

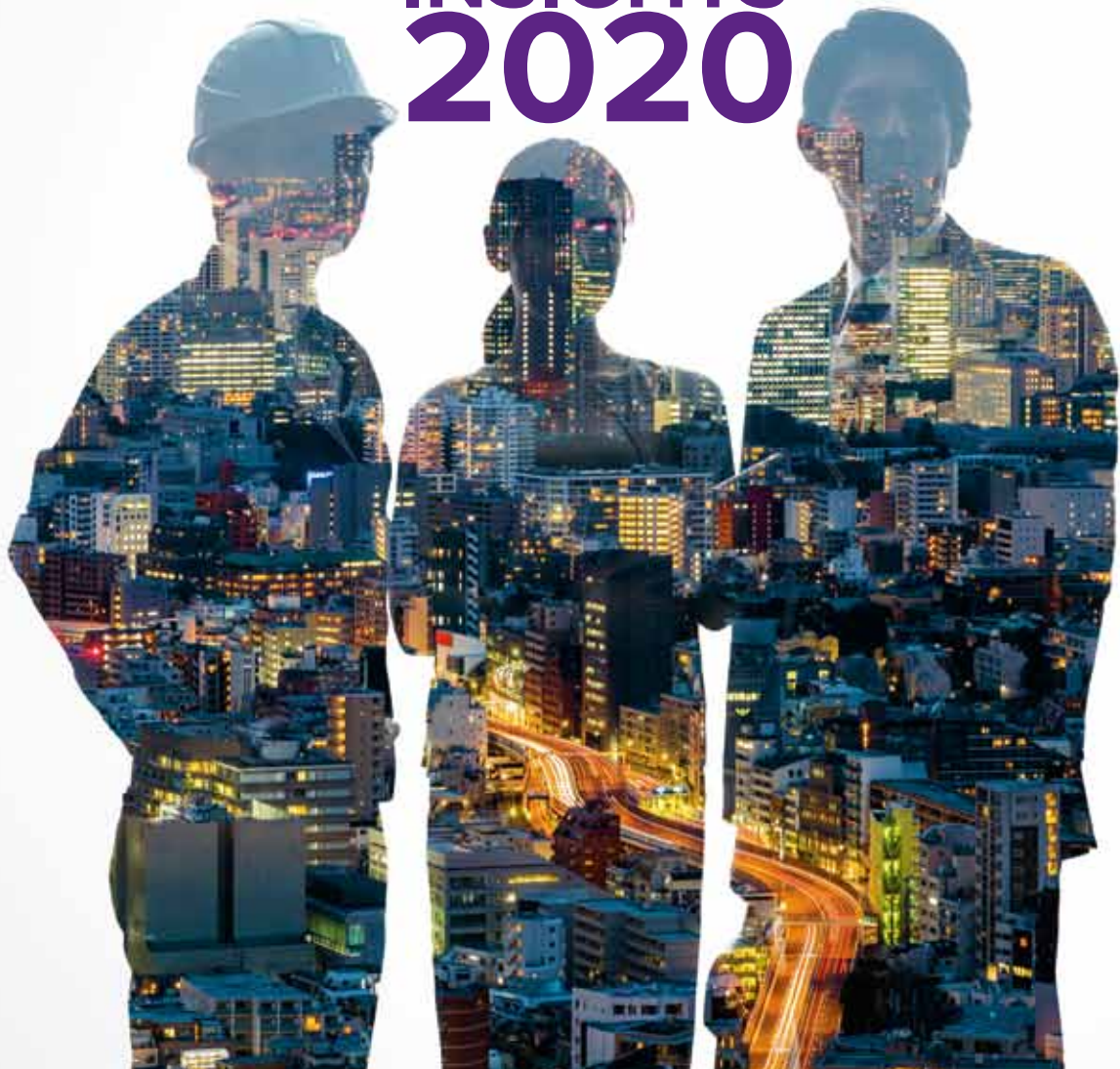
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Welcome to the 2020 Insights issue where we've asked industry leaders to provide you with their views on what challenges and opportunities lie ahead. The issue combines content from three magazines in one – Process Technology, Sustainability Matters and ECD.



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AI FINDING A HOME IN THE WATER INDUSTRY

Glenn Johnson, Editor



With water scarcity an increasing problem, artificial intelligence could help mitigate water management problems and enable water utilities to better serve their customers.

Digital technology is having a significant impact on all sectors of society, not the least of which are the industrial and utilities sectors. Advances in digital communication technology, data science and artificial intelligence (AI) will change all aspects of these industries in the near future, and for the water and wastewater industries, these advances are enabling new approaches to the planning and management of water supply and wastewater systems.

Water utilities have been involved in digital networking and data analytics for years, and like many other industries already have instrumentation and telemetry systems that collect and transmit data and report continuously on system status.

However, the rapidly advancing world of the Internet of Things (IoT) and data analytics offers so much more, and is



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beginning to offer water utilities the opportunity to make real service improvements for their customers.

AI can be defined in many ways and perhaps means different things to different people. However, it is possibly best described as intelligent response computer systems. The main benefits of AI include not only the ability to identify patterns in data, but also to learn from these patterns as a result of endlessly refining relationships between variables.

Improving customer service

Speaking at Ozwater'19, THIESS Data Science and Analytics, Innovation and Technology Manager Virginia Wheway said the capability of data systems moves from reporting through to analysis, with analysis then enabling monitoring and, eventually, prediction.

"Reporting is about what has happened. If things are not happening efficiently, you can then move to analysis. But you can't move onto analysis until you have reliable data," she said. "Of course, the Holy Grail is prediction. And the step after that is prescription; that's when the machines take over and start prescribing what to do in any event."

Early experiments in expanding the use of digital technologies are already bearing fruit. For example, Sydney Water's experiments with the IoT have already provided the benefit of the better customer relations that results from better information about outages.

Having better information about service disruptions that impact customers has resulted in financial saving from customer rebates paid due to disruptions. Notifying customers about water disruptions in advance and keeping them informed about progress on faults has resulted in a 40% reduction in inbound calls.

Also speaking at Ozwater'19, Sydney Water Customer Hub Manager Darren Cash said that the technology is allowing the organisation to improve its understanding of the types of problems customers are having.

"Generally, we have to wait for the disruption to happen before we are able to do anything about it," he said. "But we want to get to the point where we can identify issues before they affect our customers. There are a few enablers that will allow us to do that, and we see IoT as one of those.

"We might still just be responding to something that has happened, but this experience is going to give us an indication of where we need to take predictive action to help our customers in the future."

Everyone is talking about 'smart water'

But better customer relations is only the beginning of the story. Xylem CEO Patrick Decker said that 'smart water' will be "the next disruption".

Decker said there are three dominant pain points for the water industry:

1. Water loss across the distribution network, a major financial burden for utilities.
2. Stormwater overflow, with climate change seeing record weather events taking place that place greater stress on water and sewer networks.
3. Rising energy consumption and associated costs.

He believes the role of smart water technology is in being able to embed more intelligence in the actual equipment and hardware and to be able to overlay software and data analytics on top of that hardware.

"This could be data for an individual piece of equipment or an entire network, which is turned into actionable insights for our customers," he said. "These insights can help them reduce their water losses on clean water distribution networks, help them more effectively manage stormwater overflow situations, or reduce their energy consumption on the wastewater side of the network."¹



ONE OF THE ENABLING TECHNOLOGIES FOR BETTER WATER SYSTEM MANAGEMENT WITH AI IS THE SMART METER. HOWEVER, SMART METER DATA NEEDS TO BE MANAGED CAREFULLY TO BE SURE THE DATA IS INTERPRETED CORRECTLY.

Smart meters: still an open question

One of the enabling technologies for better water system management with AI is the smart meter. However, smart meter data needs to be managed carefully to be sure the data is interpreted correctly. For example, differentiating a household that has developed a leak from one that has consistent water demand requires advanced pattern recognition. Just looking for meters that never show zero flow and assume it signifies a leak could potentially generate many false positives.

But in any case, at this time only a small percentage of water meters around the world are smart. Until water utilities can better distribute smart meters, there will be some delay in achieving the promise of AI and machine learning from smart meter data.

Smart meters not needed for everything

Smart meters aren't the only tools for gathering and data. An example of the successful use of digital technologies in minimising water loss is a water pipe failure prediction tool that was awarded a UTS Eureka Prize for Excellence in Data Science in 2018.

Developed by the CSIRO's Data61 Smart Infrastructure Team, the tool utilises AI and machine learning. The research behind the project involved collaboration with a variety of utilities on failure predictions and related problems, such as water main failure prediction, sewer corrosion prediction and active leakage detection. Data was gathered from 27 national and international water utilities covering nearly 9 million pipes and 700,000 failure records.

