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Electrical Review

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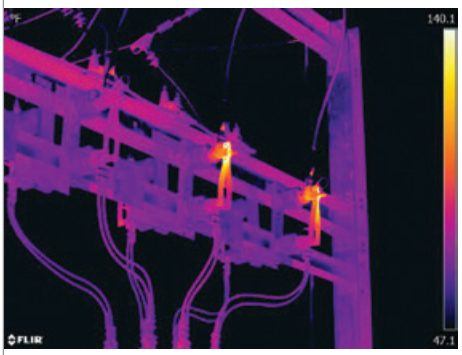

In loving memory of Elinore Mackay
1971 - 2019

For anyone not aware, last month it was with great sadness we announced the passing of our much beloved Elinore Mackay, whose tenure as Electrical Review editor spanned an incredible 16 years.

An industry veteran adored by many, Ellie had recently left the company due to ill health. Despite being poorly on and off, Ellie's passing was sudden, unexpected and a complete shock to us all.

If you were lucky enough to have met Ellie, you will know she was a wonderful woman and an incredible talent, whose loss will be felt across the industry. She will be sorely missed by her friends and colleagues here at SJP, and our heartfelt condolences and thoughts remain with her family at this incredibly sad and trying time.

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Industry figure warns of the perils of 'cowboy' electricians

Stricter regulations within the electrical industry would have a significant uplift on the economy, while also driving massive improvements in public safety, Fiona Harper, secretary of the Scottish Joint Industry Board (SJIB), has said.

Speaking on 19 September on BBC Radio Scotland, Harper welcomed moves by the Scottish government to publish a consultation on the regulation of electricians. She told the BBC's Andrew Black why change must come sooner rather than later.

"In Scotland, at this moment in time, anyone can call themselves an electrician and carry out electrical work," she said. "Even if you decided tomorrow, Andrew, that radio is no longer for you, you could buy a van, call yourself an electrician, and it wouldn't be against the law.

"But electrical installation is what is described as a safety-critical activity. It's always important that installations are safe, because if not, they can result in injury or death."

News of the consultation contained in the 2019-20 Programme for Government released earlier this month was immediately endorsed by SJIB and SELECT, the electrotechnical trade association. Both are among bodies campaigning to raise public awareness about the need to use registered electricians.

"Some faults lie hidden for years, lurking behind a socket, under a floorboard or hidden in a wall, just waiting for a combination of circumstances for a flashpoint to occur," said Harper, who is also head of employment affairs at SELECT.

SELECT has estimated that as many as 16% of all domestic electricians operating in this country are either unqualified or under-qualified. They and others want the title of electrician protected in law, helping to ensure that anyone claiming to be an electrician would have the necessary qualifications, knowledge and experience to carry out work.

"We would estimate that up-skilling training would cost around £1,000 per person, so if that meant 10,000 unqualified or under-qualified people, that's about £2 million," Harper added.

"By up-skilling the workforce and regulating the playing field, we would inevitably reduce damage caused by faulty work, there would be fewer injuries and deaths and better-functioning installations – but most importantly, happier and safer consumers."

SkillELECTRIC UK finalists announced

After successfully completing a round of regional heats earlier this year, eight finalists have been announced to compete at the 2019 SkillELECTRIC UK final.

Finalists will go head-to-head in November at WorldSkills UK LIVE at the NEC Birmingham, where over 70 WorldSkills UK competitions will be held, watched by around 70,000 visitors.

In the quest to be crowned SkillELECTRIC champion, contestants will have to complete a complicated two-day practical task set to a strict timescale and against a rigorous marking criteria.

The finalists are:

- Alex Rendall, Bridgwater and Taunton College
- Ben Kidner, Rogers Restorations Ltd
- Blair Angus, SECTTDarren Kerr, SECTT
- Jonathon Sherratt, Oldham College
- Kevin Brown, Army – Royal Engineers
- Lewis Sim, Moray College Technology Centre
- Scott Barr, South Eastern Regional College.

SkillELECTRIC is the only UK electrical competition aligned to the WorldSkills UK network. Those who score most highly will have a chance to compete at the next WorldSkills competition taking place in Shanghai in 2021.

Earlier this year, past-SkillELECTRIC finalist Thomas Lewis competed internationally in Kazan, Russia, receiving a Medallion of Excellence in recognition of his work reaching the international skills standard.

Major fair payment and mental health initiative launches

ECA and BESA are spearheading a new payment and mental health survey to understand how poor payment practices are impacting mental health and business wellbeing.

The survey has been launched by 27 bodies in the UK construction industry, in association with the Prompt Payment Directory. ECA director of legal and business Rob Driscoll commented, "Mental health is an increasingly important – and costly – issue in both construction and wider society.

"This major initiative from ECA and BESA aims to connect the dots between poor payment practices and the impact on the

mental health of business owners and senior managers, along with the wider impacts on other employees and their families."

BESA head of legal and commercial Debbie Petford added, "Poor mental health is bad for wellbeing and bad for business. The survey is an important next step in the campaign to reform retentions and the late payment culture in the industry. It will help us gain an understanding of the human costs of these practices, that are often overlooked."

Survey supporters cover a range of construction activity, including electrical, plumbing, building, scaffolding, roofing, civil engineering, fire safety, painting and decorating, and interiors. They include the National Federation of Builders, SEC Group and FETA. Survey supporters are all part of a wider industry coalition pressing government to reform the practice of cash retentions in construction.

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Bureau Veritas welcomes upcoming 18th Edition amendment

Bureau Veritas has welcomed news that the Institution of Engineering and Technology (IET) is planning an 18th Edition amendment on electric vehicle charging.

The company has said that the imminent changes will be critical to ensuring the faster roll-out of the UK's charging network for cleaner vehicles.

Earlier this month, the IET announced it will publish a standalone update to Section 722 of the 18th Edition on electric vehicle charging installations in early 2020, as part of a new amendment to BS 7671:2018. The amendment, which will be implemented immediately and free to view on the IET website, follows advances in technology. It is expected to make installing charging points quicker and easier, and cheaper for both installers and consumers.

Welcoming the amendment as a 'positive step forward' for the industry, Michael Kenyon, technical manager at Bureau Veritas, has said the update will be vital in helping the UK create one of the largest electric vehicle charging networks in Europe – as latest figures show sales of electric cars rose to their highest level last month.

Kenyon commented, "As part of its Road to Zero strategy, the government has ambitious targets in place for half of all new cars sold to be 'ultra-low emission' by 2030 – and to realistically achieve this requires a world-class charging infrastructure for electric vehicles, which needs to be deployed quickly and cost-effectively.

"Despite being a fledgling industry, the technology in this area has come on leaps and bounds in just a few short years and it's great to see the IET getting ahead of the curve by ensuring the wiring regulations adequately reflect this."

According to Bureau Veritas, the amendment is unlikely to feature any wide sweeping reforms, but instead focus on changes in-line with EU regulations, as well as evolving practice on the PME supply issues and residual current devices (RCDs).

The Draft for Public Comment for Amendment 1 will be available from October 2019, while in February 2020 the IET will publish the 4th Edition of the Code of Practice for Electric Vehicle Charging Equipment Installation.

Schneider Electric cuts five years from its carbon neutrality goal

At Climate Week NYC 2019, Schneider Electric announced plans to drastically step up its commitment to carbon neutrality, outlining three new points of action. One – accelerating its 2030 goal of achieving carbon neutrality in its extended ecosystem by 2025, bringing forward its objective by five years; two – achieving net-zero operational emissions by 2030 as part of validated SBT target; and three – engaging with suppliers towards a net-zero supply chain by 2050.

These targets are expected to contribute to the Intergovernmental Panel on Climate Change's (IPCC) goal of capping the global temperature increase at 1.5°C. Schneider Electric is also calling on other companies to reduce emissions, offering support through products and services to help businesses streamline and find efficiencies within their own operations.

"Climate change is the single biggest threat to the health and wellbeing of our society. We must work together to reduce our carbon emissions and halt the rise in temperature," said Jean-Pascal Tricoire, chairman and CEO at Schneider Electric.

"At Schneider Electric, our commitment to carbon neutrality is weaved into our business decisions and governance, but we need to do more and faster. Not only are we stepping up our carbon commitments and moving up our timeline, but also calling on others to take bolder actions to reduce carbon emissions and establish more sustainable business practices that will help set the stage for a post-carbon world."

In the move towards carbon neutrality, Schneider Electric has established several safety nets to ensure communities are not negatively impacted during the transition. The company's Access to Energy programme will provide electricity to 80 million by 2030 and train more than one million underprivileged people by 2025.

The company has two impact investing vehicles aimed to support inclusive startups, which activity contributes to SDG7 (clean and affordable energy), through equity investments. The expected outcomes of these vehicles are to increase the number of households and small and medium enterprises connected to the grid in remote areas (Africa, India and South East Asia), and to decrease the number of households facing energy poverty in Europe.

"Access to energy is a basic human right, but it is also crucial that we are mindful of the effects of energy consumption on the environment," Tricoire added. "We must find ways to bring energy-poor populations access to energy and allow them to develop in a sustainable way."

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GOSSAGE

Cluster muster

Energy companies have ignited multibillion-pound plans in the Humber region for the UK's first carbon-neutral "industrial cluster". An alliance of companies, including National Grid, Drax and Norway's state energy company Equinor, are leading a project designed to shrink the carbon footprint of Britain's most polluting industrial zone.

The cluster includes hundreds of refineries, factories plus the Drax coal-fired power plant near the Humber estuary, ostensibly safeguarding 55,000 jobs and a local industrial economy worth £18 billion a year.

It should be remembered that this area is also responsible for the highest concentration of industrial carbon dioxide emissions in the country, so daily undermining the UK's goal to become a carbon-neutral economy by 2050.

The alliance plans to undertake (yet another) trial of CCS technology and hopes to break down natural gas to, "create hydrogen, which can be used in industry, heating and transport without creating greenhouse gases." Good luck with that.

Atomic nightmare

I accept that no Annual Report issued by the Business and Energy department, BEIS, is ever likely to make the Sunday Times' best sellers list. But as part of my devotion to my readers, I have been perusing the recently issued 2019 edition. In particular, the financial figures appearing in the section concerning the Nuclear Decommissioning Authority.

The NDA is responsible for 17 nuclear licensed sites across the country, with a range of facilities including former nuclear power stations, research sites, and nuclear fuel fabrication and reprocessing facilities. The Authority has made its best estimate of the future costs of decommissioning these sites.

In preparing these figures, we are assured that the methodologies used in the calculations follow the official "HM Treasury Green Book guidance" and (crucially) "the need to remove optimism bias."

Apparently, project estimates like these will typically have a range of from -50% to 300%. So, the range of costs for cleaning up nuclear contamination could range from just £99 billion up to the almost unimaginable sum of £232bn.

But overall the Government's official watchdog reckons that, over the next century, best bet is that costs will amount – at present prices – to approximately £123.3 billion. And all without producing a single usable kilowatt hour of electricity.

Bar RAB

According to the latest wheeze from the Business and Energy Department, future nuclear power projects should be funded via something called the 'Regulated Asset Base' system. Called RAB for short.

What is this when it is at home? Put simply, the RAB would fund new projects via an extra levy, placed on all consumers and payable from the moment construction begins. The objective is to reduce borrowing costs for companies building the projects – and thus in turn theoretically bring down the level of future bills.

The dream is that the extravagant £92.50 per MWh agreed for the under-construction Hinkley Point C might come down to £80 per MWh for any future twins. The dream arrangement for any company must be to pass the burden of risk in any project onto someone else, whilst collecting a guaranteed stream of income once the project is up and running.

This method of funding may be proving a serious option for other long-term projects with high upfront capital costs, having been used effectively in the water industry and elsewhere. However, as a mechanism for funding new nuclear, it is far from convincing.

Water projects, such as reservoirs and pipeline systems, do require large-scale capital. But these operate in an entirely non-competitive market and their technology is proven, so construction risks are low.

In contrast, we can observe across Europe that new nuclear construction's financial risks are high, and getting higher. Placing them on the shoulders of consumers is unfair. Both to consumers, who will be landed with higher bills even though most are never likely to be customers of the nuclear company. And to rival companies offering different technologies and techniques.

In my humble view, the unfairness of such an outcome makes this entire RAB model unsustainable. Lovers of the Great God Atom should go swiftly back to the drawing board.

Very un-smart meters

Nobody now pretends that the long-standing Government target, to put 63 million smart meters, into every home and SME by this January, stands any chance of being met. What is most galling is the news that eight out of the 25 electricity vendors charged with delivering this scheme are still installing those seriously old-fashioned SMETS-1 meters.

Those are the clunky old devices that don't work if you change supplier, won't operate with differential time tariffs, and consistently break down. They were officially supposed to be off the market four years ago. This spring, Energy Minister Claire Perry announced that henceforth absolutely no more old meters would be installed; only the SMETS-2 versions, which are vaguely worthy of the epithet "smart".

But the old meters remain – unsurprisingly because they are useless. And so, regardless of any ministerial diktat, there are now well over 13 million occupying space in British buildings. Every single one of which will require costly upgrading to work properly. When will we learn?

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FITNESS project sets roadmap for digital substations

With innovation being essential to the future of the energy industry, Priyanka Mohapatra, RIIO-T2 innovation lead for SP Energy Networks, tells Electrical Review about progress on the RIIO-funded Future Intelligent Network Substation (FITNESS) project.

As the UK's first multi-vendor digital substation installation, SP Energy Networks' FITNESS is a landmark project that could radically change the way substations are built and maintained. During the project, vendors ABB and GE have equipped two substation bays with digital protection and control schemes at Wishaw 275 kilovolt (kV) substation near Glasgow, with support from project partners Synaptic, Omicron and the University of Manchester.

As it is the first UK multi-vendor project, a key output has been the seamless integration of devices supplied by different manufacturers. This is vital to the deployment of the IEC 61850 smart grid standard in the long term as it will enhance competition and keep costs under control for electricity consumers – Ofgem's driver for awarding funding for the project under the RIIO NIC (Network Innovation Competition) programme.

Before IEC 61850 standardised the format and timing of digital communication using the GOOSE (Generic Object Oriented Substation Events) model, each vendor had its own proprietary approach, meaning that equipment from one vendor could not be slotted into a scheme developed by another vendor. Therefore, projects like FITNESS are essential to establishing digital substation technology.

> **"Our existing processes are closely aligned to traditional technology – so we can only realise the full benefits of digital technology by updating and refining our processes too"**

RENEWABLE ENERGY INFEED

The scheme is a 'piggyback' trial that is now working alongside a conventional substation protection and control scheme to enable a direct comparison between conventional and digital technologies.

Since the project won funding in 2015, early engineering design took place to ensure multi-vendor interoperability. ABB then installed the scheme for the first bay on site in 2018, with GE commissioning the second bay in July 2019.

Now that both bays are in place, SP Energy Networks is evaluating their performance and has been sharing its learning points with the industry.

One potential challenge anticipated early on was the possibility of conflict between the two main vendors. Our concern was that they'd be overly protective of their own intellectual property with a preference to stick to their own technology and products.

However, we found that after a few initial challenges and testing the waters, both vendors showed true professionalism and commitment to make the multi-vendor aspect of IEC 61850 succeed. The project team consisted of the best engineers from across the industry which meant the few technical challenges that presented themselves were solved swiftly and efficiently.

Danny Lyonette, ABB's digital lead for Substation Automation, Northern Europe said, "An important milestone was system verification at ABB's facility in Stone, Staffordshire. We carried out extensive testing and commissioning by simulating real-life conditions in factory conditions. This proved the solution would work before it was delivered to site, saving time, effort and project risk during commissioning and testing."

CULTURE AND SKILLS

An important point arose when we started to engage our operations team, including our wiremen. They were naturally curious about the new technology and recognised that digital technology will represent changes to the practical tasks they will cover, as well as a major shift in the skills and working practices required. As a result, they raised multiple comments and questions on the impact of digital technology.

We addressed these by reminding our team that the transition from copper wiring to fibre optics will be gradual. SP Energy Networks has over 100 transmission network substations and will only integrate digital protection and control technology when the time comes to retire or refurbish assets. Therefore, we'll still need the team's existing knowledge and expertise for many years to come.

But at the same time, we also need to develop our team to have the right digital skillset. An important aspect of this was recognising that not everyone needs detailed and in-depth technical knowledge of digital technology – it's about matching the right skills to the right roles. For example, a technician may just need to have the right tools and knowledge to use the basic functions.

SP Energy Networks has also established new specialist roles for digital substations and has appointed candidates who have been undergoing rigorous training on how to apply IEC 61850. A key point for these new roles is that the candidates need to understand the technology at every level from the substation level to overall system integration – which would previously have required dedicated engineers working in silos.

