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Welcome to the 2018 Insights issue where we've asked industry leaders to provide you with their views on what challenges and opportunities lie ahead. The issue combines content from three magazines in one — Process Technology, Sustainability Matters and ECD — with views on how smart technology, big data, cybersecurity, digitisation and energy security could impact industry.

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AUSTRALIAN ENERGY SECURITY

IN A CONNECTED WORLD

Glenn Johnson, Editor, Process Technology

Politics aside, the future of Australian energy networks is looking exciting, with digitalisation and a greater mix of cheaper energy sources coming online — but we mustn't ignore the elephant in the room: cybersecurity risk.

Unless you have been living in another country it would have been near impossible to be unaware of the debate over energy security. But then again, with a Prime Minister who has sloganised "engineering and economics" as the Coalition approach to energy security, and the constant Canberra political blame game, it would be no surprise if you have switched off. As with the climate change 'debate' before it, it is mainly only the politicians and commentators that we tend to hear from regarding energy, and very little is heard from real experts. That's not to say that expert opinion is not sought: it's just that it seems to only be of interest to politicians when the advice given fits in with their current political agenda.

Nevertheless, engineers and scientists need to keep on finding real scientific and engineering solutions to the problem of energy security, as they have always done, regardless of the political melodrama.

There are many elements to the energy security debate, and to the work going on in the background, whether it be the 'economics and engineering' of fossil fuels versus renewables, or energy storage and energy demand — and of course solving the problem of the reliability and resilience of the distribution network. One such, perhaps more esoteric, element of energy security is cybersecurity: a subject that doesn't seem to make it into the mass media as a talking point.

Cybersecurity: the third aspect of energy security

Energy security, as presented in the media, tends to revolve around two aspects:

1. Ensuring there is sufficient generation to meet demand when it is at its peak.
2. Ensuring that the energy grid can deal with contingencies like faults or generation failures.

The achieving of these two goals is obvious and fundamental to achieving a reliable energy supply. In the public media debate we only hear discussions of energy prices for consumers and arguments about resurrecting ageing coal-fired power stations — arguments dumbed down and simplified for mass public consumption.

But we live in a highly connected and digital world. Achieving maximum control of the grid in today's world necessarily implies greater digitalisation and networking: the best results and the greatest efficiency will be achieved by leveraging modern digital technologies such as the Industrial Internet of Things (IIoT). Enhanced grid intelligence through digitalisation and data sharing will make the grid more responsive to changes in electricity demand and better at integrating new sources of generation.

Leveraging digitalisation introduces a greater need to focus on cybersecurity. In the past, energy grids were based on centralised generation, and energy distribution was managed by a proprietary SCADA network disconnected from the internet and business networks. Modern connectivity, which enables greater data sharing, has the side effect of introducing new cyber hazards.

Reports and recommendations

In the Australian Government's *2016 Threat Report*, released by the government's Australian Cyber Security Centre (ACSC), the energy sector was identified as the sector with the highest number of reported incidents or near-incidents relating to critical infrastructure. The report stated that between July 2015 and June 2016, CERT Australia responded to 14,804 cybersecurity incidents affecting Australian businesses, 418 of which involved systems of national interest and critical infrastructure.[1]

The famous Finkel review 'Blueprint for the Future'[3], discussed the need for strong cybersecurity measures and recommended that an "annual report into the cyber security preparedness of the National Electricity Market should be developed by the Energy Security Board, in consultation with the Australian Cyber Security Centre and the Secretary of the Commonwealth Department of the Environment and Energy".

Cybersecurity has become a key strategic priority for energy networks in the past two years, with energy network businesses using advanced cybersecurity strategies to deter, detect and respond to threats. With the increase in cybersecurity risks, networks have strengthened collaborative approaches in the past 12 months to heighten the capacity of the sector to identify hazards and respond quickly.[4]

For obvious reasons, efforts and initiatives to manage cybersecurity risk to protect the safety and security of Australians are not discussed openly. However, the recent publication by Energy Networks Australia, 'Cyber Security and Energy Networks'[5], provides an overview of the areas where Australian energy network providers believe that cybersecurity must be managed.

In some ways we have been here before

Adapting to the management of cybersecurity is not dissimilar to other procedural and technological changes that industry has adapted to in the past: occupational health and safety (OHS) and plant safety systems. The standardised management of OHS is now an integral part of every business, although it was some years in the development of comprehensive procedures and policies. Businesses have learned from the OHS journey and are increasing the priority placed on cybersecurity in terms of engagement with employees, contractors and suppliers.

Similarly, the methodologies of cybersecurity threat and risk assessment, and subsequent risk mitigation strategies, should be generally familiar to organisations that have done the same in the development of plant safety systems. The main difference for energy networks, however, is the distributed nature of the potential 'attack surface'.

New technologies, new attack vectors

A major problem for energy networks in recent years has been the adoption of renewable energy sources, which create network management challenges due to their variable supply characteristics. Better utilisation of modern digitalisation technologies and the IoT will help to manage these variable energy sources, while ever these systems are under the control of the energy networks.

However, energy systems around the world are also experiencing the rapid adoption of other types of distributed energy resources, such as smart meters, smart inverters, electric vehicles, rooftop solar photovoltaics, battery storage and home energy management systems.

Many of these technologies are connected through the Internet of Things (IoT) and are creating a fast-growing relationship between millions of 'uncontrolled' IoT devices and the energy networks themselves. On one hand, this IoT ecosystem is very useful for energy networks to help with real-time system balancing and to support the reliability, safety and quality of energy supply. On the other hand, the increased interaction between the grid and the customer introduces a plethora of devices connected to the internet that could potentially present a threat to the integrity of the system.

The careful management of interfaces, strong communication protocols and the setting of safe operating parameters are essential to manage risks that IoT devices may present to network components and control systems.

Collaboration and standardisation

The Australian Government is engaging in ongoing discussion with all stakeholders, utilising available resources such as CERT Australia and the Attorney-General's Trusted Information Sharing Network (TISN).

CERT is a major contributor to the ACSC and provides services such as advice and assistance on how to deal with cybersecurity incidents, the latest information on trends, and participation in company training programs and incident response exercises. The Australian Signals Directorate (ASD) is also a member of the ACSC, and provides strategies to mitigate the risk of cybersecurity incidents.

Energy Networks Australia, in collaboration with CSIRO, has also released its 'Electricity Network Transformation Roadmap'[7] for the electricity network industry in the coming decade, in which cybersecurity is a core focus. In an energy system that utilises digitalisation and decentralised technologies, a strategic focus on cybersecurity will be an essential priority.

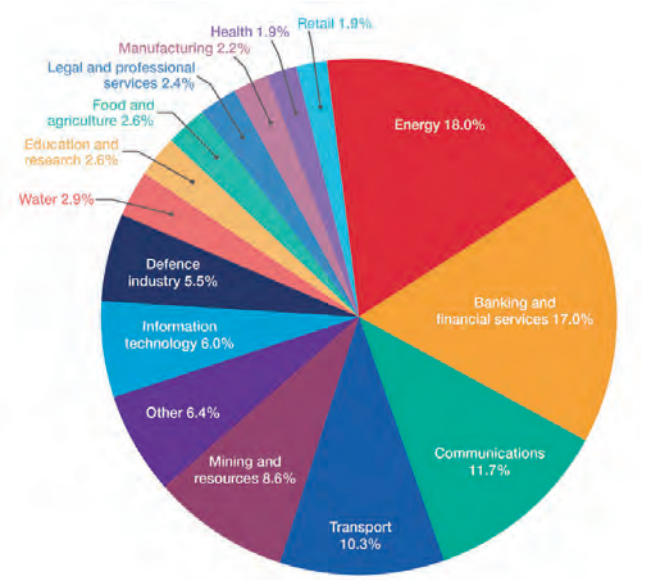
The roadmap identifies a gap in the standards required to enable effective cybersecurity and proposes an upcoming IEC standard on automation cybersecurity (IEC 62443)[8] should be reviewed with a view to its application in Australia.

For their own part, energy network operators have put in place a number of measures to prepare and respond to cybersecurity risk. They have established a cybersecurity forum dedicated to electricity and gas networks, consisting of IT and OT cybersecurity specialists, as well as information risk sharing protocols and alerts between members. A new initiative has also been started with Standards Australia to directly adopt existing relevant international cybersecurity standards, and members are collaborating with the Australian Energy Market Operator (AEMO) to review data communications security standards.

Conclusion

When we put all the politics aside (and the media doom and gloom), the future for energy networks in Australia is looking very exciting. Digitalisation and IoT technologies will help us find the way to a new world of more efficient, cleaner and cheaper energy for all Australians, if we play our cards right. But like all new advances, there will be teething problems, and new problems to be faced.

Looking at it on the positive side, new problems lead to new solutions, and that is how progress occurs. Now if we can just get the politicians out of the way...



Incidents involving systems of national interest (SNI) and critical infrastructure (CI) by sector. Source: ACSC Threat Report 2016.[2]

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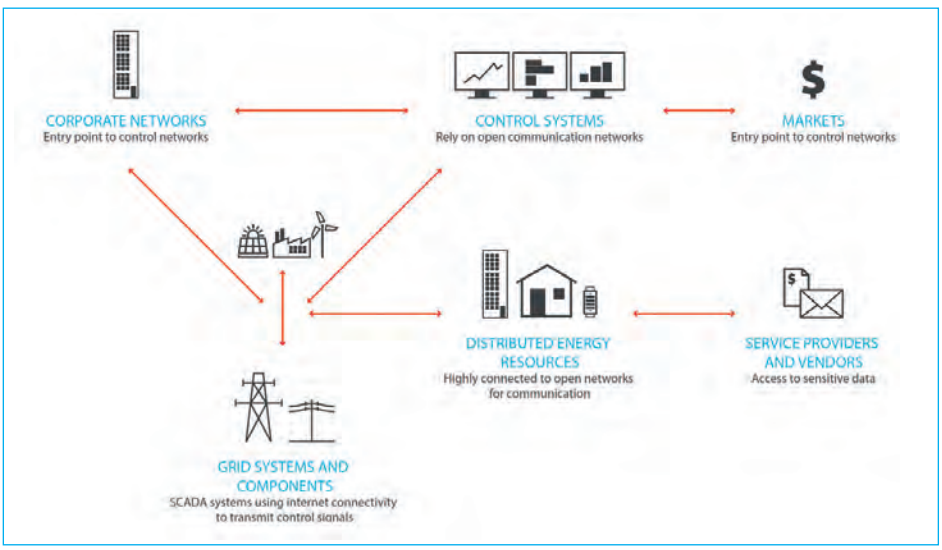

The key dimensions in cybersecurity relevant to electricity networks.[6]

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Automation revolutionises transformer core manufacturing

A strategic collaboration between SMC Pneumatics and AEM Unicore has been a catalyst in the success of manufacturing AEM Unicore's Automatic DUO Core Machine model UCM440A.

SMC and AEM, a South Australian-based company that designs and manufactures special-purpose equipment for the transformer industry, have partnered in the manufacture of AEM's Automatic DUO Core Machine. The machine streamlines the manufacturing of transformer cores through its key features. Fully programmable for flexible production, the machine produces fully formed half cores and eliminates the need for manual forming. It features a robotic arm and gripper, and an automatically adjustable core stacking and transfer system. It is fully automated and therefore improves productivity, quality and safety. With the ability to run just-in-time (JIT) production, users can enjoy the convenience of compact and lighter cores that do not compromise on quality.

AEM customers also have the additional choice of selecting a double decoiler with remote operation as an option.

The prospect of a partnership was realised when AEM noticed the substantial help and support that SMC was offering right from the inception of the project to manufacture the DUO Automatic Core Machine.

Peter Tedore, engineering design and project manager at AEM, said: "The service and support that we received from SMC exceeded our expectations; they were of more help to us than suppliers had been in the past."

The complexity of the project brought about challenges in ensuring the compatibility between components of the machine. SMC's wide product knowledge and offerings were key in enabling AEM to simplify and accelerate this design and selection process.

"One of the most critical components used in this machine is the pivoting linear drive arm," explained Tedore. "We felt that SMC had a superior product compared to other products in the market. We were impressed with the ease at which SMC products integrated with other control components used. We used EtherCAT for communication and, after we plugged in and set up each component, the system worked seamlessly."

Jason Sutton, an area sales manager for SMC Pneumatics Australia and New Zealand looking after AEM, said: "SMC wants to work with our customers to know what they need to solve the challenges they face and is always looking at how SMC can improve existing products to help them solve those challenges."

According to Sutton, the hidden vacuum ejectors used in this project are an example of how SMC offers products that have superior performance compared to existing products. The ejectors are about half the weight of their predecessors, produce twice the vacuum flow and have half the wiring to control.

Another device that stood out for Sutton is the electric drive and linear card motor. The visible vacuum heads that pick and place the laminate sheets are mounted a reasonable distance away from the carriage, which induces a large moment onto the drive. The drive was selected as being able to continuously handle the load at the same time the speed was requested. SMC was able to provide its LEJB63 belt drive with a kit to mount AEM's selected Beckhoff motor directly. This drive arrangement negated the need for a gearbox to be used.

During the design stage, AEM was unable to accurately measure laminate thickness, as many standard measuring instruments required being physically moved in and out of the measuring area. For the required accuracy of 1 µm, the favoured solution was to be a laser measuring tool. In response, SMC suggested using its linear motor as it could provide 1.25 µm accuracy, 20 mm of displacement and some clamping force at the point of measurement to increase the repeatability. Compact controllers with easy-to-use interfaces made for effortless integration.

AEM has delivered and commissioned three Automatic DUO Core Machines in a transformer core production facility in the USA and three more machines are currently in production.

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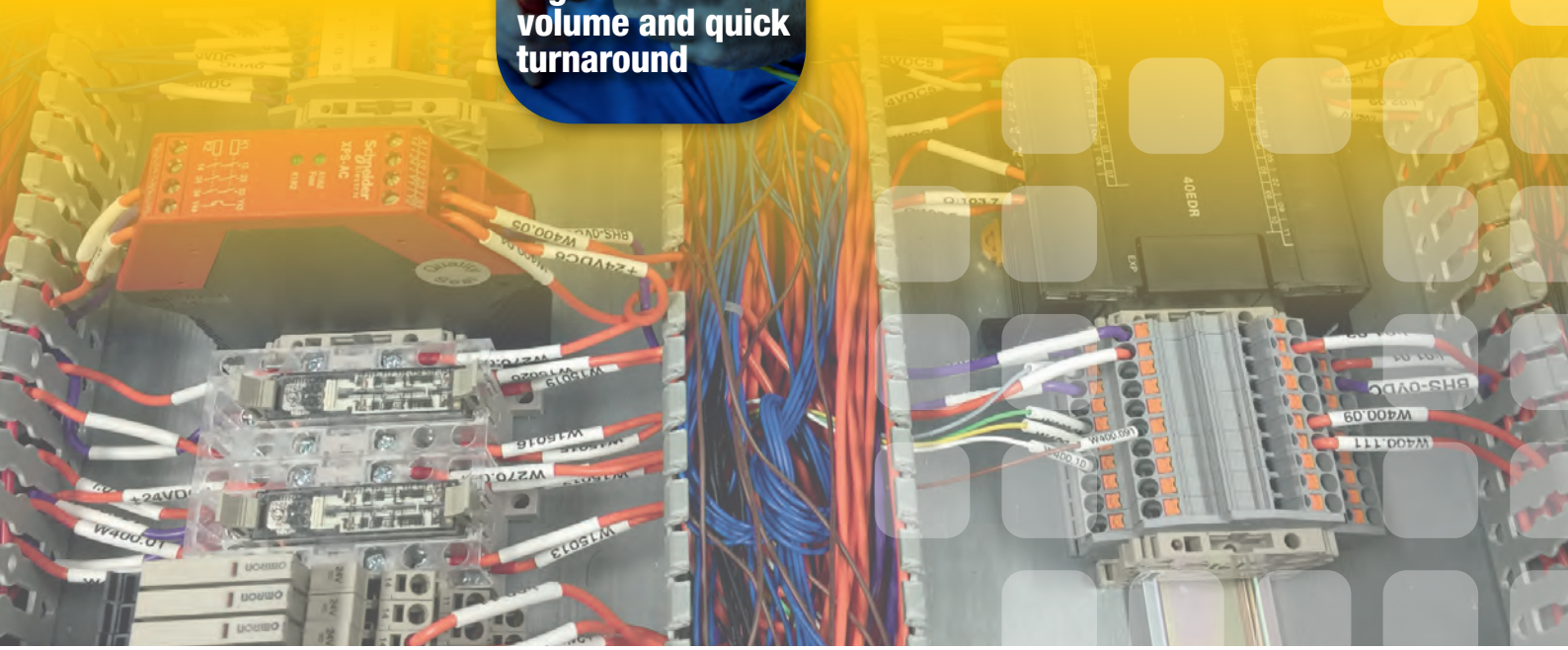

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RELIABLE POWER AT A REASONABLE PRICE

IS IT POSSIBLE AND HOW?

John Kettle, Partner, McCullough Robertson

Those interested in the development and progression of Australia's energy policy looked on with interest in 2017 as the debate bubbled away.

The market for smart energy management is gaining momentum as businesses take control of their energy costs and renew their focus on energy efficiency, demand management and on-site generation.

On the policy front, things have moved a little slower. While the Renewable Energy Target (RET) has achieved years of continued success and stability, Australia is facing an uncertain future in terms of reviewing and refreshing a comprehensive long-term national energy policy.

The Council of Australian Governments (COAG) Energy Council met in November to try and bring some clarity to the energy dilemma. The meeting was its first since the federal government announced its long-awaited response to the Independent Review into the Future Security of the National Electricity Market delivered by Dr Alan Finkel AO (Finkel Review). That government announcement in October decided against the Finkel Review's proposal for a nationwide Clean Energy Target (CET) (despite accepting virtually every other Finkel Review recommendation), deciding subsequently instead to sponsor a National Energy Guarantee (NEG) as a successor to the RET which expires in 2020.

The COAG meeting deferred the decision on whether to adopt the government's NEG plan until April 2018. The states, as expected, have asked for more modelling of the NEG by the new Energy Security Board (ESB). South Australia has asked for an explanation from the Commonwealth as to why a CET is no longer acceptable, asserting that a NEG would "stifle investment in renewables, extend the life of dying, inefficient and uneconomic coal power stations, and enrich the generators with the most market power". To proceed, the NEG requires unanimous support at COAG. So, for now at least, it remains a waiting game for business and consumer.

What is inescapable is that there is no such thing as free reliable and sustainable energy. The question now is whether we want to pay a little bit more for reliability and security of supply, or a lot more in wider social welfare costs due to an unreliable, insecure system.

Any potential solution will undoubtedly need to:

- reduce system and pricing volatility allowing business to predictably plan their energy costs;
- provide appropriate signals to facilitate rational investment in base load and renewables to meet future demand;
- stabilise the macroeconomic conditions necessary to maintain and attract sustained investment in energy and industry (both traditional and digital economies).

It is clear, in my view, alternative policy solutions have not been fully explored due to the nature of the National Electricity Market (NEM) and a failure to undertake a review or refresh of it in order to adapt it to the evolving demands of our society.

