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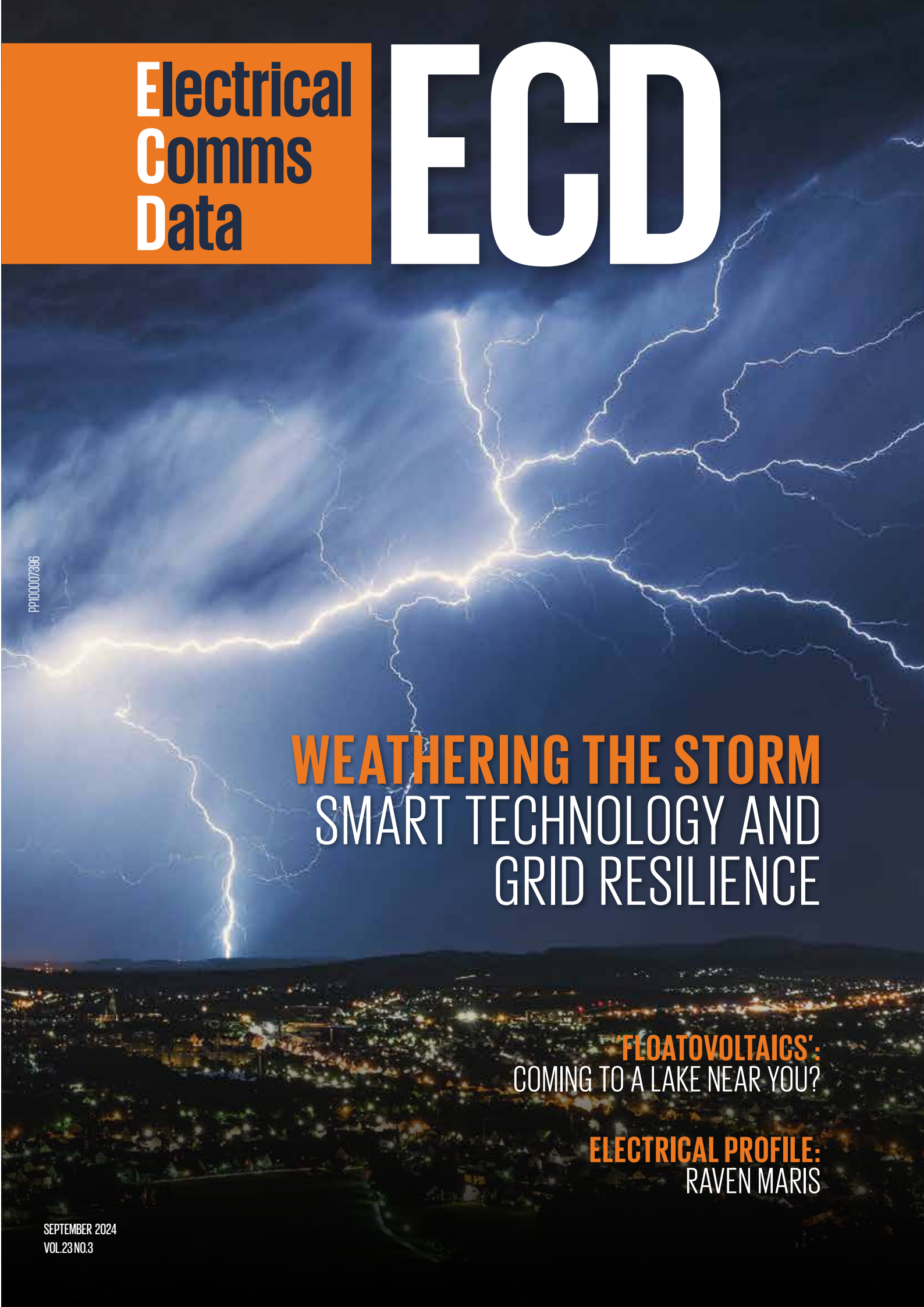
ECD



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WEATHERING THE STORM
SMART TECHNOLOGY AND GRID RESILIENCE

'FLOATOVOLTAICS':
COMING TO A LAKE NEAR YOU?

ELECTRICAL PROFILE:
RAVEN MARIS

SEPTEMBER 2024
VOL.23 NO.3

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CONTENTS

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FROM THE EDITOR

In this edition of *ECD*, we return to a perennial issue: the grid. At the time of writing, Sydney has recently experienced its hottest winter day on record, severe winds have left 180,000 homes without power in Victoria and storms in Tasmania have lashed power networks, leaving thousands without electricity.

Extreme weather events — which are increasing in frequency — present a huge challenge to the grid. How can we manage this vital infrastructure that's not only threatened by natural disasters, but is facing various other issues, including aging assets and the need to integrate renewables? Our September edition presents some strategies for combating this problem.

Jack Curtis, from Australian utility software company Neara, kicks off the discussion in our feature article on p 4, making a compelling case for how emerging technologies, including AI, can proactively help to maintain the grid. As well as increasing grid reliability, these technologies can make conditions much safer for utility workers, especially during natural disasters.

In a complementary article on p 20, Paul King from Bentley Systems explains how a digital twin of a network — "a dynamic, interactive map of your whole grid" — can introduce a much greater level of control, particularly in relation to the adoption of renewable energy sources.

Elsewhere in the magazine, Telstra commissions hydrogen generators to back up the electrical supply to its mobile phone towers, which are vulnerable to storm damage (p 13) and space scientists explore the impact of auroras on electrical infrastructure (p 16).

Excitingly, this edition also marks the start of a new series focusing on interesting people in the electrical industry. Turn to page 14 to learn all about the impressive Raven Maris, Leader of the ETU National Women's Committee and an electrician in the substation construction division of Sydney Trains.

Katerina Sakkas — Editor
ecd@wfmedia.com.au

WEATHERING THE STORM:

AI'S ROLE IN GRID RESILIENCE

Jack Curtis, Co-Founder and CCO, Neara

Australia's electricity network is struggling against the storm brewing over the energy industry. Aging infrastructure, workforce shortages and increasingly volatile extreme weather events are battering energy infrastructure as it manages the complicated shift to integrating increased renewable generation.

Image courtesy of Neara

Dynamic line rating transmission

The result? Growing concerns around energy reliability, increased network management complexity, and greater risks to the safety of utility field workers and local communities.

Extreme weather events are causing an uptick in the volume of repairs and maintenance required across the grid. Take Victoria as an example — according to AusNet Services[1], the owner and operator of Victoria's transmission network, its aging infrastructure is under immense duress. One in seven of Victoria's 13,000 electricity transmission towers are damaged by extreme or extensive rust, with more than half now set to reach the end of their 70-year service life within the next decade. The impact of volatile weather conditions on this aging network has also caused the number of downed transmission towers to increase over the last 15 years, with more extensive repair work required in dangerous conditions.

These conditions are only getting worse. 'One-in-100-year' floods, tropical-strength winds, extreme heatwaves and bushfires are fast becoming regular occurrences. Different methods are urgently needed to enable engineers, maintenance staff and SES workers to manage grid repairs while maintaining energy security for consumers and their own safety. Legacy reactive measures to these events can only provide so much security against the quickly escalating climate threat. We need new tools and emerging technologies, including artificial intelligence (AI), to help reduce the time network engineers spend in the field during increasingly volatile events while preserving the grid.

Granular insights and comprehensive risk evaluation

AI-powered tools are unlocking new levels of visibility and predictive capabilities for utilities. By identifying risks sooner, coordinating remote elements of network maintenance and modelling future weather events before they hit, AI capabilities can help form a new foundation of risk-management strategies. The urgency behind this modernised approach is only growing as manual inspection work struggles to keep pace with shifting climate and environmental patterns.

When paired with digital modelling capabilities, AI analysis can provide unparalleled visibility and oversight of electricity networks by creating hyper-accurate digital models of existing infrastructure. The leveraging of data sources including LiDAR, geographic information system (GIS) mapping and severe

Image courtesy of Neara

Large urban network model.

weather area protection zones is allowing international utilities like Scottish Power Energy Networks to deploy AI-powered weather simulations and asset health indicators. This provides extreme visibility into the state of the grid, allowing engineers to gauge the structural health of equipment and its ability to withstand future severe weather events before they even enter the field.

By aggregating data sources into enterprise-grade 3D modelling technology with advanced AI capabilities, utilities can create hyper-realistic environments for remote inspections and simulation analysis. This approach can transform inspection strategies from convenience-based to risk-based. Field visits will be targeted to the most pressing risks and correct locations, reducing time spent in the field and enabling utilities to perform urgent works faster.

Shifting from a reactive to a pre-emptive approach

Beyond grid risk analysis and improving infrastructure visibility, AI can help provide the foresight required as extreme weather events continue to hit Australian cities and towns with alarming regularity. Predicting how an oncoming storm, flood or fire might behave and impact the network is critical to optimising response plans. This will ultimately keep communities connected for longer periods, ensure accelerated reconnection post-event and help keep response crews safe. Engineers can leverage AI-powered digital models to model extreme conditions in a safe, virtual environment before or as they arrive. This simulation provides the best insights to direct their responses and prepare for infrastructure damage.

THE IMPACT OF VOLATILE WEATHER CONDITIONS ON THIS AGING NETWORK HAS ALSO CAUSED THE NUMBER OF DOWNED TRANSMISSION TOWERS TO INCREASE OVER THE LAST 15 YEARS, WITH MORE EXTENSIVE REPAIR WORK REQUIRED IN DANGEROUS CONDITIONS.

During an extreme flooding event in South Australia, thousands of citizens living and working along a 650 km stretch of the River Murray were severely impacted by the weeks-long event. The rate of rising floodwater was too fast for field crews to manage, with water levels quickly breaching safe powerline clearance zones. SA Power Networks, the state's largest energy provider, needed a new approach to manage the scale of the event. The company chose to leverage AI and LiDAR data to create a three-dimensional map of the entire River Murray region, including all its assets and their surrounding environment. This was SA Power Networks' first use of AI-powered modelling capabilities and dramatically shifted its decision-making process throughout the flooding disaster.

Network scenario modelling on different electricity distribution network assets at various flood levels was performed, allowing SA Power Networks to pre-emptively determine, without field analysis, when and where powerline clearances would be breached and require disconnection. During testing, SA Power Networks found that the model was within centimetres of accuracy to reality, and used the map to disconnect and reconnect power to its assets at the precise moments needed. This modelling also allowed customers' electricity supply to be reconnected ahead of initial timeframes.

In some cases, disconnected regions were re-energised within five days compared to the projected three-week timeframe using traditional extreme weather event processes. This not only impacted the safety of citizens and critical services, with restored powerlines providing critical services like heating, lighting, internet access and telecommunications, it also prevented SES crews and engineers from being sent into the field and dangerous flood zones. In previous events and without the use of modelling, they would have continuously physically measured powerline clearance zones.

The intensifying impacts of climate change are exposing communities and power engineers to increasingly dangerous and unpredictable conditions. Ensuring their collective safety while simultaneously maintaining grid reliability is becoming a formidable challenge. By leveraging advanced technologies like AI to enhance network visibility, simulate potential weather impacts and enable remote operations, we can substantially reduce OHS risks for field crews and build more resilient energy infrastructure for the future.

1. AusNet Services, AMS 10-77 Transmission Line Structures: 2023–27 Transmission Revenue Reset.

Jack Curtis, Neara co-founder and CCO.

AIR QUALITY IMPROVING IN AUSTRALIAN HOMES

New Australian homes are up to 50% more airtight than those tested in 2015, according to recent research from CSIRO.

When houses and apartments meet recommended air tightness levels, residents feel more comfortable and have lower energy bills and healthier indoor air quality. Air tightness minimises unintended air movements within a building, preventing outdoor air from entering and indoor air from escaping.

Poor air tightness can cause draughts, increasing energy bills by up to 20%; however, homes that are too airtight without controlled ventilation can lead to condensation, mould and health issues for residents such as headaches and nausea due to higher carbon dioxide and monoxide levels.

The researchers tested a total of 233 apartments and detached houses built in the last four years in Melbourne, Sydney, Canberra, Brisbane and Adelaide. Homes specially designed for air tightness were excluded.