FIVE ESSENTIAL ELEMENTS

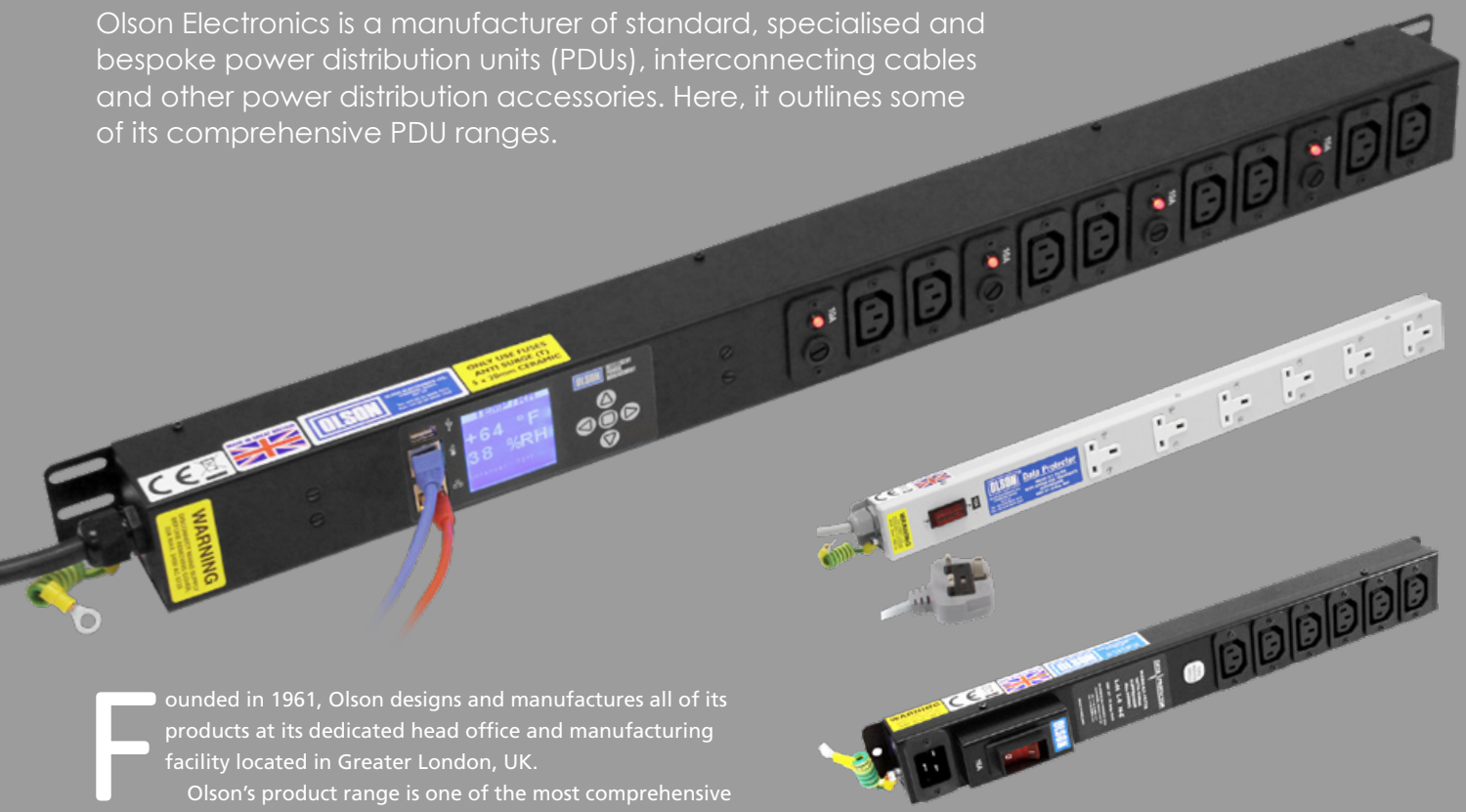
With the two digital bays in operation at Wishaw, the team at SP Energy Networks are now creating a roadmap to make digital substations business as usual. This will require major review, revision and roll-out of documentation such as technical specifications, policies and procedures at the heart of the business.

Our existing processes are closely aligned to traditional technology – so we can only realise the full benefits of digital technology by updating and refining our processes too. That requires a lot of effort and cooperation from across the whole business.

With experience from the FITNESS project under our belt, we have identified five essential elements to make large-scale deployment of digital substations a reality: senior management support; the right level of training for engineers, technicians and specialists; a root and branch review of business documentation; support from regulator Ofgem; and support from technology vendors, who need to develop and enhance the products and technologies to support operators.

Meeting the demand

Olson Electronics is a manufacturer of standard, specialised and bespoke power distribution units (PDUs), interconnecting cables and other power distribution accessories. Here, it outlines some of its comprehensive PDU ranges.



Founded in 1961, Olson designs and manufactures all of its products at its dedicated head office and manufacturing facility located in Greater London, UK.

Olson's product range is one of the most comprehensive on the market and if there is no standard unit that meets the customer's requirements, then a custom unit can be built to suit their specific needs, with a quick design, manufacture and delivery time, without compromising quality.

Olson offers other services utilising its various facilities, such as a full metal shop with metal bending capabilities and a spray booth for powder coating. Over the years, Olson has accumulated a variety of ranges which have been catered to particular sectors including healthcare, data centres, education, industrial and audio visual.

The Surge Protected and RF Filtered range is one of many in the long list of Olson PDUs: This range of units gives users peace of mind when any voltage spikes detected across the unit are regulated to an acceptable voltage, which will prevent damage to devices connected to it. The filtered option removes unwanted electrical noise that has been found on the unit.

The Suspended range is another impressive selection in Olson's catalogue of PDUs. This unit, when accompanied with the retractor and cable spring accessory, will allow the user to pull down and lock the unit to the required height, then allow the unit to retract back up towards the ceiling when they've finished with the unit.

The Intelligent Unit is the newest addition to the Olson range of PDUs, with many features which include:

- Remote monitoring and switching of up to 32 outputs
- SNMP alarm trap enabled
- Sequential start
- Temperature and humidity sensors compatible
- UPS input
- Energy consumption readings per individual outputs, as well as other great features.

The intelligent unit offers users the freedom to manage a data centre remotely while keeping a clear idea of the status of the rack. Users can utilise the SMTP alarm function where they'll be alerted via email when conditions such as the temperature, outlet states and voltages are not met.

With Olson's capabilities, the variations to suit the user's requirements are endless. Find out more at www.olson.co.uk

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Be our guest

Following the success of this year's ER Excellence Awards, which took place at the oh-so-swanky Four Seasons Hotel in London, we are gearing up to do it all again. So, keep the 21st May 2020 free, get it in the diary and dust off your posh frock. Although next year's venue is yet to be confirmed, I can assure you it will be just as magnificent; there will be no slumming it here.

We already have some brilliant sponsors lined up, in the form of: Centiel, Omicron, Vertiv, the ECA, Smart Grid Forums and GS Yuasa. And of course, we have our friends Riello UPS on board, who have been our partners for the event not once, not twice, but thrice. Thank you for the hattrick Riello.

We are thrilled to have such a strong team of industry leaders joining us for 2020, to help us recognise and celebrate the very best of what our industry has to offer. And it's not just the electrical industry we will be celebrating – oh no. Like last year, Data Centre Review will be along for the ride, but this time, in a much more prominent capacity, bringing with it a whole host of new awards categories, further opening the floor to the data centre space.

The awards are free to enter via our website, so I strongly suggest you head on over there to be in with a chance (where you will also find more information on categories, judges, as well as a selection of media from last year's event to give you a flavour of the evening.)

We had some absolutely fantastic entries last year and many more than deserving winners, which as part of our independent judging panel, I thoroughly enjoyed, well, judging.

Marrying together two incredibly strong, synergised industries, never has there been a better opportunity to network among players big and small. But I needn't list all the reasons you should get involved, as the following feature is a chance for all our wonderful sponsors to let you know not only why they have chosen to be a part of our event, but why you should be part of it too.

So please, join us for the ER Excellence Awards 2020 and raise a glass (or several) to the innovations and ideas helping to define and shape our industries.

The perfect partner

For the third consecutive year, the ER Excellence Awards 2020 is proud to be partnered with Riello UPS. A company that never stops, we find out a bit about what Riello has been up to of late, gleaning an insight into some of its latest projects, as well as finding out why this industry leader has gone for the partnership hattrick.

Riello UPS Ltd is a global leader in the manufacture of uninterruptible power supplies (UPS) and standby power systems from 400VA to 6.4MVA.

Riello enables reliable power for a sustainable world by offering products that combine engineering excellence and quality performance with exceptional energy efficiency.

The company's award-winning range incorporates 22 solutions powering the smallest desktop PCs through to the latest data centre supercomputers. Riello UPS products protect power for high-profile businesses leading sectors as diverse as manufacturing, finance, retail, healthcare, and telecommunications.

Riello UPS is part of the Riello Elettronica Group, which has subsidiaries in 80 countries and is the second-largest UPS manufacturer in Europe. This market share is driven by its ongoing commitment to reliability, innovation, and customer service.

As well as high-quality products, Riello offers a complete range of installation, servicing, and maintenance support, plus unrivalled sales and technical advice. Riello's maintenance contracts include guaranteed emergency response and fix times, whilst offering a five-year warranty as standard on all UPSs up to and including 3kVA.

Operating from purpose-built premises comprising office and training facilities, plus a warehouse filled with the UK's largest stockholding of UPS, Riello is able to deliver an end-to-end service of technical support and super-fast dispatch.

As part of the Riello Elettronica Group, Riello UPS is an official sponsor of the Ducati Corse MotoGP and Aruba.it Racing World Superbike Championship motorcycle racing teams, as well as an official partner of the Audi Sport Abt Schaeffler team competing in the FIA Formula E Championship for electric cars. And not forgetting, of course (most importantly), a principal partner to the ER Excellence Awards.

LOOKING TO THE FUTURE

The ongoing shift in the country's energy mix towards low carbon power is shaping the demands of Riello customers and also influencing many of the projects it's currently getting involved with.

Today, energy efficiency is almost as high a priority as resilience and availability as far as the company's customers are concerned.

One area where Riello UPS is aiming to live up to those competing demands is its work with leading energy company RWE Supply & Trading.

This project sees a specially-modified UPS fitted with a rectifier that enables a two-way flow of electricity to and from the grid network. The UPS is backed by premium batteries and sophisticated monitoring and comms software that interact with the grid in real-time.

Data centres and other energy-intensive, mission-critical organisations are able to harness the power in their UPS's batteries to participate in demand-side response schemes that help to balance the UK electricity grid.

Not only does this reduce a business's reliance on peak-time mains supply – cutting electricity bills and expensive grid tariffs too – it opens up additional revenue opportunities from selling surplus power back into the network.

And most importantly, the reliability of the UPS batteries isn't compromised. This perception has been the biggest stumbling block to data centres, in particular, taking part in DSR.

But the continuous battery monitoring means operators can be far more certain their cells will work when required than the sealed lead-acid blocks traditionally used with a UPS.

Another interesting concept Riello has worked on recently is its in-depth publication the *Blackout report*. This started out as a bit of a throwaway line in the Riello office, 'could there ever be a power cut affecting the whole country?'

From that initial question, Riello went away and researched documents such as official risk registers and even Acts of Parliament to see what contingency plans were in place.

The final 50+ page publication explores the likelihood of a UK-wide electricity failure, what the biggest threats to the network are, the process of restarting the grid from scratch, and what the consequences would be for not just business, but wider society too.

While the major power cut of Friday August 9 was limited to around one million customers, and was resolved relatively quickly, the widespread impact and the subsequent debate it provoked about National Grid's contingency plans raised many of the issues highlighted in the report.

In addition, it's been an especially busy few months of product updates. The most recent of these being Riello's latest UPS system, the Sentryum.

This is the company's third-generation of transformerless uninterruptible power supplies, building on Riello's best-selling Multi Sentry range.

It comes in three different power ranges (10, 15, or 20 kVA) and a choice of three cabinet sizes (Compact, Active, and Xtend) that will give customers fantastic flexibility through the option to install more battery strings for longer runtimes.

THE MAIN EVENT

So, why is Riello partnering with the ER Awards for the third consecutive year? Leo Craig, general manager of Riello UPS commented, "This will be the third year running where we're the principle partners of the Electrical Review Excellence Awards. During that time, it has fast become the must-attend event of the year for the electrical industry and an undoubted highlight in our calendar.

> **"The ER Excellence Awards allow the industry to honour the ideas, innovations, and achievements that make the electrical sector such an exciting and rewarding one to work in"**

"As a business, we're always striving for excellence, whether that's in product design, delivery, or especially in customer service. Quality, integrity, sustainability, and service – those are the values we take pride in and they're exactly the same principles these awards celebrate. There are lessons to learn from all shortlisted finalists across each of the diverse categories.

"The event provides a fantastic opportunity to catch up with friendly faces, old and new. But more importantly, it allows the industry to honour the ideas, innovations, and achievements that make the electrical sector such an exciting and rewarding one to work in."

"The introduction of new data centre categories in this year's awards really added a new dimension to proceedings and we're really excited to see what entries are put forward in that category, and all the regular favourites, next year."

www.riello-ups.co.uk

View from the top

ER Interviewed Mike Elms, managing director at Centiel UK, sponsors of the Data Centre Design and Build Product of the Year award, to find out his unique insight into the UPS marketplace and why the company chose to sponsor this particular category.

WHY DID CENTIEL CHOOSE TO SPONSOR THE ER AWARDS IN 2020?

In 2019, Centiel was shortlisted for three ER Excellence Award categories: Power Project of the Year, Power Product of the Year and Energy Saving Project of the Year, and so we felt it was right to 'put something back' by sponsoring the Data Centre Build and Design Product of the Year award in 2020. Sponsorship offers a great platform for us to join Electrical Review in rewarding excellence, innovation and collaboration.

The ER awards recognise projects that embrace the latest in electrical engineering, display forward-thinking design and implementation and champion the highest environmental, safety and energy efficiency standards which are values very close to our hearts. As manufacturers and trusted advisors in this sector, we were keen to be involved in rewarding innovation, particularly when it comes to reducing environmental impact wherever possible.

> **"As manufacturers and trusted advisors in this sector, we were keen to be involved in rewarding innovation"**

In addition, this year was the first time that Data Centre Review magazine has been involved in the awards and this enabled an expanded range of categories including new awards for products and projects, opening up the floor to the data centre industry. We are looking forward to networking and making new contacts as well as hearing about and meeting the people behind the projects on the night.

WHAT MAKES AN OUTSTANDING PRODUCT IN YOUR VIEW?

Products need to respond to market demands by addressing specific needs and providing measurable benefits to users in a timely manner. Although as sponsors, we are not involved in judging, those solutions that have been designed with the highest environmental and therefore efficiency considerations in mind will certainly be rewarded.

WHAT IS CENTIEL'S HISTORY?

Centiel is a Swiss-based technology company designing, manufacturing and delivering industry-leading power protection solutions for critical facilities. The company's range of class-leading, energy efficient, UPS systems offers the highest availability and reliability. Centiel's network of channel partners and subsidiaries is rapidly expanding, providing class-leading power protection solutions worldwide.

Although a relatively new company, Centiel's team of designers have experience that covers the last four decades. We were responsible for the design of the world's first three-phase transformerless UPS and the world's first three-phase modular UPS.

Centiel's three-phase modular UPS solution CumulusPower has now been installed in data centres and comms rooms in over 60 countries across five continents, protecting more than 50 MW of critical power loads in locations including: the UK, Singapore, Australia, Germany, Spain, the Czech Republic and now the Channel Islands.

WHAT CHANGES WITHIN THE UPS INDUSTRY HAVE YOU SEEN OVER THE LAST FEW YEARS?

In the 1980s UPS were huge, and relative to today were big, noisy, inefficient machines. A 60kVA UPS in 1988 weighed 700kg and was the size of a double wardrobe. Although they were very well engineered, they were at best only 80-85% efficient. No one talked about the need for energy efficiency back then. Certainly, the main driver for UPS design over the last 15 years has been efficiency; because of this, static UPS systems have now almost entirely migrated over to transformerless designs which reduce cost, weight, and improve efficiency.

We have now also moved from mainframe to file server, to the cloud and now to edge computing. The rapid accumulation of data is driving change exponentially. All information is being logged. Most of it is useless but it needs to be stored somewhere. This will result in the continued growth in the data centre industry and the need for small edge data centres at our homes and offices in the future, to process and store the less important data while the critical information is sent to the cloud and the mega data centres.

WHAT ARE THE MAIN CONSIDERATIONS WHEN IT COMES TO PURCHASING A UPS?

Organisations need to eliminate risks that may cause any potential downtime of business-critical applications. Availability is the key metric; data centres need to be available constantly, with zero downtime.

Untold financial and reputational damage can result from unplanned downtime and therefore availability continues to be the major concern for data centre managers and those working in critical environments.

WHY IS AVAILABILITY SO IMPORTANT?

Data centres need the highest level of availability possible to ensure their customers can depend on access to data at all times. In other words: systems must be available every second of every day. The probability that a system is operating, as and when required, is the true definition of availability.

Availability should not be confused with reliability. Reliability is an important and related factor in power protection design and is termed as: the probability that a system will not fail. For example: a UPS can be extremely reliable, but when a fault does occur, then the system can fail completely and lose load power or transfer to bypass, leaving the load vulnerable. A simple power cut could then compromise availability, leaving the data centre without critical power.

WHAT CHANGES DO YOU ANTICIPATE IN THE MARKET?

The move away from traditional lead acid battery as the primary energy store for the UPS will be a big change in the future. Li-ion has a number of benefits including: the ability to run at a higher temperature meaning that in many European locations this means cooling could, in future, be provided by the natural air temperature, if cooling is needed at all. This would result in significant savings on data centre running costs and reduced carbon footprints.

Li-ion batteries also typically require less than half the physical space of the equivalent lead acid blocks and less than 25% of the weight. In addition, 10-year design life lead acid batteries are normally replaced every seven or eight years. With Li-ion this is 13-15 years.

HOW IS CENTIEL ADDRESSING ENVIRONMENTAL CHALLENGES?

At Centiel we look at everything to reduce environmental impact by improving efficiency. This comes down to tiny aspects like the length of cables for example and investigating differing types of semiconductor materials to gain the most efficiency from a system.

As award sponsors we will be very interested to learn more about other innovative solutions which share our focus on availability, efficiency and reducing environmental impact.

www.centiel.co.uk

Who's got the power?

That would be OMICRON, who happen to be the proud sponsors for our Power category for 2020. Here, OMICRON gives us a bit of background on who they are, what they're currently up to and most importantly, why they've chosen to be a part of the ER Excellence Awards.

