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GOSSAGE

The hottest gossip from our industry insider.

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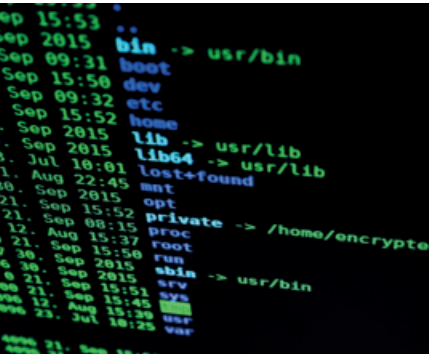
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ECIC highlights potential project policy problems

ECIC has warned electrical contractors working on major building sites and projects that they may not be covered under the site's project policy as they have been in the past.

This could leave them exposed if they are found to be at fault in an insurance claim. The warning follows an out of court settlement which has left insurers and contractors in the dark about the extent of cover offered by Project Policies in the eyes of the law.

In 2018, a High Court decision found in favour of a project policy insurer recovering their costs from the contractor who caused a site fire. The court concluded that, under the terms of the project policy, the subcontractor was required to have separate cover – which was not in place. This meant the contractor was liable for the full cost of damage caused. The contractor in this case was due to appeal the High Court's decision in early 2019 but

instead settled out of court, prior to the appeal hearing.

Ian Hollingworth, technical claims and relationship manager, ECIC, commented, "The out of court settlement has left insurers supporting the UK's construction sector in need of urgent clarity over policyholder and sub-contractors' rights under these policies, and where the sub-contractor needs to take out their own CAR/public liability insurance.

SELECT questions new fire safety regulations

SELECT has warned that new fire safety regulations under consideration by the UK government could undermine existing qualifications that currently ensure contractors are qualified and competent to carry out work in their field.

In its response to the 'Building a Safer Future' consultation, which relates to buildings above 18m high in England, trade body SELECT has cautioned against the introduction of a new overarching competence framework to minimise the risk of fire in high-rise buildings. This new framework is one of a series of proposals supported by the Competence Steering Group (CSG) set up in the wake of the Grenfell Tower fire in June 2017.

In particular, SELECT opposes the CSG's

suggestion to use either PAS or British Standards Institution certification to determine core knowledge, skills and behaviours.

"This action will undermine the existing National Occupational Standards, apprenticeship and qualifications structures already in place," SELECT said in its submission.

"In our view, the answer is that for sectors such as the electrical industry, where apprenticeships already exist, PAS/BSI standards should accept these as definitive of the core knowledge and skills for that discipline, subject only to any specific additions re: fire and structural safety, etc."

SELECT is aware that at least two previous UK government schemes – the Microgeneration Certification Scheme and the Green



Deal – used PAS to accredit those who did not hold existing qualifications as a way to measure the competence of those individuals. According to SELECT, examples of poor work carried out under these schemes demonstrated that depending solely on an individual attaining a level of 'competence' was flawed, as those individuals did not have the baseline of experience to underpin any technology-specific training.

Engineering services cautiously optimistic, says survey

The latest Building Engineering Business Survey, sponsored by Scolmore, has shown that sector growth remained steady in the second quarter of 2019 in the face of rising costs and persistent payment issues.

The survey, which included data from industry trade bodies ECA, BESA, SELECT and SNIPEF, found that more than eight in 10 (81%) businesses' turnover remained the same or increased in Q2 2019 (versus Q1 2019). Less than a fifth (18%) reported their turnover had decreased.

Outlook for Q3 suggests that the vast majority (85%) of businesses expect more or the same turnover compared to Q2.

ECA CEO Steve Bratt commented, "Businesses are continuing to show resilience in what is a challenging commercial



environment, with increased costs and poor payment ongoing concerns. With the uncertainty of the ongoing Brexit impasse casting a shadow over industry, it's vital that the new government injects some impetus by backing major infrastructure

projects and ensuring prompt payment across the sector."

More than half (52%) of respondents reported an increase in labour costs, while two thirds (62%) reported an increase in material costs.

Prompt payment remained a major challenge, with it taking over 30 days in 62% of jobs in the public sector, in breach of regulations. This comes despite 56% of businesses saying their clients promised below 30-day payment within contractual agreements.

The survey received 497 responses from companies across the industry, mainly regarding their performance in Q2 2019 (1 April to 30 June 2019), and expectations for Q3 2019.



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Trade Skills 4U opens new training centre

Electrical training provider Trade Skills 4U has announced the opening of its new training centre at Westwood Business Park in Coventry.

Opening a centre in the Midlands, just west of Coventry and situated between the M1, M6 and M40, means customers based in Birmingham, Leicester, Peterborough, Northampton, Milton Keynes and the surrounding areas can easily access the centre. Students are now able to book onto a range of courses being delivered at the centre

including: City & Guilds diplomas, domestic installer packages, inspection and testing, plus many more.

Carl Bennett, chairman and founder of Trade Skills 4U said, "I am extremely excited with the opening of the new centre. We have conducted a lot of research in the area to ensure that this is the perfect location to run our courses from. We can see from the people attending our centres in Gatwick, Leeds and Warrington that there is customer demand from around the region, so it

makes sense for us to expand to this area."

The new facility will offer brand new classrooms and workshops that have been built to the highest specifications with the latest technology. The announcement comes as a result of significant growth and investment over the last 18 months. The new centre takes the total to four, with training facilities in Gatwick, Leeds and Warrington, as well as satellite centres offering short courses in London, Tyne & Wear, Cardiff, Hatfield and Maidenhead.

JIB appoints new chief executive

The Joint Industry Board for the electrical contracting industry (JIB) has announced the appointment of Jay Parmar as its new chief executive.

Parmar will take up the post on 1 October 2019 and will replace Steve Brawley following his retirement after 11 years in the role.

Previously director of policy and membership at the British Vehicle Rental and Leasing Association, Parmar is an experienced legal professional and is skilled in negotiation, member engagement and business planning. In his current role, he will be responsible for policy work and campaigns, representing the industry at UK and EU level, and will have a consultative role on a number of government-led groups.



Speaking of his appointment, Parmar said, "I am thrilled to be given the opportunity to lead the JIB team and am looking forward to working with colleagues, members, partners, and stakeholders with a key interest in this dynamic and vibrant sector, to ensure that JIB continues to deliver a first class service. My focus will be to ensure that the organisation remains at the forefront of the industry's

fast pace of change; supporting members and further strengthening the value of membership."

Andrew Eldred, ECA director of employment and skills, added, "Jay Parmar's appointment is good news for the JIB and the wider industry. His abilities and track record position him extremely well to build on the significant achievements of Steve Brawley and his team over the past decade."

Ian Woodland, national officer at Unite the Union, also said, "We welcome Jay Parmar's appointment at a very challenging time for the industry and look forward to working with him. Jay comes with a great deal of experience and know-how that will keep the JIB at the forefront to face these challenges."

NICEIC & ELECSA announce new technical director

John O'Neill has been appointed director of technical excellence at Certsure (NICEIC and ELECSA).

A well known and much respected figure in the industry, O'Neill has almost 50 years' experience in the sector. He started his career as an apprentice at Vauxhall Motors

in Luton before working as a maintenance supervisor for General Motors in Canada and the USA. He returned to the UK to set up his own electrical contracting business, specialising in electrical work and integrated control systems.

He joined NICEIC in 2010 and has filled a number of technical positions including area engineer, customer relations engineer and more latterly the technical helpline manager.

O'Neill said, "I am delighted to take up this role at such a highly regarded organisation in the industry.

"My time spent as an area engineer gave me a great insight into the challenges contractors face on a daily basis and the many

different environments they work in.

"I look forward to helping them prepare for future opportunities in new markets whilst at the same time providing high quality, compliant installations."

O'Neill will continue to represent Certsure on the JPEL/64 committee, contributing to the BS 7671 wiring regulations, which provides guidance for electrical contractors.

Kevan Parker, managing director for Certsure said, "John is a well known and respected individual within the sector.

"He brings an immense amount of knowledge and experience to the role, both through his time as a contractor and with NICEIC and ELECSA."





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GOSSAGE

New PM very far from green

Our new Prime Minister AI “Boris” Johnson likes to portray himself as somebody committed to delivering the most environmentally friendly electricity system. The only trouble with his adopting this guise is that, since returning to Parliament in 2015, he seems deliberately to have voted against practically every measure designed to achieve just such a future.

For instance, on 14 March 2016, he voted against the concept of creating a strategy for carbon capture and storage for the energy industry. On the same day, Johnson also voted against setting a decarbonisation target for the UK within six months of June 2016, or of reviewing it annually thereafter.

The previous year, on 8 September 2015, Johnson voted to apply the Climate Change Levy tax to electricity generated from renewable sources – thus completely negating the tax’s purpose.

Johnson has generally voted against every measure designed to prevent climate change. Should we be surprised? In 2013, during a snowy UK winter, he highlighted a factually incorrect claim by Piers Corbyn (a weather forecaster who, coincidentally, is the brother of Johnson’s rival, the current Labour leader Jeremy Corbyn) that low solar activity could lead to a mini ice age.

For discerning bachelors only

Some really insightful news from the September issue of the high-society magazine, *Tatler*. The day of the ‘trophy wife’ is dead. Today’s super-rich bachelors are eschewing bimbos. Instead they are looking for feminists with “an Oxbridge first, and a high-flying career.” 2019’s super spouse is “not about what she can buy, but what she can do.”

Gone are the “days of sitting quietly on charity committees.” She is busy “empowering women.” She has “set up her own foundation”. She has “given speeches at the UN.” And, most important of all, “she is establishing an energy efficiency consultancy.” That’s right, saving energy is the ultimate in power-player activity. So, now you know.

A fracking great Ponzi scheme

2019 was supposed to be the year that American shale oil and gas producers finally reined in spending, with the goal of funding all new development from free cash flow. And just like every other year, it didn’t take long for those plans to unravel.

An analysis of 40 US shale fracking companies by Rystad Energy, an independent research organisation in Norway, has revealed how badly things had gone in the first quarter of 2019: “The gap between capex [capital expenditures] and CFO [cash flow from operating activities] has reached a staggering \$4.7 billion. This implies tremendous overspend, the likes of which have not been seen since the third quarter of 2017.”

In other words, the capital expenditures, or money spent drilling, outpaced the cash flow from operating activities, or the money made by selling fuel, by nearly \$5 billion, in the first quarter of 2019 alone. And the announcement of second quarter results is bringing no better news, with many shale companies suffering major drops in value.

The messages coming from energy analysts, the financial industry, and the fracking industry all lead to the same conclusion: The US shale industry has been a financial disaster for investors, with producers piling up huge amounts of debt despite extracting copious volumes of fuel from disappearing sweet spots. Now, shale companies are under mounting pressure to pay back that debt.

Investors seem to be finally catching up to the bad deal that fracking represents. But the question remains: What took them so long to spot this Ponzi scheme? And why is the new UK Business Secretary Andrea Leadsom so convinced we should follow the American example?

“Market ready technology” – in 15 years’ time

The government gave a boost to the nuclear sector this summer when it revealed plans to invest up to £18m in the creation of the “mini nuclear power stations.” These would be the first such entities in the world.

A consortium led by Rolls-Royce is proposing to try to build prototype “small modular reactors,” known as SMRs. This initial money will allow Rolls-Royce to develop the design of the reactor, which it predicts “may” be available during the 2030s at the earliest.

Why are these being pushed by Rolls-Royce, best known as the constructor of nuclear propulsion reactors for submarines? In the company’s own words, this is because “the expansion of a nuclear-capable skilled workforce through a civil nuclear UK SMR programme would relieve the Ministry of Defence of the burden of developing and retaining skills and capability.”

On 13 September, the Prime Minister is due to give his blessing to what he will describe as a potential £500 million investment programme as part of the Northern Powerhouse initiative. We know this because of a breathless interview afforded headlines by the *Sunday Times* by one Henri Murison, who has been the director of the Northern Powerhouse Partnership since April 2017. His chairman is, curiously, the editor of the *London Evening Standard*, George Osborne.

Murison came from working as a manager for the Yorkshire Building Society. Brimming with enthusiasm, he painted a picture of “market ready technology available globally.” Sadly, he did not specify quite where this technology could be found.

But he was confident this “market ready technology” could “be put together with the UK supply chain, with us having what is needed to build them here in the Northern Powerhouse, alongside investing in a large factory which this support will help us to achieve.”

Murison appears to have absolutely no background in electricity issues. Otherwise, he would surely never have so seriously misled the *Sunday Times* regarding likely timetables. Perhaps his chairman could explain to him that the difference between R&D and “market ready technology” is the same in Yorkshire as it is in London?

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Making the most out of UKCW

The team at UK Construction Week (UKCW) outlines seven ways busy electrical engineers can network and learn at this year's event.



As any electrical engineer will admit, it can be difficult to justify time away from the job. But learning, networking and discovering are all essential to staying on top of the latest industry insights and products.

At UKCW, electrical engineers and energy professionals get the best of all worlds, with bespoke content on a selection of topical issues – but also exposure to a wider range of learning.

So, if you're still not signed up, here are seven reasons why you should attend the largest construction event of the year, taking place between 8 and 10 October at Birmingham's NEC.

1. PRODUCTS, PRODUCTS EVERYWHERE

With over 10,000 products being showcased at the event, UKCW is the ideal marketplace to source your new product. With eight different sections ranging from build to timber and from energy and HVAC to civils, everything you need is right there under one roof.

Building Tech showcases the very latest technological advancements in automation,

lighting, security and communication technology, and shows how these can be integrated into the built environment.

Key exhibitors include Google Nest, which is focusing on creating a helpful home that takes care of the people inside

“ At UK Construction Week, electrical engineers and energy professionals get the best of all worlds ”

it. Pinnacle Infotech are on-hand to provide a range of Building Information Modelling (BIM) and CAD.