The results of the study compared well to standards in other countries like the UK, but there is still room for improvement.

Senior Experimental Scientist and project lead Michael Ambrose said his team used a blower door test to identify the leakage rate and determine where leakages occur. "Leakages were found in most new homes, mainly from bathroom fans, sliding doors and poor or missing door seals," he said.

Researchers tested a total of 233 apartments and detached houses built in the last four years in Melbourne, Sydney, Canberra, Brisbane and Adelaide.

"Some other homes, particularly apartments, were found to be extremely airtight, which can result in issues impacting building performance and resident health, if controlled ventilation is not included.

"Fortunately, there are simple and affordable ways to rectify these issues and preventative measures that can be implemented during construction."

The report outlined a range of recommendations for Australian building codes to address common air tightness issues, including establishing air tightness standards in the National Construction Code; requiring controlled ventilation in new buildings; making air barriers mandatory in new residences; and providing onsite training and educational resources for builders.

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ACTING LOCALLY TO MAXIMISE THE GRID

A new report from Energy Networks Australia makes the case that, with a few straightforward changes, the electricity grid can be made far more efficient, integrated and sustainable.

'The Time is Now' report, developed in partnership with global strategy consultancy L.E.K. Consulting, emphasises the benefit of making local changes alongside the large-scale actions required to overhaul the grid.

Energy Networks Australia CEO Dom van den Berg said there was a clear opportunity to get the local grid doing more of the heavy lifting in the energy transition and achieve greater savings for customers by 2030, but that window of opportunity was closing.

"We absolutely need to make sure we are 'pulling all levers'," Van den Berg said. "That includes keeping focused on the large-scale renewable projects and the vital transmission infrastructure we need to connect them. While we do that, it also makes good sense to do everything we can at a local level to bring down bills and provide more services to customers.

"We must get smarter with how we use existing infrastructure, how we maximise rooftop solar, how and where we store and manage it locally, and how we get more EV chargers in more places."

Actions recommended in the report include connecting locally generated solar with unused capacity in the grid to operate as 'local energy hubs' for the community to benefit from; and incentives for large commercial properties to install more solar panels on existing rooftops for energy-sharing. Increasing the number of EV chargers by enabling networks to install kerbside (power pole) charging is also advised.

"The report calls for changes that are entirely doable and can be delivered today through the right policy decisions and fit-for-purpose regulatory settings. This is about supporting customer choices and enabling a local grid that better serves them," Van den Berg said.

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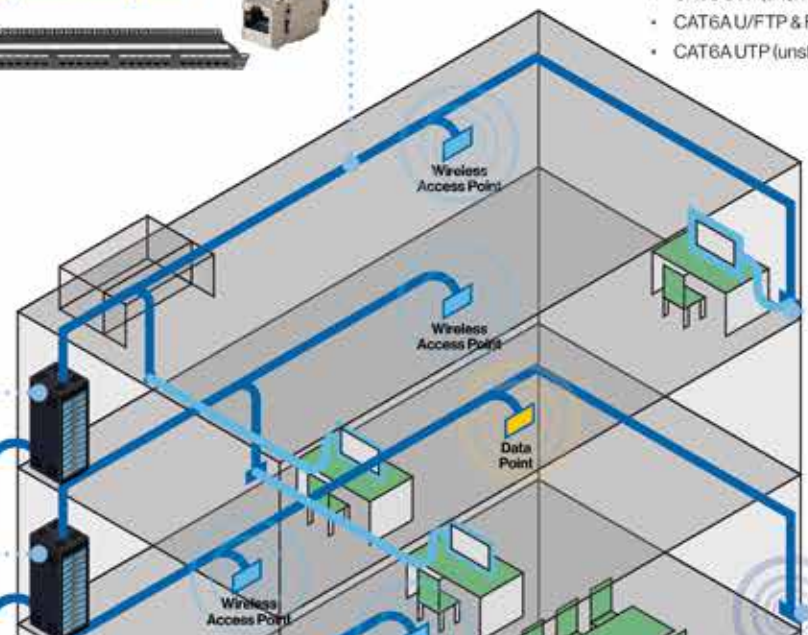

Patchcords

- CAT6 UTP (unshielded)
- CAT6A (shielded)
- CAT6A UTP (unshielded)

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- CAT6 UTP
- CAT6A STP
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MEA WARNS OF UPCOMING ELECTRICIAN SHORTAGE

Master Electricians Australia (MEA) has responded to data released by the Powering Skills Organisation indicating there will be a shortfall of 17,000 electricians, mechanics and technicians by 2030 as the nation transitions to net zero. The Powering Skills Organisation is one of the Australian Government's 10 Jobs and Skill Councils.

The report emphasises that the problem is compounded by a low completion rate of 60% in electrical apprenticeships.

MEA CEO Kate Raymond said workforce shortages are already a real issue for small and medium electrical businesses and will only worsen if nothing is done to arrest the tide.

"MEA hears all the time from our small and medium-sized members how workforce shortages are impacting their business. We can't keep sitting on our hands on this matter; the industry and government need to work together to come up with new and innovate solutions," Raymond said.

"Electrical contractors are going to play a crucial role in Australia's energy transition and their demand is only going to increase between now and 2030. If we are to safeguard the Australian economy, we need an electrical workforce that is well trained and has the capacity to service the sector."

Raymond said that while there was no silver bullet, there are some practical measures that would start the process of reversing the current trend.

"We … have a lot of qualified contractors and apprentices currently working for large energy corporations. Measures that unlock some of these workers to be seconded to small and medium businesses operating in the residential market would help in the short term," she suggested.

Raymond added that an increase in apprentices being trained by the top-performing registered training organisations would help boost the industry, and that more trainers were also needed.

"This problem is not going to go away on its own and we need a dynamic approach from industry and government to ensure we have an electrical workforce that caters to the Australian economy during the energy transition," she said.

TRAFFIC LIGHTS 'TALK TO' DRIVERLESS VEHICLES

In an intelligent transport trial led by the University of Sydney and Transport for NSW, self-driving robotic vehicles have communicated with traffic lights on the streets of Sydney.

As part of the Intelligent Transport Systems Summit in mid-August, the trial showcased vehicle-to-infrastructure technology designed to improve road safety by feeding data about pedestrians, cyclists, other motorists and traffic light signal changes to driverless vehicles.

Two self-driving vehicles drove in live traffic on the streets of Chippendale using wireless connectivity to interact with traffic lights equipped with Transport for NSW's Sydney Coordinated Adaptive Traffic System (SCATS).

As the automated vehicles approached the traffic lights, the software under development — Cit-e — sent messages about the intersection's layout, right of way, timing of signal changes and warnings of imminent hazards including vulnerable road users.

A receiver in the vehicle uses the information in conjunction with the vehicle's position, direction and velocity to gauge whether it is likely to commit a red-light violation or endanger other road users.

The technology can also be used for manually operated vehicles.

Designed by researchers in the Australian Centre for Robotics, based in Sydney's Faculty of Engineering, the self-driving vehicles underwent rigorous safety testing at Transport for NSW's Future Mobility Testing and Research Centre in Cudal, the university said.

"It's great to have something here in Sydney which we can test under Australian conditions," said Dr Stewart Worrall, a senior researcher at the Australian Centre for Robotics.

"This technology isn't just about autonomy, it's also about developing advanced driver assistance systems that can help drivers make better, safer decisions on the road."

The Cit-e software could be launched commercially as early as next year by SCATS. It can be retrofitted to standard vehicles and traffic infrastructure, which means it could be in use long before the arrival of driverless vehicles.


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COLES TRIALS NEXT-GEN COOLING SYSTEM

Researchers from the University of South Australia have worked with industry to build a new-generation, energy-efficient refrigeration system which they say could transform the way supermarkets, hospitals, abattoirs and other systems are cooled.

Co-developed by UniSA and Glaciem Cooling Technologies, the system uses indirect evaporative (dewpoint) carbon dioxide (DP-CO2) technology. It has been installed in the new Coles supermarket in Norwood, SA, and subsequently has been tested and monitored under Australia's RACE for 2030 cooperative research centre program.

Preliminary results are promising, indicating that the system has the potential to reduce annual refrigeration energy consumption by 19% and reduce peak electricity demand by 37%.

The university said that if the system proves successful, Coles and other businesses may be encouraged to adopt it across all their sites to slash electricity consumption and greenhouse gas emissions associated with cold chains.

The project's chief investigator, UniSA sustainable energy researcher Dr Tim Lau, said that heating, ventilation, air conditioning and refrigeration can account for up to 70% of customers' electricity usage and 24% of Australia's electricity consumption.

"The system uses dewpoint coolers to pre-cool the ambient air, allowing the overall system to operate efficiently, even in hot climates exceeding 40˚C, reducing energy usage by more than a third, compared to conventional systems during summer months," Lau said.

A computational model has been developed to assess the system's potential across various sectors, including hospitals, meat processing plants, cold storage and aquariums. The greatest benefits are expected to be seen in hot, dry climates like central Australia.

"This project paves the way for greener and more cost-effective commercial refrigeration, not only in Australia but across the world," Lau said.

RENTAL PROGRAM FOR ELECTRICAL CONTRACTORS


Image courtesy of LAPP Australia.

LAPP Australia has launched a rental program for its electrical contractor customers.

LAPP said its new service, offering per-day or longer rentals, opens up easier access for small and medium businesses to world-class brands of test, measurement and other technologies needed to do the best job on particular projects — without the financial commitment of having to purchase the specialised solutions involved.

LAPP Australia Managing Director Simon Pullinger said the rental program is open nationally to existing customers or on a case-by-case basis.

"This is an initiative to immediately assist our existing smaller and medium contractor customer base throughout Australia, and to attract new customers as well longer term," he said.

"We have designed the rental program to help electrical contractors who would like to extend their capabilities for new projects or new types of jobs, but who might find the initial investment to buy outright to be a strain on cash flow.

"By having the freedom to rent, they maintain the strength of their existing cash flow while being able to leverage up their business opportunities for particular jobs or particular types of jobs."

Pullinger said the program — backed by LAPP Australia's national service and supply network — delivers meticulously maintained equipment at no capital cost to the renter. Items covered by the program include test and measurement technologies, cable handling technologies, site power solutions, communications equipment and site tools.

Pullinger said the rental technologies would provide flexibility in equipment selection to enable use of the best tools for particular jobs.

"Where you need a special tool for a special application, or a quick replacement for equipment that is under repair or maintenance, why pay thousands of dollars on equipment when you can rent it?"

The inventory of rental equipment — selected by company experts working continuously on a large variety of cable, control and automation projects — is backed by technical and management services including logistics, quality assurance and design engineering as required.

Push-pull connectors

HARTING PushPull connectors offer a secure and easy-to-install solution with a tool-less push-pull mechanism. Engineered to withstand harsh conditions such as vibration, shock and extreme temperatures, these connectors have IP65/IP67 protection ratings.

PushPull connectors accommodate a wide range of contact carriers, from 1/10 GbE to 690 V/16 A power supply. Standardised mating faces like RJ45, SC-RJ, LC Duplex, Mini DisplayPort and USB support compatibility.

Suitable for diverse industries including robotics, automation, transportation and data centres, PushPull connectors help to reduce ownership costs and maintenance time. Preassembled cables with PushPull connectors lessen the risk of wiring errors and enable plug-and-play functionality, which is particularly beneficial in data centre environments.

HARTING Pty Ltd
www.harting.com.au

Brass cable glands

LAPP Australia's range of locally stocked nickel-plated SKINTOP BRUSH brass cable glands are specially designed for copper-screened cables, where they are used to achieve a low-resistance screen contact, good strain relief and a high protection class.

These glands are suited for use in control systems, motors, frequency inverters and variable speed drives (including outdoor applications), with temperature ranges of -40 to +100°C in fixed installations or -25 to +100°C in dynamic installations.

The SKINTOP MS-M BRUSH brass cable gland features a double lamella gasket to prevent lever action on heavy cables; IP68 and IP69 protection classes (depending on the model); and fast, uncomplicated assembly and installation.