In simple terms, the current NEM (due to its lightly interconnected and sprawling network) permits material regional pricing differences based on regional characteristics. While this in itself leads to some disparity and volatility in the market, that volatility is exacerbated by two distinct characteristics — state and territory sovereignty and secondly, the NEM in Australia (unlike many other OECD jurisdictions) being an 'energy-only' spot market, in which electricity generators are paid for the energy they produce but not the capacity they make available. Both of these factors go to the heart of the reliability problem Australia now faces. As the contribution of renewable technologies to Australia's energy mix continues to grow, the NEM in its current form presents challenges for successful and sustainable integration. For example, the current policy and contractual arrangements do not necessarily favour based load so having the appearance of favouring renewable energy. This, in fact, is the consequence of the energy only market. Ultimately, it disincentivises base load generators to stay in the market and deters market entry by new ones. Renewables, on the other hand, have had the benefit of the RET to sponsor their market entry. This results in a type of asymmetric system where the baseload necessary for a reliable and secure system is absent and that does not help the sensible development of renewables either.

There are two possible solutions (one proven and one prospective) and both have a common feature — a capacity payment mechanism.

I drafted the rules for the Irish Single Electricity Market (SEM). The SEM is basically like the NEM except that it included capacity payments as well as energy payments for generators. With capacity payments, generators get paid for being available and payments are set at a level to ensure that sufficient generation is available to meet demand so there is an incentive to stay on.

The Northern Ireland Authority for Utility Regulation (one of the SEM sponsors) outlined the following reasons for its decision to have an explicit capacity payment mechanism:

- Prices avoid the peaks of an energy-only pool.
- Provides a stable 'bankable' income that would help attract new entrants.
- The volatility, referred to above, would attract regulatory and political attention that would reduce confidence in the market from an investment point of view.

The move led to reduced system volatility, reduced rivalry between renewable and conventional sources of power and, ultimately, brought about a secure and sustainable energy system in Ireland.

Businesses were able to operate with confidence knowing the lights will stay on; with pricing in the system so reliable, renewable energy operators were encouraged into the market (and not always with a subsidy). In response to the concerns about generators abusing market power in bidding into the SEM, Ireland incorporated express prohibitions on generator authorisations and market rules against gaming or engaging in activity that would be an abuse of market power.

Other jurisdictions have recognised that theoretical approaches to the market, based on political sentiment one way or another, cannot be allowed to get in the way of energy security and reliability. Alberta in Canada is a striking case given its similarities to Australia, both economically and industrially. Alberta's 2016 review of its wholesale electricity market surprisingly resulted in the adoption of a capacity market solution to facilitate an orderly transition away from coal

generation. Like in Ireland, Alberta found that a capacity market for electricity would:

- reduce price volatility and market uncertainty;
- drive efficient use of the existing transmission system rather than building new transmission before it is needed;
- ensure secure, sufficient electricity supply and provide investors with a stable revenue stream while preserving key market characteristics such as incentives that drive innovation and cost discipline.

The Finkel Review recognised the need to modernise the NEM to ensure an orderly transition to a reliable and low emissions electricity system and investigated capacity compensation. However, the review put a fundamental market redesign in the 'too hard' box as it was not within its remit to be so wide-reaching.

This is why we now have the Australian Energy Market Operator (AEMO) looking at ways to ameliorate the current crisis, largely focusing on responses such as demand side management.

And while the NEG helps too, it's important to consider whether those remedies can be sustainably accommodated within a system crying out for a redesign.

What sort of redesign? Well, when we compare the justifications for introducing a capacity mechanism as referenced and Prime Minister Malcolm Turnbull's recent statements, the similarities are stark. "The National Electricity Guarantee will lower electricity prices, make the system more reliable, encourage the right investment and reduce emissions without subsidies, taxes or trading scheme. It is truly technology-neutral, offering a future for investment in whatever technology the market needs — solar, wind, coal, gas, batteries or pumped storage."

So, the NEG will do all the things that capacity mechanisms do, and electricity generators, through imposing purchasing pattern requirements on retailers, will remain available for dispatch based on regional demand. This goes beyond an energy-only market and begins to suspiciously look like a capacity payment mechanism. In net terms, more baseload power will be guaranteed across the country but some states will undoubtedly face a requirement to source more emissions guaranteed power, ie, renewables. We won't know until the regional numbers are crunched. Guarantees like these always carry a cost though — the question is who will bear the cost and where in the market will it be borne. Even though these guarantees are designed to shield against market failure, there are costs involved.

The next question is whether it will get through a NEM rule change process given the negative sentiment historically attached to such mechanisms in Australia? Or will it lead COAG to consider asserting more direct control by regulators instead of effectively being outsourced to the retailers?

Either way, the retailers must feel like the meat in the sandwich, between the NEM and the generators. There is no detail on how these guarantee requirements will be executed — via an auction, through bilateral contracting or a contract for difference?

Further, the ESB's initial advice appears to be based on a normal, functioning competitive market in a relative state of equilibrium. This point is made as the ESB's advice is based on a regionalised outcome with outsourced execution to retailers but pays no attention to the state of competition in each of those markets. For example, how will the scheme work in markets of high concentration and low contestability as against highly competitive markets? Is market behaviour so predictable so as to point unilaterally to a lower cost outcome in concentrated markets? Was the Australian Competition and Consumer Commission given the opportunity to review this advice?

Ultimately, the cost involved in introducing a capacity payment mechanism to the Australian market certainly seems less material when one considers the social and economic costs resulting from our failure, perceived or otherwise, to guarantee energy supply.

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STEPHEN COOP

CHIEF EXECUTIVE OFFICER AND MANAGING DIRECTOR, NHP ELECTRICAL ENGINEERING PRODUCTS

What opportunities do you predict for your industry in 2018?

Our industry is under increasing pressure to achieve competitive advantages through optimising asset utilisation, improving energy efficiency and complying with standards.

However, despite the competitive nature of the industry, now more than ever businesses need to not only capitalise on technological advancements but in doing so, embody and adopt an element of corporate citizenship. What I mean by this, industry should invest in and implement initiatives that are environmentally friendly ensuring a sustainable and energy-efficient future is strived for.

Within our industry, a major opportunity has been identified for 2018 cascading a steady growth into the future. With climate change impacting the automotive industry, in an attempt to reduce harmful emissions there is a shift away from fuel-reliant vehicles towards electric. Electric vehicles are forecast to make up over a third of new vehicle sales by 2040, indicating a huge part of the future of our industry.

So with this in mind, recently, we have partnered with innovative clean energy solutions provider Delta to bring their range of electric vehicle chargers to the Australian market. We are confident in the drive to a greener future and even more so with our latest global partnership and their sophisticated technology to achieve this.

What impact will big data and smart device technology have on your industry in 2018?

As we move further in to the era of Industry 4.0 and the Industrial Internet of Things (IIoT), the emergence and importance of big data and smart-device technology has never been more critical to maintain a competitive edge in our industry.

It's not just about accessing and aggregating data anymore, it's about making that data work for you by creating better visibility that facilitates improved operational performance. This is where smart-device technology provides a platform to remotely assess, manage and control collated data. New business models and opportunities are arising from managing data to empower decision makers through a centralised real-time portfolio of information.

Recently there have been huge advancements in machine learning which grant the ability to identify and correct inaccuracies. These improvements in data quality allow us to turn assumptions and ideas into actionable, testable real-world hypotheses. Companies that don't adapt by planning and implementing critical technology initiatives will fall behind, and the gap between success and failure will continue to widen exponentially.

What are your clients demanding of you now that they didn't demand five years ago?

The digital world is evolving quickly and our customers are demanding access to information and content to base their purchasing decision off faster than ever before, transforming the way we do business.

With customers at the centre of all decision making, at NHP we ensure we are not only choosing the right technologies but implementing them effectively to create value-add experiences.

As the digital world continues to rapidly expand, our customers are becoming savvier with their consumer trends. Inundated with options at their fingertips, they have developed inbuilt filters to sift through what is relevant to them and what's not. Because of this, it is our responsibility to ensure customers have access to all our business has to offer providing an exceptional and seamless customer experience.

And even though the digital realm plays a big part in satisfying customer demands, ultimately, customers are looking for a partner who is reliable, competitive and reputable — this is still a promise NHP is committed to keeping with our customers.

How should Australian industry respond to global competition?

To begin unpacking this, a business needs to have a concrete understanding of their place in the industry and the offering they supply to the Australian marketplace.

I have experienced being the global influence on the Australian industry, and now at NHP, being Australian owned and operated, have experienced how that global competition impacts our local market.

When it comes to NHP, ultimately we are a people business with a local footprint delivering the world's best products and knowledge through global partnerships to your doorstep. Working closely with these partners, NHP brings together our own extensive technical knowledge and expertise of the ranges we stock, to develop innovative customer-focused solutions that are tailored for the local market.

It's the local touch that sets us apart from the global competition, not only providing local jobs across Australia and New Zealand, but we have established a network of metro and regional locations that ensure our people, products and services are available where and when you need them.

Finding the balance between having a local presence and leveraging off global innovations is the key to assuming a successful place in the Australian industry.

Stephen Coop was appointed CEO and Managing Director of NHP Electrical Engineering Products Pty Ltd in February 2015. Previously, he was CEO of Schneider Electric's Pacific business since 2011. Prior to then, he was CEO of Schneider Electric businesses in the United Kingdom, the Balkans and Slovakia for varying periods since 2001. In total, Stephen has over 30 years of management experience in the electrical engineering industry.

AUSTRALIAN CITIES RANKED 'MIDDLE OF THE ROAD'

FOR SUSTAINABLE TRANSPORT

Brisbane leads Australia for sustainable and effective transport according to the 2017 Sustainable Cities Mobility Index from design consultancy Arcadis. Hong Kong topped the index and seven out of the top 10 spots went to European cities.

The 2017 Sustainable Cities Mobility Index ranked 100 of the world's leading cities according to the sustainability and effectiveness of their transport networks. The Index used a triple bottom-line approach of People, Planet and Profit to analyse the cities. The research was undertaken by the Centre for Economics and Business Research (Cebr).

Brisbane was the highest ranked Australian city at 48th, followed by Sydney 51st, Canberra 53rd, Melbourne 55th and Perth 87th. According to the Index, Australian cities were held back due to the effectiveness of their transit networks. Factors such as no functioning metro networks, low uptake of public transport, heavy reliance on roads and private vehicles, as well as poor uptake of active commuting options all resulted in Australian cities scoring poorly across sustainability and effectiveness measures.

Despite the relatively low ranking of Australian cities, it's not all bad news according to Arcadis Managing Director of Infrastructure in Australia Pacific Phil Kajewski.

"Australia's cities largely all ranked middle of the road for the sustainability of their transport. This doesn't mean that we are doing poorly, just that we can do better.

"We've seen significant infrastructure investment over the past year, with projects underway such as metro rail in Sydney and Melbourne, and major roads like NorthLink in WA.

"The benefits from these massive transit projects are yet to be realised. All the top global cities have integrated mobility systems including metro, light-rail, bus and road — many have had metros for years.

"For Australian cities to continue to remain globally competitive and mobile we must continue to invest in a range of road and public transport projects, ensure transport planning for these projects is strongly linked to land-use planning and do what we can in this planning to encourage mixed-mode journeys that include active mobility, such as walking and cycling."

> FACTORS SUCH AS NO FUNCTIONING METRO NETWORKS, LOW UPTAKE OF PUBLIC TRANSPORT, HEAVY RELIANCE ON ROADS AND PRIVATE VEHICLES, AS WELL AS POOR UPTAKE OF ACTIVE COMMUTING OPTIONS ALL RESULTED IN AUSTRALIAN CITIES SCORING POORLY ACROSS SUSTAINABILITY AND EFFECTIVENESS MEASURES.

Arcadis found the top ranked city, Hong Kong, was boosted by its innovative and well-connected metro network and a high share of trips taken by public transport. Hong Kong managed to achieve many of the aims of an effective urban transport system — enabling comprehensive mobility, creating economic opportunity and enriching the lives of citizens, business and tourists alike.

European cities dominated the rankings, with seven of the top 10 spots. According to the report, European cities benefited from established and well-used metro networks such as London's Underground, strong bicycle infrastructure in cities like Amsterdam and Copenhagen, and high shares of commuters using public rather than private transport. The report also found that European cities are more environmentally conscious, with incentives to lower emissions reflected in cleaner air and greener mobility systems.

The report also found that cities benefiting from 'money, mass or maturity', namely high-wealth, significant global cities, do not necessarily lead the ranking in sustainable urban mobility. Although these factors can help, wealthy, large and/or older cities were not "automatically punching their ticket to sustainable urban mobility" according to the report.

The Sustainable Cities Mobility Index explored the three pillars of sustainability: social (people), environmental (planet) and economic (profit) to develop an indicative ranking of how sustainable urban mobility systems are in 100 of the world's leading cities. It looked at how sustainable each of the cities are in terms of the social and human implications, environmental impacts of mobility in the city as well as efficiency and reliability of the cities.

The full copy of the report can be found at http://arcad.is/SCMI.

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DONG EUN KIM

PRESIDENT, NCH ASIA

What opportunities do you predict for your industry in 2018?

With the demands placed on our environment globally, NCH looks to develop sustainable solutions with total packaged maintenance products. There are many opportunities where we meet the environmental regulations and requirements with our customers, and ensure we are offering a positive environmental outcome in their business and in their industry.

What impact will big data and smart device technology have on your industry in 2018?

In the industrial maintenance industry, data is getting more important. We can use analytics available to us to analyse customers' buying patterns and trends providing us with other opportunities within their business. Our intelligent products and solutions are extremely powerful in providing information on our customers' infrastructure, which gives us valuable insight to potential areas of risk and for improvement.

Our sales reps are using mobile technology and applications in their business that enables them to sync and update data in real-time. These smart devices are great instruments for our sales teams to show our products and programs in a professional manner, but also easily access and extract data from our corporate database for their business meetings and presentations. I believe data management will play a key role in driving our sales force in the future, and will also be a big part in differentiating ourselves from other competitors.

How is your industry preparing for sustainability/climate change issues?

NCH have always held fundamental beliefs about what we value and how we will behave around sustainability and the impact it has in business. We practice and base our commitment to our employees, customers and communities around ensuring our products showcase environmentally friendly, safety and community responsibility.

We are putting more focus and R&D investments in developing more sustainable products that support this commitment.

What are your clients demanding of you now that they didn't demand five years ago?

Our customers are now demanding more the turnkey-based solutions. That is to say, the customers used to buy our chemicals and products with self-application and use. Today with downsizing, increased growth, stricter deadlines and sustainability in their business, they are requesting the value-added services we provide along with the products. There is now a trend of favouring companies that can offer multiple maintenance solutions. NCH provides this in its unique portfolio of one-stop products and services.

What is your industry doing to attract and retain young talent?

We are living in a world of constant evolution in technology and the way in which people build business networks and social circles. NCH uses SNS media to attract young talent who share the same values and interests as us. SNS actively assists us in connecting with the right people and the right talent.

How should Australian industry respond to global competition?

Australian industry has continued to sustain a good level of economic performance and management over the last 25 years. We need to continue to reform and remain nimble across declining industries, and look for areas of improvement and growth in the economy. Australia needs to focus on core strengths and competencies, and where it can be of support to more localised approaches in business.

Australia has talented skillsets amongst its growing population, and leveraging that in business today is key.

Technology will play an important role in responding to global competition, if the adaption to change, new processes and embracing these new technologies continue to strengthen. We need to remain hungry and willing to experiment with new technologies in industry if we want to ensure we are innovative and continue to connect with global markets.

Dong Eun Kim is President of NCH Asia, International industrial and commercial maintenance company across 15 Asian countries. He has been part of the NCH team for seven years, beginning in the Corporate Strategies Department in Dallas, Texas. Mr Kim has been instrumental in implementing many of the NCH Asia strategies that have transformed the business, including establishing the unified NCH brand and training a specialised sales force. He also worked as the Asia Corporate Account Development Manager in Japan, NCH Asia Chemsearch Business Manager in Singapore, and became the Country Manager of Korea in 2014.

Pumps provide hygienic solutions at Russian food plant

A global brand sauce and condiments manufacturing plant in Russia needed to replace pumps that were proving difficult to clean and maintain, being used to pump products that include cheese sauce, tomato ketchup and mayonnaise.

Hygiene is paramount in food industry applications, where any failures can have a devastating impact on brand reputation. For this reason, the Russian plant chose Bredel CIP 50 pumps from Watson-Marlow Fluid Technology Group (WMFTG) that are available with the option of externally operated retracting shoes to release the hose so that the line is open and unobstructed for cleaning. Pumps featuring this option are used with a food-approved hose and food-grade lubricant, both from WMFTG, while stainless steel sanitary connectors include DIN, ASA and JIS types.

WMFTG is a leader in niche peristaltic and sinusoidal pumps and associated fluid path technologies with over 60 years' experience and over one million pumps installed worldwide. It is a wholly owned subsidiary of Spirax-Sarco Engineering, a global organisation employing approximately 4800 people worldwide, and has 29 offices around the world.

Hygiene and sterility are crucial at the plant where, depending on the production plan, CIP is often scheduled daily. The process takes place at full velocity using food industry standard cleaning agents such as Tarmo (1%) and ET (0.3–0.5%).

Bredel CIP 50 pumps have been installed on two filling lines to transfer cheese sauce, which is heated to 75˚C. Here, the sauce needs to be pumped quickly from the hoppers to the filling line at flow rates of up to 7000 L/h. If the sauce cools in the pump hose or in the transfer lines it will solidify, which would cause huge cleaning issues because hot water and stronger cleaning agents would be needed to break down the starch and fats.

Elsewhere on the site, Bredel CIP pumps transfer ketchup through 20 m long pipework with 7 m delivery. The pumps dose ketchup with a viscosity of 50,000 cP (at 30–40˚C) from the hoppers to a line that fills plastic single-serving sachets for fast food outlets. On the same line, plastic sachets are also filled with mayonnaise (5000 cP), again for fast food outlets.

Aside from ease of cleaning, there were several important factors to consider before selecting pumps, not least of which is the shear thinning of these thixotropic sauces. Further factors included the avoidance of air entrainment, which could lead the sachets to burst upon filling, and the need for sterility. Sachets are in high demand in the Russian market, where glass bottles are deemed unacceptable. The same is true in Africa, which is a major export market for the plant.

Ultimately, the gentle, low-shear capability of Bredel pumps was put forward by the contractor that supplied the Rossi and Catelli filling system. The recommendation was supported by referencing the use of Bredel pumps at other group plants outside of Russia.

"WMFTG has a very strong competitive advantage in the quality and performance parameters of its pumps," said the plant's purchasing manager. "As a result, we are now standardising on Bredel pumps as the most reliable, efficient and minimal maintenance solution. This will have further site-wide benefits in terms of spares management and operator knowledge."

The customer is now planning to upgrade another site in Russia, where Bredel pump technology will again be deployed.

Watson-Marlow Fluid Technology Group
www.wmftg.com.au

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RUSSELL PALMER

MANAGING DIRECTOR, YOKOGAWA AUSTRALIA AND NEW ZEALAND

What impact will big data and smart device technology have on your industry in 2018?

With only 0.5% of data analysed, there is a vast bank of performance data that remains untouched. The challenge is structure and sampling speed, which are not always conducive to simple analysis using traditional data mining techniques. Vendors must therefore take the lead so industry can benefit from big data and smart device potential. For example, by controlling the flow of data through installing intelligent edge devices, sophisticated analytics can be performed in the field, only pushing relevant data back to historians. This improves the speed of response and reduces the data lake size.

