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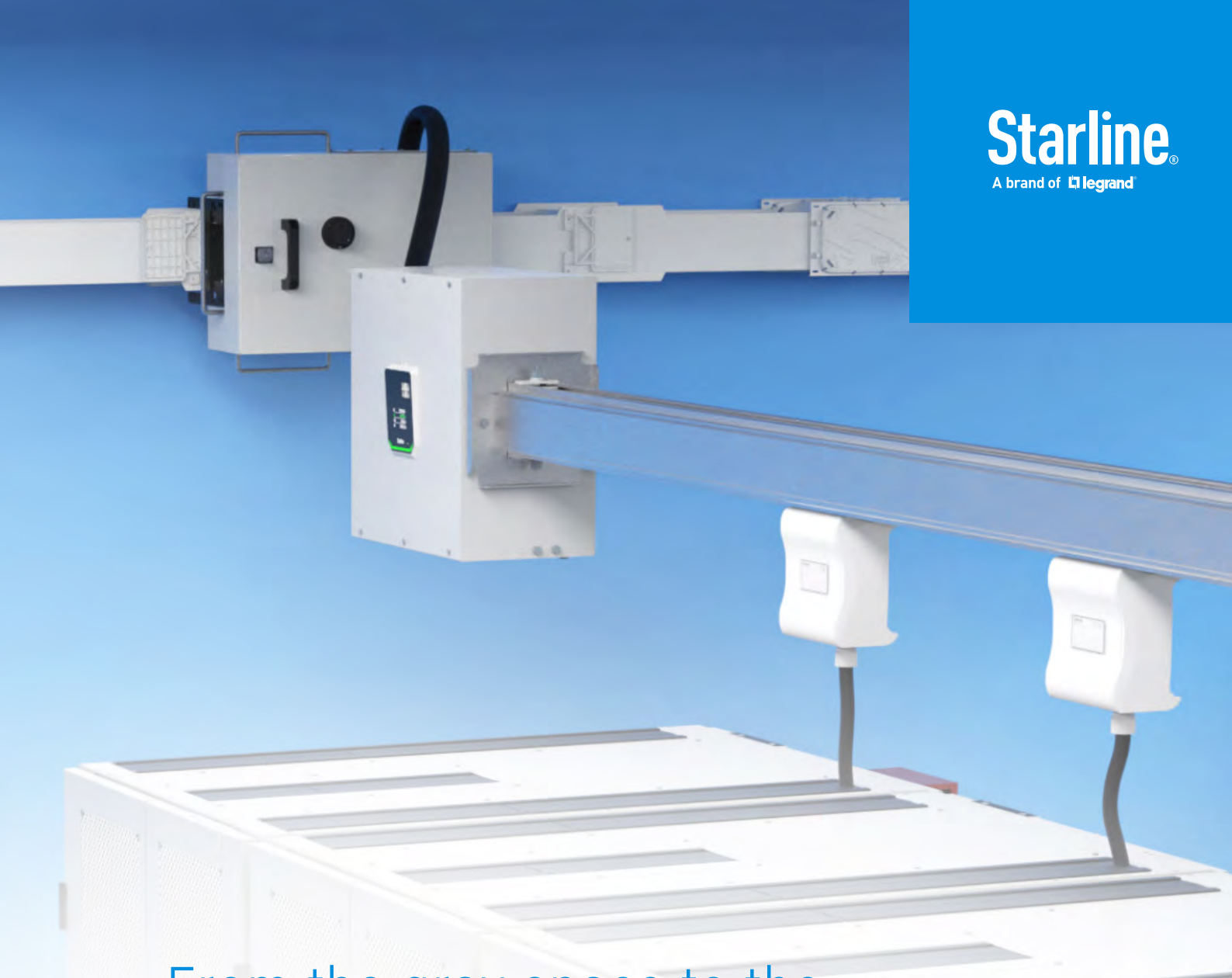

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Editor's View

By Phil Alsop

Sustainability: living on borrowed time?

WHILE all but the most obdurate of climate change deniers recognise that humans are damaging the planet at an unsustainable pace, there is rather less agreement as to what measures need to be taken and, importantly, over what time frame.

The data centre industry is no different from any other in that it has begun to address the issue of sustainability, but has plenty more work to do. Uniquely, however, it has to wrestle with the massive increase in demand for its infrastructure and services, as the digital world explodes, at the same time as it is required to reduce and, eventually, eliminate its carbon footprint. Is it even possible to achieve Net Zero if the data explosion continues to gain momentum?!

Of course, digital transformation is not an excuse behind which the industry can hide – even though the data centre industry facilitates many virtual activities which have a much lower environmental impact than their physical alternatives. No, it has to head towards Net Zero despite the requirements placed upon it, or at least until such time as the world recognises that unchecked, relatively low cost digital consumption is as environmentally damaging as many another activity and, therefore, needs regulating.

For now, the data centre industry is being allowed/trusted to address its environmental challenges without any significant government intervention – although there are increasing examples of governmental interest in the planning and building of data centres in several countries. Whether or not the industry faces what might be called an 'electric vehicle moment' (in the UK, for example, sales of petrol and diesel cars is to be banned at the end of the decade) remains to be seen. Much will depend on the progress it makes over the next few years.

I shall resist sharing my own rather bleak view of a world which takes sustainability as seriously as it should – although it's maybe not bleak, more a realisation that many, many activities which we regard as normal or our 'right' currently will simply have to stop. Rather, I can report that the several data centre industry individuals I have talked with in recent weeks all seem to be optimistic that it is possible to grow a sustainable, Net Zero sector in a timely manner.

Let us hope that the COP26 summit reinforces such optimism.

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The data centre trade association

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83% of IT and business leaders say adapting to change requires better apps and infrastructure

SUPPORTING remote workers (72%), integrating information and workflows across the organisation (69%), and changing systems and processes quickly (69%) are the top three areas for improvement.

Appian has announced the availability of "IT's changing mandate in an age of disruption," a new report from The Economist Intelligence Unit (The EIU), supported by Appian. The report's findings are rooted in a twin survey, conducted by The EIU, of more than 1,000 IT decision-makers and senior business executives at major corporations around the globe.

The survey results highlight the shortcomings of existing IT systems. IT backlogs are significant and IT's control over the digital infrastructure is slipping. As business demand for new software applications grows, more work is spilling into non-IT development, and most business leaders expect that trend to increase. In parallel, there is overwhelming agreement that applications need to improve to make organisations more responsive to changing business conditions. 83% of respondents say adapting better to external change requires moderate-to-considerable IT infrastructure and apps improvement.

"The report shows organisations are expecting more from IT at a time when employees and enterprise data are more dispersed than ever. With Low-code, IT can gain agility and deliver the complex applications that businesses need," said Matt Calkins, CEO of Appian.

The survey data also highlights a path forward. The need for business agility, spurred by the COVID pandemic, is causing IT to forge a new role based on delivering organisational resilience. When asked for the most impactful areas to improve, the top three responses were supporting remote workers (72%), Integrating information and workflows across the organisation (69%) and changing systems and processes quickly (69%). Additional report highlights include:

- 3-12 months is the average backlog for planned IT projects, and the situation is worsening as business roject demand outstrips IT budget growth.
- 55% of respondents say business units already do more than IT to procure or develop new applications.
- 53% of business decision-makers believe the volume of applications built or sourced by non-IT business units will increase over the next 12 months.
- 75% of business decision-makers state hat when procuring or creating new applications, they prefer to keep their data where it is rather than move it to new repositories.
- 61% of business decision-makers report that they've had to cancel a digital project because the proposed app or solution could not access the right data.
- Despite the importance of advanced automation technologies, 71% of respondents report that relatively few of their applications have AI and/or machine learning capabilities, and 57% report that RPA projects often fail.

Employers worry about remote work productivity, but majority fail to invest in solutions

NEW RESEARCH released by Ricoh Europe reveals that employers are failing to invest in technology to maintain productivity across their remote workforce, despite concerns about their output.

More than 18 months since the Coronavirus pandemic took hold across Europe, forcing businesses to adopt remote working practices, just over a third (36%) of employers say their organisation has provided the tools and technology to maintain employee productivity while working from any location. Despite the failure to implement new solutions, the majority of employers (53%) acknowledge that investing in AI and automation boosts productivity across a hybrid workforce. These findings come off the back of research released by Ricoh Europe last month, which found that two thirds (65%) of employers don't fully trust their employees to work remotely.

The research conducted by Opinion Matters, on behalf of Ricoh Europe, polled 1,500 decision makers across the continent. The findings suggest that employers fail to understand the barriers to productivity amongst their workforce. Employers seem to vastly over-estimate the amount of time employees spend on tasks that deliver real value to customers, while employees say they are bogged down in less impactful work. Most employers (69%) believe their staff spend up to 180 minutes each a day on high value activity, compared to the 73 minutes that employees estimated when asked a similar question in March this year.

The lack of investment in technology to enable people to work productively from any location suggests that employers are underprepared for the realities of hybrid work. Over half (54%) of European business decision makers believe that in-office collaboration is vital to the future success of their organisation. Despite this desire, only 27% believe their company will return to a five-day office-based week in the next 12 months – further questioning their lack of investment in hybrid working tools.

CIO-CFO collaboration fuels business transformation

WORKDAY, Inc. and Deloitte Global have published the results of their joint global survey exploring how digital acceleration – prompted by the pandemic – has influenced the thinking of chief information officers (CIOs) worldwide. The research finds that CIOs are helping to lead finance transformation and shifting strategies to meet evolving business and technology demands, with 70% of CIOs surveyed having accelerated their finance transformation strategies by at least a year.

The report, "A More Effective CIO-CFO Partnership," is based on a survey of more than 600 executives worldwide. Findings reveal that individuals referred to as Progressive CIOs, which represent just 8% of the total sample, take a specific approach to enterprise finance transformation and behave differently than their peers with regard to mindset, collaboration, and technology strategy.

CIOs and IT leaders are facing increased pressures to adapt and accelerate their digital strategies — without disrupting critical business operations. As a result, Progressive CIOs have built strategic alliances across their organizations, with 90% of Progressive CIOs reporting that their IT departments are much more integrated into other areas of the business than they were 12 months ago.

Progressive CIOs support finance transformation in three key areas, including:

- **Leveraging data to fuel decision-making:** Progressive CIOs prioritize data aggregation and data management and understand that building effective data use is critical. Nearly all Progressive CIOs (92%) say that "aggregating enterprise finance data into a single source of truth is their top priority."
- **Collaborating with finance to drive transformation:** When it comes to enterprise finance transformation, there can be serious financial implications when misalignment between IT and the finance function occurs. Eighty-three percent of Progressive CIOs stated that "we will miss our growth targets unless the IT and finance functions work more closely."
- **Adopting an agile, incremental loud approach to transformation:** Progressive CIOs recognize that modernization cannot be done at the expense of the business. Over half (54%) of Progressive CIOs (compared to 37% of the total sample) are more likely to incrementally deploy capabilities in an end-to-end cloud strategy to modernize their firms' legacy enterprise resource planning systems (ERPs), minimizing disruption while executing advanced digital initiatives.

Collaborate with your competitors

TATA CONSULTANCY SERVICES has published its global study titled 'Where, How and What Leaders Will Compete With in the New Decade: Findings from the TCS 2021 Global Leadership Study', based on a survey of 1,200 CEOs and senior executives.

The study reveals a sharp divide in the digital strategies of better performing companies (Leaders) versus the laggards (Followers), including unexpected insights such as: 80% of Leaders are more willing to collaborate with competitors compared to Followers (23%).

Brought out by the TCS Thought Leadership Institute – which conducts primary research to help organizations transform for long-term, sustainable growth – the study examines how large global enterprises have recalibrated their competitive strategies through 2025, following the pandemic. Specifically, it explores how management teams across the world are striking a balance between innovation and optimization in four areas – digital strategies, digital offerings, digital ways of conducting business, and leadership approaches.

"Senior executives are always challenged to lead their organizations forward to be more competitive, and increasing digitization only accelerates that momentum," said Krishnan Ramanujam, Business Group Head, Business & Technology Services, TCS. "This study captures the pulse of global business leaders and their nearly ubiquitous belief that massive digital opportunities abound in the next five years – and their company culture must embrace an innovation mindset. At TCS we use our 3-Horizon Purpose-Led Transformation framework to help organizations embrace innovation in a way that helps them compete more effectively."

Key findings of the study include:

- Innovation was ranked as the most important aspect of organization culture, followed by Diversity, Inclusion and Equal Opportunity (#2), Quality Orientation (#3), and Customer-Centricity (#4).
- Leaders ranked Customer-Centricity as the top cultural priority, above Shareholder Value, while Followers ranked it number 6, indicating that higher-performing companies embed a 'customer first' mindset across the organization.
- By 2025, respondents believe 41% of their revenue will come from new ferings. Within that, Leaders expect 44% revenue from new offerings, while Followers expect 40%.
- The respondents projected that by 2025, 46% of their revenue will come from purely digital products or services. Leaders expect it to be even higher – 56%.
- When asked where they need to more effectively use data, respondents anked Digital Marketing Campaigns f irst, followed by Sales Initiatives and Customer Service, suggesting that their companies need to improve the way customer data is used to create demand and improve customer experience.

Cloud - the key to modernisation?

SURVEY RESPONDENTS recognise the benefits of DevOps and container services adoption, yet cloud native practices remain low.

Nearly 60% of respondents agree that cloud adoption has improved their organisation's agility, but that they could be more agile still. This finding comes from the fourth and final part of the Cloud Impact Study from Aptum, the hybrid multi-cloud managed service provider. The report, titled The Modernisation Minefield, examines the deployment of workloads on different infrastructures and the adoption of cloud services at enterprise application level.

The independent research reveals that, despite only 39% of IT professionals being completely satisfied with their rate of cloud transformation, the adoption of practices that lend themselves to cloud native technology and enable agility remains low.Only 20% of respondents are utilising DevOps across all applications, and just 17% use container services to develop and deploy all apps. DevOps and container services increase agility by speeding up application deployment times, improving productivity through continuous integration (CI) and continuous delivery (CD), enabling easy and frequent patching, and minimising production costs. Respondents recognise many of the benefits of DevOps and container services adoption, with common anticipated benefits from further adoption including increased operational efficiency (77%), improved responsiveness (59%) and improved customer experience (58%).

So, what is stopping organisations from realising their cloud native potential? Effectively refactoring applications requires an up-front commitment of resources and investment, including hardware, software, people, and skillsets like DevOps.

The alternative of lifting and shifting an application into a cloud environment can often be a more expensive and less successful endeavour and can deter organisations that already have sunk costs. In fact, findings from part two of the Cloud Impact Study,

The Security and Compliance Barricade, found that refactoring legacy applications for cloud infrastructure is a top barrier to cloud transformation (35%), second only to security and compliance (38%).
As a result, for seven out of nine application categories – Human Resources (HR), Customer Relationship Management (CRM), backup, disaster recovery, bespoke applications, development, and operations – on-premises remains the preferred hosting option. Marvin Sharp, VP Product and Strategy, Aptum explains, "Moving applications from on-premises to the cloud is not a simple case of virtualising workloads in data center servers as opposed to on-site servers. To see efficient, agile, and profitable results, refactoring applications where appropriate is essential. If you don't modernise applications to make them cloud native, costs can be far more unpredictable.

Sharp continues, "Respondents want to accelerate their cloud deployments, but on-premises still serves a purpose for some and will continue to for the near future. Organisations may already have sunk costs and want to make the most of their current investment, or it's simply not a priority to migrate non-critical applications like CRM to SaaS. That's why a gradual hybrid approach to transformation that aligns with hardware lifecycles, budgets and business goals is crucial. Working with a partner with knowledge of both legacy infrastructure and cloud-native technologies will optimise that approach."

As noted in each of the Cloud Impact Study reports, organisations recognise that they need expert help to plan and execute their transformation strategies. Choosing a Managed Services Provider that understands which areas of a business can be enhanced through cloud services, and which areas should remain on-premises is a crucial step in that process.

Securing customer data is top priority

41% of IT leaders say content sprawl is increasing the risk of data breaches and leaks.

Egnyte has released their 2021 Data Governance Trends Report. The report is based on a survey of 400 IT executives conducted in July 2021, examining the challenges of securing and governing unstructured content in today's hybrid and remote work environments.

A key finding of the research is that unchecked data growth, combined with a lack of visibility, is increasing the risk of breaches, ransomware, and compliance violations dramatically. More than half of companies (52%) use more than ten sanctioned file storage repositories, and 40% report unsanctioned cloud storage in use across the organisation, as well as rampant use of informal repositories like email, Slack, and DocuSign.

"Companies are struggling with how to get a handle on the vast amounts of unstructured data they generate, and this is going to continue as the new hybrid work model proceeds into 2022," said Kris Lahiri, Co-Founder and Chief Security Officer at Egnyte. "IT executives are forced to look for new solutions that can meet their growing needs to house and analyse those unstructured data sets and keep their content safe no matter where it is accessed."

With companies continuing to see their data expand, six major trends emerged in the 2021 Data Governance Trends report:

- Remote work remains a reality: 88% said employees will work remotely at least some of the time throughout 2022.
- Content sprawl is creating more risk: 100% of IT leaders say data is stored in informal repositories like email, collaboration portals, and local devices. They also rate these among the hardest to secure.

CDO role needs redefining

LANDMARK EXASOL study defines the changes needed for today's aspiring CDOs — and the organisations that recruit them — to prosper.

Despite high demand for strong data leadership, there is still much confusion and uncertainty about the Chief Data Officer (CDO) role. This is according to a new study launched today by the high-performance analytics database, Exasol, which found half (50%) of CDOs believe the value of their role is not yet recognised in the business world, while a similar number (46%) say that organisations' expectations for the CDO role are too high and are misinformed.

This may explain why many organisations struggle to find the right candidate to fill vacant CDO roles. And even for those that do, it's often a brief relationship, with CDOs having the lowest tenure of all C-suite roles.

Exasol's study, which aims to help employers and aspiring CDOs increase their chances of carving out a successful position, supports this in finding 1 in 5 (17%) of the CDOs surveyed had only stayed in their previous role for between one and two years. High demand and headhunting are of course a factor, but Exasol's findings highlight other common patterns including: a lack of support/ resources (23%); the scope of the role not meeting expectations (20%); a lack of fit with company culture (19%); a lack of a clearly defined role (18%); and members of the C-suite being difficult to work with (14%) as key issues influencing their desire to move on.

Another factor at play here is that many organisations hiring for a CDO role are prioritising those with technical expertise. Exasol's study found that three quarters (73%) of CDOs surveyed came from a technical background, whilst just 3% were from an arts/creative background. "Organisations need help to overcome the roadblocks to success and embrace a CDO who's role is no longer about simply governing data – but liberating it and improving data literacy across all levels of the organisation.

In this respect, I believe tunnel vision towards only hiring candidates from technical backgrounds is resulting in a major missed opportunity," said Peter Jackson, Exasol's Chief Data and Analytics Officer. "From my own experience, candidates from diverse backgrounds, such as HR, marketing and philosophy, can bring a lot to the CDO position because they are inclined to focus on people, rather than just the technology.

Non-technical candidates are often great data storytellers too as they can translate data into business results that engage and influence stakeholders and improve data literacy in the process."

What's clear from the report is that change is needed for todays, and future, aspiring CDO's to prosper. For example, 60% of CDOs surveyed agreed that there is a lack of support for people looking to move into the role, and 63% say that the education system isn't doing enough to show the appeal of a data career to the next generation.

By creating greater alignment on what the CDO role is, raising awareness of the value of often overlooked skills and traits, and making greater strides to tackle the common challenges and blockers to success, there is real opportunity to create positive change.

Customer experience (CX) technology sets a new baseline but still struggles to satisfy many

38% of consumers globally say that CX systems improved during the pandemic – but 52% experience CX failures due to limited technology.

NTT has released the 2021 edition of the Global Customer Experience Benchmarking Report (GCXBR), its highly influential annual survey assessing the global state of play for CX.

Now in its 24th year, the latest GCXBR arrives at an important juncture to help organizations calibrate their rapid adoption of CX technology, revealing a significant gap in perceptions between organizations and consumers.

This year, NTT interviewed 1,359 professionals across 34 global markets and 14 different sectors. For the first time, the research also included a voice of the customer (VoC) survey, supplementing evidence from professionals with opinion from a consumer panel of 1,402 respondents.

Resounding positive signs for CX
In the context of a disrupted CX environment, responsibility for CX has been elevated to a significantly more senior level and confidence in CX has followed suit:

- 64% of UK&I organizations now have ultimate accountability for CX held at the board level, up from 42% in 2020
- The rate of UK&I organizations with 'well advanced' or 'complete' CX strategies has more than doubled to 62%, up from 25% in 2020
- The rate of UK&I organizations reporting being 'very satisfied' with their CX has risen to 48%, up from 7% in 2020

UK&I organizations now expect that the majority of CX will be automated in twelve months' time, with workloads handled by AI and robotics rising to 49% from 22% today, and over a fifth of interviewees reported that their use of AI or robotics is delivering beyond expectations.

Keeping track of consumer perception
The positive outlook from the industry was only partially echoed by the new VoC survey, however. Encouragingly, 87% are happy to continue using digital channels at the increased levels triggered by the pandemic, while 38% said that the quality of automated CX systems had improved over the course of the pandemic.
In other areas, the research found warning signs about the amount of progress yet to be made to fully meet consumer expectations:

- 52% of consumers report digital channels failing them due to limited capabilities or services
- 44% experience failures due to digital channels misunderstanding their queries
- Just 35% say they are 'very satisfied' with automated CX solutions

With forecasts for next year showing high rates of UK&I organizations expecting to have implemented voice-activated AI assistants (48%), robotic process automation (38%), web-based AI assistants (41%), and other new technologies, these developments hold a lot of potential for businesses to differentiate themselves by more

effectively solving customers' challenges. "The addition of VoC data this year has shone a spotlight on a really interesting situation," comments Rob Allman, Vice President, Customer Experience, NTT Ltd.

The need for the human touch
When asked about human-led support, 94% of UK&I based CX decision-makers agreed that it remains critical – but less than half (46%) agreed that they have the technology in place to fully support remote CX employees.

Meanwhile, 38% in the VoC panel stated that their biggest reason for avoiding digital channels is that they would rather speak to a human.

Hospital trust leans on EcoStruxure IT Expert for continuous uptime

Increasing dependence upon IT systems to deliver healthcare services to 140,000 women, men, children and young people means availability and uptime are mission critical at Birmingham Women's and Children's NHS Foundation Trust. The installation of EcoStruxure IT Expert has helped the Trust take a major step forward in the assured delivery of services.

