can it begin to measure, then improve, sustainability. Long story short, IT maturity enables CIO's to grasp the sustainability agenda, and we're on the cusp of a new age of IT maturity - the Third Age of Enterprise IT.

So, what is this third age? What were the first and second ages? How is this relevant to Sustainability? This article outlines the enterprise IT maturity journey, and why it will prove beneficial to the environmental agenda.

THE FIRST AGE - siloed and subservient

First age IT saw individual functional groups contribute their own expertise to different project phases. Silo's made sense because they created accountability, and this approach served the enterprise well.

However, projects became rigidly sequential and trapped in one speed. This model encouraged "over the wall" engineering, where team members worked locally on immediate tasks without knowledge of upstream or downstream strategic or business context.

Different teams used a myriad of tools to monitor and manage application and infrastructure performance, user experience, conversions etc. As a result, there was no single and consistent source of truth. Hence it was difficult for teams to identify the full context behind the data, or collaborate with others to improve business outcomes.

THE SECOND AGE - new priorities, old delivery model

As businesses became more reliant on digital services, enterprise IT became more critical to an organisations' ability to drive new revenue, enhance customer relationships, keep employees productive, and safeguard business operations. Over the last 20 years CIO's have continuously transformed their IT to keep pace with both technological advancements and changes to IT priorities.

The Second Age saw the role of enterprise IT transform from back-office support to essential business enabler. What once merely enabled the company strategy now actively defined it. CIO.com's 2022 State of CIO research found that 85% of IT leaders devoted time to transformational responsibilities, including modernising infrastructure and applications (40%), aligning IT initiatives with business goals (38%), and cultivating the IT/business partnership (30%).

Fundamentally the second age saw the CIO transform the role of IT within the business, without transforming how IT was delivered. It's an incredible sleight of hand that is worthy of applause. CIO's transformed capabilities, aligned IT with business units, modernised infrastructure, optimised traditional cost models and found or freed budget for digital transformations. But they're still fundamentally using the same traditional operating model, which have thrown up challenges of their own.

CIOs caught in the Second Age contend with resource struggles, conflicting priorities and difficult trade-offs. This approach creates IT integrity and security risks. Piper Sandler's 2022 CIO survey found Security remains the top concern for 78%

of CIOs and Gartner's 2022 study found 74% of technology purchases are funded at least partially by business units outside of IT, creating conflict and complexity for CIO's.

THE THIRD AGE - new priorities, new delivery model

It's becoming increasingly difficult for IT teams to meet new demand for faster innovation under the traditional operating model of siloed teams. Second Age IT is insufficient for the needs of the modern "digital first" business. The Third Age puts IT at the centre of both business strategy and operational delivery. As a result, changes are coming:

C-Suite dynamics: As technology dominates strategic business priorities, company executives will require improved technological understanding. In 2011, only 1 in 5 CIOs ranked themselves as a critical enabler of business success. Now, CIOs rank in the top three of C-suite executives most critical to organisational success.

CIO role evolution: "The role of the CIO is becoming less of a tech leader and more of a business leader. It's how you apply the technology that makes a difference." says John Gibbs, CIO at International Airlines Group (parent to British Airways). CIO's will become the "Chief Operating Officer of technology," and assume leadership roles in strategy development and execution.

Seamless alignment with business priorities: Value stems from the ability to bring assets, resources, insights and opportunities together. Aligned IT and business goals, and aligned financial and operational incentives will help companies deliver this value.

Blurring of IT and business: The boundaries between IT and business will blur significantly. Business analysts will configure business rules and functionality that would have previously required IT teams to develop, test, and deploy code.

Breaking down of silos: As a result of aligned priorities and blurred boundaries, the third age will see the creation of multifunctional teams across IT and business - what Gartner call "fusion teams". Technology will become an integrated part of business processes.

IT SLAs will become business KPIs: IT will define success based on the function's ability to support the business's key objectives. Metrics hierarchies that reflect the technical and business outcomes will help deliver dividends and identify the chain of accountability. Note, this doesn't mean that IT abdicates responsibility for uptime, scalability, resilience etc.