Process plants also need a risk-free approach. Mirror imaging your plant with a digital twin insulates the site from negative outcomes relating to big data related changes. Operators can see firsthand the impact of changes and tweak settings, free from risk to production or quality standards. Once satisfied, changes are brought online in a safe and controlled manner. Another piece of the puzzle in making big data and device analytics work for you.

What do you see as the biggest challenges that will face your industry in 2018?

Cybersecurity is undoubtedly one of the greatest challenges; for what is generally a conservative group of industries, the speed of new technology adoption can leave plants exposed. Yet convergence of information technology (IT) and operations technology (OT) teams does allow them to tackle the issue head-on. As sites employ more software solutions, the potential for hostile ingress grows, so merged teams will be critical in ensuring a secure environment.

Volatile commodity pricing will be another challenge for the process industries in 2018. As a nation, we are heavily reliant on resource exports. Once predictable market cycles are now shorter, with higher peaks and lower troughs. Planning is challenging in such times and companies that want to grow need to demonstrate greater agility, adapting to changing customer demand and expectations.

What are your clients demanding of you now that they didn't demand five years ago?

Yokogawa's major clients rely on our engineering capabilities more now than ever. As companies reduce costs, the strain on project, engineering and service departments increases exponentially. Yokogawa helps fill the void with highly skilled engineering resources, allowing clients to tackle complex challenges through process co-innovation. Working as a team, we create innovative new ways of tackling critical process issues and unlocking improvement potential.

The requirement to extend asset life is another trend, with clients looking to delay new capital investment as long as possible. The expectation is that this decision will not be detrimental to plant availability. We have a reputation for exceptional reliability and a strong support culture, which allows us to natively maintain and improve asset performance on older installations, aligning us with such expectations.

What is your industry doing to attract and retain young talent?

We are uniquely placed in an industry segment that is increasing in popularity with young talent. Obsolescence of some traditional technical and engineering skills has seen the emergence of a requirement suited to a demographic unencumbered by traditional industry concepts. Young talent at Yokogawa have input to meaningful work, where finding solutions for clients had not previously been the realm of inexperienced workers.

We provide flexible workspaces, access to exciting technology and invest in professional development as KPIs within the business. Recognising and rewarding is a continuous theme and pairs well with the individualised contributions of our young talent.

The number of students taking part in our university engagement program buoys my hope for a continuation of domestically trained, driven, young talent joining Yokogawa. Offering students bespoke learning placements allows the bright and ambitious to join us, cementing themselves as potential future leaders.

How is your industry preparing for cybersecurity challenges of the future?

Process industries are often viewed as slow to adopt new technologies. The reality is somewhat different, but technological change requires controlled management to protect process reliability, quality, availability and safety. These are all aspects that are subject to complex certification and validation, so new and more elaborate cybersecurity threats make protection an ongoing challenge.

With an 'islanded' approach less common in industry, security threats are being addressed by combined IT and OT departments to provide a more holistic view. This allows them to harden all aspects of their systems, providing a higher degree of protection. Many conduct 'hackathons', with external parties challenged to hack systems during a defined time frame. Results are analysed, with identified weaknesses reinforced to increase system integrity.

Plant security lifecycle services adhering to international standards are crucial. Experienced companies that provide threat mitigation guidance to enhance operational resilience are key to building a secure environment in the process industries.

As Managing Director of Yokogawa Australia & New Zealand, Russell Palmer is focused on collaborating with customers to create new and innovative solutions to problems faced in industry. During his more than 20 years with Yokogawa, Russell has ascended the corporate ladder from early roles in frontline engineering sales, to Director of Sales & Marketing — a position he held for 10 years.

REAPING REWARDS

FROM AGRICULTURAL WASTE

A 'second generation' technology is set to eliminate the food versus fuel tension in the agricultural industry by making fuel from the waste streams left behind once the food portion has been harvested from crops.

Currently, farmers need to decide whether their crops are used for food or fuel production, as ethanol is produced from the valuable food portion, known as 'first generation' technology.

Ethanol Technologies' (Ethtec's) 'strong acid' technology (also known as second generation technology) will use feedstock waste streams such as wheat straw, cotton stubble, sugarcane bagasse and forest material left behind after the valuable food and fibre components have been harvested from crops and timber plantations.

In partnership with The University of Newcastle, Newcastle Institute for Energy and Resources (NIER) and Muswellbrook Shire Council, Ethtec has received $11.9 million in funding from the Australian Renewable Energy Agency (ARENA) to establish a demonstration facility at Muswellbrook.

In addition to ARENA funding, the $48 million project will be funded by $11.9 million from industry partners as well as contributions from Muswellbrook Shire Council and the university.

Ethtec senior biotechnologist Dr Geoff Doherty said the project is about developing the engineering data behind the process to ensure it is commercially viable.

"We know you can take waste streams, convert them into sugars and then turn those sugars into biofuels or green chemicals, but it's got to be competitive with crude oil products," said Dr Doherty.

"The overarching benefit of this technology will revolutionise agribusiness because farmers will be able to continue to grow crops, sell the valuable part into the food market and have a second market for the leftover waste stream."

With 98% of Australia's transport energy still derived from fossil fuels, Dr Doherty said Australia was lagging behind the rest of the world in the bioenergy sector.

"By displacing a litre of petrol with second generation ethanol, greenhouse gas emissions can be reduced by over 90%."

Not only will this technology reduce the environmental impact of ethanol production, but it also has the potential to reduce the cost of biofuel and could be used to produce renewable plastics, industrial lubricants and even pharmaceuticals.

Research on the project will be carried out in phases over the next three to five years and will be tested at a demonstration facility based in Muswellbrook.

"Our demonstration facility is where we convert the feedstock to sugars in solution, which is then fermented to ethanol and potentially other biorenewable products. This pre-commercial facility can process around two dry tonnes of biomass per day and will be used to generate the engineering data to construct commercial-scale plants with a biomass processing capability in excess of 250 dry tonnes per day," Dr Doherty said.

Dr Doherty will work with Professor Peter Lewis from the School of Environmental and Life Sciences to refine the fermentation processes of converting sugars into valuable energy and other biorenewable products.

"With respect to the use of plant waste material, relatively little is known about how that waste can be efficiently used for the production of valuable products," Professor Lewis said.

The university, through Professor Richard Bush from the International Centre for Balanced Land Use, will leverage off the technology to drive economic diversification of the region.

"This university will capitalise on this unique technology and its regional location to develop an advanced bioeconomy in the Hunter Valley, bringing together stakeholders and land managers from across the value chain to create new jobs and enterprise," Professor Bush said.

Ethtec has formally partnered with the university's Newcastle Institute for Energy and Resources (NIER) and Director Professor Alan Broadfoot said the project poses a wide range of environmental, social and economic benefits.

"We are proud to be collaborating with Ethtec and look forward to seeing the outcomes of this revolutionary project applied to agricultural and renewable energy sectors across Australia into the future," Professor Broadfoot said.

Ethtec Managing Director and founder Dr Russell Reeves, an alumnus of the university, said the complementary skills across the project partners will improve the chance of success.

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WARWICK BARDSLEY

MANAGING DIRECTOR, ENDRESS+HAUSER AUSTRALIA

What opportunities do you predict for your industry in 2018?

2018 will be an interesting year in the instrumentation electrical and control arena. The Mega LNG projects are basically finished and have entered the operational phase, but mining is showing some signs of modest investment, which is a pleasing turnaround. The emphasis now in all industries is efficiency gains with fast payback. This changes the skill and competencies needed to be successful. Those that will do well are those that understand their customers' real opportunities for improvement. 2018 should be a solid but not overly spectacular year.

What impact will big data and smart device technology have on your industry in 2018?

In some ways, the instrumentation and control industry has been waiting for the rest of the world to catch up for some time. Digital 'smart' devices (although it be at extremely slow baud rates) have been available since the early 90s from many of the leaders in instrumentation. Now comes the question: "what do we do with that information?" This is where the impact of big data comes in. The what-if questions are starting to be answered, and often by inquisitive individuals that are not from the traditional disciplines.

There is a merging of the minds. For decades, we have been providing better and better accuracy — which is important for process control — but now it's about trends, what-ifs, data patterns, predictive and feedforward information, all calculated in real time. This is the impact.

What do you see as the biggest challenges that will face your industry in 2018?

Our industry, like all others, faces global competition and equalisation. Is a European engineer at $200 per hour any better or worse than an engineer from Central or Eastern Asia at $50 per hour?

This provides challenges for local organisations and individuals in higher cost countries. The ones that will survive and prosper are the ones that accept the paradigm, and reassess their place in it. If there is no realisable value to the end user or buyer of the service locally then the service will go offshore to a lower cost provider. Industry needs to understand it, accept it, use it, and capitalise and add value to it. Only organisations that can harness this changed and changing landscape will be the winners — the protectionists will be the losers unfortunately. Everyone needs to have a global outlook and seek opportunities internally and externally.

What percentage of your management time is being spent on the general theme of digitisation and how will this impact your business in 2018?

Digitisation is *the* hot topic and a lot of our time from a strategic and deliverables perspective is spent here. The general marketplace has woken up, and within our industry we have always had a plethora of digital solutions that have been providing digital data regarding process conditions for many years. With this awakening, and with the digitalisation of signals at source, this potentially changes the whole playing field. The proprietary and industry-based protocols are being migrated to more open platforms and as such, this opens the field to both new entrants and to growth in the industry in general. Our industry starts with the physical interface between the real analog world and the digital world. Our solutions take many points in time and digitalise them. This allows that information to be transmitted, stored, analysed and interpreted without error and distortion. We live digitally now, but with the rise in understanding of what is possible with data integration, we stand in a position to deliver on the digital promise. The challenge is to produce tangible value, not just something to which we say "oh that's interesting".

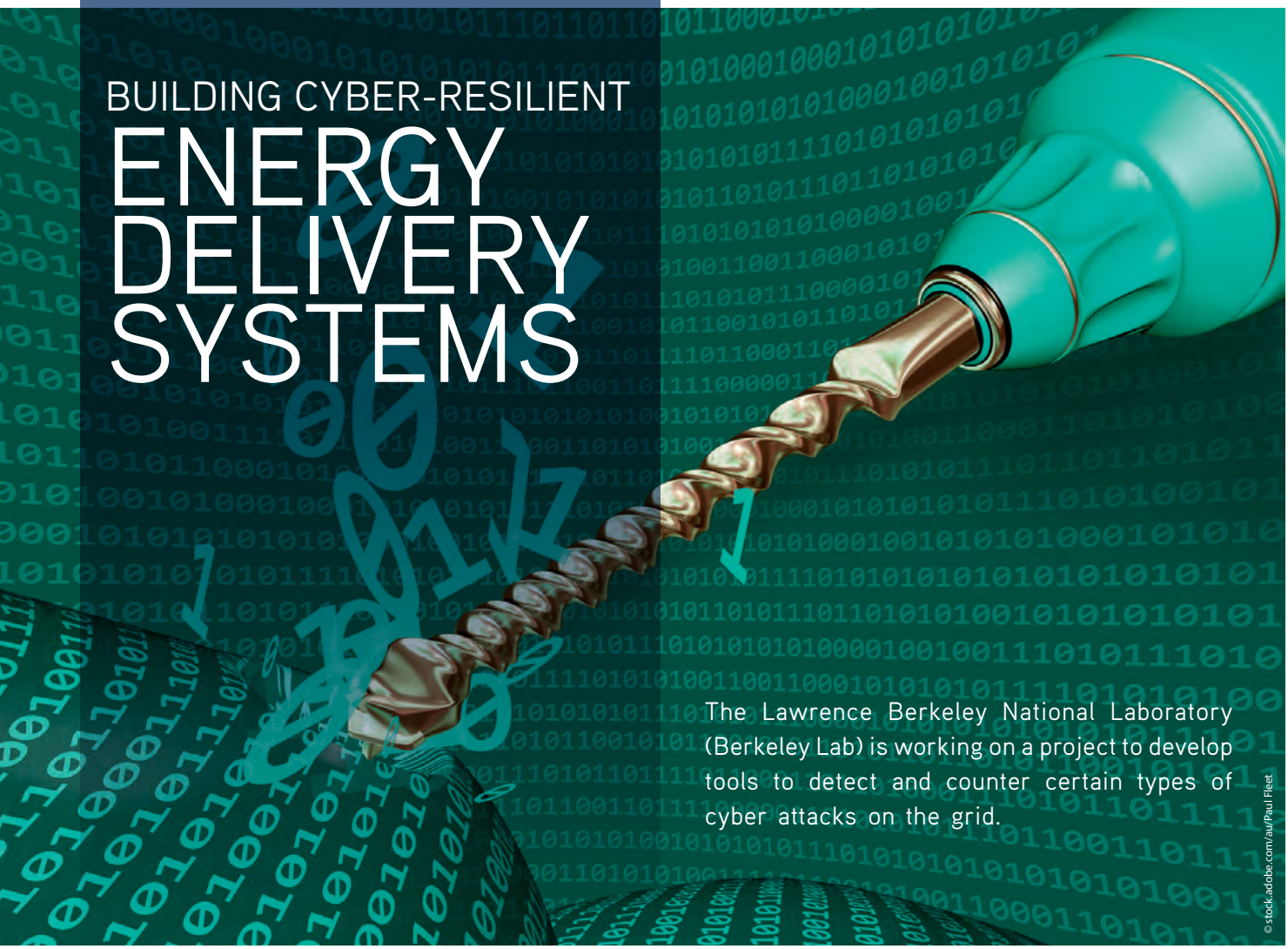
How should Australian industry respond to global competition?

Firstly, the long-term answer is not to try to win on price or to put up walls. We are a small population of 24 million people with a powerhouse of industrial capacity and bigger populations just to the north of us. If you operate a business in Australia today, particularly in the manufacturing or globally transportable service industries (IT, finance etc.) you can't just look at the domestic market. Firstly, we have to drop the inferiority complex. We collectively are better than the rest of the world. Why? Because we go out and experience it. Immigration, along with those collective rights of passages to the UK, USA, Asia, or Europe let us understand how to get things done, working either domestically or globally.

We can operate comfortably in multiple measurement units, standards and jurisdictions. Yes, we are at the bottom of the world, but we have the best containerised transport system and most efficient ports in the world. If you can fit it in a 20- or 40-foot container, let's do it! The other side of this is in realising that sometimes it can't fit it in a container or from a cost base we can't compete. In that case, what can we do smarter and better than anybody else in the world? We are "people people" generally — we get things done, on time, at the correct quality — but let's get our international glasses on. Our local market is too small for the long-term success of domestically focused industries. The government is realising this and is supporting it with various programs, which is great to see.

Warwick Bardsley is Managing Director of the Australian operations of Endress+Hauser, a Swiss-based innovator and manufacturer of both lab and process instrumentation. Warwick has worked from the ground up in industrial instrumentation and control over a career of more than 30 years, and has a family history in manufacturing and small business operations and engagement.

BUILDING CYBER-RESILIENT ENERGY DELIVERY SYSTEMS



The Lawrence Berkeley National Laboratory (Berkeley Lab) is working on a project to develop tools to detect and counter certain types of cyber attacks on the grid.

The project is part of the US Department of Energy's (DOE's) commitment to building cyber-resilient energy delivery systems. It has been awarded up to $2.5 million in funding over three years by DOE.

The project focuses on solar inverters, devices that turn the direct current from rooftop solar panels into alternating current that is fed back onto the grid. So-called 'smart inverters' can enhance overall system reliability and reduce operational costs.

Daniel Arnold, a Berkeley Lab researcher and engineer who is one of the leads of the project, said, "As we modernise the grid, our belief is that we, as a society, can enjoy all of the benefits of large amounts of distributed PV, such as reduced greenhouse gas emissions and a more resilient system, and still have a secure network that is potentially more robust to cyber intrusions than it was before the introduction of large amounts of distributed PV."

In this project, Berkeley Lab will develop algorithms to essentially use the system in the same way the hackers might do but sending opposite signals to nullify the attack, similar to what a noise-cancelling headphone does. "If an attacker tries to manipulate the settings in a number of PV inverters, we'll observe these manipulations, then identify the settings in PV inverters that have not been hacked, and finally, dispatch the appropriate settings to the inverters deemed safe in order to counter that attack," said Arnold, a researcher in Berkeley Lab's Grid Integration Group.

The concept is based on watching for irregularities in the physical behaviour of the grid. "There are laws that govern the way the power grid operates from a physical perspective," said Sean Peisert, a cybersecurity expert in Berkeley Lab's Computational Research Division and the principal investigator on the project. "So we leverage those insights to understand the ways in which hackers might attempt to do something to the grid."

Ultimately, the algorithms will be able to monitor the grid to provide advanced warning to a utility operator of a possible emerging attack.

Berkeley Lab is teaming with a number of partners on this project, including OSISoft, SunSpec Alliance, SolarEdge, HDPV Alliance, Power Standards Lab, Arizona State University, Siemens, the National Rural Electric Cooperative Association and the Sacramento Municipal Utility District.

SunSpec Alliance is a global industry alliance working on information and communication standards for distributed energy resources such as solar PV and battery-based systems. "As the distributed energy grid takes shape, cybersecurity risks are increasing," said Tom Tansy, chairman of SunSpec. "The work that will take place in this program leverages best practices and standards, developed by SunSpec and others, and takes them to the next level by providing sophisticated technology to maintain and enhance grid security."

"Berkeley Lab has pioneered the development of algorithms that can optimally manage distributed energy resources, like wind, solar and batteries, and are completely plug and play," said Arnold, who is leading the Berkeley Lab part of the Grid Resilience and Intelligence Project, or GRIP.

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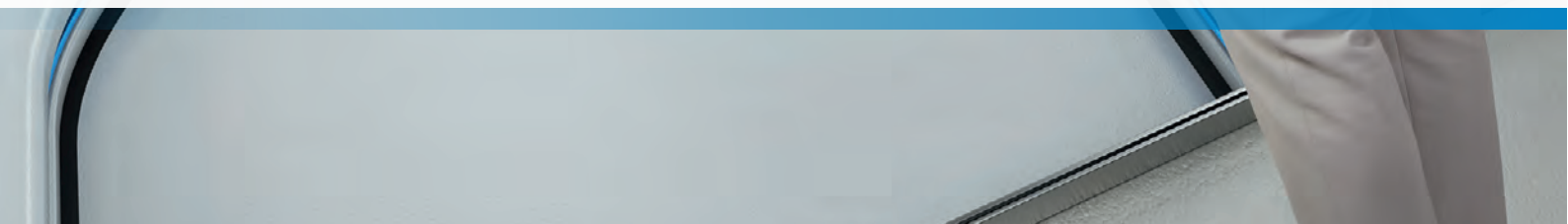

DAVID DUNCAN

MANAGING DIRECTOR, SICK PTY LTD AND SICK NEW ZEALAND LTD

What opportunities do you predict for your industry in 2018?

Embracing the principles and implementation of Industry 4.0 in the manufacturing, logistics and process industry sectors will provide massive opportunities for benefits to be gained, and to remove inefficiencies — driving Australian manufacturing to be competitive in a global context.