BIRMINGHAM Women's and Children's NHS Foundation Trust was founded in 2017 as a merger between two existing hospitals and is a specialist provider of healthcare services to women, children and families living in the English Midlands.

The Trust's operations are supported by an extensive IT infrastructure whose functions were combined and continue to be integrated on the campuses of both hospitals. Following the merger, most IT equipment is centralised in what IT Infrastructure Manager Jas Purewal describes as a "shiny new data centre" at the larger of the two sites, formerly the Birmingham Children's Hospital.

Another older data centre is located at the site of the former Birmingham Women's Hospital and there are also various hub rooms - distributed IT facilities - throughout both campuses which variously house

servers running applications needed to support healthcare, switchgear and networking equipment. Some hub rooms also host physical servers running SQL-based applications, but there is an ongoing programme to virtualise the majority of the Trust's applications on NetApp servers housed in the main data centres.

The necessity for always-on power for IT and patient health

Continuous uptime is the top priority for the Trust's IT department. Any impairment to the IT systems running patient-management or clinical applications inevitably impacts the delivery of treatment to patients. To ensure continuous operation in the event of a computer systems failure, the Trust maintains a detailed disaster-recovery (DR) plan which now sees the data centres in each of the constituent hospitals acting as failover resources to one another; in the event of a systems outage in one location, the servers in the other take up the load immediately.

Of more fundamental concern is the mains electricity supply itself. To guard against any service disruption, the Trust operates nearly 100 uninterruptible power supply (UPS) systems which provide battery back-up power to essential systems in the event of a utility power interruption or blackout. The UPS systems are designed to provide temporary ride-through power either until mains power is restored, or in extremis, until secondary back-up power generation can be brought online. Many of the UPSs are installed outside the main data centres, in remote edge locations, on both campuses.

A runtime challenge for the Trust

Maintenance of UPS systems is a vitally important routine. Because UPS batteries have a finite operating lifetime, they must be checked and replaced at regular intervals to ensure that they are fit for purpose should they ever be required to respond to the loss of mains power. Traditionally, inspection of the UPS battery systems has been a manual process conducted annually. The disadvantage of this method was that any degradation of the batteries that occurred between scheduled maintenance operations was not visible. This presented the risk that in the event of an outage or blackout, the UPS systems would be unable to power the IT infrastructure until the mains power was restored.

Just such a problem occurred during a routine generator test: A UPS that was specified to provide more than 20 minutes runtime to the load failed after only a few seconds, causing the main data centre to crash. According to Jas Purewal, ICT Infrastructure Manager at Birmingham Women's and Children's NHS Foundation Trust:

"If our systems shut down gracefully, they will come back up gracefully. But in this case, because the power was cut abruptly, it took us several hours to recover all our systems. The most important ones were returned to full operational status within an hour, however, others took three to four hours to recover. We also had to replace some disks over the next few days, so it was a very busy time with all hands on deck!"

Whilst the loss of IT services presented no risk to the health of people in the hospital's care, the incident caused a headache for the IT department, with the realisation that an unplanned mains outage might adversely affect the hospitals' ability to deliver critical IT services. As a result, the issue was discussed at board level and a decision taken to improve the resilience of the Trust's IT systems to withstand any similar instance in the future.

Automating inspections; using data to make decisions about availability and uptime

The Trust decided that it needed a better system for monitoring key infrastructure such as UPS systems, and it engaged the support of Advanced Power Technology (APT), an Elite Partner to Schneider Electric and specialist provider of energy-efficient critical power and cooling systems, particularly for use in IT installations. APT had previous experience at the site, having installed Schneider UPS systems for the Trust.

APT took a hard look at the actual requirement and took the novel approach of recommending the installation of EcoStruxure IT Expert, Schneider Electric's next-generation data centre infrastructure management (DCIM) software to remotely monitor and manage the UPS and battery systems. This cloud-based application allows connected hardware assets in data centres as well as distributed IT and edge locations to be monitored continuously from a central console. Status updates and alarms can be routed to any remote access device, such as a notebook,

EcoStruxure IT's capability extends beyond accurate monitoring of UPS systems and batteries as it can also be used to monitor equipment throughout the physical and IT layers, as well as environmental conditions such as temperature and humidity

tablet computer or smart phone. "The main thing we like about EcoStruxure is its dashboard facility," says Purewal. "You can very quickly see if you have a critical problem that needs immediate attention. It also has very useful features like power forecasting which allow us to estimate how long a battery is likely to last, even if it's not in critical condition, so that we can plan for timely replacement."
Another useful function is the ability to assess the effects of increasing the load on a UPS before additional equipment is installed. "This is where EcoStruxure is very good," says Purewal. "We can assess the impact of additional load and determine whether we need to upgrade the UPS at the same time. Using data from the application, we can decide whether to scale up or scale down the UPSs to right-size them for the IT and optimise the system for efficient operations."

Evaluating EcoStruxure IT Expert

EcoStruxure IT's capability extends beyond accurate monitoring of UPS systems and batteries as it can also be used to monitor equipment throughout the physical and IT layers, as well as environmental conditions such as temperature and humidity. The easy-to-use dashboard feature means that information on such matters can be easily absorbed by management who are not necessarily IT specialists. This is particularly useful in the case of the Trust where responsibility for the environmental management of the smaller IT hub rooms is shared between Purewal's IT department and general estates management.

"The data centres are my team's responsibility, but a lot of the networking gear is in small rooms – remote IT installations where the environment can be dusty and the ventilation poor. Overheating in these crowded facilities could easily become a problem," he says. "With the dashboard and graphical functions available in EcoStruxure IT Expert, I can make the case to management in other departments, or higher up the chain, that some small investment in air conditioning, or perhaps moving the equipment to a more suitable room, could reduce operating costs in the long run, as well as improving availability and reducing the total cost of ownership."

The value of Schneider Electric and partners

APT advised the Trust on the deployment of EcoStruxure IT Expert and provide ongoing support and consultancy regarding its flexibility and potential to deliver further benefits in the future. "We've got this great tool now from a leading vendor and that gives us great peace of mind as try to get the most benefit out of it," says Purewal. "APT's people have extensive knowledge that we can tap into, and they have been very supportive when we have any questions."

John Thompson, managing director of APT said: "The purpose of annual inspections was to provide assurance to the customer that the UPS systems were sufficient to meet the needs of emergency operations. Unfortunately, when called upon in the moment of need, Birmingham Women's and Children's Hospital found this approach to be lacking. The good news is that despite the outage, there was never any threat caused to human health at the hospital. The installation of EcoStruxure IT Expert means the team now has continuous, 24x7x365 assurance of the UPS's operational status as well as the runtime available to support the IT and critical loads."

Moving forward, Birmingham Women's and Children's NHS Foundation Trust will continue to expand the amount and variety of cloud-based services from its data centre. The use of EcoStruxure IT Expert is being extended to monitor environmental conditions in the IT rooms including temperature and humidity.

This will enable the IT department, in co-operation with estates management, to provide detailed information to senior management to drive investments that will not only guarantee maximum uptime but also help the Trust to manage its hardware assets in a more sustainable and efficient way.

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Redefining IT to address sustainability

As the UN Climate Change Conference (COP'26) in Glasgow approaches, Simon Reynolds considers how technology has a key part to play in achieving net zero ambitions, focusing on some of the challenges and opportunities facing IT leaders, and the wider significance of their actions to their businesses.

BY SIMON REYNOLDS, ENERGY & UTILITIES LEAD, COEUS CONSULTING

AS THE WORLD'S ATTENTION turns to COP26, the latest United Nations Climate Change Conference set to be held in Glasgow from 1st to 12th November 2021, much of the dialogue is expected to be centred around ambitious targets, with 70-plus countries committing to become net zero carbon economies by 2050. However, while governments are expected to take the majority of headlines, it is worth considering the impact on industry.

The question we are asking is: Do UK business leaders understand the full range of actions they could, and should, be taking to ensure their organisations play their part in meeting these goals? Research conducted by the British Standards Institute (BSI) has shown that while awareness and knowledge of net zero is growing, there is still work to be done. According to its survey of 1,000 senior decision makers across a range of UK industries, almost two thirds (64%) of businesses are not confident they fully understand the implications of net zero for their firm. Furthermore, seven in 10 UK businesses confirmed they had made, or were considering, making a commitment to net zero, while 82% responded that they required more guidance to achieve the target.

It is not just the business leaders who require further guidance; while keen to support initiatives in principle, IT leaders also often lack knowledge in regard to the full range of actions that they could be taking to help reduce their organisation's carbon footprint.

Understanding the environmental impact of IT operations is critical to ensuring companies can measure and understand their journey to net zero. So, where can IT leaders start?

This can feel like a daunting question, but it needn't be. No transformation or mind-set shift, be it digitally inspired or sustainability-driven, happens overnight. Rather, it is a journey that will unfold over a lengthy period of time, progressing as a measured, logical transition.

With this in mind, IT departments should therefore start small.

Consider your operations, activities, solutions and processes. By breaking the day to day down in a modular fashion, different aspects of the overall IT

function can more easily be identified, understood and then tackled in relation to net zero.

Curiosity, impact consideration and improvement

At Coeus we use a methodology that helps companies define their operations and breaks activities down into four umbrellas below. These will be relevant to the majority of IT departments – strategy, sourcing, change delivery and architecture.

Below we break down what 'IT sustainability' means in each of these areas:

- **Strategy:** In this area, IT sustainability is about enabling clients to transition from linear operating models to circular ones using a reduce, reuse, recycle approach. There are multiple ways of making a start with this strategy. For example, partnering with utility companies to transition data centres to 100% renewable energy-based power is a trend that is already gathering momentum. As renewable energy prices continue to drop over the coming decade, such strategies could be key differentiators for organisations in the future.
- **Sourcing:** Done correctly, clients can minimize waste creation and negative environmental impact through sustainable procurement practices and insist on collaboration across the whole value chain, including supplier take-back agreements. A key part of this is ensuring the right questions are asked during IT considerations to ensure the programmes, processes and activities put sustainability at the forefront of the agenda. According to a 2021 survey conducted by IT research agency Vanson Bourne, 77% of respondents rate environmental and sustainability considerations as 'extremely important' when electing a supplier for IT equipment or services. Ensuring that the correct questions are asked and scored when engaging suppliers in sourcing activities is therefore critical.
- **Change delivery:** The goal is to enable clients to speed up their sustainable transformation and meet Government regulations. By using the notion that no transformation should ever be considered fully complete, companies should consider the use of key structures and governance processes with the aim of tracking the progress of initiatives, reporting status and correcting course as required.
- **Architecture:** Companies need to understand the environmental footprint of transition to, and operations on, Cloud, and to build a better understanding of the technology needs for each sustainability initiative considered. Companies need to consider the impact of IT architectures and operations, with common efforts including the deployment of environmental maturity and materiality assessments and development of key performance indicators relating to carbon consumption. For example, being able to track and measure Power Usage Effectiveness (PUE) and Water Usage Effectiveness (WUE) can prove vital, putting in place precise cooling requirements in different floors of a traditional data centre, but also optimising general operations at all sites.

Aligning sustainability and business goals

Indeed, when it comes to sustainability and IT, asking the right questions of suppliers, considering the impacts of technology and architecture, and focusing on continual optimisation by adhering to key structures and governance processes are vitally important steps to take.

In doing so, firms can make several improvements that not only further their sustainability transformation, but equally drive other business benefits. Companies operating their own data centres may wish to consider moving to the cloud for example – a well-known step to reducing carbon emissions, but also one that can uncover productivity benefits, and unlock access to a range of new applications and solutions that can enhance process efficiencies. Alternatively, they could adopt a strategy of optimising their own data centre operations via the use of renewable energy, reclaimed water cooling or even purchasing Renewable Energy Certificates (RECs) to accelerate their sustainability agenda.

They might also seek to adopt data analytics tools, not only to gain insight into carbon intensive processes, but equally to enhance understanding of customer behaviours in order to improve the end-to-end experience.

Indeed, these are just two examples that merely touch the surface.

From cost savings and improved marketing efforts, to securing more business and inspiring employees, placing sustainability at the forefront of the IT agenda will provide many benefits.

For instance, IT can work with its business on new ways of working and inspire creative digital solutions, or help the company manage the increased dependence on digital solutions by developing and designing more flexible systems and operating models.

IT might also support sustainability targets and identify opportunities to reduce environmental impact across the organisation, as well as respond to regulatory requirements to demonstrate how a company is innovating for a low carbon future.

By building an architecture and suite of applications for the future, using appropriate technologies and suppliers and supporting changes in customer expectations, IT leaders can play a key role in helping companies to reduce emissions, increase sustainability and keep up with increased demand, all while elevating the customer experience.

How data centres can improve their green credentials and move towards NetZero

The data centre industry has a historically bad reputation when it comes to energy consumption. Yet our increasingly digitally automated lifestyles demand the existence of bigger and bigger data centres. How can companies which are notoriously consumption-hungry keep up with the calls for growth while also exercising smart sustainability and NetZero initiatives?

BY ZULA LUVSANDORJ, CURRENTLY WORKING AS A PROJECT FINANCE ADVISOR TO THE UK GOVERNMENT'S INFRASTRUCTURE AND PROJECTS AUTHORITY (IPA) REPORTING TO HM TREASURY AND CABINET OFFICE

IT IS ESTIMATED that currently, in 2021, data centres are responsible for around 2 percent of the globe's CO_2 emissions (GeSI, Smarter 2030). That is already the equivalent of the world's entire airline industry.

Forecasters predict that by 2025, data centres could be consuming as much as one fifth of the world's energy. This type of growth is simply unsustainable, so looking to alternative sources is not so much a choice as a necessity. Despite the grim figures, there is optimism on the horizon. This year saw the launch of the Climate Neutral Data Centre Pact in January, with many key players in the industry pledging to achieve climate neutrality by 2030. This is a vital step forward in Europe's bid to achieve climate neutrality by 2050.

Sector giants are establishing impressive sustainability strategies. Microsoft has pledged that its data centres will be run carbon neutral. Google has said that by 2030 it aims to replenish 120 percent of the water it consumes through its data centres. Facebook has developed efficient cooling designs saving billions of gallons of water worldwide.

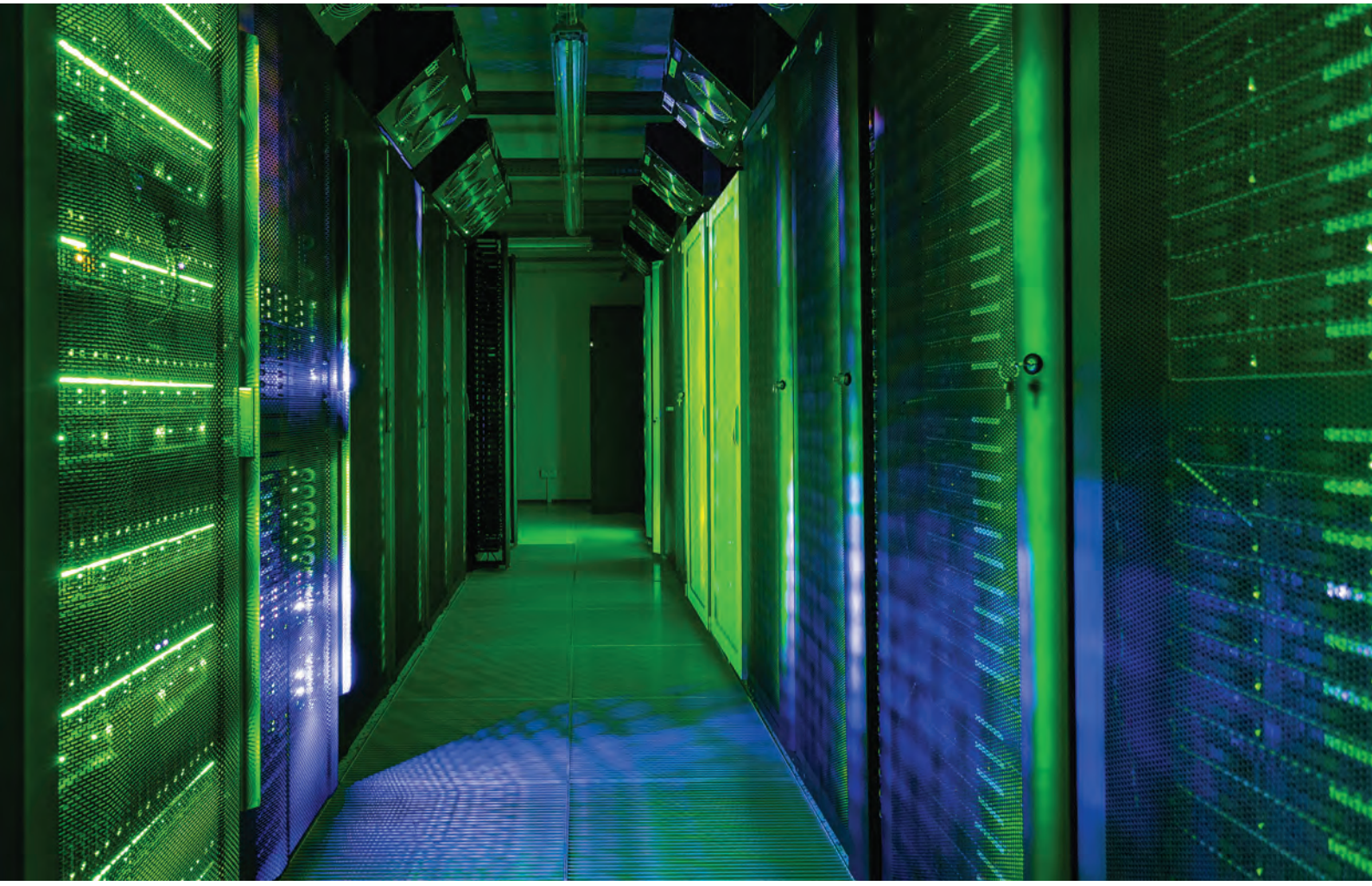
Liquid cooling is also much more efficient that air, which means that not only is this a sustainably sound switch, but a smart business decision. Locating data centres in colder climates as a method of reducing energy consumption is another tactic. Three of the largest data centre providers – Facebook, Google and Amazon – are using this approach, having purchased sites in Sweden. Amazon has even announced its plans to power all its operations with 100 percent renewable energy by 2025 and is now the largest corporate buyer of renewable energy in the world.

There are plenty of improvements being made in the data centre industry. However, many related industries – such as cryptocurrency and in particular Bitcoin mining - have been under fire of late, accused of somewhat damaging the progress that has been made by renewable generation technologies.

This is not due to lack of opportunity for sustainable capabilities, though. In fact, there are potential opportunities for the renewable energy developers such as hydro to sell excess energy to Bitcoin miners and data centres. But the price must be affordable and not threaten the demand from other industrial users.

The digital currencies and exchanges industry has huge potential to efficiently collaborate with the renewable energy sector, particularly when it comes to hydro power, as we have seen in countries such as the USA and Canada.

Other technologies such as solar and wind are still subject to study and expensive options for Bitcoin mining. Beyond Bitcoin, Ethereum is moving to low energy technology model, which has significant



processing power and consumes much less energy. With multiple major world economies already committed to 2050 NetZero commitments, green premium adoption is likely. The arrival of the new US administration, and the upcoming United Nations Climate Change Conference (COP26) in October, means that there will be ever more pressure on the world's economies to push for net zero commitments.

A report by the Irish Academy of Engineering (IAE) estimates that data centre expansion will need up to EUR9bn in new energy infrastructure and inject in the region of 1.5m tonnes into Ireland's carbon emissions by 2030. That's an increase of 13 percent to the country's existing electricity sector emissions.

Though there has been a growing number of pledges to the net zero by 2050 initiative in the past year – covering approximately 68% of the global GDP, according to a report from Oxford net zero and ECIU (Energy and Climate Intelligence Unit) – no sector can go unturned as both demand for greener solutions and environmental regulations increase, it is vital for data centres to embed sustainability into their strategies in order to secure their futures.

Why the data centre industry needs to ban cooling towers to end its water waste problem

With COP26 round the corner, we're going to be hearing a lot about how technology can support the path to net zero. But for the data centre industry to play a meaningful role in the low carbon transition, it must make sure its own house is in order. And that means ensuring that it is operating in the most efficient, sustainable way possible, particularly with regards to the world's most important resource: water.

BY NICOLAS FONTES, VP SALES DATACENTER SCALEWAY

ENERGY EFFICIENCY has understandably been a major focus in our industry for some time. However, all this focus has diverted attention from one of the industry's most controversial excesseses: it's industrial scale wastage of water.

In our recent roundtable with Manuel Mateo Goyet, deputy head of the European Commission's Cloud and Software Unit, he remarked that the industry's wasting of water is almost never touched on[1]. This is despite countless gallons of water being wasted everyday to cool data centres. To give an example, a 15 megawatt data centre in the USA can use up to 360,000 gallons of water a day[2] - a vast amount of water that is held, more often than not, in cooling towers. When one considers the size of our industry globally, the scale of this waste is almost difficult to comprehend. But worst of all, in addition to being inefficient and unsafe, this waste is completely unnecessary. That's why we're calling for the industry to implement a global ban on the use of cooling towers in data centres.

What are cooling towers?

The received wisdom is that because servers heat up, they need to be in highly air conditioned environments to keep them at optimum temperatures. But to understand the issues posed by cooling towers, we first need to understand the two ways in which liquid can be cooled.

The first way is to use a closed circuit with an

exchanger through which air passes. This is known as 'dry cooling'. It's the same principle as your car's radiator: there are two separate circuits - one for the air, and one for the water which needs cooling. The two circuits are never in direct contact, and they both pass through the same exchanger. Due to the fact that they are never in direct contact, no water is consumed by the system. This is the process that Scaleway has been using for around 15 years in our data centres.

The second way consists of spraying water from the top of a tower against an air flow going in the opposite direction (a cooling tower). The water partially evaporates, cools down and exchanges its heat with the air. This type of system is less expensive to purchase but uses large quantities of water. Many data centres use cooling towers because of the lower cost and also because they take up far less space.

What's the problem with cooling towers?