The Aurora Lighting Group is returning once again to UKCW; Aurora's AOne smart lighting system offers innovative smart lighting products, it is compatible with SmartThings and Alexa, and it can be controlled from anywhere in the world.

2. THAT LUCKY ENCOUNTER

Meeting face to face is the most engaging way to do business and UKCW can facilitate that. If you have spotted a business that you want to connect with, contact them through the exhibitors' portal and arrange the meeting in advance. 4,000 business meetings were booked by UKCW visitors prior to the show last year, and exhibitors reported that they had generated 70,000 new business leads at the event.

3. GENUINE INNOVATION, NOT ANOTHER WIDGET

You could leave the future of the industry as a surprise, but where's the business sense in that? Disruptors are now present in many different markets, so this year UKCW is shining a spotlight on the serious change-makers in construction. To aid the search, a new Innovation Zone has been established in partnership with the Construction Innovation Hub (the Hub).

Marsh Industries will be launching their new acoustic vibration reduction unit, Whisspurr, which is designed to reduce noise and vibration from diaphragm compressors, as part of the Innovation Zone.

4. YOUR OWN PERSONAL INDUSTRY MBA

Condense your strategic business learning into one, two or three days of insights. UKCW brings together more than 300 expert speakers, including; Mark Farmer who is spearheading policy initiatives on Modern Methods of Construction (MMC); Professor Birgitte Andersen of the Big Innovation Centre; Keith Waller, programme director at the Construction Innovation Hub; and Sonia Zahiroddiny, BIM strategy manager for HS2.

This year, there will be more than 150 hours of CPD content available. The programme will take on a different theme for each day of the show, tackling fire safety, health and wellbeing and sustainability.

There are also numerous mini-theatres addressing additional topics in-depth. SSE Enterprise, sponsors of day one of the



Energy and HVAC Hub, will be covering 'What is a commercially viable alternative to diesel power generators? The SSE case study.' They will also be considering 'Game changing generation technology to reduce NOX levels: How it works in practice.'

There's also a new Careers Centre offering workshops on career progression, apprenticeships, staff retention, diversity, career change and new talent.

5. HEALTH AND WELLBEING

Launching at UKCW this year, the Mind Your Head campaign is designed to promote mental wellbeing for those working in the construction industry, with particular focus

●● Meeting face to face is the most engaging way to do business and UKCW can facilitate that ●●

on men who are at greater risk of suicide. It is a straight-talking, no-nonsense and accessible way to reach this target audience.

As part of the campaign, Carwyn Lloyd Jones, the creator of the Tiny House at last year's UKCW, will be using his talents

to create an artistic installation of swings which has a mental health focus.

6. AN EXPERIENCE NOT EASILY FORGOTTEN

So, when did you last get to run a building site? Make a beeline for the Coventry University stand and its site simulator. It has been hailed as one of the most powerful experiences of any construction show. If

you're feeling brave, you can step into the site hut, take on the role of the site manager and get first-hand experience of what it's like to work on a busy project. Not for the faint hearted!

7. CELEBRATIONS AND A BEER FESTIVAL

Everyone enjoys a good awards night and UKCW is no exception. The show hosts the UKCW Role Model of the Year, the new Building Trades Awards with Fix Radio and the new UKCW Construction Awards. Plus, to encourage young people into construction, the iBuiltThis competition is back and the winners will be announced at UKCW.

Don't miss the Beer Festival, sponsored by NBS, and look out for the Fischer bar in Hall 11 or the Rawlplug bar in Hall 12. Thanks to its success last year, Rockaoke is back on the Wednesday night to help break the ice. There will be live music and street food on hand to help visitors mix and mingle during the three-day show.

UKCW is one event with many sections, including Build, sponsored by Easy-Trim, Building Tech, Civils, Energy and HVAC, Surface and Materials, and Timber. It also features Concrete Expo (8 – 9 October only) and Grand Designs Live (9 – 10 October only).

Single registration gives access to all areas of the show. For further information, visit: www.ukconstructionweek.com ER



On the safe side

Martindale Electric looks at what's needed to stay safe when working on electrical plant equipment and identifies simple solutions to ensure equipment safety ratings match the application.

Safe isolation procedures are in place to ensure that workers on-site are not exposed to danger when working on or near live electrical systems and equipment. Both the standards for the equipment and the potential penalties for non-compliance have changed recently.

With around 1,000 serious accidents in the workplace each year and 16% of all fatalities linked to electricity, it's clear to see how following simple safe isolation procedures and using the correct equipment can keep your team safe and avoid heavy penalties for non-compliance which can exceed £10m. In fact, changes to sentencing guidelines for health and safety offences have resulted in average fines trebling over recent years.

WHAT DO ELECTRICIANS AND MAINTENANCE TEAMS NEED?

The essential equipment needed to stay safe and achieve compliance with the regulations are:

- Locking off devices
- A clear method of labelling the hazard
- A dedicated voltage indicator
- A proving unit to verify the voltage indicator.

Comprehensive locking off kits are available to ensure the right locking off device is always to hand. A basic kit should include the following; a selection of MCB and breaker locks, a padlock with a unique key, a hasp if more than one person is working on a system and lock out tags and warning labels.



Changes to sentencing guidelines for health and safety offences have resulted in average fines trebling over recent years

However, locking off the circuit correctly is just one part of the procedure. Before carrying out any work on the circuit, it is essential to prove the circuit is dead. Circuits are frequently mislabelled so there is no certainty that the correct circuit is locked off.

DEAD CERTAIN

Multimeters are not suitable as it's all too easy to select the wrong range. They rely on battery power to function, so it's possible to

make a false 'dead' reading on a live circuit if the batteries are flat.

When it comes to choosing the right voltage indicators, there are a number of suitable models on the market which are fully compliant with the latest standards, so what features should be taken into account?

Apart from the obvious issue of reliability, many voltage indicator models now come complete without batteries, ranges or switches to worry about, which increases user friendliness. When it comes to test lamps, many models, such as the MTL10 and MTL20 from Martindale, also bring added benefits of a 360° viewing angle, even in bright sunlight with high density LEDs indicating four voltage bands of up to 690V. When selecting a test lamp, it is also important to look for a model which comes with interchangeable right angled and straight probes to ensure easy access, even in difficult to reach locations. As an added precautionary measure, a finger barrier also helps to ensure a safe distance from line conductors.



The future is 'smart'

Garrett Walsh, P.E., control and monitoring product manager at nVent, assesses the benefits of smart technology in electric heat-tracing systems.

Progress in the world of industrial processing and production is closely linked to the development of new heat-tracing technology. Since the introduction of the self-regulating electric heat tracing (EHT) cable in the early 1970s, processes have become increasingly complex, with specifiers demanding a greater level of accuracy and energy efficiency than ever before. In applications requiring the maintenance of moderate to low temperatures in particular, self-regulating technology provided considerable improvement over traditional constant wattage cables.

More cost competitive and simpler in terms of infrastructure and planning, self-regulating systems provided the ability to automatically adjust power output based on localised heat loss. This was the first step in the evolution of smarter, more reliable heat tracing systems. Today, as the industry becomes even more specialised, the demand for more efficient systems has culminated in another technological development: the introduction of 'smart' heat-tracing.

●● As systems become ever more sophisticated, what does the future hold for the heat-tracing industry? ●●

SMARTER SOLUTIONS

Offering comprehensive connectivity, insight and control, smart heat-tracing systems integrate EHT data with Distributed Control Systems (DCS) to allow open communication and real-time monitoring. Such systems are already being adopted to improve efficiency and reduce operating costs, suggesting that the debate over the coming years will be when, not whether, to adopt smart electrical heat-tracing equipment.

What are the benefits companies can expect from 'smart' heat-tracing? As systems become ever more sophisticated, what does the future hold for the heat-tracing industry?

SMART, CONNECTED AND COST-EFFECTIVE

The remote monitoring capabilities and advanced connectivity of smart systems offer significant advantages for a range of applications: from chemical production to tank storage and offshore oil and gas facilities. Whereas traditional monitoring devices such as thermostats require regular manual maintenance checks, smart system controllers can eliminate the need for these checks and associated costs by connecting and integrating every EHT system component. This allows EHT data from any point in the system to be delivered digitally to where it can be used.

This digital method of monitoring allows real-time status to be presented instantly – making the location and cause of faults easily identifiable and helping to reduce the need for costly site interventions. With smart monitoring, engineers are also better equipped to make informed decisions regarding the severity of an issue and to prevent unscheduled system shutdowns. This not only results in increased uptime and fewer unnecessary stoppages, but also ensures heat-tracing systems operate as safely and efficiently as possible.

●● This digital method of monitoring allows real-time status to be presented instantly ●●

Smart systems can also significantly increase performance and value in freeze-protection applications. Traditional heat-tracing systems are designed for worst case scenarios during the coldest months, leaving them oversized and inefficient throughout the majority of the year.

New smarter systems can accurately calculate the precise level of power needed based on current conditions and make intelligent control decisions resulting in significant energy savings, helping to reduce total operating costs (TOC). With these benefits taken into account, the energy and cost savings offered by intelligent heat-tracing helps offset the total installed costs (TIC) of the system, making these systems the smart choice for a variety of applications.

SMARTER IS SAFER

System insight is arguably the most powerful tool in the plant engineer's arsenal in terms of ensuring safe and reliable operations. Without complete knowledge of the status of each component, faults may not be identified until they become critical issues, and key decisions may be delayed while data

is gathered from disparate parts of the system. The advanced connectivity offered by smart heat-tracing technology delivers this timely insight, enabling the integration of heat trace data into process control, power management and maintenance management systems.

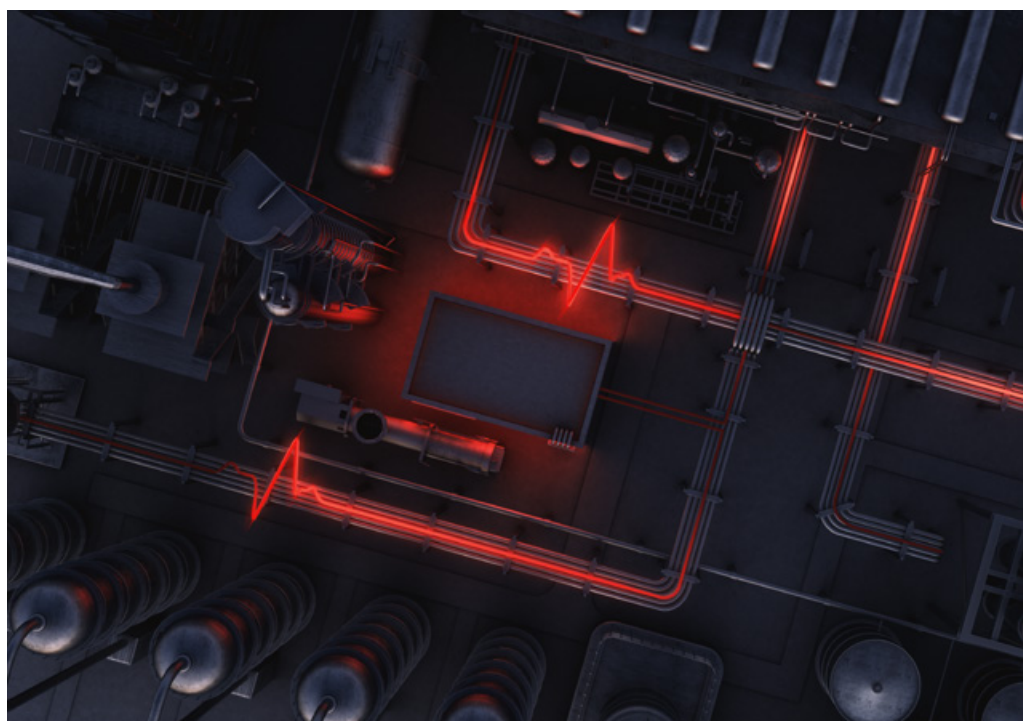
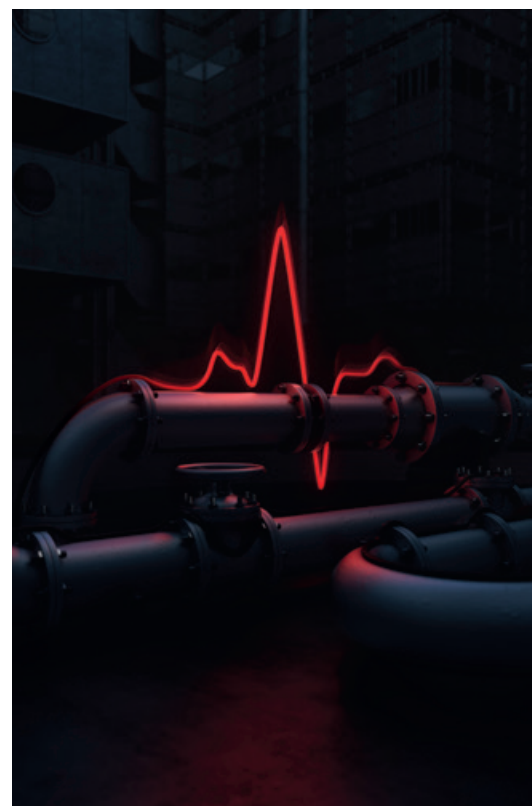
This allows engineers to assess information from all areas of a system simultaneously and in-real time, enabling them to quickly make informed decisions. This capturing of historical data and analysis of trends provides a more proactive approach to plant safety. The implications of these comprehensive insights for operational reliability and safety are significant, minimising the chances of system shutdowns.

WHAT'S NEXT?

What can we expect from smart heat-tracing in the future? While safety and reliability continue to be paramount, technology will play an increasing role in maximising production. Managers and engineers, in particular, value the opportunity to better understand how their systems are working to stay abreast of the status of their operation at all times.

The value of systems that provide this highly accurate, real-time test and measurement data will only increase as

more components become smarter and connected. Whatever the next few years bring in terms of technological developments and new products, it seems that the future of heat-tracing is looking 'smart'. **ER**





The world's lightest test & diagnostic system in its class

Megger explains how it helped Nebraska Public Power District clear its cable replacement backlog.