SO, WHAT DOES OMICRON DO?

An international company serving the electrical power industry with innovative testing and diagnostic solutions, the application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered include consulting, commissioning, testing, diagnosis and training which all make the product range complete.

Customers in more than 160 countries rely on OMICRON's ability to supply leading edge technology of excellent quality. Service centres on all continents provide a broad base of knowledge and extraordinary customer support. All of this together with the company's strong network of sales partners is what has cemented OMICRON as a market leader in the electrical power industry.

DOES OMICRON HAVE A UK-BASED SERVICE CENTRE?

OMICRON has a service and training centre based in the Midlands, purpose-built to provide the electrical power industry with innovative products and services for the testing and monitoring of assets.

Equipped with state-of-the-art workshop facilities and test objects, the centre is home to a large team which delivers quick responses to both commercial and technical requests and supports clients with everything from coordinating listing strategies to complete commissioning and maintenance regimes.

OMICRON engineers share a broad range of experience in commissioning, factory testing and design and are also expert trainers, delivering professional courses for technical staff from electrical utilities, industrial plants, equipment manufacturers and service companies.

Covering both primary and secondary testing, OMICRON Academy training courses are built around real testing situations, through which delegates can gain knowledge of assets and applications, fully utilise OMICRON test equipment and apply effcient test procedures to interpret test and measurement results.

To ensure that the company remains at the forefront of technology, OMICRON is committed to investing more than 15% of its profit into research and development, providing the industry with new, cutting-edge devices such as StationScout, StationGuard and MONTESTO 200.

STATIONSCOUT - IEC 61850 SUBSTATION AUTOMATION SYSTEM TESTING:

Testing the automation, control, and SCADA communication in an IEC 61850 Substation Automation System (SAS) is as time consuming as testing the protection – or often even more. StationScout simplifies this testing and reduces the required effort significantly.

STATIONGUARD - CYBER SECURITY AND FUNCTIONAL MONITORING FOR SUBSTATIONS:

The StationGuard intrusion detection system can monitor Ethernet networks in substations and detects suspicious behaviour, unauthorised actions and malfunctions on the IEC 61850 station or process bus.

StationGuard uses the substation's SCL file to create a complete system model of the IEC 61850 SAS and substation and then compares each individual packet in the network with the live system model.

MONTESTO 200 - ONLINE PARTIAL DISCHARGE MEASUREMENT AND TEMPORARY MONITORING SYSTEM FOR VARIOUS ELECTRICAL ASSETS:

MONTESTO 200 is a portable, two-in-one solution that enables you to perform both online partial discharge (PD) measurements and temporary online PD monitoring on various medium-voltage and high-voltage electrical assets under load. You can use the IP65-rated **MONTESTO 200** both indoors and outdoors. Online PD measurements can be easily made onsite.

WHY IS OMICRON ATTENDING THE ER EXCELLENCE AWARDS?

As a business, **OMICRON** is constantly striving for levels of excellence within our product range and services and we believe that the Electrical Awards 2020 reflects this ethos. By supporting and attending the event we can also fully engage with changes and challenges within the industry.

WHAT ARE YOU LOOKING FORWARD TO MOST AT THE EVENT?

The awards will be a great opportunity to celebrate success while enjoying a fun evening networking with like-minded engineers and key customers.

www.omicronenergy.com

Three, is a magic number

Sponsoring our Colocation Supplier of the Year category for 2020, Vertiv is a winner in its own right, having scooped an impressive three awards itself over the last two years. Find out what makes Vertiv such a worthy winner and you never know, you might pick up some tips for your own winning entries.

Data is built into the fabric of our society, from our jobs through to our personal identification. The increasing demand for data must be met through smart data centres managed with reliability, security, and passion. Vertiv addresses the most important challenges facing our data centres, communication networks and commercial and industrial facilities.

The company's game-changing portfolio of power, cooling, access and control and IT infrastructure solutions extend from the cloud to the edge to ensure customer applications run continuously, perform optimally and grow alongside their business needs.

THE VERTIV MISSION

Headquartered in Columbus, Ohio, Vertiv employs around 20,000 people and does business in more than 130 countries. From video to e-commerce and from healthcare to industrial, Vertiv ensures its customers work with reliable, safe, uninterrupted digital operations and bridge their digital realities to their future operations.

"Vertiv is thrilled to support an event which recognises the latest engineering and forward-thinking design and implementation in the data centre space"

As one of the leaders in the data centre market, Vertiv is committed to sharing insight on the latest issues facing data centres. These include how the adoption of edge computing will shape the evolution of the IT infrastructure's network edge and how critical infrastructure across industries is changing.

Most recently, Vertiv issued a report in partnership with 451 Research, Telco Industry Hopes and Fears. This delivered new insight into how global operators are preparing for the transition to 5G and edge computing, including an assessment of which technologies and services will most affect 5G success over the next decade, along with the unique challenges that 5G and edge computing present.

The executive team at Vertiv value the importance of sharing insights into how data centres will evolve to meet customer needs. The company therefore continues to conduct long-term research into what data centres will be like in 2025, with the first report published in 2014.

The second edition of this research published this year, *Data Centre 2025: Closer to the Edge*, gives us a glimpse into the future of network infrastructure, predicting that edge sites are set to triple by 2025. Giordano Albertazzi, president for Vertiv in Europe, Middle East and Africa points out that a key

future challenge will be managing this new infrastructure effectively and efficiently, with remote management playing an increasingly important role in the industry.

ONTO A WINNER (OR THREE)

The Electrical Review and Data Centre Review Awards has and continues to be a strong platform for Vertiv to raise its profile and establish its position in the data centre market. This recognition has enabled team members such as Alex Pope, enterprise sales director UK, to drive consultant relationships and promote Vertiv to customers. Off the back of the company's successes, Vertiv continues to be approached to enter similar awards and speak at conferences across the globe.

Proud to be a winner of three categories in the past two years, (2018 Excellence Award for Power and 2019 Excellence Awards for Project of the Year and Energy Efficiency Project of the Year), Vertiv has used these successes to increase brand awareness, raise its profile in the tech sector, and engage with peers.

It was the company's UPS, temperature control, monitoring and diagnostics capabilities at Cineca that gained recognition in both 2019 wins. Cineca, is a non-for-profit Interuniversity Consortium, comprising 67 Italian universities, nine Italian research institutions and the Italian Ministry of Education, Universities and Research (MIUR).

Cineca was looking for a partner to support its requirement for constant enhancement of infrastructure to increase efficiency, availability and reliability whilst also reducing energy consumption and costs. Vertiv helped Cineca implement efficient technologies, increase operational agility as well as save energy and administration costs.

Being a multi-award winner did not just spur Vertiv to enter more categories, but also encouraged the company to support exceptional industry practice through sponsoring the Colocation Supplier of the Year category. Vertiv's mission is to meet the increasing demand for data through passion and innovation, traits that can be found in abundance in the colocation sector.

Vertiv is proud to sponsor the Electrical Review and Data Centre Review Excellence Awards. Putting passion and innovation at the centre of its mission, the company is thrilled to support an event which recognises the latest engineering and forward-thinking design and implementation in the data centre space.

In addition to the Electrical Review and Data Centre Review Awards recognising Vertiv's successes as a market leader, its presence at the event has also encouraged other organisations to participate and enter the categories. Vertiv strongly believes the ER Excellence Awards are a fantastic opportunity for data centre professionals to come together and celebrate innovation and best practice.

www.vertiv.com

Keeping it clean

With it being Smart Grid Forums' mission to champion the agenda for clean energy, it was only right and fitting that it took the sponsorship for Electrical Review's Sustainable Project of the Year award for 2020. Here we learn a little more about the pressures faced within the smart utility sector, as well as why Smart Grid Forums has chosen to support our event (as they have done from day one), with 2020 set to be the company's third consecutive sponsorship.

Smart Grid Forums is an independent conference producer specialising in the smart utility sector. Launched in 2011, the company's mission is to drive the clean energy agenda by facilitating techno-commercial meetings and conferences where utility implementation leaders and technology innovators can come together to collaborate and cooperate on new ways of driving the clean energy agenda forward.

The company is formed of a group of engineers and environmental scientists who represent the voice of the utilities. Through their combination of investigative audience research, in-depth technical content, utility driven speaker selection, and well facilitated networking, they provide stimulating meetings and conferences where participants are encouraged to think deeply and laterally, open up fully and express their real-world issues. Attendees are also urged to challenge the technology innovators and the status quo, and become receptive to new partnerships and alliances that compound their efforts and drive their infrastructure development at the speed of the digital age.

> **Smart Grid Forums is privileged to continue to demonstrate its commitment to the smart utility sector and support progress through the recognition of outstanding work**

Smart Grid Forums uncovers the facts, figures, issues and challenges, as well as addressing the emotive blocks and hurdles around participants' perceptions of their strengths, weaknesses, opportunities and threats, both on an individual and organisational level. With a focus firmly on the next 12 months, the company understands the pressures that smart utility teams face today and appreciates that these pressures

are only set to intensify in the future. The starting point when shaping a new programme is always the question: what do participants need to do differently today to drive exponential results in the next 12 months?

INVESTIGATING THE CIM MARKET

One such conference is Smart Grid Forums' forthcoming Common Information Model 2020. Supported by the IEC, this groundbreaking new forum provides a clear roadmap for utilities to gain investment and drive the practical implementation of the CIM standard across their wider infrastructure.

Participants at the event could be at the start of their CIM journey or have already integrated several systems, and they will be coming together with like-minded CIM advocates and pioneers who are determined to push the maturity, organisation, and practical application of the standard to its next level.

They will join CIM representatives from TSOs, DSOs, system suppliers and integrators who will not only address the implementation challenges currently impeding CIM, but also discuss new frameworks for procuring CIM-based tools and technologies that will enable them to drive down costs and deliver more tangible value to their organisations. This forum is not for the faint hearted. It is designed for those who want to challenge the status quo, address CIM's greatest flaws, and move the needle on this important standard. It will be the most in-depth, inspirational, and innovative review of CIM yet.

SUPPORTING SMART UTILITY EXCELLENCE

Smart Grid Forums is delighted to sponsor the Electrical Review Excellence Awards 2020. Having been sponsors of this prestigious award ceremony since its inception in 2017, Smart Grid Forums is privileged to continue to demonstrate its commitment to the smart utility sector and support progress through the recognition of outstanding work.

www.smartgrid-forums.com

Driving the industry forward

ECA is the UK's largest trade association representing electrotechnical and engineering services organisations at regional, national and European level. It is therefore fitting ECA has proudly taken sponsorship of our coveted Consultancy/Contractor of the Year award for 2020.

ECA member companies are rigorously assessed before membership is approved, with member firms boasting a combined annual turnover in excess of £6 billion.

Member firms carry out design, installation, inspection, testing, maintenance and monitoring activity across the domestic, commercial, industrial and public sectors. This ranges from power and lighting to data communications, to energy efficiency and renewables, as well as the design and installation of cutting-edge building control technologies.

ECA's 2,700 members range from SME electrotechnical businesses to nationwide engineering services organisations that employ thousands of professionals on major UK projects.

Hiring an ECA member can help clients, specifiers and consultants minimise risk as they:

- Are thoroughly assessed for technical capability
- Are supported by the ECA Warranty & Bond
- Have access to industry-leading technical support
- Have access to industry-leading health, safety and other business and CSR support
- Have access to extensive industry information, advice and updates
- Have access to eRAMS – task/project-specific risk assessment and method statement software.

WHY THE ER EXCELLENCE AWARDS?

ECA is proud to sponsor the Consultancy/Contractor of the Year award 2020, supporting excellence in the electrical industry. ECA is keen to recognise the accomplishments of businesses within the industry and to promote best practice and success.

The Electrical Review Excellence Awards reward greatness and innovation in the electrical industry, an approach which reflects the work of ECA and its core membership. The award represents a great opportunity for contractors and consultants to showcase their exceptional work and show how they lead the way in improving industry standards.

www.eca.co.uk

That's entertainment

From deep sea submarines to deep space, GS Yuasa is trusted globally for countless applications. So, who better to be sponsoring the all important enterainment for our 2020 ER Excellence Awards? Here, we take a look at what places GS Yuasa at the top of its game, as well as why you should get involved in what is already set to be a night to remember.

GS Yuasa, manufacturer of Yuasa Batteries, is the world's leading battery manufacturer and global leader for quality and innovation. The GS Yuasa Group consists of 65 subsidiaries and 33 affiliates in countries throughout the world.

For over 100 years GS Yuasa has continually created advanced stored energy solutions under the philosophy of 'innovation and growth' and established itself as the number one choice for vehicle and industrial batteries. The battery manufacturer's award-winning products, service and supply lead the industry and continue to set new standards of customer care, quality, choice and year-round availability.

From sales and distribution centres in the UK, Italy, Spain, France and Germany, GS Yuasa supplies European markets with an extensive range of high-quality energy storage and network stabilisation solutions.

GS Yuasa offers a wide variety of market-leading valve regulated lead acid battery ranges including FXH, SWL, EN and ENL types, as well as innovative lithium-ion modules. These batteries are trusted by technicians for their quality, reliability and performance, and are used in an extensive range of industrial applications including uninterruptible power supply, fire and security and telecoms.

With a dedicated team of specialist engineers and technicians, GS Yuasa's experts are on-hand to provide support and advice to thousands of GS Yuasa users each year. Furthermore, GS Yuasa Battery Manufacturing UK Ltd is a large state-of-the-art manufacturing facility in Ebbw Vale, Wales, UK. Production began at the site in 1981, manufacturing Yuasa NPL, EN, ENL, and SWL battery ranges with well over 85 million batteries being produced since the factory opened.

Mark Greer, general sales manager, Reserve and Renewable Power Division at GS Yuasa Battery Sales UK is looking forward to being part of the awards, commenting, "The Electrical Review Excellence Awards showcase the very best of the industry. We are proud to be entertainment sponsors for the 2020 event and very much looking forward to seeing which companies are recognised with these prestigious awards.

"As Europe's leading manufacturer of industrial batteries for over 35 years, Yuasa batteries are trusted in countless UPS installations and other industrial applications. They are used in deep sea submarines, the International Space Station and a wide range of applications in between. We work with our customers to provide the optimum standby solution for their individual project from planning through to installation.

> **"The Electrical Review Excellence Awards showcase the very best of the industry"**

"The event is a fantastic opportunity to network with all the major players in the industrial market. With the awards being a great success in 2019, we are looking forward to seeing what 2020 will bring. It's been an outstanding year for the electrical sector, so we are excited to see who has achieved each award and celebrate the success with everyone on what is sure to be an excellent evening."

www.yuasa.com

How to get involved

We at Electrical Review and Data Centre Review are delighted to be hosting the Excellence Awards again in 2020.

The positive reception to these Awards so far from entrants, sponsors and readers alike proves that there are plenty of products and projects out there which deserve recognition.

Equally, it is our pleasure to highlight the people who work tirelessly behind the scenes across the industry, to innovate and set ever higher standards that others can look up to.

This is why we look forward to receiving entries for the 2020 Awards welcoming the industry on 21 May 2020 in London.

Entering the Awards is free via our website www.electricalreview.co.uk/awards where you can also learn more about the awards categories, the judges, as well as last year's winners should you need some inspiration. Also make sure to check back regularly for sponsorship updates and confirmation of our 2020 venue.

We also have a few sponsorship opportunities remaining – so if you are an electrical or data centre organisation with excellence at the heart of your values, then being involved is a great opportunity to reward your team and clients, and network for future business.

For sponsorship enquiries or further information please contact Sunny Nehru sunnyn@sjpbusinessmedia.com 07741 911296 or Amanda McCreddie amanda@electricalreview.co.uk 07741 911314

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- ✓ Top-down design
- ✓ Process bus
- ✓ Remote monitoring and testing
- ✓ Cybersecurity
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Event highlights include:
- ✓ Case study programme
- ✓ Utility heavy speaker line-up
- ✓ Roundtable discussions
- ✓ Fundamentals workshop
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- ✓ Solution Zone
- ✓ Live demo labs
- ✓ Evening networking reception

20+ Utility case studies including:

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10% Discount
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www.smartgrid-forums.com/IEC19ERMA

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Accelerating the mass roll-out of digital substations to maximise grid visibility, reliability and security

In-depth insights on:
- ✓ Digital Substation Refurbishment
- ✓ Substation Design & System Architecture
- ✓ Operation & Maintenance
- ✓ Advanced Data Analytics
- ✓ Cybersecurity
- ✓ Competency Management

Event highlights include:
- ✓ Case study programme
- ✓ Tutorial on AI & ML
- ✓ Technology innovation panel
- ✓ Roundtable discussions
- ✓ Networking evening reception

20+ Utility case studies including:

SP ENERGY NETWORKS, sse, enel, VATTENFALL, UK Power Networks, fluvius, innogy, swissgrid, Eletrobras Eletrosul, edp, STEDIN, e·on

10% Discount
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Use Promo Code **DIG-19-MEDIA-ER** when registering online

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www.smartgrid-forums.com/DIG19ERMA

Time to fess up

With a potential energy theft amnesty from Ofgem currently on the horizon, Lloyd Birkhead, group managing director at Grosvenor Services Group, part of Echo Managed Services, questions whether it's really the lightbulb moment they think it is.

A new initiative is being considered by Ofgem, in which UK consumers can own up – risk free – to breaking the law by stealing energy through a tampered meter.

Energy theft is a serious crime, but one that often goes under the radar. Last year alone, the practice injured or killed at least one person every 10 days through electric shocks, burns or even street-wide gas explosions. And it's not only a danger to the community; meter tampering also costs the UK economy almost £500 million annually and adds around £20 to every household's bill.