Put simply, they are responsible for most of the water that is wasted in data centres across the world.
They are also hugely energy efficient and subject to technical limitations including unplanned downtime, spikes in energy consumption, and lower efficiency during heatwaves. It is mind boggling that we have reached a point where it is deemed acceptable for a data centre to be using 30-40% of its total energy consumption for air conditioning in winter.
Out of the estimated 650 billion kWh of electricity consumed in 2020 by data centres, at least 240 billion kWh is wasted on air conditioning - a staggering number. Worse still, cooling towers are unhygienic and the ideal breeding ground for bacteria. In the USA, the Centre for Disease Control identifies cooling towers as one of the main sources of legionnaires' disease[3]. While in France, 18 people died and 86 were infected by a faulty cooling tower in the Nord-Pas-de-Calais area in 2003[4].

To avoid the risk of a Legionella infection, most data centres use chlorine and bromine-based chemicals and disinfectants which contribute to pollution and acid rain. Bromine, in particular, is a nasty chemical that is highly toxic and impacts the neuronal membrane. It has a toxic effect on our brains, and exposure to the chemical can result in drowsiness and psychosis amongst other neurological disorders.
With such downsides to cooling towers, it's imperative our industry takes control by replacing them with truly energy efficient technologies that also protect the health of those working on our sites and living close by to them.

What's the alternative?

The good news is that "dry" technologies, like the dry coolers widely used in European data centres, have been around for decades.
Our latest data centre - the DC5 - has been built with an environmentally conscious approach: even when we are hit by the biggest of heatwaves, we never turn on the air conditioning. From the ground up, it is exceptionally energy and water-efficient but it also provides a significant financial edge for our clients, leaving outdated, environmentally heavy technology out in the cold. We use an adiabatic cooling system – mimicking how the human body sweats to cool down. By evaporating a few grams of water into the air, a few hours per year, the air coming from the outside can be cooled by nearly 10°C.

We've known about this process since ancient times, and it allows us to maintain stable, optimal conditions for our precious servers - both those that belong to our customers and also to Scaleway's public cloud. Our process is incredibly straightforward. It works with standard computing equipment without the need for proprietary modifications. We have even built a climatic chamber to study the impact of all weather and humidity conditions on virtually all IT equipment available on the market today. It goes to show that keeping a data centre cool can be done without a cooling tower.

What's the way forward?

We need to take a threefold approach:
Firstly, less than a third of datacenter operators measure water consumption. This needs to change and we need to have far greater transparency about water usage across the whole industry. We are in a powerful position, with an opportunity to manage our own fate and come together to determine our own regulation. If we don't act soon, that power will be placed in the hands of regulators who will determine the disclosures for the industry, which may not be as favourable.

Secondly, we need to educate the wider industry including customers about water waste and this includes our customers. Thanks to technological developments, new equipment classes can withstand higher temperatures than previously possible, meaning that temperature requirements from customers need to be adapted to match and allow for more energy-efficient solutions. Not only do customers need to turn toward more efficient practices in line with what their equipment can withstand, but investors need reassurance, and those writing specifications need to be better informed.

Finally, we need to push for an outright ban on cooling towers. The French government and other European governments have already prohibited their use but we need a blanket ban if our industry is going to be able to say goodbye to this wasteful practice.

1 https://www.youtube.com/watch?v=jVuhUKeiMZE&t=4371s
2 https://datacenterfrontier.com/data-center-water-usage/

3 https://www.cdc.gov/vitalsigns/legionnaires/
4 https://en.wikipedia.org/wiki/List_of_Legionnaires%27_disease_outbreaks

Data centres, Combined Heat and Power (CHP), carbon abatement and the future of the grid

How a sustainable data centre design using CHP could set us on the right path for lowering emissions towards net zero carbon operations.

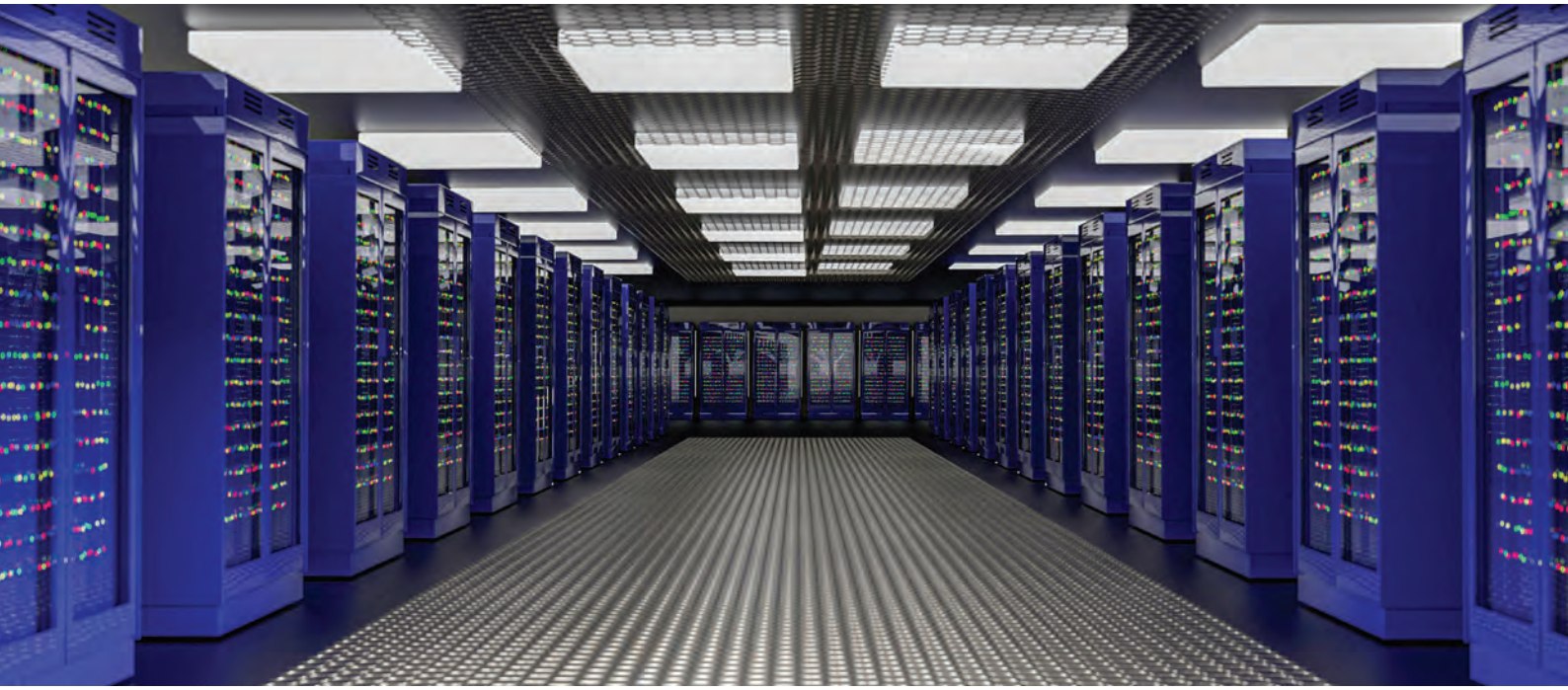
BY ED ANSETT, CHAIRMAN AT i3 SOLUTIONS GROUP AND GARDSON GITHU, SENIOR MECHANICAL ENGINEER AT EYP MISSION CRITICAL FACILITIES, INC.

GLOBAL CLIMATIC CHANGE means that for every part of the power chain from generation, across the grid and for intensive energy users such as data centres, the name of the game is carbon abatement. A response is needed from the data centre sector. This must align with where data centres of the future will be located – e.g., in data centre parks or within industry campuses. It must also encapsulate how their operation will be integrated with local, metro and national power, heating and cooling infrastructure. From a data centre perspective, the changes happening in upstream power can appear chaotic. The first question to be raised is: "Can the data centre play a role in reducing its own carbon footprint while supporting greenhouse gas abatement of the grid itself?"

That alone sounds ambitious.

A second consideration is that as well as bringing benefits to the grid, future designs may well have to provide carbon-free cooling and heating for a surrounding campus or to the local public or privately owned built environment.

Yet more complexity arises because data centre operators have their own priorities. Any improvements to the whole power chain and use of cooling and heat must be achieved using existing energy sector



technology while improving, or at least maintaining, on-site power reliability and reducing GHG emissions. The third paper in a series from the EYPMCF and i3 Solutions and GHG Abatement Group, Towards More Sustainable Data Center Design Using CHP will sets out how on-site energy production, harvesting, utilisation and heat recovery of data centre energy can, in appropriate circumstances achieve these aims.

Global Context

Current and future data centre space, power and cooling demands present the industry with new challenges.

Fundamentally the challenge is the need for on-site embedded power generation, based on a sustainable design with a low carbon footprint. Such challenges call for new ways of designing data centres.
One proposed solution is an innovative approach built around Combined Heat and Power (CHP) which includes a list of considerations encompassing decentralisation of energy production, use of renewable energy, small scale energy production (Microgrid), improvement of energy usage and power distribution efficiencies, how power at the site is generated and used, together with how the waste heat harvested on-site is re-used.

The benefits of a design that involves the use of CHP production at the site of the end-user eliminates power transmission losses and enables the capture of heat from the exhaust of a gas turbine, so improving the overall efficiency of the power production process. Installing co-generation plant at the site will provide all required power, as well as cooling. Also, heating for nearby campus buildings or agricultural use.

This can be achieved because within the data centre itself, power reliability can be improved by multiple on-site power generations sources. The use of natural gas in such a design creates an added environmental benefit in that NOx, SOx and particulate production is reduced dependent upon the overall grid fuel mix emission factor.

Case study – how CHP can work to lower data center emissions

There follows a sample study of a data centre with an assumed IT power capacity of 10MW (overall electrical capacity of 11.48MW) and associated cooling demand of 3000-Ton (10.5 MW). A typical installation would include three (3) turbine engines in an (N+1) redundant configuration. All mechanical cooling equipment is also configured in an (N+1) redundant configuration.

Turbine exhaust gas temperature ranges from approximately 340°C to 540°C. Exhaust gases are diverted through a heat exchanger to produce steam which is used in an absorption chiller to produce chilled water. Two (2) 5-megawatt gas turbines have a cumulative exhaust gas flow rate of approximately 150,000 lb/hr., - sufficient to produce over 7000-Ton of cooling (24.6 MW).

In the example, an absorption chiller replaces traditional cooling plant including a centrifugal chiller and cooling towers to reject the heat utilising a reversed Carnot cycle process. Typical cooling plant utilises water cooled chilled water plant with a centrifugal compressor, cooling towers and pumps. The range is 0.8 to 1.0 kilowatt per Ton of cooling. For a typical 1.0 kilowatt per Ton centrifugal chiller plant, energy usage is approximately 3MW, leading to total site energy usage of 13MW (i.e., IT load plus mechanical load). By comparison, the use of an absorption chiller frees 3MW of power, which is available to provide relief on the electric grid and reduce the overall energy consumption of the facility. Such a design cuts the carbon footprint of a 11.48MW total connected load data centre by 50%, while fuel consumption is reduced by 553,431 MMBtu.

The subsequent reduction in carbon emissions is equivalent to total annual greenhouse gas emissions generated by, e.g., 20,258 cars or 10,818 homes. (A detailed case study, complete with graphics and calculations of stream output estimates, overall CHP Thermal Performance, Electricity profiles, Overall benefits of Co-generation power and cooling Plant and an Emissions Summary table is available within the Whitepaper.)

Conclusion

As noted above, a global response to a global problem is needed. A single solution will not fit all circumstances. However, many of the problems to be faced are common to different geographies. Depending on existing national power strategies and fuel mix, different locations have different dependencies. Countries with easy access to and a high dependency on e.g., coal, may have low-cost power but high $kgCO_2e/kWh$.

Some countries, such as Poland, China and Germany already face criticism from environmental activists for their continued use of coal power. In all territories, whether in advanced or developing economies, how CHP for data centres is deployed must not add to the total or marginal emissions of changing grid infrastructure.

Between now and 2030, how such grids decarbonise may dictate the adoption rate of CHP based on its carbon footprint and return on investment. Nonetheless, the time to consider CHP as one design option is now.

The third paper in the Data Center GHG Abatement series from EYP and i3 is titled Towards More Sustainable Data Center Design Using CHP and will be available to download soon, in the meantime please visit the i3 website to catch up on the previous white papers.

A green revolution within the data centre market

Sustainable data centres are vital to achieving global net-zero targets.

BY FABRIZIO GARRONE, ARUBA REPRESENTATIVE ON THE BOARD OF DIRECTORS OF CLIMATE NEUTRAL DATA CENTER PACT

THE DATA CENTER INDUSTRY must prioritise energy efficiency and renewable energy. In the data center industry, COVID-19 has created an interesting tension between speeding up digital transformation and bringing environmental and sustainability issues to the forefront of public awareness.

The pressure is certainly on businesses to show they're at the forefront of the transition towards eco-friendlier processes, but for those within the data centre space, this is mission critical. With remote working becoming the norm, more and more organisations have started to rely on outsourced data centre services and cloud computing to support their everyday operations. The servers, backups, and power cooling infrastructure of these account for 1% of total yearly global energy use. Of course, the alarm bells are not yet ringing, but to place this into context, let's focus on the fact that annual CO2 emissions from data centres equal those of the commercial airline industry at pre-pandemic levels. Data center construction demand is predicted to increase by 85% by 2021 in a survey by Turner & Townsend of IT industry professionals. . It's not that surprising after all that there are those who are forecasting an unsustainable growth in electricity use and carbon emissions as new data centres continue to come online worldwide.

The pursuit towards 'greener' efficiency

The good news is that suppliers and operators have become much more aware of the need to prioritise energy efficiency. Although data center workloads are expected to increase by 50%, electricity demand

from data centres globally is expected to remain flat to 2021.

The monumental task of cooling servers and backups is the primary source of energy consumption in most traditional data centres. Maintaining and operating a server below 26 degrees Celsius can consume up to 40% of electricity. As a result, Aruba's Global Cloud Data Centre (IT3) campus in Milan uses a geothermal system that uses naturally occurring cold water underground to replace traditional cooling solutions. This system powers all air conditioning for the data rooms across the campus, making it very energy efficient. The rack cabinets housing the servers are also equipped with a clever cold air containment system that guarantees maximum energy efficiency and a comfortable working environment.
As such, interest in innovative cooling solutions is growing within the industry. Those that adopt this particular route, the long-term monetary savings can be impressive. For example, by moving to natural cooling technology, Aberdeen University (UK), improved the power usage effectiveness of its data centre from 2.6 (ranked inefficient) to 1.15 (ranked highly efficient) and is now saving £100,000 per year. Considering that cooling UK data centres currently costs an estimated £4-7 billion per annum, switching to other more efficient cooling systems may prove significant in terms of savings in the long-term.

Beyond renewables

Maximising energy efficiency is just one side of the puzzle for data centres; the other is sourcing electricity from low or zero-carbon sources. Data centre operators frequently prioritise reducing their energy consumption due to the significant investment required to get renewable energy projects off the ground.

However, technical advancements have resulted in a dramatic reduction in the cost-per-unit of renewable energy production over the last decade. The levelized cost of energy for solar photovoltaic panels, for example, has decreased by 82% (which evaluates lifetime costs divided by energy production) (2010-2019).

As such, the data centre market is witnessing a strong shift, with many making the leap towards self-generation. For instance, Aruba's Global Cloud Data Centre – the largest, state-of-the-art data campus in Italy – has 60MW of renewable power production capacity onsite. Photovoltaic panels cover the surfaces of the buildings, alongside a purpose-built hydroelectric plant. Where sufficient electricity cannot be generated onsite, it is supplemented by renewable energy from European Guarantee of Origin scheme (GO) certified sources, meaning the campus is 100% powered by renewables.

Our point of view is that we want to continue to improve the energy efficiency of our data centres using new technologies that not only focus on optimising the supporting infrastructure of the data centre in an isolated manner, but also tap into previously untapped potential of the energy used in a data centre as a whole (e.g. AI-driven Data Centre Infrastructure Management systems (DCIM) and waste heat recovery and reuse).

As we seek to protect our planet for future generations, it's heartening to see innovations in energy efficiency and renewable energy use happening across the data centre industry. To achieve success, it's important that operators and vendors hold each other to account through initiatives like the Climate Neutral Data Centre Pact. The pact's signatories – which includes some of the biggest European Cloud providers – have publicly committed to making their data centres in Europe are carbon neutral by 2030, in line with findings from the European Commission's 2020 report, 'Shaping Europe's Digital Future'. Moreover, the signatories of this self-regulatory initiative have agreed to provide evidence of this through: evidence of measurable targets using efficient energy, purchases for only 100% carbon-free energy, water conservation targets, server repairs and recycling of parts, and other ways of recycling heat.

Although global data centre capacity will undoubtedly expand in the coming years, we cannot accept that emissions will grow at the same level. As an industry, we can and should prioritise protecting the environment as we continue to deliver vital data centre and cloud computing services.

Building sustainable data centres for the future

As the Climate Neutral Data Center self-regulatory pact in Europe advances and customer demands for greener solutions accelerate, data centre providers are building sustainability into their ongoing strategies to meet new environmental standards.

BY RICHARD BRANDON, HEAD OF EUROPEAN DESIGN AND CONSTRUCTION, CYRUSONE

DATA CENTRES built today are 'greener' than they have ever been, however, these facilities consume an enormous amount of resources and power around the world to function 24/7 to meet the growing hyperscale demand. According to some estimates, data centre facilities consume up to 1% of the world's total energy consumption. However, across Europe, that status quo is changing – the EU recently announced the EU Green Deal that "data centres, can and should be carbon neutral by 2030" and raised the prospect of forcing this through via regulatory change.

Shifting Public Opinion

The beginning of the pandemic saw the largest absolute drop in annual global energy-related CO2 emissions in 2020, according to International Energy Agency. This was as a result of Covid-19 grounding the majority of economies to a halt.

Since then, public opinion has changed with 80 percent of UNDP survey respondents from countries with the highest emissions favouring a move towards renewable energy. Additionally, 52% of those surveyed support investing in green businesses and jobs.

However, emissions are already returning to, or exceeding, pre-pandemic levels, as major economies lead the resurgence as returning economic activity increases energy demand.

Now, all industries must do their part. And despite the longstanding focus on the automotive, manufacturing and agricultural industries, there's no pathway to a cleaner planet without addressing the sizable energy consumption of the data centres powering an increasingly digitised global economy.

What are the key strategies data centre providers must employ when building next-generation facilities?

Setting Ambitious Goals

The first goal for data centre providers is to fully understand the impact their data centres are having on the environment and communities around their sites. Across Europe the BREEAM certification - the world's leading sustainability assessment method for master planning projects, infrastructure and buildings - is a critical measurement for assessing the

energy efficiency and sustainability credentials of data centres.

CyrusOne recently mandated that all new facilities built in Europe will be, at the very minimum, BREEAM certification rated Very Good. As an organisation, we recognise that we must continually push to address the key sustainable categories detailed in the BREEAM certification process. Below are the key sustainability value areas we are focusing on in Europe:

Energy efficiency

Many data centre providers have prioritised developing new data centres with low competitive Power Usage Effectiveness (PUE) ratings ensuring that the energy consumed within their facilities is as efficient as possible. For instance, our Building Management Systems and flexible infrastructure allow precise delivery of cooling to support the electrical load in each facility. These features give our new facilities an excellent design efficiency when operating at full utilisation. Our drive for lower PUE also includes our capital plant initiative, only procuring the best-in-class energy efficient equipment to be used in our data centres.

Water usage

At CyrusOne, all our newly built data centres are designed with zero water consumption cooling. This means no cooling towers, no evaporative cooling, and very low water usage. While small amounts of water are still used for humidification, facility maintenance, and domestic water, this is a fraction of the reliance other facilities place upon on water usage for their cooling infrastructure.

Materials

We prioritise sourcing local materials to limit the carbon impact of transporting equipment and components for construction from other countries. This is an increasingly important issue as transportation of goods is a growing source of greenhouse gas emissions. This approach has also shielded CyrusOne from the worst of the global supply chain disruption caused by the pandemic.

Recycling valuable resources / waste

The construction phase of data centres utilises large volumes of materials and energy. Embedded carbon – the sum of all the greenhouse gas emissions resulting from the mining, harvesting, processing, manufacturing, transportation and installation of building materials – is a major source of carbon globally. The embedded carbon during the build programme could offset the operational efficiencies if this is not considered from the outset.

Ecology

Data centres can have a major impact on the local environment and the wildlife that depends on them. That is why we have a commitment to local habitats manifested across all of our facilities, including applying Host In Ireland's DC's for Bees Pollinator Plan within our bespoke landscaping and also biodiversity schemes in Dublin and Amsterdam. Data centre developers can not only do more to limit the disruption to the delicate ecosystem in areas in which they operate but should be going the extra mile to significantly enhance it.

In the past, businesses have had to balance profitability against sustainability, however, investors and customers are under increasing pressure from governments and the public to improve their Environmental, Social and Governance (ESG) performance and will increasingly only work with businesses that have robust sustainability strategies to help them meet those objectives. This means sustainability is now compulsory for data centre providers and operators.

To remain competitive in the long run, it is no longer enough to meet the very minimum standard, the most successful data centres are pushing new technologies to achieve their sustainability goals.

What next?

The more digitised our economy becomes post-pandemic, the more we will all rely on data centres to support this new reality. Due to their scale, data centres will need to play a key role to support the global efforts to meet a carbon neutral future.

In 2020, CyrusOne joined the European Data Centre Association Board of Directors and Policy Committee as an Associate Member to support the organisations efforts to monitor, educate and encourage best practice in data centre policy in Europe and the rest of the world.

So far, we have achieved 100% renewable energy across our full European portfolio, nine years ahead of the 2030 target outlined in the self-regulatory Climate Neutral Data Centre Pact, of which CyrusOne is a founding member.

CyrusOne is also committed to working at the forefront of sustainability in Europe and strives to create a more sustainable future in the data centre industry. Last year, we pledged to become carbon neutral by 2040. We are focused on purchasing renewables, leveraging green power, and integrating sustainable design components for all facilities. At existing locations, CyrusOne is strategically evaluating upgrades and technologies that reduce carbon intensity and add renewable power to the grid, while remaining cost-effective to meet customers' needs.

To support your own sustainable data centre strategy, your provider and operator must have the mindset that sustainable and efficient data centres are very much achievable today.

How tech can build a sustainable future

Chris Greenwood, UK Managing Director at NetApp, writes about reducing digital wastage.

THE COVID pandemic has made the cloud essential to business. Earlier this year Gartner reported a 23.1% YoY increase in worldwide end-user spending on public cloud services, which will see global cloud spend rise to $332.3 billion. Our own research also revealed that convenience is king when it comes to the benefits cloud services can bring, with 87% of employees stating that storing data in the cloud is easier than other storage methods.