With the backlog in its cable replacement programme proving difficult to clear, Nebraska Public Power District (NPPD) decided to evaluate a new strategy based on testing its cable network with Megger equipment. This approach made it possible for NPPD to quickly clear the backlog by concentrating budget and resources on only those cables where the risk of imminent failure was high.

Until recently, NPPD operated a cable replacement programme based on two criteria. The first of these criteria was faults – if more than three faults occurred on a single cables section, it was deemed in need of replacement. NPPD's second criterion for cable replacement was age, with the oldest cables, many of which have been in service for more than 25 years, scheduled for replacement first. Often, a URD loop would be identified for replacement based on similar age to a faulted section. However, budget constraints would limit replacement to only the faulted cable section without any insight as to the condition of the remaining cables in the loop.

The overall result was that NPPD had a backlog of cables identified within the cable replacement programme. However, replacing the older cables on the basis of their age alone meant cables that still had a useful working life were being taken out of service unnecessarily.

To address these issues, NPPD decided to investigate the possibility of setting up a more efficient and cost-effective cable replacement programme based on routine testing to assess the true condition of its cable network. NPPD considered both partial discharge (PD) and Tan Delta (TD) testing, and in this instance decided that the latter would be more straightforward to apply in the field, and that the results would be easier to interpret.

However, NPPD faced another challenge, as the IEEE guidelines relating to TD testing provide no insights into how the results should be used to decide whether or not a cable needs replacing. In response, they devised a simple but powerful algorithm that would distil the test results down into a single number with a defined threshold that could be used to rank and prioritise replacement criterion.

All test results are loaded into a geographical information system (GIS) so the NPPD personnel can see immediately which sections of the network have been tested, and which cables need to be replaced.

To carry out the test, NPPD chose a Megger VLF45 Sine Wave 45kV test set with integrated Tan Delta facilities. The main factors that influenced this choice included the compact construction of the VLF45, its Tan Delta functionality, its ability

“ Nebraska Public Power District (NPPD) decided to evaluate a new strategy based on testing its cable network with Megger equipment ”

to test up 35kV class cables, and the excellent technical support received from Megger.

Other benefits of the VLF45 are that it incorporates earth loop monitoring and automatic discharge functionality to maximise user safety. Also, it needs no external computer, which makes it particularly convenient for use in the field. Another important consideration that influenced the choice of instrument was ease of use, as several different maintenance crews are involved with cable testing across the state, and all would need training in how to use it safely and efficiently.

NPPD purchased one instrument and has now used it extensively to investigate the condition of its state-wide cable network. NPPD personnel working with the instrument have found it to be intuitive in operation, with a simple test set up and results that are easy to analyse and interpret. Those results have proved invaluable, as they have revealed that 70% of the cables NPPD tested need no further action. This has allowed the utility to concentrate its resources on the cables that are most likely to give problems.

By moving to a cable replacement programme based on actual test results produced by a Megger VLF45 Sine Wave 45kV test set rather than relying on arbitrary age and condition criteria, NPPD has now eliminated its cable replacement backlog. Additional benefits are that it has been able to improve its System Average Interruption Duration Index (SAIDI) and System Average



Interruption Frequency Index (SAIFI) ratings, both of which are important and widely monitored indicators of a power utility's performance.

Cable faults are a major challenge for all power utilities, especially in parts of the world where much of the supply network is approaching, or in some cases has already exceeded, its original design lifetime. Wholesale replacement of aged cables to address this issue is rarely an option, so a rational and well-structured replacement programme is essential. As NPPD has discovered, testing with a Megger VLF45 Sine Wave 45 kV test set provides a cost-effective and easy-to-implement foundation on which to build such a programme.

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What could cause a Britain-wide blackout?



In June, virtually all of Argentina, Uruguay, and Paraguay were left without electricity following a massive power failure. Could something similar happen in the UK? Leo Craig of Riello UPS outlines the biggest threats to our power supplies and unveils a new report that investigates the consequences of a nationwide blackout.

On 16 June, nearly 50 million people in South America lost power after problems with two 500 kV transmission lines disrupted the flow of electricity from the Yacretá hydroelectric plant.

Suspected design flaws escalated what – in theory – should have been a localised failure into a complete network failure, an incident described by Argentinian President Mauricio Macri as ‘unprecedented’.

While power was quickly restored within a few hours, focus this side of the Atlantic Ocean centred on whether it could happen here too.

Our new analysis, the Blackout report, reveals there’s a one-in-200 chance that

there will be a complete grid shutdown in the next five years. That’s still highly unlikely, but when you consider you’ve got a one-in-240 shot of dying in a road accident, it’s certainly not beyond the realm of possibility.

What could cause such a catastrophic power failure? Here are the five biggest threats.

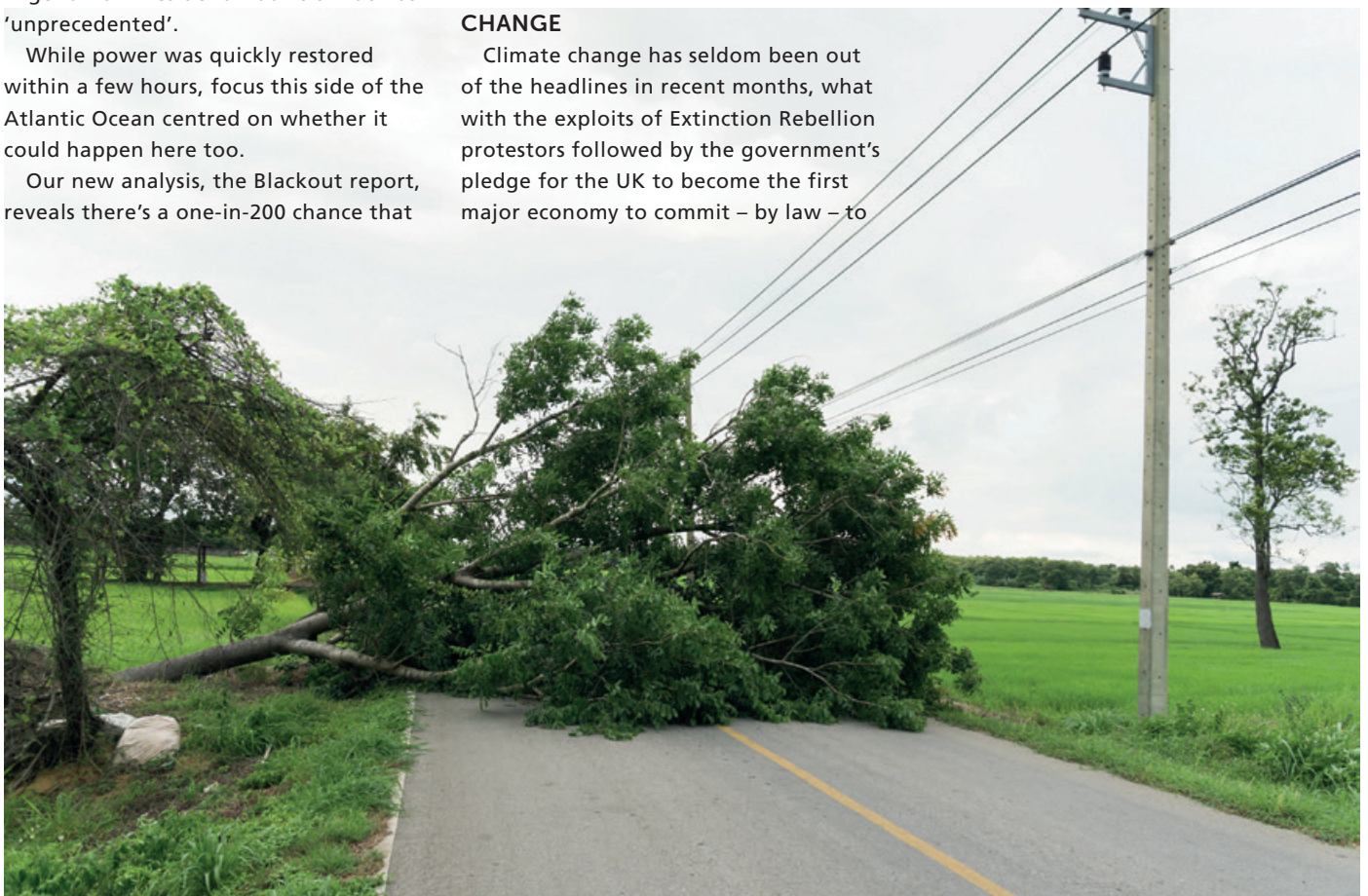
EXTREME WEATHER AND CLIMATE CHANGE

Climate change has seldom been out of the headlines in recent months, what with the exploits of Extinction Rebellion protestors followed by the government’s pledge for the UK to become the first major economy to commit – by law – to

net zero carbon emissions by 2050.

In terms of the risk to our power supply though, this could be a case of shutting the stable door after the horse has bolted.

The 10 hottest years on record in Britain have all taken place since 1990, while the sea levels around our coasts rise by 3mm a year as ice caps melt and warm water expands.





“ Hacking into a single smart meter or virtual assistant might not have much impact by itself, but what if it's thousands – or even millions – powering up at the same time? ”

All trends point to more weather at either extreme end of the spectrum, namely scorching heatwaves, icy cold snaps, torrential rainfall, and ferocious winds.

All these events threaten serious disruption to our energy grid. Gale and storm-force winds bring down trees that knock out transmission lines. Flooding from downpours damages vital electrical infrastructure and hinders efforts to fix faults. While severe temperature fluctuations produce dangerous spikes in demand as we rely on either air conditioning to keep cool or heaters to warm up.

Previous examples of extreme weather give us a glimpse of what might be to come:

- The Great Storm of October 1987 – brought down 15 million trees in south-east England
- The St Jude Storm of 2013 – left more than 850,000 homes without power
- The 2015-16 winter floods caused by Storm Desmond – in just three months between November 2015 and January 2016, seven separate storms hit the UK and Ireland
- Winter 2009-10 – widespread snow building up to 20-30cm in many areas,

while temperatures regularly fell to -5°C or even -10°C

- Summer 2018 – the joint-hottest on record for the UK.

SPACE WEATHER

This is the collective term to describe a series of phenomena originating from the sun, such as asteroids, meteors, and magnetic fields.

While we've known about solar flares and geomagnetic storms for hundreds of years, our interest has grown over recent decades alongside our increasing dependence on GPS satellite signals.

Space weather incidents are rare, but their potential impact is devastating. Even relatively weak solar flares are capable of knocking satellites out of action.

Historically, the largest space weather event recorded on Earth was the 'Carrington Event' in 1859, a huge magnetic storm that disrupted telegraph systems and electrical equipment across the world.

There's a 1% annual probability there'll be a recurrence of such a 'perfect storm' today, which would cause devastating disruption to modern electrical and telecoms systems.

In 1989, a smaller magnetic storm led to

the complete collapse of the Hydro-Québec electricity network in Canada, leaving nine million residents without power for nine hours.

SYSTEMS FAILURES AND ACCIDENTS

Naturally, there are a lot of potential incidents that fall under this category. They cover everything from component faults and software crashes, through to fires and explosions.

The impact of most of these events would be restricted to a specific location or service and dealt with locally, although that's not to downplay the disruption they could cause to significant numbers of people and businesses.

INFRASTRUCTURE ATTACKS

Of course, the threat of malicious attacks and terrorism is nothing new to the UK. But a global pattern seems to be emerging where a nation's power supply is increasingly likely to be targeted by both state and non-state actors.

Deliberate strikes using explosives or other physical weapons could be ►

used to knock out essential networks and infrastructure such as substations or transmission lines.

The 1990s saw numerous attempts to blow-up electric substations, including the IRA attacks in Bishopsgate in 1993 and Docklands in 1996, while in more recent years terrorists have conducted concerted attacks against energy infrastructure in countries such as Algeria and Yemen.

Earlier this year, anti-government rebels were rumoured to have taken out one of the main hydroelectric plants in Venezuela, which led to a blackout affecting 18 out of 23 states that left 30 million without power.

CYBER ATTACKS

In 2017, the former chief executive officer of National Grid Steve Holliday warned, "Nowhere else is as worried as the UK about cyber threats. We are just off the scale on our energy system concerns on cyber."

Hacking today isn't just the realm of a small band of elite, state-backed actors. The availability of high-grade malware means anyone armed with just a laptop and modicum of knowhow

“ The UK's power grid was compromised by hackers on 7 June 2017, the day the country voted in the General Election ”

has the power to launch a potentially devastating attack.

Combine this with our ongoing shift towards renewables-led smart energy grids, plus society's increasingly internet-driven way of life, and there are far more opportunities for hackers to expose any vulnerabilities.

Many 'smart' devices used in both energy tech and our day-to-day lives are plagued by cybersecurity fears. Hacking into a single smart meter or virtual assistant might not have much

impact by itself, but what if it's thousands – or even millions – powering up at the same time?

Compromised appliances could be turned on in the middle of the night when the network isn't expecting such a power surge. Or they could feed back incorrect information to our smart grids, exaggerating or understating the actual demand for power.

The most infamous cyberattack on a country's energy network took place before Christmas 2015 in Ukraine, when malware shut down 30 substations and left 250,000 people without power.

But did you know the UK's power grid was compromised by hackers on 7 June 2017, the day the country voted in the General Election? And this spring saw the USA experience its first electricity-related cyber event too, with grids in both California and Wyoming infiltrated.

As well as covering the biggest threats to our power supply, the Blackout report also examines how prepared we are, how long it could take to restart the grid from scratch, and what the ramifications of a complete shutdown would be for society. It can be downloaded at

www.theblackoutreport.co.uk 



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Reliable power for a sustainable world

It pays to invest

Chris Pearson, managing director at Vickers, explains why it makes sense for commercial and industrial businesses to invest in an energy management system.