The tool is already helping utilities in Australia and overseas realise the data they collect has practical applications, including pinpointing the most at-risk pipes in their network.

Melbourne Water has also had some success in utilising AI to optimise water pumping, in order to reduce energy consumption. A custom program mines operational data to 'learn' the most efficient pump configuration at any given time, and is expected to help the pumping station reduce energy costs by as much as 20%.

The program utilises historical data to determine the most energy-efficient combinations of pumps and the associated speeds necessary to achieve the right flow rate, and is able to take into account other data such as reservoir level, available pumps and past performance. It determines optimal pump calibrations and sends them directly to the pump system without any human intervention — an example of the AI determining the best settings and applying them in real time.

Water scarcity: AI to the rescue?

In 2018 UNESCO published a report stating that around five billion people are expected to be living in countries or regions tackling water shortages by 2050, and in Australia, our experiences with the drought and massive water shortages in our rural areas should be an incentive to make better use of technology to manage water usage.

AI has the potential to fundamentally transform the economics and productivity of water management in years to come. In turn, more intelligent water solutions will become available to areas suffering from water scarcity.

Conclusion

Across many industries, but not least in the water and wastewater sectors, AI will be a driving force for change across industry. In a future where water scarcity is an ever-growing problem, the application of AI solutions could help mitigate water management problems and enable water utilities to better serve not only their customers, but the environment as well.

Reference

1. Henderson C 2018, *Xylem CEO Patrick Decker: Smart water is the next disruption*, Xylem, <<<https://www.xylem.com/en-us/making-waves/water-utilities-news/xylem-ceo-patrick-decker-smart-water-is-the-next-disruption/>>>

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Ready Foods keeps its cool with viscous cooling solution



Based in Denver, Colorado, Ready Foods is a cook and chill company that manufactures soups and sauces for restaurants and the meat industry. After receiving a large order for one of its meat marinades from a leading chain of quick-service Mexican restaurants, the company needed to increase capacity. The existing process of kettle cooking and steaming the marinade, then chilling it in 2.25 kg pouches in a water cooling system for three hours, would not allow Ready Foods to meet the customer's increased demand for 900 kg totes.

Marco Antonio Abarca, President and Owner of Ready Foods, and Greg Hefter, Plant Engineer, set out to find an alternative solution that would enable them to decrease the length of time it took to cool the marinade from 93°C to 3°C and thereby increase production levels.

However, they soon discovered that finding the right cooling system was no easy task. "We are a medium-sized company but it became clear that most of the equipment suppliers were accustomed to dealing with much larger firms than ours; their proposals were totally unsuitable for our size of operation," Abarca admitted.

"Some recommended systems which required a large footprint or a 6 m ceiling height; others could only supply one or two parts of the solution and expected us to source the rest and integrate it ourselves; while some showed us systems which were far too complex and sophisticated for our operatives to use," Hefter added. "We don't have the luxury of a team of engineers on call 24/7, so any system we chose had to be simple to operate and straightforward enough for our mechanics to take care of."

HRS Heat Exchangers, however, was able to meet every one of Ready Foods' requirements, so Marco and Greg sent them two versions of their marinade for testing. One was very thin while the other was a concentrated form of the product.

"At first, Ready Foods proposed cooling the thinner product using R-404 refrigerant," said Cameron Creech, US Sales & Engineering Manager at HRS. "As that's an aggressive cooling medium, we considered a two-stage cooling system: the first phase would cool the product with chilled water, a much-less aggressive medium; the second stage would involve chilling with ammonia."

HRS's turnkey solution for Ready Foods comprised a transfer pump to move the product from the cook kettles into the balance tank; a balance tank to receive and mix both recycled and new incoming product; a BP-6 hydraulic pump to push product through the system; a pre-cooler, consisting of 10 AS Series triple-tubes as the pre-cooling exchanger, which cools the product using chilled water; the final cooler, comprising two Unicis scraped surface heat exchangers; and finally, a three-way valve that sends product into the filler tank or back to the balance tank, depending on whether the temperature requirement is met or the filler tank is too full to receive product.

HRS also supplied auxiliary equipment, including a cleaning-in-place (CIP) system and a steam-powered hot water set to prevent freezing in the event of a production halt (also used to heat the solution during the automated CIP program).

The cooling system was commissioned in September 2018 and has been operating successfully ever since. The difference in the volume of product Ready Foods is now able to produce is considerable.

"It used to take us three hours to chill the marinade, but we are now able to cool it in just one hour. We've been able to keep up with our client's new, increased demand, even at peak times. On a five-day-a-week basis, we can hit 90,000 kg," Abarca said.

From an operational standpoint, it has proved itself to be an integrated system that is not too complex and boasts a small footprint. In addition, due to the fact that a large percentage of Ready Foods' employees are Spanish-speaking, HRS incorporated a feature on the main page of the program that allows the controls to be switched between English and Spanish.

"I'm surprised by how smoothly this project has gone," Abarca enthused. "It normally takes a long time to integrate a system into a factory and that's what I was expecting here, but that has not been the case. The cooling system has evened out the playing field by allowing a medium-sized company such as ourselves to compete with the larger firms. Not only that, but it's the type of technology which suits a lot of applications. We are using it to make a meat marinade, but the reality is that we can do anything with it. For us, this is 21st-century, advanced technology and is the standard we now expect for everything we do. The HRS cooling system has set the bar for us."

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ANTHONY WONG

REGIONAL DIRECTOR, SOUTH PACIFIC, ROCKWELL AUTOMATION

At Rockwell Automation we see the three biggest challenges facing us to be:

- Creating a purpose-driven work environment
- Creating a culture of innovation
- Closing the IT/OT security gap

Creating a purpose-driven work environment

Attracting the best talent into industrial automation has always been a challenge of perception for our industry. Even the term 'industrial' can have connotations of being engineering-centric, and manufacturing is seen as a conservative industry when it comes to adopting new technologies.

The reality though is that industrial automation is at the forefront of the digital transformation journey that is disrupting industry — in a race to improve productivity and safety and be a sustainable company at the same time. Having our workforce excited about this transformation while attracting new talent to help us accelerate the understanding of both sides of the OT/IT equation is the balancing act.

So how do we attract and retain talent and increase our employee engagement when industrial automation still has the stigma of being more industrial than digital, where our organisations seem to be more complex to be more agile? We are finding a good starting point that is making a difference is creating a strong value proposition for our employees.

Incorporating purpose-driven work into corporate culture is paramount. Today our employees are much more concerned about the future of our environment, sustainability and climate change, and about giving back and community, in addition to what is expected: such as being in a great place to work, with job security, a career path, training and engaging work. Hence the vision and the value of the company needs to tick all the boxes to retain and attract talent in our organisation.

Creating a culture of innovation

Digital disruption is well and truly upon us and as a result there are new business models and market access channels being created — while we see the displacement of existing products and solutions. If we look back over the last 10 years, the top global corporations have dramatically changed and the list is now dominated by tech companies that have leveraged innovation to quickly become global giants. We are all — in some form or other — at a strategic inflexion point where our future success is not guaranteed and we must decide whether we accept change and new methods or we reject change and maintain the status quo.

Assuming we accept change, then innovation becomes a core pillar of future success — but it is not easy to force onto an organisation. Acquiring technology or partnering with start-ups is a good way to accelerate innovation, but this will not necessarily create a culture of innovation within the organisation. At the grass roots level we have set out to find the next generation of innovators, builders and makers through the "You Make it Challenge" competition and through a social media campaign. At the

next level we have formed a strategic partnership with FIRST (For Inspiration and Recognition of Science and Technology), a global, non-profit organisation that has reach among students around the world to demonstrate what a career in STEM and manufacturing can look like.

Within Rockwell Automation we have an Innovation Program that exists to accelerate innovation and professional development opportunities across the company where we focus on collaboration and open discussion of real-world problems to help catalyse creative and valuable solutions for implementation.

Closing the IT/OT security gap

With all the benefits that can be gained with the contextualisation of OT data and digital insights, new challenges have emerged around cybersecurity as organisations now become more interconnected. Half the industrial companies in a recent survey said they suffered a data breach or cyber attack in the last 12 months.

Although developing products with cybersecurity in mind is a necessity in today's world, it does not necessarily mean that you will have a cybersecure system. Companies require a comprehensive approach to people, technology and processes for their OT infrastructure and a good starting point is a security assessment to identify priority risk areas and then build up a strategy, which may include threat detection software, strategies for patch management, virtualisation of servers and 24/7 monitoring, along with new security policies and practices.