The danger of the cloud is that it affects our mindset towards sustainability. While cloud services bring a huge amount of opportunity, we need to ensure we're using it in a way that is truly sustainable. The main problem is that many organisations are unaware of the environmental impacts of using the cloud.

Firstly, we cannot forget that the cloud ecosystem is still reliant on a physical data centre and as a result, there is an environmental impact. Data centres consume huge amounts of energy which can make it difficult to control the consumption of data and not be as efficient. According to Greenpeace, by 2025 the tech sector could consume 20% of the world's total electricity, increasing by 7% due to the expansion of cloud computing.
Secondly, and perhaps most importantly, this is an issue about digital waste. It doesn't matter if the hyperscalers and their data centres are incredibly efficient, if the businesses that are using them are wasteful in their approach to data management, storage and use, for example by regularly increasing the capacity of the cloud, then they won't be sustainable. In 2018, 50 million metric tons of e-waste was generated globally.

Our own research reveals that businesses using cloud could reduce their digital wastage by up to 60%. By reducing the digital wastage caused by paying for services they do not use or are failing to maximise the potential of, organisations can become more sustainable. This will enable them to accelerate the use of cloud-based technologies such as AI and data analytics, which take the management of data off their hands, giving them the time and the tools to use data more strategically. Through our cloud optimisation tool, SPOT, and our Cloud Volumes ONTAP solution, NetApp is helping companies find the most efficient way to manage their data, use the cloud, optimise storage spend and minimise digital waste. We found that as a company ourselves we were paying 73% too much for cloud services, and so by using SPOT, we were able to minimise digital wastage and start investing in technologies which had a genuine business impact.

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In today's digital world, data centers are an essential part of our infrastructure, that suffers from an increasing pressure to build quicker, achieve higher levels of energy efficiency, and avoid downtimes during their operations. For that, it's required mission-critical cooling plants where the equipment and piping must be highly reliable and as energy efficient as possible, but also fast in its installation. But, can plastic pipes be used in a data center? What added-value do they bring? Which applications and where? The Data Center green and brownfield market are under increasing pressure, and no risk should be taken. The Swiss company GF Piping Systems provides leading-edge piping systems for reliable mission-critical cooling. Their range of leading-edge plastic piping systems, which can be used for numerous applications in data centers, cater to these high demands of the industry, offering significant advantages during commissioning and operation.

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The future of data centres

With the demand for the Internet of Things (IoT), automation and 5G continuing to grow, and heavily influencing businesses and supply chains over the coming years, the sheer volume of data that companies will be dealing with will become more and more overwhelming.

BY PETER RUFFLEY, CEO, ZIZO

WHEREAS five to ten years ago we'd see new data centres popping up everywhere to store and move all of the data around, this is no longer the case. Many cities, such as Amsterdam, have put a stop to any more data centres being built as they drain power from the grid and cities have to invest more in power and cooling systems to keep them running efficiently. There is an urgent need for existing data centres to be utilised better and for businesses to become savvier in how they store and move data. Just because businesses can store data, doesn't mean they should. Sustainability is something that should be baked into the strategy as businesses move forward and seen as a positive process, as opposed to one that is a burden. There is a misconception that having more servers is the way forward. While they are able to store large volumes of data, they do not reduce the power needed and increase cooling costs in the data centre, and only a few of the capabilities of these servers are ever fully utilised. There must be smarter initiatives put in place.

Over the coming years, we are going to see a tremendous investment in large scale and High-Performance Computing (HPC) being installed within organisations to support data analytics and AI. At the same time, there will be an onus on data centre providers to be able to provide these systems without necessarily understanding the infrastructure that's required to deliver them or the software or business output needed to get value from them. There's no denying that the majority of data centres are now being asked how they provide AI solutions and how they can assist organisations on their AI journey. Whilst organisations might assume that data centres will have everything to do with AI tied up. Is this really the case? Yes, there is a realisation of the benefits of AI, but actually how it is best implemented, and by who, to get the right results, hasn't been fully decided.

Solutions to how to improve the performance of large-scale application systems are being created, whether that's by getting better processes, better hardware or whether it's reducing the cost to run them through improved cooling or heat exchange systems. But data centre providers have to be able to combine these infrastructure elements with a deeper understanding of business processes. When it comes to AI, there has to be an understanding of what the whole strategic vision is and looking at where value can be delivered and how a return on investment (ROI) is achieved. What needs to happen is for data centre providers to work towards educating customers on what can be done to get quick wins. There are some fascinating innovations already happening, where lessons can be learnt. In Scandinavia for example, there are those who are building carbon-neutral data centres, which are completely air-cooled, with the use of sustainable power cooling through solar. The cooling also comes through the building by basically opening the windows. There are also water cool data centres out there under the ocean.

As the global costs of energy rise, and the numbers of HPC clusters powering AI to drive our next-generation technologies increase, new technologies have to be found that lower the cost of running the data centre, beyond standard air cooling. It's great to see people thinking outside of the box, with submerged HPC systems and full, naturally aerated data centres, but more will have to be done (and fast) to meet up with global data growth.

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A cooler way for data centres to enjoy a more sustainable future

With the COP26 Conference taking place in November in Scotland, it serves as a reminder that the needs of the environment are ever more pressing, not least because climate change is bringing with it extreme weather events and acts of considerable devastation to all four corners of the globe.

BY RAYMOND MA, GENERAL MANAGER FOR EUROPE, ALIBABA CLOUD INTELLIGENCE

The perilous state of the environment, combined with the increasingly tech-centric lives we live today, puts society in a quandary. Morally, we have a personal and corporate duty to protect the environment. But, practically, our personal and professional lives depend on us being connected to each other via devices and networks, all of which consume energy in their production and their use. To compound the conundrum, the pandemic accelerated the uptake of initiatives like Working From Home (WFM), which put increased demands on bandwidth and connectivity in order to accommodate the additional data flowing around the 'datasphere'. Remember, too, that during the lockdown periods, people weren't just WFM, but many were being educated and entertained via the internet as well, creating an additional drain on energy and environmental resources. Looking ahead, mega trends like 5G and autonomous driving will further

serve to put considerable demand on energy use and production.

It's unsurprising then – but no less worrying – that the global datasphere is predicted to grow from 33 zettabytes (in 2018) to 175 zettabytes by 2025, according to IDC. Of course, it is datacentres that facilitate the connected, online world that we all live and work in and the responsibility falls on their shoulders to ensure they play their role in protecting the environment by being designed, built and operated in such a way that their impact on the environment is minimal. With the Swiss Federal Office of Energy saying that datacentres could account for half of the country's energy consumption by 2035, it is imperative that those operating them are acutely aware of their responsibilities to the environment and the communities they serve.

Globally, data centres currently use around 205 terawatt-hours of power each year, and the predicted growth in the datasphere over the next few years will have a significant impact on power demands. As a result, the datacentre industry needs to look at new and innovative ways to drive efficiencies, especially when it comes to cooling, not least because conventional datacentres, particularly older ones, are often incredibly inefficient in that respect. Consumption for standard air conditioning is estimated to be around 40 per cent of their total energy bill. Not only does this inefficiency have a financial cost, it also has a huge environmental impact.

To address these challenges, a core green technology that datacentres should consider, includes liquid cooling, which plays a role in helping to ensure the operation of datacentres is environment-friendly. For instance, Alibaba's hyperscale datacentre in Hangzhou, has one of the world's largest server clusters submerged in a specialised liquid coolant, which quickly chills the IT hardware. This reduces energy consumption by over 70%, while its Power Usage Effectiveness (PUE) approaches the ideal target of 1.0, which means nearly all of the energy is used for computing.

Immersion cooling involves an immersed, liquid-cooling server solution that uses insulating coolant instead of traditional air-cooling equipment. All IT equipment in the datacentre is wholly immersed in the cooling fluid and heat is transmitted to the outside in a highly efficient way through the liquid cooling system. As a result, low-efficiency traditional fans and air conditioners are no longer used.

It is estimated that datacentres with immersion cooling can reduce energy consumption significantly and lower operational costs by around a fifth. For example, Alibaba Cloud supported $38.4 billion worth of transactions in a single day during Alibaba's 11.11 Global Shopping Festival in 2019. The liquid-cooling

technology used in the datacentre enabled savings of around 200,000 kilowatt hours of energy in that 24-hour period – enough to power 18 U.S. households for a year.

In Ulanqab, where temperatures drop to as low as -22 degrees Celsius during the winter, the datacentre can leverage the free-air cooling system and has no need for additional machine-powered cooling for 10 months of the entire year. In Nantong, Alibaba Cloud leverages its proprietary uninterruptible power supplies solution to enhance electricity usage efficiency, as well as intelligent robots to automate monitoring and maintenance tasks.

Closer to home, Alibaba Cloud operates a datacentre in the UK – which is set to celebrate its third anniversary in October this year – and it has had datacentres present in continental Europe for more than five years, supporting local customers in the region while complying to local regulations. It is possible for datacentres to marry their responsibilities to the environment while meeting our growing dependency on technology and energy needed to power it. As with all challenges, it requires dedication and commitment, along with the willingness to take a new perspective on how best to solve age-old problems. Getting it right will mean a win-win situation for the environment and how we live our technology-powered lives, both now and in the future.

It's not easy being green

The challenges of data centre sustainability and how to make effective changes.

BY TERRY STORRAR, MANAGING DIRECTOR, LEASEWEB UK

THE DATA CENTRE INDUSTRY has an unspoken mandate to change its ways. Expected to become the biggest global consumer of electricity in the ICT sector by 2025, the data centre industry is set to leave a far from desirable footprint in the wake of the current climate change agenda.

As businesses large and small have seen their digital transformation efforts accelerated by a global pandemic, meaning workers need access to data 24/7, from wherever they are, on any device, data centres must accommodate expectations of increasing uptime and round-the-clock accessibility. As businesses continue to become aware of the benefits of cloud services, the growth of the data centre industry is set to increase. Whilst this presents great opportunities for the data centre sector, we must remain aware of the sustainability black mark that could soon have an adverse effect on the industry's reputation and future success.

Taking responsibility for long-term sustainability

Moving at the current trajectory of energy consumption is unsustainable. With increasing pressure both within the industry and externally, data centre managers must take responsibility for the long-term sustainability of their infrastructure.

Earlier this year, key industry leaders signed a commitment to become climate neutral by 2030. This Climate Neutral Data Centre Pact, backed by 17 industry bodies, laid out targets and goals for more efficiency, better use of green energy and aims for circular economy outcomes.

Operational performance vs greener practices

For many, making long-term changes seems daunting, not least because there are an overwhelming number of factors that could determine a data centre's individual energy consumption, and committing to greener performance can be time-consuming. When it comes to power consumption, data centres must consider much more than just the storage and hardware requirements. Up-to-date retention guidelines call for reliable and easily accessible backups, with all additional data secured, cooled, and transmitted effectively. Likewise, if data centre operators need to upgrade and expand their physical space to make way for new racks and equipment, all of this must be well lit, cooled, and secured.

With server networks relying on fans, consoles, monitors, lights, and cooling systems running around the clock, data centres consume a significant amount of energy on a daily basis. What's more, with increasing requirements for continuous uptime, power consumption has increased even more as systems run 24/7 regardless of whether they're actively being used. So how can data centre operators find ways to effectively reduce their energy consumption and make changes for the long term?

Making the changes that matter

It's time for the data centre industry to step up and commit to implementing more energy-efficient practices. Building a greener infrastructure means making changes, but here are a few that could significantly improve the green credentials of your organisation.

1. Invest in new equipment

Legacy systems, hardware, and other equipment may not have been built with the best energy efficiency in mind, and often require more energy in order to remain operational.

Now, with manufacturers more focused on the green agenda, hardware is built to perform more effectively over the product lifespan. Investing in new, more efficient hardware could significantly help operators build a greener infrastructure.

2. Retire redundant servers

Research has found that 25% of 16,000 assessed servers were 'comatose', meaning they were using power without doing any useful work. This is common in data centres as operators frequently allocate additional space automatically for customers in anticipation of their customers' future growth.

That means, data centres hold a large amount of dormant server space until that customer's business expansion occurs, which sometimes doesn't happen at all. Turning off these servers in zombie mode could have a significant impact on their energy consumption in the future.

3. Improve virtualisation

Improving your virtualisation practices could help to increase your environmental performance. This could be achieved by running multiple pieces of software on the same server or combining multiple servers into one, improving your overall efficiency and the environmental impact of each user storing data. This can also eliminate the need for full-time on-site staff, allowing you to run with a reduced energy footprint.

4. Make use of power-on-demand

Switching to an on-demand energy model could significantly reduce your site's power consumption. With monitoring and analysis in place, operators can keep track of their power consumption and oversee where they might make any necessary further energy savings.
With tools on the market to allow data centres to reclaim unused power and distribute it elsewhere, data centres could work towards a more circular economy, perfecting their infrastructure for years to come.

Cooling is key to greener IT

An increasing appetite for connectivity is placing strain on the world's data centres. With such a significant portion of the planet's electricity produced used to power data centres, and much of this on cooling alone, the need for more efficient heat transfer solutions is apparent. Considering this, **GEMMA REEVES, BUSINESS UNIT MANAGER AT ALFA LAVAL**, discusses how new heat exchanger technology can facilitate the transition to greener IT infrastructure.

STATISTICS from IBM indicate that the planet's internet users have grown from 2.5 billion in 2012 to 4.1 billion in 2019 – a 64% increase in just seven years. However, behind this digital demand, there is a very real physical consequence. According to recent reports, the world's nine million data centres' CO2 emission were equal to that of global air travel in 2019. While this is already a startling figure, it may well increase if internet users continue to rise at the current rate.

This figure is even more troubling when pressing commitments to achieve net zero carbon emissions by 2050 are considered. At a time when carbon footprints should be decreasing, the environmental impact of data centres looks to be going in the opposite direction. As such, it is clear that innovative solutions will be required to bring greater efficiency to the data centre sphere.

How do data centres use energy?

In order to effectively mitigate the inefficiencies of current data centre infrastructure, it is important to first address how these sites use their energy. In an effort to limit downtime to an absolute minimum on their services, data providers are expected to maintain 99.999% uptime per year – the so-called 'five nines'. This high availability is roughly equivalent to just 5 minutes of downtime each year. Understandably, this requires the internal servers to be in near constant use. To stop them from overheating, some form of cooling system is required. This can be done through a variety of methods, such as immersion cooling of the servers, or more indirectly using cooling towers. However, the main takeaway here is that cooling currently constitutes around 40% of a data centre's energy consumption, so the need for more efficient heat transfer solutions is apparent.

Mechanical cooling

At present, mechanical cooling remains the industry standard in data centres. This is most commonly done through a system filtering cold air through the server intakes to cool the internal components, and then dispersing the hot air. Though this method was previously considered an effective way of cooling the severs, it is far from efficient, consuming thousands of kilowatt hours each year.

Concerningly, much of this electricity is generated

through the combustion of fossil fuels. So, in order for IT infrastructure to go greener, viable alternatives need to be employed that reduce reliance on mechanical cooling.

Harnessing free cooling

An effective way to minimise usage of mechanical cooling is to instead utilise free cooling using the outside air. In the UK and northern Europe, the ambient air temperature is often cold enough to allow free cooling, with mechanical assistance only required on the warmest of summer days. Cooling towers, which are most commonly used to dissipate heat from the data centre, can be equipped to enable free cooling and bypass the chiller in the system. However, an open cooling tower also presents risks of reduced thermal efficiency and equipment failure due to fouling, which could prove counterintuitive to efficiency drives should something fall foul. Installing a gasketed plate-and-frame heat exchanger, such as those made by Alfa Laval, provides an effective intermediate that both enables free cooling and minimises risk.

Waste Heat Recovery

Another option to decrease energy usage is to make better use of the residual heat produced by the data centre itself. With thousands of servers functioning within any one floor, a vast amount of residual heat is produced as a by-product of regular operation. At present, this heat is going to waste. Fundamentally, this heat is thermal energy, which can be used to feed a number of applications.

This concept remains a relatively new one as far as data centres are concerned, but has recently been trialled at a Danish data centre where Alfa Laval equipment provided the interface to heat a district heating network using residual heat from servers. Savings of 100GW were made – enough to power 30,000,000 homes – so the potential for this application is clear.

The future of cooling

Mechanical cooling has undoubtably been a valuable asset to the growth of the data centre market in the past few decades. However, just as the market has grown and developed, it is important that cooling techniques mature alongside this. Traditional mechanical cooling techniques are becoming increasingly ill-suited to the demands of the modern market, as climate commitments and the advent of high-density computing necessitate a move towards more efficient practice.

Considering this, the viable successor to mechanical cooling will be one that delivers increased cooling effectiveness with a decreased carbon footprint. One such method that fits both of these criteria is liquid cooling. Primarily, the main advantage here is that liquids are far better at absorbing heat – up to thousands of times more effective than air in the case of water.

A more advanced application of this is immersion cooling, submerging the servers and racks into a dielectric coolant. Placing electrical equipment into liquid may seem counterintuitive to function, but in this case, the liquid is only thermally conductive and not electrically. This solution is available in two formats: single phase and two-phase, with energy savings ranging between 35% and 75%.

Crucially, this method achieves industry-high levels of effectiveness while maintaining a diminished environmental impact. This will be a key consideration as strain on data centres continues to grow amid rising user numbers. Air-cooled systems are growing increasingly ineffective to the data needs of the modern world, so immersion cooling will likely have a vital role to play in the near future.

Combined cooling potential

When the number of alternatives to mechanical cooling are set out, it is clear that there is a more sustainable way forward for the planet's data centres. Thinking bigger than renewable energy – free cooling, recovering waste heat and immersion cooling could all prove effective solutions to the sustainability challenges facing data centres, and will all become increasingly important as machine learning develops and online user numbers continue to grow.
While the burden should not fall on any single one of these to be the sole remedy, it is through the combination of innovative solutions such as these that IT infrastructure will be able to go green. It is worth noting that what has been covered here today is just the tip of the iceberg in terms of optimising data centre efficiency, so for those looking to learn more, please visit: **www.alfalaval.co.uk/data-centre-cooling**

When the number of alternatives to mechanical cooling are set out, it is clear that there is a more sustainable way forward for the planet's data centres

A holistic approach to energy management

The UPS and PV system at the Wellcome Genome Campus, the world-renowned biomedical research site.

BY SOLAREDGE CRITICAL POWER

SITED ON *The Wellcome Genome Campus*, The Wellcome Sanger Institute is at the heart of a global hub of genomic research, education and engagement. It carries out scientific studies to understand the biology of humans and pathogens and leads partnerships across the globe to support ground-breaking research and transformative healthcare innovations. The institute's study programmes are of a magnitude way beyond that of most biomedical research foundations. In short, its science is on an industrial scale.

In addition to a research site, the campus delivers educational and collaborative programmes and conferences, bringing together scientists from across the globe, with on-site accommodation set within a tranquil environment.

The Challenge

On a site of such significance, protecting critical equipment, servers and security systems is a given, and reliability, flexibility and the ongoing cost of maintenance are key in the choice of an uninterrupted power supply (UPS) solution. In addition, increasing numbers of organisations appreciate that keeping energy expenses in check goes hand-in-hand with reducing their carbon footprint. The Wellcome Genome Campus addressed both of these challenges.

The UPS Solution – Protecting Critical Loads

The relationship between The Campus and SolarEdge Critical Power (previously Gamatronic) began with the installation of the first UPS system over ten years ago. Currently, the site includes over thirty UPS systems ranging in capacity up to 800kW (made up of 4 x 200kVA modular UPSs utilising 25kW power modules).

The flexible, modular approach was key in the choice of SolarEdge Critical Power as it allows the UPS systems to be upgraded as power demands grow and allows the customer the flexibility to select and distribute the 25kW modules where they are required. In addition to critical UPS product delivery, the SolarEdge team provides annual, preventative maintenance services to the site's UPS systems.

As a result of the SolarEdge Critical Power team's efforts, significant improvements in mean time before failure (MTBF) and mean time to repair (MTTR) have been made. Furthermore, due to the success of the SolarEdge UPS solutions, a replacement programme to swap out non-SolarEdge systems with SolarEdge Critical Power modular UPS equipment is now in place.

"We are very pleased with the SolarEdge UPS systems that have been installed across our facility for over a decade and they maintain stable and trouble-

free operation. SolarEdge provides us consistent world-class service throughout the years for a growing portion of our UPS fleet," says a Wellcome Institute spokesperson.

The Solar PV System – Driving Down Energy Costs

Some years ago, two non-SolarEdge, rooftop solar PV systems were installed to generate long-term savings with green, renewable energy. However, the inverters had developed faults and stopped generating. With no ability to remotely monitor the systems and receive valuable, real-time data directly from the inverters, the failures resulted in valuable lost production.

Based on the reliability and serviceability of the SolarEdge UPS systems and, with energy storage and expertise in power electronics and manufacturing common to both divisions, when it came to overhauling the two PV systems, the site engineers turned once again to SolarEdge.

Future-Proofing the Asset

The selection of a SolarEdge PV solution gave the client the opportunity to optimise the system and take advantage of secure and comprehensive system monitoring. Repairing and upgrading the 260-panel solar PV system involved replacing the inverter and installing sixty Power Optimizers on an accommodation building, and replacing two inverters on a research building and installing a further one hundred Power Optimizers. The installations were completed, with inverters generating green AC power in under seven days.

The Bottom Line – Improved Reliability, More Energy and Greater Peace of Mind

Today, the SolarEdge Critical Power solution at The Wellcome Genome Campus comprises two parts: a series of fully maintained UPS systems, and two solar PV systems, delivering energy savings alongside continuity and peace of mind.

The modular UPS systems provide continuous power support to a number of Campus research facilities and their site security systems, which will continue to grow in step with the developing power needs of the site. The upgrade to DC-optimised PV systems now maximises the power output from the solar panels, to reduce energy bills even further by allowing the panels to work at their optimum points. Remote, module level monitoring enables the customer to stay informed about system performance 24/7, so faults can be detected immediately. In the future, it will also mean fewer site visits, increased system uptime, and lower operational and maintenance costs. The customer also benefits from a system that includes both SafeDC™ and arc-fault detection and interruption to protect staff and visitors to the site.

"The fact that SolarEdge has been providing us with

advanced and reliable UPS solutions for years made the decision to choose SolarEdge for the PV system an easy one. By upgrading the solar PV system we've increased the energy yield, and now that we are able to monitor the system on a regular basis, we can see exactly what's going on," says a Wellcome Institute spokesperson.