As the UK aims to meet its carbon reduction targets for 2020 and 2050, there's growing pressure on commercial and industrial premises to use energy sparingly and as efficiently as possible. The built environment has long been identified by the government as a major contributor to Greenhouse Gas (GHG) emissions – responsible for about 46% of UK emissions, with non-domestic buildings accounting for around 19%. With increasing legislative measures being levied on commercial and industrial premises to reduce energy consumption, the investment in an energy management system can yield significant savings in both energy and money. Let's take a further look.

It's estimated that 20% of a business' energy costs is due to wasted energy. This can be caused by inefficient equipment or simply due to heat loss in older buildings. This alone is reason to plug the wastage and recover losses by investing in improved equipment.

Today, there are a whole raft of legislative measures now in place to ensure existing commercial and industrial premises conserve energy. The Minimum Energy Efficiency Standard (MEES) currently tackles older commercial buildings. This requires landlords to provide an Energy Performance Certificate (EPC) upon the proposed letting of a property. Should the EPC rating fall lower than band E, the landlord will be prevented from leasing the property. With an estimated 20% of UK commercial property unable to meet this criteria, and with the possibility of MEES rising in the future, the work that's required to bring these buildings up to scratch will be colossal.

Industrial buildings aren't exempt from the legislative heat either. The Energy Savings Opportunity Scheme (ESOS) is just one example. This is a mandatory energy assessment scheme for larger UK organisations that requires an ESOS assessment to be carried out every four years. This includes audits of the energy used by the building, as well as industrial processes and transport, to identify cost-effective energy saving measures.



It's estimated that 20% of a business' energy costs is due to wasted energy



MAKING AN INVESTMENT

This is where a simple investment in an Energy Management System (EMS) comes in. Designed to deliver accurate heating control with maximum efficiency, an EMS can make savings of up to 60% on energy bills – a sure fire way for both commercial and industrial premises to gain control of their heating and reduce energy bills and CO2 emissions at the same time. A typical EMS works by monitoring, controlling and regulating the performance of a building's heating system, ensuring that it's always fully optimised and only using energy as and when required, which ultimately increases efficiency.

Of course, every business is different. For example, some manufacturing, storage, and retail sites often require different temperatures throughout various zones within the building. Chilled food may be stored in one area and curing products in another, whilst the office space will require a much more comfortable environment. Advanced systems can monitor and regulate temperatures throughout a building without the need for manual intervention, multiple systems, clock settings or extra equipment. Advanced self-learning programmes also enable the system to calculate the necessary burn time for individual heaters to achieve their target temperature and can even detect how long each will take to cool down and

switch off accordingly. The inclusion of an external sensor provides further efficiencies by varying the internal target temperatures in response to prevailing weather conditions.

The best Energy Management Systems are those that are compatible with all makes of heating systems and that work alongside varying types of heaters including; warm air, radiant, air handlers, boilers and thermoliers.

Some of the more sophisticated systems have the capability to control lighting too, with some of these being compatible with DALI protocol (Digital Addressable Lighting Interface). This widely available digital technology allows scheduling, dimming, and scene setting the lighting within commercial and industrial buildings. Lighting management generates additional energy savings of 30-50%, according to the Carbon Trust.

FLEXIBLE SCHEDULING

Significant savings come from the flexibility of scheduling lighting by allowing multiple lighting zones to be created and controlled,

●● The best Energy Management Systems are those that are compatible with all makes of heating systems and that work alongside varying types of heaters ●●

independently of wiring, and times can be pre-set to switch on/off or dimmed outside of working hours or in specific areas. Dimming the lighting can also contribute to further energy reductions. Not only will lighting fixtures last longer, lower refurbishment and maintenance costs can be realised.

Lights which are not DALI compatible can still be controlled by EMS. Lighting zones will then be limited by the wiring – however significant energy savings are still possible

to achieve. Sensors can switch off the lights when not needed, or adjust the brightness depending on the natural light level entering the room. This is ideal for areas that aren't used regularly.

Using an EMS is usually fool-proof too, and can be monitored from any location courtesy of cloud-based, secure technology. In addition to viewing performance and energy usage, changes can be made from any internet enabled device; thereby providing the ultimate in control. It's also possible to produce automated monthly reports to show the benefits gained from installing the EMS.

As the drive to improve energy efficiency through more stringent regulations continues, we will see smart technologies such as building automation and control systems take on even greater importance. There's no time like the present to invest in an EMS or to upgrade to a more sophisticated version. With a typical payback period of just two to three years, it's an investment that will yield substantial returns for years to come. **ER**

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Higher efficiency during substation commissioning testing

Thomas Schossig, Product Manager, Business Development Power Utility Communications at OMICRON electronics, explains the benefits of the StationScout testing system.



The IEC 61850 substation automation system (SAS) has become an essential part of substations. As a critical infrastructure feature it requires a steady stream of security patches and updates. Testing then has to be carried out in order to ensure that all of the devices and the system itself are still functioning as required.

The effort for testing a protection system compared to an automation and control system differs considerably, with the SAS losing by a long shot. Increasing complexity of the structure and the quantity of signals being transmitted are among the main causes here.

However, the IEC 61850 engineering process and the data available in the SCD (substation configuration description) files enable new test methods that make commissioning and factory acceptance tests faster and much more efficient.

OMICRON has developed the StationScout testing system specifically for this purpose. It dramatically simplifies and speeds up testing for automation and control technology in IEC 61850 automation systems and covers the whole lifecycle of a SAS.

The software is easy to operate while the powerful MBX1 (mobile) or RBX1 (rack-mountable) hardware provides a cyber secure connection to the station network offering unrivaled insight into GOOSE and MMS Report communication.

Because the SAS is often organised into several networks at once, MBX1 comes with four Ethernet interfaces for connection and

analysis whereas the RBX1 provides eight Ethernet interfaces. Both additionally have separate interfaces for local or remote control of the test set.

The Smart Overview Package, released in 2018, enables signals to be tracked in the SAS, and detects any GOOSE publish or subscribe problems. It also allows interlocks to be tested manually and to simulate individual components or the whole SAS – a huge time saver when testing protocol gateway/RTU configurations.

COMMISSIONING LICENSE ACCELERATES TESTING

The new Commissioning package greatly simplifies the testing of an SAS. It automatically identifies the signals used within the SAS or communicated to the control centre and allows signal lists to be imported from spreadsheets. The tester can create a watch list to filter individual signals to focus on the information relevant for a test. This makes troubleshooting communication and logic errors much easier and faster.

StationScout dramatically simplifies and speeds up testing for automation and control technology in IEC 61850 automation systems

Each test case can be described step by step to avoid accidental damage to equipment during the test. In addition, for each test case, it can be defined in advance which signals are required for assessing the result. For example, for the interlocking of a load switch, the switch must not be operated under load and the corresponding signals must therefore be traced.

Once created, test plans and test results can be printed and duplicated for reuse in other feeders. Therefore, any tests that have already been carried out can be repeated quickly and easily. This saves a lot of time, especially when tests have to be performed frequently as a result of the numerous security patches and firmware updates being released.

StationScout also facilitates the documentation of all tests that were carried out, including test cases and test steps, and provides new overviews for this purpose. It works with any network topology and is the ideal tool for testing HMI and SCADA.



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Good enough?



Zumtobel Lighting UK's Graeme Shaw discusses emergency lighting regulations and what the minimum requirements are.

Emergency lighting is a legal obligation that should never be compromised. The importance of emergency lighting in the event of a power failure cannot be understated and it can quite literally mean the difference between life and death. Without light, even a familiar environment immediately becomes more dangerous and more frightening, so it is essential not only that the emergency

lighting comes on when needed but also stays on for the required duration.

UK fire safety legislation states that people in a building must be able to find their way to a place of total safety if there is a fire by using escape routes that have enough lighting. Emergency routes and exits requiring illumination must be provided with emergency lighting of adequate intensity in the case of failure of their normal lighting.

Owners or occupiers of all premises in which people are employed must, by law, carry out fire precautions risk assessments. If you employ five or more persons, whether or not they are at work at any one time, or at separate workplaces, there is a legal requirement to make a record of significant findings of the risk assessment and measures proposed to deal with them.

A formal record must be kept of all significant findings together with details of measures taken to deal with the risks identified. The Regulatory Reform (Fire Safety) Order 2005 places the onus on a designated 'responsible person' within an organisation to carry out assessments to identify, manage and reduce risk, and put appropriate measures in place. However, there is still a lack of awareness of the risks around not dealing with emergency lighting correctly.

●● Owners or occupiers of all premises in which people are employed must, by law, carry out fire precautions risk assessments ●●

TYPES OF EMERGENCY LIGHTING

Emergency escape lighting – this provides illumination for those trying to leave the location. It is an important part of the fire and safety provision of a building and requirement of 'Regulatory Reform (Fire Safety) Order 2005'.

Escape route lighting – this ensures all means of escape can be identified and safely used by occupants of the building.

Open area lighting – this allows sufficient illumination to guide occupants to reach part of the building where an escape route can be found.

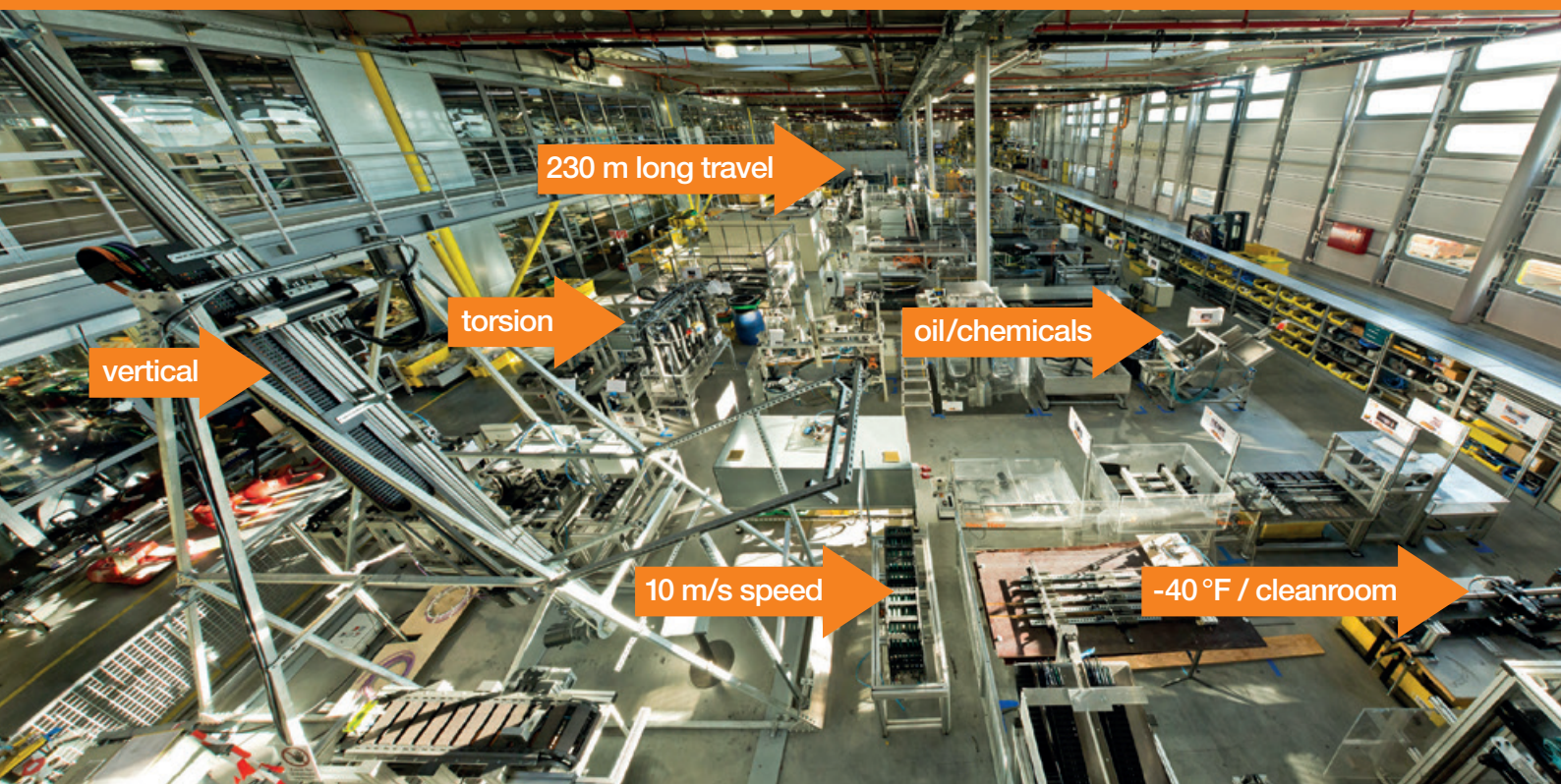
Legislation should be adhered to in order to identify a building's specific emergency lighting requirements. The Workplace Directive 89/654 states



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that signs, in accordance with national regulation, must indicate specific routes and exits. Additionally, The Construction Products Directive 89/106/EEC says that the purpose of an emergency lighting installation is to ensure that lighting is provided promptly, automatically and for a suitable time in a specific area when normal power supply to the lighting fails.

This is all encapsulated in BS 5266-1, Code of Practice for the emergency lighting of premises. BS 5266-1 provides information on the correct lighting provision for the safety of people and provides facilities managers with information regarding minimum levels of illumination, duration of operation and the maximum brightness levels needed to prevent glare. When persons have designed, installed, commissioned and maintained systems in-line with the standard, they can be confident they have a properly designed scheme.

INNOVATING SAFETY

There have been significant advancements in the technology deployed in emergency lighting systems in recent years, with the result that they now offer a level of intelligence that combines high levels of reliability and ease of use. Furthermore, light emitting diode (LED) luminaires offer significant additional benefits in terms

●● The Workplace Directive 89/654 states that signs, in accordance with national regulation, must indicate specific routes and exits ●●

of size, lifetime and energy efficiency. LED luminaires offer some impressive features and 3W fittings are available that run at 700mA and come in standard format three-hour duration.