Having more collaboration and exchange, while defining best practices, helps give guidance in this constantly evolving topic — which is why a standards-based approach can reduce the risk of being compromised. Rockwell Automation is a founding member of the ISA Global Cybersecurity Alliance that brings together different stakeholders such as end users, IT infrastructure and service providers, and automation and control system providers to proactively address the growing concerns around cyber threats.

Within Rockwell Automation, closing the IT/OT security gap to protect our customers and our employees will be a never-ending battle of proactive and reactive measures as hackers attempt to gain unauthorised access to our systems.



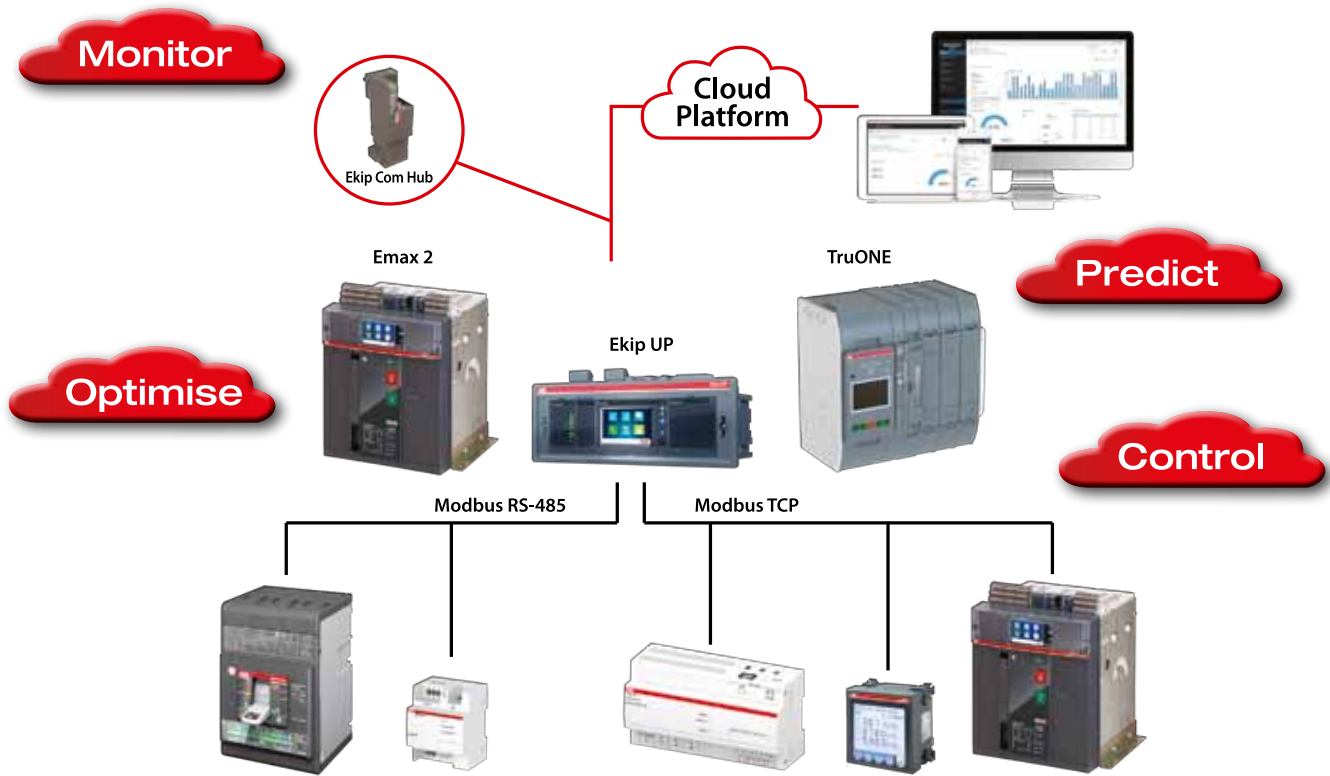
Anthony joined Rockwell Automation in 2019 as Regional Director for the South Pacific Region. He holds a bachelor's degree in electrical engineering and an MBA. Prior to joining Rockwell Automation he held various roles of increasing responsibility within Schneider Electric in Australia, also working in France and the United States before returning to Australia.



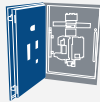
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MICHAEL SAINSBURY

CHIEF EXECUTIVE OFFICER, IPD GROUP LTD

What key trends will have an impact on the growth of your industry in 2020?

Growing public awareness of environmental footprints is set to further accelerate change in our industry for the better. With 'dirty' and 'clean' energy now part of our vocabulary, demand exists for more solutions catering to end users' preferences of clean technology wherever possible. We see this shift in attitude as a driver of growth as we further align our solutions portfolio to match the trend.

Australia's energy crisis has led to greater demands of the industry, but we're also hearing of more end users taking greater individual responsibility of their power usage for better cost and environmental outcomes. To respond to this thinking, we educate customers and industry around the need for energy monitoring technology to ultimately minimise consumption, and offer a substantial and scalable range of solutions featuring highly connected and configurable IoT devices capable of delivering granular yet accessible energy insights.

What are the three biggest challenges facing your industry in 2020?

We suffer from an energy policy vacuum on a federal level. Mixed messaging has led to lots of uncertainty, hindering our ability to guarantee cost-effective energy solutions for end users that also generate environmentally sound results at the highest level possible. A lack of government incentives (successfully implemented abroad) has also dampened demand for these solutions.

The industry is also facing headwinds in the labour market. We have a need for skilled specialists who can work with our partners to drive results in the power distribution market, but the breadth of talent isn't where we'd like it to be at the moment, with much of these skills already absorbed by significant long-term projects including major road and rail upgrades.

We'd welcome greater focus on the rollout of public electrical infrastructure to ensure our readiness for next-generation technology, of which there's already significant public appetite. For example, widespread adoption of electric vehicles (EV) in Australia still faces significant hurdles because of insufficient charging infrastructure; we're simply unable to accommodate much greater uptake of EVs. This is an area around which we expect change, and are actively working with a number of leading international partners to bring solutions to the table when the environment is more favourable.

What is your industry doing to attract, upskill and retain talent?

Capable and driven people are at the heart of our business, and we believe the value we place on them and their contributions goes a long way in sourcing similarly high-calibre talent, as well as maintaining our reputation as an employer of choice.

We do this through a multi-tiered approach featuring programs that develop and support individuals as well as their aspira-

tions, help them align with the DNA of our organisation and place a priority on promoting from within to reward excellent contributions to the firm.

How is your business planning to help Australia meet the 2030 climate change targets?

Meaningful action on climate change (with reaching official targets being just one element within a broader picture) is now being driven by the private sector and households. To reflect our collaborative approach, we continue to build upon an already broad suite of energy-saving solutions and knowledge-sharing platforms to help our partners maximise the efficiency our end users expect.

We're committed to the use of solar and photovoltaic (PV) technology, offering various balance of system (BOS) solutions which allow clients to use PV to its full capacity. We are also proud to act as the Australian distributor for Socomec's impressive power monitoring portfolio in this space. In switchgear and power distribution, we represent ABB and their products featuring built-in smart capability for use with BMS and standard systems, which allow end users greater visibility and interrogation of energy-usage insights.

Closer to home, we make use of minimal and environmentally friendly packaging for the products that leave our premises and are seriously considering EV solutions for our staff that spend time on the road.

To assist our partners on the national level, our experts conduct technical seminars promoting the environmental benefits of our new solutions and educate them on how their portfolio can assist in achieving NABERS compliance and Green Star-friendly status.



Michael Sainsbury is Chief Executive Officer of IPD Group Ltd and a member of the company's board of directors. He joined IPD in 2013, bringing more than 15 years of technology-based industry leadership, electrical solutions and power monitoring expertise, and senior management experience to his role.



Wireless fieldbus solves robot problem for NZ manufacturer



Residing in Hawkes Bay, Hawk is a proudly New Zealand owned and operated company. Sustainability is at the heart of the organisation, and as one of the leading moulded fibre packaging suppliers, all of its products are made from 100% recycled paper.

“Our paper is deliberately sourced from kerbside collected recycling paper. We don’t use any nasty bleaches, pigments, biocides or toxic chemicals in our manufacturing. Our products are recyclable and compostable after end use,” said David Styles, Engineering Manager of Hawk Packaging.

“Our facilities are located in the centre of the largest apple-growing region to ensure minimised transport requirements and a lower carbon footprint,” David added.

With this unique approach to business, energy savings remains a fundamental focus and partnering with like-minded suppliers is key. As a preferred supplier and in collaboration with East Coast Automation, SMC offered an innovative solution to a problem that was hindering Hawk’s production processes.