However, last year, despite 150,000 cases being investigated, only around 1,500 people were charged.

During the proposed 'Energy Theft Amnesty', which would take place during a fixed and limited period of time, energy thieves would neither be prosecuted, fined nor back-billed for committing the crime. Their meter would be made safe by an engineer and they would simply "get away with it." The sentence would normally be up to five years in prison.

A PUBLIC SPLIT

It's a polarising issue. That much was evident when we surveyed 1,000 UK

billpayers on their attitudes towards the proposed amnesty. When provided basic information regarding energy theft and asked their opinion on the matter, an average of 58% of people stated they would be in favour of the process. Following this, respondents were made aware of some of the benefits and drawbacks of an amnesty. When asked their opinion again, the total number of those in favour dropped to 52%.

We also questioned respondents on whether they would be in favour of a knife amnesty, such as that carried out by the government in March 2019. More than eight in 10 (85%) people said that they were in favour of this action.

All of this suggests that UK residents are not just uninformed about the potentially life-threatening consequences and financial implications of energy theft, but that many still do not perceive them as high-risk.

Even when survey respondents were informed of the dangers, there was still not an overwhelming majority in favour of an amnesty – despite the very real threat that the practice presents.

Our findings also suggested that the public is in favour of action generally, but only when it has a tangible, full and direct appreciation of the dangers at stake. The risk posed by dangerous weapons and violent crime is – rightfully – well-reported and well-understood, which helps to explain why 85% of people would approve of a knife amnesty. The dangers of energy theft, meanwhile, are not universally understood.

Let's look in more depth at the key issues surrounding an energy theft amnesty and the implications for UK energy companies if it were to go ahead.

SAFETY – THE MOST IMPORTANT OUTCOME?

As with a knife amnesty, the driving force behind such a large-scale initiative is to make communities safer. Fewer tampered meters equates to a smaller chance of potentially fatal injuries taking place in UK homes.

Those who are most likely to come forward will be those who are not hardened criminals. It may be that they simply didn't understand safety implications, or could have been going through temporary financial hardship and saw meter tampering as a quick fix.

Furthermore, given that consumer awareness around energy theft is generally low (our previous study showed that 39% of people are ignorant of the safety risks) a UK-wide amnesty would provide the issue with a much-needed profile boost. Marketing campaigns – delivered through bill-based messaging, TV or social media, for example, would create impact in the public consciousness. In turn, this would raise awareness of the dangers and create a ripple effect whereby tampers are more likely to be spotted and solved.

> **Meter tampering costs the UK economy almost £500 million annually and adds around £20 to every household's bill**

Taking the above into account, then, surely we should prioritise action to make properties safe above all else?

In reality, it's not so clear cut. Firstly, despite good intentions, where energy theft amnesties have taken place elsewhere – for example, in Northern Ireland – uptake has been relatively low, with only a handful of people coming forward. There is therefore a danger that efforts from suppliers and Ofgem would ultimately count for nothing.

It's also important to recognise the resourcing and financial burden that such a proposal could place on energy companies – many of which will already be stretched to their limit in aiming to meet the government's current smart meter installation targets. If consumers came forward in their thousands, would the sector be able to cope with servicing what would be many urgent priority cases within a few days? What's more, with backdated energy charges written off, suppliers could also stand to lose millions – a destabilising amount, especially for newer entrants to the market.

There is also the question of fairness and the simple notion of "right and wrong." A backlash from law-abiding citizens who have paid for their energy seems highly likely; as does the potential for an amnesty driving longer term criminal activity. By publicising that there are no repercussions for those who have committed a crime, could the industry inadvertently encourage others to tamper with their meters in future, without fear of prosecution? This would ultimately devalue what energy suppliers are trying to achieve in the long term.

WHERE NOW?

Clearly, there is a plethora of benefits and disadvantages when it comes to the potential implementation of an energy theft amnesty. The regulator will undoubtedly be weighing up the benefits and drawbacks of this decision in the coming months – so it will be interesting to see whether the process is driven forward.

It's something that the UK Revenue Protection Association (UKRPA) will also be focusing on, stating that it "plans to work closely with its members and Ofgem to thoroughly consider the pros and cons of any proposed initiative in this area. The ongoing focus on customer safety remains of paramount importance."

Above all, the sector must work harder to educate communities on the potentially-fatal risks that meter tampering can present if an energy theft amnesty is to garner public support and be successful in future. ER

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Room for improvement

With the subject of climate change now hotter than ever (pun intended), are utility companies doing enough to improve sustainability? Love Energy Savings is here to answer that question and gives us an insight into what the future holds for the consumer.

This summer was one that put climate change at the forefront of everyone's minds. In July, the world experienced the hottest month in recorded history. Temperatures topping 40°C swept through Europe, setting all-time heat records in several countries, and Greenland lost a staggering 200 billion tons of ice – three times the summer monthly average.

With the climate crisis worsening, companies can no longer afford to live in denial. Energy and utility companies face particularly intense scrutiny. Their position as producers and suppliers of energy requires accountability, and as more and more consumers wake up to the need for ethical practice in power production, they risk losing customers if they fail to act.

The good news is that many utility companies are in fact doing their part to help reduce emissions — and it's never been easier for consumers to go green.

WHAT ARE SUPPLIERS DOING ALREADY?

One of the key ways suppliers are helping consumers be more sustainable is offering 'green tariffs' to their customers. On a green tariff, suppliers promise to match some or all of the electricity consumers use with energy from renewable sources. In the UK, this energy is most often sourced from solar and wind power.

> **Experts predict that green energy will be cheaper than fossil fuels by 2020**

Many suppliers have increased investment in green energy production to make their regular tariffs more environmentally friendly. The amount of renewable energy these suppliers generate depends on environmental factors and the demand on the network, which means your tariff might not be 100% green all year round.

Some suppliers offer specific green energy tariffs, which guarantee your electricity or gas is generated from 100% renewable energy at all times. These tariffs are usually offered by specialist green suppliers, who tend to be smaller independent companies.

However, not all 'green' suppliers are 100% renewable quite yet. It's important for environmentally conscious consumers to check the fuel mix of their supplier – that is, how much of the electricity they produce is from sustainable sources and how much is not. It's a legal requirement for energy suppliers to publish their fuel mix. Most will share these details online.

Some larger suppliers are also leading ▶

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by example in the way they themselves use energy. A few large established energy providers have promised to purge petrol and diesel from their fleets by switching to exclusively electric vehicles by 2030.

WHAT DOES THE FUTURE LOOK LIKE FOR CONSUMERS?

While green energy might have been more expensive than a regular tariff in the past, a lot has changed. Today, many renewable electricity providers can match the prices you might be paying currently because renewables are becoming cheaper to manufacture thanks to EU subsidies.

Energy could become cheaper overall if the UK successfully migrates to a more sustainable model. Experts predict that green energy will be cheaper than fossil fuels by 2020. The International Renewable Energy Agency (IREA) estimates that energy produced by onshore wind and solar photovoltaic projects will cost as little as 2p per kWh, far less than today's average cost of around 15p per kWh.

COULD ENERGY COMPANIES BE DOING BETTER?

While there are many steps being taken to make renewables the de-facto option for UK households and businesses, there is still some way to go.

Currently, only 25% of the electricity in the National Grid comes from renewable green sources. This includes power generated on wind farms, by solar panels, and on hydroelectric power plants. The rest of the National Grid's energy is generated in nuclear power plants or by burning fossil fuels.

> **Energy could become cheaper overall if the UK successfully migrates to a more sustainable model**

Moreover, some of the UK's biggest energy firms have been accused of failing to tackle the climate crisis by withholding support for a legally binding EU emissions target, despite backing the plans publicly. The failure to agree to the new goal has made them the target of accusations that they might be 'greenwashing' their agenda – that is, making themselves seem more supportive of climate action than they are.

The good news is that in June this year, the UK became the first major economy to put into law plans to cut carbon emissions to net-zero by 2050. Under these new laws, energy firms that fail to do their part in reducing emissions will come under greater pressure to take action from the government, who have the legislative power to drive change by mandate.

"We're at the point now where the benefits of going green – even from a commercial perspective – far outweigh the costs," comments Phil Foster, CEO at energy specialists Love Energy Savings. "With new UK laws putting pressure on suppliers, the ethical providers are rising to the top and consumers are taking notice.

"I'm hopeful that bigger suppliers will follow the lead of more progressive independents who have typically led the green energy revolution, and the resulting increased competition benefits customers, domestic and business alike." ER

Is your desk in an old banger of a building?

"Baby you can drive my car," sang The Beatles back in 1965 when cars were very different. It is easy to see how car technology has evolved since then but have commercial buildings kept pace too? Terry Sharp, vice-president of the Building Controls Industry Association (BCIA), believes we should demand more from our places of work in the same way that we expect certain features as standard on a modern car.

The Aston Martin DB5 tops many petrolheads' "dream car" lists. Its classic look has taken on iconic status ever since Sean Connery's James Bond was first introduced to his new, gadget-laden set of wheels in Goldfinger way back in 1964. There are many cars from bygone eras that remain favourites to this day, such as the E-Type Jaguar, the Lotus 7 and the AC Cobra, and original models still fetch huge sums at auction. However, as good as they are to look at, none of them are likely to function, drive or be as comfortable as a modern, standard family saloon.

Technology has progressed in recent times and features that were once perhaps only special additions on a vehicle have become standard on many models.

Features we now take for granted include: Automatic climate control (inc. fan speed and heating/cooling/air-conditioning/pollen filtration), cruise control, electronic engine management systems, automatic rain detecting windscreen wipers, and reversing bleepers. These are no longer just for top-end luxury models, and most cars these days have comfort and efficiency systems.

We are fed data for performance, range, outside temperatures and even our tyre pressures are monitored. Technology pushes further, of course; adaptive cruise control and automatic lane-keeping steering is available and soon driverless cars will be here too.

Windscreens don't haze with condensation anymore, and airbags, auto tension seat restraints and crumple zones all contribute to our safe passage. Engine management systems and technology has contributed to improved speeds and efficiencies, while electric cars further enhance energy harvesting from brakes and down-hill free-wheeling.

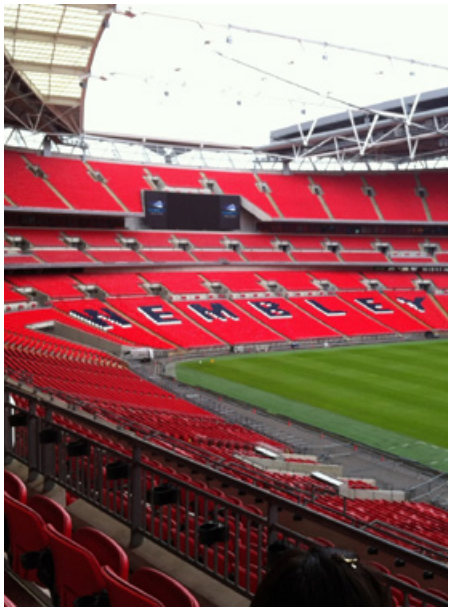
Anyone lucky or rich enough to own one of the classic cars mentioned earlier is very unlikely to use it as their "everyday" car, in many cases the car might not even make it out of the garage at all. For regular driving and commuting, drivers want comfort, reliability, safety and practicality – things that very few, if any, classic sports cars can offer.

With this in mind, it does seem odd that we don't always have the same attitude towards the buildings we work in. For decades it has more or less been taken for granted by employers that their staff will work in whatever building the company is based in, whether it's a historic listed building, a mobile hut or a city skyscraper.

EXPECT MORE

But in the 21st century, with all the technology available to us, should we not expect more from the buildings we occupy? Or are we just content to sit at our desk in a building that is the equivalent to an old banger?

Some historic buildings are replaced completely in order to adapt to modern demands. Sports stadia are a prime example of this. The old Wembley Stadium was considered a national treasure, particularly among traditionalist football supporters from around the world. It enjoyed unofficial status as the "home of football" since it opened in 1923, but its trademark twin towers and decades of history counted for little as it fell further and further behind multifunctional stadia designed for the 21st century. The new stadium, opened in 2007, is not to everybody's liking aesthetically, but, complete with its retractable roof, it provides a venue suited to the needs of a



range of activities, from sport and music to catering and exhibitions.

While cars have evolved from being essentially boxes with four wheels and an engine to advanced, accessory-laden machines, buildings have been left trailing in the way we make use of the technology available to us. Some advancements in the automotive industry, such as the development of hybrid and

> **Buildings account for over 40% of the world's energy consumption**

electric cars, have of course been driven by environmental concern and now, the building industry is beginning to follow suit.

Buildings account for over 40% of the world's energy consumption, but the introduction of the Minimum Energy Performance Standard (MEPS) in April 2018 means the building industry is now falling into line. The government's target is for the commercial property sector to be achieving a minimum EPC band of C by 2030 in the battle against climate change. Many might argue that the building industry has been too slow to address the issue, and the recent climate change protests, whether you agree with their methods or not, have certainly put many industries, including ours, under more scrutiny than ever before.

EMPTY SHELLS

In the past, buildings may have been viewed purely as empty shells to keep us warm and dry, but modern technology raises their potential to be so much more – and building owners who take advantage will reap the benefits. We have the technology to drastically reduce emissions from buildings and this, in turn, will enable us to convert existing buildings into living, working structures that will meet today's environmental emissions targets.

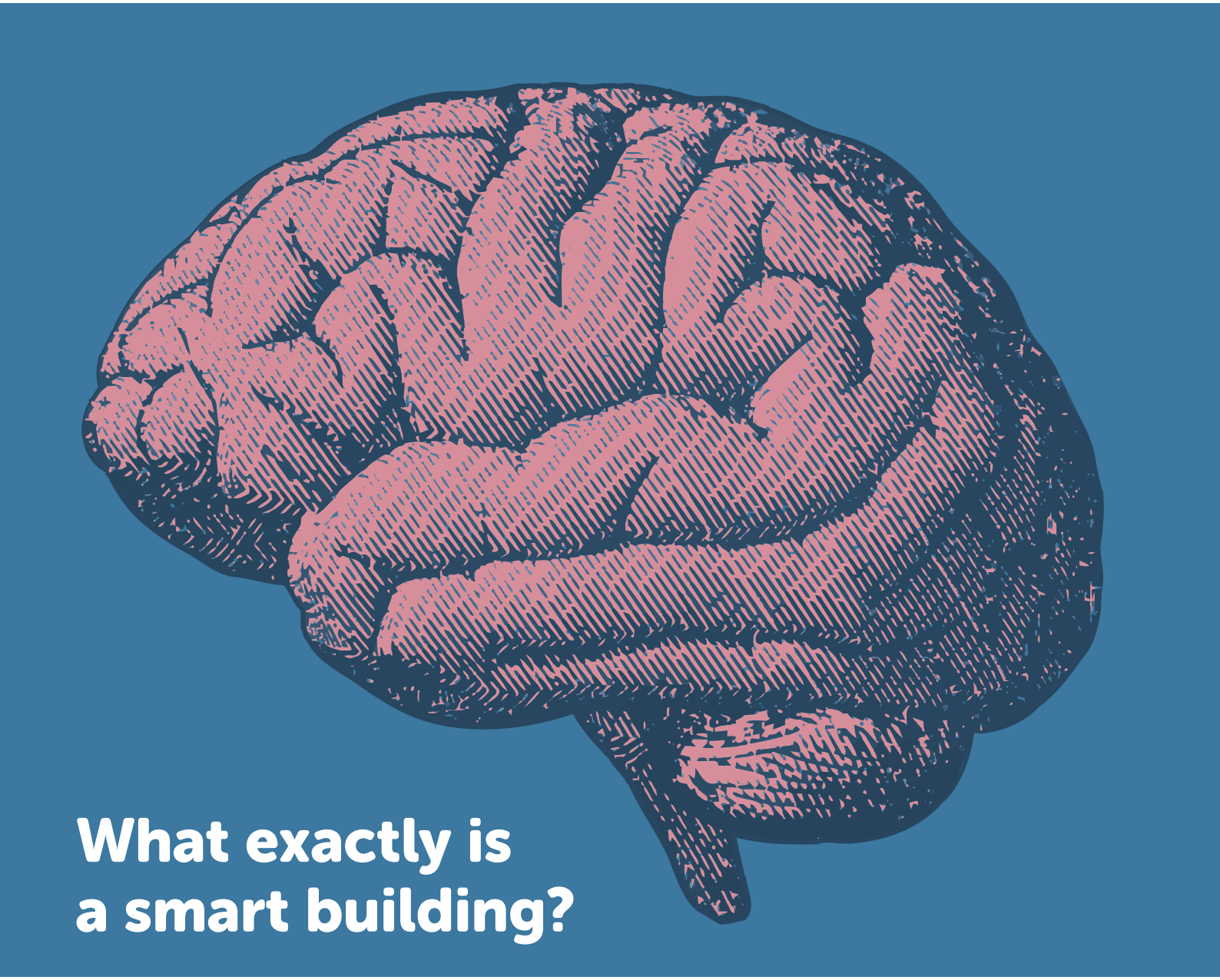
A 2016 study by global research firm Ipsos, on behalf of Steelcase, found that UK workers are the least satisfied with their office ambience, with 33% of workers saying they don't like their office environment, suffering from a lack of control over making it suit their needs. Nearly half (45%) of UK workers are dissatisfied with the room temperature at work, and 32% are unhappy with the light intensity. Only 39% of respondents said they could adjust the office temperature, and only 21% were able to alter the lighting.

These factors could have a serious detrimental effect on the concentration, productivity and engagement levels of workers, with the study showing that a lack of flexibility and control over the physical work environment correlates with a lack of engagement. In contrast, highly engaged employees are those that have the most flexibility over how and where they work.