Smaller emergency luminaires also have less visual impact on the space and make it easier for the lighting designer to address sensitive aesthetic requirements. The ideal situation is that the emergency lighting is only noticed when it is required – namely, when in emergency operation. And this applies to both conversions and stand-alone emergency luminaires.

STAYING COMPLIANT

In order to comply with BS 5266-1, all emergency lighting systems must undergo a short duration test on a monthly basis and an additional annual test for the full rated duration of the emergency lights. A full record sheet needs to be maintained for each emergency luminaire and entered into a logbook, which must be available for inspection by the authorities at any time. Failure to provide full test records can result in legal action and closure of a building, and if the system is defective, the insurance policy for a building may be invalid.

Modern systems utilise the digital addressable lighting interface (DALI) protocol, as set out in IEC 62386, so that full remote operation and self-test is possible. DALI assigns an address to each luminaire, allowing management of each individual device, and this can be as simple as a single luminaire containing a driver and a sensor. Scheduling of monthly self-tests and annual duration tests can be set up via the internet, with all test results automatically logged.

Given the high safety importance of system testing, it makes sense to automate this function. Software can be used to monitor all the luminaires linked to the system and can schedule and run a test, with the additional ability to schedule tests in designated areas. There is also the ability to carry out either functional or durational tests, which are time definable.

A high-quality emergency lighting system will give occupants a way of evacuating a building safely in the event of a fire. The regulations, standards and guidance when it comes to specification, installation testing and maintenance are comprehensive, and designed to ensure that each building's particular needs are thoroughly examined and understood. It is therefore imperative that facilities managers understand their legal obligations in this area and act accordingly. **ER**

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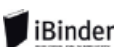


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How lighting controls can enhance the school day experience

Paul Jones, country director- UK and Ireland, BEG Lighting Controls discusses the importance of lighting for a productive learning environment.

It is well documented that the spaces in which we live and work have an impact on our mood, energy levels and wellbeing throughout the day, and it could be argued that nowhere is this truer and more important than in a learning environment.

Human comfort is controlled by four key factors: thermal, physical, personal and visual, and when the balance is just right on each factor, we are able to feel at ease and perform at our best. Lighting in particular has the power to subconsciously change mood, energy levels, and even our focus. It can even be used to shape and change spaces.

●● Whether in an old Victorian building or a state-of-the-art construction, lighting controls offer solutions to enable schools to make the most of their spaces ●●

With recent advances in lighting controls, a lighting designer can now effectively make use of these 'human centric lighting' techniques to make a classroom space fully adaptable and flexible to suit the full range of moods and activities the school day encompasses.

Research has shown if school buildings are designed with more naturalness, such as with the light, temperature and air quality, then this accounts for nearly half of the learning impact.

Consider a class of school children, maybe tired after lunch break, needing to be taught something new and complex. If the classroom is badly lit, with a yellow





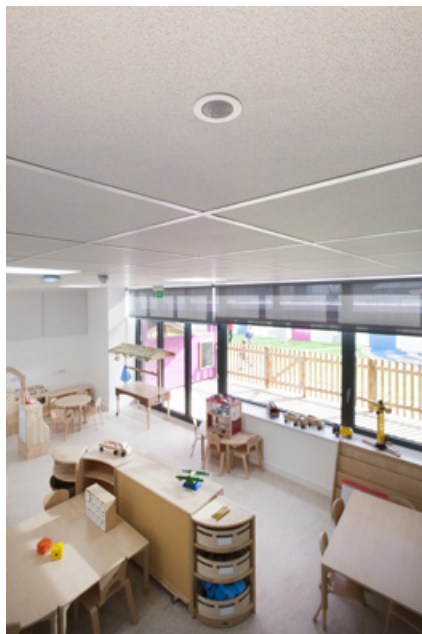
coloured light, we can imagine how the children might respond: yawning, restless.

Think how differently they might respond if the room is evenly lit, with a bright white light, directed on their work area. Instantly they will feel differently, more alert and focussed and they will be able to get more from the lesson.

Maybe after 40 minutes, the lesson changes and the teacher needs the class to concentrate on the whiteboard and listen intently. The lighting around the edges of the room fades subtly, drawing the attention to the front of the class. Without even knowing or being told by the teacher, the class is directed to behave differently.

The same class, after a break, might be feeling hyper and excited and need calming down for a quiet exercise. Again, at the press of a button the teacher can dim the lights slightly, add a warmer tone, and instantly the room feels calmer and more relaxing, influencing the mood of the children in the class, making them easier to manage and getting the best results from them for the lesson.

Increasingly schools are requesting this intelligent use of the available lighting control technology when they are carrying out refurbishments or new-build projects. Whether in an old Victorian building or a state-of-the-art construction, lighting controls offer solutions to enable schools to make the most of their spaces, by creating multi-purpose rooms, and rooms



that are more effective. This is even more important where space is at a premium and school budgets are tighter than ever.

For example, a library space can be adapted by a simple change in lighting to become a quiet one-to-one teaching area, or a space for lunchtime clubs, or for after-school meetings, thus maximising the space available without the need for costly extensions to the school building itself.

Lighting controls can also benefit school budgets and environmental impacts with well-planned use of occupancy sensors where lights turn off or reduce in brightness when a space isn't in use.

BEG Lighting Controls recently undertook a lighting controls project for a brand-new school in London, John Keats Primary Free School, which is focussed on providing an enhanced learning environment for its pupils and also has energy efficiency high on the agenda.

The entirety of the building is designed with education in mind, and the lighting had to be designed and controlled in a way that would maximise the pupils' comfort, concentration and alertness. The lighting also needed to be automated and adjustable, with different areas requiring different lighting levels and timings, and the additional need that areas were only lit when occupied, to save energy and reduce costs.

The classrooms have been set up to operate in semi-automatic mode (sometimes referred to as absence



detection). This means the lights and the detector must be turned on with a wall switch.

The lights then set their brightness levels automatically and will continue to operate until there is enough natural daylight or no occupancy present in the room. Reading the level of daylight in the room, the sensors automatically adjust the luminaires to the required level to make sure the lighting level is always enough and make maximum use of natural light.

Using as much natural light as possible, especially in the summer months, can be hugely beneficial to the wellbeing of school children. For example, many do not realise that by sticking pupils' work to classroom windows, is inadvertently blocking out a lot of that natural light and its benefits.

It is wonderful and inspiring to see how the great strides that are being made in lighting controls technology are being used to their maximum potential in a building designed to educate future generations.

It is important when planning lighting controls in our public spaces, especially within academic buildings, that we push the boundaries of what is possible. It is essential we use the available technology to develop creative solutions that can really make a difference to an entire school's learning environment and educational experience – and most importantly to those children's lives. **ER**

The lighting evolution

Rob Walker of Lighting Controls Ltd takes a look back at the early days of lighting control, and ahead to its bright future.

From a user perspective, the transition from mechanical switch to high-tech went moderately smoothly. Compared to the early days of the PC, when copious volumes of hair were removed and paper wasted as users tried to resolve the battle between printer and computer, the introduction of networking protocols such as DALI went relatively smoothly... from the perspective of the user, anyhow.

That was less true for installers. Used to the interconnection of traditional analogue wiring harnesses, network-based lighting control systems were sometimes challenging. In a similar way to old-school telephone engineers transitioning to the resolution of internet 'issues', the problem was not so much to do with competence but with the introduction of a new way of thinking; a way of thinking that included the control of lighting zones along with

“ Used to the interconnection of traditional analogue wiring harnesses, network-based lighting control systems were sometimes challenging ”



a host of new capabilities, limitations and innovations.

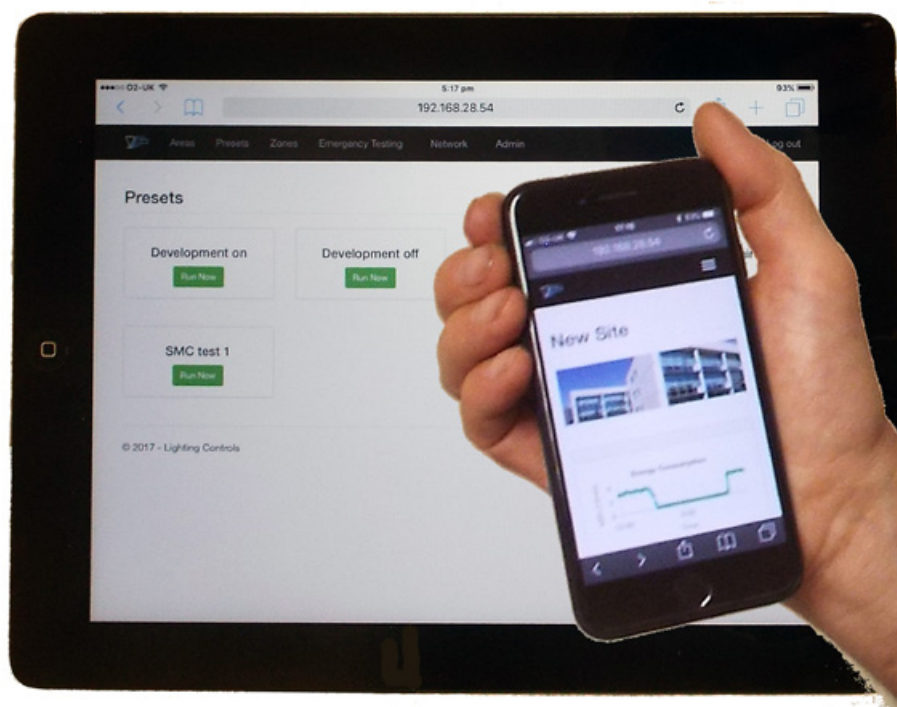
These innovations have tended to fall into four categories:

1. Innovations that improve the 'fit' between the technology and the environments into which it is destined to be installed
2. Increasing ease of installation and reducing the costs of commissioning and ownership
3. Improving the ease and flexibility of the user experience
4. Reducing the intrusive nature of the new technology (particularly when retrofitted into older buildings).

IMPROVING THE 'FIT'

Early, DALI-based lighting control systems coped well with simple, one storey, self-contained installations. Such installations had no need for computer (head-end) control or to interface with other management systems. However, they did not cater for many environments.

A new or refurbished office or industrial building, for instance, with one landlord and several storeys that may be leased to different tenants, with common areas, perhaps including the carpark, is a frequently typical environment requiring lighting control systems. This scenario presents challenges to many traditional systems. For instance, a lighting control system requires completion for a whole



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building (the CAT A fit out), which is sufficiently versatile for future leased spaces to be controlled independently.

However, a landlord's responsibilities, although they may vary according to use, invariably do not end with ensuring common areas are well lit. For example, to be fully protected, the landlord may need to ensure that emergency lighting checks are carried out and documented in a timely fashion throughout the whole building. On the other hand, tenants will not feel comfortable with the landlord having control over the lighting programming in leased spaces. There may also be times when a tenant needs certain common areas to be lit outside normal business hours; a sales conference may need ground floor corridors and the carpark lit during a particular weekend, for instance.

ENTER COMPUTER CONTROL

Computer, or head end, control of the DALI network has been with us for some time, but is only now sufficiently versatile to address the above problems in such a way as not to require a PhD in computer science to programme and operate!

“Several relatively small innovations have had quite a dramatic impact on saving time and money”

This advance has been achieved in a number of ways. First, more user-friendly programming enables the use of a tablet or smart phone so that the person making the adjustment can actually be in the area for which the programming is being adjusted. In other words, it's 'Plug'n'Play'; you can see what you are doing as you are doing it.

The second way in which simplicity of use has joined forces with sophistication of control is by divesting control away from a central computer, by, for instance, giving area-controllers computing power. This enables an authorised user in a particular area to easily adjust lighting programming in that area without having access to a central head-end control system.

EASE OF INSTALLATION

Several relatively small innovations have had quite a dramatic impact on saving time and money. The latest area controllers, for instance, allow for the testing of area lighting and DALI strings immediately after the network wiring is completed. This enables a building's lighting to be functional before a fitout is completed, saving time and pre-commissioning costs.

Another example of time saving innovation is in the assignment of DALI addresses to luminaires. This can now be done after installation with a handheld device using Bluetooth or Wi-Fi. This increases versatility and can make an installation easier and quicker.

COST OF OWNERSHIP

Having a computer-based control network enables remote diagnosis in case of a problem. Savings in time and money resulting from this can be dramatic. Also, if there is a faulty component – a lighting control module, for instance – an innovation such as a replaceable memory module can make installation of a new module trivial.

KEEPING TECHNOLOGY DISCREET

To those who take pride in, and win prizes for, designing the spaces in which we work, technology is not always their friend. Whether new build or refurbishing a listed building, keeping technology discreet is a priority. Thankfully several evolutionary innovations have helped this cause.

For instance, older style motion sensors can be replaced by much smaller PIRs, some of which can be almost invisible when mounted within a luminaire. There are also ultra-slimline switch interfaces that can enable architectural switches to be interfaced with the DALI network, dramatically simplifying the task of updating older buildings during refurbishment.

Considerable progress has been made, in the past couple of years particularly, regarding making the customer interface more user-friendly, reducing the cost of installation and ownership, and increasing the compatibility with other building management and building automation systems. This trend can only continue. **ER**

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HVO biofuel: The future of data centre emergency power fuelling



Mark Andrews, director of Crown Oil, discusses the role of HVO (hydrotreated vegetable oil) biofuel in the future of emergency power for data centres.

Downtime is a costly endeavour for data centres and their customers. For this reason, DCs invest in backup power generators to defend against downtime caused by power outages and most rely on red diesel to fuel their backup power generators in an emergency.