The Area Sales Manager for SMC in New Zealand, Dirk Siekmann, explained that a fault in a stacker robot designed to stack bundles of finished products on top of pallets was causing downtime. “An intermittent fault in the control of this particular robot was instigated by a communication cable failure. The robot had seen its fair amount of wear and tear after years of rotation and bending.”

Working together with East Coast Automation, SMC recommended its recently launched Wireless Fieldbus System, EX600-W. The EX600-W met the brief to deliver on time, on spec and on budget. “The installation was simple, and the solution was the perfect match for this particular application,” said Chris Robertson, Director of East Coast Automation.

Answering to the call for more robotic applications, the EX600-W is currently being used extensively in the packaging industry, and the response from the market has been overwhelmingly positive.

According to Dirk, this decentralised solution is EtherNet/IP and Profinet compatible, can withstand electric noise and is suitable for harsh, industrial environments. “This wireless fieldbus system can manage both digital and analog signals, as well as pneumatic products, making it a flexible solution for all applications.”

The EX600-W was designed to make robotic applications easier. The EX600-W is small and lightweight, fits onto the robot head, has minimal wiring, and offers remote control and fault finding, among other features.

“The EX600-W uses the 2.4 GHz ISM frequency band and every 5 ms frequency hopping. The noise resistance design makes it even suitable in welding environments,” Dirk said. “We are pleased to say that we have a happy customer.”

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The Neosys PB-9250J-SA and PB-4600J-SA are standalone supercapacitor-based uninterruptible power backup modules that can protect equipment against power outages. They are designed to operate in harsh environments from -25 to 65°C and have high durability allowing them to last over 10 years.

PB-9250J-SA is composed of eight 370 F, 3 V supercapacitors and the PB-4600J-SA is composed of four 370 F, 3 V supercapacitors. They store 9250 Ws and 4600 Ws of energy respectively. Neosys's CAP Energy Management Technology can supply 180 W power to the back-end system and automatically manage boot and shutdown without installing additional drivers or software.

In addition to UPS-like power backup mode, the products also offer two advanced ignition control modes for in-vehicle usage. The series can work with either standard box PCs or in-vehicle controllers to provide stable power supply and execute user-configurable power-on/power-off delay according to an IGN signal input.

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The Testo 340 is a portable flue gas analyser that can detect emission problems before they become too severe. This includes O₂, CO (H₂ compensated), CO₂ (calculated), NO and NO₂ sensors. The Testo 340 device eliminates costly downtime and provides the user with maximum tuning flexibility. It is available to rent from TechRentals.

The Testo 340 is built to measure high concentration with its unique, automatic 5X dilution system. With its simple interface and durability, the device can withstand the most rugged field environments. It also has an automatic CO-dilution sensor that keeps the analyser working longer.

The Testo 340 provides five user-defined measurement data logging programs that can be changed as needed.

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As debate rages across the globe on how to best reduce the environmental impact we have upon the planet, a community of building designers and system integrators are using smart building technologies today, to prepare our cities for a sustainable tomorrow.

“The overall summary of any [building] management control is to collect data and see where we can refine energy bills,” said David Ashworth, State Manager for mySmart, a national systems integration company.

mySmart recently developed a building management system — built on a hardware and software solution of Schneider Electric products — for a new engineering annexe on the Joondalup campus of Edith Cowan University. The new system leverages automation to monitor and control heating and air conditioning, and lighting conditions in laboratories.

In the same way that the human body has nerve endings and neurons to detect changes in physical conditions and distribute physiological resources accordingly, a smart building comprises a number of networked sensors and systems that monitor resource usage. When collated and presented as an accurate snapshot of the building’s condition, facility managers can better manage building resources to reduce waste.

“For a commercial development, obviously, you have energy metering,” said Ashworth. “You have HVAC (heating, ventilation and air conditioning), mechanical services, and pulse counters for gas and water.

“When all this information is displayed for a facilities manager, it gives them better knowledge of what the systems within the building are doing. Then, with the trend information they’re getting, they can do things like heat mapping [of occupancy] and utilise spaces better.”

When you incorporate automation programmed to respond to the collected data, a smart building can then assess the building condition and automate the distribution of services — like HVAC or lighting in active work spaces.

This is the concept at the heart of a cutting-edge education facility in New South Wales: the Lindfield Learning Village. Across various campus buildings — including sports, science and engineering, theatre and hospitality facilities — smart building solutions



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have been implemented to improve both student experience and campus-wide energy efficiency.

“The first thing is visibility,” said Bartek Kacperski, Managing Director of EC Controls. “We want to be monitoring all utilities and put that information in front of someone, and give them the visibility of how much power, or water, or gas they’re using.

“With Schneider’s product we’re able to give them simple visibility of the data coming in; and from there, because of all the functionality behind the scenes, they’re able to see changes they can make to save on consumption.”

Built upon the Schneider Electric EcoStruxure Building Operations system, the facilities at Lindfield Learning Village have transformed the former site of the University of Technology into a truly smart campus.

For many of the projects undertaken by systems integrators like Ashworth and Kacperski — both endorsed to deliver Schneider Electric technologies through the company’s professional training and

certification program, EcoXpert — this will be the goal; to leverage cutting-edge hardware and software to improve the sustainability of buildings old and new.

A future-ready aspect of the products Kacperski works with is the open nature of system protocols, allowing integration with third-party systems and even products not yet created. With the life of these systems measured in decades rather than years, today’s smart buildings are equipped to meet the sustainability goals of tomorrow.

“There is no limit,” said Kacperski. “With EcoStruxure we can expand and add things into one seamless platform, rather than have multiple systems where [users] log into different computers and different headends to get information.

“The main focus was to use the most up-to-date IoT [Internet of Things] technology on the campus, which allows for expansion of the technology for the next 10–20 years. They can even expand to a different campus, in a different area, in the comfort that the system is expandable.”

Across many levels of enterprise — including health care, agriculture, manufacturing and retail — many businesses moving towards a zero-emissions operating model are now looking to future-ready buildings in such a way.

For one of Australia’s largest supermarket chains, improving the sustainability of operations now and into the future was a key requirement when approaching a recent build.

“As Australia’s largest retailer, we recognise the environmental impact of our operations and understand we have a responsibility to lead in this space,” said Andrew Hall, Woolworths Victorian State Manager. The company recently finished work on a new concept store, led by LJ Services (a Schneider Electric Master EcoXpert), which reduces energy usage as well as the bottom line.

“In recent years we’ve been working to run our stores more sustainably by investing in a range of initiatives to optimise our energy use. These efforts not only reduce our environmental footprint, but also help us keep operating costs down.”

To realise these goals, LJ Services utilised the visibility and resource management offered by EcoStruxure to address the largest consumer of energy in the building: air conditioning.

“The single largest user of energy is the HVAC system, which is where EcoStruxure can minimise usage,” said Greg Murphy, Senior Project Manager at LJ Services.

“By comparing data on external conditions versus internal conditions, we can better manage the environment inside at a comfortable level. This means building managers are only using power on services that are needed.

“The HMI [human-machine interface] of EcoStruxure lets you see all this information graphically. FMs can then export it to run trend reports, so they can create snapshots of short- and long-term usage to then implement changes as needed — whether that be seasonal based, time or activity based.”

With the help of smart digital infrastructure, drawn from decades of intelligent design and application across a variety of industries, EcoXperts like the teams at LJ Services, mySmart and EC Controls are here to ensure we can all look forward to a greener future.

For more information on Schneider Electric’s EcoXpert program, and to find an EcoXpert near you, visit www.se.com/au/ecoxpert.



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RAFAEL KOENIG

MANAGING DIRECTOR, WEIDMÜLLER AUSTRALIA

What key trends will have an impact on the growth of your industry in 2020?

From a technological point of view, the ability to securely extract, connect and analyse data in various forms and complexities is a field that has enormous potential for us in the foreseeable future. Digitalisation and data processing are essential parts of Industry 4.0 and Weidmüller has a strategic focus to realise IoT connectivity in industrial scenarios. From sensor to the cloud is a slogan that embraces our goal to provide simple user-friendly connectivity solutions.

Our products and solutions are vital in conventional power generation but also in solar and wind. The main challenges here are the ability to provide front-to-end support for our clients. In the PV segment alone, we have substantial dedicated engineering resources that not only design for our clients but also support commissioning and operation. The booming infrastructure sector demands similar efforts and Weidmüller offers a host of dedicated engineering and assembly services and solutions to meet customers' expectations.