GREATER CONTROL

Installing a Building Energy Management System (BEMS) not only helps a building manager increase their building's energy efficiency, it also gives the building's tenants greater control over their working environment. Individual regulation of room temperature using window contacts, daylight-dependent lighting and building automation systems adapted to customer requirements can all contribute towards conserving energy.

So, if your office was a car, would it pass its MOT or fail on the emissions target? Those of us who spend 30 hours a week or more in the same place of work should expect a healthy working environment – and a well-managed building will produce a happier, healthier and more productive workforce. ER



What exactly is a smart building?

Karl Walker, market development manager at Beckhoff, explains why the term "smart building" may greatly vary in meaning, depending on who you ask.

The proliferation of domestic Internet of Things (IoT) devices, such as smart meters, smart lighting and smart thermostats, has led to some misunderstanding of the phrase "smart building" in the truest sense of the word.

Depending on who you ask, a smart building could be anything from a modern high-rise office building with multi-functional, interactive control panels to a professional footballer's house boasting state-of-the-art audio-visual and security systems controlled from a smartphone app.

The Construction Innovation Hub's 'Smart Buildings Project', a consortium of the BRE (Building Research Establishment), the MTC (Manufacturing Technology Centre) and CDBB (Centre for Digital Built Britain), describes a smart building as follows:

"A smart building should be intelligent, sustainable, secure, adaptive and occupant-centred in its design, construction, operation and integration with other smart infrastructure within the built environment. It has a passive environmental design with digitally changeable characteristics that react, learn and predict any alterations within its internal and external environment."

"SMART" DEVICES

A smart meter in the home doesn't actually save energy on its own – but it can provide the user with information that might allow them to adapt their way of living to use

less energy. A smart lightbulb that you can control from your phone can still be left on all day, and there is no point in having a smart thermostat that controls the temperature throughout an entire house if, say, two of the four bedrooms are rarely used. A truly smart building can therefore only be achieved when it has a controlling infrastructure behind the devices and software to analyse all the data they produce.

In reality, a building should only really be considered smart if it is performing the functions the end user wants it to perform efficiently and with minimal input from the user – and the desired functions of a smart building will vary from user to user. Measurement and control to a highly granular level is always the best strategy. In a domestic environment, this might mean having independent control of temperature and ventilation in each room.

For example, a lightbulb that can be controlled from a phone is not really going to appeal to a social housing tenant experiencing fuel poverty, where a convenient, comfortable service offering lower energy costs will be of utmost importance. A tenant of a private rented sector (PRS) development in the city, on the other hand, is more likely to enjoy the full interactive experience with less concern about energy costs.

Smart technology can be used by housing authorities to ensure that their property isn't being abused by the tenant (e.g. damage from condensation where an extractor fan isn't being switched on in areas of high humidity such as kitchens and bathrooms) and also to ensure that assets are working correctly and have been correctly maintained (e.g. boilers or emergency lighting systems). This has taken on greater importance since the publication of the Hackett Report in the wake of the Grenfell Tower disaster.

> **A building should only really be considered smart if it is performing the functions the end user wants it to perform, efficiently and with minimal input**

In the commercial sector, energy efficient smart working environments are viewed as a way to attract and retain the best workforce, and indoor air quality (IAQ) has become a major factor for healthy workplaces. This means commercial landlords are able to set premium rental rates for tenants looking for a healthier, more comfortable working environment.

BUILDING PERFORMANCE

Designers, consultants and construction companies need to be able to monitor and understand the performance of buildings (e.g. the thermal performance of the building's envelope), the factors affecting actual energy performance vs. modelled, and the effects of changing the layout of buildings to adapt to the ever-evolving patterns of working life (e.g., through the monitoring of people's movements through the building, which record occupancy patterns that reveal how spaces are used).

The requirements of the users of buildings are unlikely to be considered by the main contractor during the construction phase and there is no way of knowing how that building will be eventually used. Most smart control is implemented retrospectively, attempting to use existing disparate control hardware. The installation of additional sensors and convergence of systems into one centralised system or cloud-based platform, has been made easier by wireless technologies and IoT devices.

SENSORS MAKE SENSE

The key to ensuring your smart building achieves what you want is to use data – lots of it! Through the combination of data within existing building control systems and that of additional sensors, knowledge can be generated by software systems, which could include analysis of historic data using machine learning and other artificial intelligence algorithms.

Therefore, the more sensors you have in the building, the better. For effective predictive maintenance, most likely required by the likes of building/facilities managers, data needs to be captured from all sensors and controllers throughout the building or estate and consolidated onto a single platform. The environment can then be accurately controlled according to the needs of the occupiers, and recommendations can be generated that can be operationalised and turned into work orders for facilities managers.

As evidenced above, a smart building can now relate to much more than just a building's energy efficiency. A modern smart building will be easy to manage, it will run efficiently, be adaptable to future changes and ensure a comfortable environment for its occupants. ER

Kiss from a rose

It all started with one man and an idea. An idea so simple (and brilliant) that it was assumed it had already been done. But, after much hard-work and perseverance, the world's first BS67 smart ceiling rose was born. Having already received many accolades, as well as scooping 'Lighting Product of the Year' at our very own ER Excellence Awards this May, here we tell the story of Adaptarose's Moni Razzaque as we explore how he turned the ordinary into the innovative.

A common and unassuming sight in millions of homes across the globe, the humble ceiling rose has remained unchanged since Thomas Edison first patented the light bulb in 1879 – until now.

Lights left on in unoccupied spaces is a bad habit many of us are guilty of, and unfortunately carries a significant impact on our carbon emissions.

Typically, a traditional ceiling rose requires the operation of a wall switch to switch lights on or off. The smart ceiling rose, however, brainchild of Chartered Building Services Engineer (CIBSE) Moni Razzaque, switches lights automatically by overriding the wall switch.

A specialist in electrical engineering, Moni became fed up with his children always leaving lights on in his house – a common problem shared by many parents. Before Moni came up with his idea, he visited several hardware stores in search of something that would switch the lights off automatically to mitigate this problem.

He discovered that he could not find anything that would avoid rewiring, builders work and maintenance. So instead, he found himself improvising by cannibalising a PIR sensor from an outdoor patio light and rewiring its control facility back into a standard ceiling rose. With no pun intended, that was when he had his light bulb moment.

Despite the unsightly appearance of the crudely assembled device, Moni knew he had constructed an early prototype of the device he wanted. If used as a replacement ceiling rose in a retrofit, Moni's creation would require no rewiring or builders work, and better still, once installed, would remain maintenance free.

(SURELY) IT'S BEEN DONE BEFORE?

Confident he had stumbled onto a good thing, with much trepidation, Moni tabled his device complete with dangling wires in front of Les Norman, principal lecturer at London South Bank University (LSBU) and asked him for his opinion. Les Norman's first remarks were, that the idea was so obvious he should check his invention with the patent office at the British Library IP office before wasting any more time.

> **It is clear that any hallway or landing is unoccupied far more time than it is occupied – and this is the potential of the savings for many homes**

He also suggested in the unlikely event it had not been patented, he could consider approaching the Carbon Trust for support to develop the idea further. Les Norman's last piece of advice to Moni was to make sure any future patent should only be written by a patent lawyer.

So at Norman's behest, Moni visited the Intellectual Property department at the British Library and met with information expert, Maria Lampert. Maria undertook a patent search lasting several weeks. Once she had completed her patent search, she called Moni back to the library and arranged for him to collect several folders containing all her findings.

Maria explained the documentation would normally be used by a patent lawyer should he decide to seek a patent. Those who had already seen the early prototype and shared the view that this was an obvious invention, were astonished to discover that in fact there was no UK patent for improving the BS67 ceiling rose. Armed with this information, Moni took heed of Les Norman's advice and approached LondonIP, a patent attorney firm that worked closely with the patent office at the British Library to write the patent.

It took LondonIP several months of preparation before they could file a UK patent application titled, '*Apparatus for improved ceiling roses*'. Once the patent was filed, Moni approached the Carbon Trust and discovered they had an Entrepreneurs Fast Track (EFT) programme, designed to help entrepreneurs by incubating and investing in low carbon solutions.

TESTING, TESTING

To be eligible for this programme, Dave Raval former head of the EFT programme and current CEO of LoftZone, required Moni demonstrate that his invention could provide evidence of carbon reduction. To meet this requirement, he agreed with the Carbon Trust that he would provide evidence by conducting a field trial in his own home and then have the results independently validated by London South Bank University.

For the field trial Moni already had the perfect location in mind. This was the exact location that had inspired him to think about a solution in the first place: a section of corridor between his children's bedrooms.

By connecting a data logger to an existing ceiling rose, he gathered a months' worth of data before replacing it with his device. The actual energy saving in this location was staggering. In his first ever field trial he identified a saving of up to 173%. ▶

Smart ceiling rose fully functional 3D printed prototype

He then submitted his data to LSBU for independent validation. The LSBU technical report concluded that whilst they did not doubt the data submitted by Moni, he had failed to explore the full potential of savings that could be achieved with the use of this smart ceiling rose.

The LSBU technical report raised an interesting question by asking readers of their report to ask themselves the following question: 'In a transitory area of my home – say a hallway or a landing – how much time during the evening do I (or one of my family), actually walk through this hallway.'

Stop to think about the answer to that question yourself, and it is clear that any hallway or landing is unoccupied far more time than it is occupied – and this, is the potential of the savings for many homes.

MAKING PROGRESS

In 2013 Moni was formally accepted into the Carbon Trusts EFT programme. For the following six months, the Carbon Trust commissioned various marketing studies. By the time the studies were complete, all the signs for the smart ceiling rose were clear. There was now overwhelming mounting evidence the low-cost solution with the smart ceiling rose could present a simple and practical opportunity for consumers to stop wasting energy and reduce utility bills.

A national Consumer Survey with 6,000 respondents stated 83% of consumers would have a propensity to purchase the device. If sold at a suitable Recommended Retail Price (RRP) of £29.99, the device would sell like smoke detectors. At this point, it was obvious the smart ceiling rose had retail opportunity potential.

A SPANNER IN THE WORKS

Just as Moni entered talks with the Carbon Trust to build the first prototype through matched funding, public sector cuts forced the Carbon Trust to terminate the EFT programme.

By now Moni was anxious to build a prototype, and after approaching a few companies (who were charging several thousand pounds to build a single prototype) he knew a single prototype would not be enough, as at some stage, there would need to be a field trial.

Feeling deflated, Moni returned to Les Norman at LSBU for guidance. Norman suggested he could still build his prototype if he was prepared to fund it as a product design student's final year project.

Moni agreed to the suggestion and LSBU introduced Moni to Miguel Ricciolini, a final year undergraduate. Together, over a period of nine months, Moni and Miguel designed and built the first fully functional 3D printed prototype and many others besides in anticipation of a field trial.

"The local authority did instruct Moni to remove his devices at the end of the field trial, but not one single volunteer household was willing to part with any of the smart ceiling roses"

POWER TO THE PEOPLE

Eager to field trial the fully functional working prototypes, Moni approached his former local MP Heidi Alexander, who is currently deputy mayor of London. He made the offer of a free trial with volunteer households in the London Borough of Lewisham.

Heidi introduced Moni to Martin O'Brien, the sustainable resources group manager for the borough. Martin helped identify volunteer households from a list of householders who had lost out on a building insulation project due to insufficient funding.

For the field trial to proceed, Moni agreed to pay for the electrician's costs and liability insurance. As a gesture of goodwill, the London Borough of Lewisham provided the data logging equipment like the one Moni had used earlier in his own home.

Each volunteer household was measured for a period without the devices and then remeasured after equipping each house with as many devices as possible. The local authority did instruct Moni to remove his devices at the end of the field trial, but surprisingly, not one single volunteer household was willing to part with any of the smart ceiling roses.

POSITIVE POTENTIAL

At the end of the field trial, Moni met with Miguel's tutor Dr. Deborah Andrews from the LSBU Department of Engineering to analyse the data collected. Dr. Andrews, upon analysing the data, wrote a paper titled, '*The design, development and testing of a bespoke ceiling rose motion sensor for use in domestic properties*.'

In the paper, she deduced that the general trend was very positive, and calculated an average summer household energy saving of up to 4.3%. The paper recommended more extensive testing with more participants over a year would be beneficial; nevertheless, the potential energy saving benefits of the product had been identified.

In the five years it has taken to design, develop and test the prototype, Moni's notable achievements to date include being recognised as a 2014 London Leader by the London Sustainable Development Commission (LSDC). The smart ceiling rose was also a finalist at the 2014 CIBSE Building Performance Awards under the Energy Saving Products category, and most recently won Lighting Product of the Year via an independent judging panel at the 2019 ER Excellence Awards.

When attending such awards, Moni said he felt like a 'minnow in the electrical manufacturing industry', but proud to be able to share a platform with other major manufacturers in the same category. But Moni certainly shouldn't sell himself short, as thanks to his perseverance and faith in his invention, he has proven undoubtedly that when it comes to securing success, you don't have to be the biggest fish in the pond. ER

The smart revolution is happening
Are you ready?

Smart technology makes people's lives easier; it ensures businesses work more efficiently and it helps combat climate change. Now's the time for contractors to get smart about smart homes (and commercial spaces) and the vast opportunities the connected living market brings, says CEF.

Connected living is increasingly seen as the answer to people's busy lifestyles. Demand for devices that can talk to one another and be controlled remotely is on the up. According to YouGov, almost a quarter (23%) of Britons now own one or more smart home devices, while one in 10 (8%) now have two or more.

Controlling your heating, lighting and home security through a smartphone or tablet is now the norm and consumers' expectations of their devices will only grow. In fact, analysts at PWC have revealed that £10.8bn will be spent on smart devices in the UK in 2019 alone, with 40% of device owners expecting to upgrade within two years.

Andrew Moseley, CEF's commercial director comments, "Over the last six months we have seen a real upturn in the demand for "smart" devices. Connected living solutions are undeniably growing very fast, and we are now starting to see recognised brands introduce products for the commercial market."

This matches contractors' expectations, as a recent survey by a leading industry body found that 95% of the contractors surveyed believe smart home installations will continue to rise. However, despite this, 66% of respondents said they do not or rarely undertake smart home installations, highlighting just how much potential there is for more electricians to take advantage of this growth area.

Manufacturers are working hard to reduce the complexity of smart technology and simplify the user experience, making it more accessible for all kinds of consumers – including technophobes. With more products entering the market, connected living is no longer an expensive dream but an affordable reality that contractors can bring to their customers.

GROWTH DRIVERS AND WHAT IT MEANS FOR CONTRACTORS

Much of the growth in smart technology comes from the smart security market, with demand for smart surveillance and door locks rising significantly. According to techUK, 37% of consumers see security as the biggest benefit of smart home technology. Given that cameras and smart home security generally requires a professional installation, this is excellent news for the trade sector.

Smart heating and smart entertainment are also driving growth, with PwC reporting that around 39% of consumers are introduced to

smart technology via smart entertainment systems, such as smart TVs.

Lighting is another area with significant potential. Lighting design for impact and effect is commonplace in commercial environments and the introduction of smart, connected lamps and luminaires is set to revolutionise how lighting is installed and used in domestic properties. More than 30% of households believe they are likely to own smart heating, lighting and security services in five years' time, as suggested by research conducted by EY.

Despite the specialist nature of the technology involved, only half of respondents to the aforementioned survey had undertaken formal training in fitting smart devices. Instead, many contractors choose to test devices in their own homes before installing them for clients. Whilst the leading industry body doesn't criticise this approach, it does recommend that contractors invest in some formal training – plenty of which is available to suit all budgets.

THE SMART WAY TO COMBAT CLIMATE CHANGE

The benefits of connected living go beyond just convenience; smart technology also has a major environmental role to play. The UK Government's smart meter rollout requires energy companies to install smart meters in all homes and small businesses by the end of 2020. By encouraging consumers to monitor their energy usage, it's hoped they'll make their homes more efficient too – helping the Government meet its greenhouse emission targets.

Energy efficiency is a huge benefit of smart installations that should not be overlooked. As consumers – particularly younger generations – become more environmentally conscious, they're looking for new ways to make their properties more energy efficient. Contractors have an opportunity to recommend solutions to these consumers, such as remote lighting and heating, which help them avoid waste by being able to turn appliances on or off, up or down, from anywhere.

> **Almost a quarter (23%) of Britons now own one or more smart home devices, while one in 10 (8%) now have two or more**

HOW SMART TECHNOLOGY WORKS

Smart homes vary in their complexity. At the simpler end of the spectrum they're put together using plug-in modules and household wiring and, at the more sophisticated end, they involve wireless systems that are programmed over the internet.

X-10 smart home automation systems use ordinary household electricity wiring to switch multiple appliances on and off without the need for extra cables to be fitted. This approach uses household wiring like it's a computer network.

For the more advanced approach to smart tech, wireless connectivity is the answer. X-10 and RF lets you switch on devices at particular times, but a wireless system allows you to use a cloud-based system to control devices remotely.

As for wired technologies, in larger homes and commercial properties, CAT5/CAT6 systems such as Smart Home Head Ends (SHHE) are typically used. Due to the complicated, large-scale nature of these jobs, it's recommended that contractors undertake training before installing these systems.