With a 360° brass brush creating a low-resistance contact between the copper braided screening and the gland, the gland is designed to provide optimum electromagnetic compatibility (EMC) screening.

For thick-walled housings, an "XL" version is available with an exceptionally long connection thread. For painted, anodised or powder-coated housings, LAPP's SKINDICHT SM-PE-M lock nut can be used for equipotential bonding, an important electrical procedure that reduces the risk of personal injury and damage to equipment.

LAPP Australia Pty Ltd
lappaustralia.com.au

Limit switches

Eaton Electric is a well-known supplier of electromechanical components and other products applied in industrial and power supply systems. Its LS-Titan series of limit switches is a diverse group of products designed with automated manufacturing, processing, storage and distribution systems in mind.

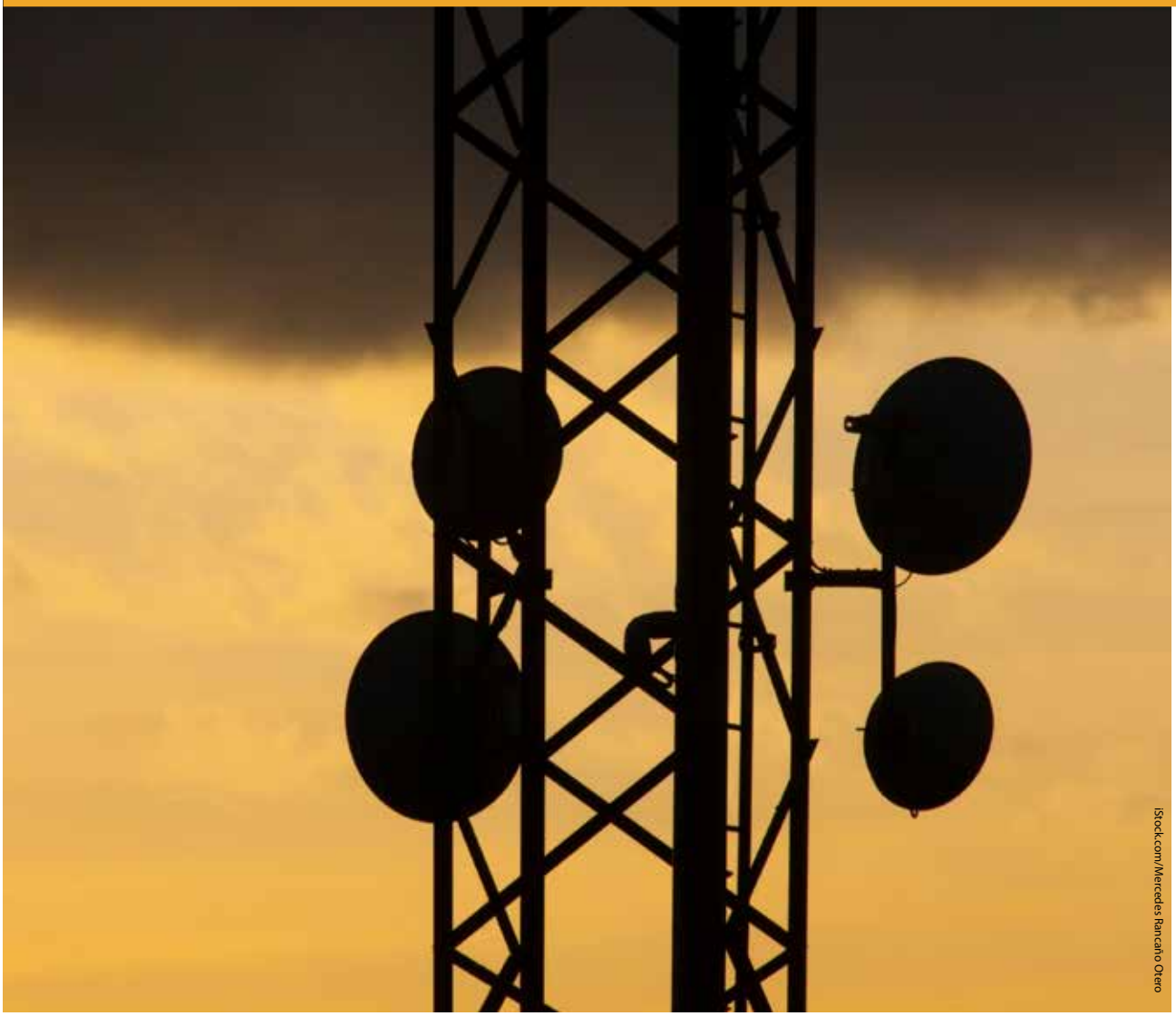
The LS-Titan limit switches contribute to safer and more reliable position detection. They are available in different versions and configurations, with actuators designed as a lever with a roller, a pin plunger or a plastic rod. The operating heads of the switches can be oriented in different directions, making them easier to adapt to a variety of applications. They feature two pairs of contacts: NO, NC (depending on the model) and an optional PNP transistor output.

Their contact rating reaches up to 6 A for mains voltage (240 VAC) and 10 A at 24 VDC. This makes them suitable for the direct control of actuators. With a high IP rating of IP66 or IP67, these limit switches can be applied in difficult conditions such as highly humid and heavily dusted environments.

Transfer Multisort Elektronik Sp. z o.o.
www.tme.com/au/en/

CASE STUDY

Using hydrogen to firm up critical communications



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In regional Victoria, there are five Telstra mobile phone towers that are particularly vulnerable to electricity grid storm damage. At the same time, these assets are critical in supporting local communities during extreme weather events.

Telstra needed a way to provide a consistent electricity supply to the phone towers — at Neerim North, Chum Creek, Christmas Hills, Coldstream and Kinglake — in the event of natural disasters and other unplanned electricity grid outages. To address the problem, the telco has worked with Energys to officially commission a hydrogen-powered back-up generator at each of the five sites.

Energys specialises in designing and delivering advanced hydrogen generators and modular fuel cell engines. The company uses its expertise in feasibility studies, engineering and global consulting services to help industries adopt zero-emissions energy solutions.

The Hydrogen Fuel Cell Generators, manufactured by Energys at its Mulgrave facility, will provide long-duration zero-emissions power when it is needed.

Now, the final site — at Neerim North in East Gippsland — has come online and was inspected by Victorian Minister for Energy & Resources Lily D'Ambrosio.

"I'm thrilled to be here ... standing next to the future," said Energys Managing Director Roger Knight at the launch of the new generator.

"When it comes to the transition away from diesel power, Telstra is showing their leadership by trialling hydrogen.

"We're thankful for Telstra's trust in Energys to deliver critical back-up power systems that will service these five sites during natural disasters and extended grid outages. It's a huge endorsement of the reliability and readiness of our Hydrogen Generators," Knight said.

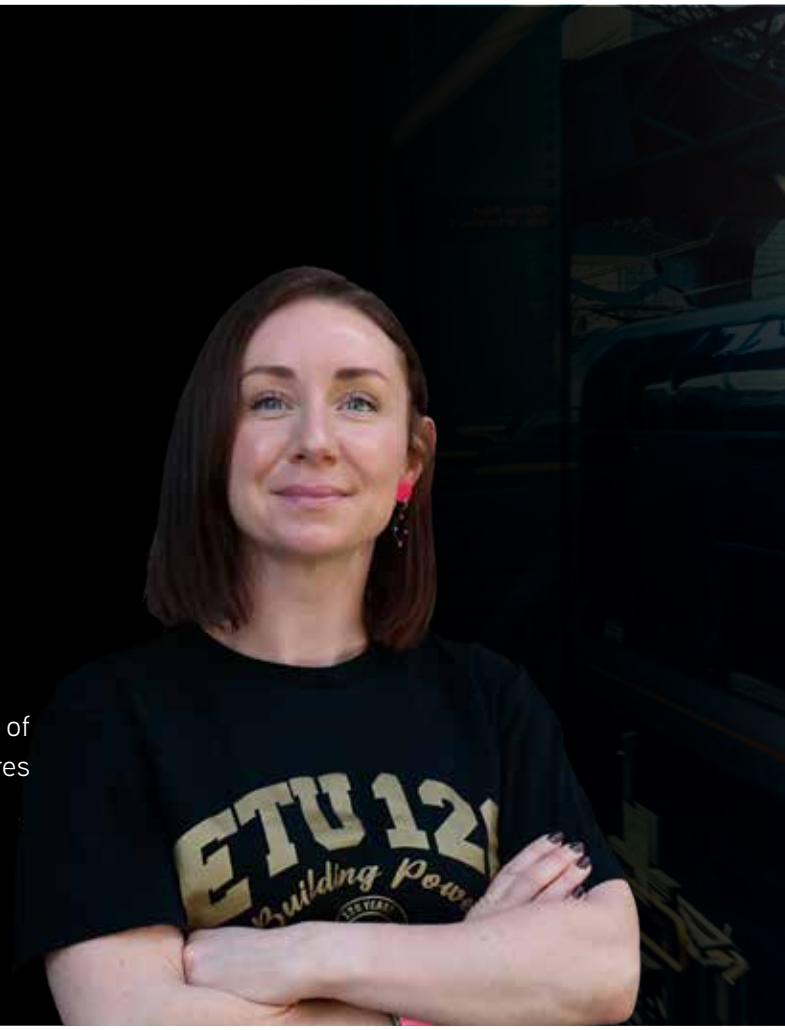
Designed to international and Australian standards, the Energys hydrogen generator range features commercially ready power products that handle the most common applications currently serviced by diesel generators. These include 12, 40, 125 and 250 kW systems available to customers 'off the shelf'. Energys said these turnkey power products are drop-in zero-emissions replacements for traditional diesel electric generators, which will inevitably be phased out as businesses focus more on emissions and rising diesel prices.

Energy Safe Victoria has signed off on Type B regulatory compliance for the five Telstra sites and the Energys Hydrogen Generator, which has been operating at Toyota in Altona since 2019. Further systems in Queensland and Western Australia are also in advanced stages of regulatory approval.

Energys acknowledged the support of the Victorian Government through the Renewable Hydrogen Commercialisation Pathways Fund.

FOCUS ON RAVEN MARIS

The Sydney Trains electrician and Leader of the ETU National Women's Committee shares her experiences and insights with *ECD*.



How did you get into the electrical industry?

I began my career in Canada as a chef, then got married, had children and became a stay-at-home mum. I emigrated to Australia 16 years ago and decided to retrain as an electrician, becoming a 'mature-age apprentice' with Sydney Trains and Transport for NSW. I had to juggle my apprenticeship with being a mum of a four-year-old and a seven-year-old.

What attracted you to working as an electrician?

Having a background in working in kitchens, a male-dominated sector, I wasn't intimidated by working in another one. I was inspired by my father, who was an industrial electrician working in the oil and gas industry. At the time of my applying for apprenticeships, I faced significant discouragement from my family; they were of the opinion that I should work in a more feminised industry like retail or go back to hospitality.

In hospitality you're overworked, underpaid, underappreciated. You deal with cranky customers on a constant basis. It's not conducive to a good work–life balance. I know myself well enough to know that being told that I can't do something makes me want to do it more. It was just logical, the amount of security in having a trade is unparalleled; that is even more evident now with the transition to renewables. Once you're licensed, you have the ability to take it anywhere and you can stop, raise a family, and then come back to it. The qualification never disappears once you've got it.

What does a typical workday look like for you — or are no two days the same?

I'm blessed to work in one of the industries where variety is part of the job. No two days for me in the substation construction division of Sydney Trains are the same. I spend a great deal of my work life travelling and living in some of the more remote locations of the network. Some weeks we're putting high-voltage cable routes in the ground in the bush outside Lithgow, or [there are] weeks when a project requires wiring protection circuits for the new high-voltage switchgear we're installing. I truly enjoy the variety — it gives me the opportunity to grow in my trade and I'm never bored.

Can you tell us a bit about your advocacy work as Leader of the ETU National Women's Committee? Why was it important for you to take on this role?

I was elected to the role with the ETU last year, and in all honesty it's been a very steep learning curve. The aim of the National Women's Committee is to get more women into the trades. Part of our role is to create greater visibility around women working in the trades [and] we have been given opportunities to consult with government on model clauses that help lift the standard of parental leave or similar that makes our industry a more inviting place for primary caregivers.