Last but not least the proximity to our customers is a key differentiator for Weidmüller. To realise a high level of service we continuously focus on the development of our key channel partners. Our collaboration with our national distribution partner APS Industrial (all states) as well as our regional partners Quador (Vic), Pacific Automation (WA), PRTS (QLD), Excell Control (NSW) and Cuthbert Stuart (NZ) is essential to provide the market with our products and solutions when and where they need them.

What is your industry doing to attract, upskill and retain talent?

We are a subsidiary of a German family-owned "Mittelstand" company. Our family character helps us to attract people who fit in while our technology focus demands lifelong learning. Together with our HQ where we operate our internal training organisation, the Weidmüller Academy ensures that our teams are equipped with the knowledge they need in their individual roles. The only effective way in my opinion to retain talent is to provide a work culture that is combining ambition with trust and respect and is challenging for the individual. Ultimately this leads to an enjoyable work environment that is not only fun but also produces high levels of success.

What difficulties has your business faced when implementing advanced manufacturing capabilities?

Helping Australian companies to adopt state-of-the-art technology advanced manufacturing is part of what we do. If you look at Industry 4.0 and digitalisation in general, these fields are growing exponentially in other parts of the globe due to the realisation that they are key to staying competitive. The relative isolation of Australia and the wealth created by its natural resources in

the past often did not create the urgency to adopt the latest technologies. As part of a global network of companies within the Weidmüller Group we consistently benchmark our manufacturing operations to our company's best practices in Germany, Europe and Asia. In addition, we are deeply engaged in collaboration with academia in various countries and disciplines to stay at the forefront of new technology and manufacturing trends. Industry 4.0 is making the production of low quantities (lot size 1) efficient; this in return will not only benefit us but make the local Australian manufacturing industry more attractive and revive the future of our manufacturing sector.

What effect could global economic uncertainty have on your business in 2020?

Being a global company, things that go on around the world certainly will also affect us at Weidmüller. However, we can only worry about things we can influence, and this is where we have decided to get involved in several activities that will hopefully contribute to our business situation here in Australia. We are deeply involved with the German Australian Chamber of commerce and I am a member of the foreign policy advisory committee which currently plays a supporting role in the negotiations for a free trade agreement between the EU and Australia. In addition, we have joined AIG's Industry 4.0 task force which strives to support the technology adoption process in Australia. With a proud history of almost 50 years in Australia, Weidmüller is a committed member of the Australian electrical engineering community.

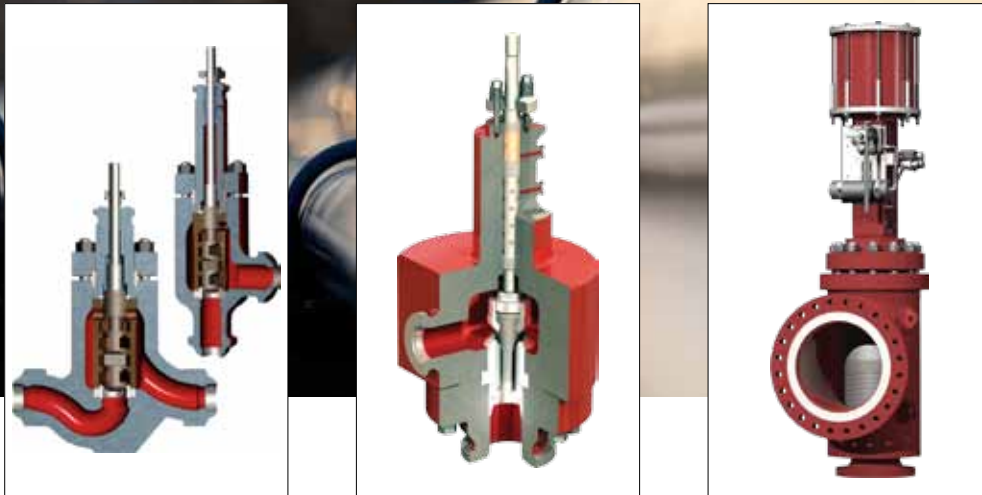


Rafael Koenig is the Managing Director of Weidmüller Australia and responsible for all operations, local production, sales and marketing. He has held several senior roles in Australia since migrating from Germany in 1996. In addition to his role at Weidmüller, Rafael is a member of the foreign policy advisory committee at the German Australian Chamber of Commerce (AHK). With a background in electrical engineering, Rafael Koenig holds a master's degree in business and technology from the University of NSW, Australia.



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KATHRYN WOOD-ENRIQUEZ

MANAGING DIRECTOR, POWERFLO SOLUTIONS PTY LTD

What key trends will have an impact on the growth of your industry in 2020?

In a word 'Globalisation'. This is not a bad thing; the world is far more accessible than in the past and we are working more collaboratively with other nations than ever before. The interconnection of markets — as a result of massively increased trade and cultural exchange — has increased the production of goods and services. Large international engineering houses are centralising their procurement or engineering teams in countries where it is more economically viable in terms of transaction costs, staffing costs etc, but it does affect Australian business.

From a sales perspective, we have to be committed to go out there and lobby hard for companies to buy from Australian-owned companies, who can and do provide service, long after the project team has left. We have to adapt to ever changing procurement strategies, which are not always orientated towards 'long-term' solutions with a low cost of ownership; sometimes a short-term — 12 months and one day — solution works for a particular project.

And from a local manufacturing perspective, we face more competition from imported products, often sourced from low-cost countries. We need to follow the trends of nations much larger than we are, to buy Australian products and keep as much engineering and after-market service in Australia as reasonably possible.

What are the three biggest challenges facing your industry in 2020?

I am frankly very concerned about the lack of knowledge in our specialised field of engineered valves (control valves, regulators and safety devices) for a number of reasons. Firstly, we have had a real 'brain drain' in Australia: the experienced (mature-age) engineers are leaving the industry, without having sufficient younger engineers to mentor — or for the lack of willingness of many younger engineers to do the 'hard yards'. Secondly, there is a critically reduced number of graduate engineers looking to enter this industry.

We all appreciate the saying that 'knowledge is power' but knowledge cannot be 'gifted'. Knowledge comes through understanding and experience, a clear understanding of fluid dynamics and process control, product design and sizing, an appreciation for material application and functionality. It takes years to gain even a reasonable level of knowledge and this requires enthusiastic dedication to the task.

Planning is also an issue, both for projects and day-to-day MRO business. Forward planning of plant equipment purchases provides many opportunities to reduce costs, to secure the right equipment and to prevent unscheduled downtime. Planning and execution of routine maintenance is crucial to the reduction of unplanned outages and situations where the equipment is beyond repair. Again, this requires knowledge and a strong appreciation of the industry; engineered valves can take many months to deliver, after the design has been done.

The right people are the backbone of any business. The engineering industry needs to promote itself better to young people, as a career with excellent opportunities for personal growth,

recognition and above-average remuneration, so that more school leavers will consider this field of employment. At the same time, companies need to offer more stewardship, whether that be through apprenticeships or other training programs, and younger engineers need to 'want and commit to being mentored'.

How is your business planning to help Australia meet the 2030 climate change targets?

In conjunction with our engineered valve partners, our business is heavily involved in developing solutions for use in renewable energy plants within Australia and parts of South East Asia. We are active in hydro and geothermal power and have recently secured control valve orders for the new brown coal to hydrogen plant being constructed in the Latrobe Valley. We also have a wide portfolio of valves for use in concentrated solar thermal plants (CST) — and while the uptake in Australia and globally has been relatively low in comparison to solar PV and wind, we believe that this will change in the next decade or two. Further, we have proven solutions for use in waste-to-energy plants.

While there are a large number of 'standard' valves used in these plants, applications within geothermal, CST and hydrogen in particular require 'tailor-made' valves that are designed to provide low or zero emissions of contaminated or corrosive media, which are sometimes exposed to very high pressures. The use of bellows-seals or live-loaded packings, welded or RTJ bonnets and flange connections and superior trim tightness is of paramount importance. SIL certification is, without a doubt, critical, as is the use of high-quality materials and cutting-edge manufacturing processes.

In addition to this, we offer specialised valve controllers and monitoring devices that aid data collection and scrutiny of the performance of the device, as well as to provide much more accurate control than ever before. Effectively, these devices act as 'sentinels', protecting the environment against unwanted emissions, through proactive reporting.



CEO and Managing Director of Powerflo Solutions, Kathryn Wood-Enriquez has been in the engineered control valve industry for over 35 years. With an expansive knowledge of control valve design, sizing and application, Kathryn focuses on engineering long-term solutions for the most difficult of control applications. In recent times, she has expanded Powerflo's business beyond Australia, New Zealand and the Pacific, into South East Asia where she expects the business to grow substantially over the next 10 years.