KEY PRODUCTS FOR THE SMARTER HOME AND OFFICE

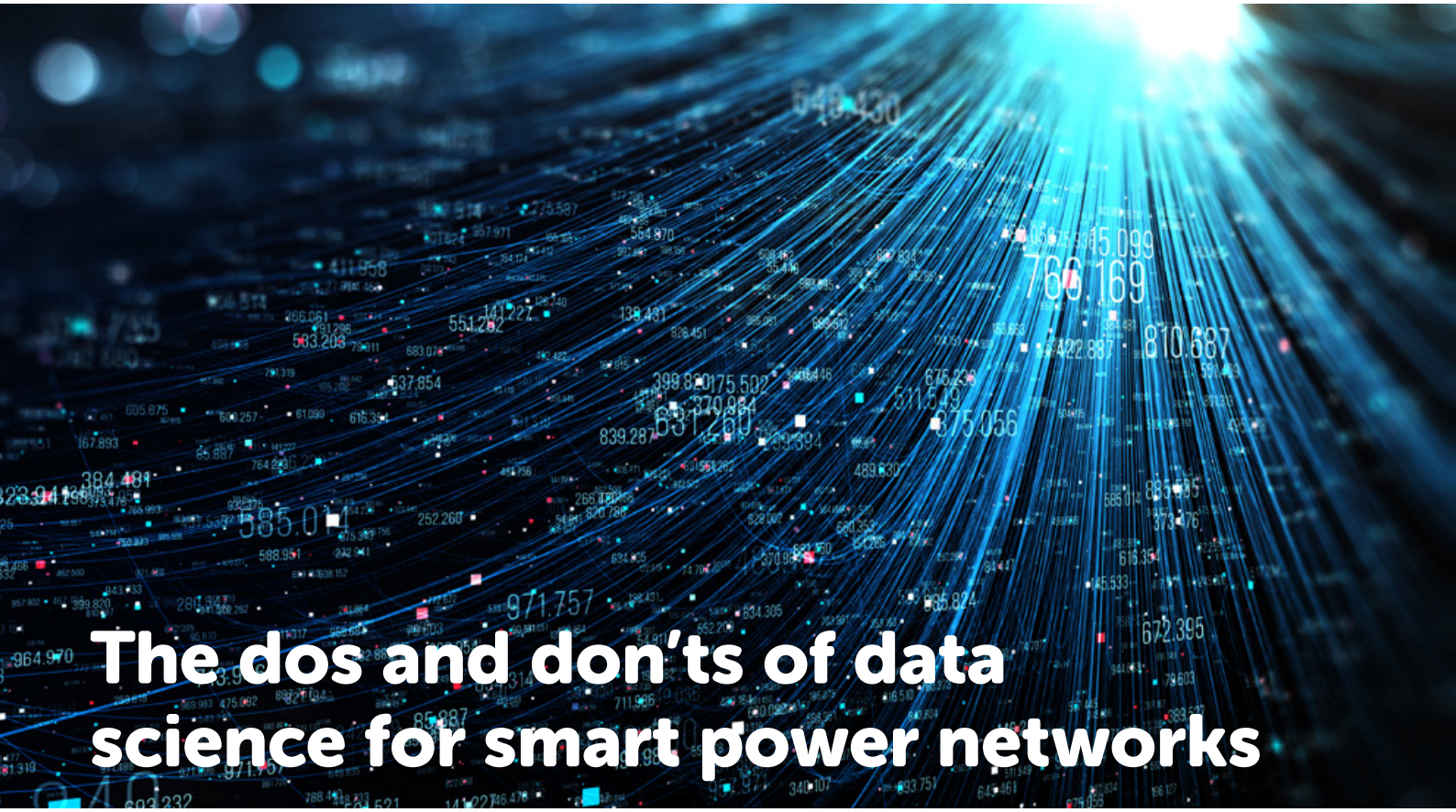
With such a range of smart products available, knowing where to start and what to recommend can feel daunting. Thankfully, you can categorise smart technology products as you would ordinary ones – for example, smart lighting, smart electrical, smart heating, smart security, smart entertainment and even smart bathrooms.

When it comes to installing smart products, start by talking to your customers about their needs and budget, as you would for any other job. Then, consider whether it's a new build property, in which case wiring should be straightforward, or an older property, which may benefit from wireless technology only (e.g. Wi-Fi), so as not to disturb the fabric of the building.

CONCLUSION

The demand for smart technology is here and it's growing. Consumers understand that the tech they want to make their home and working lives easier exists, but what they need is guidance about how to make it work for them in practical terms.

The smart revolution is happening, and now's the time for contractors to take advantage of the range of information and products available from CEF and leading manufacturers to create truly smart working and living environments for their customers. Embrace the technology, seize this opportunity, and the possibilities are endless. ER



The dos and don'ts of data science for smart power networks

TNEI shares with us some "dos and don'ts" for those working in the power sector, to bear in mind while getting to grips with conducting good data science – either yourself or when commissioning others.

We live in an era of data, where the sheer amount being captured and stored in all areas of life is exploding. With that, as the challenges faced across all industries grow in both number and complexity, so does the requirement for increasingly sophisticated use of this data.

The electrical power sector is no exception, with the types of data that are likely to be available in much greater amounts, particularly at the lowest voltage levels, including more granular network monitoring, weather monitoring and the smart metering of individual customers (subject to privacy rules). This data will surely be an immense resource in embracing the challenge of delivering a low-carbon, secure and affordable energy system with pro-active consumers.

TNEI believes that, in order to realise the potential benefits of this data, the power sector must embrace the field of data science while ensuring that the analysis conducted follows good practice to produce truly helpful results. The field of data science can serve as an incredibly valuable tool, drawing out carefully derived insights and translating business questions into questions answerable using currently available or forthcoming data.

> **Spending most of your time solving problems that others have already solved is bad business value**

1. Do use a multidisciplinary team with expertise in statistics, computer science, and power systems.
Data science brings together a mix of three components: programming skills – including visualisation techniques; expertise in statistical reasoning and inference; and domain knowledge.

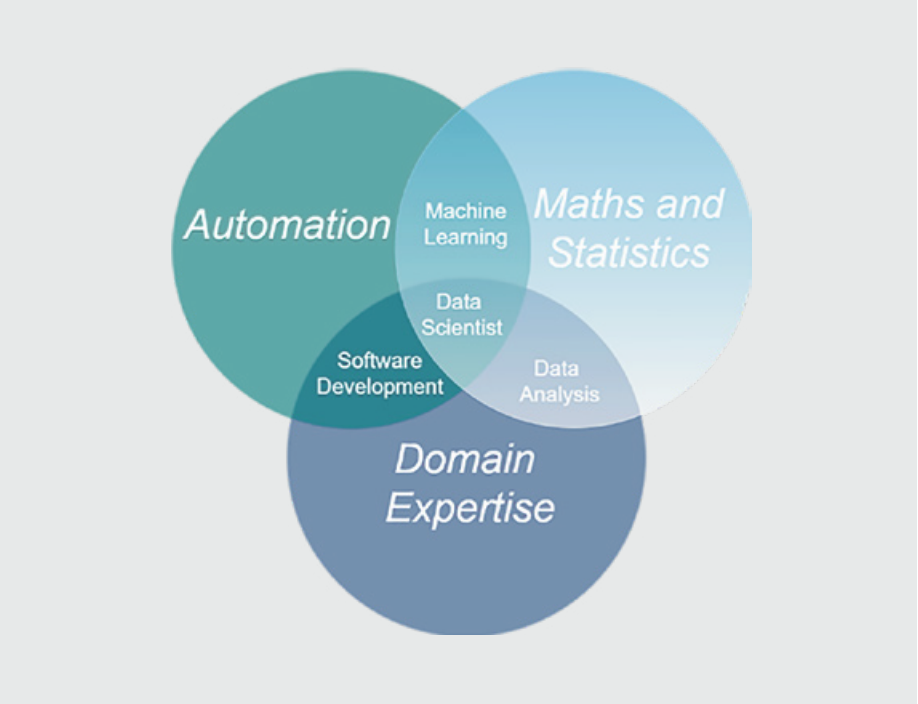
Good data science requires strength in all three distinctive skill sets, and problems are likely to arise if one of those skill sets are missing or neglected by a data scientist or team. Analytical teams should ensure that domain expertise informs every stage of their analysis, and software developers should try to avoid off-the peg and/or black box methods without scrutiny from an experienced statistician.

2. Do make sure you have clear objectives before scoping out a Machine Learning tool, leveraging extensive domain expertise.
The ability to do this well is one of the main benefits of integrating the components outlined above. It is easy for an analytical team to spend almost all of their time solving a technical problem, at the expense of thinking deeply about what exactly the problem is to be solved.

The problem should be worked down from objectives that can be expressed in natural language to one expressed purely mathematically, in the context of a fully specified probabilistic model.

3. Don't build algorithms from scratch if you can use an open source Python or R package.
Spending most of your time solving problems that others have already solved is bad business value. Using libraries will drastically improve development efficiency and support a neat, modular design.

Typical development tools such as Python and R supply versatile libraries with well-established support bases through comprehensive documentation and online forums such as 'Stack Overflow'. However, a balance needs to be struck to ensure that each process is well understood, and black boxes treated with caution.



4. Do consider a wide range of possible Machine Learning and probabilistic programming algorithms, and use the right one for the problem and the available data.
Unfortunately, it's rare to find any algorithm that's always the best at solving a certain type of problem. Selection must be tailored to satisfy various factors, e.g. scalability, speed and the amount of data required for accurate results – check you have enough.

> **Be vigilant in checking whether any analytical tools or models that you use are based on assumed relationships that haven't been tested**

5. Don't overfit or underfit your model.
Given a finite amount of data, a model of any type has an optimal level of complexity. Building a model that's too complex is known as over-fitting and means that the model-fitting process inadvertently 'learns' from noise in the data as though it was a genuine pattern. Underfitting means building a model that's unnecessarily simple – a more complex one would deliver more accurate predictions, if there is enough data to fit it properly. Save a proportion of your data to test for this.

6. Don't use models that haven't been validated.
Ensure models are rigorously validated, and that the tests applied confirm that your model performs well with regard to the specific aspects that are salient to your application, e.g. if predicting one-in-10-year demands, validating against mean values has limited use.

Be vigilant in checking whether any analytical tools or models that you use are based on assumed relationships that haven't been tested. Be careful in your interpretation of confidence intervals – they can be misleading.

7. Don't assume that data removes the need for predictive models.
Power system professionals new to data science might believe that the existence of data – e.g. monitored LV network voltages and thermal utilisations over a period of months – eliminates the need for modelling power flows in that network.

Conversely, they may believe that the application of a power flow model, fitted to only one data set, is sufficient. In fact, data and modelling always complement each other, and more data combined with a good model always equals a better result.

8. Do present results smartly for a technically diverse audience.
Sometimes, generating new and effective visualisations of data can be a difficult task, but one where help is available – look for inspiration! There are a variety of open-source libraries that permit users to upload interactive data visualisation online. Dynamic data visualisations can be much more powerful than a static, overloaded image, and these can optimise the target readers' experience by allowing them to manipulate the field of view.

Obviously, we've only touched on our selected dos and don'ts here, and why they're so important, although it would have been easy to fill many pages discussing each one. Nonetheless, we hope they provide food for thought and have triggered your curiosity about making sure you tackle your business or organisation's data science needs in the best possible way. ER

Leading the charge

Gregory Allouis, strategic solutions director at SPIE UK, outlines why first and foremost, an efficient EV charging infrastructure must start with the grid.

Currently, the UK government plans to ban the sale of new conventional petrol and diesel cars by 2040. Yet some commentators, such as the Committee on Climate Change, believe that deadline should be brought forward in order to tackle the burgeoning issue that is global warming.

It's all well and good setting ambitious targets to encourage the uptake of electric vehicles (EV), but some thought must be given to the charging and power supply infrastructure that will support a dramatic increase in energy use for transportation purposes. We need to ensure that the infrastructure itself is energy efficient. But as a country with over 38 million vehicles on our roads, how will this be possible?

The problem goes deeper than the EV charging infrastructure. For a reliable and efficient charging network to become a reality, we need to consider how the entire National Grid is managed. Reflecting upon the extensive blackout experienced by millions of households in August resulting from a sudden drop in electricity frequency on the grid, evidently extreme care needs to

be taken when it comes to adding further strain to the nation's power infrastructure.

Part of the solution could be to diversify the production of electricity to mitigate the danger of interrupted supply, with smart management of consumption being a key part of this. This is because when there are many consumers all using power at the same time, electricity frequency goes down.

In a situation where everyone is charging their cars in the evening, managing frequency will become a big problem. Smart management is needed to smooth out fluctuating frequency levels. For example, by having the means of switching the electricity supply on and off to machinery, depending on frequency levels, both energy and money can be saved. Large manufacturers are already using this technology to switch their machinery off when frequency is low.

> **For a reliable and efficient charging network to become a reality, we need to consider how the entire National Grid is managed**

What's more, EV charging should not be considered a one-way street. Two-way electric charging technologies, that treat the grid as an energy transport network should also be considered as it allows for the most efficient use of energy.

By embracing Vehicle to Grid technology (V2G), or Vehicle to Home (V2H), which enables users to charge their vehicles but also return energy to the grid and/or home and effectively smooth demand, will dramatically help reduce frequency anomalies as necessary. Utilising V2G and V2H technologies may also result in EVs acting almost as a mobile battery that can store renewable energy and return it to the grid during peak times. Potentially with the EV owner being rewarded financially for doing so.

There are also concerns about the longevity of EV batteries, and how they might be recycled when they no longer work for cars. EVs' design currently makes use of edge batteries, however, this type of battery has a finite lifespan. Unfortunately, the fast and ultra-fast charging stations may damage the batteries and repeated re-charging puts a strain on the technology.

However, once they are no longer fit for use in vehicles, these batteries could find a new lease of life by helping to diversify power supplies in buildings. This would be achieved by using the upcycled batteries as storage for local renewable energy generation, such as solar panels or wind turbines on buildings, instead of the energy being dispersed across the grid. In reality, we can expect to see this sort of process in the next five to 10 years.

With concerns regarding the scarcity of Lithium, we should also question whether charging and batteries will even be required for our EVs. Hydrogen cars could be another option, or other ways of charging may become viable, such as by induction. However, as with the adoption of EVs themselves, change will be slow.

There is a high probability that plug in charging infrastructure will become obsolete and that wireless charging will eventually supersede it. Right now, however, wireless charging technology is inefficient and results in large energy losses. Whilst there are vehicles, such as buses, operating in the UK which take advantage of wireless charging, the majority of electric vehicles in circulation to date are not compatible. In short, we are a long way off from having standardised wireless vehicle charging.

The impact of the sharing economy might also mean that the number of vehicles on our roads will go down. The 'shared mobility market' has allowed people living in urban areas to completely rethink the way they move around. With so many alternatives to traditional travel, city inhabitants are shunning car ownership, especially amongst younger generations.

In fact, research from GlobalData Technology found that after 2034, it's likely there will be a decline in sales of new passenger vehicles as ride sharing apps combined with autonomous driving technology create transport networks that reduce demand for car ownership. This will be music to the Mayor of London's ears, who is aiming for 80% of all trips in London to be made on foot, by cycle or using public transport by 2041. This target might be much easier than first anticipated because soon we might actually have fewer cars on the road!

In order to develop a charging network that is both sustainable and efficient, and for the aforementioned strategies to become a reality, it is wise to bring together a variety of stakeholders so that a broad spectrum of aims and concerns are taken into account. A huge amount of planning and funding will be required for EVs to truly become ubiquitous and we need to make sure the correct foundations are in place, else we risk overloading the nation's already vulnerable power supply. ER

Saving energy needn't cost the earth

Paul Lawrence, managing director of Aermec UK, outlines how the HVAC plant (and equipment) is becoming more efficient, reducing energy costs and delivering more sustainable solutions.

The HVAC industry has made intensive efforts to improve the efficiency of equipment and is rapidly embracing the Internet of Things (IoT) to enable equipment to work harder, smarter and maximise the lifespan of plant and equipment. Every sector is under pressure to minimise its environmental impact, and boost efficiencies whilst addressing reductions in the overall costs of ownership. It's a tall order, but one that the HVAC industry has embraced enthusiastically, with many of the key players leading the way.

For many, the environment has always played an important role and underpinned many companies' philosophies long before climate change became a hot topic. HVAC manufacturers are continually investing in R&D and looking for solutions that are environmentally benign, affordable but also offer efficiencies that reduce dependence on natural resources and offer a more sustainable approach.

Chillers, air handlers (AHUs) heat pumps, compressors, fans and associated peripherals can be found in many industries and in an equally wide variety of applications. From heating and cooling commercial buildings to cooling for injection moulding, precision-controlled environments in the pharmaceutical industry to heat management in mission critical data centres, the HVAC industry serves them all.

The HVAC landscape is changing faster than at any other time. Encouraged by legislation and greater environmental awareness, end-users are looking to maximise their investments and expect equipment to perform optimally, boost their businesses green credentials and offer a good ROI.

Taking a holistic approach and changing the way machines operate, upgrading them to maximise efficiencies, (for example switching from fixed speed to variable speed compressors) and even changing the water temperature – increasing the water temperature can be more energy efficient – can have a considerable impact on how HVAC plant and equipment are used across a wide range of applications and the savings that can be achieved in energy and costs.

REPLACE OR REPAIR?

Replacement of plant is not always the right route to take. Investing in an appropriate BMS (Building Management System), having a good planned preventative maintenance (PPM) strategy and exploiting advances in components can all have a positive impact. But for aged equipment that is no longer cost effective to maintain and can't reach the efficiencies required, investing in new plant offers an opportunity to invest in the latest technologies.

Modular AHUs and chillers are increasing in popularity as they can offer the flexibility to increase the capacities as businesses expand. Often height, width and weight restraints require an alternative solution to standard unit. Modular systems that can be built in modules and assembled on-site offer excellent performance levels and flexibility

as customers can upscale (when it comes to increasing capacity, the modular approach offers significant partial load efficiencies) reconfigure or downscale according to their requirements.