As part of Industry 4.0, various applications and topics are discussed in a manner that generates public interest. At the machine level, that includes what is known as human-robot collaboration. Track-and-trace, quality control and state-of-the-art production logistics systems can be modelled both at machine and cloud level. Dynamic real-time optimised, self-organising value creation processes such as flexible manufacturing are typical examples of applications in the cloud. Process automation solutions that are typical for SICK, such as data acquisition and preparation used to control combustion processes and to document compliance with regulations, have to be assigned to a system level.

Industry 4.0 is the linking of industrial production with state-of-the-art information and communication technology — shifting to dynamic, real-time, optimised, self-organising and cross-company value creation networks. This is the future for all industry sectors to embrace, and to be disruptive or be disrupted.

What impact will big data and smart device technology have on your industry in 2018?

The collection of data from smart device technology and the analysis of this collected data to provide information will be a game changer for all industry sectors. Considerable gains in efficiency will be achieved for individual machines or the complete plant, which is one of the core principles of Industry 4.0: to add value.

If the data collected by a sensor is typically shared with higher-level information systems, this is typically being referred to within automation circles as an Industry 4.0 sensor. The key characteristic of Industry 4.0 is how it liberates the data world from the hardware and software structures that surround it. This data world, in turn, is the foundation of autonomous decisions that make it possible for value-creation networks to organise themselves and further drive industrial automation to new heights.

What do you see as the biggest challenges that will face your industry in 2018?

SICK sensor technology in the context of Industry 4.0 ensures that customers are able to express their reality in data ("get data") and employ it purposefully for their application ("use data"). The issue of data security is therefore of key importance. The topics with which sensor technology has to deal with in the data world of Industry 4.0 are at a higher data aggregation level and involve networking, data security and applications.

When it comes to networking, the first important aspect relates to the integration of the sensor into the overall architecture of the application. This includes a clear and structured description of the data required from a sensor and how it is combined with the further data world of the application (data integration). In contrast to the earlier, often simple I/O world, it is of fundamental importance due to the almost limitless possibilities for the overall architecture of the application. To put this into practice, the decision-maker above all needs extensive knowledge of the application in addition to sensor know-how.

These challenges continue to evolve as the implementation of higher-level industrial automation and autonomous networks into the connected world gain industry-wide acceptance.

What are your clients demanding of you now that they didn't demand five years ago?

Our customers continue to expect a high level of competence from our people relating to the implementation of intelligent sensor systems and the integration of these systems into data networks. The ability to add value to our clients' processes and assist in flowing the tangible benefits through to the clients' customers is paramount to the customer relationship. The understanding of a customer's processes and how to measure the effectiveness of these processes is an additional demand by customers that requires significant investment in people, their competencies, their skills and the development of customer-centric thinking.

How is your industry preparing for cybersecurity challenges of the future?

As part of Industry 4.0, the data created by sensors and possibly later refined has an economic value. As a result of this, it has to be protected against unauthorised access.

This places high demands on the trustworthiness of the companies that supply the hardware and software for the automation solution. Solutions need to be developed that enable data to be shared securely, and which offer the necessary institutional framework for this. It is for this reason that SICK is a founding member of the association Industrial Data Space e.V.

The integrity of the data is a further aspect in this regard: it must also be ensured that sensors and their results cannot be manipulated, especially in the case of critical infrastructures as they are described in IT security legislation.

David Duncan is the Managing Director of SICK Pty Ltd and SICK New Zealand Ltd. He is a member of the Board of SICK Japan and SICK South Korea subsidiaries, with additional responsibilities as a member of the International Management Board of SICK AG and the Sales and Service Board AG.

David has been involved in the industrial automation industry for more than 30 years holding various roles with technical, sales and management responsibilities during this time. With an MBA and as a Fellow of the Australian Institute of Management, he has held the position of Managing Director of SICK Pty Ltd for Australia and New Zealand for the past 10 years.

ALGORITHMS IMPROVE RESPONSES TO ENVIRONMENTAL INCIDENTS

Robin Ormerod, Managing Director, Envirosuite

When an environmental incident occurs, acting quickly and effectively is the aim of every regulatory agency and industry involved. Locating the source of the problem and alerting those affected must be done as swiftly as possible so any impact can be kept to a minimum. It might be a nuisance problem like a bad odour from a process upset or a more serious incident that could affect health and safety.

In many cases, however, achieving the goal of speed and effectiveness can be difficult. For example, where there are multiple facilities in an area, complaints about odours can be aimed at a variety of different locations. Each has to be investigated and evaluated before the agency is able to pinpoint what is causing the problem and where it is located. In the meantime, staff may have been dispatched to the field to deal with the event without a clear idea of the true situation.

This challenge is exacerbated when weather conditions — particularly wind — change quickly, a situation that happens often in many places. The wind direction occurring while the investigations are being carried out could well be different from that which occurred when the incident first happened. This can make tracking down the source more difficult and time consuming.

An example of this challenge occurred in the San Francisco Bay Area in December 2016. During that event, more than 1400 complaints were received from residents about strong petro-chemical odours. The odours resulted in some 120 hospital admissions of people suffering from headaches, burning eyes and sore throats.

Investigations into the source of the odours took months before it was finally traced to oil that had leaked during the unloading of a tanker kilometres away. This news was small comfort for all those who had suffered at the time but could not at that stage be told exactly what had happened.

Taking an algorithmic approach

Clearly a better approach is needed to manage environmental incidents, and this can be achieved through appropriate software. By making use of sophisticated algorithms based on the best science, agencies can radically transform the way they respond to such events. They can also help companies that experience such incidents respond in a more proactive manner, reducing the chance of such events in the first place and improving the speed and effectiveness of response. This reduces the negative impact on nearby citizens and can help to build trust around longer term concerns that might be present in the community.

When an incident occurs, one quick and powerful step enabled by such software is to generate a real-time trace of where the odour or pollution has travelled from. The algorithms take the time and location of received reports and combine them with data about current and recent wind and other atmospheric conditions. In this way, the likely path of the offending release can be traced back to the source much more quickly than has previously been possible — within seconds rather than days or weeks.

This approach can also be used by industries that experience an event that results in odours or pollutants being released off-site. The tools also can generate a forward trajectory map showing where plumes are likely to travel and the areas that will be most affected, allowing more effective management of response activities.

Significant operational benefits

For environmental regulatory agencies, adopting such analytical and predictive systems can deliver significant benefits. When an incident occurs and complaints are received, the source of the problem can be found much more rapidly. The tools also reduce the need to send officers out into the field without some prior information, which can waste considerable time. Instead, a back trajectory can quickly determine the likely source and resources sent there to investigate immediately. Time saved in fruitless searches for offending sources can be considerable.

The essential first step to getting a quick response is to receive information about incidents and complaints as they happen. Enabling citizens and field workers to easily lodge their complaints and observations through a smart mobile app is the best way to get the process of investigation started. Linking the latest data communications technology to the relevant scientific algorithms in a smart system leads to better, faster decisions that resolve issues and protect communities more effectively.

For companies experiencing a problem, the same system will allow staff to quickly identify the likely source of the issue and enable on-site responses to be activated without delay. Time lost in the early stages of a complaint event or incident can be critical. The ability to alert potentially affected residents and the regulator without delay can avoid more serious consequences later.

Because they can be more proactive, companies are less likely to face fines or other penalties as a result of an incident. Not only are there advantages for a technical solution — reducing or even avoiding adverse impacts — but also in terms of the perceptions formed by the community and regulators. A company's ability to meet corporate and social responsibilities will have been significantly enhanced. It will be able to clearly show to agencies that appropriate steps were taken as soon as an incident occurred and those steps resulted in reduced impact.

By taking advantage of real-time data sources, and making use of forecasting and analytical tools, combined with smart IT platforms, both regulators and industries can be in a much better position should an environmental incident occur.

Communities in affected areas can be better informed and comforted by the knowledge that authorities have a clearer picture of what is happening and are taking targeted action to minimise any consequences. Taking an algorithmic approach to environmental management benefits all parties involved.

EnviroSuite Pty Ltd
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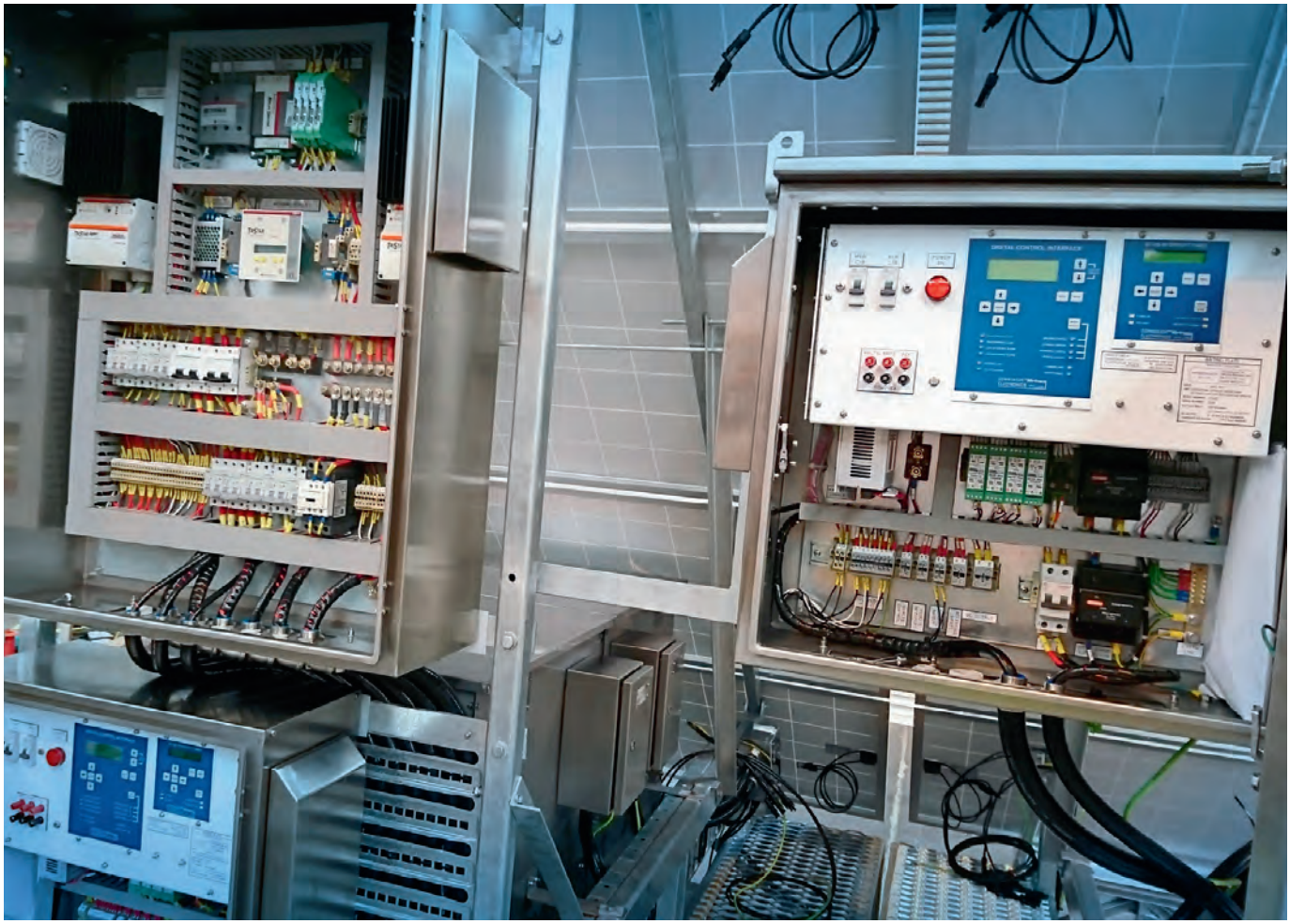
Off-grid power systems delivered for Northern Gas Pipeline



Engineering company MPower has commenced delivery of the first of several off-grid DC power systems for the Northern Gas Pipeline (NGP), which runs between Tennant Creek in the Northern Territory and Mount Isa in Queensland.

The goal of the NGP is to connect gas fields in the Northern Territory with customers in the Eastern Gas Market. It will include 622 km of high-pressure buried gas pipeline with gas compression facilities at each end, as well as midline facilities such as scraper stations. It is being constructed by gas supplier Jemena.

MPower has been engaged to design and construct 10 autonomous remote power systems to be delivered in stages between now and early 2018. The high-specification renewable systems, to be installed at remote stations along the pipeline, incorporate in-built redundancy and will support the ongoing operation of the critical infrastructure project.

The bespoke renewable power systems integrate a mix of solar PV arrays, battery energy storage and a sophisticated control system designed to provide cathodic protection along the length of the pipeline. By integrating the various aspects of the system, MPower is facilitating pipeline protection against corrosion. And while the remote location and the requirement for reliable and continuous power where there is no access to network power present challenges, MPower believes these challenges fall within its core expertise.

"We're delighted to be delivering a world-class solution to this important infrastructure project," said Nathan Wise, CEO of MPower's ASX-listed parent, Tag Pacific. "MPower is known for its capability in providing high-reliability power solutions for critical applications. We have drawn on our vast experience in remote renewable power systems and integrated battery energy storage to design a sophisticated solution that meets the demanding requirements of the Northern Gas Pipeline."

MPower
www.mpower.com.au

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The fifth annual Australian Energy Storage Conference and Exhibition (AES 2018) will take place in Adelaide, 23–24 May 2018, in partnership with the Government of South Australia.

The diversity of this market exemplifies the importance of the many different applications, use cases, and technologies that make up the Energy Storage umbrella. This is not a 'one size fits all' technology, but rather offers a 'solution to fit every situation'. The common outcome of energy storage, regardless of the energy source, is increased sustainability.

This can be the financial sustainability of a business through lower operating costs and efficiency or environmental sustainability by enabling higher penetrations of renewable energy and lowering carbon emissions. In that vein, the theme of AES 2018 is Storing Energy for a Sustainable Future, which will take a wide focus on the technologies that will help us achieve these desired results.

KEYNOTE SPEAKER

Sanjeev Gupta
Executive Chairman of GFG Alliance

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SALES MANAGER AND CONFERENCE PROGRAM MANAGER, AUSTRALIAN ENERGY STORAGE CONFERENCE AND EXHIBITION

What opportunities do you predict for your industry in 2018?

2018 looks to be an exciting year for Energy Storage. I expect the industry to continue growing exponentially and market offerings to become increasingly diverse in regards to the technologies available and in use on the grid. 2017 saw significant growth in this sector with some major milestones achieved in Australia. The largest lithium battery in the world was recently turned on in South Australia, paired with a wind farm. As this installation proves the value and reliability of energy storage, particularly where paired with renewable generation, we will see the number of approved energy storage installations increase across the country. When considering the number of utility-scale solar and wind installations, and taking into account the upcoming closures of certain coal-fired generators, the potential market and value of energy storage makes this technology increasingly valuable to Australia's energy networks. Another growth area for this technology is with the end consumer, for both commercial and residential applications. Energy storage costs have been falling rapidly for the past few years, making the financial case for homeowners and commercial business much more attractive. Feed-in tariffs for energy consumers who have invested in solar panels have begun to expire in certain regions, with significantly reduced rates being offered when exporting excess energy to the grid. This will only increase the incentive for customers to consume as much of their generated electricity as possible by utilising energy storage. On the commercial side, peak shaving has proven to be a financially beneficial use of energy storage technologies, even when not paired with renewable generation.

What impact will smart technology have on your industry in 2018?

Smart technology and software solutions are a big factor in the large-scale uptake of energy storage technologies by enabling energy networks to effectively manage the increasing number of intermittent generation sources and stored energy connected to the energy grid. Distributed energy resources such as residential solar have significantly changed the demand curve for energy, and while distributed energy storage has the capability of levelling this demand, it also creates unknown variables for utilities, particularly when the number, size and location of these systems are unknown. Smart software is beginning to enable utilities to utilise these distributed energy resources and harness them to stabilise the electricity grid, a trend which will increase in importance and effectiveness in 2018 as these technologies are improved and innovative access models are being explored. Blockchain accounting is another technology that is being experimented with in Australia and overseas to allow for peer-to-peer energy trading, a function that will significantly improve the financial case for customer sited solar plus storage. While the technology is not exactly in its infancy, its application for energy trading is in the early stages but is quickly becoming an important tool.

On a more localised scale, smart management systems for energy storage are becoming increasingly sophisticated, allowing owners of the systems to maximise the financial benefit of their energy assets. For larger-scale sites, particularly microgrids, weather-predicting software is being implemented to ensure that energy storage assets are prepared for sudden reductions in solar resources due to weather factors. As these improvements continue in 2018, they will increase the effectiveness of the technology.

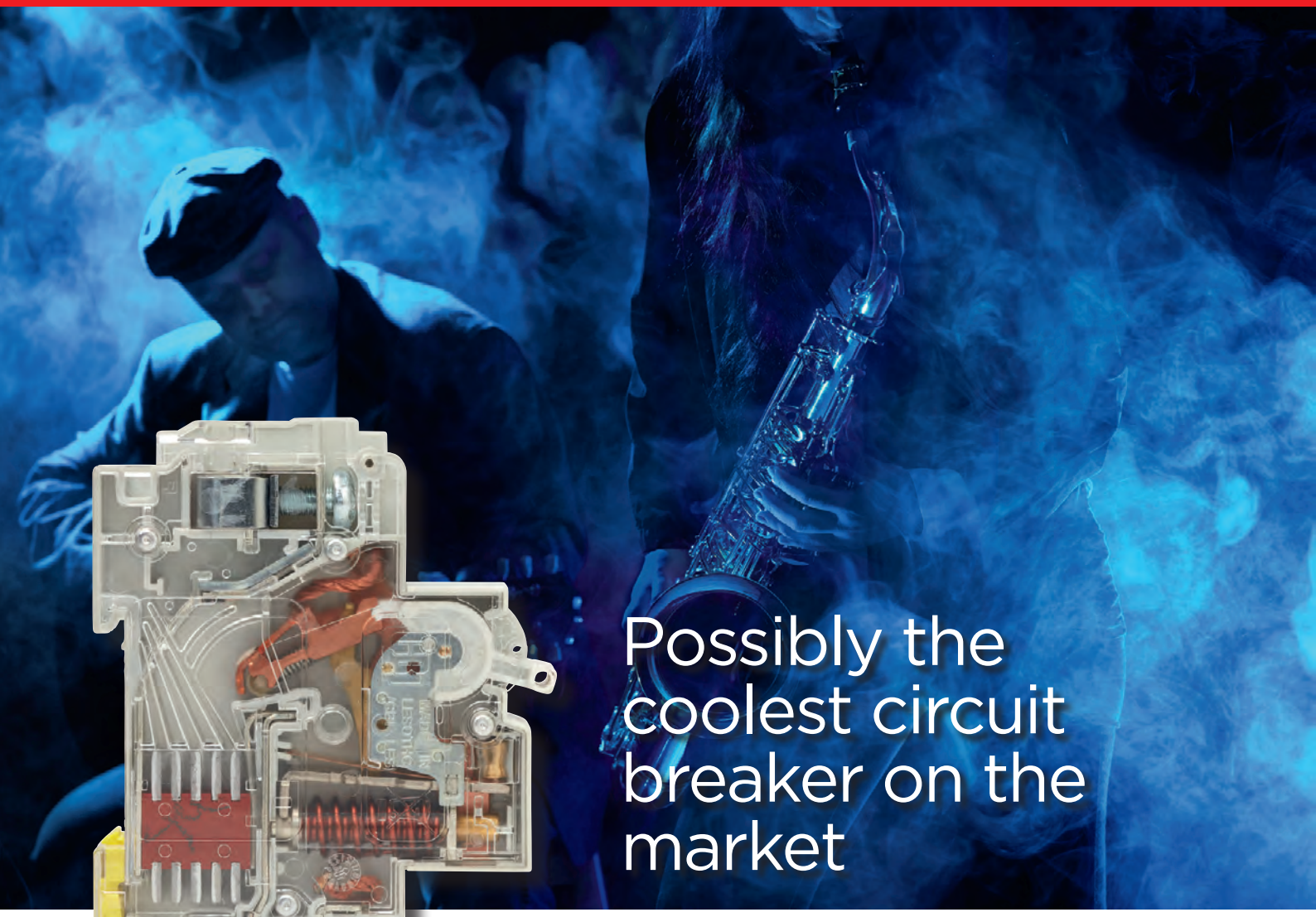
How is Australia's energy policy uncertainty affecting your industry?