PV Systems at a Glance

- **Accommodation building**
  1 x SE27.6K three-phase inverter 60 x P650 Power Optimizers
- Research building 2 x SE25K three-phase inverters
  100 x P600 Power Optimizers
  UPS Systems at a Glance
- **Wellcome Genome Campus**
  6 x 200kVA
  2 x 100kVA
  1 x 80kVA
  2 x 60kVA
  1 x 50kVA
  1 x 40kVA
  2 x 30kVA
  17 x 10kVA
  4 x 3kVA

Power and cooling are a crucial consideration for efficiency and performance

Data centres have always been critical for businesses, but as almost every aspect of our lives becomes digital, they are being scrutinised more and more. And "more" is the operative word. Demands on data centres are increasing in line with the growth of data: more computing power, more space, more flexibility. But organisations are wanting these demands to be met with greater efficiency and better performance.

BY DARREN WATKINS, MANAGING DIRECTOR, VIRTUS FOR VIRTUS DATA CENTRES

THE MOST EFFECTIVE WAY to improve efficiency and performance is to create the optimum environment for the servers that are housed in the data centre – two major components being enough power and the right temperature. Because power and cooling consume the most water and energy, they are crucial considerations to achieve more efficient data centres with lower Power Usage Effectiveness (PUE) and Water Usage Effectiveness (WUE), without compromising performance.

Power

There's no denying that data centres use a huge amount of power and can generate a vast amount of heat due to the demand organisations require from them. Data centre power consumption alone amounts to around 416 terawatts, or three per cent of all electricity generated on the planet. So, when it comes to energy use, efficiency and sustainability are two sides of the same coin; sustainability so customers can meet their own environmental goals and efficiency

to reduce the amount of power used – both of which can result in cost savings. The first step is to move away from fossil fuels. The cost of renewable power is increasingly cheaper than any new electricity capacity based on fossil fuels. Indeed, on average, new solar photovoltaic (PV) and onshore wind power costs less than keeping many existing coal plants in operation, and auction results show this trend accelerating – reinforcing the case to phase-out coal entirely. And data centres are particularly well placed to benefit from renewable energy sources due to their stable power consumption.

Innovation is also critical to achieving better power consumption efficiencies. It may be logical to assume that more compute power results in significantly more power usage, but in practice, it actually uses and produces higher temperatures, leading to greater efficiency - not only in PUE but also in other resources. Higher powered compute often uses greater intelligence in its software, so there is an opportunity to innovate further to lower the PUE even more. In the future it may even mean that this kind of software could enable the removal of generators or UPSs completely. And when it comes to back-up power, the industry continues to investigate alternative, efficient, sustainable sources; fuel cells are being looked at as a standby energy source. Although, at present, this technology is not available at the scale required for large data centres.

Cooling

Cooling is a notoriously energy hungry element of the data centre infrastructure. As much as 40 per cent of power delivered to a facility can be used for cooling and other ancillary functions rather than being delivered to the IT equipment within the data halls. This energy is not being wasted because it is used to maintain conditions of temperature and humidity within, at which the IT hardware can be guaranteed to operate reliably. However, it is not productive energy, and data centre operators are striving to minimise its use. By increasing the efficiency of cooling systems, not only can the environmental impact can be reduced, but performance can be improved.

PUE can be found in a variety of innovative design elements whilst actually lowering costs:

Liquid cooling: There are the well-established technology developments including liquid cooling. Some data centres deployed their first liquid cooled customer racks back in 2015, but there are also key design elements with regards to air flow management too. This technology can't be discounted, as liquid cooling has fast made a comeback as a way of maintaining optimal operating temperatures - notably in the HPC arena together with innovative techniques like using indirect evaporative air.

Indirect evaporative cooling: This technology produces better PUE statistics in comparison to traditional HVAC systems, but there are some additional operational overheads so the technology needs to be considered holistically rather than a standalone cost. Furthermore, to deploy IEAC in the most efficient manner, the build needs to have a particular layout, so the technology isn't always appropriate for every building.

Adiabatic cooling: Although this technology may seem new, VIRTUS deployed it seven years ago. However, with the de-carbonisation of the grid, the purchase of accredited green energy, innovation in compute and mechanical cooling, there isn't a need to use additional valuable natural resource, i.e. water. Instead, electricity can be used for cooling with little to no impact on the environment, provided it comes from renewable sources and still achieves the same PUE or less.

Direct chip liquid cooling: This can offer some of the lowest PUE possible, as the temperature at which it operates means that no mechanical or adiabatic cooling is required. The warm water can be reused within the data centre or exported to other heating requirements. If a computer room air conditioning (CRAC) system was deployed, the waste heat and water from the units could be used to cool liquid cooled compute, which means that the cooling medium would be used twice, making it more sustainable.

Chilled water systems: The cooling demands of hyperscale data centres tend to favour chilled water-cooling systems so the water impact is negligible. This is because once a system is operational, only limited amounts of make-up water are required. Chilled water systems have significantly improved in terms of energy efficiency with the increase in "free-cooling" capability i.e. using ambient outside temperatures for cooling.

While cooling is a vital part of keeping data centres up and running, data centre administrators seeking to prevent infrastructure failures can risk overcooling their systems and wasting valuable energy. Overcooling is generally caused by redundancy and hot spots, both of which can be addressed with proper airflow management. With the right controls and knowledge of the actual cooling needs of the IT load, redundant cooling units can be kept in standby mode and turned back on automatically when needed. This points to a wider trend of energy waste in the sector; "zombie servers" and a significant amount of retired equipment being sent to landfill rather than recycled. By establishing proactive efficiency measures at inception and leveraging the latest technology, data centre providers can ensure that their facilities provide a better performance. Reports show that infrastructure efficiency has improved by 16 per cent since 2014, demonstrating that where steps are taken to improve necessities such as heating and cooling, cost savings can be made. The same is true when it comes to energy.

When a one-size-fits-all approach to data centre design no longer fits all

Pressure to construct new data centres to keep up with the rapid increase in global data volumes is pushing data centre designers, builders and operators to adopt innovative new ways of working.

BY IAN WILCOXSON, CHANNEL MANAGER (DATA CENTRES) EMEA POWER SOLUTIONS, KOHLER

ONE SUCH ADVANCE is to take a modular approach to the design and construction of data centre infrastructure such as the building, its connectivity, grid power connections and other services, and then populating it in stages as demand grows. This ensures that capital investment does not get ahead of actual – rather than forecast – demand, while speeding up the implementation process. Critical equipment such as servers and networking equipment, and ancillary services such as chillers and backup generators, can be built and tested offsite and then brought to site for rapid installation and commissioning.

According to market analysts Mordor Research, the global market for containerised (modular) data centres was worth $7.52bn in 2020, and is expected to grow at a compound annual growth rate of 25.49% between 2021 and 2026, to reach $29.34bn. The analysts found that more than 40% of the organisations it surveyed were concerned about scaling their data centres, an issue that a modularised approach can easily address.

The rise of modularity in data centers

With demand for cloud services growing so rapidly, data centre architects are looking for efficient, cost-effective ways to build facilities that enable them to match the level of capital investment to current demand, while providing a low-cost way to expand in future.

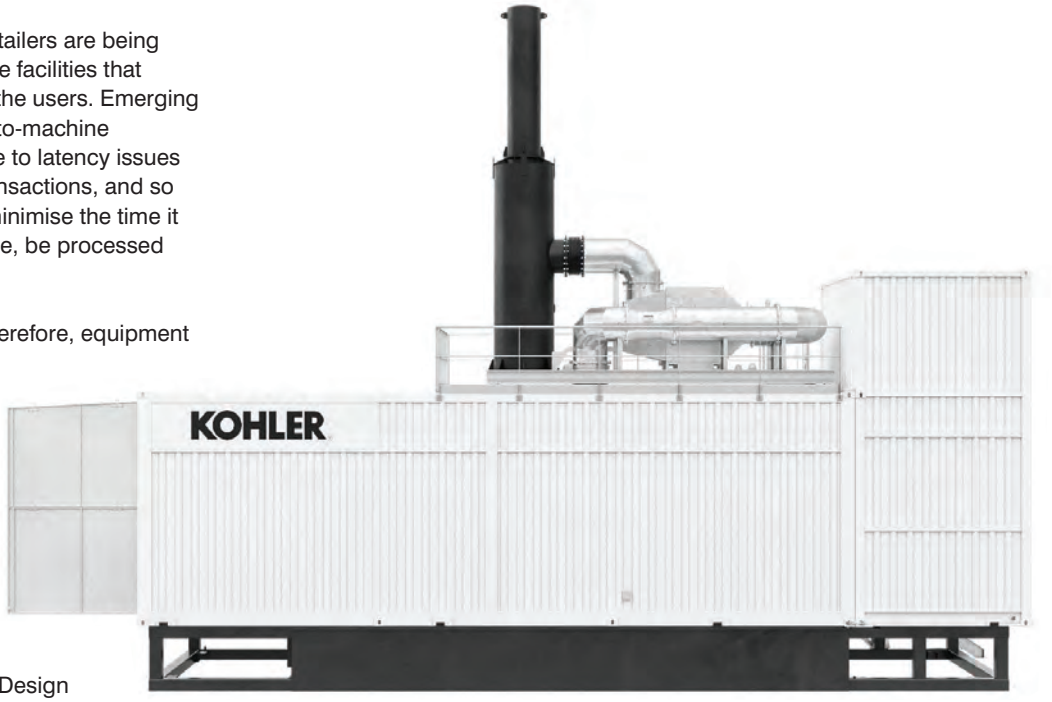
Modular data centres are being used in a wide variety of contexts. They are shipped into areas that have been struck by natural disasters to provide emergency computing power. They are used to temporarily add capacity, or bring in high-performance computing facilities to handle additional loads, without interrupting core systems. Other areas where modularisation may be attractive are in banking and finance, especially as the pandemic has driven more of their services online (when did you last buy something with cash?). And there is also interest in using modular approaches to build hyperscale data centres quickly, to keep up with our shift to a more online life during the pandemic.

Different data centres, different demands

Data centres are proliferating around the globe as demand for processing capacity grows. The design of data centres is also evolving. The vast hyperscale data centres that we think of as providing the infrastructure

of search companies and online retailers are being joined by smaller regional and edge facilities that bring cloud computation closer to the users. Emerging services such as 5G and machine-to-machine communications are more sensitive to latency issues than, for example, e-commerce transactions, and so localisation is also being used to minimise the time it takes for data to reach a data centre, be processed and return to its origin.

To serve the data centre market, therefore, equipment providers need to offer flexible, modular systems that can be configured to work effectively in edge, regional and hyperscale data centres, and which meet all the local requirements, standards and regulations wherever they are installed anywhere on the globe.



Power Optimised Design

A key solution is Power Optimised Design Solutions (PODS), which are low and medium voltage gensets that offer high performance, reliability, robustness and safety.

The PODS are of a modular design and can have set-mounted radiators on the generator base-frame, making handling and installation simpler. They use standard components and are available in a variety of configurations, so they can be available on short lead times for quick deployment.

PODS are designed to be delivered complete and then mounted on an external concrete slab, with all the customer's specified options already connected and tested, making for quick and adaptable installation. PODS can also be stacked or mounted in racks, in modular fashion, so they can be installed incrementally as data centre capacity and backup power needs grow.

Of course, as data centers grow and appear in more locations, strict noise standards come into play when trying to gain approval for data centre implementations, and for being a good neighbour once they are in service. This is critical as data centres, especially at the edge of the network, move into office parks and mixed-use areas of cities where concerns about noise generation may make it more challenging to complete the planning process quickly. PODS should be fitted with soundproofing panels made of mineral wool with an M1-class fire rating covered by glass fibre. Noise suppression is essential, from top-level of 85dB(A) measured at a distance of 1m, although more stringent options at 75dB(A) or 65dB(A) are available to suit the site requirements. With the diversification of data center scale and location, different PODS should be put in place to meet varying specifications and requirements. For local or edge data centres that draw up to 5MW, PODS can be packaged in a standard 20-foot container, with a skin-tight enclosure that can be customised to user requirements, or with a simple canopy. They're compact and available on a short lead time.

Regional data centres that need up to 25MW of backup power can be served with Modular PODS, which are available in a 40-foot shipping container, for ease of transport and integration with data centres that also use racks and stacks of such containers to house server and networking equipment. The Modular PODS are also available in skin-tight enclosures, which again can be customised to meet user needs.

Finally, for the largest hyperscale data centres, which may need up to 500MW of backup power, Kohler offers what it calls Density PODS. These are packaged in a 45-foot container that has enough space inside to allow for the internal cooling necessary to accommodate very high power gensets, while also allowing operator access. Walk-in PODS are a sensible choice for this large-scale operations as they give technical teams access to all the most important aspects of the genset, so that they can easily operate and maintain it.

At Kohler, we offer gensets that operate at a wide variety of generating power levels, with flexible configuration and rich customisation options. These modular systems help data centre architects, operators and implementers to build new facilities quickly, provide the scalability needed to match levels of capital investment to demand, and provide a low-cost way to expand in future.

Battery technology: the backbone of modern data centres

The benefits of Thin Plate Pure Lead (TPPL) technology.

BY MICHAEL SAGAR, SENIOR STRATEGIC MARKETING MANAGER, DATA CENTERS & EMEA, ENERSYS

DATA IS CENTRAL to our modern lives, whether that is in business or personally. As a result, the reliance we put on the data centers that contain this data is increasing rapidly. In fact, research firm IDC recently created a report ('Data Age 2025') that illustrates the scale of the challenge[1]. In their report they predict that by 2025 there will be 6 billion connected users, each accessing a data center almost 5,000 times per day (a factor of ten increase on 2015) and as a society we will generate 275 ZB of data annually.

In parallel, as we become more concerned about energy usage, it is important to note that data centers use around 1-1.5% of global energy[2] – and this figure will inevitably rise even though efficiency improvements mean that energy consumption is rising at a slower rate than data generation. However, managing electricity consumption is a key issue for data center operators, to meet international guidelines and to comply with their social responsibility.

Any form of downtime is a significant issue for data center operators as it reduces customer confidence and prevents data access. According to the Uptime Institute's '2020 Global Annual Data Center Survey', 78% of data center operators have had an outage in the past 3 years and 37% of these are related to power failure[3] – the most common cause.

Changes in Data Centers

In the face of this growth, it comes as no surprise that the structure of data centers is changing and this is equally applicable to the Uninterruptible Power Supplies (UPS) that they rely on to address power outages. Until recently, UPS batteries were sized to give typically 10 to 15 minutes of autonomy thereby allowing enough time for generators to be brought online, or an orderly shut-down performed. However, as modern generators can be remotely or automatically operated this time has reduced to less than 5 minutes in many cases, therefore requiring less battery capacity.

Another trend that seeks to reduce energy consumption is running data centers at elevated ambient temperatures that reduces the need for air conditioning. To achieve this, all equipment (including the servers and UPS batteries) must be capable of being reliable in these conditions.

Battery Technology

Battery technology has progressed significantly in recent years, although lead-acid remains a popular technology in data center UPS systems. In the early days, traditional flooded lead-acid batteries were used. While effective, their operation meant over time maintenance with the topping up with water was required and due to the rate of gas emissions high ventilation requirements were needed.

The next generation was valve regulated lead-acid (VRLA) that immobilized the electrolyte in a gel or absorbent glass mat (AGM). This approach significantly reduced the water loss resulting in no topping up being required and a significant reduction in the ventilation requirements, thereby improving

operating costs. In fact, AGM-based VRLA batteries have become very common in data centers in recent years.

AGM VRLA technology has further advanced with the advent of Thin Plate Pure Lead (TPPL) technology that adds a number of significant benefits. Here, thinner grids of very high purity are utilized to form the plates, resulting in a greater contact area between the plate and the active material / electrolyte.

Benefits of TPPL Technology

As the plates in TPPL batteries are thinner, more can be stacked in the same volume. This not only boosts power density; it also ensures that TPPL batteries are faster to charge and can deal with larger current peaks. The higher density reduces the space occupied by batteries by around 20%, freeing up additional space for servers, thereby increasing revenue for the data center operators.

Batteries are a significant part of data center expenditure and all batteries have a finite life expectancy. TPPL-based batteries have been demonstrated to have a lifespan of 8-10 years which represents a 25% increase over VRLA-type batteries. Furthermore, TPPL batteries are suited to the higher temperatures found in data centers that have reduced their air conditioning capacity to reduce energy usage. However, there is some degradation of service life due to the elevated temperatures so data center operators should consider the best trade-off between reduced energy costs and more frequent battery replacement.

Another feature of TPPL technology is its low self-discharge characteristics that mean they can be stored for longer than traditional lead acid battery types. Typically, a TPPL battery can be stored at 20?C (68?F) for up to 2 years without needing a refresh charge.

As they exhibit high charge acceptance when compared to other lead-acid technologies (AGM, VRLA or flooded), TPPL batteries can be recharged quickly, and they are ready to respond again within a very short period. This means they can deal with situations where multiple outages could occur.

EnerSys? Battery Technology for Data Centers
As an example, one currently available TPPL battery range is DataSafe? XE from EnerSys?. This TPPL battery range has been designed specifically to meet the challenging needs of modern data centers and is fully compliant with the stringent needs of IEC 60896-21/22 and IEEE-1188.

DataSafe® XE batteries offer the benefits of TPPL technology including the ability to operate at elevated temperatures and to support a longer float life, which extends the service life. They also support fast charging and have a low self-discharge which, together, ensure that they are normally ready for

use when required. The enhanced power density of the DataSafe® XE battery range provides high-rate performance of up to 1150Wpc at the 5-minute rate (1.67Vpc at 20?C / 68?F), ensuring that they can meet the rigors of life in a data center. As the pure lead plates corrode much more slowly than the plates in standard AGM VRLA batteries, the capacity of DataSafe® XE batteries remains higher for longer. When the batteries are finally ready to be decommissioned, 99% of the materials are able to be recycled giving a large, retained value that will offset the cost of replacements.

Summary

The pace of change in data centers continues to increase, fuelled by the increasing amounts of data our society is generating as well as the thirst for ever more frequent access to this data. The recent pandemic will have exacerbated this situation due to increased remote working.

Coupling this with greater instability in mains power, due to a variety of factors including increased demand and it is more important than ever before that data center operators have access to reliable, high-performance battery technologies to support their UPS. TPPL batteries represent the latest generation of lead-acid batteries that have been used in backup applications for decades and this exciting new technology delivers many benefits that help data center operators meet their demanding challenges.

Reference
[1] https://www.import.io/wp-content/uploads/2017/04/Seagate-WP-DataAge2025-March-2017.pdf
[2] Digitalization and Energy Report, International Energy Agency, November 2018.
[3] https://uptimeinstitute.com/2020-data-center-industry-survey-results

Covering all bases

The range of threats facing data centres is ever growing, and these mission-critical facilities are firmly on the radars of those wishing to cause chaos and disruption. With the pressure to maintain uptime and keep information secure more intense than ever, **ALEX BUCKLE, EUROPEAN SALES SUPPORT MANAGER AT 3xLOGIC,** examines the key considerations for optimising physical security in and around data centres.

WE LIVE IN an information age in which data centres are central to the functionality and operation of the global economy. However, when the subject of data centre security arises, all too often the focus is on the prevention of cyber attacks. While no one would doubt the importance of effective cybersecurity, it is only one part of the picture – and preventing damage to the fabric of a data centre and stopping criminals from accessing the information housed within it is just as vital.

Threat analysis

Data centres should be designed, built, and maintained to withstand everything from terrorism and corporate espionage to natural disasters, riots, vandalism, and opportunist theft. These kinds of threats are all too real, as highlighted earlier this year when the U.S. Department of Justice arrested Seth Aaron Pendley for planning to use an explosive to destroy an Amazon Web Services (AWS) data centre in Virginia to, in his words, "kill off about 70 percent of the internet".

With our reliance on data processing, transmission, and storage continuing to rise, the loss or compromise of a data centre could have a disastrous economic impact and cause significant reputational damage to customers affected by any operational disruption. Even though most data centre owners and operators understand the implications of an attack, there are a number of physical security considerations that contribute significantly to maintaining secure and continuously available IT systems, applications, and services.

Perimeter to core

A physical security strategy should take the form of a multi-layered approach, much like peeling an onion, and be based on a comprehensive risk assessment that factors in a data centre's location, size, environment, and surroundings. This could even involve carrying out a simulation attack to highlight weaknesses from a physical perspective, including those that were not immediately apparent.

This process can also facilitate a better understanding of the associated risks to service operations if they are compromised.

Once any risks have been identified, a security infrastructure should begin with high-grade perimeter fencing using, for example, laser-based technology that offers an early warning detection system by setting off an alarm if anyone attempts to break, climb, or jump over it. We also know that vehicles can be weaponised in order to inflict injury or cause property damage, so obstructions such as anti-ram bollards are highly effective, as is a gravel "moat" around a data centre.

Defining moment

These measures should be complemented by high-definition CCTV to provide a clear view of the entire perimeter area using a zonal system, which points cameras into specific locations when alarms are triggered. Integrating perimeter detection with surveillance technology that has features such as thermal detection can also enable security officers to get to the scene of an incident as quickly as possible, at any time of day or night.

Early detection can be the difference between a contained incident or a successful attack. Cameras with artificial intelligence-based functionality help to avoid false alarms by using alarm verification. Likewise, cameras with automatic number plate recognition (ANPR) can be used to issue a warning if someone is acting suspiciously around a facility, identify known vehicles or offenders, limit the number of vehicles on-site, and/or act as an additional form of staff and visitor identification.

Entry level

Managing who enters a data centre, and where they can go once inside it, requires the implementation of rigorous access control procedures for both staff and visitors. One of the biggest security loopholes is around contractor management, so issuing a unique identification card can help ensure these individuals only have access to assigned areas.

Biometric access control is increasingly used as a part of a two-factor authentication (2FA) strategy. This can be further complemented by issuing an individual with a mobile credential installed on their smartphone – a secure method of recognition that is much harder to share or replicate than conventional solutions.

Lock and key

Robust access control should also be extended to enclosures, racks, and cabinets, with intelligent door locking systems that restrict access based on specific equipment, roles, and time periods. Mechanical locks and keys are insufficient, as they do not provide an audit trail around when an enclosure, rack, or cabinet was accessed, who accessed it, why they accessed it, how long it was accessed for, and whether or not they were authorised to access it in the first instance. Nor do they provide alerts in the event of unauthorised or forced access scenarios. Door locking options are now available that utilise personal identification number (PIN) and radio frequency identification (RFID) system tokens, offering compliance with privacy regulations such as the General Data Protection Regulation (GDPR) and Sarbanes-Oxley. In addition, cameras can be provisioned within an enclosure, rack, or cabinet, taking a snapshot or recording of the person accessing it on motion or on card swipe.