Modular AHUs and chillers offer a factory tested and proved solution, with the added benefit of being able to 'pull' components from the system to fix it and then 'plug' it back without the entire system shutting down. This gives the degree of redundancy that standard units lack.

Depending on the manufacturer, the configurations can be extensive. Some modular chillers offer capacities from 90 kW up to 3,500 kW, achieved with numerous arrays, shapes, sizes and refrigerants. Energy efficiencies are enhanced with the potential of free cooling and the use of HFO refrigerants helps to minimise the environmental impact.

A choice of air-to-water and water-to-water models offer an attractive ESEER of up to 6.5. This has raised the bar and offers an innovative mechanical design solution for businesses looking for a scalable approach.

A PPM strategy in place can help reduce energy wastage but can also prevent shutdowns and high repair bills. Paying closer attention to how buildings and their energy systems are being used can also have a significant impact on HVAC costs.

Investing in remote diagnostics for service and maintenance, fully integrated BMS, simulators and Computational Fluid Dynamics (CFD) services give facilities managers greater control of their plant and in mission critical sites such as data centres, any tool that delivers a greater understanding of air flows and helps with the design of optimised heating and cooling solutions adds considerable value.

There are many technologies in the pipeline and some still on the drawing board, but we are already taking advantage of magnetic levitation chillers, compressor-less cooling, particularly in data centre environments, variable speed drives, multiple scroll compressors, VRF (Variable Refrigerant Flow) systems and EC (Electronically Commutated) motors.

Compressor technology has also rapidly advanced; inverter driven screw and scroll compressors are now commonplace and new highspeed centrifugal compressors and Turbocor have gained considerable traction.

NRV chiller modules

Stack in line

Heat exchanger technologies have also helped drive down HVAC energy consumption with improved micro channel heat exchangers (MCHX) and spray evaporating technology, which maximises heat exchange effectiveness, lowers working pressures and increases overall chiller/heat pump efficiencies, whilst also reducing refrigerant charge by 50%.

> **Paying closer attention to how buildings and their energy systems are being used can also have a significant impact on HVAC costs**

Free cooling technology is also being applied more widely to further maximise the energy saving benefits.

Predictive control and maintenance strategies are also being deployed with autonomous monitoring of operating parameters and adaption of operating envelopes with maintenance alerts that can sustain original design efficiency levels.

Building energy preservation particularly in high rise offices and commercial buildings is a must for all countries and the latest heat pumps (four and six-pipe) are designed to redistribute building heat energy where previously it was rejected to ambient air and wasted.

Refrigerant manufacturers are promoting a shift towards HFOs or natural refrigerants like hydrocarbons such as 1234ZE, R32, Carbon Dioxide and Ammonia and the F-Gas Regulations, Enhanced Capital Allowance (ECA) schemes, CRC Energy Efficiency Scheme and Energy Performance of Buildings Directive (EPBD), all help to drive change and improve our environments.

Collaborative working can deliver energy efficiencies too. System design now includes end-users and design contractors collaborating to ensure optimum system efficiency levels are achieved, as opposed to the old school 'Silo' approach where each party was kept at arm's length and operated within their individual silos focusing on erosion of margins and breaches of confidentiality. BIM (Building Information Modelling) has opened the process, and injected transparency whilst offering a greater insight into the planning, design and management of buildings and their infrastructures.

The days of over specifying have also been replaced with a more holistic approach, that factors in the impact on the environment. Solutions are no longer geared toward cost cutting, but focus on minimising wastage, reducing carbon emissions, PUEs, promoting longevity, reliability and delivering more sustainable outcomes that are better for the customer, for business and the planet. ER

Powering the UK's Infrastructure

It is vital that train manufacturers today keep trains operating with minimal disruption and downtime. With more passengers relying on train services than ever before, it is crucial that engineers have access to the components they need quickly to undergo repair and maintenance work. Paul Bentley, managing director of GD Rectifiers explains how power electronic components are helping keep the UK's infrastructure running seamlessly.

The railway industry is undergoing rapid changes in the quest for energy efficiency, increase of economies, reliability, effectiveness and quality of railway transport. Today's railroads evolve into an ever more high-tech industry, with the aim to reduce commute time and the UK's global footprint.

Whether it is rolling stock, services, system and signalling, including railway related telecommunication equipment or infrastructure, many challenges are being faced throughout the market and manufacturers are under immense pressure to provide high quality, reliable and sustainable designs.

When a train is manufactured, numerous rigorous steps are required before launch, this includes research and studies, full-scale design models and aerodynamic tests, manufacturing train components, traction chain tests, testing elements for crash simulation and fabricating and testing the structure. Followed by the interior/fascia details such as painting, window and floor installation, cable assembly, installing interior equipment, electrical tests, placing the body on to the bogie, train assembly, loading the on-board software, static tests, followed by dynamic tests in the factory and customer's lines.

When customers think of rail engineering and manufacturing, they think of the big systems such as traction converters, PEBBs, liquid cooling systems, auxiliary drives, power supplies and rolling stock. One of the most unknown and underrated elements to providing reliable train systems today is the power electronic components used to repair and prolong the life of the systems. Train manufacturers and OEMs rely heavily on an extensive range of passive electronic components, including: IGBTs, MOSFETs, thyristors, diodes, resistors, capacitors, high voltage rectifiers, fuses, heatsinks and rectifiers.

Today, railway manufacturers and contractors are seeking further efficiency savings in the full range of electrical components that meet low life-cycle costs. Passive components, including rectifiers, high voltage diodes, heatsinks, filters and capacitors enable increased productivity

and capabilities. This improves operational availability and control of on-going maintenance costs which is a colossal priority for engineers.

One of the biggest challenges the railway industry faces when sourcing power electronic components is obsolescence. Components have to undertake rigorous testing in order to be an approved component for manufacturers and this process costs engineers a lot of time and money.

With power electronic component OEMs issuing end-of-life notices more rapidly year-on-year than ever before, engineers are put under increasing pressure to either source a last time buy (knowing that they'll need to replace the component in the future), use superior components that are mechanically and electrically interchangeable from the same manufacturer, or to source a completely new component and start the rigorous testing process again. The engineer's decision will be impacted by how quickly they need the component and how severe the maintenance issue is.

The following electronic components, devices and systems are commonly used throughout the modern rail industry, contributing to technological innovation and providing custom solutions to suit the ever-changing demands of rail engineering:

- **IGBTs** are used across a wide range of railway traction technologies
- **MOSFETs** provide auxiliary power supplies in the railway sector
- **Thyristors GTOs** are designed for railway traction
- **Fuses** are used in main and signaling circuits at railway stations
- **High voltage diodes** are usually used in overhead signalling lines and on tracks
- **Heatsinks** are used to provide LED lighting on the platforms
- **Capacitors** are used to track the presence of the trains on the rail tracks
- **Rectifiers** are used for railway DC traction
- **Resistors** are used across trams, metro, light rail and high-speed trains, they all need resistors for different kinds of applications
- **Trackside converters** are fed with energy from overhead line, they supply various loads in substations, including power supply for integrated lighting and information systems, railway signalling and protection systems
- **Converters for coaches** offer high quality and reliability that significantly increase traffic availability of passenger coaches

Traction converters, power electronic building blocks and liquid cooling systems

> **Components have to undertake rigorous testing in order to be an approved component for manufacturers and this process costs engineers a lot of time and money**

- **Converters for trains** convert voltage from generators into the drive power for the traction motors, three-phase auxiliary power supply for the train on-board consumers and into DC auxiliary power supply for charging train batteries
- **Converters for trams** supply the main and auxiliary drives of trams
- **Converters for locomotives** are used for supplying the main and auxiliary drives for locomotives
- **Liquid cooling systems** are designed for installation in the traction converter, the liquid cooling system uses water to cool the converter power modules
- **Power electronic building blocks** are subsystems for traction converters, they are liquid cooled building blocks designed for propulsion converters in traction applications.

The wide spectrum of track and traffic conditions found in the railway environment heavily rely on electronic components, devices and systems to keep the rail industry operational. Today, engineers need to work with OEMs and distributors as their supply chain partners to secure the stock quickly, ensuring minimal downtime or system failures.

Electrical and mechanical components for the railway industry must provide safe and reliable operations even under extreme application conditions. Engineers need to focus on the most effective ways to revolutionise the industry by using components that will deliver longer in-service product life, increased safety, reducing maintenance, energy consumption and renewal costs for customers. ER

Electrifying the track

Faced with growing pressure to reduce carbon emissions, European countries are increasingly making moves to power trains with electricity instead of diesel. In the UK, however, progress has often appeared hampered. Here, Simone Bruckner, managing director at power resistor manufacturer Cressall Resistors, looks at why the electrification of rail transport should be prioritised.

According to the Institution of Mechanical Engineers (IMechE), the UK's share of electrified railways comes in at 42%. In contrast to the over 60% of other comparable European countries, this figure seems rather meagre. In 2018, the government announced proposals to phase out all diesel trains by 2040. For this ambition to come to fruition, we must act on the benefits of electrification.

WHY ELECTRIFY?

Many people working in the rail industry feel that recent electrification cutbacks are a mistake. One reason for the reduction is the potential of bi-mode trains, which use both electric and diesel to run on electrified sections of the network before switching over to non-electrified sections when the former aren't available.

While this technology means that passengers can benefit from electric rail much sooner, as less disruptive electrification works such as overhead wiring and masts are required, bi-mode trains cannot be seen as a silver bullet solution. Uncertainty continues to arise over their performance compared to totally electric locomotives, as well as the implications of continuing to use diesel power.

Diesel engines have obvious disadvantages. Fuel is significantly more expensive than electric traction, with a report from the Office of Rail and Road

(ORR) revealing that Virgin West Coast trains spends 40% of its traction cost on diesel fuel, despite the fuel powering just 15% of its fleet. Diesel engines are also expensive to buy and maintain, and their heavier weight requires additional track maintenance.

With electric trains being increasingly powered by renewables, their fuel source is not affected by fluctuating oil prices and shortages. In addition, the power output of a diesel engine is limited by its rating, and its traction power is further reduced as the engine also has to supply the train's hotel load. Electric traction power, however, is limited by its thermal loading and as a result it can operate for short periods at peak power. Partly for this reason, an electric multiple unit has typically twice the acceleration of a diesel multiple unit.

In diesel mode, bi-mode trains suffer from the same cost and carbon drawbacks as diesel-only trains. When in this mode, they only have the traction power of around 60% of their electric mode, lacking the speed and acceleration needed to improve services.

BREAKING POINT

When braking, a train's kinetic energy cannot be stored on-board. On a diesel train, this energy is dissipated as heat using brake discs or from a roof-mounted rheostat that regulates the current flowing through it by changing the resistance. On electric trains, this braking energy can be fed back into the grid, offering energy savings of up to 20%.

During rheostatic braking, electric energy is dissipated by a bank of onboard resistors, often referred to as the braking grid. In regenerative braking, the electricity is immediately reused by other locomotives or stored for later use. This electricity can be transmitted through overhead wires or an electrified third rail. Alternatively, it can be stored onboard using a flywheel, battery or other energy storage system.

> **For routes with dense traffic and lines that need electric traction to obtain high speeds, electrifying the rail is the most effective and sustainable means of network upgrade**

As such, regenerative braking benefits both the environment, by reducing the demand of energy from the public grid, and the economy for the rail operator, by prolonging maintenance intervals thanks to the reduced wear of the mechanical brakes.

PUTTING INTO PLACE

While this method of braking helps make rail transport one of the most energy-efficient forms of mass transportation, it comes with limitations. The ability to return electricity is only available for trains that are electrically powered and in constant contact with their power sources, such as subways and other underground rail systems.

In cases where there are no other trains on the track, or the distances between trains is too great, the regenerated energy is dissipated in brake resistors, mounted either on the trains themselves or else at fixed locations alongside the track.

While there is some reluctance in switching to electric power, it is difficult to ignore the benefits of ditching diesel. For routes with dense traffic and lines that need electric traction to obtain high speeds, electrifying the rail is the most effective and sustainable means of network upgrade.

However, while we must welcome progress towards electrifying the rail, we must also make sure that the technology is in place to boost efficiency on the tracks even when electrifying is not possible. As part of a fully electrified rail system, dynamic braking resistors are critical in ensuring excess traction can be dissipated safely.

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MARTINDALE ELECTRIC

Getting warmer

Andrew Baker, sales director North Europe, FLIR Systems Ltd, explores the role of thermal imaging when it comes to predicting substation failure.

The risk of blackouts and brownouts (a fall in voltage, typically causing lights to dim) are increasing on the power distribution grid due to ageing infrastructure and a lack of automation systems that monitor the condition of critical equipment at substations and elsewhere on the grid.

For example, transformer fluid leaks or internal insulation breakdown cause overheating that leads to failure, but many utilities don't have automated thermal detection systems that reveal these problems.

Whatever the cause, a critical substation failure may cascade into a series of failures and impact massively on banking facilities, security systems, manufacturing plants, food refrigeration, communication networks and traffic control systems. Of course, the electric utility also stands to lose huge amounts of revenue and incur high costs in getting its systems up and running again.

Although electric utilities have, for many years, used hand held thermal imaging cameras to monitor substation equipment, the adoption of permanently installed systems is relatively new, but certainly on the increase. These provide continuous early warning of impending equipment failures.

These systems employ advanced sensing and measurement technology control methods and digital communications. They anticipate, detect and respond rapidly to problems, thereby reducing maintenance costs, the chance of failure, a blackout and lost productivity.

An example; one large utility discovered a hot bushing rod in a substation transformer and repaired it at a cost of only £11,000. A similar problem that occurred before the company instituted its thermal imaging programme resulted in a catastrophic failure that cost more than two million pounds.

Typical substation components whose thermal signatures are precursors to failure include power transformers (oil levels and pump operation); load tap changers (oil levels, other internal problems);

insulator bushings (oil levels and bad connections); stand-off insulators (moisture, contamination, degradation); lightning arrestors (degradation of metal oxide disks); circuit breakers (oil or SF6 leakage); mechanical disconnects (bad connections and contamination); control cabinets (wear and tear on fans, pumps and other components) and batteries.

WHAT IS THERMAL IMAGING?

The principle of thermal imaging is 'many components heat up before they fail'. Secondly, all objects emit thermal radiation in the infrared spectrum that is not seen by the human eye.

Thermal imaging cameras convert that radiation into crisp images from which temperatures can be read. This non-contact temperature data can be displayed on a monitor in real-time and sent to a digital storage device for analysis.

The cameras do not require light to produce images and can see hot spots well before excessive heat or loss of insulation leads to failure. They can be mounted in all-weather housings and placed on pan/tilt drive mechanisms to survey large areas of a substation.

Differences in the heat signatures of electrical components and their surrounding background are recognised and compared to temperatures of similar components in close proximity.

Built-in logic, memory and data communications allow the cameras to evaluate the temperatures in the images with user-defined settings and send that data to a central monitoring station for trend analysis, alarm triggering and the generation of reports. The devices can even notify managers in remote locations of abnormal conditions by sending an email.

TYPICAL SYSTEM CONFIGURATION

In co-operation with automation system suppliers, a quality camera manufacturer can create customised thermal imaging and non-contact temperature measurement systems for substations. They can automatically perform site patrols and monitor equipment temperatures without human supervision. The video images and their temperature data are carried over Ethernet, wireless or over fibre optic cables to an appropriate interface that communicates this data to the central monitoring location.

Switched on

Alex Emms, operations director at Kohler Uninterruptible Power, looks at the role of static switches within different UPS architectures, and how they ultimately contribute to power availability.

During normal operating conditions, a UPS accepts incoming mains power, conditions it to remove transients, brownouts and any other aberrations, and makes its filtered output available to its critical load. If the mains does fail, the UPS batteries take over the load without interruption until the mains is restored, a backup generator comes online, or the load has had time to shut down gracefully. Alternatively, in a poorly-designed installation, the battery autonomy may simply expire, causing a system crash and all its consequential damage.

A yet further scenario is that the UPS itself fails, or is subjected to an overload condition beyond its capacity. Accordingly, practical UPS installations include a static switch which can select between the UPS inverter output and a raw mains bypass to feed the critical load.

In online UPS systems, the switch remains 'on UPS' unless a UPS fault develops, in which case it changes over automatically and seamlessly to the raw mains supply. This puts the load at risk from mains-borne power problems, but is preferable to the load losing all power without warning. In any case, the UPS will generate an alarm while on bypass to draw attention to this risk.

In offline UPS systems, however, the static switch feeds the critical load from the raw mains under normal conditions, and only changes to the UPS if the mains fails. Although this allows greater operational efficiency through eliminating losses in the UPS' rectifier and inverter stages, it means that the critical load is continuously exposed to any incident mains power problems; the UPS provides a battery backup function, but no power protection. For this reason, nearly all data centre operators choose online systems – they regard power protection as essential.

STATIC SWITCH INTERNAL DESIGN

The static switch is so-called because it is implemented using semiconductors rather than electromechanical moving parts – and being semiconductor-based, it can provide the fast, break-free transfer essential for effective load protection.

The decision to transfer is shared between the static switch's internal logic and the UPS control system in an installation-specific arrangement; it's based on continuous monitoring of the inverter and raw mains voltages. Additionally, the control logic typically manages the inverter voltage phase and frequency to facilitate synchronisation between the inverter and mains bypass outputs. This synchronisation is essential to allow bi-directional, break-free transfer between the two power sources.

Figure 1 shows a simplified form of a single-phase static switch's internal design. It comprises a pair of inverse parallel connected SCRs in series with the bypass and inverter supplies. During normal UPS operation, SCRs 3 and 4 are triggered ON, while SCRs 2 and 3 are triggered OFF; the opposite is true when the switch is selected to Bypass. In a three-phase circuit, the same SCR arrangement is repeated for each of the three phases.