Policy uncertainty is never a good thing for investment and the energy industry is feeling the effects of this longstanding problem right now. Years of policy uncertainty and lagging incentives slowed the uptake of large-scale renewable energy and particularly energy storage, which has rebounded in recent years. Energy providers are finding the maintenance and upkeep of ageing coal-fired generators cost prohibitive on a purely economic basis, but replacing the generation capacity of these facilities is not something that can be done overnight. Large-scale wind and solar for power generation is now significantly less expensive to build and operate than a new coal power plant, but due to the variable output from sun and wind, cannot 100% power the electricity grid without some form of energy storage. The variety of storage technologies, the speed at which some of them can be deployed, and the dropping costs are making the addition of energy storage an integral part of Australia's energy grid. In short, while policy has the ability to speed the uptake of energy storage, economics is the main driver.

How should Australian industry respond to global competition?

While Australia has a number of home-grown energy storage technologies and companies, the majority of the manufacturing is done overseas due to costs. When talking about Lithium batteries in particular, Australia has the unique advantage of being one of the only countries with access to all natural resources needed in the manufacture of this particular chemistry. Investment in highly automated manufacturing facilities to capitalise on localised mining of the resources has the potential to position Australia as a major global producer of high-quality, lithium-based batteries. This would not only provide an economic boost, but reduce the cost of the product locally.

Sam Staples is the Sales Manager and Conference Program Manager for the Australian Energy Storage Conference and Exhibition, a business to business trade event focused on educating consumers and facilitating business connections in the Australian energy storage and renewable energy industries. 2018 will be Sam's 4th year managing the event.



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The CBE range

The CBE range boasts a wide selection of circuit breakers for equipment in the B, C, and DD FRAME and also includes the 13mm narrow profile QY and QDC ranges available for AC and DC applications. These products can be customised to a customer's needs and individual specifications assuming the specification falls within the relevant standard. The full range and technical data sheets are available at our web page.

Lack of Space? Q Range 13mm Circuit breakers

Due to the fact that the modular width is 13mm instead of the traditional 18mm, you will realize a space saving of more than 30% in the same cabinet size.

This is ideal if you are going to upgrade existing equipment, equally so if you would like to fully optimize and reduce the dimensions on a new design. More compact dimensions are often associated with higher temperatures, but as the Q-range is hydraulic magnetic the trip point is unaffected by ambient temperature thus allowing for the 13mm profile, it will always hold rated current. Specially adapted busbars with 13mm modular width are available in various configurations.

Telecommunications: The new 300V, 400V and 600V DC Y frame breakers

Within the CBE range of products we have recently released the Y frame also in the 13mm profile for Telecommunication DC applications again utilizing the Hydraulic Magnetic technology and taking advantage of the 30% space saving as per the Q range.

Solar battery storage: For off grid and residential and commercial applications

Utilizing our Hydraulic Magnetic technology we have released a range of Circuit breakers and enclosures for the Battery Storage market. With a range from 80A to 250A at 80Vdc this range is available complete with enclosure or sold separately to fit to customers' individual cabinet requirements. The 250A unit uses a unique 19mm design per pole with the 80–200A utilizing our unique 13 mm design per pole. 80–100A 2 Pole, 125–150A and 200A 4 Pole. The complete enclosure houses 2 breakers to safely protect and isolate battery strings, the customer can save space and ease of switching against standard fuses or MCCBs.

250A

80–200A

Remote Actuation Unit for DD FRAME MCBs

The Remote Actuation Unit (RAU) is a factory fitted module that enables the automated switching of DD-frame circuit breakers. The unit can actuate the circuit breakers both ON and OFF. The actuation of the circuit breaker pole occurs completely internally. The RAU unit is mounted on the left hand side of the circuit breakers and can be connected to up to a three pole unit. The circuit breakers can be manually operated when in the REMOTE mode. Two indicators are present on the face of the RAU unit. The first is an LED that provides an indication of the mode of operation as well as showing the unit's operational status. The second is a colour flag indication which indicates the position of the latching mechanism of the connected circuit breakers. The unit has a select switch, providing the ability to specify the operation mode — remote or manual. A signal output provides feedback to the user that there is power on the load side of the circuit breakers. The unit comes with a universally standard connection terminal. For DC circuits up to 300A and AC circuits up to 100A. The RAU has an operating voltage range of 15Vdc to 80Vdc. Applications include battery storage, Telecommunications, Railways, Solar, System Automation. At CBI we can design this product to your needs whether it be 3 individual circuits at different current ratings or up to the full capacity using 3 bridged breakers. Available in 1, 2 and 3 pole configurations.

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Our in house design and assembly has to date completed projects using Polybox enclosures for utilities, solar installations, commercial and industrial projects including temporary power boards specifically designed and manufactured for the Sydney tunnel projects.

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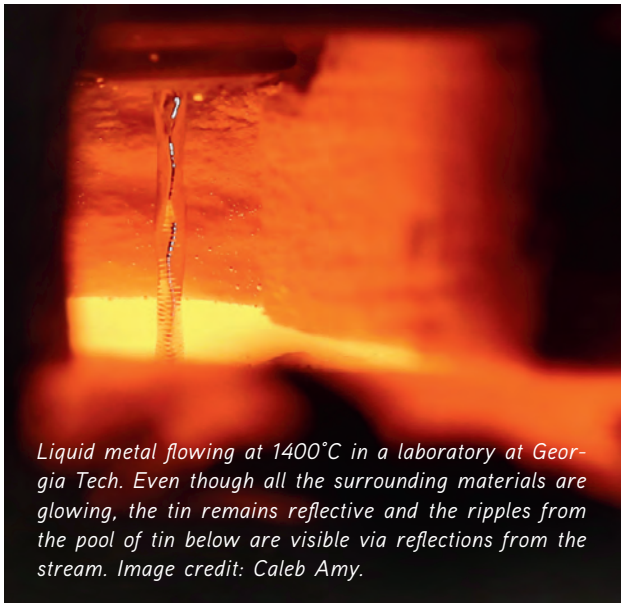
Pump that can move molten metal offers new energy conversion and storage technologies

Research conducted at the Georgia Institute of Technology has demonstrated the possibility of pumping molten metal at over 1400˚C using ceramic pump components, opening up new possibilities in high-temperature heat transfer and storage — a critical factor in efficient energy conversion.

A ceramic-based mechanical pump able to operate at record temperatures of more than 1400˚C can transfer high-temperature liquids such as molten tin or silicon.

The research was supported by the Advanced Research Projects Agency-Energy (ARPA-E) and reported in the journal *Nature*. The pump was developed by researchers from Georgia Tech with collaborators from Purdue University and Stanford University.



Liquid metal flowing at 1400˚C in a laboratory at Georgia Tech. Even though all the surrounding materials are glowing, the tin remains reflective and the ripples from the pool of tin below are visible via reflections from the stream. Image credit: Caleb Amy.

"Until now, we've had a ceiling for the highest temperatures at which we could move heat and store it, so this demonstration really enables energy advances, especially in renewables," said Asegun Henry, an assistant professor in Georgia Tech's Woodruff School of Mechanical Engineering. "The hotter we can operate, the more efficiently we can store and utilise thermal energy. This work will provide a step change in the infrastructure because now we can use some of the highest temperature materials to transfer heat. These materials are also the hardest materials on Earth."

Thermal energy, fundamental to power generation and many industrial processes, is most valuable at high temperatures. Liquid metals such as molten tin and molten silicon could be useful in thermal storage and transfer, but until now engineers didn't have pumps and pipes that could withstand such extreme temperatures.

Ceramic materials can withstand the heat, but they are brittle — and many researchers felt they couldn't be used in mechanical applications like pumps. But Henry and graduate student Caleb Amy decided to challenge that assumption by trying to make a ceramic pump.

The researchers used an external gear pump, which uses rotating gear teeth to suck in the liquid tin and push it out of an outlet. The gears were custom-manufactured by a commercial supplier and modified in Henry's lab in the Carbon Neutral Energy Solutions (CNES) Laboratory at Georgia Tech.

"What is new in the past few decades is our ability to fabricate different ceramic materials into large chunks of material that can be machined," Henry explained. "The material is still brittle and you have to be careful with the engineering, but we've now shown that it can work."

Addressing another challenge, the researchers used graphite to form the seals in the pump, piping and joints. Seals are normally made from flexible polymers, but they cannot withstand high temperatures. Henry and Amy used the special properties of graphite — flexibility and strength — to make the seals. The pump operates in a nitrogen environment to prevent oxidation at the extreme temperatures.

The pump operated for 72 hours continuously at a few hundred revolutions per minute at an average temperature of 1473 K — with brief operation up to 1773 K in other experimental runs. Because the researchers used a relatively soft ceramic known as Shapal for ease of machining, the pump sustained wear. But Henry says other ceramics with greater hardness will overcome that issue, and the team is already working on a new pump made with silicon carbide.

Among the most interesting applications for the high-temperature pump would be low-cost grid storage for surplus energy produced by renewables — one of the greatest challenges to the penetration of renewables on the grid. Electricity produced by solar or wind sources could be used to heat molten silicon, creating thermal storage that could be used when needed to produce electricity.

"It appears likely that storing energy in the form of heat could be cheaper than any other form of energy storage that exists," Henry said. "This would allow us to create a new type of battery. You would put electricity in when you have an excess, and get electricity back out when you need it."

The Georgia Tech researchers are also looking at their molten metal pump as part of a system to produce hydrogen from methane without generating carbon dioxide. Because liquid tin doesn't react with hydrocarbons, bubbling methane into liquid tin would crack the molecule to produce hydrogen and solid carbon — without generating carbon dioxide, a greenhouse gas.

The ceramic pump uses gears just 36 mm in diameter, but Henry says scaling it up for industrial processing wouldn't require dramatically larger components. For example, by increasing the pump dimensions by only four or five times and operating the pump near its maximum rated speed, the total heat that could be transferred would increase by a factor of a thousand, from 10 kW to 100 MW, which would be consistent with utility-scale power plants.

For storage, molten silicon — with still higher temperatures— may be more useful because of its lower cost. The pump could operate at much higher temperatures than those demonstrated so far, even past 2000˚C.

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Portable oxygen analysers, such as the GPR-1100 from Analytical Industries, and so are easily carried to the point of use. They also need little power to operate — the GPR-1100 operates continuously for 30 days, over 8 h with the pump running, on a single battery charge — and will measure down to less than 10 ppm O_2. Simple and intuitive operation is paired with a robust casing that prevents accidental damage in a heavy industrial environment.

To maximise the lifetime of the sensor, the analyser is available with quick-connect fittings to protect the sensor from ambient air when not in use. Users can expect sensors to last up to 24 months, with replacement sensors readily available and simple to fit.

A range of sample conditioning options are available for filtration, pressure reduction and flow control. As not all tanks have pressures positive enough to generate a flow to the analyser, the analyser can be supplied with an internal pump.

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Its fast spectrum mode allows the user to view short duration ingress, impulse noise, electrical interference, CPD and other impairments on a single screen-even under upstream QAM signals.

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Key features include additional applications for live search, Telnet, SNMP, FTP, remote desktop plus options for Wi-Fi, Signature Capture and more; high-resolution true non-interfering 5 to 1000 MHz downstream sweep system with manual and automatic gain and slope offsets; fast spectrum with 0.3 μs sample rate; equaliser stress, frequency response and group delay measurements in digital and cable mode; i-QAM option identifies impairments in a QAM signal; gated CCN, CSO, CTB and HUM tests on active channels; DOCSIS 3.0 cable modem with up to 8 DS and 4 US bonded channels; futureproof flexible and upgradeable DSP software-defined receiver technology; fast 5 to 200 MHz upstream sweep, plus ingress detection and display; Wi-Fi 802.11g wireless USB adapter option; fast 1 GHz spectrum analyser with 1000 MHz span and 1 MHz to 30 kHz RBW; 6.4″ full VGA, colour touch screen (daylight visible); BPI+ and PacketCable digital certificates installed; weather and shock resistant; Net-Tools including ping, trace, throughput and IP details via Wi-Fi, Ethernet and cable modem; and user-programmable automated 24-hour testing.

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- Simple push and twist connection

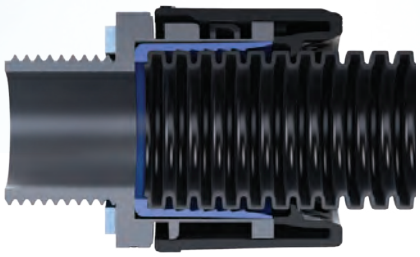

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ABB microgrid to power Aruba

Technology company ABB has agreed to provide an advanced microgrid to WEB Aruba, the main power utility serving the Dutch Caribbean island of Aruba. A popular tourist destination, Aruba is just 32 km long and 10 km across its widest point, with a land area of 179 km^2 and a population of about 103,000 inhabitants.

Aruba has a peak demand of 134 MW currently met by a mix of thermal, wind and solar photovoltaic generation. Now, WEB Aruba has set a goal to generate half its annual average energy supplied from renewable energy sources and the other half from alternative fuels by 2020, supporting the government's vision to become completely fossil-fuel-free.

ABB's microgrid solution allows for integration of a complex energy generation portfolio and maximises the use of renewable energy, while optimising operations in real time. Using 24-hour forecasts of both renewable output and system load, the system will help plan operations and adjust dispatch in real time to accommodate changes in renewable output, load or generation availability. This leads to a more automated grid.

At the heart of the solution is an advanced control system with dynamic load shedding capability. When major system transients occur that the generation and storage are not able to accommodate, the system immediately calculates the minimum load shed required to stabilise frequency. It also ensures the distribution of load shed events so that no critical facilities are impacted.

"This innovative microgrid solution will support the island of WEB Aruba to integrate more renewables and maintain reliability and efficiency of power supplies to meet increasing demand for electricity," said Massimo Danieli, head of ABB's Grid Automation business. "The embedded software, automation and control technologies will also facilitate 24-hour forecasts and enable a stronger, smarter and greener grid."

"We're eager to continue developing future projects together with ABB as they have enabled us in achieving our goals by introducing new renewables, new technologies and by adding value to our island's economy," said Francis Ras, division manager technical affairs at WEB Aruba.

ABB Australia Pty Ltd
www.abbaustralia.com.au

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Mobile biomass-to-energy plant

Australia's agriculture sector is soon set to benefit from the arrival of a mobile biomass-to-bioenergy plant down under. Not only can the plant generate bioenergy at the biomass site in seconds, it can be used as a mobile bolt-on electricity plant that can potentially make agribusinesses completely independent of the grid.

An alternative to fossil fuels, bioenergy has the potential to be predominant in rural areas thanks to technologies than can convert biomass — woody waste and feedstocks — into biofuels, biochemicals, heat and electricity. The expense of transporting biomass to a high-cost off-site conversion plant, however, has been a deterrent for many Australian agribusinesses — until now.

The Mobile Pyrolysis Plant (MPP) uses fast pyrolysis technology — high-temperature, low-oxygen treatment of woody waste — to generate biofuels and biochemicals (such as bio-crude oil, wood gas, charcoal and wood vinegar) and electricity. The technology mimics nature's process at high speed, producing bio-crude oil and its offsets in a similar way that the environment formed oil reserves over millions of years.

The MPP comes in two sizes and can be used by agribusinesses for bolt-on electricity generation. The 2-tonne version is transportable on a car trailer, while the 10-tonne size is collapsible, easily transportable on a truck and able to generate 1.2 MW of energy over a 12-hour process. This enables agribusinesses to power up machinery — and potentially their entire operations — independent of external energy sources.

Developed in the Netherlands by renewable energy technology manufacturer Nettenergy BV, the MPP will be distributed across Australasia by Pyrotech Energy, which also has the rights to manufacture and license the plant throughout the region. With a high thermal energy output yet very low emissions, it is claimed to reduce carbon dioxide emissions from biomass by up to 85%.

"Australia's agriculture sector produces millions of tonnes of waste wood and second-generation feedstock residue annually — these create carbon dioxide emissions when left as waste," said Pyrotech Energy Director Christos Karantonis. "The MPP technology turns this waste into valuable product without harming the environment, allowing agribusinesses to create legitimate commercial income far easier than through existing bioenergy plants or technologies.

"Farmers, forestries, waste collectors, municipalities [and] water treatment facilities can use the bio-crude (pyrolysis) oil in boilers, furnaces, kilns or turbines to create heat and electricity. When connected to their grid, they can supply their operations with 50–25 kW of electricity per hour, depending the project and the application."

New catalyst converts CO_2 to natural gas

Australian scientists have developed a new efficient catalyst that converts carbon dioxide (CO_2) from the air into synthetic natural gas, in what is claimed to be a clean process using solar energy. Invented at the University of Adelaide in collaboration with CSIRO, the process has the potential to replace fossil fuels while continuing the use of existing carbon-based fuel technologies without increasing atmospheric CO_2.

"Capturing carbon from the air and utilising it for industrial processes is one strategy for controlling CO_2 emissions and reducing the need for fossil fuels," said University of Adelaide PhD candidate Renata Lippi, first author of the research published in the *Journal of Materials Chemistry A*.

"But for this to be economically viable, we need an energy-efficient process that utilises CO_2 as a carbon source.

"Research has shown that the hydrogen can be produced efficiently with solar energy. But combining the hydrogen with CO_2 to produce methane is a safer option than using hydrogen directly as an energy source and allows the use of existing natural gas infrastructure.

"The main sticking point, however, is the catalyst — a compound needed to drive the reaction because CO_2 is usually a very inert or unreactive chemical."

The researchers created this catalyst using porous crystals called metal-organic frameworks which allow precise spatial control of the chemical elements. As noted by Dr Danielle Kennedy, AIM future science platform director with CSIRO, "The catalyst discovery process involved the synthesis and screening of more than 100 materials."

Other catalysts have suffered from issues around poor CO_2 conversion, unwanted carbon-monoxide production, catalyst stability, low methane production rates and high reaction temperatures. The new catalyst efficiently produces almost pure methane from CO_2, with minimal carbon-monoxide production and high stability under both continuous reaction for several days and after shutdown and exposure to air.

Importantly, only a small amount of the catalyst is needed for high production of methane, which increases economic viability. The catalyst also operates at mild temperatures and low pressures, making solar thermal energy possible.

"What we've produced is a highly active, highly selective (producing almost pure methane without side products) and stable catalyst that will run on solar energy," said project leader Professor Christian Doonan, director of the University of Adelaide's Centre for Advanced Nanomaterials. "This makes carbon-neutral fuel from CO_2 a viable option."