IT governance will change: IT will decide where it can relax "ownership" of applications. Governance will transform to balance the business's desire to move quickly, whilst mitigating operational or security threats. This will require overhaul of models, processes, and supporting systems.

Unilever have already begun their third age transformation. "Everything we're trying to do and every choice we make as a business is to be as data-informed as possible. We want to surface data at every decision point—the right data at the right time to the right person, when it matters most." Steve McCrystal from Unilever.

Sustainability enabled

I'm sure at some point you asked "what does this have to do with sustainability"? The third age is not the age of sustainability. However, it's the age where the CIO has the ability to impact sustainability. As

IT becomes part of daily business operation and delivery, it embeds itself in every business activity. Thus it becomes possible to conduct activity based environmental accounting using data that is already being collected and used for activity based performance and monitoring.
The third age creates the right environment for data-based decision making, data-based reporting, data-based accounting, hence CO2e accounting, benchmarking, and auditing, and so on.

conclusions, caveats and calls to action

I appreciate that I have taken a great many liberties in summarising IT transformations into three distinct ages. In reality, enterprise IT has and will continue to evolve at an uneven pace. I also acknowledge that I use the term CIO as though it had a common job description. CIO roles vary more than any other C-suite role and often include partially or wholly, the role of the CTO. I only had a 1000 words. Mea culpa. Nonetheless I think the argument carries that a) as enterprise IT matures, it embeds IT further into the business and b) the further embedded, the exponentially easier it is to measure, track, reduce, report and improve enterprise sustainability performance.

If you're interested in assessing or improving your IT sustainability performance, or would like to incorporate an assessment into your current IT transformation plans, feel free to reach out to us.

Can DCs ever be carbon neutral? Truth vs Green Wash

By Ian Bitterlin, Portman Partners Associate

THE 'EFFICIENCY' of nearly all data centres is zero unless you define them as heaters. They are 100% efficient as heaters, as they turn all the incoming energy to heat and >99% of them reject that into the environment. That is why the most common metric of PUE (ISO/IEC 30134) uses the term 'effectiveness', not 'efficiency'. Very few offer low-grade waste heat to adjacent use/processes, but it can be difficult to engineer unless you have a district cooling/heating system passing your door, especially if your facility runs at partial load. There is not enough heat generated to pay for the recovery and make a profit.

The question refers to 'carbon neutrality' and 'greenwash', which are inextricably linked, but we are trying to achieve Sustainability, so I will start there. By definition, Sustainability is achieved in three steps that must be taken in order:
1. Reduce consumption
2. Improve the process
3. Use renewable energy

The data centre industry has turned this on its head. Today, it goes straight for renewable energy, even from other countries and continents, and claims that the data centre is 100% green, sustainable, or zero-carbon. In terms of greenwashing, this claim, in isolation, is a perfect example, mainly because all forms of energy production (including hydro, wind, solar, and nuclear) has a carbon content, and IPCC 2014 sets down the internationally agreed kgCO2/kWh. Luckily wind and nuclear (one each of intermittent and continuous) are the lowest carbon sources at ~14gCO2/kWh. If you are unsure why wind has a carbon expenditure, consider the energy used to manufacture turbine blades, masts, foundations, installation, connection, service, substations etc. The life is 15 years, and a high proportion of the turbine cannot be recycled; hence the embodied carbon is amortised over the service life. So, 'zero' or 'neutral' isn't possible, but don't get me wrong, low-carbon sources must supplant fossil fuels as soon as possible to check the rate of climate change.

Step 1: Reduce demand

Data centres have grown exponentially in response to data traffic growth, despite the exponential increase in ICT hardware capacity per watt.
Data traffic in Europe has been increasing at an exponential rate of 4% per month for more than 20 years. This is in the order of 60%CAGR, whilst ICT hardware has been improving at 40-50%CAGR. Thus, data centre power has been growing at a net -15%CAGR. Of course, the detailed growth and capacity curve have been step-functions over time, but the trend line has been inexorably steady. Currently, personal use such as HD video streaming and social networking is the dominant driver of that growth. Even through the pandemic with the correlative move to remote working, daily traffic continued to peak at 10 pm, unlikely caused by work meetings on Zoom.