KNOWING YOUR AC FROM YOUR DC

Jon Young, APAC Director



In a world dominated by alternating current, it seems direct current has virtually disappeared from use. But a revived interest in energy-saving methods poses an interesting question: is DC still a worthy player? John Young weighs up the pros and cons.

If Thomas Edison were to experience electricity today, we think he'd be feeling rather smug. Despite being beaten down by Tesla, Westinghouse and other AC advocates, many are now considering whether Edison might have been right in the first place — is DC actually the better option?

War of the currents

Considering that computer systems, telecommunications and data storage systems are already using DC, in an age where we are constantly looking at ways to become more energy efficient, it might be surprising to know that the power supplied by the grid is AC.

The ability of AC power to control its current using magnetism to make the currents go forward and reverse in alternating motions makes it the more reliable power option, despite it not being able to produce voltage levels as high as those of DC. However, the alternating current loses more than 10% of valuable electrical

energy when the current needs to be converted from AC to DC — and vice versa.

The rise of DC

Although a complete switch from alternating current to direct current is highly unlikely, there are areas where direct current provides a distinct advantage. Financially, DC power applications are cheaper to install, operate and maintain than AC alternatives. In addition, there is no need to adapt capacity to account for phase balancing or harmonics, as they are not a factor with DC power.

High-voltage DC is a much more efficient method of transmitting electricity over long distances, not least because the amount of energy lost during transmission is significantly reduced. DC also requires fewer components — so there is less that can go wrong, making it more reliable. The infrastructure of DC is also smaller, requiring a reduced footprint in comparison to traditional overhead pylons while offering huge space-saving opportunities.

One of DC's greatest advantages is its suitability for transmitting renewable energy powered by resources such as wind, solar and water, as

their sources are often located long distances away from highly populated areas. Unlike AC, a direct current doesn't undergo switching and the current flows in a single direction with a steady voltage.

However, DC can lose power as heat; a trait that Edison used to power the first light bulb. But, despite its disadvantages, the generation of semiconductors has paved the way for its return.

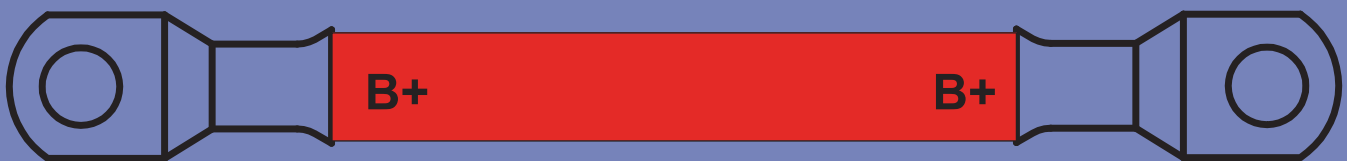
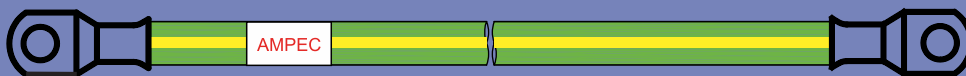
While a DC current system requires fewer components compared to an AC system, meaning there are fewer pieces that can fail, this does not eliminate risk completely. No matter which current a manufacturer prefers, making sure its required components run efficiently is vital to ensuring a reliable power supply. A relationship with an equipment supplier such as EU Automation, which can provide new, used and obsolete parts without the need for extensive downtime, is crucial to extending a system's life cycle.

The internet, computers, smartphones and tablets are such an intrinsic part of our lives and all rely on DC. Now, the data heavy platforms like Google and Facebook are using entire buildings to house servers that store data for their users, all running on DC.

It seems that the battle between the two will continue to rage — even if it isn't to the same degree of the war of the currents in Edison's age. It's likely that the two will continue to coexist while the battle is argued out by engineers and technicians.

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5 ENGINEERING AI TRENDS FOR 2020

Paul Pilotte and Bruce Tannenbaum, heads - Data Analytics and AI marketing

As AI starts to gather speed and practical uses become more apparent, here are five industry trends we are likely to see emerge throughout the coming year.



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Artificial intelligence is no longer a theoretical concept. As it moves into mainstream industry, system complexity increases while costs are driven down. Here's what 2020 is likely to bring.

Workforce skills and data quality barriers start to abate

As AI becomes more prevalent in industry, more engineers and scientists — not just data scientists — will work on AI projects. They now have access to existing deep learning models and accessible research from the community, which allows a more significant advantage than starting from scratch. While AI models were once majority image based, most are also incorporating more sensor data, including time-series data, text and radar.

Engineers and scientists will greatly influence the success of a project because of their inherent knowledge of the data, which is an advantage over data scientists not as familiar with the domain area. With tools such as automated labelling, they can use their domain knowledge to rapidly curate large, high-quality datasets. The more availability of high-quality data, the higher the likelihood of accuracy in an AI model, and therefore the higher likelihood for success.

The rise of AI-driven systems increases design complexity

As AI is trained to work with more sensor types (IMUs, Lidar, Radar, etc), engineers are driving AI into a wide range of systems, including autonomous vehicles, aircraft engines, industrial plants and wind turbines. These are complex, multidomain systems where behaviour of the AI model has a substantial impact on the overall system performance. In this world, developing an AI model is not the finish line, it is merely a step along the way.

Designers are looking to model-based design tools for simulation, integration and continuous testing of these AI-driven systems. Simulation enables designers to understand how the AI interacts with the rest of the system. Integration allows designers to try design ideas within a complete system context. Continuous testing allows designers to quickly find weaknesses in the AI training datasets or design flaws in other components. Model-based design represents an end-to-end workflow that tames the complexity of designing AI-driven systems.

AI becomes easier to deploy to low power, low cost embedded devices

AI has typically used 32-bit floating-point math as available in high-performance computing systems, including GPUs, clusters and data

centres. This allowed for more accurate results and easier training of models, but it ruled out low-cost, low-power devices that use fixed-point math. Recent advances in software tools now support AI inference models with different levels of fixed-point math. This enables the deployment of AI on those low-power, low-cost devices and opens up a new frontier for engineers to incorporate AI in their designs. Examples include low-cost electronic control units (ECUs) in vehicles and other embedded industrial applications.

Reinforcement learning moves from gaming to real-world industrial applications

In 2020, reinforcement learning (RL) will go from playing games to enabling real-world industrial applications particularly for automated driving, autonomous systems, control design and robotics. We'll see successes where RL is used as a component to improve a larger system. Key enablers are easier tools for engineers to build and train RL policies, generate lots of simulation data for training, easy integration of RL agents into system simulation tools and code generation for embedded hardware. An example is improving driver performance in an autonomous driving system. AI can enhance the controller in this system by adding an RL agent to improve and optimise performance — such as faster speed, minimal fuel consumption or response time. This can be incorporated in a full autonomous driving system model that includes a vehicle dynamics model, an environment model, camera sensor models and image processing algorithms.

Simulation lowers a primary barrier to successful AI adoption — lack of data quality

Data quality is a top barrier to successful adoption of AI — per analyst surveys. Simulation will help lower this barrier in 2020. We know training accurate AI models requires lots of data. While you often have lots of data for normal system operation, what you really need is data from anomalies or critical failure conditions. This is especially true for predictive maintenance applications, such as accurately predicting remaining useful life for a pump on an industrial site. Since creating failure data from physical equipment would be destructive and expensive, the best approach is to generate data from simulations representing failure behaviour and use the synthesised data to train an accurate AI model. Simulation will quickly become a key enabler for AI-driven systems.

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ADRIAN MINSHULL

GROUP CHAIRMAN AND CEO, HYDROFLUX

1. What key trends will have an impact on the growth of your industry in 2020?

Locally, in Australia, the major impact on growth is the extended drought, followed closely by the growing social awareness of climate change. Many of Australia's medium and large food processing facilities are located in regional and remote inland areas, significant distances from major cities. Drought and water scarcity in many of these areas are driving businesses to look more diligently at the risk of having limited or, in the worst case, no water supply to their factories in the near future. Water efficiency and recycling of wastewater are trending topics with industry leaders, particularly given that industry worldwide currently uses around 20% of all available clean water, which is predicted to rise to 40% by 2060. Modern industrial water recycling technology is well proven in Australia and it is without doubt that many large water-using businesses will be implementing systems to remove any water supply risks from their operations entirely in the very near future.