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STEPPING STONE

TO FUTURE ENERGY IN SOUTH AUSTRALIA

Work on Schneider Electric and Planet Ark Power's $13.9 million solar and battery pilot project in South Australia is expected to commence early in 2018.

The project combines solar power and battery technology optimised by a Schneider Electric-led microgrid management system integrated with an Advanced Distribution Management System to deliver more secure and reliable energy back to the grid. The project was recently awarded a $1.95m grant by the South Australian Government to support the delivery of a secure, sustainable and affordable energy supply to the state.

The grant will help build a $13.9 million solar and battery pilot project at a major distribution centre in Adelaide's north.

Schneider Electric Australia & New Zealand Zone President and Managing Director Gareth O'Reilly said that this is a significant milestone for Australia's renewable energy future.

"Nationwide, there is potential for 10,000 MW or more of demand side response and load shifting, equivalent to five Liddell power stations, and 20% energy efficiency improvements across the National Electricity Market.

"At Schneider Electric, we believe demand side response and energy efficiency should be explored as a first priority to make energy for all Australians safer, more reliable, more sustainable and more affordable. Full adoption of demand side response and load shifting solutions will reduce the need to open new large-scale power stations. It will also provide the network with the flexibility to allow high levels of renewable penetration into the system," said O'Reilly.

The grant is one of four grants from this round and part of the SA Government's $150 million Renewable Technology Fund designed to support projects in four categories — renewable generation, bulk energy storage, bioenergy and hydrogen infrastructure. This grant comes as recognition for Schneider Electric and Planet Ark Power that their current and proposed future work is contributing to a more secure, sustainable and affordable energy future.

"The microgrid harnesses the full potential of renewable energy by dealing with the intermittent nature of solar. This project is an example of South Australian leadership in building a stable and affordable energy future," Planet Ark Power General Manager Jonathan Ruddick said.

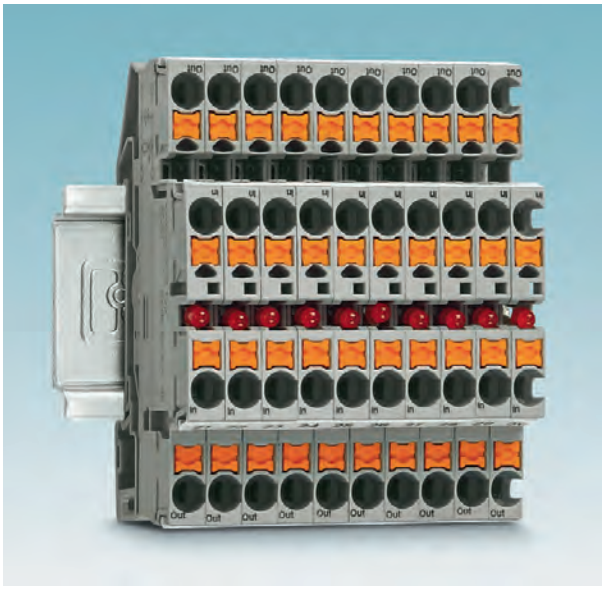
"This microgrid project allows the demonstration of the technology that will power our future energy supply both locally and globally. The microgrid harnesses the full potential of renewable energy by dealing with the intermittent nature of solar. This project is an example of South Australian leadership in building a stable and affordable energy future."

The project will include a grid-connected microgrid with 2.9 MWh of smart battery storage, demand management, new network integration technology and up to 6 MW of rooftop solar power.

Central to this project will be the integration of Schneider Electric's EcoStruxure Platforms, including its Advanced Distribution Management System and Microgrid Advisor, which will optimise the site's solar PV and battery storage. Embedding solar generation and storage with microgrid control will improve the grid's resilience and the energy security of the site.

Schneider Electric
www.schneider-electric.com.au

CURRENT INDICATOR TERMINAL BLOCK



The Phoenix Contact PTTB 2,5-ILA 100 current indicator terminal block simplifies the connection process with Push-in Connection Technology, which allows direct plug-in capability. Whether working with solid conductors or conductors with ferrules, technicians can connect directly to the terminal point without any fuss.

The technician simply aligns and inserts the wire into the marked terminal points. The low insertion forces of the push-in connection terminal block enables the conductors to be inserted easily and directly, and tool-free. The installation process is fast and convenient.

The current indicator terminal block detects interruptions or line breaks during operation to ensure good performance. The voltage drop is evaluated at a Zener diode in reverse direction and is indicated by an LED so that the technician can see the operating status of the system. The device also features a printed circuit diagram for clear identification to help minimise faulty wiring and ensure performance.

The compact system helps users save on space with its slim design, while providing flexibility when it comes to configuration. Shock and vibration resistant, the device is robust and safe to use and operate.

The unit is suitable for use in a range of industries including systems manufacturing and machine building, process technology and process engineering, chemical and petrochemical, rail and shipbuilding, as well as in energy technology.

Phoenix Contact Pty Ltd
www.phoenixcontact.com.au

STRAIN RELIEF SYSTEM

The Honeycomb universal strain relief system saves engineering and assembly time while keeping cables and hoses safe in motion.

The cables and hoses can simply be inserted into the honeycomb. It is then closed, whereby the outer walls of the honeycomb cavities are pushed tightly around the cables. In this way, the structure simply adapts to the cable diameters.

Other benefits of the system include: saves space, protects the cables in the e-chain, easy to open — to insert new cables or to replace them.

Treotham Automation Pty Ltd
www.treotham.com.au

DIN RAIL POWER SUPPLY

The compact PIC240.241D power supply, by PULS, is the latest addition to the PIANO series. It has many useful characteristics, including an efficiency level of 94.8% and a lifetime of 74,000 h.

The 24 V, 10 A DIN rail power supply has a wide range of 100–240 V and comes with a DC-OK signal relay contact. The terminals are robust and the unit has low power losses.

The product has a slim, single-board design in a high-quality polycarbonate housing. It is 49 mm in width.

Control Logic Pty Ltd
www.control-logic.com.au

COMPACT ELECTROMAGNETIC FLOW METER

In industrial process measurement and automation, demand is steadily rising for simple, reliable and maintenance-free measuring instruments in a pocket-sized format. The Picomag from Endress+Hauser fulfils such requirements, measuring both the flow of conductive fluids and also their process temperature. In addition, Picomag offers easy commissioning with Bluetooth using its SmartBlue App, as well as seamless system integration with IO-Link technology.

The large and user-friendly display allows an instant local process reading of flow, temperature and totaliser values. Errors occurring during operations are displayed via diagnostic symbols in accordance with NAMUR recommendation NE 107. The screen rotates automatically depending on the installation position (horizontal, vertical), guaranteeing optimal readability at any time. Configuration parameters can be called up and monitored by simply knocking on the device.

With a Bluetooth connection, it is possible to carry out wireless configuration or data retrieval over a distance of 10 m. The SmartBlue App provides the user with quick and easy navigation through all device and diagnostic functions.

The IO-Link master as an interface allows users to have comprehensive data access, and provides the digital data transmission to process control systems.

Endress+Hauser Australia Pty Ltd
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COMPACT AS-I SLAVE MODULE

The Pepperl+Fuchs AS-Interface G10 Ultra-Compact Module is an AS-I slave module with dimenisons of 22 x 27 x 40 mm per I/O. The ultra-compact safety module fits into every cable duct and can be mounted securely using a single stainless steel screw. Since it fits easily into the cable duct, the flat cable remains in the cable tray at all times.

In applications where sensors are widely scattered, the decentralised installation reduces cable lengths and optimises line lengths to sensors and actuators. Since cable outputs are used, this means that no connection cables are required. The one-piece enclosure can be quickly installed and give every standard sensor AS-Interface capabilities.

Pepperl+Fuchs (Aust) Pty Ltd
www.pepperl-fuchs.com

WATER DRIVE

The ABB580 is an all-compatible drive for water and wastewater from ABB. Created exclusively for the water industry, the robust, compact drive can be wall mounted or cabinet built and features built-in pump application functionalities. This includes sensorless flow calculation, multipump control, level control, soft pipe fill, dry run protection, quick ramps and a solution for keeping the impeller of the pump clean.

With a power range of 0.75 to 250 kW and an optional IP55 enclosure for wall or cabinet installation, there is also a built-in energy calculator to visualise the user's energy savings. A TUV certified Safe Torque Off function will help to save on energy costs, according to the company, and an intuitive hand-off-auto control panel and PC tool drive composer is available for easy usability.

The ACQ580 drive controls virtually any kind of motor, including ABB's IE4 synchronous reluctance motors, with connectivity supported by a wide range of fieldbus protocols.

Control Logic Pty Ltd
www.control-logic.com.au

UV-RESISTANT CONTROL CABLE

LAPP has released two variations to the ÖLFLEX CLASSIC 110 range: the 110 Black and 110 Black LT. These two variations have new features including improved UV performance, making this cable suitable for installation outdoors and in applications where users might prefer black cable.

The ÖLFLEX 110 Black LT is specially designed for flexing applications at extra low temperatures (down to -30° with occasional flexing). Traditional ÖLFLEX 110 is suitable for occasional flexing down to -15°, so the LT variation adds an extra 15°.

LAPP EXPRESS Australia
lappexpress.com.au

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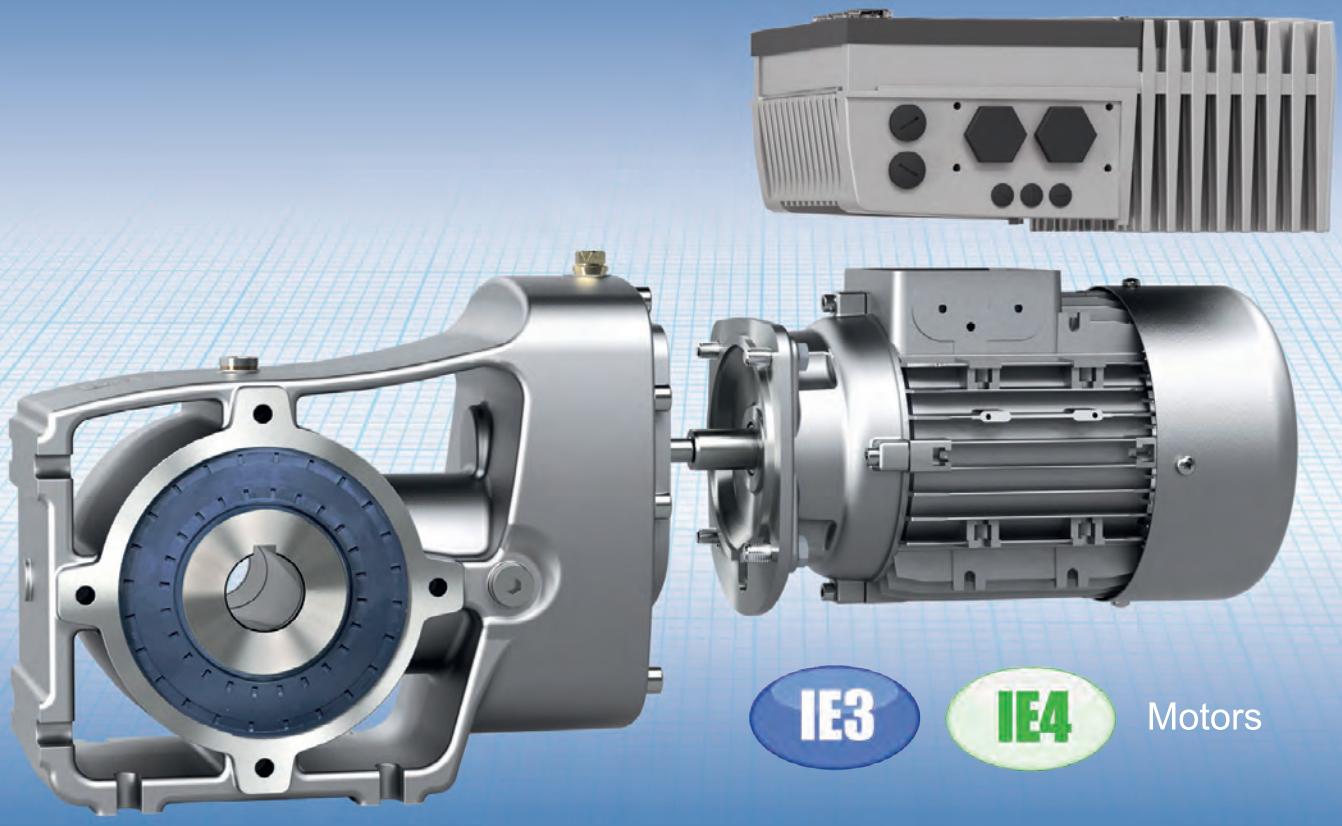

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AUTOFOCUS VIDEO INSPECTION PROBE

Dirty or damaged optical connectors greatly affect network performance. Contamination, scratches and chips on optical fibre connector end faces reduce transmission quality and increase network transmission errors leading to additional I&M work, cost and missed schedules.

The Autofocus Video Inspection Probe G0382A eliminates these issues by verifying the condition and cleanliness of connector end faces during the installation phase where they are easily corrected. Complete connector inspection is performed quickly and automatically with the press of a button including: auto-focus, image cantering, analysis and image capture. The detailed pass/fail status as defined by IEC 61300-3-35 is displayed ensuring quality and consistency from connector to connector and technician to technician. The VIP also includes a green and red LED indicator to quickly and easily display the pass/fail status.

The compact and lightweight Video Inspection Probe is supplied with seven tips as standard. It can also be optionally equipped with a MPO tip. The Autofocus Video Inspection Probe G0382A is available for the Network Master Pro MT1000A, Network Master Flex MT1100A and Windows-based PCs.

Anritsu Pty Ltd
www.anritsu.com

DISTANCE SENSOR

The Wenglor P1KY10x high-performance distance sensor is small, intelligent and efficient. With miniature dimensions of just 32 x 16 x 12 mm, an IO-Link interface and ranges of up to 1500 mm, the sensor offers a combination of compactness and performance.

The sensor determines the distance between the sensor and the object on the basis of transit time measurement. Two mutually independent switching outputs and an IO-Link interface permit multifunctional use for precisely ascertaining the distance to an object, or for detecting the object at any two switching points. This not only makes it possible to implement complex applications such as shelf-full messages and empty location checks in the field of intralogistics, but also applications such as slow-stop circuits in shuttle systems.

The large working range of up to 1500 mm assures top performance in a miniature format and flexibility where range is concerned — which is brought to bear in particular in the field of handling and assembly technology. With a current consumption of just 15 mA, the product is highly energy efficient. The sensor's integrated laser class 1 light source is non-hazardous to the human eye. It also offers insensitivity to extraneous light, highly visible status LEDs and a weight of only 4 g.

Treotham Automation Pty Ltd
www.treotham.com.au

Close-up of a module showing individual hollow fibre membranes potted together.

AUSTRALIANS ENJOY A GOOD DRINK...

... and that includes healthy, sparkling clean and tasty tap water. To give us this essential product involves dedicated people like our water operators. They maintain and work around catchments, reservoirs, treatment plants, tanks and distribution networks — all the way to your property connection.

Congratulations to all the finalists in WIOA's 'Best Tasting Tap Water Competition' and good luck to the Mt Kynoch team at the international event.

We should also acknowledge all suppliers, service providers and industry peers who support our water operators with market-leading technologies, systems and products to safeguard production of high-quality drinking water. Filtration, disinfection, control and monitoring are vital tools for operators to manage their daily tasks.

Evoqua Water Technologies brands include Memcor and Wallace & Tiernan to perform membrane ultrafiltration and all of the analysis and control requirements for disinfection. The Memcor systems manufacturing plant, including global R&D, is located in Windsor, NSW. The plant provides local jobs for over 150 people to produce complete membrane systems for global supply, made in Australia.

TasWater's Regional Towns Water Supply Program to upgrade drinking water supplies for communities will include Memcor skid-mounted pressurised membrane modules, VAF self-cleaning pre-filters, Barrier-S UV systems and Wallace & Tiernan control packages.

Our southern region distributor, Hydramet, and their parent company, TRILITY, will complete construction for eight townships, with Stornoway adding another five systems by August 2018.

It comes as no surprise that many of our products and systems can be found at these Utilities and Councils competing for the best tasting tap water. Demonstrating that our combined local Australian competence shared between water operators and their business partners is world class and ensures that our population has continued access to clean healthy water — the essence of life.

In parallel, we must take care of our environment, and responsible wastewater management is only possible through skilled wastewater treatment operators, diligent process steps and utilisation of various technologies from sewage collection to re-use or safe discharge.

Again, Australia is well positioned to not just manage our own country but to further export our combined know-how and expertise across the world. Evoqua's Memcor Membrane Bio-Reactor is the backbone of many plants, in addition to aerators, clarifiers, biogas harvesting and other key technologies.

WIOA (Water Industry Operators Association of Australia) has for the past few years organised the 'Best Tasting Tap Water Competition'.

Each state winner will compete for the national bragging rights with the eventual winner going to represent Australia at the international event held in the USA. Goulburn Valley Water's Marysville plant was the 2015 Australian champion and even won the silver medal at the global competition.

TasWater's Barrington water treatment plant scooped the 2016 prize and this year's honours went to Queensland, with Toowoomba Regional Council collecting the shield for water supplied from their Mt Kynoch plant. The other finalists included Icon Water — Mt Stromlo (ACT/NSW), SAWater — Morgan (SA), TasWater — Lake Fenton (Tas) and Goulburn Valley Water — Merrijig (Vic).

www.wioa.org.au/awards/national-awards/australia's-best-tap-water

We have over 100-year heritage of innovation and industry firsts, market-leading expertise and unmatched customer service. Our cost-effective and reliable treatment systems and services ensure uninterrupted quantity and quality of water, enable regulatory and environmental compliance, increase efficiency through water re-use, and prepare customers for next-generation demands.

With more than 200,000 installations across the world, we serve the water needs of hundreds of millions of people, as well as tens of thousands of businesses across the globe.

On the 3rd of November, Evoqua (aqua) became a publicly listed company on the New York Stock Exchange with our CEO, Mr Ron Keating, ringing the bell.

EVOQUA WATER TECHNOLOGIES

Evoqua Water Technologies Pty Ltd
www.evoqua.com.au
Ph 1300 661 809

UNIVERSAL TRANSMITTER

The ECD Model X80 Universal Transmitter is a single- or dual-channel transmitter designed for the continuous measurement of pH, ORP, pION, dissolved oxygen, turbidity, conductivity or resistivity in a general-purpose industrial environment.