With the skills shortage that is felt all over the world, not just here in Australia, the push to have a greater number of electrically qualified people coming through to meet the need couldn't be more evident; a significant number need to be women and more gender diverse people. The ETU is not the only body

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with that aim; the initiatives from state and federal governments underpin that sense of urgency. I would always encourage someone to never, ever be afraid to step outside their comfort zone and try something. It's in those places where we feel most discomfort or fear or trepidation that we have our greatest growth.

When a woman steps into this industry she becomes a trailblazer, and chooses a hard path that is worthy of recognition. Over the four years of my apprenticeship I have come away with a qualification, and confidence and new skills that I didn't know were even possible for me. It is my hope that along with the other women leaders in my union we can make the industry a significantly more enticing place to find a career. Come on in, the water is just fine!

What advice do you have for aspiring female sparkies?

One of the saddest things I have come across talking to other women working in male-dominated industries is the need to erase their femininity to fit in. I want to help break that; I never want to see young people making themselves 'smaller' to fit into a box. I want to empower young women and those that are gender diverse to be true to themselves. I still wear perfume and mascara to work; I might be an electrician, but I very much am a woman, and if others onsite find that uncomfortable it's their problem.

I also want to send the message that you don't have to be a big bloke to succeed here; I'm on the smaller side and work in one of the most physically demanding sections. Physical abilities are no longer a barrier to women, with WHS rules preventing anyone — male or female — lifting over a 20 kg bag of concrete. We have mechanical aids for everything these days. No one should have to overexert themselves or put themselves in any physical risk. So no, you don't have to be big. I am only 5′ 4″ and I weigh the same as two and a half bags of concrete.

AT THE TIME OF MY APPLYING FOR APPRENTICESHIPS, I FACED SIGNIFICANT DISCOURAGEMENT FROM MY FAMILY; THEY WERE OF THE OPINION THAT I SHOULD WORK IN A MORE FEMINISED INDUSTRY LIKE RETAIL OR GO BACK TO HOSPITALITY.

Are there any trends, changes or innovations in the industry that you're excited about?

Just being an electrician is being part of the future; helping construct the infrastructure for the transitions to renewables is exciting. The amount of work that needs to be done to get us to net zero is immense, but all the new technology that will make it safer, cleaner and more sustainable is inspiring. The 10,000 km of new transmission lines, the upgrading of every household to all-electric, and the new tech coming with battery or storage of electricity makes the future bright.

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AURORAS COULD THREATEN ELECTRICAL INFRASTRUCTURE

Spectacular auroras like the ones seen in the solar storm of May 2024 can cause damage to critical infrastructure, according to recent research.

Auroras are produced when particles from the sun hit the Earth's magnetic field and cause a geomagnetic storm or when interplanetary shocks compress Earth's magnetic field. These shocks also generate geomagnetically induced currents, which can damage infrastructure that conducts electricity. More powerful interplanetary shocks mean more powerful currents and auroras — but frequent, less powerful shocks could also do damage.

Scientists writing in *Frontiers in Astronomy and Space Sciences* have demonstrated that the impact angle of interplanetary shocks is an important factor in the currents' strength — a finding that could help to forecast dangerous shocks and shield critical infrastructure.

"Auroras and geomagnetically induced currents are caused by similar space weather drivers," said Dr Denny Oliveira of NASA's Goddard Space Flight Center, the lead author of the article. "The aurora is a visual warning that indicates that electric currents in space can generate these geomagnetically induced currents on the ground."

Oliveira said the auroral region could expand greatly during severe geomagnetic storms. "Usually, its southernmost boundary is around latitudes of 70 degrees, but during extreme events it can go down to 40 degrees or even further, which certainly occurred during the May 2024 storm — the most severe storm in the past two decades," he said.

"Arguably, the most intense deleterious effects on power infrastructure occurred in March 1989 following a severe geomagnetic storm — the Hydro-Quebec system in Canada was shut down for nearly nine hours, leaving millions of people with no electricity," Oliveira continued.

"But weaker, more frequent events such as interplanetary shocks can pose threats to ground conductors over time. Our work shows that considerable geoelectric currents occur quite frequently aftershocks, and they deserve attention."

When shocks hit the Earth head-on, rather than at an angle, they are thought to induce stronger geomagnetically induced currents because they compress the magnetic field more. The scientists investigated how geomagnetically induced currents are affected by shocks at different angles and times of day.

To do this, they took a database of interplanetary shocks and cross-referenced it with readings of geomagnetically induced currents from a natural gas pipeline in Mäntsälä, Finland, which is generally in the auroral region during active times.

To calculate the properties of these shocks, such as angle and speed, they used interplanetary magnetic field and solar wind data. The shocks were divided into three groups: highly inclined shocks, moderately inclined shocks and nearly frontal shocks.

They found that more frontal shocks cause higher peaks in geomagnetically induced currents both immediately after the shock and during the following substorm. Particularly intense peaks took place around magnetic midnight.

"Moderate currents occur shortly after the perturbation impact when Mäntsälä is around dusk local time, whereas more intense currents occur around midnight local time," Oliveira said.

Because the angles of these shocks can be predicted up to two hours before impact, this information could allow protections to be put in place for electricity grids and other vulnerable infrastructure before the strongest and most head-on shocks strike.

"One thing power infrastructure operators could do to safeguard their equipment is to manage a few specific electric circuits when a shock alert is issued," Oliveira said. "This would prevent geomagnetically induced currents reducing the lifetime of the equipment."

Something the scientists did not find was a strong correlation between the angle of a shock and the time it takes for it to hit and then induce a current. This may be because more recordings of currents at different latitudes are needed to investigate this aspect.

"Current data was collected only at a particular location, namely the Mäntsälä natural gas pipeline system," Oliveira said.

"Although Mäntsälä is at a critical location, it does not provide a worldwide picture. In addition, the Mäntsälä data is missing several days in the period investigated, which forced us to discard many events in our shock database. It would be nice to have worldwide power companies make their data accessible to scientists for studies."

Automotive charging cables

HARTING provides charging equipment for electric and plug-in hybrid vehicles. The AC Mode-3 cables are designed to safely and efficiently transfer power from charging stations to a vehicle.

HARTING offers a variety of AC Mode-3 cables to fit different needs. These can also be customised, with lengths ranging from 2.5–10 m. All charging cables meet SAE J1772 and IEC 62196 standards for safety and quality. They have an ergonomic design, making them comfortable to hold and use.

HARTING Pty Ltd
www.harting.com.au

Hybrid cloud security platform

The video surveillance market is increasingly utilising connectivity to cloud, driven by the need for remote access, data-driven insights and scalability.

Axis Cloud Connect, from network video provider Axis Communications, is an open hybrid cloud platform designed to provide customers with more secure, flexible and scalable security solutions. In tandem with Axis devices, the platform enables a range of managed services to support system and device management, facilitate video and data delivery, and meet high demands in cybersecurity.

These managed services enable secure remote access to live video operations as well as improved device management with automated updates throughout the lifecycle. They also offer user access management for easy and secure control of user access rights and permissions.

Axis Cloud Connect gives customers the flexibility to integrate Axis products with a range of systems, regardless of complexity. Leveraging the benefits of edge, on-premises and cloud, this platform is suitable for both traditional and more modern architectures.

The platform's security measures comply with industry standards and regulations.

Axis Communications Pty Ltd
www.axis.com

Lockout hasp

Made from durable, non-conductive plastic and with a red body to increase visibility, the Master Lock S442 lockout hasp accommodates up to four personal padlocks and includes labels in English, French and Spanish.

The S442's thin, 3 mm diameter plastic shackle suits businesses that need to secure electrical panel enclosures with small isolation points. Optimal operating temperature is -10 to 50°C.

Master Lock offers a limited lifetime warranty.

Mayo Hardware Australia
www.mayohardware.com.au

Setting a New Standard in Industrial Enclosures: Introducing Rittal AE Compact Enclosures

APS Industrial is proud to introduce the Rittal AE Compact Enclosures, a premier solution tailored to meet the stringent demands of today's industrial environments. With over 25 million units in operation globally, the Rittal AE series has consistently proven to be the reliable choice for compact enclosure solutions, offering unparalleled flexibility, durability, and user-friendly features. These enclosures are designed to safeguard your valuable equipment while ensuring ease of installation and long-term performance, making them an essential component in a wide range of industrial applications.

The Rittal AE enclosures are distinguished by their robust construction, featuring a fully seam-welded steel body. This design approach ensures maximum protection and structural integrity, allowing the enclosures to withstand harsh environmental conditions and mechanical impacts. Available in both powder-coated and stainless steel variants, these enclosures benefit from a meticulous three-stage surface treatment process. This process not only provides superior corrosion resistance, extending the life of the enclosure even in challenging environments, but also ensures a professional and aesthetically pleasing finish that complements any industrial setting.

A key highlight of the Rittal AE Compact Enclosures is the innovative wall mounting bracket system. This system has been designed with the user in mind, offering a significant improvement in installation efficiency. Unlike traditional mounting systems that often require the mounting plate to be removed or modified, the AE enclosures allow the wall brackets to be installed externally. This means that the mounting plate can be fitted in advance, and the wall brackets can be secured afterward, without any interference. This streamlined installation process not only saves time but also reduces the need for additional tools or adjustments, thereby lowering installation costs and minimising downtime.

In addition to ease of installation, the Rittal AE series is packed with features that enhance its versatility and functionality. The enclosures come equipped with reversible doors that do not require drilling, providing the flexibility to adapt to various installation scenarios. Whether you need the door to open from the left or right, the AE enclosures can be configured quickly and easily to suit your specific needs. Furthermore, the AE series supports baying, allowing multiple enclosures to be joined together seamlessly. This is particularly advantageous in applications that require expanded space or the integration of additional components, as it enables a modular approach to enclosure design.

Another standout feature of the Rittal AE enclosures is the large mounting plate, the most spacious available for enclosures of this size category. This generous internal space offers ample room for equipment and cabling, making it easier to organise and manage your installations. The sophisticated cable management system further enhances this by ensuring that all components are securely housed and easily accessible, thereby improving overall operational efficiency and reducing maintenance time.

Adding further value to the Rittal AE enclosures, APS Industrial's manufacturing centre is equipped with the advanced Perforex Milling Terminal MT S. This state-of-the-art machinery allows for precision customisation of the enclosures, including cut-outs and drilling tailored to specific project needs. The Perforex Milling Terminal MT S enhances the versatility of the AE enclosures by enabling bespoke modifications that streamline installation and reduce on-site work, providing our customers with a fully integrated and customised solution that meets their exact specifications.

Rittal's commitment to quality and safety is evident in every aspect of the AE Compact Enclosures. These enclosures undergo rigorous testing to ensure they meet the highest standards of performance and reliability. The AE series is certified to meet critical safety and performance requirements, providing assurance that they are built to withstand the demands of industrial applications across Australia. Additionally, Rittal conducts extensive load capacity testing on the AE enclosures, ensuring that they can handle the weight and stress of the equipment they protect, making them a dependable choice for any local industrial setting.

For engineers and designers, Rittal offers comprehensive support through a range of online resources. Detailed CAD files are available in all major formats, making it easier for users to integrate the AE enclosures into their designs with precision. These files facilitate accurate planning and design, reducing the likelihood of errors and ensuring that the final installation meets all specifications. Additionally, Rittal provides advanced configuration software that streamlines the design process. This software allows users to optimise the layout and functionality of the enclosures, ensuring that every detail is accounted for and that the enclosure is tailored to meet the specific needs of the application.

One of the key advantages of the Rittal AE Compact Enclosures is their versatility in various industrial environments. Whether used in manufacturing, telecommunications, or energy sectors, these enclosures provide robust protection and adaptability, ensuring that sensitive equipment is safeguarded from environmental hazards and operational wear and tear. The flexibility of the AE series, combined with its ease of installation and robust construction, makes it an ideal choice for professionals seeking a reliable, high-performance enclosure solution.