Unfortunately, despite the convenience afforded by price and availability, diesel fumes are damaging to the environment, diesel oil is toxic when spilt and what's more, the oil requires regular testing for contamination and degradation.

Therefore, data centre managers need to consider viable environmentally friendly alternatives such as hydrotreated vegetable oil biofuel (HVO biofuel) as a potential replacement to mineral oil (fossil fuel diesel).

HVO biofuel has been on the market for a while; however, supply issues that made it inhibitive have been overcome, with the result that it is being used for power generation by eco-conscious sectors, such as the event sector, most notably at the most recent Glastonbury Festival.

“ HVO can be stored for up to 10 years in well-maintained storage tanks, whilst mineral diesel and FAME biodiesel have a shelf life of around a year ”

The UK Government's pledge to cut emissions to net-zero by 2050 places the environment as a priority – understandably so, as according to the ONS, the UK used 35 billion tonnes of diesel in 2017, further highlighting how the sector is facing mounting pressure to look at greener, more carbon-friendly and cost-effective solutions to generate emergency power.

As a result, DC operators are likely to consider other sources of renewable power generation as a backup plan when grid power fails.

RENEWABLE ENERGY

In the current technological environment, although zero-carbon alternatives such as wind power and solar power are readily accessible, they present their own challenges and inefficiencies that data centres cannot





reduce their dependence on diesel for backup power.

Both wind generators and photovoltaic panels are relatively inefficient at generating large amounts of electrical power and therefore require adequate space for enough wind turbines and/or photovoltaic panels to power an entire data centre if and when the grid fails.

Moreover as both work by charging batteries which will then power the site, your data centre will need to invest in considerable battery storage capabilities to have enough power to keep the data centre running for adequate time.

The cost of investing in solar or wind infrastructure is considerable and does not lend itself to emergency power application. Instead, this form of power lends itself to reducing DCs' dependence on the grid and is a good way to reduce overall energy use and carbon footprint on days of normal operation.

HVO BIOFUEL

HVO biofuel is a credible alternative to other renewable energy sources, without the pitfalls. It is a second-generation biofuel that is a drop-in alternative to diesel, with approvals from a range of OEMs, requiring no modification to existing back-up generators and can be readily mixed, i.e. needing no additional investment other than ordering a supply of the fuel to add to your diesel tank.

HVO biofuel is made from renewable and sustainable sources and offers up to 90% reduction in greenhouse gas emissions when compared to regular diesel. Some suppliers also offer schemes to offset the remaining emissions for a net-zero carbon fuel, assisting with any carbon offsetting

your data centre may be undertaking.

HVO has additional benefits: the production process involves hydrotreating vegetable oil which creates a chemically identical fuel to mineral diesel, allowing it to be readily mixed and also removes unsaturates and impurities from the oil.

The resulting oil boasts a far longer storage life than mineral diesel or FAME biodiesel; HVO can be stored for up to 10 years in well-maintained storage tanks, whilst mineral diesel and FAME biodiesel have a shelf life of around a year due to their vulnerability to bacterial attack. There is also a reduced need for regular fuel testing with HVO due to its purity.

Other environmental benefits of HVO biofuel are that, compared with mineral diesel, particulate matter is reduced up to 30%; hydrocarbons up to 30% less; carbon monoxide is reduced by 25%; NOx levels are

up to 10% less. Additionally, HVO is much less environmentally harmful in the event of a spill, as it is fully biodegradable.

CONSIDERATIONS BEFORE BUYING HVO FUEL

HVO biofuel is a direct replacement for diesel with plenty of environmental and logistical benefits. However, there are key considerations to make before switching over, as it does not perfectly replicate gas oil performance, due to the lower level of impurities present in the fuel.

HVO differs from diesel in having a higher cetane number (up to 90, compared to mineral diesel's 51), so releases more energy per kilogramme. However, it is a lighter, less dense fuel so releases slightly less energy per litre with significant overall greenhouse gas reductions.

HVO production globally is limited and production volumes are much lower than mineral diesel. This creates additional costs in the supply chain meaning that you should expect to pay a little more for HVO material.

Currently there are limited amounts of HVO being supplied directly by the manufacturers to a selected number of fuel suppliers, therefore data centre operators should research those suppliers offering HVO and make sure that they have material in stock, purchased directly from the producer, to avoid long lead-times and additional costs.

Crown Oil is working hard to minimise costs throughout the supply chain and as HVO usage increases, we expect these costs to reduce. For data centres that are keen to improve their carbon footprint, HVO biofuel is certainly emerging as a credible, practical and cost-effective alternative to mineral diesel. **ER**

HVO biofuel is made from renewable and sustainable sources and offers up to 90% reduction in greenhouse gas emissions when compared to regular diesel

Transforming offshore wind energy

ABB partners with wind energy operator to generate power at world-beating efficiency.

The ABB Power Grids business has won an order from turbine manufacturer MHI Vestas Offshore Wind to supply one hundred of its reliable, energy efficient and compact WindSTAR transformers for installation in wind turbines in the North Sea. The 295 km² Moray East offshore wind farm will be capable of providing enough clean energy to power up to one million households.

ABB will supply its WindSTAR transformers for Moray Offshore Renewable Power's highly competitive Moray East offshore wind project. The enormous wind turbines – up to 204 m tall to the turbine's blade-tip – will each generate 9.5 MW of power at 690 volts and the transformers will convert it to 66 kV, a world record for wind farms.

The increased voltage of the turbine-generated electricity enables efficient transmission with a significant reduction in losses and increased efficiency. This step change in renewable power generation also brings lifecycle benefits and cost optimisation. Compared to coal generation, the wind farm could save up to 3.3 million tons of carbon dioxide per annum.

The Moray East wind farm will have a capacity to generate 950 megawatts (MW) of renewable wind power in the Outer Moray Firth, 22 km off the coast of Scotland.

In terms of cost efficiency, it will supply low-carbon electricity at £57.50 per MW-hour, less than half the cost of power generated by comparable offshore wind farms currently under construction.

The site generates power from the UK's natural wind resources and therefore helps the UK to reduce its use of fossil fuels, thus improving security of supply as well as driving down costs for consumers.

Moray East is the first of two wind farms in development in the Moray Firth Zone and is approved for expansion of up to 1,116 MW. Connection to the national grid will be via a new substation to be constructed at New Deer adjacent to the existing transmission line.

The project was granted consent by the Scottish government in 2014, as part of an ambitious plan to connect a significant amount of renewable energy to the GB transmission network over the next 10 years.

TRANSFORMERS FOR OFFSHORE WIND

Offshore wind has the advantage of stronger and more consistent wind speeds than onshore, making offshore conditions more conducive to high-quality power output than is possible in onshore.

As wind speed increases, small changes in wind speed also yield large steps in energy production: a turbine in a 25km/h wind can generate nearly twice as much energy as a turbine in a 20km/h wind. In addition, there are fewer neighbours to contest development of new wind parks.

These advantages have resulted in offshore wind farms growing in scale and wind turbines are becoming larger and more



“ Compared to coal generation, the wind farm could save up to 3.3 million tons of carbon dioxide per annum ”

powerful to take advantage of the strong winds. At the same time, wind energy operators are keen to step up voltage to minimise transmission losses and ensure efficient production. Consequently, an increasing number of operators like MHI Vestas are stepping up their offshore collection networks to 66 kV, compared with the previous best-in-class of 33 kV.

CUSTOM DESIGN

Harvesting power from the wind at sea requires state-of-the-art technology, as the corrosive nature of sea water and salty, damp sea air can have a severe impact on equipment. The technology also has to be extremely reliable, as poor weather often hampers access to the turbine platforms to perform maintenance. This means that offshore wind turbines and associated equipment have to be more rugged than their onshore counterparts to ensure asset availability and minimise maintenance costs in the long term.

Offshore wind transformers therefore need to be designed to reduce losses and operate in environments with high vibrations,

as well as in harsh ambient conditions where salt, sand and 100% relative humidity are common. They must be compact and lightweight to minimise the structural engineering required to support the asset.

The nature of wind power means that it does not blow according to any regular schedule or wind speed, so turbine output energy varies continually. The transformers must therefore be able to withstand sudden movements and variable electrical loading.

In addition, offshore wind farms are often sited in environmentally sensitive areas, so operators must build installations to minimise the potential for environmental risk. As a result, transformers like ABB's WindSTAR are manufactured with biodegradable and totally environmentally sound ester insulation fluid. Their fabrication is based on proven marine technologies from the offshore oil and gas industry, where safety, environmental protection and high availability are critical.

"The WindSTAR transformers are custom designed to meet specific application needs under the mechanical and structural constraints of offshore wind farms, making them a critical factor in offshore wind electricity generation. As such, they contribute to ensure an economically feasible and sustainable future for the industry," says Laurent Favre, managing director of ABB's Transformers business line.

RELIABILITY

Renewable energy technologies provide the main pathway to universal energy access. With wind turbines having already reached ratings of 8-10 MW, offshore wind turbine output is forecast to attain record-level rated capacities of 12 MW by 2020. The transition from 33 kV to 66 kV transmission voltages will further reduce Levelised Cost of Energy (LCoE), encourage ongoing technology improvements, and create more efficient wind generation systems.

Energy efficiency, high transformer availability and reliability are important to help reduce operational and maintenance costs in order to minimise LCoE – a key determinant in the investment case of renewable energy installations.

Any repair or maintenance activity is subject to weather and sea conditions, and in winter it may take weeks to access an offshore wind turbine. If a crane is required for a major replacement, it is also subject to the availability of appropriate vessels. This means weeks or months of lost energy income on top of the repair cost.

High transformer availability thus ensures that operators will be able to make the most of their wind production. And by minimising energy losses using an energy efficient transformer, operators will also make the most of their investment.

EXTENDING THE MHI VESTAS AFFILIATION

The new contract for the Moray East project extends ABB's well established relationship with MHI Vestas. In the last year, ABB has won two more orders from MHI Vestas Offshore Wind for the supply of similar WindSTAR transformers to two other large offshore wind projects.

BORSSELE III AND IV: NETHERLANDS

Borssele III and IV, 22 km off the coast of Zeeland in the Netherlands, comprise the second phase of the Borssele wind



farm, which is located in shallow water of 38 m deep across an area of 138 km².

Due for completion in 2020, the new phase will provide 731 MW generating capacity from 9.5 MW turbines, which is enough clean energy to power more than 800,000 households.

Once completed, Borssele will be the largest offshore wind farm in the world with a total generating capacity of 1,484 MW. This is more than double the size of the world's current largest wind farm, the Walney Extension wind farm in the Irish Sea with a capacity of 659 MW.

WINDFLOAT ATLANTIC: PORTUGAL

Windfloat Atlantic, a floating, offshore wind project 20 km off the coast of Viana de Castelo where the sea is 100 m deep, features the world's largest and most powerful wind turbines ever installed on a floating platform. The 8.4 MW wind turbines boast an imposing tip height of 190 m, nearly the length of two football fields.

A major benefit of the floating system is that it avoids the complex offshore operations associated with installing traditional fixed structures, thus reducing the potential environmental impact. The platform and wind turbine will be entirely built and assembled on land and later towed out to their final location.

The WindSTAR power transformers have the benefit of being specifically engineered to be extra resilient against strong vibrations and extreme and sudden movements encountered on floating wind farms.

In addition, WindSTAR transformers are already in operation in UK waters in the five-turbine 41.5 MW Blyth Offshore Demonstrator, as well as in the 11-turbine 92.4 MW European Offshore Wind Deployment Centre (EOWDS) off the coast near Aberdeen. Blyth was commissioned in 2017 and EOWDS in late 2018.

In 2017, ABB also delivered its specialty transformers for the 258 MW Burbo Bank Extension offshore wind farm in the Irish Sea, where they are in operation inside MHI Vestas' 8 MW turbines.



How much does UPS efficiency actually



David Bond, chairman at Centiel UK Ltd, highlights why buying cheaper will only cost you (and the environment) in the long-run.

The operating efficiency of a UPS solution and its total cost of ownership are closely linked, and the most environmentally friendly systems enjoy ongoing operational cost savings. For contractors, getting the 'best deal' for any organisation is important. However, if we take a long-term view and add the cost of air conditioning, running costs, maintenance, repairs and spares to the initial purchase price, what is actually the 'best deal', both financially for the organisation and in terms of the environment is drawn into question.

Selecting the most efficient UPS is essential to minimise its running costs and its carbon footprint. Operational efficiencies are often stated by manufacturers as being 'greater than 99%', however, this level of efficiency is normally related to offline operation or 'ecomode'.

This figure is therefore deceptive as no serious data centre ever runs on ecomode,

as it means they would be operating on raw mains and only transferring (with a short break in power) to full UPS operation when there is a power problem. To compare the efficiency of UPS solutions, it is necessary to look at their true online efficiency, as this measure indicates the UPS' efficiency when it is actually working.

●● No serious data centre ever runs on ecomode ●●

The type of battery technology used can also add to the Total Costs of Ownership (TCO) of the system and its impact on the environment. VRLA (lead-acid) batteries are classified as 'special waste' and five-year design life batteries will typically

be replaced every three to four years (if operated at 200C) because it is better to replace VRLA batteries six months early rather than one day too late. Only one aged battery in a string will cause the critical load to crash.

Compare this to Li-ion battery technology which only needs replacing every 13-15 years in normal ambient temperatures. Li-ion batteries may be more expensive initially but as well as not needing to be replaced, they do not need air conditioning, further reducing their operating costs. VRLA batteries start to prematurely age at temperatures above 200C and so require air cooling. This is expensive both financially and for the environment as currently more than 60% of the UK's power comes from burning fossil fuels.

In Northern European locations such as the UK, using Li-ion means UPS cooling could be provided by the natural air temperature, resulting in significant savings on data centre running costs and, equally importantly, reducing its carbon footprint.

UPS maintenance costs also add to its TCO and if we take an overall view about the total financial and environmental burden of the system, then this also needs to be taken into consideration.