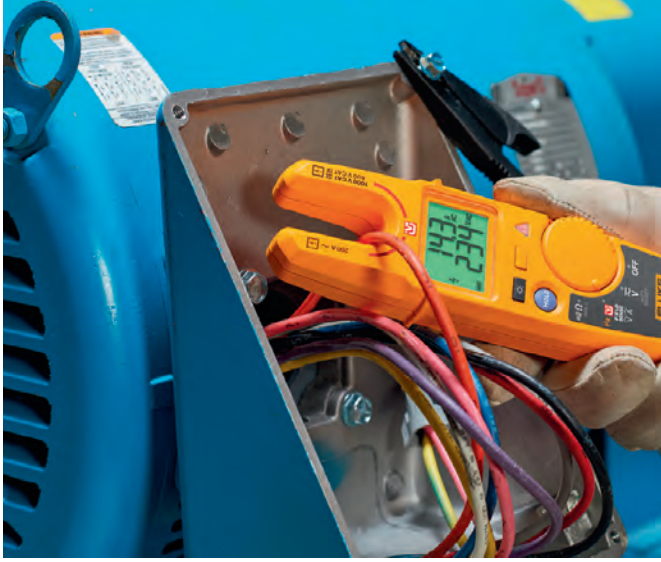
The transmitter digitally communicates with any ECD Model S88 or S80 Intelligent Sensor, automatically configuring the transmitter's menus and display screens to the measured parameter. The same transmitter can be used for any of the measurements; eg, plug an S88 Conductivity Sensor into a Model X80 pH transmitter and it will automatically reconfigure into a conductivity transmitter. There is no longer any need to inventory multiple instrument types, as the one transmitter will automatically configure to any of the listed measurements.

The Model S88 Intelligent Sensors facilitate two-way communication with the Model X80 transmitters. The type of sensor, identity and serial number are stored in the sensor's memory along with calibration registers. The sensors are calibrated at the factory, so they are ready to use when connected to the transmitter. The sensors are waterproof and submersible, with all internal components epoxy encapsulated inside the ¾″ OD housing.

The transmitter features a large, easily viewed LCD display. Loop-powered instruments have black lettering on a grey background, while the 24 VDC powered instruments have blue lettering on a white background when the LED backlight is on. The product has three easily switchable main display screens: the data screen, the millivolt screen and the graphical display screen (six screens for two channel units).

The data screen displays the measurement type, the measured value with units, the % milliamp output of the 4–20 mA channel and the temperature. The mV screen displays the measurement type, the raw mV signal from the sensor, the % milliamp output of the 4–20 mA channel and the temperature. The graphical screens display the measurement type, the measured value with units and a graphical representation of the % milliamp output. Three graphical styles are available: a trend line, a bar graph or a gauge.

AMS Instrumentation & Calibration Pty Ltd
www.ams-ic.com.au



OPEN-FORK ELECTRICAL TESTERS FOR BOTH VOLTAGE AND CURRENT

Fluke has developed FieldSense technology that takes the open-fork functionality of the T5 electrical tester and adds AC voltage measurements. Now electricians can carry out simultaneous voltage and current measurements, not just detection, without test leads.

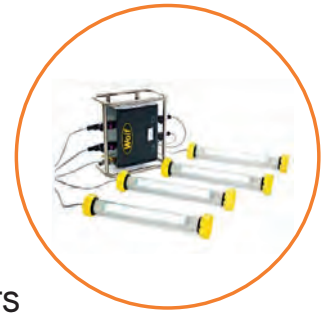
Because the measurement tool and the voltage source under test are isolated, the person performing the test is safe from potential electric shock.

The open-fork voltage sensing technology involves transducing and calculating a known signal to derive measurements for the source voltage. This is done by designing the device to generate a reference signal of known amplitude and frequency. Then, when grounded, the resulting composite waveform is detected by an electronic sensor built into the tester. After amplification, processing and digital calculations, voltage and frequency measurements are derived.

With FieldSense Technology, electricians can measure voltage to 1000 VAC through the open fork, without test leads. There is no need to pull panel covers or remove wire nuts to find a conductor, since measurements can be made anywhere along the wire run.

The 17.8 mm open fork of the T6 can measure up to 200 A on 4/0 wires (120 mm^2) and can take readings on 14 AWG wiring.

Fluke Australia Pty Ltd
www.fluke.com.au



TANK LIGHTING KITS

The Wolf Safety Lamps Linkex tank lighting kits are all IEC Ex certified. They provide low-voltage temporary lighting solutions for Zones 1 and 2 (gas) and 21 and 22 (dust) hazardous areas, where potentially explosive gases, vapours, mists and dusts may be present in confined spaces. The kits allow for a flexible set-up of high-quality task and ambient lighting to suit all working conditions in tanks and vessels, and offer a high level of safety.

Users can choose configurations from: LED temporary luminaires; fluorescent temporary luminaires; LED floodlights; hand-held lead-lamps; transformers (230 V or 110 V to 24 V); a range of cables, plugs and socket types and power distribution systems; and protective, fixing and mounting accessories.

JT Day Pty Ltd

www.jtday.com.au

LOOSE TUBE FIBRE CABLE

The Garland GLT series loose tube fibre cable is designed for external optical fibre applications. Its features include: loose tube construction; dry water blocking between tubes for a cleaner workplace; UV-stabilised PE jacket and nylon termite barrier; suitable for all outdoor applications including duct and direct burial; available with OS2, OM1, OM3 and OM4 fibre; and 4 to 72 fibres.

The series comes with a UV-stabilised polyethylene jacket and an outer nylon 12 termite barrier, making it suitable for duct and direct burial applications.

The 6-around-1 construction is available in fibre counts from as low as 4 fibres up to a maximum of 72 fibres.

To stop water penetrating the cable, each tube is jelly filled and the space between tubes is blocked using SAP dry-blocking technology.

Two high-strength rip cords are embedded under the PE jacket to allow for easy stripping of long lengths of cable.

Available in all fibre types and RCM compliant, these cables are suited to both long- and short-haul applications. Standard lengths are 2, 4 and 6 km.

Madison Technologies

www.madisontech.com

CAN AUSTRALIA LEAD THE WORLD IN STORAGE?

Mansi Gandhi

Australia has the potential to lead the world in developing large- and home-scale energy storage systems, says a report by the Australian Council of Learned Academies (ACOLA).

However, without proper planning and investment in energy storage, electricity costs in Australia will continue to rise and electricity supply will become less reliable, warns the ACOLA report, titled The role of energy storage in Australia's future energy mix.

Co-funded by the Office of the Chief Scientist Alan Finkel, the report found that there is public awareness of energy storage solutions such as batteries and pumped hydro, but there is very limited knowledge of other emerging technologies such as renewable hydrogen.

There are 1.8 million homes with rooftop solar power systems that could use battery packs for energy storage but there is reluctance from customers to install batteries at home for perceived safety reasons, according to the report.

"This report clearly shows the two sides of the coin — that energy storage is an enormous opportunity for Australia but there is work to be done to build consumer confidence," said the chair of the ACOLA expert working group, Dr Bruce Godfrey.

"Australia has world-class resources of raw materials used in battery manufacturing, most notably lithium. Our raw materials, together with our world-class expertise in the development of energy storage solutions, including batteries, the design of software and hardware to optimise integration in smart energy systems, and expertise in the design and deployment of systems

for off-grid energy supply and micro-grids, demonstrate that Australia has the potential to become a world leader," states the report.

"While the possibility of Australia becoming a manufacturer of existing battery technologies is highly unlikely, there is opportunity for manufacturing of next-generation battery technologies.

"There is a legitimate role for governments to ensure that the right policy settings are enacted to drive growth in energy storage. Policy leadership will result in innovation, investment, the establishment of new high technology industries, the growth of existing high-technology industries and increased or new energy exports. A proactive approach will provide the opportunity for Australia to lead and facilitate reskilling of workforces and the creation of jobs across all levels of the value chain from mining and manufacturing through to consumer spending.

The report explains that energy storage solutions can improve Australia's energy system in two major ways. First, by providing greater security by stabilising frequencies that fluctuate within seconds, especially with renewable energy sources such as wind and solar farms. Second, by improving reliability by providing additional back-up power when needed in times of high demand such as heatwaves.

Below are the 10 key findings of the report:

1. **Security** — There is a near-term requirement to strengthen energy security in NEM jurisdictions. Maintaining acceptable energy security levels for customers will dominate energy reliability requirements until well in excess of 50% renewable energy penetration. Batteries are cost-effective for system security when installed with a high power-to-energy ratio, noting that there are other ways to strengthen system security (eg, installation of more fast-start gas turbines, use of spinning reserve in wind turbines, and demand response and load shedding measures).
2. **Reliability** — At an aggregated national level, Australia can reach penetrations of 50% renewable energy without a significant requirement for storage to support energy reliability. Installing the levels of storage power capacity (GW) required for the purpose of security creates the opportunity to expand energy stored (GWh) capacity for reliability at a lower marginal cost than would otherwise be the case. Despite significant development time, pumped hydro energy storage (PHES) is presently the cheapest way to meet a reliability requirement. Projections indicate that the most cost-effective energy storage options available in 2030 will be PHES, lithium-ion batteries and zinc bromine batteries. These all have similar levelised cost of storage (LCOS), depending on the PHES sites selected and uncertainty in the rate of reduction of battery costs.
3. **Policy and incentives** — Australia is well placed to participate in global energy storage supply chains. Business opportunities will arise, given appropriate policy decisions at state and Commonwealth levels, and incentives. Australian companies and researchers are commercialising their energy storage intellectual property through international and global partnerships. Australia has abundant resources (eg, solar), appropriately skilled workforces and established supply chain relationships to generate renewable hydrogen and ammonia at the volumes required to supply potential export markets, such as Japan and Korea.

> AS AN EARLY MARKET 'TEST BED' FOR BATTERIES, AUSTRALIA HAS AN OPPORTUNITY TO PROMOTE AND LEAD DEVELOPMENT OF SUSTAINABLE SUPPLY CHAINS FROM MINING TO DISPOSAL.

4. **Enhanced collaboration** — Australia is recognised as conducting world-leading research in several energy storage disciplines, but deriving the full return-on-investment from this research requires improved research translation through national and international industry-research collaboration and commercialisation.
5. **Funding and revenue** — The availability of private sector risk capital and profitable revenue streams for Australian energy storage start-ups and projects is a challenge for new ventures, as is policy uncertainty. Profitable revenue streams from energy markets together with consistent, stable and integrated energy and climate policies will be essential to drive investment in energy storage and other technology solutions that support decarbonisation of the electricity system while ensuring system security and consumer equity. Technology-neutral market-based reforms will be required to address these challenges at least cost.
6. **Sustainability** — A high uptake of battery storage has a potential for significant safety, environmental and social impacts that would undermine net benefits. The development of safety standards is required given anticipated rapid uptake of batteries. As an early market 'test bed' for batteries, Australia has an opportunity to promote and lead development of sustainable supply chains from mining to disposal. This would use Australia's expertise in sustainable mining to lead and support the development of international standards. There are opportunities for consumers to influence commercial behaviour globally through improved awareness of the environmental and social impacts of battery development.
7. **Waste management** — Unless planned for and managed appropriately, batteries present a future waste management challenge. Australia has an opportunity to play a product stewardship role to ensure the sustainable repurposing of used electric vehicle batteries and recycling of all batteries. Focused development of recycling infrastructure and technology will be crucial and provides an opportunity for industry development and job growth.
8. **Affordability** — Australians are deeply concerned by the sharp rise in electricity prices and affordability. Deregulation of the electricity market, changes in feed-in-tariff schemes and other time-of-use tariffs have led to an underlying general mistrust of the government and energy providers. Focus group participants believe that individual consumers who can afford home battery storage units may elect to become independent of the grid to avoid rising energy costs.
9. **Safety** — A majority of respondents surveyed said they did not know enough to make an informed decision about whether to purchase a home battery storage unit. Although a battery storage installation standard is currently being developed, there are concerns that an early incident may have serious ramifications for household deployment, with many referring to the 'Home Insulation Program' failure. 'Pumped hydro' was recognised by some as an established utility-scale technology, but that possible 'social licence' issues may arise due to the perception of competing land use and a potential lack of water. There is an opportunity for governments to increase the public's knowledge and awareness of energy systems (from energy generation through to storage — at utility and consumer levels).
10. **A higher renewable mix** — Australians favour a higher renewable mix by 2030, particularly PV and wind, with significant energy storage deployed to manage grid security. The majority of those surveyed suggested they would look to government to play a role in the future energy mix, but lacked confidence that their preference for higher renewables would be achieved without consistent energy policies.

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Outdoor goods retailer gets lighting upgrade

When retail lighting specialist Retailite, part of Gerard Lighting, was designing a lighting solution for outdoor and camping goods retailer Kathmandu, the key challenge was to bring the outdoor look inside.

"Kathmandu's active and adventure-based product range is generally used outside, therefore achieving high-colour rendering index as close to 'true colour' as possible was a priority for us when designing this store's lighting," said Retailite Senior Lighting Design Specialist Patty Tartaglia.

For this project for Kathmandu's Chadstone Shopping Centre store in Victoria, the retailer's colourful merchandise was artificially saturated in order to render as close to 'daylight' (100% CRI) as possible.

The Quadretto Light fixture was developed, which was similarly matched in CRI, ensuring that colours were rendered consistently across the store, said Tartaglia.

The general illumination was achieved using a dual light layering approach, using Retailite's newly released Mura wall wash track spot to evenly lift the base line lighting levels of the merchandise to 400 lux.

"This approach distributes 30 W of lighting energy in a soft wide distribution. Such lighting effects are traditionally applied in art galleries, where artworks like large oil paintings require soft and even distributions of light," said Tartaglia.

"In addition, we then overlaid an accent lighting strategy with our Cilindro track spot to hero products and lifted areas of the merchandise displays to 800 lux, which our design team considered appropriate. This created a dynamic contrast ratio between the 400 lux base merchandise lighting layer to the bright hero elements.

"The intent of a dual layered lighting strategy was to efficiently light the merchandise with less fixtures, whilst employing a visual hierarchy — the theatre of lighting design — and reduce any harsh scallops often caused by a singular lighting strategy."

The floor plane was also deliberately isolated and set backward from the general merchandise to approximately 160 lux, thereby reflecting a considered retail lighting strategy which regards the floor as the least important element in the space.

To accentuate the interior architecture of the Chadstone store, LED lighting was integrated into the decorative timber slat features. This created a central zone within the space and isolated the point of sale from the entry and perimeter hiking zone (place-making).

The timber LED detail emphasises the height of the suspended ceiling, creating open space. The aesthetic of the Chadstone Kathmandu space is now vibrant, clean and bright with seamless integration of interior architecture with lighting design. Kathmandu Store Development Manager Abigail Wasmer said the whole design process ran very smoothly. "We are delighted with the finished results, and feel that Retailite's lighting design reflects the vibrant nature of the Kathmandu brand, and complements the store interior style perfectly," she said. "Given the success of this project, we are working with Retailite on the rollout of additional stores and are eagerly anticipating some more beautiful results."

Retailite
www.retailite.com.au

Image courtesy of Retailite

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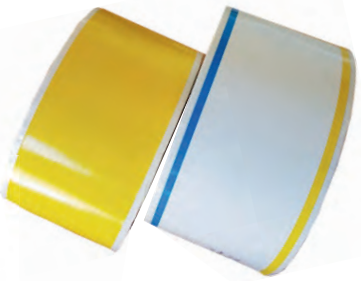

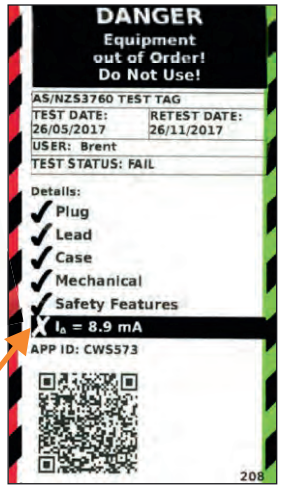

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COMPACT MODULAR EDGE GATEWAY

The UNO-2271G smart factory edge gateway is the same width and length as a 2.5″ SSD but still includes the ability to expand its performance to meet application needs through six mounting solutions (stand, pole mount, VESA, DIN rail, wall mount and vertical mount) and over 30 iDoor modules.

The entry-level system includes enough features to perform basic functions; however, for increased functionality an additional module that accepts iDoor modules is recommended. Advantech's iDoor technology is a modular way of adding flexible functionality to a wide range of devices and gives system integrators the flexibility to choose the functions that they need without purchasing devices that have excess costs and functions that they'll never use. There are over 30 iDoor modules for tasks as broad as: fieldbus protocols like Profibus, Profinet, EtherCAT and Powerlink; memory expansion and storage with backup MRAM, Cfast/Compact Flash and SD/mSD; digital and analog I/O such as multifunction, analog I/O, digital I/O and counter; smart sensors such as smart meters, pressure sensors, temperature sensors and light sensors; and communication such as GPS, 3G, LTE, Wi-Fi, GPS, GPRS, ZigBee, RFID, Bluetooth and LTE.

The UNO-2271G has been designed for cloud-enabled HMI solutions and has integrated remote display technology, which enables users to remotely control the UNO-2271G via VNC.

For a more visual system, the UNO-2271G also supports WebAccess/HMI, an HMI runtime software that allows for a range of HMI control and visualisation applications due to its high degree of customisation and user-friendly interface.

Advantech Australia Pty Ltd
www.advantech.net.au

EVAPORATION TECHNOLOGY FOR WASTEWATER TREATMENT

Veolia's EVALED evaporation technology for wastewater treatment provides manufacturers with an effective system to accelerate the natural evaporation process and reduce industrial wastewater volume and disposal costs.

The system has proved particularly successful for a China-based manufacturer in the mechanical industry, who was able to reduce the costs for disposal of highly polluted and corrosive wastewater from the production line by more than 20 times, and recycle more than 95% of the treated water.

The company's extensive range of EVALED models and capacities provides high-quality, adaptable solutions for a wide variety of waste streams, and is suitable even for heavily polluted water. The technology also offers high automation, low energy consumption and low carbon footprint.

Veolia Australia and New Zealand
www.veolia.com.au

PLC WITH LARGE I/O CAPACITY

IDEC Corporation has released its MicroSmart FC6A Plus, a PLC with up to 2060 local I/O. With its expanded I/O capacity, the FC6A Plus is said to be able to control and monitor the largest machines or entire small-scale manufacturing facilities.

Basic instructions can be executed at a speed of 21 ns and program memory is 800 kB (100k steps). These features, along with a large data memory, allow the product to handle large programs with complex control requirements such as PID, flow totalisation and recipes.

Two models are available: a 16 I/O model and a 32 I/O model. Each model includes a 0–10 VDC analog input with 12-bit resolution. Each can accommodate up to three plug-in discrete, analog, serial or Bluetooth cartridges. Each discrete cartridge has four I/O points, either four inputs or four outputs. Each analog cartridge has two analog I/O points, either two inputs or two outputs.

Up to 63 I/O expansion modules can be added, providing the ability to handle up to 2060 I/O with a maximum of 511 analog I/O.

The Bluetooth wireless communication adapter allows the monitoring of the PLC and transfer of programs from any device with Bluetooth capability. FTP communication is also available, as well as full-featured app access for iOS or Android.

All models have two built-in Ethernet ports, and optional plug-in cartridges can create additional RS232C/RS485 ports (up to 33 ports). The PLC's Ethernet port supports the Modbus TCP protocol and the serial port supports the Modbus RTU protocol.

IDEC Australia Pty Ltd

www.idec.com/australia

POWER REDUNDANCY MODULES

The active redundancy modules in the QUINT product range from Phoenix Contact increase the availability of a system through decoupling and monitoring. The ORING modules run the cable to the load redundantly and separately. In combination with the QUINT POWER power supplies, the redundant system is monitored continuously.

Using preventive function monitoring, the redundancy module informs users about the output voltages of the power supplies, defects in the wiring and the decoupling section, as well as the actual load current. Critical operating states are therefore detected at an early stage.