The improvement in ICT capacity/watt has largely exceeded that forecast by Gordon Moore's law. Still, we are just on the cusp of graphene replacing silicon and reaching 1.5nm. That could be the last gasp of Moore's Law when we will have no choice but to constrain data traffic growth. We probably can't get the lid back on Pandora's Box, so if we want to talk about 'sustainable' data centres, we must dislocate demand and view the data centre in isolation. I disagree with doing that, as it is sweeping the environmental problem under the carpet. Still, if we don't do so, then ICT is not sustainable in any form as demand will continue to grow unfettered. Let's not forget that more than 40% of the global population doesn't have an internet connection, but in the future, they could be streaming 4K movies to

An argument can be made to shift all load to hyperscale facilities – what you may call the cloud, but I would not – where utilisation is maximised, but that must not come with lower availability, reducing attractiveness to the user

their mobile phones whilst the floodwater passes their chins. I regret that I am not optimistic about us solving this problem until well after the 11th hour.

Step 2: Improve process

Here we have three opportunities to reduce energy demand, manage the ICT hardware, the PUE, and reuse waste heat. Managing the ICT hardware is both behavioural and practical. First, we need to purchase hardware with capacity/watt as the main factor for the application.

Then, we need to utilise the hardware to the maximum possible extent (including virtualisation if applicable and at >60%), ending our long-term under-utilisation in colocation and enterprise facilities (even today at 10-15%). Finally, whilst the effect of Moore's Law et al. are available to us, we then need to refresh hardware regularly to take full advantage of increasing capacity/watt.

An argument can be made to shift all load to hyperscale facilities – what you may call the cloud, but I would not – where utilisation is maximised, but that must not come with lower availability, reducing attractiveness to the user. Cloud, just another data centre, should be viewed with the energy used in data transport, not just in the data centre - the advantage of 'Edge'.

There is a stronger argument for regulating the demand for social networking via taxation and restricting the video definition to save energy, particularly on mobile devices. In the face of climate change, anything that saves energy that is nice to have but not essential should be regulated, most probably by taxation, as was recommended in 1865 by WS Jevons and his Paradox.

In Step 2, we must include reducing PUE to improve the process, but here we run into a problem highlighting some of our dirty washing. Reducing the PUE in new facilities is easy. However, it usually requires the client to agree to take increased risks to his availability of ICT service by reducing M&E redundancy and investigating various ways to manage the ICT hardware thermally. In climates like those of London, Frankfurt, Amsterdam, and Paris, reaching a PUE of 1.30 without water consumption and 1.20 with is not hard.

So, why has the reported PUE (EU CoC Participants Scheme) hardly reduced in the last five years and is still higher than 1.75? The reason is that data centres are built to serve a purpose in a location to suit the business plan. They are rarely fully loaded, and only a very few use evaporative or adiabatic cooling, and PUE largely depends on climate, cooling efficiency and load. The high PUE reflects the preference of most data centres to achieve high availability before low energy. Even the innovative Google (1.12) and Facebook (1.07) don't shout about their PUE anymore.

The greatest opportunity to reuse waste heat will be 'edge' single cabinets in city centres, local hotels that can use 15-20kW of low-grade hot water 24/7.

Step 3: Renewable energy

Operators can buy any blend of power they want where the data centre is in the same grid network in an acceptable Power Purchase Agreement (PPA). The grid then has to balance supply and demand when the fuel/source mix varies. That is why places like Dublin, Frankfurt and Amsterdam have occasionally placed moratoriums on new data centres - because their grid emissions rise when the wind doesn't blow hard enough. But Virtual PPAs should be better explained. Plenty of large operators have data centres located in 100% fossil-fuelled grids that claim to be '100% green' (renewably powered) by purchasing the Renewable Certificates in distant grids with no power connection.

In sum, energy efficiency and carbon neutrality is a big subject that can only be addressed when the audience is fully aware of what is really happening at this time – First-Class Greenwash!

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