Knowledge is power

Traditional security has evolved from disparate standalone systems to platforms that blend hardware, software, and analytics to drive integration and automation among various individual components such as the aforementioned CCTV, access control, and door locking systems. For example, if a contractor is working in a cabinet, a control room operator can use CCTV as a chaperone system to instantly see what's happening, speak to the individual using two-way audio, and make sure they exit the building when and where they should.

Information gathered from a security system can, and should, be combined into an analytics platform that integrates valuable information from across an entire security infrastructure. Feeding information into a single pane of glass drives operational efficiency, enabling real-time data collection, analysis, and verification, and enhances situational awareness, threat management, and workflow analysis. Centralised management also offers a high level of situation resolution, investigative analysis, and organisational compliance.

It is important to remember that physical security and cybersecurity are not mutually exclusive, as much of the equipment that comprises a security infrastructure resides on a network. For example, CCTV cameras at the perimeter offer would-be attackers a point of connectivity to the network. To help mitigate this threat, best practices in design and deployment must be followed, and planned preventative maintenance, firmware updates, regular patching, firewalls, malware prevention, encrypted password changes, and other safeguards must all be factored in.

Protect and survive

Despite the rising threat level, data centres remain some of the world's best-protected buildings. That said, any vulnerabilities have the potential to be exploited by those with malicious intent, so physical security must be employed, reviewed, and maintained at every level to ensure attackers can't gain access to data or disrupt operation. Partnering with a security technology vendor that has experience in the data centre sector, and can configure a fully integrated physical security strategy, can help increase the chances of a threat being detected and ensure maximum levels of operational resilience.

Green data centres: the key to driving sustainable strategies

As we become more environmentally conscious as a society, it is of paramount importance that we push for more sustainable business practices.

BY JACK BEDELL-PEARCE, CEO & CO-FOUNDER AT 4D DATA CENTRES

IFOR THE AVERAGE INDIVIDUAL, being more sustainable may amount to taking on more eco-friendly habits, such as recycling and reducing water consumption, or investing in electric or hybrid vehicles. It's all about the small adjustments that will amount to bigger results in the long run.

For businesses and more specifically larger corporate entities, it's a more challenging and decidedly nonlinear task. In recent years, there's been noticeable public and shareholder pressure on corporations to prove they're taking the necessary steps towards tackling climate change, mainly by publicly setting goals on how they plan to reduce their carbon footprint.

One good example is the IT industry, which is actively seeking ways to minimise electrical power generation from fossil fuels, as well as improve waste management and water conservation. However, IT also happens to be a sector that is in constant expansion, predominantly due to our increasing reliance on digital tools and platforms, which means that reducing energy consumption presents something of a conundrum, especially when it comes to data centres.

The role that data centres have to play

For the data centre industry, which is single-handedly responsible for at least 1% of global energy consumption, sustainability takes on a more intense

and innovative path. Based on the sheer size and scope of its business, data centres, like enterprises, have an obligation to implement and promote more sustainable choices and solutions.

If we think of these hubs as the epicentre of connectivity, data storage and processing, as well as a variety of business-critical applications, it is only natural to believe that data storage and internet use will continue to increase in the years ahead.
This does mean however that there is an expectation to keep energy consumption at sustainable levels using green technology in data centres. After all, we're growing ever more dependent on the kind of technology that's driving innovation, such as 5G, IoT and machine learning, all of which require data centres to operate.

It could even be argued that data centres have an ethical responsibility to be champions of change, and therefore take on the crucial role of implementing measures that minimise the impact that data storing is having on our ecosystem. Some businesses are already making pledges to reduce environmental footprint and invest in more sustainable energy solutions as part of their long-term green strategy.

But what can be done to drive change in this space?

What can data centres do to effect change?
There are many steps being taken to address the energy usage of data centres, but this process will need to be accelerated if consumption is to be kept to a minimum, especially when considering that data usage increased by 47% just in the first quarter of 2020, during the first COVID-19 lockdown.

Data compression is one example, which allows for far greater levels of efficiency especially when incorporating advancements in cloud technology. The process involves the reduction of a file's size by re-encoding the file data to use fewer bits of storage when compared to the original file.

The main advantage of data compression is that a compressed file requires less time for transfer and consumes less network bandwidth. By diminishing file size, data transmission time and communication bandwidth, less storage capacity is required, which results in decreased energy consumption, increased productivity, as well as significant cost savings. Immersion cooling, on the other hand, represents a more practical measure for addressing challenges around energy inefficiency. The process sees computer components or even full servers being immersed in a dielectric liquid that enables higher heat transfer performance than air.

This solution was recently embraced by 4D, which installed a highly energy efficient "pod" at its Gatwick site that uses immersion cooling technology. The "pod" uses a biodegradable dielectric fluid – that has half the density of water – and heat exchangers to cool down IT equipment. The fluid is kept cool by using intercoolers and water, via an internal heat exchanger that extracts heat from the fluid and redistributes it into chill water, which is subsequently pumped away and cooled down again in 4D's adiabatic cooling towers, a similar process is used in the automotive industry.

Another way data centres can be more sustainable is by harnessing renewable energy sources. With electricity being the primary source for running daily operations, a single data centre's environmental impact will be largely determined by where it gets its electricity from. This means that, depending on their resources and location, there is scope for data centres to implement a set-up that relies more on environmentally energy sources, such as wind, solar or even tidal.

Next steps

Data centres have a real opportunity to drive change by embracing sustainability. Committing to a green agenda is obviously a step in the right direction for any organisation but, to become a truly sustainable company, business owners need to ensure energy efficiency is at the heart of every aspect of how a data centre is run.

By sourcing the most sustainable materials and technologies for designing and maintaining these energy-intensive hubs, business owners are able to run their data centres in a smart and clean way, ensuring that their impact on the environment is minimised as data consumption continues to thrive.

Planning tier classification for data centres

Systemized preparation and growth planning can help smooth the path for the expansion of datacentres. However, early assessment of the strategic ambition of the facility is critical when it comes to gaining approval and achieving the correct Tier classification. This in-turn enables the datacentre to attract more lucrative revenue streams from clients, including those demanding the very highest levels of security, resilience, and maintainability.

BY LOUIS MCGARRY, SALES AND MARKETING DIRECTOR, CENTIEL UK

THE UPTIME INSTITUTE describes itself as 'the Standard bearer for Digital Infrastructure performance'. The organisation's Tier Standard created more than 20 years ago, has been used in data centre design, construction and operations across the world and is the globally recognized standard for data centre reliability and overall performance. To gain classification, datacentre topology and operational sustainability are assessed as performance criteria. Final certification confirms that the infrastructure has no weak areas, and the approved datacentre has worldwide accountability for excellence.
Achieving Tier certification can be a lengthy process. Therefore, understanding a datacentre's ultimate goal from the outset is necessary to ensure the right infrastructure is in place to help make any future transitions or developments as straightforward as possible.

Tier Classifications

The Uptime Institute certifies four Tier classifications to identify the anticipated performance of different site infrastructure design topology. From a UPS perspective, Tier I can simply be described as one UPS and one critical power path to the load: we call this an N configuration.

Tier II brings N+1 resilience into the system where N = the quantity of UPS required to support the load and "+1" = the value associated to redundancy. There is still only one critical power path to the load. This configuration offers a robust power protection solution which is unlikely to fail. However, both Tier I and Tier II infrastructure require a full shut down for essential maintenance and so clients demanding a higher level of availability may look for a Tier III or Tier IV certified facility.

Tier III datacentres are required to have a minimum of 2N (N+N) within their infrastructure. This means two independent critical power paths each with their own UPS, ensuring that each path is concurrently maintainable, with at least one path always being available to support the critical load.
Tier IV is a significant improvement on all other tiers as it requires redundancy on both sides plus multiple critical power paths: we call this 2N+1 ((N+1) + (N+1)). This concept provides a fault tolerant

configuration with resilience and redundancy on both critical power paths, resulting in a fully concurrent, maintainable system.

For datacentres, the transition between Tier II and Tier III requires the most significant investment in infrastructure. So often, datacentre clients are concerned about a common point of failure within the overall infrastructure. but the latest UPS technology has removed all single points of failure from within the system.

The area that needs to be addressed is the common point of coupling or common node which is the shared element between the UPS and the downstream infrastructure. It is not possible to escape this in an N+1 infrastructure. However, common nodes are highly unlikely to fail because they are very strong reinforced cable connections. Electrical switch components are far more likely to expire so the N+1 or Tier II configuration remains particularly robust.

Therefore, we encourage our datacentre clients who are considering making the move between Tier II to Tier III to design their infrastructure very carefully. Moving up a Tier, means upgrading the UPS: cables, switchgear, generators, and can increase footprint and energy usage needs too.

The investment needed can be significant. However, if designed with flexibility and future growth in mind you should only need to do this once. At the end of the day, this should be a strategic and economic decision based on the need to attract premium clients who are looking for higher levels of security, resilience, and maintainability.

Interpretation

We work closely with Data Centre Design and Build consultants and have experience of working with the Uptime Institute to provide appropriate UPS solutions for various Tiers. Therefore, we understand the process and the importance of careful consideration and correct interpretation of the relevant documentation.

Particular attention needs to be paid in relation to terminology. Terms such as active, passive or alternative need to be addressed and clarified as they can be perceived in different ways depending on the scenario. For example, if you asked several people from the industry what their understanding of a passive path is, you are likely to get several different interpretations. This can impact system design and so communication with the relevant parties involved is important to ensure the design is correct according to the relevant Tier classification.

It is also necessary to keep up to date with the evolving changes to topologies in the Uptime Institute's documentation. Just like electrical regulations, certification needs to be kept current.

Modular UPS Technology

Understanding the ambitions of a datacentre early on, means the right infrastructure can be implemented from the outset. By selecting a scalable true modular UPS, a critical power protection system can be right-sized, flexible, resilient and futureproofed for the short and long-term. Modules can easily be added on a pay-as-you-grow basis ensuring the system continues to match actual load requirements from day one, day two and for the future.

True modular UPS systems are also designed with distributed architecture and redundant self-isolating capability. This means that no single module makes decisions for the whole system, and if any part of the system has a fault it is automatically isolated while maintaining the load. Installing UPS frames which are capable of housing far more modules than initially required, means the datacentre has the flexibility to add additional UPS modules when needed. Investment in additional UPS modules can be planned and introduced in incremental steps to help manage cost.

In order to move from Tier III to Tier IV classification it can be as simple as adding additional modules. Take for example a 200kW 2N (N+N) modular UPS configuration, with a frame containing 4 x 50kW modules protecting each critical power path. The addition of just one more module in each frame will take the resilience level of the UPS system to 200kW 2N+1 ((N+1) + (N+1)), all without the need to purchase additional infrastructure.

In contrast, a standalone UPS system can be costly in terms of Capex and Opex, as any growth could mean doubling the size of the whole infrastructure.

Achieving Certification

A datacentre will normally apply for certification once the relevant infrastructure is in place. However, if the criteria are not properly met, approval will not be granted. Any remedial works required to resolve the issues identified can be both time-consuming and expensive to rectify.

Interpretation will need to be revised and refined to match the required classification, and agreement reached that the configuration resolves any potential challenges. It is far more than a box ticking exercise. The process can be intense and involves a collaborative approach to ensure a consensus of understanding is reached. It is a necessarily detailed process.

Gaining the required Tier certification means datacentres can offer a resilient and fully certified solution to attract new revenue streams and develop their client base. Selecting a flexible, true modular UPS system, and working with a UPS manufacturer that has the strategic goals of the datacentre in mind, can help on the journey to achieving the required Tier certification.

Tips on how to commission a data centre for successful operation

Ensuring proper coordination and communication between key stakeholders, alongside the strict adherence to a meticulously verified plan can ensure the success of a data centre deployment strategy.

BY PATRICK DONOVAN, SENIOR RESEARCH ANALYST, DATA CENTRE SCIENCE CENTRE, SCHNEIDER ELECTRIC

TODAY DATA CENTRES underpin many of the mission and business-critical digital services that we take for granted. Such services vary greatly from streaming platforms to healthcare and bio-medical research, while also supporting key segments such as enterprise, finance and retail. No matter their intended purpose, today's data centres must perform with efficiency and resiliency, and while much of this responsibility falls on the operational staff once a facility is up and running, the burden can be eased if, from the outset, the data centre is commissioned for optimum performance.

Deployment strategy undoubtedly remains crucial, and a primary way to ensure successful operations is to conduct a commissioning exercise before a data centre is built. This process, which is often carried out by an external commissioning agent, reviews the physical design of a new facility and tests it as a holistic system. When done properly, it will anticipate potential difficulties, verify that the design meets the expected end-user objectives or industry standards, and will ensure that the build takes place according to the desired schedule and budget.

Communication and expertise are essential

For a commissioning exercise to be successful, however, it must avoid a number of pitfalls. This includes bringing the agent into the process at too late of a stage to be effective. Here, it's important that the agent should be engaged weeks or months before the data centre is constructed, in order to overcome complications such as incomplete testing and poor communications between stakeholders.

It's also important to align testing procedures with the specific technologies deployed, as all too frequently, procedures for testing legacy infrastructure may not be appropriate for use with newer more advanced equipment. By ensuring they utilise updated testing procedures consistent with current technology, agents can avoid confusion among personnel and mitigate malfunction or downtime once the facility is up and running.

As with any successful project management exercise, there must also be a clear identification and allocation of roles between the various stakeholders. Greater coordination and clear communication between all groups will prevent duplication, confusion, and delays. Validation of the project plan is also important, especially in terms of work schedules and delivery dates, so that all partners are clear on what is expected of them and by when. Preparation remains critical, and greater validation can help to anticipate problems caused by differences of interpretation between siloed teams, or inconsistencies in timing.

Driving efficiency

With cooling a fundamental component of data centre design and operation, and with greater needs to maximise energy efficiency and keep operating expenses (opEx) or costs low, it is essential that the agent carry out a detailed analysis of the potential heat loads once a data centre environment is deployed and live.

Fortunately, many data centre infrastructure management (DCIM) tools and other software systems can quickly analyse a facility based on its design and hardware systems, and deliver accurate simulations that will ensure the facility is performing both adequately and efficiently.

Avoiding human error

The task of a commissioner can often be complex, as they must also identify any weak links in a design, which are likely to surface in real-world conditions. However, this more stringent approach will avoid having to diagnose problems at a later stage and here a simple checklist of anticipated inputs and outputs for critical components can help to quickly rectify any issues.

More often than not, the people responsible for designing a data centre and anticipating any potential events are not usually the same professionals responsible for its operation. Should an unexpected event such as equipment failure or outage be experienced, it's crucial that a comprehensive list of emergency procedures, alongside other documentation, is kept up-to-date, as the technologies within a data centre may change over time.
Finally, every effort must be made to reduce human error during the commissioning process. It may be inevitable that as demands increase and deadlines loom, those fitting out a data centre may be expected to work long hours or consecutive days to meet the desired schedule.

Here, over burdening personnel at such a crucial stage can lead to simple mistakes with potentially costly problems such as equipment malfunction. Ensuring that you have access to adequate technical experts during commissioning and testing, while insisting that there is proper rotation of key personnel, will help to avoid potential human errors caused by fatigue.

Overall a commissioning agent's role is a bit like that of a conductor of an orchestra: all of their hard work is done before the system goes live and is critical to delivering operational reliability. Ensuring proper coordination and communication between key stakeholders, alongside the strict adherence to a meticulously verified plan can ensure the success of a data centre deployment strategy.

For more information, Schneider Electric White Paper #149, "Ten Errors to Avoid When Commissioning a Data Centre", can be downloaded here.

The hybrid cloud advantage for SMEs

While we are still grappling with many uncertainties in businesses and lives due to the COVID-19 pandemic, one thing is clear – organisations large and small have crossed the Cloud Rubicon.

BY LANCELOT GUO, PRESIDENT, ECOSYSTEM AND SALES OPERATIONS, ALIBABA CLOUD INTELLIGENCE, AND JOHAN ARTS, SENIOR VICE PRESIDENT, SALES, EMEA, EQUINIX

RETAIL BRANDS with a purely physical play are now online to keep up with the digital consumer, and F&B stalls and hawkers are embracing online channels to maintain their already razor-thin margins.

According to the Equinix 2020-21 Global Tech Trends Survey[1], 47% of IT decision-makers globally reported they accelerated digital transformation plans because of the pandemic, while a significant majority (60%) of respondents across all regions said the pandemic forced them to revisit and revise their IT strategy.

How Does Cloud Fit In?

Beyond the immediate concern to continue business-as-usual with a remote workforce, small and medium-sized enterprises (SMEs) have now focused on enhancing their employees' digital experience. Hybrid cloud is a major building block in these digital infrastructures and IT decision-makers (ITDMs) are

quickly realising this, with more than 2 out of 3 (68%) of ITDMs in the recent Equinix survey1 saying they want to move more IT functions to the cloud and two-thirds hoping to accomplish this within the next 12 months.

On top of providing staff with the necessary digital tools to access company apps and services outside of the office's network, SMEs have to strategise how to deploy business-critical information to make timely decisions, manage supply chains and serve the changing needs of customers. According to the same Equinix survey[1], nearly 6 out of 10 ITDMs (58%) want to invest in technology that makes their companies more agile in the post-COVID era.

As a single, central touchpoint to manage data how and where they want it, hybrid cloud allows SMEs to house and scale their workloads based on compliance, policy, and security requirements, and replicate business-critical data to the cloud. This not only helps them backup key data, but also accommodate fluctuating computing demands – whether to meet surging workload in online platforms or maintain a seamless and secure digital employee experience.

Keeping Costs Low

Keeping overheads low is always a priority for SMEs in a pre and post-pandemic world. Requiring lower capital expenditure upfront, but arming SMEs with the option of buying IT resources when they need to, hybrid cloud keeps SMEs nimble and responsive while dancing around roadblocks that they cannot just stride over like bigger companies can. An IDC study notes that organisations reported a 69 percent lower migration cost in hybrid cloud compared to the public cloud3 from its ability to consume resources on-demand and when needed.

Where scalability and performance may come at the expense of higher capital and operating expenditures in other cloud models, hybrid cloud is the best option to protect and preserve SMEs' bottom lines, while providing the flexibility to migrate data and apps at any given time.

One Less Uncertainty to Cope with in a World of Uncertainties

Modernising and moving legacy, monolith systems is a major roadblock in any SME's cloud journey. Yet another key advantage of the hybrid cloud approach is that it saves time and resources needed to adapt to new architectures and frameworks. With hybrid cloud models that are capable of seamlessly integrating local software to public cloud, enterprises can enjoy the advantages of public cloud without re-architecting their familiar on-premise work environment and succumbing to disruptions on network and security.

For SMEs embarking on and pivoting their journeys – instead of building another layer of complexity to slow down their transition – the jump to hybrid cloud

should be as speedy and as painless as possible. This is particularly critical as going online becomes a make or break situation.

As employees adapt to new efficiencies in remote working, hybrid cloud fundamentally protects their time in having to cope with IT changes or even learn a new digital workspace system from scratch. This also gives employees a peace of mind in not having to struggle with yet another uncertainty, resulting in a happier and more productive workforce.

The Perfect Union

At the end of the day, SMEs not only need a hybrid cloud infrastructure but also a proper hybrid cloud strategy to truly recover and grow – one that can deliver high performance, secure cloud workloads, provide consistent operations and access to vibrant business ecosystems like that of Equinix's, and to support business innovation and growth without the worry of costs and an incompatible existing infrastructure.

SMEs should also understand that businesses are on their own personal cloud journeys and no journey is identical. They need to select the right public cloud service provider that is able to bridge their business operation needs, without sacrificing security. As SMEs bound forward towards an increasingly digital world, they should look to hybrid cloud to protect their business-critical applications, and reduce operational expenses while seamlessly ensuring a smooth working experience for employees at home or at the office.

Reference

[1] Equinix 2020-21 Global Tech Trends Survey – DX in the wake of the pandemic

[2] 86% of Businesses in Singapore Claim Cloud is Key to Surviving Covid-19, February 2021

[3] The Business Value of Hybrid Cloud with VMware, IDC White paper, August 2019

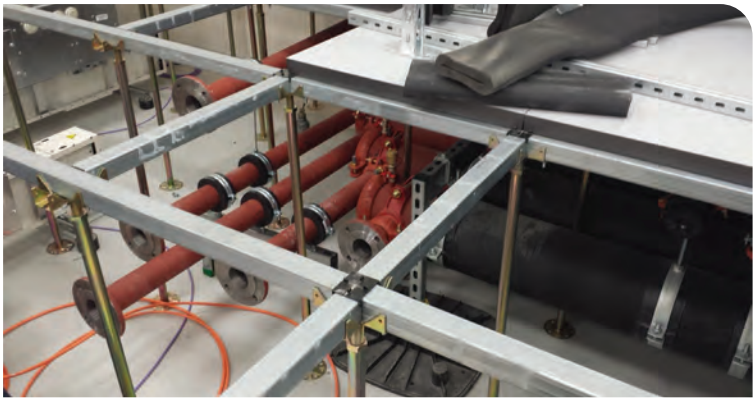
Data Centres:
The lessons others could learn

Recent data centre projects at Technická Univerzita Ostrava and The European Centre for Medium-Range Weather Forecasts (ECMWF).

MANY FACETS of human existence are focused on driving towards the future and breaking new boundaries. We don't want to stand still, which is why billions is invested into the latest cutting-edge technologies. While on the one-hand, consumer-facing advancements – for instance in phones, cars, or televisions – are very clear to see, in the background supercomputers and data centres are proving the catalysts for progress.

Out to the East of Czech Republic is the city of Ostrava, home to the Technická Univerzita Ostrava. The university has been positioned itself as a vanguard for progress, setting up IT4Innovations within the educational establishment, a leading research, development and innovation centre in the field of high-performance computing (HPC), data analysis (HPDA) and artificial intelligence (AI). The centre has the integral role of operating the most powerful supercomputer system in the Czech Republic.

Due to the incredible operating speed of a supercomputer – compared to 'high-street' desktops a supercomputer operates around 200,000 times faster at a processing speed of near 10 quadrillion calculations per second – data centres are a necessary accompaniment to store the huge amounts of information generated.