With a capacity of 40 A, the modules are suitable for DC voltages from 12 to 24 V. They feature a narrow design of 32 mm, DIN rail mounting and an operating temperature range from -40 to +70°C. The active redundancy module with protective coating (plus version) also ensures system availability under harsh environmental conditions such as dust, dirt, corrosive gases and 100% humidity. Overvoltage protection ensures surge voltages are limited to 30 VDC.

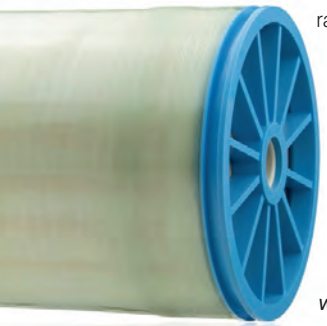
Phoenix Contact Pty Ltd
www.phoenixcontact.com.au

NANOFILTRATION AND REVERSE OSMOSIS PRODUCTS

FLUID SYSTEMS' nanofiltration (NF) and reverse osmosis (RO) product lines are suitable for the delivery of consistent, high-quality filtration, offering municipal and industrial clients a total treatment solution with re-use potential.

The NF and RO products are available in 8″ FRP hard overwrap configuration (8040) in standard and high area construction, and are listed under ANSI/NSF Standard 61. The line includes multiple products engineered to serve in potable water and industrial water applications.

For example, the TFC SW series of high-rejection seawater RO membranes can be used for the treatment of high TDS industrial streams and seawater desalination. The TFC HR range of robust high-rejection and low-fouling brackish water RO products offers consistent operation when treating industrial streams and wastewater effluents. The TFC SR low-energy NF products can meanwhile be used for water softening, seawater sulfate removal and organics removal.



Koch Membrane Services
www.kochmembrane.com

FUSION SPLICER AND CLEAVER

The FITEL S179 is a handheld, high-performance core alignment fusion splicer that delivers rapid splicing (6 s) and heating (9 s) with consistent results. It is available for rent from TechRentals.

The splicer has a wide, 4.3″ LCD touch screen and a keypad for enhanced operator flexibility. Additionally, the S179 comes embedded with near field communication (NFC), which allows operators to lock and unlock the splicer via smartphone.

The FITEL S179 fusion splicer is highly effective for use in data centres, long-haul operations, Metro, LAN and FTTx fibre, including ultra bend-insensitive fibres as well as large area effective fibres. To support usability and visibility in low-light environments, the S179 is equipped with 3+1 LED lights, which illuminate the entire splicing chamber.

Features include S326 cleaver; high-speed splicing and heating; easy, intuitive operation; and state-of-the-art communication methods.

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Finding sustainable alternatives for 'nuisance waste'

With over 7 million tonnes of mollusc shells discarded as waste by the seafood industry each year, Dr James Morris and a team of CACHE researchers from the Royal Belgian Institute of Natural Sciences are looking at environmentally and economically sustainable options for these biomaterials.

The mollusc shells are regarded by the aquaculture and seafood industries as 'nuisance waste' and so are largely disposed of in landfills. According to Dr Morris, this is not only "an expensive and ecologically harmful practice, it is a colossal waste of potentially useful biomaterials".

Artificial oyster reef in the Netherlands. Image credit: Dr James Morris.

One application proposed by Dr Morris is to use the discarded shells to restore damaged oyster reefs and cultivate the growth of new oysters. The restoration of these reefs requires little money and effort, but can have huge ecological advantages.

"Healthy shellfish populations can have many benefits to the environment: cleaning the water, providing a complex structure for other organisms to call home and also acting as a coastal protection structure," explained Dr Morris.

As mollusc shells consist of over 95% calcium carbonate, they could also be used in many agricultural and engineering applications. Crushed shells can be spread on farmers' fields to control soil acidity or fed to egg-laying hens as a calcium supplement. Calcium carbonate is also a common ingredient in cement mix and has found additional use in effectively treating wastewater.

"Re-using shell waste is a perfect example of a circular economy, particularly as shells are a valuable biomaterial. Not only does it improve the sustainability of the aquaculture industry moving forwards, but it can also provide secondary economic benefits to shellfish growers and processors as well," said Dr Morris.

Unfortunately, the vast majority of the world's calcium carbonate comes from ecologically harmful and unsustainable limestone mining. By researching how mollusc shells can act as a secondary source of calcium carbonate, Dr Morris and his team hope to provide a more sustainable alternative to mined limestone. He hopes that his work will emphasise the economic value of recycling these discarded shells back into use.

"The proper disposal procedure for shell waste is in landfill, which costs a lot of money and can be a big burden for shellfish farmers and seafood producers," said Dr Morris. "Simply finding a use for shells to avoid taking them to a landfill already has economic value."

Making the most of car parking spaces

Creating car parking space for new property developments in metropolitan and regional areas is a challenge for any local authority, and in the age of environmental awareness, there is pressure for car parking land to be multipurpose.

Northam Boulevard Shopping Centre is about an hour east of Perth, and it was recently upgraded to include a solar-powered car park.

A prime example of how car parking can have a dual purpose, the solar car park in Northam was developed by Perdaman Advanced Energy.

The car park with 900 solar panels together with a roof-mounted array provides 40% of the shopping centre's annual power requirements, bringing down electricity bills for the owner and tenants.

A driver for this project was the anchor tenant, Woolworths. It understood the need for a shaded car park area to encourage consumers to stay and shop longer in the knowledge their vehicles would be protected from Western Australia's blazing heat. Solar car parks provide the opportunity for shade to improve amenity and customer satisfaction without owners having to incur a cost.

Car parks with solar panel facilities are suitable for community hubs, sports centres, sporting ovals, shopping centres, hospitals, aged care, schools and universities. They provide benefits by turning car parking space into an asset that provides shade and generates clean power. The facilities are designed to make practical, economic and environmental sense.

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COMMERCIAL POWER OPTIMISERS FOR PV MODULES

SolarEdge Technologies has announced that its power optimisers supporting high-power panels for commercial solutions are now available for the Australian market.

Complying with Australia's AS5033:2014 2.15 installation and safety requirements and already installed around the world, SolarEdge's commercial power optimisers offer management and monitoring of two modules. They are designed to support two modules per power optimiser, enabling effective commercial installations.

Specifically designed to work with SolarEdge commercial inverters, the commercial power optimisers are said to offer increased energy production, improved design flexibility, enhanced safety and easy operation and maintenance, with monitoring of each power optimiser and remote troubleshooting. Supporting panel ratings up to 400 Wp, the commercial power optimisers allow long strings up to 15.3 kW.

SolarEdge Technologies Inc.
www.solaredge.com

PANEL PCs

The Aplex Technologies ViPAC 8XX and 9XX Series of 15″ to 32″ panel PCs are powered by Intel's 6th and 7th generation of i3/i5/i7, iCore and Celeron processors. They are available in either wide screen (16:9) or traditional (4:3) aspect ratios which come in sizes 15″/15.6″/ 17″/ 21.5″ with a resolution of up to 1920 x 1080, and a 7H anti-scratch surface.

The ViPAC series come with IP66 full metal chassis, while the front bezel adopts either an aluminium or SUS304/316 stainless steel option. Both series can be equipped with optional USB and RFID function at the front panel for easy access with an extra option of two speakers at the side. They feature a wide variety of I/O ports with two expansion slots. They also include projected capacitive and resistive touch screens, plus antireflection glass, with a wide range 9–36 VDC power input, AT/ATX mode and a panel-mount design to meet requirements. This series of panel PCs also support various operating systems and diverse communication interfaces (3G/4G, LTE, Wi-Fi, Bluetooth, GPS) for all industrial applications.

Considering the flexibility of the complete system, the ViPAC series encompasses diverse options: it primarily supports sunlight-readable solutions with auto-dimming to quickly adjust the brightness, and the OPS modular concept brings an easy-to-deploy solution. The OPS modular design mainly enhances the efficiency for maintenance and upgrade, as well as saving time and money.

Backplane Systems Technology Pty Ltd
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ENCLOSURES

The Eaton RE Series enclosures provide an easy-to-configure solution for IT equipment storage. Through its high-quality and flexible design, the RE Series enclosure minimises installation time and reduces costs while serving as the foundation of a complete data centre infrastructure solution.

As more companies shift mission-critical IT systems to virtualised infrastructures, data centre professionals face increasing pressure to consolidate resources. The RE Series enclosure meets these challenges by providing flexible configurations across a range of environments, from network closets to data centres.

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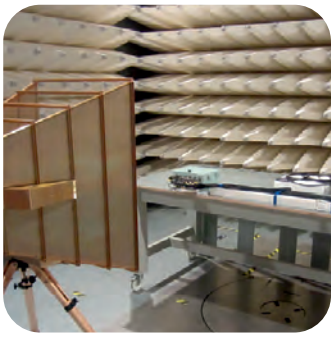

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NEW PRODUCTS

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The TriOS nanoFlu sensor is an online fluorescence sensor (fluorometer) for precise and selective measurement of coloured dissolved organic matter (CDOM, yellow substances), rhodamine, tryptophan and chlorophyll A in green algae or phycocyanin in cyanobacteria.

It operates by emitting UV light at a set wavelength targeted for specific waterborne flora and fauna. When present, these water constituents will re-emit light at a different wavelength following the excitation from the external light source. The nanoFlu monitors for the presence or change in re-emitted light, which is calibrated to the concentration of the known organic matter.

Long-term stability is ensured by the combination of low power consumption, a hydrophobic nanocoating on the sensing window and a chemical-free anti-fouling solution. Maintenance may also be reduced with the incorporation of air cleaning of the sensing window either from fixed compressed air lines or the standalone TriOS AirShot accessory. Internal reference signals of the LEDs used for fluorescence excitation compensate ageing effects and temperature influences.

The submersible nanoFlu can be used in a range of applications including the real-time monitoring of sea, river or freshwater reservoir systems; incoming/outgoing flow at drinking and wastewater treatment plants; and to detect potential filter membrane leaks during rhodamine testing.

Mounting alternatives include inline fittings, flowcell, small sensor floats and unmanned buoys. Mobile lab staff can couple the nanoFlu with a TriOS Pocket Power G2, which provides battery power, Wi-Fi connectivity to the sensor and GPS logging for instantaneous indication and accurate geographical location.

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MFB has further enhanced its range of Sentinel IP-addressable, rack-mountable power products with upgraded software and hardware components to ensure faster and smarter performance from the entire range including its custom-made solutions.

Available with either Australian or IEC outlets, these power boards have the ability to view power, temperature and humidity levels via a web browser or receive SNMP-based alarms when conditions exceed defined thresholds. User-defined outlet control access can be managed by the administrator with the ability to reboot attached appliances in a controlled timed sequence. It also offers the ability to customise the outlet layout and switching configuration.

MFB Products Pty Ltd
www.mfb.com.au

PHOTOVOLTAIC INVERTER WITH INTEGRATED ENERGY STORAGE

ABB's residential energy storage system REACT (Renewable Energy Accumulator and Conversion Technology) allows home owners and landlords to store any excess energy produced by their PV installation during peak times for periods with higher energy demands.

The solution consists of a 4.6 kW or 3.6 kW, respectively, single-phase ABB inverter and a lithium-ion battery providing 2 kWh of usable energy. Due to its dual MPPTs, broad input voltage ranges and high efficiencies, the integrated inverter offers maximum installation flexibility for optimal energy harvesting.

The energy storage system has been designed for a long life cycle with a 10-year expected life of the battery. The solution can also be expanded by additional battery modules to up to 6 kWh of usage energy. Due to the integrated Ethernet port, the energy storage system allows for remote or local monitoring without requiring any additional interfaces.

Highlights include: the REACT-3.6/4.6-TL (Renewable Energy Accumulator and Conversion Technology) is a PV single-phase grid connected inverter able to store energy in a 2.0 kWh useful capacity Li-Ion battery integrated within the same product enclosure, expandable up to 3 x; all features found in the family of string inverters are maintained, including double fast MPPT, broad input voltage range, top class efficiency with TL topology, compactness and installation flexibility; and up to four onboard load management outputs are included as well as an auxiliary AC back-up output for off-grid capability in case of a blackout.

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A step change for better profitability

In the island state of Papua New Guinea, Ok Tedi Mining Limited (OTML) runs the copper and gold mine Ok Tedi. Like many mines in Papua New Guinea, the drive train infrastructure on the grinding mills there is in excess of 30 years old, and OTML was aware of the potential problems with the ageing equipment. The company also knew that in order to ensure long-term profitability, a move to industry-standard variable speed control of the SAG mills was required and therefore invited solutions from a number of suppliers.

Siemens has a longstanding relationship with OTML that started in 2005. Since then, Siemens has been committed to improving operational performance in many areas on site — most recently through the supply of two Planurex P2KB20 planetary gear units in 2015.

On the basis of the trust and mutual respect gained over the years, Siemens and OTML conducted a mill drive train audit in 2014 and identified areas for potential improvements. Both parties agreed that the biggest potential would be in changing the operational concept from fixed speed to variable speed on both SAG mills, since the benefits to process efficiency and liner life alone would make the project viable.

Over the next two years, Siemens developed several modernisation scenarios for the existing mill drive train, ranging from a partial modernisation (keeping the existing motors and adding variable speed drives only) to a complete modernisation (installing new motors and variable speed drives). Initially, OTML was leaning towards the partial modernisation that would have re-used the existing motors to the maximum extent possible. In the end, Siemens was able to convince OTML that by removing the air clutch on SAG 1 and removing the slip-ring motor with its brushes on SAG 2, maintenance activities on the mills could be reduced. Adding an online condition monitoring system would continue that strategy even further and allow OTML to better manage its new infrastructure, track mechanical wear, assist with proactive maintenance and increase overall productivity.

Furthermore, Siemens showed that by increasing drive power capacity by 15% to 20%, it would be possible to eliminate momentary power limitations and throughput restrictions on the mill as a result of changing ore hardness.

In December 2016, OTML decided to go ahead with the complete modernisation and tasked Siemens with the supply and installation of new motors and couplings, variable speed drives and a cloud-based condition monitoring system to track mechanical wear as well as electrical performance of the supplied equipment.

As a result of the modernisation, the SAG mills will benefit in many ways. For example, by using variable speed drives to start the new induction motors on both mills, starting currents will be reduced to less than 100% of nominal current. That ensures smooth starting and minimal mechanical stress on reducers, pinions and girth gear. 'On-the-fly' frozen charge detection is also performed automatically during every start-up, which saves precious process time.

Frozen charge is a condition that can occur when a mill has not been operated for a while. The slurry inside the mill solidifies and, rather than sliding off the inner shell when the mill is turned, it sticks to the mill shell. The worst-case scenario is that the solid or frozen charge is carried all the way to the top of the mill (180° rotation from start) and then falls down. The massive impact will cause the mill shell to crack and mill bearings to be damaged. On-the-fly frozen charge detection monitors the mill angle and the load torque demanded from the mill — the load torque is an indication of whether the charge inside the mill is cascading or not. If the charge hasn't cascaded past a certain point (usually about 50° or 60° rotation from start), frozen charge is present and the mill is stopped immediately.

Variable speed mill control also has an impact on grinding efficiency. A common issue is that the lifting capacity of liners deteriorates over time as they wear on the edges. Subsequently, material cascades earlier, which reduces grinding performance. Variable speed mill control compensates for liner wear through an increase or decrease in mill speed. Grinding performance thereby remains constant over the life of the liner.

The mill modernisation will enable OTML to improve uptime and throughput, which will increase overall productivity. The drives are scheduled to go into operation in spring 2018. After that, two further two-year contracts will go into effect: one for full service and support for the complete electrical and mechanical mill drive system, the other for drive train analytics.

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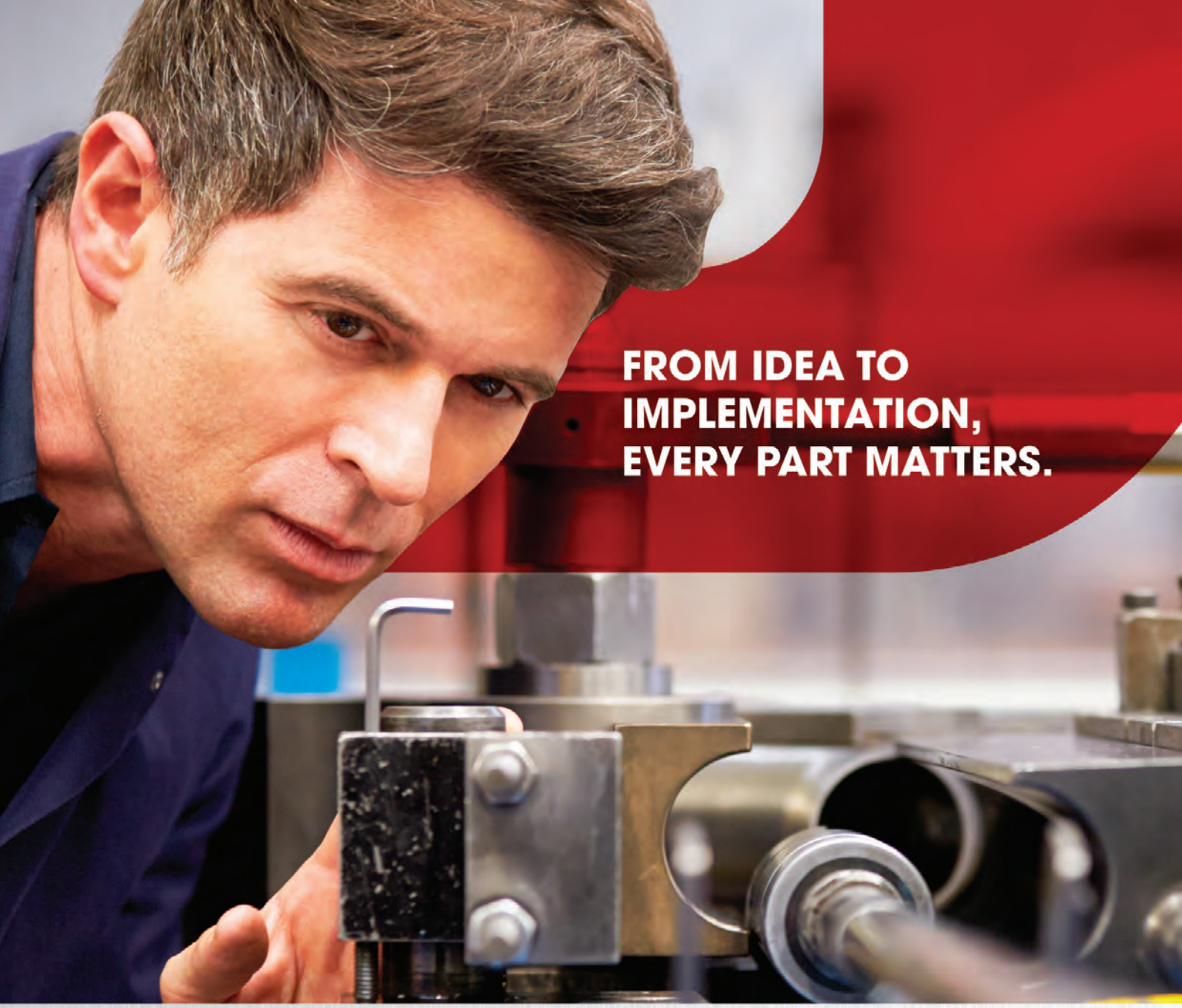

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