The triggering is arranged to ensure that bypass and inverter supplies are briefly paralleled; this ensures a break-free transfer, and explains why synchronisation of the supplies is essential. Without this, the load would almost certainly suffer a power disturbance. While the UK's mains supply frequency is usually very stable, the same may not be true for an onsite standby generator.

THE STATIC SWITCH IN PARALLEL MODULAR UPS SYSTEMS

The static switch's role is a little more complex in multi-module parallel UPS systems, because it depends on whether the UPS has centralised parallel architecture (CPA) or decentralised parallel architecture (DPA).

CPA refers to UPSs that share some common components, including the static switch. The major benefit of CPA is that expensive components such as those used in module control electronics and static switches are shared instead of duplicated, thus reducing cost. The downside of this architecture is that the shared components create single points of failure, which adversely affects the UPS' availability.

By contrast, DPA systems have completely self-contained modules, each with their own control electronics and static switch. This component duplication makes DPA UPS systems costlier, but it also significantly improves their availability by eliminating single points of failure. For most data centre

Fig.1: Simplified static switch design

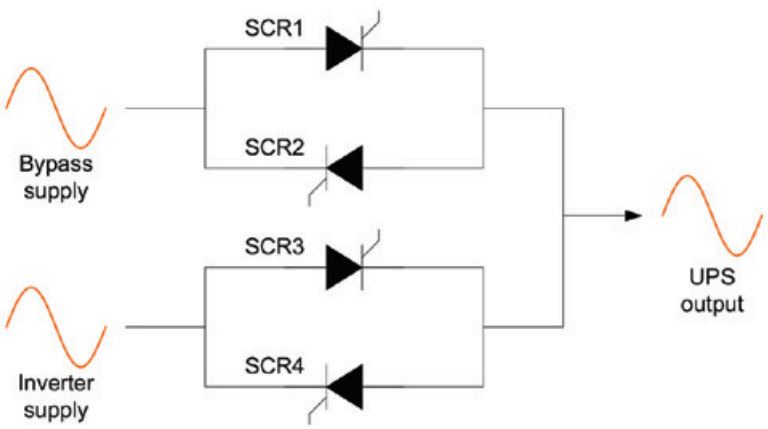
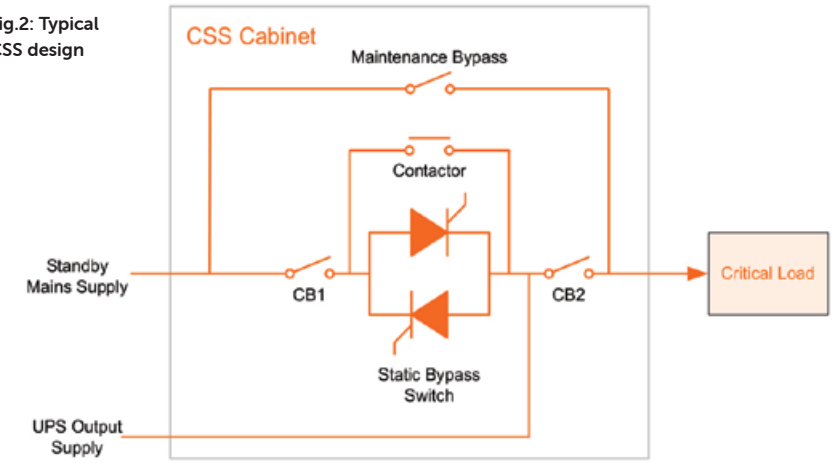


Fig.2: Typical CSS design



operators, higher availability will always trump cost considerations – within reason.

Figure 2 shows a typical CPA centralised static switch (CSS). The maintenance bypass switch is normally open, and only closed during CSS maintenance. During normal operation, all the UPS modules are synchronised to one another and to the mains supply, and share the load equally. If one UPS module fails, the load is shared equally between the remaining modules. However, if they find this load unsustainable, they transfer it to the standby mains via the CSS.

Interlocking circuitry between the CSS and each UPS module prevents the static switch from turning on while the modules are active. This is important because if the static bypass switch and module static switches were simultaneously on, backfeeding of power from the standby mains through the static bypass and into the UPS module output terminals would damage the modules.

As previously mentioned, DPA systems avoid single points of failure, including central static switches. Instead, all the UPS modules are connected in parallel, directly to the load as shown in Figure 3. The total system capacity depends on the individual module ratings and the number of modules used. Each module has its own static bypass switch, which is rated for the full load capacity, including overload. Each module switch supplies the load from either the UPS inverter output or the raw mains supply. The critical load can also be fed from the maintenance bypass switch if the UPS must be shut down and taken offline for maintenance or troubleshooting work.

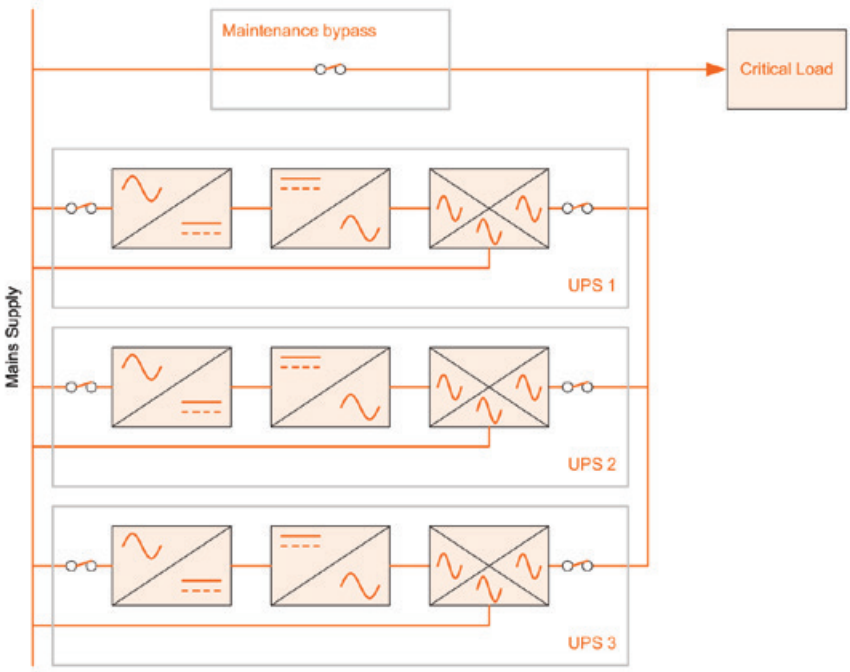
During normal operation, all the UPS modules are online, with their inverters feeding the load through their internal static switches. All the inverters are synchronised to one another and to the standby mains supply if present, and share the load equally. If a module becomes faulty, it automatically isolates itself from the critical load by inhibiting the inverter side of its static switch. The remaining, healthy modules continue to share the load, provided their combined capacity is sufficient to do so.

If this is not the case, all the modules, including the faulty unit, transfer the critical load to the standby or raw mains via their internal static switches. If the system is synchronised, the transfer is break-free and is achieved by enabling the operation of the bypass side, while inhibiting the inverter side of each module's static switch. However if the system is not synchronised, the UPS modules will not allow any transfer to mains, and instead endeavour to supply the overload for as long as possible before switching off to protect themselves.

CONCLUSION

Although decentralised control systems once required complex data and signal processing electronics, this is no longer true. Additionally, modern internal static switches offer the same fault clearing capacity as a CSS. Meanwhile, centralised systems typically require a separate CSS cabinet, which adds to their complexity, cost and footprint. When these factors are added to the CSS's single point of failure risk, it's easy to see why decentralised parallel systems have become the most popular choice.

Fig.3: Three module decentralised UPS system



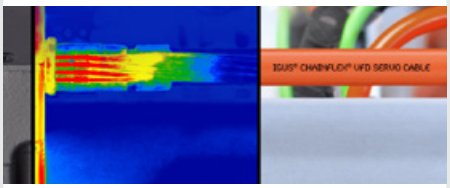
NEW IGUS MATERIAL OPTIMISES INSULATION FOR CHAINFLEX VFD

igus has developed an innovative new material for its latest generation of motor and servo cables which meets electrical and thermal specifications.

The trend for variable frequency drives (VFDs) is moving towards more compact drives with the same or a higher performance level than their predecessors. The more compact design of the motors can result in higher temperatures within the system.

If the insulation material for the cable does not withstand the elevated temperatures in the long-term, short circuits can occur inside the cable and in the vicinity of the connectors, which in the worst case can lead to fires.

That is why igus has developed a material that meets these new challenges for its latest generation of motor and servo cables. In tests, it was able to withstand a bend radius of 7.2 x d over 45 million strokes. As with all chainflex cables, the new VFD and servo cables come with a 36-month guarantee.



igus • 01604 677240
www.igus.co.uk

NEW WIRELESS HDMI SENDERS FROM ESP

ESP has launched a new range of wireless HDMI senders that are designed to overcome the problems associated with HDMI cable restrictions.

Part of ESP's Essentials product range, the wireless HDMI sender connects AV devices and allows them to be controlled from a different room. The signal quality stays optimal, even through a wall or floor.

The range includes wireless and wired options, and in addition features KVM (keyboard, video and mouse) functions on selected models, enabling a user to control menus and settings from the source device.

The compact wireless senders offer a smooth transmission of up to 100 metres (open field range) for quick and simple set up, whilst the wired version utilises network cable to support up to 120 metre transmission distance.

ESP • 01527 515150
www.espuk.com

KEY LOCKABLE SWITCHES AND SOCKETS FROM SCOLMORE

Scolmore supplies a range of key operated switches and sockets across its range of wiring accessories collections, to offer specifiers a varied choice when it comes to procuring products that have this required security feature.

Providing the means to lock and unlock the power supply to the sockets and switches makes them ideal in a range of applications where security is of prime importance – such as hotels, schools and care homes. With only the key holder able to operate them, this will prevent any unauthorised use of the switch or socket outlets.

The range includes 20A double pole lockable switches and 13A one-gang double pole lockable sockets, and they are available in all of the Click wiring accessories collections – Mode, Polar, Metal Clad, Deco, Deco+, Define and Definity.

Scolmore • 01827 2063454
www.scolmore.com

ELLIS' INNOVATIVE TWIST GIVES INSTALLERS PLENTY TO SHOUT ABOUT

Ellis has given cable cleat installation an innovative new twist that will significantly reduce installation time and costs, and simplify the ordering process.

The leading cable cleat manufacturer has designed and developed a twist foot fixing mechanism for use on all sizes and types of its best-selling standard cable cleats, Emperor and Vulcan+.

The twist foot cleats, which are supplied pre-fitted, are suitable for all installations using cable channel and ladder with inverted rungs. There are single footed versions for cables in trefoil up to 58mm, and double footed versions for cables with diameters ranging from 59mm to 128mm.

The single version locks in place with nothing more complex than a 90 degree turn and the tightening of the integral securing bolt, while the double footed version is secured with tabs that are simply rotated 90 degrees to engage the channel nut, before the securing bolt is tightened.

Ellis • 01944 7583965
www.ellispatents.co.uk

NEW FLUKE 179 DIGITAL MULTIMETER OFFER AVAILABLE

Until 31 December 2019, and while stocks last, Fluke is offering a DMM safety bundle consisting of a Fluke 179 digital multimeter (DMM).

The offer also includes a free Fluke TLK-225 SureGrip master accessory set of leads and connectors, representing a discount of over 20% (manufacturer recommended prices) on the items purchased separately.

The Fluke 179 DMM is a full-featured, precision multimeter for the troubleshooting and repair of electrical and electronic systems, also featuring a built-in thermometer to measure temperature without having to carry a separate instrument. Productivity is increased with manual and automatic ranging, Display Hold, Auto Hold, and Min/Max/Avg recordings.

Also included in Fluke's autumn campaign are a Fluke T6-1000 non-contact voltage tester kit; Fluke two-pole tester offers; Fluke 1663/1664 FC multifunction tester kits; Fluke 87V DMM with free current clamp and accessories; as well as Fluke 1507 insulation resistance testers, and Fluke 561 IR and contact thermometers at special prices.

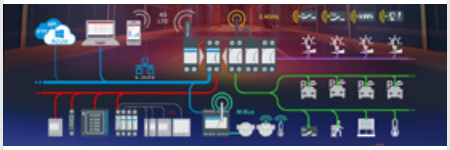
Fluke • 020 7942 0708
www.fluke.com

CARLO GAVAZZI'S SMART BUILDING SOLUTIONS ON SHOW AT SMART BUILDINGS SHOW

Following the success of last year, controls and automation specialist Carlo Gavazzi will be returning to this year's Smart Buildings show at London's Olympia on 9 - 10 October.

The Carlo Gavazzi team will be on hand to discuss the latest technological innovations and advantages, showing you how simple-to-install energy meters are easily integrated into the latest energy platforms, whilst its two-wire bus system for smart buildings provides a unified approach to controls services such as HVAC, lighting including DALI, and other building services.

So, whether you need an energy management system that delivers information to reduce your carbon footprint, or a smart building system that can provide a consolidated approach to control services such as HVAC and lighting, or an infrastructure that ensures future flexibility and intelligence; why not talk to the experts on Stand No.F9.



Carlo Gavazzi • 0127 685 4110
www.carlogavazzi.co.uk

NEW MARTINDALE PROVING UNITS VERIFY SAFETY AND CALIBRATION

Smaller, lighter and with new options for calibration checking test equipment, Martindale's next generation PDSX proving units enable contractors and maintenance teams to safely and simply prove the operation of voltage indicators, two-pole testers and test lamps, plus common 18th Edition tester functions.

The PDSX series includes an additional CALCHECK feature for verifying the calibration consistency of multifunction installation testers to provide confidence in the performance of all essential test equipment before and after measurement.

CALCHECK is designed to make it easy to verify the insulation and low resistance ranges on 18th Edition testers on-site, making it ideal for identifying potential calibration issues with test equipment prior to certifying a new wiring installation or carrying out a condition report. This procedure is recognised by electrical contractor assessment bodies to ensure reliable results and avoid unnecessary and expensive retests.

Martindale Electric • 01923 441 717
www.martindale-electric.co.uk

CEF: GET SMART, GET CONNECTED

CEF is helping its customers enter the smart home market, and issue number three of the Get Smart, Get Connected brochure has all the products and information electrical contractors need to become a smarter smart home installer.

Get Smart, Get Connected issue three will be available to pick up in your local CEF store from October 14, 2019, and is accompanied by the new Get Smart, Get Connected micro-site: cef.co.uk/get-smart-get-connected. You will also be able to request a copy of issue three online via cef.co.uk/getsmart.

CEF • 01763 272 717
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COST EFFECTIVE TECHNOLOGY FROM NETBIT

Netbit is pleased to offer the Solar Kit, which can be used to generate the electricity needed for an average three-bedroom household. The solar kit is expected to produce electricity that will pay back within six years under today's electricity bill rate, enhancing cost-effective technology.

Netbit • 0845 3752128
www.netbit.biz

LONG RANGE WIRELESS SOLUTIONS FOR ENERGY MONITORING FROM CARLO GAVAZZI

Controls and automation specialist, Carlo Gavazzi will be using the Smart Buildings show at London's Olympia on 9 – 10 October to launch its long-range wireless solution for energy monitoring. The UWP-A and UWP-M can reduce installation costs and avoid expensive cabling significantly for many energy efficiency monitoring projects.

The UWP-A is an endpoint adapter which provides long range (up to 10 km) communication to Carlo Gavazzi energy meters and power analysers for easy integration into standard LoRaWAN gateways (private networks) and LoRaWAN public networks (smart cities).

The UWP-M master module makes it easy to create a wireless network of UWP-A based endpoints, and integrates into the Carlo Gavazzi's UWP monitoring gateway and controller.

Using the EU868MHz band, a license and cost-free frequency, the UWP-A enables easy and fast configuration, making it easy for installers to set-up a secure and reliable wireless network of meters.

Carlo Gavazzi • 0127 685 4110
www.carlogavazzi.co.uk

ERA DOORCAM – SMART TECHNOLOGY'S LATEST LEAP FORWARD

Using a smartphone app, the ERA DoorCam Smart Home Wi-Fi Video Doorbell allows householders to view callers and talk to them in real time, whether they're home or not. A motion detector which alerts householders when someone has arrived also provides added peace of mind.

Once DoorCam is wired in, the householder can simply plug in the Wi-Fi chime which comes as standard, connecting up to four more chimes in the home.

Working with existing household Wi-Fi using the app, there are no cloud-based recording fees for the first 12 months, and once fees are introduced, there will always be a free option dependent upon the level of recording required.

DoorCam allows for two-way talk with high quality sound with adjustable volume, brightness and colour to suit. The camera has a 180° field of view and records in 720pHD resolution, with infrared night vision ensuring 24-hour operation.

ERA • 01922 490000
www.eraeverywhere.com

OMICRON LAUNCHES PARTIAL DISCHARGE MEASUREMENT AND MONITORING SYSTEM

The new MONTESTO 200 combines online partial discharge (PD) measurement and temporary online PD monitoring functions into one portable system.

The IP65 rated MONTESTO 200 can be used both indoors and outdoors for insulation condition assessments on various medium-voltage and high-voltage electrical assets under load, including motors and generators, power transformers and power cables.

A variety of PD measurement sensors can be permanently installed and connected to MONTESTO 200 via Omicron's terminal box, which is also permanently installed at the asset. This enables safe and convenient plug-and-play connections while the asset is online to avoid unnecessary downtime during setup.

For temporary PD monitoring, users can easily mount MONTESTO 200 to a surface on or near the asset, connect it to the terminal box, and then leave it unattended. PD monitoring sessions can be quickly set up in less than 10 clicks of a mouse.

Omicron • 01785 848 100
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