When it comes to UPS purchase, there are usually two budgets: one for the capital expenditure and one for maintenance. However, the cheapest UPS are invariably built with the cheapest components which have much higher repair and maintenance costs and are therefore actually 'cost money' over the system's working life.

A UPS such as Centiel's CumulusPower, using Li-ion batteries, will need just one capacitor change and no battery changes in 13-15 years. An inferior solution will need three capacitor changes and three sets of replacement VLRA batteries in the same period. This increases the TCO and the UPS user will need to dispose of many tonnes of scrap VRLA batteries which the current legislation classifies as 'special waste'. This is why it is essential to calculate the real TCO of systems to compare the financial and environmental differences.

It is important for organisations to recognise that purchasing the cheapest UPS system does not "save money"

The next point to consider is right sizing. From an efficiency perspective, the big challenge is that the IT power requirement in most organisations will change over time and selecting a UPS that operates at the optimum point on its efficiency curve is essential.

A system which is too small will be overloaded, compromising availability, while a system which is too large will be

inefficient, waste energy and be costly to run. It will also cost more than necessary to maintain due to its size. Scalability and flexibility are therefore essential considerations when ensuring the continual 'right sizing' of the UPS.

Today's state of the art UPS technology offers 97% true online efficiency and a flat efficiency curve for loads above 15%, thereby offering the combined benefits of increased flexibility, scalability and lowest running costs.

It is important for organisations to recognise that purchasing the cheapest UPS system does not "save money" and certainly does not adhere to an environmentally friendly approach. The true TCO (as opposed to a cheap purchase price) for the UPS needs to be fully understood and decision makers must select the right UPS to please their boss, the company's shareholders and the planet. **ER**



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With today's demand for 'always on' digital services, how can operators ensure customers aren't left disappointed? Marc Garner, vice president, Secure Power Division, Schneider Electric UK & Ireland, examines the methods deemed essential for dodging that dreaded downtime, as well as ways to increase energy efficiency and security.

Today's economy has become dependent on the continuous availability of 24/7 digital services, which in almost every case are delivered by an ecosystem of data centres that range from massive hyperscale cloud facilities down to smaller, localised edge computing solutions.

Downtime is the curse of any business reliant on digital technology and where mission critical applications such as those used in healthcare are concerned, power outages and interruptions to service cannot be tolerated. New and advanced surgical operations, for example, using robotic instruments will utilise video streaming to deliver images to doctors in an adjoining room. Data collected from scanning equipment will need to be aggregated, backed up and placed within the patient's digital health records in real-time. Moreover, the scanning equipment itself will need to be protected from power surges or outages.

All of these examples are dependent on connectivity, availability and resilient IT equipment. The slightest malfunction could mean loss of information, changes in treatment, or worse, loss of life. It follows, therefore, that the data centres and network infrastructure systems supplying such services must become ever more reliable, ensuring that any potential IT issues do not result in unacceptable levels of downtime.

POWER AT THE EDGE

This is especially true of the Uninterruptible Power Supply (UPS); a battery-based backup system that takes over instantaneously in the event of any disruption to mains power. Not only must a UPS be reliable in its operation, it must also be energy efficient, cost-effective to run and easy to maintain.

For edge computing solutions, those

which are much smaller in size but also infinitely more numerous than hyperscale or regional data centres, this presents a particular challenge for operators. Especially as the advent of 5G services, hybrid IT deployments and new Internet of Things (IoT) applications is only expected to increase in number and geographical spread.

“Not only must a UPS be reliable in its operation, it must also be energy efficient, cost-effective to run and easy to maintain”

Given their size, diverse locations and number, edge data centres will almost never have trained IT personnel permanently on-site. Management and maintenance, therefore, must be achieved remotely through a combination of cloud-based software, 24/7 access to real-time data and by acquiring the expertise of specialist service partners or Managed Service Providers (MSPs).

Moreover, physical security remains a critical concern when ensuring resilience at the edge and finding a way to deliver all of these critical attributes in a cost-effective way has previously been a major challenge for the industry.

TECHNOLOGIES TO DRIVE LOWER COST OF OPERATION

Fortunately, this challenge is being met through advancements in new technologies including artificial intelligence (AI)



software, machine learning and lithium ion (Li-ion), which help the operator to drive uptime, power availability and energy efficiency through every critical IT deployment.

The latest evolution of cloud based data centre infrastructure management (DCIM) software, for example, provides greater levels of resilience and uptime for the user. Furthermore, within new Li-ion UPS solutions, developments in modular construction have enabled backup power systems to be deployed faster and with the specific power rating for the task in hand.

In mid-range applications, for example, power modules of typically 10 or 20kW capacity can be combined within the same ►

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chassis to deliver a power rating of up to 100kW. This is particularly useful for edge applications where the load sizes can vary from one location to another, and where a “one size fits all” approach will be far from cost effective. Matching the UPS to the load in a modular undoubtedly delivers a far better solution to the customer in terms of cost.

The modular approach also greatly simplifies maintenance. The ability to swap out key components, such as the batteries, a system controller or a charging module, and replace it with another standard part minimises downtime without incurring large labour costs. Depending on the function of the module, some components can even be swapped out without bringing the UPS off-line at all.

KEY BENEFITS OF LI-ION

Lithium-ion technology is of particular benefit in UPS applications, despite the fact that it still commands a small up-front cost premium over traditional valve regulated lead-acid (VRLA) batteries. This cost, however, is diminishing over time due to technology advancements and an increase in volume through the use of large format Li-ion battery systems for electric vehicles and energy storage applications.

Li-ion batteries are smaller in size, both in terms of weight and footprint, than

●● Over a 10-year period, the total savings derived from using a Li-ion UPS in economy mode can be as high as 50%, which is incredible ●●

a lead-acid battery of equivalent rating. Typically, an Li-ion battery will take up half as much space in a UPS and is around 50% of the weight of its alternatives. They can also withstand many more charge/recharge cycles and can consequently deliver twice the operational life.

Over the lifespan of a UPS, the total cost of ownership (TCO) of a Li-ion battery works out far less than one using lead-acid. One such study conducted by Schneider Electric's Data Centre Science Centre found that over a 10-year period, Li-ion delivered a TCO that is between 10% and 40% less than an equivalent UPS using VRLA.

SOFTWARE AND ANALYTICS

Due to their chemical makeup, Li-ion batteries can be sensitive to overcharging. Consequently, today's UPS systems incorporate advanced battery management systems comprising sensors, switches and microcontrollers as standard, all of which is managed by software. This can be further exploited by cloud-based DCIM systems, which allow greater levels of remote management for owners and operators.

With its comprehensive monitoring abilities, real-time reports can be delivered securely to any smart-device, so that unexpected problems can be identified and addressed either before, or as soon as they occur. This allows service personnel to be proactively despatched to any location both quickly and cost-effectively. For the most distributed edge data centres, this is of vital benefit as it allows numerous edge or IT locations to be maintained by a team of remote service personnel, including third-party MSPs.

UPTIME AND ROI

Reducing power consumption while guaranteeing uptime is also of great concern for data centre operators. Many UPS systems offer an economy mode which improves the efficiency of the unit without impacting the overall reliability.

In the latest power protection solutions, such as the Schneider Electric Galaxy VS UPS, the efficiency of the system can be boosted from 97% in its normal operating mode to 99% in economy mode. This may seem like a small difference but over time, the cost savings can be significant.

By some estimates, using economy mode can yield cost savings, in terms of unused electricity, that equate to the acquisition cost of the UPS after only two years' use. Over a 10-year period, the total savings derived from using a Li-ion UPS in economy mode can be as high as 50%, which is incredible.

When tasked with ensuring the continuous delivery of digital services in both a cost-effective and resilient way, UPS systems incorporating Li-ion batteries and cloud-based management tools are essential; providing greater reliability, increased energy efficiency and higher levels of availability for today's always-on businesses. **ER**





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Does your UPS have your back?

Paul Brickman, sales and marketing director at Crestchic, explores the critical role of UPS testing and discusses why backup power alone just isn't enough.

A report by BloombergNEF at the end of 2018 identified that global electricity demand is set to increase 57% by 2050. It's no great surprise. In today's ever-connected world, most of us can't even begin to imagine our lives without electricity.

From the basic necessities of heat, light and utilities and the abundance of consumer tech that we've become accustomed to, through to the steady growth of electric vehicles and massive growth of power-hungry data centres.

Hand-in-hand with this increase in demand, the UK's energy mix is going through a transition from fossil fuel-generated electricity to an increased reliance on renewable sources – posing challenges to the National Grid when it comes to balancing demand with ensuring a stable, consistent supply.

In commercial environments which rely on electricity to operate, the consequences of even a short power system failure could at best have a significant financial impact and, at worst, be a threat to human life.

Many businesses are well-aware of the impact of a break in mission-critical

“It is absolutely critical that backup power systems are commissioned accurately and tested in-situ”

power – from machinery in industrial settings, computers in banks, financial institutions and data centres, to the need for constant power in our hospitals and operating theatres.

While many look to alleviate this risk by ensuring that they have backup power in place, an astonishing number fail to implement a robust testing regime – making an assumption that the backup will merrily kick-in if an outage occurs.

WHY FACTORY TESTING IS NOT ENOUGH

Most backup generators and uninterruptible power supply (UPS)

systems are tested by the manufacturer in the factory prior to delivery. Many businesses wrongly believe this to be enough to ensure that the equipment will operate effectively when installed. However, with on-site conditions such as temperature and humidity often varying between locations, not to mention the impact of lifting, moving and transporting sensitive equipment, the manufacturer-verified testing may be thrown off kilter by on-site conditions or even human intervention during installation.

Crucially fuel, cooling and exhaust systems may all be different from the systems used at the factory. For this reason, it is absolutely critical that backup power systems are commissioned accurately and tested in-situ in actual site conditions using a loadbank.

THE BASICS: WHAT IS A LOADBANK?

Where businesses rely on power to remain operational, having backup power such as a generator is crucial. Wherever there is standby power, there is also a need for a loadbank – a device which is



“ All generators should at very least be tested annually for real-world emergency conditions ”

used to create an electrical load which imitates the operational or 'real' load that a generator would use in normal operational conditions.

In short, the loadbank is used to test, support, or protect a critical backup power source and ensure that it is fit for purpose in the event that it is called upon.

THE VITAL ROLE OF PERIODIC TESTING: WHAT DOES GOOD LOOK LIKE?

Properly planned and implemented, preventative maintenance strategies can minimise the likelihood of unscheduled breakdowns and outages, effectively negating the potential risk of costly commercial, reputational and legal issues.

A robust and proactive approach to the maintenance and testing of the power system is crucial to mitigate the risk of failure. However, it is vital that this doesn't become a tick-box exercise.

Implementing a testing regime which validates the reliability and performance of backup power must be done under the types of loads found in real operational conditions. With this in mind, what does good actually look like?

Ideally, all generators should at very least be tested annually for real-world emergency conditions using a resistive-reactive 0.8pf loadbank. Best practice dictates that all gensets (where there are multiple) should be run in a synchronised state, ideally for eight hours but for a minimum of three.

Where a resistive-only loadbank is used (1.0pf), testing should be increased to two to four times per year at three hours per test minimum. In carrying out this testing and maintenance, fuel, exhaust and cooling systems and alternator insulation resistance are effectively tested, and system issues can be uncovered in a safe, controlled manner without the cost of major failure or unplanned downtime.

THE STARK REALITY OF INADEQUATE TESTING

The reality is, in many instances, that those in charge of maintaining backup power have no regular testing schedule, making an assumption that occasionally powering the generator up, or testing for a minimal period, will suffice.

By not testing the system adequately, the generator is put at risk of failure – with the fuel, exhaust and cooling system untested, along with the potential for embedded moisture, putting the system in the very high-risk category.

WHY IS RESISTIVE-REACTIVE THE BEST APPROACH?

Capable of testing both resistive and reactive loads, this type of loadbank provides a much clearer picture of how well an entire system will withstand changes in load pattern while experiencing the level of power that would typically be encountered under real operational conditions.

Furthermore, the inductive loads used in resistive/reactive testing will show how a system will cope with a voltage drop in its regulator. This is particularly important in any application which requires generators to be operated in parallel (prevalent in larger business infrastructures such as major telecoms or data centres) where a problem with one generator could prevent other system generators from working properly, or even failing to operate entirely. This is something which is simply not achievable with resistive-only testing.

MAKING A BUSINESS CASE FOR LOADBANKS

The importance of testing is being clearly recognised in many new facilities, with the installation of loadbanks often being specified at the design stage rather than being added retrospectively.

Given that the cost of a loadbank is typically only a fraction of that of the systems which it supports, this makes sound commercial sense and enables a preventative maintenance regime, based on regular and rigorous testing and reporting, to be put in place from day one.

While testing of power systems is not yet a condition of insurance, some experts believe it is only a matter of time before this becomes the case. At the very least, by adopting a proactive testing regime, businesses are taking preventative action towards mitigating the catastrophic risk associated with power loss. **ER**

Blackout: How energy storage averted a UK-wide disaster

Hornsea One is the world's largest offshore wind farm, and is partially responsible for the UK's recent power outage

On August 9, 2019, just five minutes before millions of commuters were set to head home for the weekend, disaster struck the UK's power infrastructure. Jordan O'Brien, contributing editor, looks at the lessons we can learn from the recent UK-wide power outage and the role energy storage can play in keeping the grid online.

Described as an incredibly unlikely event, two power stations simultaneously went offline; the first a small gas-fired plant in Cambridgeshire, while the second was one of the world's largest offshore wind farms. The result? More than a million people were left without power.

The UK is no stranger to power outages, having previously experienced widespread disruption in 2003 and 2008, but those instances were mostly localised. In 2019, however, the blackout affected nearly every region in England and Wales, leading to widespread disruption.

So, what went wrong? Well, that's a complicated question, because the network performed exactly as expected. In fact, had it not been for the contingencies put in place by the National Grid, the UK could have faced a much greater outage than it did.