APS Industrial is proud to be the distributor of Rittal AE Compact Enclosures in Australia, offering customers a dependable and versatile solution for their industrial enclosure needs. The AE series, with its superior design, ease of installation, and robust performance, represents the pinnacle of compact enclosure technology, setting a new standard in the industry. Whether you are upgrading existing installations or planning a new project, the Rittal AE Compact Enclosures provide the reliability and flexibility you need to ensure long-term success.

For more information on how Rittal AE Compact Enclosures can revolutionise your industrial operations, visit https://apsindustrial.com.au/rittal-compact-enclosures-ae/.

APS Industrial
www.apsindustrial.com.au

DYNAMIC AND INTERACTIVE:

USING DIGITAL TWINS TO SHAPE SUSTAINABLE GRIDS

*Paul King**

Electric utilities in Australia face many challenges. Climate change is a major concern, along with vegetation encroachment, legacy systems and rising cybersecurity threats, which all further complicate the industry's resilience and reliability.

To meet the government's target of net-zero carbon emissions by 2050, the energy sector must find innovative solutions to maintain reliability while transitioning to cleaner technologies.

A key technology that has gained traction in recent years is digital twins. Australian states are already making substantial investments in different areas with this technology, with NSW committing $40 million, Victoria investing $37.4 millio, and Western Australia leading with a $140 million investment.

These advanced visualisation and analysis platforms enable real-time monitoring, modelling and optimisation of energy grids, leading to more effective resource management. If utility organisations understand how to leverage this technology, they will contribute to the development of more sustainable grids. Here are some of the benefits.

Reliability and resilience

Imagine you are managing a vast utility grid, constantly striving to keep it running smoothly and efficiently. A digital twin is your go-to technology for ensuring grid reliability and resilience. Think of it as a dynamic, interactive map of your entire grid, providing you with a real-time visual snapshot of how everything is functioning. You can see performance metrics, spot network anomalies, receive feedback from analytics and track changes as they happen.

By connecting these data with other essential systems — such as geographic information systems (GIS), simulation technology and asset management — the digital twin becomes your single source of truth. And it doesn't stop at providing a static picture; it actively links the physical grid model with operational and engineering data and simulation capabilities. This connection offers you deep, actionable insights into your grid's status. You can respond promptly to emerging needs, extend the operational life of critical assets, and reduce risks, losses and system failures.

In essence, a digital twin empowers you to keep the grid running optimally, safeguarding both your infrastructure investments and the reliable service that you provide to customers.

Design and project efficiency

A digital twin's value begins well before operations, playing a crucial role in a utility's design efforts.

For the grid to evolve, the real-time digital twin used in operations is repurposed to initiate the design process, ensuring accurate representation of existing conditions. For greenfield projects, the digital twin will start as a simple distribution diagram combined with physical models, such as maps and GIS information. Designers may incorporate electrical designs and protection controls, using integrated engineering analysis software to optimise operations and evaluate potential failures.

As the design process advances, dynamic 4D modelling captures a comprehensive record of all changes, storing physical and engineering modifications within the digital twin. It provides utilities with critical historical data and facilitates business processes, such as design reviews.

Integration of renewables

In May, the engineering community gathered at Bentley Systems' Illuminate event in Sydney, where Bob Freeman, Information Management Lead at WSP in Australia, highlighted how digital twins are not just about technology; they represent the future of sustainability, enabling us to design with foresight and responsibility for generations to come.

The Australian Energy Market Operator predicts that solar and wind capacity in the national grid will triple by 2030, and rooftop solar capacity is expected to double. That's why Australia needs a well-rounded strategy to integrate more renewable energy into the existing power systems. Digital twins can be a game changer.

By providing a real-time picture of how solar panels and wind turbines operate, they enable utilities to fine-tune energy production and distribution strategies effectively. Operators can monitor these energy sources continuously, adjusting operations to maximise efficiency and respond swiftly to fluctuations in output.

"THINK OF IT AS A DYNAMIC, INTERACTIVE MAP OF YOUR ENTIRE GRID, PROVIDING YOU WITH A REAL-TIME VISUAL SNAPSHOT OF HOW EVERYTHING IS FUNCTIONING.

A sustainable future for electricity

Digital twins are revolutionising the management of electrical grids, offering utilities a transformative tool for precise, forward-looking ecosystem management. By facilitating the seamless integration of renewable energy sources and minimising carbon emissions, electrical utilities will visualise and assess the environmental impacts of their operations. This capability guides decisions that prioritise sustainable development, helping to achieve environmental goals.

In essence, digital twins empower utilities to navigate the complexities of the energy sector effectively. By promoting operational excellence and driving towards a sustainable energy future, they pave the way for enhanced efficiency, reduced environmental impact and strategic decision-making in utility management, all while ensuring safe, reliable and affordable energy delivery.

**Paul King is Director of Solution Engineering at Bentley Systems.*

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‘FLOATOVOLTAICS’: COMING TO A LAKE NEAR YOU?

Recent research from Bangor and Lancaster Universities and the UK Centre for Ecology & Hydrology has explored the potential for deploying low-carbon floating solar arrays around the world.

Floating solar photovoltaics (FPVs), known colloquially as ‘floatovoltaics’, typically consist of an array of PV modules mounted upon a series of floats, which are moored into position on the surface of a water body.

The researchers calculated the daily electrical output for FPVs on nearly 68,000 lakes and reservoirs, using available climate data for each location.

Their calculations were based on the lakes and reservoirs that were most suited to the installation of floating solar technology. This meant that the bodies of water studied had to be no more than 10 km from a population centre and not located in a protected area. They also couldn’t dry up or freeze for more than six months each year.

Electrical output was calculated based on FPV covering 10% of each water body’s surface area, up to a maximum of 30 km^2.

“We still don’t know exactly how floating panels might affect the ecosystem within a natural lake, in different conditions and locations. But the potential gain in energy generation from FPV is clear, so we need to put that research in place so this technology can be safely adopted,” said lead author of the paper Dr Iestyn Woolway, from Bangor University.

“We chose 10% of a lake’s surface area as a likely safe level of deployment, but that might need to be reduced in some situations, or could be higher in others,” Woolway said.

> **“ FPV HAVE VARIOUS ADVANTAGES OVER LAND-BASED SOLAR INSTALLATIONS: THEY FREE UP LAND FOR OTHER USES AND KEEP PANELS COOLER.**

While output fluctuated depending on altitude, latitude and season, the team estimated that the total annual power output would be 1302 terawatt hours (TWh) across all 67,893 water bodies — about four times the total annual electricity demand of the UK.

Benefits of floating solar farms

FPV have various advantages over land-based solar installations: they free up land for other uses and keep panels cooler, making them more efficient.

Potential environmental benefits include reducing water loss through evaporation by sheltering the lake surface from the sun and wind; and reducing algal blooms by limiting light and preventing nutrient circulation. However, the researchers cautioned that further research is needed on the overall environmental impact of FPV. They recommended that decisions to deploy FPV should consider the intended function of water bodies and how they are used, as well as the potential ecological impact.

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When the figures were considered on a country by country basis, five nations could meet their entire electricity needs from FPV: Papua New Guinea, Ethiopia, Rwanda, Kiribati and Benin. Others, such as Bolivia and Tonga, would come very close, respectively meeting 87% and 92% of electricity demand.

Many countries, mainly from Africa, the Caribbean, South America and Central Asia, could meet between 40% and 70% of their annual electricity demand through FPV. In Europe, Finland could meet 17% of its electricity demand from FPV and Denmark, 7%.

Australia could meet just under 6% of its demand.

"Even with the criteria we set to create a realistic scenario for deployment of FPV, there are benefits across the board, mainly in lower income countries with high levels of sunshine, but also in Northern European countries as well," Woolway said. "The criteria we chose were based on obvious exclusions, such as lakes in protected areas, but also on what might reduce the cost and risks of deployment."

The study co-author, Professor Alona Armstrong of Lancaster University, added: "Our work shows there is much potential for FPV around the world. But deployments need to be strategic, considering the consequences for energy security, nature and society, as well as net zero."

The team's findings have been published in *Nature Water*.

CAT6A modular jacks

The Warren & Brown HY series Category 6A UTP modular outlet is designed to simplify and accelerate network deployment. These modular jacks feature easy visual inspection of the wiring colour code to help ensure every connection is correct, making them suitable for modular patch panels, wall outlets and floor distributors.

These unshielded jacks can be terminated quickly and easily without a termination tool and are available in black or white. Compatible with unshielded cable (U/UTP), they meet or exceed ISO/IEC 11801 Ed.2.2 system performance for Class EA networks (10 Gbps, 500 MHz). The HY series CAT6A shielded jacks are suitable for PoE and PoE+ applications, with secure metal contacts supporting earthing integrity at the patch panel.

To further simplify network deployment, these jacks offer multidirectional cable entry for straight or angled installation. The printed circuit design enhances high-frequency crosstalk performance.

Warren & Brown Technologies

www.wbnetworks.com.au

High-capacity EV charger

Designed to support the electrification of the mining industry, the Ampcontrol MegaWatt Charger uses high-capacity charging technology to reduce charging time and operational impact.

The charger's dual-mode charging feature enables multiple vehicle types to be charged via a single unit. It powers vehicles ranging from light passenger vehicles, such as Ampcontrol battery electric vehicle DRIFTEX, to large machines, including electric haul dump trucks, trains and buses.

Liquid cooled with integral air-to-liquid exchanger, the charger uses a biodegradable dielectric coolant. It complies with AS/NZS 4871.6:2013 and is Category 4 compliant to EN 61800-3:2004, EMC Directive 2004/108/EC.

Ampcontrol Pty Ltd

www.ampcontrolgroup.com

Switcher ICs

Power Integrations' InnoMux-2 family of single-stage, independently regulated multi-output offline power-supply ICs consolidate AC-DC and downstream DC-DC conversion stages into a single chip, providing up to three independently regulated outputs for use in applications requiring multiple voltages.

The elimination of separate DC-DC stages reduces component count and PCB footprint while increasing efficiency in comparison to traditional two-stage architectures. Efficiency is aided by the ICs' 750 V PowiGaN gallium-nitride transistors, zero-voltage switching (without an active clamp) and synchronous rectification.

InnoMux-2 ICs deliver up to 90 W of output power with regulation of better than ±3% across the full input line, load, temperature and differential current step conditions, according to Power Integrations. The InnoMux-2 controller also manages light-load power delivery, avoiding the need for pre-load resistors and reducing no-load consumption to less than 30 mW.

InnoMux-2 devices leverage Power Integrations' thermally efficient InSOP24 and InSOP28 packages with PCB cooling, so no heatsink is required. Device options include dual- and three-output constant voltage (CV); optionally, one output may be dedicated to constant current (CC) drive, suitable for powering LEDs in displays or for high-speed charging of an internal battery.

Typical applications include TVs, monitors, appliances, networking, home and building automation, LED emergency lighting and industrial power supplies.

Power Integrations

www.power.com

CASE STUDY

Retrofitting a German wind farm

A major operator of a wind farm in northern Germany needed a solution for the remote control and monitoring of its wind turbines, which are older Vestas V90 models that are no longer maintained by the manufacturer.