Climate change, renewables, rising gas and electricity costs are also stacking together to create the perfect storm for bioenergy. Bioenergy is both sustainable and carbon neutral. Industry and municipal sewage treatment plants are rapidly coming to the realisation that their wastewater and solid waste is a viable energy source. Technology is well advanced now to enable biogas to be easily and reliably used as an alternative to natural gas in boilers and in electricity generation plants. Even the sludge produced by wastewater plants can be economically dried and used as a sustainable solid fuel.

2. What are the biggest challenges facing your industry in 2020?

Panic and wastewater treatment plant (WWTP) technology! We are already experiencing the beginnings of fear from medium- and large-scale food processing facilities in regional and remote inland areas wanting industrial water recycling plants delivered yesterday. As the drought continues and more large towns and small cities run dry, our ability to implement re-use schemes before factories start to suffer will be tested.

WWTP technology is advancing continually and WWTPs are becoming more efficient every year, but also more technically complex. Unless clients have skilled in-house specialist engineering staff designated to the WWTP, having long-term relationships combined with remote online support/control from the original WWTP designer/builders is becoming essential. Packaging specialist operational and maintenance support with chemical supply is technically and economically a massive OPEX win for industry.

5. What strategies are being implemented by your industry to improve resource recovery?

Education about what's possible! The water industry is reasonably advanced in the area of power efficiency, and in the main, our municipal clients recognise that although power efficiency has a higher capital cost, it also offers a good long-term operational and sustainable impact. Bioenergy from both wastewater and waste biomass is slowly

gaining commercial appeal. We need to demonstrate to both industrial and municipal customers that they can realise significant operational savings and, in some cases, become exporters of electricity by converting their waste organic resource to biogas. Back on the subject of water... with the extended drought showing little sign of abating, it is without doubt that water is becoming Australia's most valuable resource. The technology to recover water via recycling is well-proven technology and although industries' confidence in the processes and technology are increasing, it is far from the 100% where it needs to be. Again, more education about the possibilities is required.

6. How is your business planning to help Australia meet the 2030 climate change targets?

The Hydroflux Group catchphrase "Protecting Our Most Valuable Resource" is embedded throughout our short- and long-term business plans. Originally intended to just describe water as a valuable resource — and thus the missing "s" on the end of resource — the Group now recognises "resource" to mean water and sustainable bioenergy. Biogas production and utilisation is already contributing to Australia's National Greenhouse Gas (GHG) emission targets by providing both a renewable energy source and capturing emissions from organic and animal waste and landfill sites. Through both education and the implementation of practical and reliable technology, we believe Hydroflux is well placed to assist industry and municipalities make a serious contribution towards the necessary sustainability required to meet the 2030 climate change targets.

7. What are the three biggest threats facing your industry in 2020?

I am not sure there are any material threats to our industry, but there certainly are hindrances. The Australian power network has been caught out with a lack of planning for the rapid growth in solar, wind and biogas energy generation, and its follow-on effect on the existing unsustainable fossil fuel-based natural gas and coal generation plants and their respective distribution assets. This in turn is often leading to lengthy delays in assessments and approvals for grid-connected biogas power generation systems.

Power pricing uncertainty, both to measure biogas offset savings and feed-in tariff returns, needs to be resolved. Biogas energy's ability to be produced during periods of higher demand means it can contribute to smooth peak supply issues, greatly offsetting our reliance on fossil fuels whilst remaining carbon neutral.



Adrian Minshull, Group Chairman and CEO of Hydroflux, has overseen the design and construction of thousands of water, wastewater and water recycling projects throughout Australia, the Pacific and the SE Asian region. His specialist areas include new product and process design and development, large project management and

corporate strategy and governance.



In search of dark energy



Located on the edge of the picturesque Warrumbungle National Park in New South Wales, Siding Spring Observatory is Australia's premier optical and infrared astronomical observatory with five unique telescopes. They are part of a global network of observatories which allows researchers to track a star in the sky 24 hours per day, seven days per week.

University collaborations allow the observatory to globally facilitate a variety of research, from probing the depths of the cosmos in search of dark energy to searching the Milky Way for other planets and signs of life.

Each telescope is unique, varying in size and capability, with some able to see fainter objects and others able to move faster through the sky, facilitating different observations and new discoveries.

When the back-up power system for one of its largest telescopes was coming to the end of its life, Siding Spring Observatory decided to upgrade its technology.

Protection for all conditions

Mark Willis, Siding Spring Observatory Site Manager, is responsible for maintenance, upgrades and breakdowns at the observatory.

He is tasked with implementing a global maintenance plan which tests equipment and implements necessary upgrades every 18 months. A preventive maintenance plan also ensures the emergency backup system is tested every 12 months. This is to give the team confidence that in the event of power loss, the backup generator will work as intended.

One of the telescopes, a 2-metre equatorially mounted telescope, is much larger than the others. It has a hydraulically operated roof that can open and close multiple times per night. If the roof is open and there is loss of AC mains, there is an emergency backup DC power system complete with batteries that close the roof.

One night, researchers at Siding Spring Observatory opened the roof of the telescope to view the night's stars. When they were finished, they noticed that the roof of the telescope would not close.

"This really alarmed the researchers at the observatory as any rainfall could cause huge damage to this multimillion-dollar equipment. After some testing, we found that it was the batteries in the backup power system that failed to close the roof of the telescope," Willis said.

Choosing a reliable partner

Willis was aware that their 48 VDC power backup system was 15 years old and the batteries were nearly due to be replaced. He decided that it was a good opportunity to install a more modern system.

Willis approached Natural Power Solutions as they are a trusted provider of other uninterruptible power supplies (UPS) to the site. Natural Power Solutions recommended that Eaton's DC power backup system was the best fit for the observatory.

"All of the observatory sites run Eaton AC UPSs globally, so we trust

their power systems. Another thing we really value is their backup support. This is what ultimately led us to choose them as our supplier of power backup system," Willis said.

Eaton's DC power backup system (48 V) was chosen to back up the emergency hydraulics motor for the telescope.

A local build

This telescope is unique in that it is the only one on this site that needs backup power to the large AC motor that opens and closes it. This is to ensure that in the event of a power outage, the backup DC motor will kick in and ensure the roof can still close.

The DC power backup system that Eaton manufactured works in tandem with a PLC/hydraulic control panel in order to know when to close the roof.

The solution required a lot of intelligence and so configurations were carried out onsite to ensure that the software was configured to know when the roof should open and close, what time it should operate at and when it is fit to operate.

Eaton custom-built the DC power backup system in a couple of weeks and installed it over the course of four days. The system had multiple components including batteries, system SC200 controller, rectifiers and Eaton configured additional features via software which provided safe operation and monitoring.

"Having to get all inputs and outputs done and systems integrated takes a lot of time, but thankfully, Eaton manufactured the DC power system locally and so it only took a couple of weeks to build. This was a key advantage for Eaton as it resulted in a much shorter lead time," Willis said.

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FINDING THE RIGHT SOLUTION FOR PFAS REMEDIATION

WHAT TO CONSIDER WHEN FACE TO FACE WITH A PFAS PROBLEM

Jason Lagowski, Director — Remediation Technologies, Arcadis Australia Pacific

PFAS is a complex problem, and with recent news on tightening regulations in Australia and around the globe and with PFAS in the news headlines almost daily, many of us are wondering how to tackle the problem. As an environmental professional with 30 years of experience, it is comforting to know that the situation is not insurmountable, and with good planning and effort, we can still solve the challenge.

For those who are less familiar with the matter, per- and polyfluoroalkyl substances (PFAS) are a large group of chemical compounds used widely within industrial and commercial applications since the 1940s. PFAS compounds do not occur naturally in the environment. They are highly mobile and extremely persistent when released into the environment. Research and scrutiny from recent years has increased the understanding in toxicity, persistence, mobility and potential of PFAS to enter our drinking water supplies and the food chain.

The problem is real and serious, but unlike one might think, there is no single generic solution to fix the issue. Because of their unique physical and chemical characteristics, PFAS compounds have been found in soils and water systems across the globe. Very often, PFAS compounds are found in places that have a strong connection to the environment.

So, how can PFAS contamination be solved? How can you trust you have the right partner and technology for your remediation project?

As a client in the middle of a PFAS problem, it's not always easy to know where or who to turn to. There are a lot of solu-



tion providers, and finding the right solution and partner is not always easy. Media and various solution providers are talking about PFAS and presenting multiple threats and quick-fix solutions for those threats. It can be a confusing place to find relevant and accurate information.

When choosing the most suitable PFAS remediation solution, there are a couple of key questions to consider before making the decision. Always ask yourself and the solution provider:

- Is this solution technically effective?
- Is it scalable and cost-effective?
- What is the waste strategy for a PFAS treatment process?
- Is the solution and technology behind it sustainable?
- Does the process create harmful by-products?
- Can the solution meet the current and future regulatory guidelines?
- Do you have a thorough understanding of PFAS sources and distribution on the site?