QUICK RESPONSE

During a sharp drop in frequency, the National Grid's procedure is to shut down parts of the system to protect the network. Then, additional power generation is brought online in order to plug the gap. Traditionally, this additional generation could be as simple

as bringing a coal-fired power station online, although that's not a quick job, and is one of the reasons that the power outages of 2003 and 2008 lasted for hours.

Thankfully, in 2019 we don't have to wait for a power station to come online. That's because batteries have the capability of kicking into action in a matter of seconds. Their job isn't simply to maintain the frequency through providing back-up power, however, as they also have an advantage power stations don't have – the ability to consume surplus energy.

Electrical Review spoke to several leading companies in the energy storage market to get their take on the role played by energy storage in keeping the grid online.

NICOLA WATSON, TECHNICAL LEAD, ELECTRICAL DESIGN ENGINEERING AT REDT ENERGY STORAGE:

Energy storage is an important provider of 'flexible' capacity on the UK electricity system and is ideally suited to responding quickly to events like this. Unlike conventional generators such as gas and diesel turbines, they also have the advantage of being able to provide bi-

directional flexibility.

More and more cheap renewable, non-synchronous generation (mainly solar and wind power) is coming online every day. It is replacing conventional, synchronous generation such as coal-fired power plants, and as a result, overall system inertia is reducing. This creates a strong case to invest in energy storage, which can deliver the synthetic inertia required to support our future energy system.

In order to provide maximum benefit, energy storage needs to be adopted across the entire system, both on a distributed level (alongside behind-the-meter renewables at industrial sites for example) and increasingly, at transmission level too. The responsibility does not rest on just one organisation or customer group, but clearly National Grid have a leadership role to play in the design and operation of the market for flexibility.

Energy storage played an important part in stabilising the grid during the recent disruption, but there simply wasn't enough installed capacity to overcome a nearly 2GW shortfall in generation. The solution is clear, more energy storage needs to be deployed across the UK, not only managing load for

end-users, but also balancing supply and demand at transmission level on a more centralised basis.

JEREMY HARRISON, PRINCIPAL ANALYST, DELTA-EE:

This blackout was an exceptional event and extremely rare in the UK, and clearly illustrates the very high level of reliability we have become accustomed to – which is no doubt why it was headline news.

Could energy storage have helped prevent the blackout? Technically the answer is clearly yes: batteries are well suited to providing millisecond response time for grid stability – when National Grid tendered for a new sub-second response frequency product in 2016, all of the contracts were won by batteries. However, the blackout raises more fundamental and interesting questions around the future of the grid through the energy transition.

A simple but costly approach would be to reduce the risk of such a blackout by having a higher level of reserve contingency. It could include a number of technologies, including batteries, but somebody would have to pay for it.

A different approach – preferred by Delta-EE as it's potentially lower cost and more sustainable in the long term – would be to embrace the growth in distributed energy resources: namely, to use embedded generation, DSR and interconnected local energy systems, also known as microgrids, to provide an increased level of resilience.

MAREK KUBIK, MARKET DIRECTOR UK AND IRELAND, FLUENCE ENERGY:

Battery-based energy storage is an extremely fast-responding technology, which makes it an important tool for maintaining grid reliability and resilience. Storage can charge or discharge power within milliseconds as opposed to the minutes it takes fossil-fuel plants to ramp up. In emergencies, providing this kind of instant power can reduce or avoid the need for secondary actions such as cutting off demand.

While it may not have prevented the recent blackout, energy storage already played a demonstrably important role in limiting its severity. The National Grid ESO interim report on the incident highlighted that nearly 500 MW of battery storage on its network responded quickly to provide

power and help stabilise frequency. Without batteries, the extent of the power cuts would have been deeper, and their duration longer.

Having a large enough fleet of fast-acting batteries could have contained the rate of change of frequency and possibly prevented the power cut outright. The confluence of events that caused the blackout was rare, which has triggered a debate on what might be the appropriate level of such assets to have on call at any given time.

Aside from helping regulate frequency, storage can help to balance voltage, provide digital inertia, smooth the intermittency of renewable resources and, of course, store electricity to be used when it is most needed.

These services are relevant for every grid in the world regardless of energy mix, but doubly so as increasing levels of renewable energy are deployed. Wind and solar are becoming the cheapest forms of electricity generation in a growing number of markets, but energy storage is critical to their integration.

In Ireland – where, at times, over 65% of electricity comes from wind – steps have been taken to reward battery response times all the way down to 150 milliseconds, compared to the 10 seconds – or 10,000 milliseconds – typically required in the UK. Having this kind of market incentive makes a huge difference in the ability to manage sudden changes in the careful balance power of supply and demand.

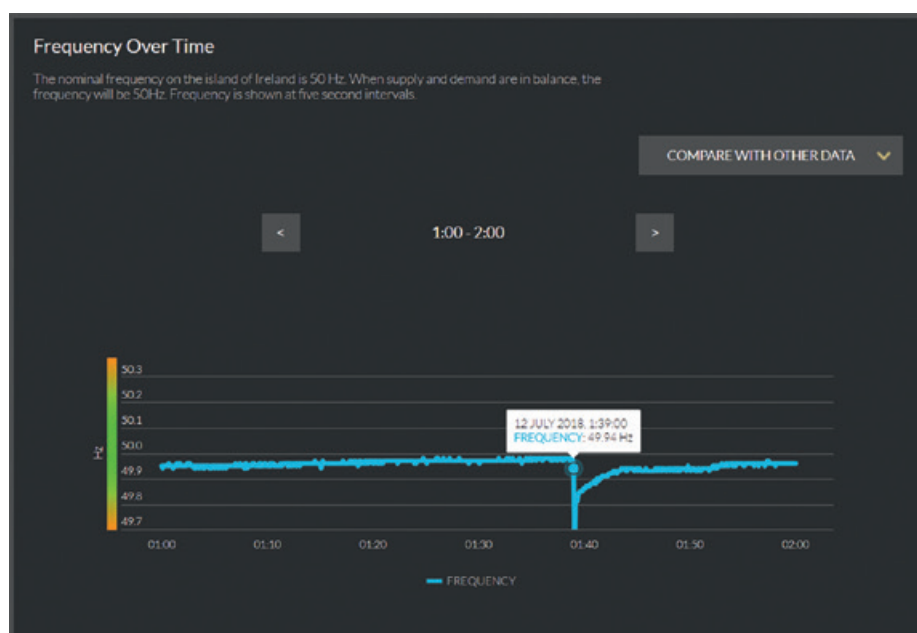
In Ireland, EirGrid is already leveraging technology from Enel X in order to provide fast frequency response in the event of a drop in frequency

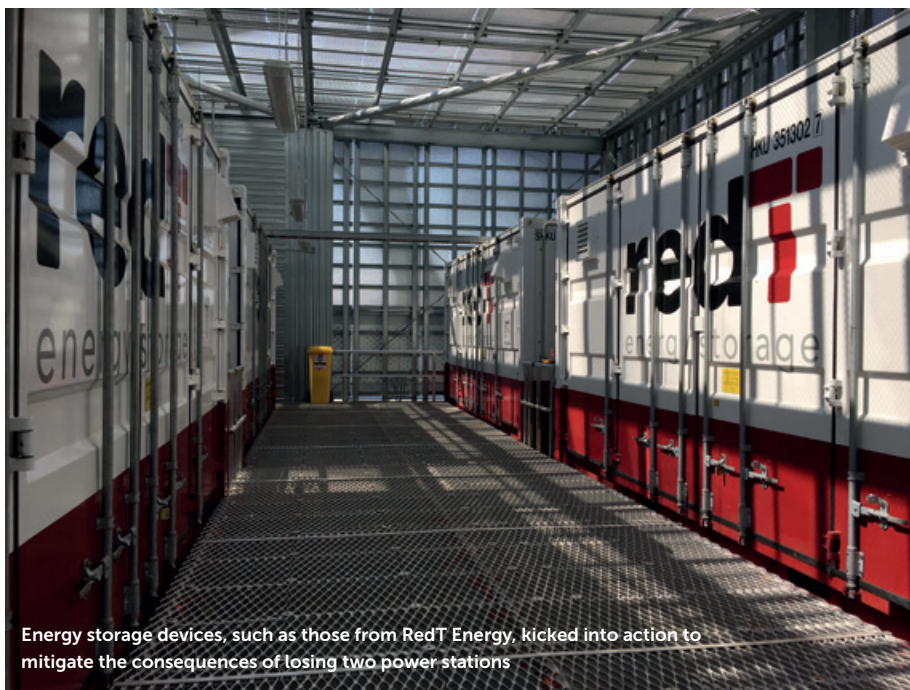
JONATHAN DINKELDEIN, DIRECTOR EMEA MARKETING COMMUNICATIONS AND PUBLIC AFFAIRS, EATON:

The core issue behind the recent UK power cut was that the system operators were unprepared to provide the amount of support required to help stabilise the grid. Part of the answer to improve resilience in the future could lie in easing the requirements for Firm Frequency Response (FFR) in order to open the market to participants with smaller more distributed assets, as is already the case in the Nordic markets and Ireland.

The Nordic market has for some time benefited from a very stable and beneficial regulatory environment with a careful introduction of new rules. The Nordics also benefit from a lower threshold to participate in Frequency Regulation (FR) tenders to help with grid stability, with a different price point per kW for small and large installations. This is important as it creates more opportunities for storage capacity behind-the-meter, where it is most efficient for the economy as it is where the largest number of services can be 'stacked' to enhance the economic value of those assets.

By participating in the frequency containment reserve energy market, UPS systems can aid the stability of a more renewable-rich power grid to support the UK's future power needs.





Energy storage devices, such as those from RedT Energy, kicked into action to mitigate the consequences of losing two power stations

PAUL TROUGHTON, SENIOR DIRECTOR OF REGULATORY AFFAIRS, ENEL X:

National Grid procures enough frequency response services from generators, batteries, and end-users to cope with the loss of a certain amount of generation without it

leading to an unplanned blackout. There's a cost-benefit trade-off: they could procure more, and hence protect against more unlikely events, such as what occurred on 9 August, but this would cost more.

Our experience in other markets shows

that demand-side response can provide large volumes of fast frequency response services much more cost-effectively than either generation or batteries, but only if care is taken in the design of the service and the procurement method to avoid erecting unnecessary barriers to end-user participation. If National Grid can get this right, they could unlock a greater level of demand-side provision of frequency response services, and so reduce costs. Their current hodge-podge of different products and manual procurement methodologies is far from optimal.

If the costs are reduced substantially, then the cost-benefit trade-off will change, and it might be judged worthwhile to procure greater volumes so as to protect against more unusual events. But this won't necessarily be the case: systems where they take a very sophisticated approach to frequency management, such as New Zealand, typically aim for events like this to occur on average once a decade, and it's 11 years since the last one here. **ER**

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Key Note Speaker

Jim Phillips

Jim is Vice-Chair of IEEE 1584 and International Chair of IEC TC78 Live Working. For over 35 years, he has been helping tens of thousands of people around the world understand electrical power system design, analysis and safety. Having taught over 2500 seminars during his career to people from all seven continents, he has developed a reputation for being one of the best trainers and public speakers in the industry. For more information about Jim, visit www.Brainfiller.com

Conference Agenda

Take a deep dive into the NEW 2018 Edition of IEEE 1584 with Jim Phillips as he shows you how to perform arc flash calculations and arc flash studies based on the latest edition of this landmark standard. After 16 years in the making, this second edition changes everything you thought you knew about arc flash calculations and studies. You will solve many in-class problems using Jim's calculation worksheets based on the NEW 2018 IEEE 1584. Learn how to perform intermediate and final calculations of incident energy, arcing current and arc flash boundary as well as enclosure size correction factor, arcing current variation correction factor calculations and much more!

- Overview of changes to the 2018 Edition
- Arc Flash circuit dynamics and testing
- Electrode Orientation VCB, VCBB, HCB, VOA, HOA
- Enclosure size correction factors for different sizes
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Wieland Electric has added the wipos PSW to its wipos power supply series to offer a wider range of input options. The wipos range is compact, reliable and robust, incorporating essential features for drive technology applications.

The wipos PSW series has a one, two or three-phase input AC (187-550 Vac) and DC (250-750 Vdc), making it ideally suited for worldwide use. The units have a high efficiency of > 92% and > 35% overload (power boost) for 5s with different variants for 24/48 V DC output. The slim and powerful wipos PSW units have compact dimensions of only 73 x 140 x 137 mm and provide a performance that far outweighs their size.

Various protection mechanisms have been included in the design of the the wipos PSW series, including input under voltage lock-out, output overcurrent, short circuit and temperature fluctuations.



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Eaton has launched a new range of sounder and sounder beacons for industrial safety and controls. The X10 is corrosion proof and has been designed to IP69K and IK08.

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The X10 range offers six LED beacon colours and can be fitted or swapped out in under 30 seconds.

Available in three housing sizes and depending on which is selected, it produces sound outputs of between 90 to 120dB. The range has multiple voltage options, 10 to 60V low voltage DC or 10 to 30V AC and a mains AC version where a switch allows you to select between 115V or 230V.



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NEW EMERGENCY LIGHT TEST SWITCH FROM ESP

ESP's Duceri range of emergency lighting products has been expanded to include two new emergency light test switches. Designed to test batteries, lamps and duration function of emergency lighting luminaires in accordance with current emergency lighting standard BS5266, the new products will help ensure compliance.

These automatic, key-operated emergency lighting test switches are permanently wired to the emergency luminaire supply. The key switch is used to interrupt the supply for a pre-programmed period of time. At the end of that period, the supply to the luminaires is automatically reinstated, so there's no risk of depleting the batteries in the emergency fitting by leaving them connected for prolonged periods.

There are two models available: standard LED display or countdown digital display. Both feature four pre-programmed test intervals: 10, 30, 60 and 180 minutes. There is the option for an audio buzzer alert for completion of duration test.



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