However, this creates a challenge for initiatives like IT4Innovations: data centres produce a vast amount of heat and require cooling at all times to keep them operating at top capacity. To complete a recent extension to their system's data centre – originally built in 2015 and previously extended in 2017 – IT4Innovations partnered with non-IT infrastructure integrator PRONIX and grooved pipe joining specialist Victaulic for a solution which ensured the project's data centre stayed at the perfect temperature.
The secret to making the project a comprehensive success was in overcoming barriers, whether by adjusting to overcome the demands of modern society, or through initially securing funding, or producing a solution for a complicated installation.

Overcoming barriers to keep IT4Innovations cool
IT4Innovations currently operates four supercomputers: Anselm, in operation since 2013; Solomon, in operation since 2015; and Barbora and NVIDIA DGX-2, both in operation since 2019. All four supercomputers are located in the same data hall, covering an area of 500m2 and with a total load capacity of up to 2.5t/m2, representing a huge facility which is increasing in size.

IT4Innovations took the decision to continually grow its infrastructure due in part to the increasing demands put on supercomputers and data centres by modern society. The past year has proven a perfect case study for why data centres are so vital: as the COVID-19 pandemic forced people to stay at home, watch more television, and make greater use of their internet, supercomputers and data centres have been called upon to maintain this lifestyle. Higher demand is a barrier IT4Innovations needed to overcome; it responded by investing in larger infrastructure, matching growth in demand with its in own increased capability.

Jiri Aulehla, the Head of Design Department, PRONIX said: "Victaulic products were a clear choice for us at PRONIX. We have a time-tested positive experience

with these technologies in the IT4Innovations data centre. The great advantage of Victaulic system elements is also easy adjustment and variability in case of need for expansion."

The extension to the system's data centre plays a central role as IT4Innovations continues to operate a supercomputer system fit for the future. Before the initiative could put its plans into action, it first had to successfully secure funding – for data centres are not cheaply produced. IT4Innovations applied for funding at both a national and continental level, receiving support from both the Czech Government and the European Union. With sufficient funds in place, IT4Innovations was ready to kickstart their project.

To produce a system which ensured the extended data centre was kept cool, IT4Innovations chose to work with renowned non-IT integrator PRONIX to build the complete infrastructure, who in turn partnered with Victaulic to draw up the designs for the cooling system. Experts in drawing up blueprints, at the initial stage of the project Victaulic utilised its Virtual Design & Construction (VDC) team to create a virtual 3D model of the pipework for PRONIX to take to the client. Although becoming more common place in the construction industry, use of VDC or BIM at the design phase of the project is not yet ubiquitous. But the advantages are there to be seen: the 3D model not only helps contractors showcase their proposals more effectively to clients, the construction team can also benefit from a more visual demonstration of the pipework they will subsequently build and install.

A solution fit for small spaces

The final challenge to overcome was set to PRONIX and Victaulic: to produce a cooling solution suitable for the small space afforded by the data centre and executed without the use of a "traditional" construction site. As part of Technická Univerzita Ostrava, and thus situated on the university's campus, IT4Innovations' data hall is surrounded by other university buildings, welcoming hundreds of students into its corridors every day. The result: a site far too small for PRONIX to effectively complete all the construction and installation necessary for the project.

To overcome this challenge, PRONIX opted to prefabricate much of the pipework offsite, renting a small hall in the city of Ostrava and using it as the base for building. The benefits of prefabrication are multiple: building sections of the piping offsite leads to less time spent on the construction site, quicker installation, a safer project and ultimately a reduction in costs. And like with all projects Victaulic is involved in, representatives from the company joined the construction team onsite to provide support and guidance on how to use the products.

The designs, outlined in collaboration between contractor and supplier, required a series of different pipe types, including approximately 160 "ice hockey"

pipes – long pieces of piping with a bend towards the bottom so as to resemble the shape of an ice hockey stick – to be joined together, as well as distribution piping in the data room and mechanical room with pipe sizes ranging from DN20 (26.9mm) up to DN200 (219.1mm). All coming together, the system created a path for water to flow through roof installed cooling towers to any part of the data centre which required its cooling effect.

To join the piping system together, the designs were based around the use of Victaulic's Style 107 QuickVic™ rigid couplings – which hold the two pieces of pipe firmly in position – and Style 177 QuickVic™ flexible couplings – which allow for a small degree of movement in the pipe joint – in addition to a combination of the company's Series 761 Vic-300™ MasterSeal™ butterfly and Series 716 check valves, Series 731 suction diffusers – saving space in the mechanical room by allowing building up at 900 angle from the pump – and the Style 920 Mechanical-T® bolted branch outlets.

Michal Bek, Eastern Europe Regional Sales Manager, Victaulic, said: "Working with PRONIX on this important data centre project proved extremely successful as we were able to overcome what were considerable challenges for the client. Combining our rigid and flexible grooved couplings was the key to producing a solution for IT4Innovations.

We foresee more data centres coming to fruition in the coming years ahead as well as existing centres, such as IT4Innovations, requiring extending. We encourage those planning these projects to take into account the various barriers they will also face when coming up with their team to deliver the project."

Always bring the weather with you…

There's power in the weather. On a micro-level, the weather dictates everyday decisions like travel, choice of activities, and clothing. On a macro-level, forecasts can form the very foundations for sustainable economic progress and the strategic outlook for safety and security. In essence, the weather has the power to determine how we live our lives.

The European Centre for Medium-Range Weather Forecasts (ECMWF), based in Reading, UK, and now with 360 staff across more than 30 nations, is a research institute and 24/7 operational service producing global medium-range numerical weather predictions and other data for its member states. Following its core mission to produce medium-range numerical weather forecasts and carry out scientific and technical research, the Centre plays an integral, if not completely vital, role in providing meteorological data to almost the entirety of the European continent. Producing numerical weather forecasts is a computationally expensive process, taking in data from satellites, weather balloons, buoys, and radars to predict every kind of weather imaginable, and this requires exceedingly large supercomputers to both drive this incredible data intake and also perform necessary analysis. Thus, to cater for the increased need for data processing, the ECMWF decided to open in 2016 an international competition for bids from the ECMWF member states to host a new data centre.

The bid from Italy, which proved to be the competition's winner, was put forward by the Regione Emilia Romagna (R-ER), focused on bringing the proposed data centre to the city of Bologna and leveraging on the synergies with Tecnopolo di Bologna planned developments. Designing a whole new data centre is a huge task and it was clear from the outset the design concept for the project would be incredibly important in showcasing the benefit of the project.

Studio TI who produced blueprints for the different data centre components, worked closely with global grooved mechanical pipe joining solutions specialist Victaulic to create the design concept for the data centre's cooling system. As a result of processing thousands of pieces of information a second, data centres build up an enormous amount of heat. Ensuring Italian bid could remedy that heat safely and securely was always going to be a crucial piece in the overall puzzle.

Bologna: a city with a data heritage

In the words of the Italian Minister for Environment Gian Luca Galletti, Bologna is a pole of environmental data which shapes the heritage of the city. Housing the new data centre and allowing the ECMWF to continue its important work in studying and predicting weather phenomena is a responsibility Galletti said the city would "surely honour". So, it was no surprise that when the ECMWF released plans for a new data centre, Italy championed Bologna for its bid.

At the very start of the design process, Studio TI approached Victaulic to bring its appetite for innovation to this demanding project. Taking this lead, at a very early stage, the mechanical pipe joining specialist employed its Virtual Design & Construction (VDC) services to draw up 3D models of its proposed piping system.

Ing. Lanfranco Ricci, Mechanical Systems, Studio TI, praised Victaulic's proactive approach, stating: "The positive approach Victaulic took to this project was fantastic to work with. From the offset they understood what was required for the project and how best to produce a system which keep the data centre cooled and the weather forecasts running. A particular benefit was being able to use their digital prowess to build 3D design concepts."

Keeping the weather forecasts running

The site chosen for the new ECMWF data centre was the new Tecnopolo di Bologna, a 13-hectare space for public and private research facilities built on redeveloped unused buildings and the grounds of a former tobacco factory. However, the piping system created by Victaulic involved the use of prefabrication offsite. Victaulic understood that by prefabricating the system could ensure the highest level of reliability through greater quality and level of control and ultimately convinced the contractor Gianni Benvenuto S.p.A to opt for initially building offsite and installing later.

By working with Victaulic, Studio TI, and in turn the overseeing contractor SITE, were in the fortunate position of having a partner it could almost let run the cooling aspect of the project. Victaulic operate to

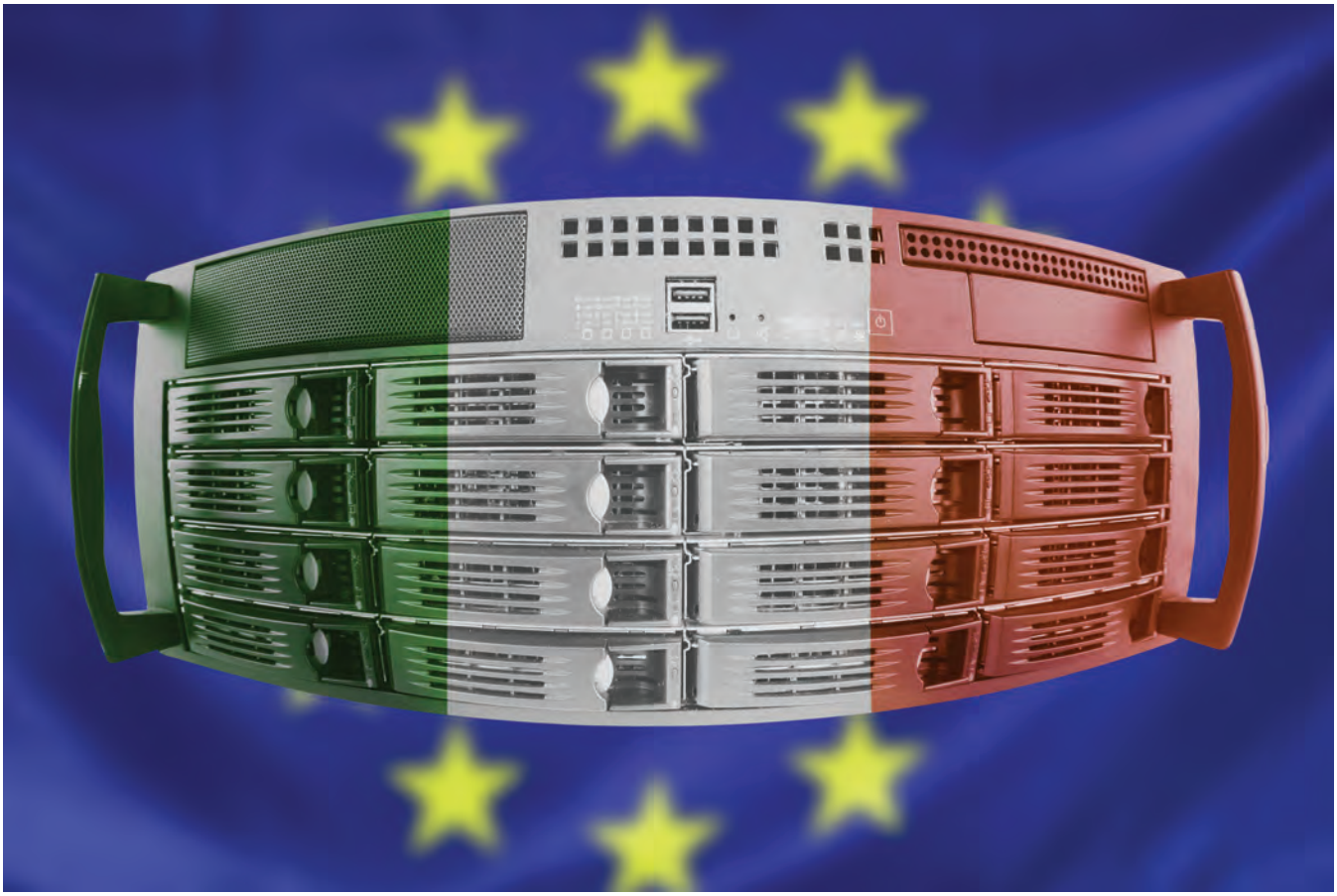
be more than simply a manufacturer and supplier to their clients: the company also acts as a consultant. Victaulic produced the pipe designs, provided the products and were onsite to oversee and guide the construction team in how to best operate their products.

One of the key reasons for choosing Victaulic products is the scalability for future system changes or expansion and the improved reliability compared to traditional solutions. Furthermore, a primary factor for the contractor's choice to work with Victaulic was the simplicity and speed of installation provided. As a result of Victaulic's Installation-ReadyTM technology, which only requires two bolts and nuts to be tightened, installation can often be up to seven times faster than traditional methods: a valuable saving of time and resources for any project lead.

This solution also paves a way forward for the future of existing data centres: expansions required in the coming decades to process more information can be undertaken without the use of fire – evidently a huge hazard for data centres – which are necessary for methods such as welding and brazing.

In total, for the mechanical room, technical tunnel and distribution of air to the computer room air conditioning units, more than 8600 couplings, 2400

fittings and 990 valves were installed, ranging from DN40 on the smaller scale to DN350 at the larger end. Matteo Vecchiato, Sales Engineer, Victaulic said: "Bologna is a proud city; one which sits at the vanguard of progress. It was a pleasure for us to work with Studio TI and Gianni Benvenuto on this project and to deliver a data centre which will not only propel the city forward but provide ECMWF member and co-operating states with vital weather data so they can plan and prepare for the challenges ahead.



What's driving data centre market growth in Ireland?

And what does this mean for wider tech infrastructure?

BY NOEL O'GRADY, DIRECTOR, IRELAND, SUNGARD AVAILABILITY SERVICES

OVER THE LAST DECADE, Ireland has very quickly emerged as a cloud computing hub for global technology organisations, providing a safe, compliant, and versatile environment for data storage. Major providers such as Amazon Web Services, Microsoft and Google have already started collocating core platforms across the country, encouraging others to quickly follow suit.

With Dublin hosting several major tech EMEA headquarters, storing data within close proximity to original deployment locations makes logical sense. And with so many of the big, and small, providers putting their data in the country – particularly as a result of the virtual world in which we now live – the number of data centres across the region has rapidly increased.

In the last twelve months alone, 10 new data centres have popped up, putting investment in these facilities above €7 billion between 2010 and 2020. It's now estimated that there are 70 operational data centres in Dublin alone, with a further eight under construction and several more in the planning stages.

The pandemic has accelerated this growth significantly with more organisations flexing towards a virtual workplace and recognising the benefits of storing their company data and applications within the security of the cloud. Ireland is certainly feeling the benefit of this, but other than being the preferred location for the big players, what is it that's attracting businesses to store their data in the country?

External factors impacting growth in Ireland

As technology advances and new data regulation

With the pandemic forcing much of the world to pivot to remote, dispersed working environments, the need for a versatile data infrastructure has grown, with many organisations moving away from physical data storage solutions to ones that are based in the cloud. Technology infrastructure everywhere has been tested, but the move to securing data centres has seen significant strain put on pre-existing infrastructures

laws are introduced, politics is having an increasing impact on our approach to data and where it should be stored.

Looking back at one of the biggest British geopolitical stories of a generation, and the uncertainty it has often created, it's clear why Ireland has become the chosen home for big corporations looking to continue the free flow of data to other regions in and out of the European Union. Choosing Dublin has made for a safer and more secure home within Europe for many organisations.

Ireland is also well on its way to a sustainable clean energy future – an important consideration as more organisations look to factor this into their buying decisions. Irish targets to achieve net-zero carbon within the next 30 years aligns with continued consumer and company demands. With more businesses now factoring in and recognising their environmental impact, decision-making processes have been overhauled to ensure data centre capacity purchases are done in a sustainable and ethical way long-term.

What this means for wider tech infrastructure
Because of continued growth in data volumes and broadband penetration driving digital services housed in Ireland, existing tech infrastructure has been massively stretched.

A total of 54 new data centres have been built since Amazon invested an estimated €1bn in its Irish expansion back in 2004. As a result, Ireland is now the fastest-growing data centre market in Europe, with more than a one-billion-euros worth of projects planned, according to the Data Centre Developments in Europe report.

With the pandemic forcing much of the world to pivot to remote, dispersed working environments, the need for a versatile data infrastructure has grown, with many organisations moving away from physical data storage solutions to ones that are based in the cloud. Technology infrastructure everywhere has been tested, but the move to securing data centres has seen significant strain put on pre-existing infrastructures.

With a continued number of companies expressing interest in moving their data away from individual servers and instead to cloud facilities, current infrastructure is going to need to be overhauled whilst at the same time ensuring it is being decarbonised.

Research from EirGrid highlights that by 2027, data centres could account for 29 percent of Ireland's total energy demand. Finding a way to do this sustainably and safely without contributing to the growing climate crisis will be key. There will be a significant need to grow the IT infrastructure serving data centres, but there will be a greater need to ensure this is done in a way that is sustainable.

What the immediate future holds

With the growth in the number of data centre sites within Ireland, has come an increased number of jobs created for the Irish population. Ireland has one of the youngest and most diverse workforces in Europe, and the clustering of technology companies and data centres has provided a critical mass of talent and skill to satisfy current demand.

But with demand set to grow over the coming years as cloud becomes even more important for businesses, statistics suggest the number of pupils choosing IT subjects at exam level are decreasing. Organisations and third parties need to ensure there is no gap in skills in the not so distant future.

Apprenticeship programmes and early insights into the sector are going to be needed to ensure a steady supply of skilled employees is maintained so the market can continue to grow well into the future. Ensuring new, skilled, and talented individuals continue to be attracted to the Irish data centre market is key to its future success.

DCA Data Centre: Data Centre Design Concepts

BY DCA CEO STEVE HONE

THE DCA are taking a break from the features related to Special Interest Groups during the summer, to focus this month on various aspects of Data Centre Design and construction. This month articles range from design of Edge DC's to design of DC lighting systems.

The DCA are currently considering introducing a new group that will focus on the challenges facing data centre construction both for investors and those organisations tasked with delivering the service. This will be reliant on the level of interest we receive to setup this working group so please contact The DCA if this would be of interest to you (contact details are below).

The purpose of the group is yet to be fully defined, but its broad objectives will focus on removing barriers, identifying best practice, and increasing consumer awareness.

Although this is not an exhaustive list, t he scope of this group could include key areas such as:

- Carbon assessments and embedded carbon energy reuse
- Sustainability and technology reuse
- Development planning and risk assessment
- Design Management
- Prefabrication
- Standardisation
- Speed of Construction/delivery and removal of barriers
- Essential utility supplies water, power, comms
- Energy shortages and grid capacity
- Supply chain contracts and SLAs
- Planning and Building Regulation
- Phased construction and dealing with live halls
- Managing the changing needs of consumers
- Skilled labour shortage
- Investment and DC financing
- Insurance and Legal considerations
- Ever changing regulatory pressures
- New disruptive technologies

Many of the suggestions above also feed into other Special Interest Groups we have set up, cross collaboration between groups is openly encouraged.

The DCA currently facilitates nine Special Interest or Working Groups and DCA members are welcome to join any of the groups and contribute, to find out more here: **https://dca-global.org/groups**

If you or your organisation are interested in being part of the Data Centre Design and Construction Special Interest Group please contact Steve Hone: **steveh@dca-global.org** or call **0845 873 4587.**

Is The Industry on the Edge of a Great Opportunity

BY STEPHEN WHATLING, CHAIRMAN AT BUSINESS CRITICAL SOLUTIONS, BCS

The changing landscape

THE DATACENTRE landscape is fundamentally changing and alongside the hyperscale development, we are also seeing an increasing market towards edge data centres to support a growing need for greater connectivity and data availability. Whilst the decentralised data centre model has been around in various guises for some time, it fell out of favour for a lot of businesses as they sought to exploit the efficiencies of operating fewer, larger datacentres. However the phenomenal growth of The Internet of Things (IoT) is driving a resurgence in its popularity. Cisco is predicting that in the five years upto 2022, 1.4Bn internet users will have been added, there will be 10.5Bn more devices and connections and broadband speeds will have increased by over 90%. Only edge networks can provide the high connectivity and low latency required by the IoT to meet users' expectations and demands for instant access to content and services.

The rise of AI

In addition, the rise of AI and immersive technologies such as virtual and augmented reality (VR/AR) is also a factor that will help drive this move. Whilst not perhaps mainstream yet many sectors are assessing the benefits. For example, in the manufacturing environment, the now ubiquitous robots on many production lines can be improved and their role expanded by AI. A recent report by the Manufacturer (26th February 2019) found that 92% of senior manufacturing leaders believe that the 'smart factory' will help them increase productivity and empower their staff to work smarter but a similar Forrester report also found that only one in eight large manufacturing businesses are using any form of AI. However, these kinds of innovations

require a lot of computing power and an almost immediate response as a single machine that 'pauses for thought' could create a knock effect that causes immeasurable damage to the factory, production line and productivity. Once again edge computing is best placed to support this.

In the case of AI and AR, speed is an important factor. In the edge decision making is held closer to the point of need and as a result the reduction in latency between the device and the processing power enables a much faster response time. Equally importantly the data itself can be better managed in an edge environment. The data is often governed by local legislation and now it can be held in smaller data centres closer to the point of use it becomes easier to meet the legal requirements in the local region.

Data Security

One of the major factors that needs to be considered is data centre security with cyberattacks increasing in both frequency and scale. Problems originating from the physical infrastructure have also been found to be behind outages in recent years. Some experts have suggested that edge computing potentially represents a soft underbelly for cyber security. For some the use of the word 'edge' has allowed users to assume the security of these systems is not as important as local or Cloud systems. However, moving forward clients will be expecting significant investment in security and disaster recovery processes as well as the physical maintenance and security of these localised data centres.

Investment in Telecoms

Another key consideration is that the increasing adoption of edge and cloud-based infrastructure for both social and business use is also placing greater demands on the distribution network in terms of latency, bandwidth and capacity. The increase in data over the next five years will place a lot of pressure on the telecoms network. It is the telecoms industry that will need to continue to invest and upgrade capacity to ensure that the infrastructure supports the growing demand for data flows to and from the edge and the cloud. Our Summer Report, which is available to download from our website, also highlights this issue with three-quarters of respondents agreeing that

the telecoms industry needed to provide this investment. Less than 2% of all those surveyed believed that the current infrastructure would be able to support the current predictions of growth in data. This is likely cause for concern.

The need for Power

Similarly, these new data centres will need power. The thousands of servers across all connected countries will need to be located and designed with energy in mind. It is perhaps worth noting too that countries that can't support the wider network demands will quickly fall behind in the race to realise the value of AI and AR.