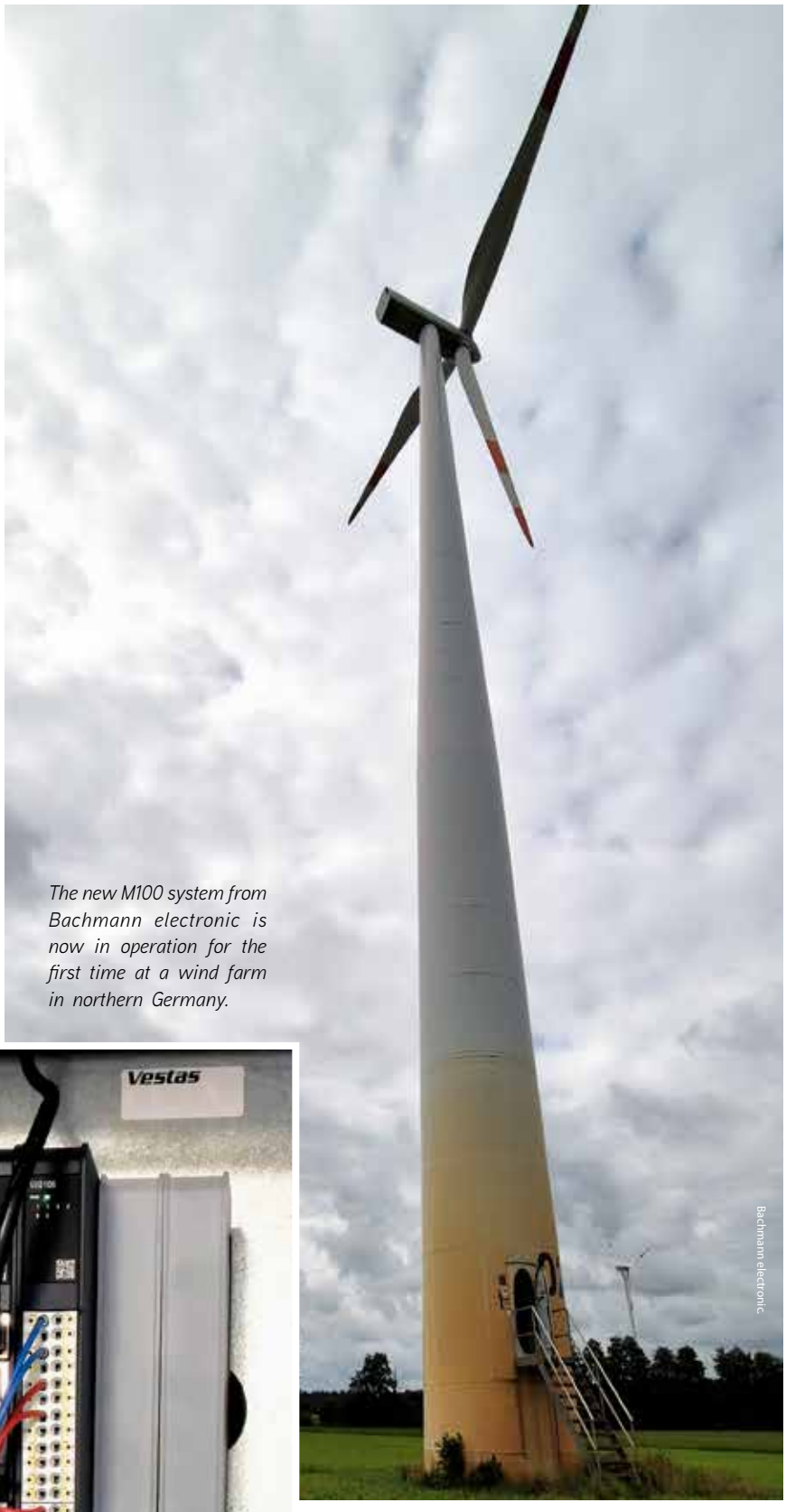
The company collaborated with Bachmann electronic to install Bachmann's new M100 system — the first time this technology has been deployed in the field.

A Bachmann MC212 controller module was installed in the nacelle of the wind turbine, allowing the plant operator to remotely access real-time data about the turbine's functioning, something that was not offered by the turbine manufacturer.

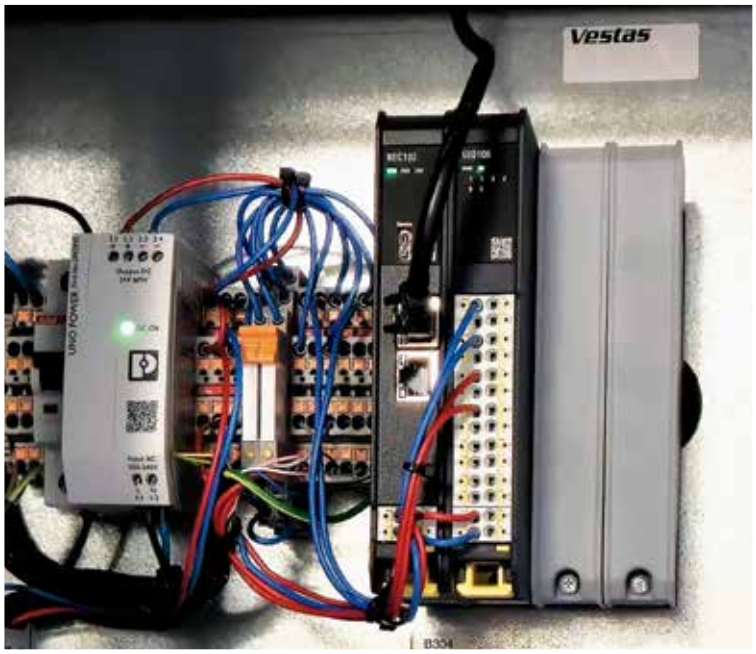
Meanwhile, the M100 station was installed in the tower base of the turbine, enabling service technicians to access the wind turbine's control unit. The system reads the service key switch and shows the remote access on the display, with the highest priority given to onsite service and transmission of information about system status.

Communication between the M100 station and the MC212 module in the nacelle takes place via a fibre-optic cable already installed for a Bachmann content management system (CMS) in combination with media converters.

Bachmann electronic and the operator have already begun to discuss the next development steps, including the creation of a prototype for the entire V90 fleet. The solution is then planned to go into series production.



The new M100 system from Bachmann electronic is now in operation for the first time at a wind farm in northern Germany.



The UIO106 input/output module plays a key role in the project.

Solar-powered security camera

TP-Link's Tapo range of smart wire-free security cameras has a new member, the C410 KIT. Its internal 180-day battery is recharged via an integrated solar panel for 24/7 security, and the panel itself is part of the mount, providing a streamlined wire-free install. IP65 dust- and weatherproofing mean the C410 KIT can be positioned outside in any reasonably sheltered position.

While it is possible to connect a Tapo A201 solar panel to an installed camera, this requires an extra mounting point and a wired connection to the camera. In the C410 KIT, the solar panel is integrated into the mount, with all power routed internally.

Based on standard environmental conditions (1000 W/m^2, 25°C, AM1.5) and specified working scenes (up to 100 events triggered per day), about 45 minutes of sunlight exposure is enough to give the camera's internal battery sufficient charge for a full day of coverage, resulting in a 24/7 security solution that does not require periodic charging or back-up power.

For periods of heavily overcast weather and rain, the Tapo C410 KIT offers up to 180 days of operation on battery alone when fully charged, based on Tapo laboratory tests with 250 s of use per day. This makes the camera suitable for properties or locations that do not require frequent visits or maintenance (actual battery life may be shorter depending on how often the camera is activated).

The Tapo C410 KIT features colour night vision and a 2K 3 MP sensor. Built-in spotlights on the C410 KIT activate automatically in low-light conditions and can be activated manually when required. The camera's smart AI can identify people and notify users via the Tapo app, reducing false alarms and unnecessary alerts. This functionality is included and does not require a monthly subscription.

TP-Link Australia
www.tp-link.com/au/

Group lock box

The lightweight Master Lock S3570 group lock box is an efficient, multi-purpose solution for smaller teams. The S3570 can be wall mounted and is also highly portable. Its compact design holds up to six padlocks internally for protected storage and can be locked out with up to eight padlocks or hasps externally.

The top-hinged transparent polycarbonate window allows for easy key viewing and there are two external hooks to hold folded permit paperwork, or hang tags and extra items.

When group lockout is required in various areas throughout a facility, the S3570 provides flexibility regarding where it is placed and how it can be used. Permanently mounting brackets in areas where group lockout may take place allows the lock box to be fixed in place or quickly and easily moved from one bracket to another within the facility as needed. Optimal operating temperature is -40 to 65°C.

The product comes with a limited lifetime warranty.

Mayo Hardware Australia
www.mayohardware.com.au

Sustainable circuit breaker

Siemens Smart Infrastructure and chemical company BASF have developed an electrical safety product that includes components made from biomass-balanced plastics. Used across industrial and infrastructure applications, the Siemens SIRIUS 3RV2 circuit breaker is now manufactured using Ultramid BMBcert and Ultradur BMBcert from BASF, where fossil feedstock at the beginning of the value chain is replaced by biomethane derived from renewable sources such as agricultural waste. Both materials are designed to provide the same quality and performance as conventional plastics.

The SIRIUS 3RV2 circuit breaker meets the criteria of the recently introduced Siemens EcoTech label, designed to give customers a comprehensive insight into product performance across selected environmental criteria. In addition to most of the product housing and functional parts being made from biomass-balanced plastic, the product also offers lower power consumption over its lifetime compared to its predecessor.

Siemens Ltd
www.siemens.com.au

GigaREACH XL: Extend your network's reach, not your risk

iStock.com/Jacob Wackerhausen

Reach further

The GigaREACH XL solution is a simple, non-invasive UTP solution that supports 100 Mbps/90 W up to 200 m, 1 Gbps/90 W up to 150 m, and 10 Mbps/90 W up to 250 m, all without the cost and risk of invasive network modifications.

Warrantied performance

CommScope warranties your extended reach performance with our Applications Assurance and further supports you with a 25-year Extended Product Warranty and technical support, training, education and resources available online and onsite.

Simplify the network

Running one cable versus adding telecom rooms, PoE extenders, optical equipment and patch panels reduces network complexity, points of failure, OpEx and deployment times. GigaREACH XL cables and channels meet all your Category 6 requirements. So they easily integrate into your structured cabling architecture and use the same installation tools, procedures, panels and jacks as the SYSTIMAX family of GigaSPEED® solutions.

Another tool in our extended reach arsenal

The GigaREACH XL solution is the latest addition to the SYSTIMAX portfolio of extended reach solutions that includes our Constellation® edge-based platform and Powered Fiber system. Together they're enabling tomorrow's hyperconnected, edge-based enterprise networks.

Why 100 meters?

Commercial cabling standards define the maximum supported length for a Cat 6 cable as 100 m. This limitation is based on the electrical characteristics of twistedpair copper cabling. As the signal travels along the cable, its strength decreases. The longer the cable, the greater the signal loss.

WHY?

A growing need to connect and power devices beyond the 100-meter limit defined in the standards, while ensuring the reliable performance of a standards-based connection. Options exist to extend the network's reach, but each involves a level of cost and risk that is hard to justify when connecting just a few devices.

WHAT?

SYSTIMAX GigaREACH XL. The only extended reach Category 6 cabling solution warrantied to support 100 Mbps/90 W up to 200 m, 1 Gbps/90 W up to 150 m, and 10 Mbps/90 W up to 250 m.

HOW?

Proprietary UTP twist technology enables use of a coarser 21 AWG conductor, lowering loss and cutting DC resistance per meter in half versus standard Category 6 cables. This reduces signal loss and voltage drop over distance to assure extended reach support.

WHEN?

Any time a limited number of edge-based devices need to be deployed quickly, easily and with minimal disruption, versus adding additional telecommunication rooms and equipment.

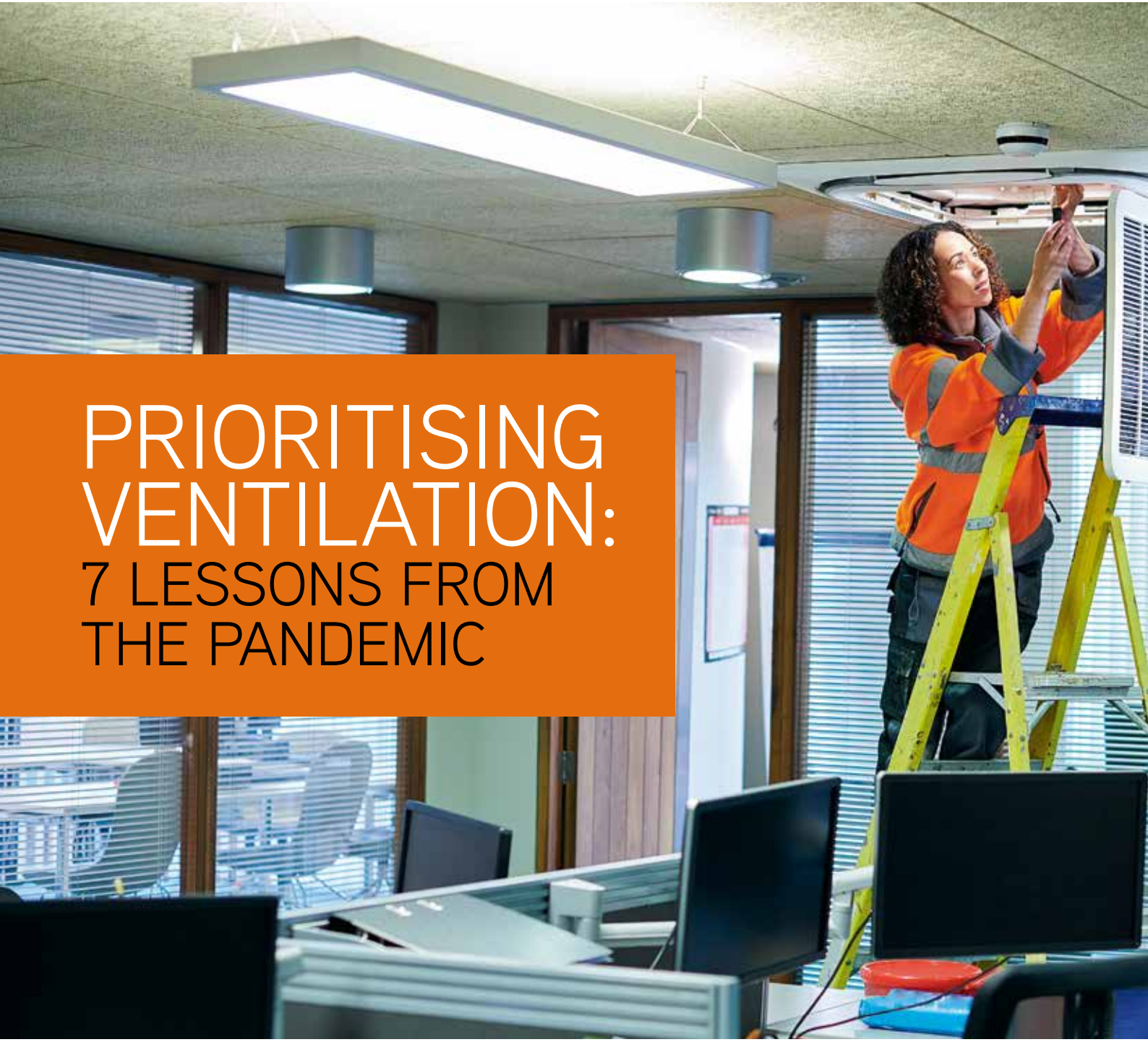
WHERE?

Typically, at the edge, >100 m from the nearest telecommunications room, where network devices need reliable power and data.

For more information about our SYSTIMAX GigaREACH XL extended reach solution, contact your CommScope representative or visit www.systimax.com.

COMMSCOPE®

CommScope Technologies Australia Pty Ltd
www.commscope.com



PRIORITISING VENTILATION: 7 LESSONS FROM THE PANDEMIC

The COVID-19 pandemic revealed serious deficiencies in the way indoor air quality (IAQ) is managed on an official level — something that contributed to the virus's devastating impact.

This is the finding of a group of experts who have analysed the relationship between ventilation and indoor airborne infection transmission in the wake of COVID-19. Their research has been published in the journal *Science*.

Air quality scientist Professor Lidia Morawska, from QUT's School of Earth and Atmospheric Sciences, said the rapid global spread of COVID-19 had soon made it clear the world was unprepared to respond appropriately.

"In the early days of the pandemic the World Health Organization and many national health authorities claimed the virus was 'not in the air' but rather present in large quantities on surfaces. This led to a misconception about how the virus was transmitted," Morawska said.

"Public health authorities rejected existing knowledge, which led to misguided control measures aimed at cleaning surfaces, instead of ventilation, filtration, face-masking and deactivation of airborne viruses.

"However, for science and building engineering experts there was no doubt from the beginning that the virus was transmitted predominantly through the air and the most important control measure to reduce infection risk was to remove the viruses from the air through ventilation or inactivate them through UVC radiation."

In their paper, the scientists — Morawska, Professor Yuguo Li from The University of Hong Kong and Professor Tunga Salthammer from the University of Surrey — state that contemporary buildings are not designed with provision of good indoor air quality as a requirement, and specifically not with the aim of controlling airborne infection transmissions. Also, there are usually no measures in place to check whether ventilation is adequate in relation to the number of people occupying the space; whether it functions without faults; or whether it is effectively distributed throughout the space.

This has been a longstanding problem. Not even 'sick building syndrome' (SBS) — which occurred after the reduction of ventilation flow rates that followed the energy crisis in the 1970s — prompted better ventilation of public buildings, despite research showing a strong connection between poor air flow and SBS.

To address the issue, the experts have presented seven key lessons to emerge from the pandemic.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BUILDING AND VENTILATION DESIGN ARE CLOSELY RELATED AND SHOULD BE EQUALLY IMPORTANT IN PLANNING AND OPERATION.

1. Interdisciplinary knowledge is vital for public health decision-making.

The experts who advised the WHO at the beginning of the pandemic were mostly public health experts, while the value of physical, chemical and engineering expertise was considered less relevant. For example, current epidemiological studies of outbreaks commonly do not include the measurement of ventilation rates, which results in incomplete assessment.

2. Ventilation must go beyond the 'open window' solution.

Modern society cannot rely solely on natural (open window) ventilation in buildings that are not designed to provide sufficient and effective air supply.

Mechanical ventilation must be part of the solution. An HVAC system can implement various air supply techniques such as mixing, displacement and personal ventilation. At the same time, HVAC offers the possibility of air disinfection using germicidal ultraviolet (GUV) and filtration.

The performance of the HVAC can be controlled using suitable indoor air quality and outdoor air parameters, which are measured and processed using a smart sensor system.

3. Building and ventilation design go hand in hand.

Different types of buildings — housing, offices, shopping centres, airports, railway stations, school buildings etc — are becoming increasingly complex, but are mostly planned and built with design and operation constraints.

Sufficient ventilation, which is the basic function to make a building livable, is often not considered among the key criteria. Building and ventilation design are closely related and should be equally important in planning and operation.

4. Equivalent ventilation is a solution for existing buildings.

Buildings such as aged care facilities and schools that are naturally ventilated cannot be easily or cost-effectively retrofitted. In such cases equivalent ventilation is needed, using the techniques of air filtration and GUV.

Filtering does not remove water, carbon dioxide and gaseous pollutants from the air, but it is "equivalent to ventilation" for particulate matter (eg, pollutants from a bushfire). GUV deactivates pathogens in the air, so it may be equivalent to ventilation in relation to infection control.

The researchers noted that there are some concerns that the operation of GUV systems may result in the formation of harmful secondary air pollutants, adding that these concerns are based on laboratory experimental studies or modelling studies. There is little evidence from real building studies, which are very rare.

5. Control and risk assessment tools should be considered in future.

Risk assessment tools have value in estimating the probability of airborne infection, but are too complex to be used as a day-to-day control measure in modern buildings. New technologies are being researched, developed or optimised to control the ventilation of buildings.

6. Monitoring is crucial.

Ventilation performance should be monitored at all the times when buildings are occupied to dynamically inform ventilation control in response to building occupancy and use.

Numerous CO_2 monitors are installed in modern buildings and a raft of low-cost CO_2 sensors are available for continuous monitoring of ventilation performance in housing and transport cabins, with the preferred method for measuring CO_2 being non-dispersive infrared (NDIR).

Modern devices are calibrated against reference methods and their performance can be improved using machine learning tools. Combining CO_2 measurement with other relevant parameters is possible and recommended.

7. IAQ must be mandated in public buildings.

Indoor air quality must be mandated and controlled like water and food by the relevant authorities. Without regulations, good IAQ cannot be assured by volunteer occupants' efforts or even building operators if the building was not designed with this as an objective and/or equipped with adequate engineering systems.

"The COVID-19 pandemic showed us that not only is ventilation a key control measure to lower the risk of airborne infection transmission of any pathogens, but also that ventilation must be considered as part of the control of IAQ from outdoor generated pollution, beyond infection transmission," the researchers said.

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ELECTRICITY DEMAND SET TO DOUBLE BY 2050

Global electricity demand is set to double by 2050, according to a report from DNV, a global assurance company specialising in energy.

DNV's 'New Power Systems' report states that, as the world steadily decarbonises, three things will need to happen to accommodate the increased dependence on electricity. Firstly, there will need to be significant grid expansion. Secondly, solutions for grid congestion will be required. Thirdly, there will need to be new business models to deal with rising electricity demand and generation from wind and solar.

In some good news, the report concludes that grid expansion will be affordable. DNV also expects that global grid charges passed on to consumers will remain stable or even decline in the long term.

The growing demand for electricity and renewables

The primary drivers in this predicted surge in global electricity demand are global economic growth and the electrification of transport, heating and industry. The development of data centres, especially for AI applications, will also be a significant factor in this increase; however, AI also has the potential to make both the provision and use of power more efficient.

By mid-century, electricity will constitute 37% of global final energy use, up from 20% in 2023. This upswing is accompanied by a dramatic shift towards renewable energy, with wind and solar expected to generate half of the world's electricity by 2040 and 70% by 2050. The decarbonisation trajectory predicts that nearly 90% of electricity will be sourced from non-fossil sources by 2050.

A flexible system is critical

The growing share of renewable power will require considerable flexibility and a robust system of demand-response. As variable renewable energy sources (VRES) expand ninefold, the need for short-term flexibility will double.

Fluctuating demand from sectors like heat and transport will require new services such as synthetic inertia products (which maintain a

steady power frequency) and fast frequency response (delivery of a rapid increase or decrease by generation or load in a time frame of two seconds or less)[1]. It is critical that market and regulatory frameworks adapt to support these technologies.

"Deep digitalisation, including the application of AI, is crucial for managing the increased complexity of a renewable-dominated power system," said Remi Eriksen, Group President and CEO at DNV.

"So there will be a rapid growth in both information technology and operational technology in the coming years which must be supported by a robust approach to risk management, particularly on cybersecurity, to reap the benefits of the new power systems."

Energy storage will also be hugely important in tackling the intermittent nature of renewable energy sources. According to DNV, lithium-ion battery technology is set to play a dominant role in this segment, offering three times more storage capacity than hydropower and pumped storage by 2050. However, achieving the necessary level of flexibility will require innovative market designs and advanced tariff schemes to incentivise automated demand-response, vehicle-to-grid (V2G) and behind-the-meter storage systems.

Power-to-hydrogen value chains are a critical market element for renewable generation and will need to be scaled through concerted investment efforts.

Grid expansion is necessary: will it be affordable?

For the energy transition to succeed, global grid capacity needs to grow 2.5 times its current size, DNV said, with annual expenditure on grids more than doubling to US$970 billion by 2050.

While grid enhancing technologies (GETs) can offer potentially significant temporary relief, the long-term solution lies in accelerating the construction of new grid infrastructure and advanced controlling systems, which are currently hampered by permitting timelines, the scarcity of human and material resources, and financial constraints.

Luckily, despite a rise in global grid expenditures from 15% to over 25% of annual energy expenditure by 2050, efficiencies in grid technology and increased electricity distribution will likely keep consumer grid charges stable or declining in most regions. Only four out of 10 regions might see an increase.

Predicting future unit electricity costs is challenging due to varying tax treatments and government incentives. However, the continuous decline in renewable power costs suggests that consumer prices are unlikely to rise. Electrifying end-use sectors like transport and heating will further enhance efficiencies and cost savings, leading to lower overall household energy bills in high- and middle-income regions. In low-income regions, while absolute household energy expenses may slightly increase, rapid GDP growth should offset this rise.

A systemic approach to the energy transition

"We believe in systems-thinking, looking at the big picture, to consider how energy is generated, transmitted, consumed and stored across all energy carriers," said Ditlev Engel, CEO for Energy Systems at DNV.