The Opportunity

There is no doubt that massive increase in the data that is available from billions of devices and the rise of AI is both an opportunity and a challenge for businesses. Companies that can handle the scale, analyse the data and monetise its true value will have a real advantage. Edge computing will be able to handle more than a traditional network with many more transactions per second over many more locations and architectures but how and when will this infrastructure be delivered?

Conclusion

The fact that half of our respondents believe that edge computing will be the biggest driver of new datacentres tallies with our own convictions. We believe that the edge of the network will continue to be at the epicentre of innovation in the datacentre space and we are seeing a strong increase in the number of clients coming to us for help with the development of their edge strategy and rollouts.

In our view, the recent trend of migrating computing power and workload from in-house, on-site data centres to remote cloud-based servers and services will reverse a little. The next evolution, led by the need to make more and more decisions with little or no discernible delay, will see a move towards computing power being closer to the source of the user and the data that needs to be processed. More and more connected devices relying on the edge means more and more data centres, probably smaller than the typical Cloud data centre but no less important. With future trade, manufacturing, autonomous vehicles, city traffic systems and many other valuable applications relying on edge computing the security and maintenance of these systems will be paramount. However, there is no doubt that edge computing forms part of the future data centre landscape.

Design & Build

The following information provides an insight and details as to why more clients are moving away from traditional procurement routes and opting to engage with MEP contractors much earlier than traditionally might have been the case, through a Pre-Construction Services Agreement (PCSA) and two stage tender processes.

BY LAWRENCE HOOKER, OPERATIONS MANAGER – SECTOR LEAD FOR MISSION CRITICAL AT MICHAEL J LONSDALE

THE PCSA and early engagement of the MEP contractors means we can properly familiarise ourselves with the project and really contribute to the design process, advise on buildability, programme, sequencing and construction risk while the project is still in its infancy.

This without doubt integrates the whole project team, results in a high-quality design that doesn't stray from the client's intent and reduces the likelihood of disagreements later on.

Design

Traditionally the consultant would design the project to stage 4 and then produce a tender information pack for the MEP contractors to price. The design would be complete but would include several CDP packages and elements that that would not be fully developed until a MEP contractor is appointed.

This often means that unavoidable changes to the services design, spatial co-ordination, façade and structural penetrations and associated builders-works are realised late in the design process and impact upon procurement and even the commencement of physical works on site.

A similar thing can happen with suppliers of major plant items, which would also benefit the from early project engagement.

Having a MEP contractor on board during the stage 3 design means CDP specialist and the suppliers can be brought in early in the process, this aids the co-ordination, maximises the pre-fabrication possibilities and leads to a better developed scheme earlier than could normally occur through the traditional route.

Design Risk

At MJL we are frequently seeing the MEP packages being let as a Design and Build; currently, around 60% of our work is on a design & build basis. We do still see a lot of projects taken to Stage 4 by the client's consultant and then let under a D&B contract. While this may provide the client with the ability to test the market-place and obtain more detailed competitive quotations for the MEP services, the cost for the design is somewhat duplicated.

Early engagement of the contractor through a PCSA during the stage 3 means that we can really get into the detail of a project and validate the design, understanding the risks and putting strategies in place to reduce them. It also means that we can support the client's designer and assist them with information and ideas that would otherwise not be available to them, through our direct experience and through the involvement of our specialist supply-chain at a stage early enough for their suggestions and proposals to be considered and adopted.

Innovation

Innovation through the traditional procurement route is extremely problematic, even when better solutions are proposed it is often too close to the necessary deadlines for procurement and commencement on site for them to be incorporated into the final design. Through a PCSA period however, innovation can be really explored. When innovation is offered in a true D&B scenario, there is time to review, challenge and investigate all the various options before having to decide and incorporate into the final design.

Health & Safety

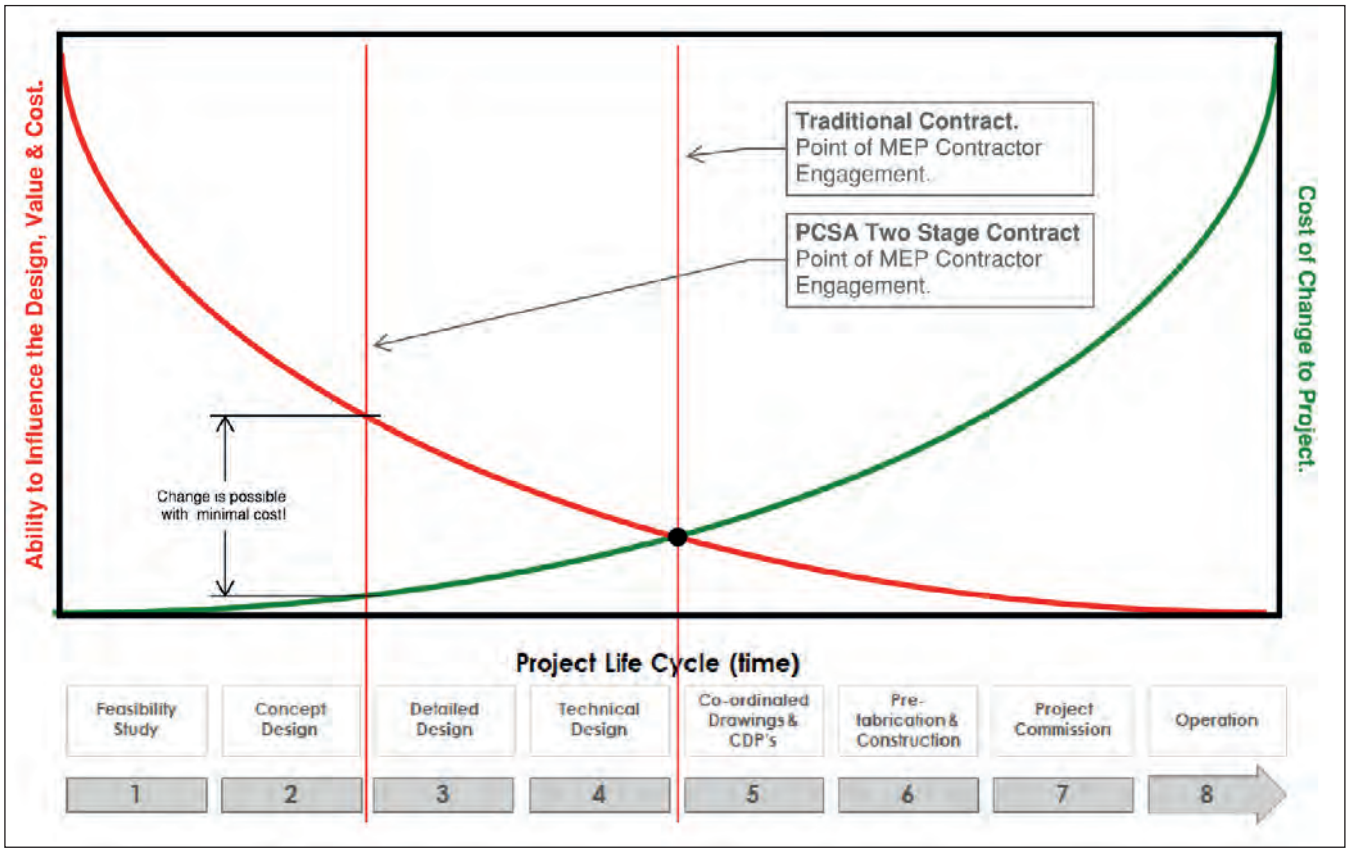
Health & Safety of the construction workers, the future occupants and the maintenance staff who will continue to operate the building is of upmost importance to all stakeholders on the project. By being engaged early we can undertake a full risk analysis of the MEP services design and suggest ways of mitigating risk through construction techniques and services layout while there is opportunity to do so. This also often involves engaging the specialist supply chain so that we can bring in their expertise to the project.

Logistics

The logistics requirements on projects is something that becomes more involved year on year, the construction of buildings has changed and the way we do things has had to change too. What we bring to site now is large, prefabricated modules and assemblies rather than the raw materials and a different set of skills and capabilities is required to undertake this safely. MJL have invested heavily into our in-house Plant Logistics division, that now handle all plant and materials across our 60-plus sites. This integral facility reduces risk and allows us to take a proactive role during the design phase, producing detailed logistics, cranage and plant movement methodologies to ensure what is being designed is optimal from a logistics point of view.

Pre-fabrication

Pre-fabrication is the most efficient method of installing services when it is possible to do so. By early involvement in a D&B contract we can achieve a true appreciation of the construction sequences. This allows us to consolidate and confirm pre-fabrication opportunities which can then be reflected in the services design layouts. By having



the MEP contractor involved early it's possible to maximise the opportunities for off-site pre-fabrication and therefore streamline the installation process, reduce the on-site build programme and reduce the level of site labour man-hours.

Commissioning

One of the most important elements of a project is ensuring the MEP services are setup and commissioned properly. MJL has its own in-house commissioning team that can assist from the outset. Having the commissioning managers who are going to be involved with the delivery of the services involved in the earliest possible reviews of the design as it develops gives certainty over the commission-ability and de-risks project delivery.

This is particularly important when there are partial, phased hand overs of systems, or areas of the project that need releasing early for client fit-out with some services functionality.

BIM & Pointcloud

BIM has without doubt transformed the way we design and build projects, however its deployment is still not well timed to fit in with the overall design and procurement processes and is far from efficient. Through a traditional procurement route the MEP services consultant would develop a fully co-ordinated BIM model as part of their stage 4 information.

Unfortunately, while this should avoid co-ordination issues it doesn't incorporate certified manufacturers data which only becomes available once full purchase orders are in place. Likewise, the federated project model will consist of the structural engineers models and this also will normally change once the structural frame contractor updates the level of the design detailing.

The reality is that the consultant's models are often parked, and the MEP contractor will model the whole services installations from scratch, resulting in lot of abortive work being done by the consultant and being paid for by the client. If MJL own the co-ordinated model during stage 3 the consultant can concentrate on getting the design and schematics completed while we can develop a stage 4 model. This can then be developed into a construction model and produce the construction issue drawings without having to start again.

On existing buildings, the advantage is even more evident as we would PointCloud survey the structure early in the design process so that we have pinpoint accuracy to base our models on which again would avoid problems later and speed up the design process.

Price

As we are all aware if change can be captured early then the impact on cost and time is minimised. By having MJL involved as the design develops, we can track the cost plan and flag any risks to the cost plan. This enables informed discussion and where acceptable to the client, the design to be altered to either avoid cost growth or provide compensatory savings on other elements of the scheme.

Traditionally, projects get priced at the end of stage 4 and then value engineered to meet the available budget, this is the worst potential outcome for a quality building and the most likely scenario under which the original design intent gets diluted and the client's operational requirements become unachievable. The PCSA process is generally undertaken on an open book basis with the cost consultant, using pre-agreed rates and OHP.

Getting that little bit more

ZAC POTTS, ASSOCIATE DIRECTOR (DATA CENTRE DESIGN) AT SUDLOWS

discusses what getting the best performance from a Data Centre means as this can be interpreted in numerous ways.

WHAT DOES IT MEAN to you to be squeezing every drop of performance out of a data centre? The answer will undoubtedly change depending on the angle you are coming from, but should it?

Designers of the cooling, or power systems, may read this as delivering the highest capacity or most efficient cooling or UPS System. IT teams will have different ideas of "performance" depending on what they do: Compute power, bandwidth, agility or storage capacity perhaps.

Finance, of course, will likely look at the bottom line – a high performance data centre is one which generates a lot of money, or costs very little to support a business which generates a lot of money. Yes?

Fundamentally, performance is about output, so it is critical that we understand what performance means to the data centre in question. Unfortunately, there are very few data centres with a single function - bitcoin mining farms maybe - but the vast majority are inherently complex with numerous functions, the proportion and distribution of which may even change with time.

Getting the most out of any single facility can mean a variety of things. Is it more racks, more power, or higher density? Is it high performance compute, GPU arrays, or other specialised hardware? "High Performance" can mean many things to different people.
Performance is different than efficiency but often the two become closely linked - make it more efficient, and then use the spare capacity you've created to deliver more.

Whatever the intended meaning, there are two things critical to delivering high performance; definition, and operation. The definition stage outlines what is needed, and within what limitations. Depending on the application it could be simple or fairly complex, but to be able to squeeze every bit out of a facility or design, it is important to ensure the definition is sound, free from ambiguity or issues, and applies the right constraints in the right places. It is not the supply air temperature to the data centre, which is important, for example, but the temperature of the equipment being supported. Defining the wrong parameter often results in great effort and expense being invested meeting a specific requirement which is later uncovered to either be outdated or set arbitrarily. Whether a new facility or an existing one, the investment in the definition stage will always pay off as once fully defined, we are then able to maximise the performance of the facility, and because of a good definition we will know what performance means.

For many years, and indeed still today, many high-performing data centres will consist of a number of carefully tuned systems, each looking after part of the system and reacting to changes in demand, be it at the IT or facility level. These control systems work to balance the performance targets and constrains set out in the definition stages, so the importance in getting that right is clear. Advanced design tools like CFD and advanced load placement algorithms offer a way to refine operation but are still based on the same definition and only offer information based on a snapshot in time.

A data centre with a solid definition, well designed with a modern deployment of sensors and controls, would still be a good example, delivering good figures in any number of KPIs chosen to be reported. That said, momentum is growing with the adoption of more complex systems with a wider scope and some level of machine learning.
Machine learning can in some cases be overstated. At this time, the level of adoption is limited, and within active deployments, there is a range of successes and failures.
The proven potential of machine learning systems cannot be undervalued though, especially when it comes to the final incremental improvements in efficiency and performance. It is in this area where

machine learning offers an impartial, multi-skilled, constantly working, and constantly watching, team member. One who is aware of the goals and can predict how these are best achieved.

The same tools which feed into leading design processes, are being integrated into the ML decision tree of the ML models. At Sudlows for instance, our modelling and simulation team are integrating CFD and hydraulic system models so algorithms can work with both observed historical data, and continually recalculated simulated results of scenarios which, hopefully, we'll never experience – unnerving combinations of poor load placement, system failures, peak days and grid power interruptions.

Limited to just improving the performance of the M&E, a developed ML system will soon become unchallenged, but fortunately the scope is much greater. Systems have expanded to consider long and short-term reliability, offer predictive advice on imminent faults and issues, and, perhaps most importantly, bridge disciplines to advise IT and M&E systems based on the calculated impact to the other.

There is a huge gap between the majority of the industry and the small few who are implementing such systems at scale and given the adoption of basics such as aisle containment, it might well be a long time before we see such systems in the majority of spaces, but we will eventually. The key to squeezing every last drop of performance out of a facility might one day be a highly refined machine learning system, but first and foremost, in my opinion anyway, it is the project definition. A poor definition of what is required and the constraints within which to operate will hinder the future deployment of machine learning much the same as it will hinder the initial design and manual refinement.

For today, although such advanced controls will always offer an edge, a well-designed facility with a "standard" system can still be optimised for a good level of performance gains through good initial design and constant review, indeed using many of the same tools which feed into an advanced ML platform.
In many ways a modern facility with its extensive data collection and dynamic operation, is "ML Ready" when the time comes, but in the meantime, it is critical to build up from the basics and invest in the definition and design, or the additional layers of the future will have a very poor foundation upon which to build.

Zac Potts, Associate Director, Sudlows
Zac leads both the award-winning Data Centre Design Team, and the Engineering Simulation Team at Sudlows where he has directed the design, simulation, construction and testing of multiple high specification data centre projects.

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Top design considerations for the most efficient data centre lighting solution

BY ZUMTOBEL UK

LIGHTING may only consume a fraction of the total energy used within a data centre but its impact and cost savings go far beyond the cost of lighting. In addition to saving energy, money and maintenance efforts, a highly efficient LED lighting system can offer data centre operators a simple solution to maximise both safety and the productivity of their staff.

Extremely long life, low carbon emissions and excellent task lighting are just some of the benefits of highly efficient LED lighting. Spending a little extra time during project design stage and partnering with lighting experts will lead to fewer issues in the long-term. Zumtobel Lighting are experts in this sector and have looked at addressing key lighting specification considerations for Data Centre applications:

Ambient air temperature

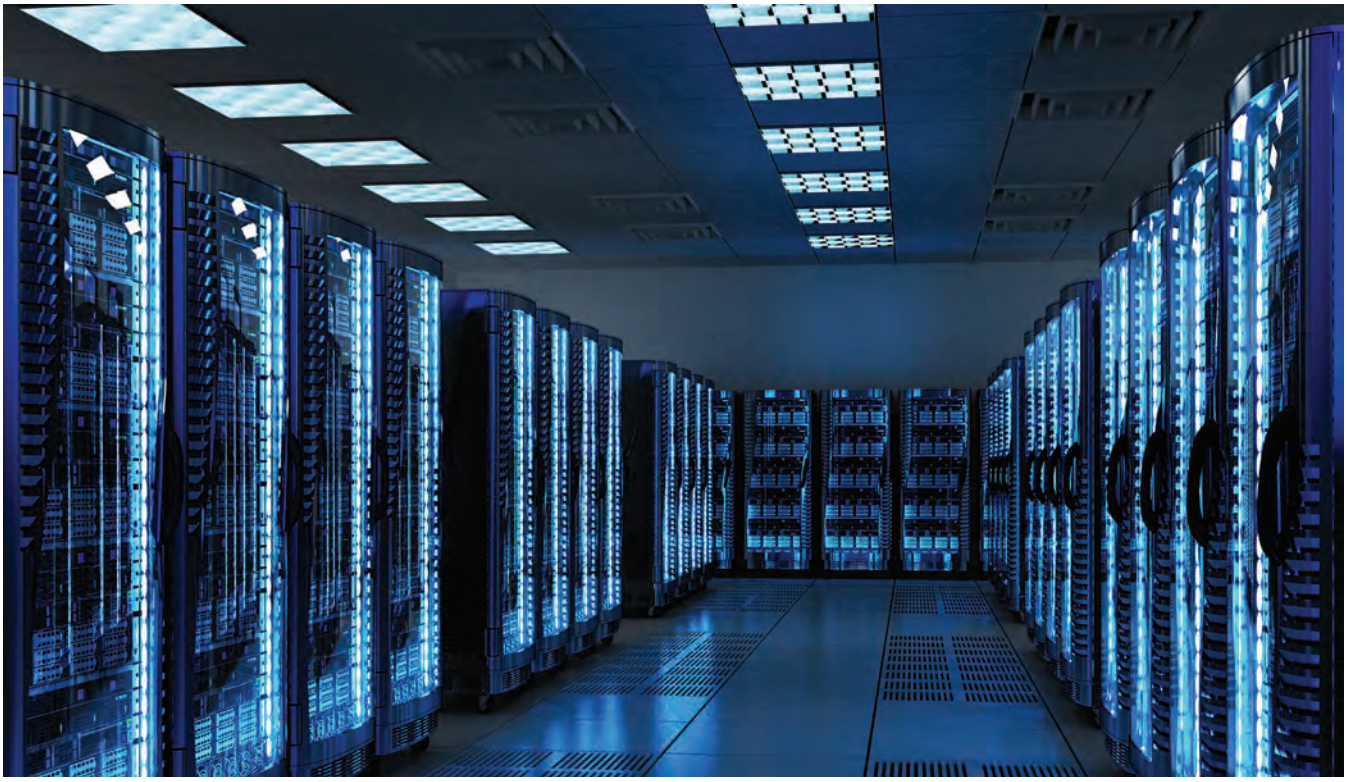
The ambient air temperature of a facility is often considered one of the most important aspects of data centre design. Hot and cold aisles typically result in fluctuating temperatures and increasing pressure on any hardware found within a data hall. The first step is to determine if the luminaires being considered have been fully tested and have an appropriate ambient temperature rating for the environment.

Task lighting

Although data centres do not have the same occupation rate as traditional commercial businesses, technical engineers need to monitor and work in close proximity to the servers. A well-lit working plane is crucial, engineers can accurately record information and clearly see the task at hand. It is vital that the lighting system is designed to light the face of the servers, similar to a library where you are illuminating the spines of books to 500lux for ease of identification.

The introduction of innovative lighting control can also prove beneficial, additional energy savings of at least a further 10 per cent can be experienced when LED luminaires are integrated with sensors to manage when and where light is used, reducing running time and unwanted heat gain.

Lighting control should be the rule rather than the exception as the right choice of highly efficient lighting coupled with an intelligent lighting control system will enable consistent monitoring of a lighting installation whilst enabling remote reporting of potential faults within the system.



Emergency lighting

Every data centre is laid out differently so there is no one size fits all solution. Emergency lighting systems are a critical part of any commercial building, data centres are not an exception they must have a proven emergency lighting scheme, this is a legal requirement forming part of the wider life safety system. Along with a consistent and reliable power stream, your emergency lighting back-up system needs to provide power to the emergency luminaires for between 1 and 3 hours depending on the geographical location.

High ambient air temperatures can lead to a design preference for central battery systems (which can be located remotely) as over self-contained emergency luminaires, due to heat exposure, can result in reduced battery life expectancy and increased susceptibility to overheating and failure.

External lighting

Data and premises security are at the forefront of a Critical Facility operator's priorities, whilst IT security measures are paramount, unfortunately external lighting is all too often a neglected design focus when fortifying a facilities perimeter defences. External lighting can help support and define the building's entrance, perimeter and produce better visibility for CCTV identification. In addition to security lighting, the use of architectural lighting within client-facing zones such as a reception area, can support brand identity. The correct choice of products used across external areas will give the facility an identity whilst improving security for the building and its employees surroundings.

Modularity

The Data Centre Industry is growing fast, one of the key challenges facing Developers and Operators is how to build and scale to meet client demand. Products which offer modular construction allow for greater design flexibility and enable the build to progress piece by piece, increasing MW capacity without compromising on time or value. Prefabricated sections constructed within off-site controlled manufacturing facilities, improve build consistency, decrease on-site install time, and reduce the quantity of large multi-skilled site based install teams when compared to traditional methods of construction, and are also kinder to the environment.

About Zumtobel

We are passionate about designing and producing the highest quality of light. Our work is driven by the knowledge that the right light can create the right environment for people to thrive when tailored to their individual needs. Guided by a unique design approach, we continuously push our boundaries in search for perfection through unique and timeless design. As we develop the next generation of lighting, we build on our family heritage to refine the aesthetics of light and shape the lighting of tomorrow. With a special blend of passion, grace and avant-garde ideas, we turn light in to an experience and remain committed to the goal of improving the quality of life through light. Zumtobel is a brand of the Zumtobel Group AG with its headquarters in Dornbirn, Vorarlberg (Austria).
Zumtobel. The Light.

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