"There will be no transition without transmission. The new energy system will require data-driven solutions and policies that address all interconnections, from permitting to the integration of AI and cyber-resilience. Planning for a new wind farm must include a strategy for grid connection; similarly, GETs and new wire integrations require IT upgrades at most control centres," he continued.

"The pathway to a decarbonised power system is clear: renewables integration and grid expansion require significant investment, innovation, coordination and commitment from all players, especially governments. As the world moves towards a greener future, addressing these challenges with a systemic and forward-thinking approach will be essential for a successful energy transition."

DNV's Energy Transition Outlook 2023 served as the foundation for the report, with additional insights provided by experts in demand modelling, power grids, new market models, digitalisation and AI.

The full report can be accessed at: https://www.dnv.com/publications/new-power-systems-report.

1. https://www.aemc.gov.au/faster-frequency-response-support-future-security-power-system

Cooler systems

EXAIR's 316 stainless steel ATEX Cabinet Cooler systems are designed to protect sensitive electronics in ATEX-classified areas. They are UL tested and CE compliant, meeting stringent requirements for purged and pressurised electrical enclosures classified for use within Zones 2 and 22. With cooling capacities of up to 5600 Btu/h, the systems are appropriate for protecting electrical enclosures with problematic overheating in areas with explosive atmospheres, both indoors and outdoors.

EXAIR ATEX Cabinet Coolers produce and circulate cold air inside enclosures with the aim of preventing overheating, high-temperature faults and costly shutdowns. They easily mount via a standard electrical knockout while maintaining the NEMA 4 and 4X integrity of enclosures in explosive areas. These systems include an auto-drain filter separator so that no water, dirt or contaminants from the compressed air system pass into the electrical enclosure. Thermostat controls are available to minimise compressed air use, while cold air distribution kits disperse a balanced flow of cold air within the enclosure.

Compressed Air Australia Pty Ltd

www.caasafety.com.au

Thermocouple input module

I-7018Z-G/S3 is a high-performance 10-channel thermocouple input module designed for precise temperature measurement. The versatile module supports current, voltage and thermocouple inputs, making it suitable for various industrial applications. It features automatic cold-junction compensation for each channel, helping to support consistent and stable temperature outputs.

With high overvoltage and common voltage protection, the I-7018Z-G/S3 provides robust performance in harsh environments. Each channel can be individually configured, and the module includes open thermocouple detection to enhance data collection. Built-in dual watchdog timers support operational performance, and the module's safety is underscored by compliance with CE, UKCA, FCC, RoHS and WEEE standards.

The module's ability to handle multiple types of analog inputs, including a wide range of voltage inputs from ±15 mV to ±2.5 V, adds to its flexibility. Overvoltage protection up to 240 VRMS safeguards the device from electrical surges. Additionally, the M-7018Z variant supports both Modbus RTU and DCON protocols, providing easy integration into various industrial systems. The I-7018Z-G/S3 suits applications in building automation, factory automation, machine automation, remote maintenance, remote diagnosis and testing equipment.

ICP Electronics Australia Pty Ltd
www.icp-australia.com.au

Heated workwear

Milwaukee Tool has expanded its M12 Heated Gear line with the introduction of new colours in the M12 Heated Hoodie range.

Milwaukee Heated Gear products utilise carbon fibre heating elements to generate and trap heat across core body areas, while adjustable heat technology allows users to adapt to changing conditions by simply increasing or decreasing the heat level with the touch of a button.

The garments are designed to provide users with the freedom of movement they need to stay productive on and off the job site. The hoodies are available in a variety of colours, including grey and fluoro for men and black for women.

The M12T Heated Gear jackets and vests are available in either TOUGHSHELL stretch polyester or AXIS RIPSTOP polyester — both built to last and provide wind and water resistance. FreeFlex Mobility Gussets also enhance user mobility. In addition, all garments are washer and dryer safe for easy care.

M12 Heated Gear features a one-touch LED controller for easy operation, three heat settings and up to three

heat zones (back, chest and pockets) for customised comfort. They also provide up to eight hours of runtime on a single charge with an M12T REDLITHIUM-ION 3.0 Ah battery pack, ensuring the wearer stays warm throughout the workday. The heated gear also features a battery pass-through pocket design for versatile front or back battery placement, increasing comfort and flexibility.

Milwaukee Tool Australia
www.milwaukeetool.com.au

Smart solutions for sustainable urban energy

The mobility hub features charging stations for shared electric vehicles, with 554 solar modules providing climate-friendly electricity, which is optimised with intelligent controls.

German state-owned energy supplier Stadtwerke Stuttgart GmbH has been working to make its facilities run more smoothly and efficiently with the help of Siemens Smart Infrastructure.

After 18 months of collaborative planning and implementation, the new Stadtwerke Stuttgart headquarters have recently opened, bringing together Siemens' expertise in sustainable infrastructure development with Stadtwerke Stuttgart's experience in renewable energy generation and supply.

The new facility uses an intelligent energy management system across its office complex, warehouse and workshop, which is controlled by applications from Siemens' open digital business platform, Siemens Xcelerator. This system has been designed to optimally connect the supply of, and demand for, renewable energy for everything from heating and lighting to elevators and office equipment. It also electrifies the facility's mobility hub, which will be used to charge electric vehicles from the Stadtwerke Stuttgart fleet.

The two companies will partner in a similar way on other Stadtwerke Stuttgart projects, including a hydrogen production facility in the city's port.

"The combination of Siemens' expertise in building management and ours in the energy industry creates solutions that not only help us to achieve our own sustainability goals but also help us to support other organisations in their energy transition," said Peter Drausnigg, Technical Managing Director at Stadtwerke Stuttgart.

"We see ourselves as the driving force behind the energy transition in Stuttgart and are proud to be working with Siemens to set an example for other businesses and cities to follow around the world."

The basis of Siemens' building management system is intelligent digital twin technology. This means that Siemens Smart Infrastructure Building X 360˚ Viewer and Energy Manager offer digital representations of the headquarters, using artificial intelligence (AI) to retrieve and process relevant real-time data from installed building and e-mobility technology. Building X is a digital building platform that enables customers to digitalise, manage and optimise their building operations.

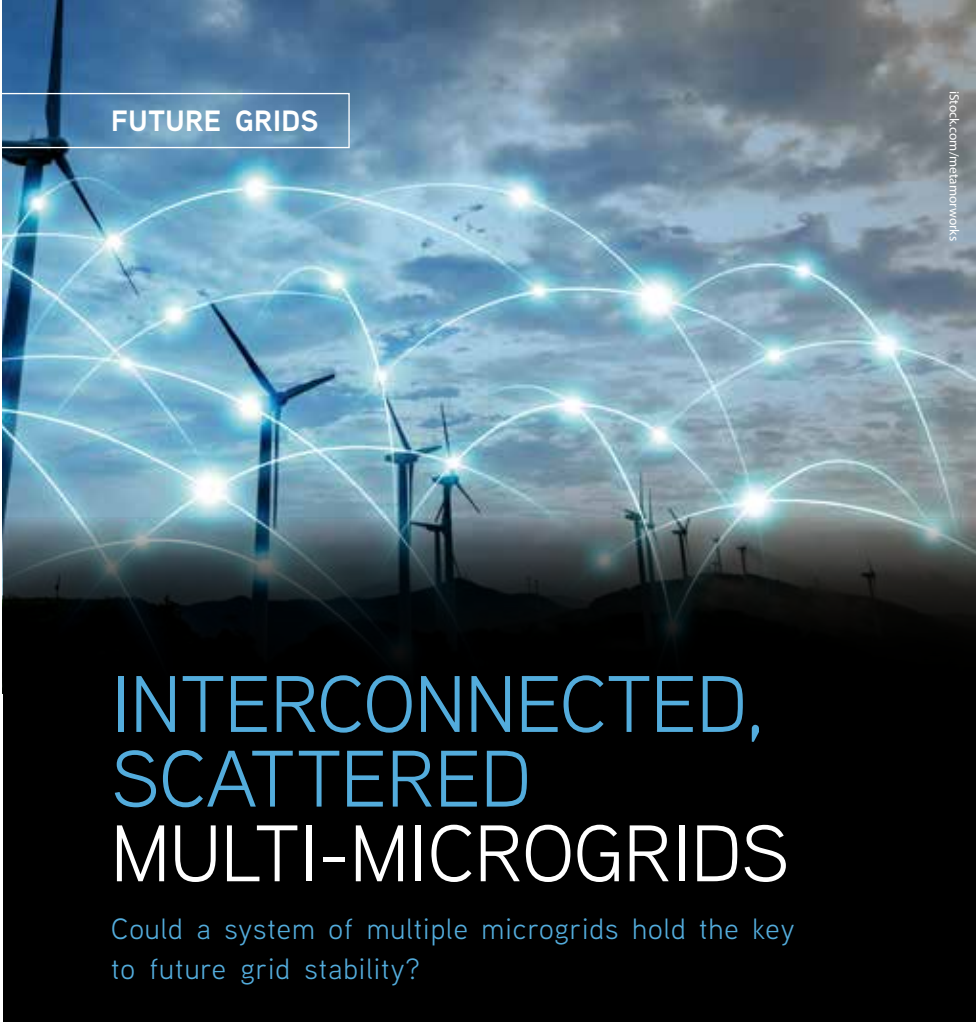
The AI system includes Internet of Things (IoT) sensors for lighting control as well as fire protection and security applications. According to Siemens, the insights produced by the AI will help to achieve energy savings of up to 30%. Such insights enable 24/7 transparency of live and historical events and generate up to 10% more net operating income, the company added.

For example, in the mobility hub, electric vehicle charging is optimised to maximise available renewable energy and, by using intelligent insights on working patterns, charging is timed to be complete for when each employee finishes work.

"We are delighted to be working in partnership with Stadtwerke Stuttgart to show how we can combine the real and the digital worlds to drive genuine sustainable transformation," said Matthias Rebellius, Managing Board Member of Siemens AG and CEO of Smart Infrastructure.

Rebellius said that intelligent building and energy management optimises the use of renewable energy sources, maximising efficient operations while minimising impact on the energy grid. "This is setting a new standard not only in Stuttgart but for cities across the world which are facing the challenge of making both new and existing buildings fit for purpose as we collectively transition towards a more sustainable future," he said.

Siemens Digital Industries Software
www.siemens.com.sg/en



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INTERCONNECTED, SCATTERED MULTI-MICROGRIDS

Could a system of multiple microgrids hold the key to future grid stability?

The answer to this question is "yes", according to researchers from Murdoch University.

The future large-scale use of renewable energy will create certain challenges for the grid, including how to manage surplus generation and the variable nature of wind and solar. A new study, led by Associate Professor Ali Arefi from Murdoch's School of Engineering and Energy, seeks to address these issues through the concept of an interconnected multi-microgrid system.

"There are challenges associated with the intermittent nature of both energy demands and renewable energy sources that cannot be handled in traditionally designed power grids," Arefi said.

"Our new research suggests that interconnected scattered multi-microgrids may be the way of the future."

Arefi described microgrids as small-scale power systems powered by clean energy. "By creating a system to efficiently exchange power among the microgrids, we can mitigate variability in load demand and renewable energy source generation," he explained.

The Murdoch research team's idea involves connecting a collection of small microgrid systems so they can support each other when needed. By coordinating the links between microgrids based on system requirements, technical challenges can be addressed and operational costs reduced.

One of the main factors the scientists considered was how an increase in electric vehicles (EVs) could affect the grid. While EVs are an important part of decarbonising transport, the additional, variable demand they place upon the grid can present a problem for microgrids, which have originally been designed for predefined load demands.

To address this issue, the study explored in some detail how a reconfigurable system of multiple microgrids could be used to integrate the scheduling of EV aggregations and the penetration of renewable energy sources.

Arefi said this new system could help maximise the use of renewable energy sources, like solar and wind power, and efficiently integrate electric vehicles in microgrids for enhanced sustainability.

"This would reduce our reliance on fossil fuels, maximise the use of renewable energy sources and help us to replace fossil fuels by clean energy resources as we fight against climate change," he said.

"The findings of this research have the potential to revolutionise the way renewable energy and EVs are integrated into microgrids."

The full study has been published in *Electric Power Systems Research*.

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