I strongly believe that the key to success is finding the best and right solution for each remediation project. At Arcadis,

we value ourselves as solution agnostics. Instead of offering a generic solution, we rely on our long history and deep understanding of PFAS management and remediation to achieve an outcome for our clients. We believe in bespoke solutions that are site-specific and tailor-made for the problem in hand. Through research, development and partnerships with some of the most innovative companies around the globe, we are at the forefront of PFAS remediation.

We all have a responsibility to improve our quality of life by taking care of our environment and protecting human health. Managing and remediating PFAS contamination is not an easy or simple task. But with smart planning, the right partner and suitable solutions, it can be done safely and efficiently.

At Arcadis our commitment is to improve the quality of life. For me personally, this means using all the knowledge, skills and resources we have, in order to find the best solutions and outcome for our remediation clients.

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www.arcadis.com

BÜRKERT AUSTRALIA CELEBRATES 40 YEARS

Q&A WITH CHRIS HOEY

1. Can you tell us something about how the Bürkert company began and how it got started in Australia?

It was way back in 1980, Malcolm Fraser was PM, Alan Jones won the F1 driver's championship, Evonne Goolagong won her second Wimbledon, Queensland won the first ever State of Origin, *Sale of the Century* launched and we were listening to Split Enz sing 'I Got You' on the radio. It was that same year, on 8 February, that Bürkert Australia was registered. It was the first Asia-Pacific office for the Bürkert group, with a goal to further develop not just Australia, but the whole region.

Over the following years, Bürkert grew exponentially, servicing customers throughout the APAC region. Thanks to this strong market growth, it was able to develop independent offices in the key Asian countries and finally hand them over to the group in the 1990s. From then Bürkert Australia concentrated on the Pacific region, which has experienced strong growth since that time.

2. How has Bürkert's range of products and solutions grown over its history?

"Bürkert... you guys do Solenoid Valves" is our most heard sentence, still to this very day. This is because back in 1980, we were predominantly solenoid valves and pneumatic angle seat valves. We used this smaller range to quickly become market leaders in this area, a position we believe we still hold today. However, the 'Solenoid Valves' that kicked us off now make up less than 30% of our overall business.

Bürkert globally has developed into a technology leader, always innovating and always one step ahead of the market. This led to many unique inventions like networked pneumatic manifolds, valve control tops, digital positioners and many more. By the year 2000, Bürkert manufactured a whole range of equipment for the process industry, including pressure, temperature, level, flow, analytical and of course our extensive range of valves and process actuation. Around this time we also started to add value to our product offering with system integration and panel building. Today we have an entire department designing and building state-of-the-art networked systems with advanced diagnostics and cloud connectivity.

Our company operates in every market where fluids and gasses are being measured or controlled, but our key focus is in just four areas: Water (treatment, waste treatment, distribution, etc.); Hygienic (food & beverage, pharmaceutical, biomedical, etc.); Gas Handling (mass flow meters, mass flow controllers and complete systems); and Micro (medical machinery, dosing, etc.). At Bürkert, we have a drive to deliver value, not just things. We like to get in early on a project and then challenge the way it has always been done. We strive to deliver 'Different & Better' in every project. Whether we utilise technology to come up with a whole new design with massive installation cost savings, or we use mechanical innovation to link components together into a manifold or system to offer a single-point solution.

3. How would you describe the company's ethos?

Bürkert global is a company of engineers, starting with our CEO at the top and all the way down to the field. Our company has three corporate pillars: Technology & Quality Leadership, Independence and Culture. The first is evident in that almost 10% of our total turnover is reinvested back into R&D. Our independence is in every part of the organisation, from our products and services right through to finance. This is proven by our 74 years of continuous operation under the same entity, with our owners stating often 'We are not for sale and never will be'. Our culture is the third, but probably most important pillar, as it defines who we are in the market. We strive for a flat and very open organisational structure, innovative and fast acting.

4. What is it like working for Bürkert, and how does the company foster the development of skills, knowledge and personal growth?

An excerpt from our global mission states 'Customers insist on Bürkert people as unique partners'. It is worth noting that it does not ask that customers insist on our products, our services, our company, or anything else. It states clearly that the success of the company is all about the quality and commitment of our people. Once you get into this mentality, it gets in your blood... which might explain why we have over 50% of our staff with >10 years' service and negligible staff turnover. We strive to be the best in the market and offer the best solutions. To do this, we must have the best people. To get and keep the best people, you need to look after them.

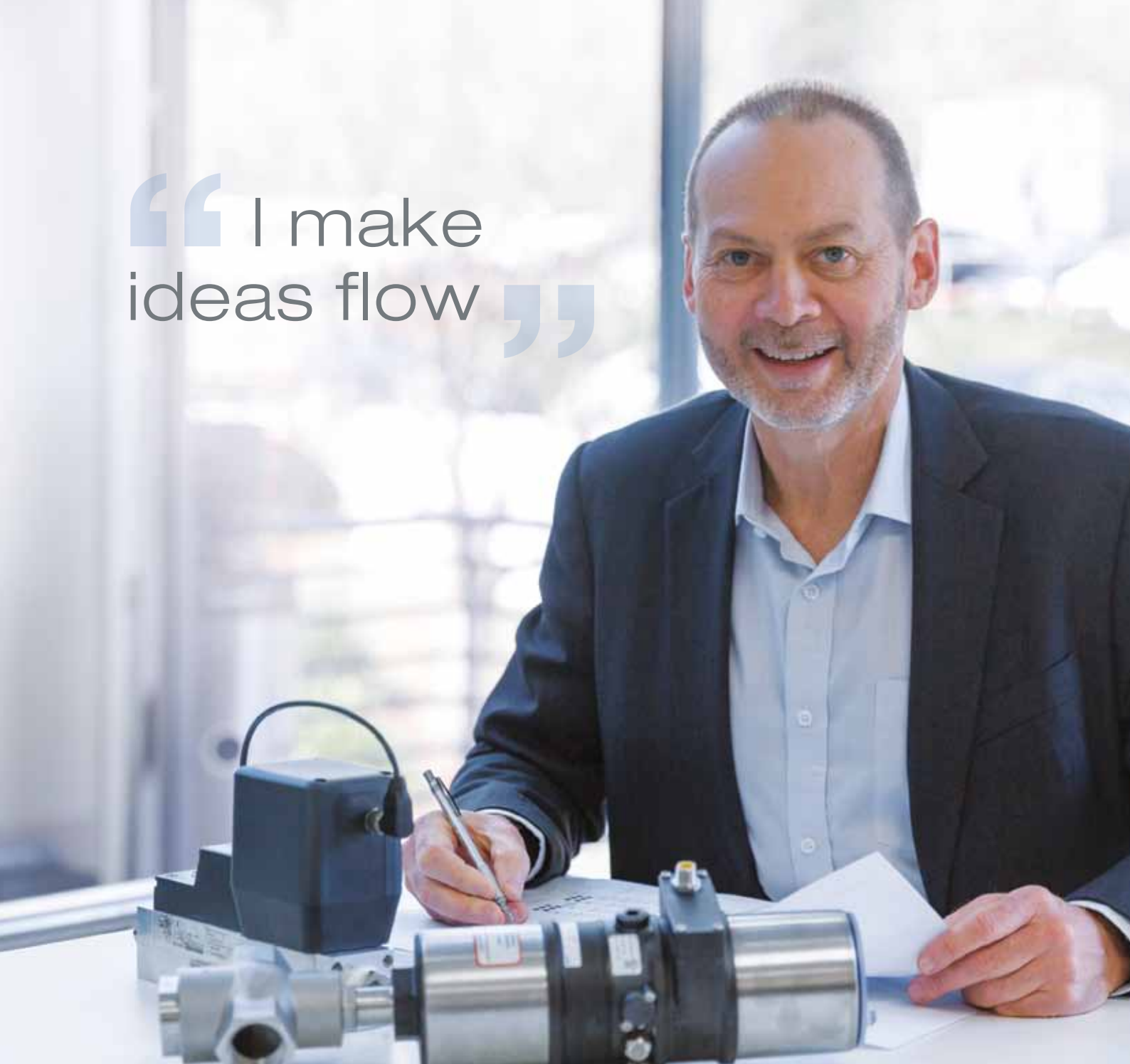
5. What is Bürkert Australia doing to prepare for the challenges of the future?

Bürkert started planning for the digitised factory over ten years ago and we now feel we are in a market-leading position to bring the company into the future. By utilising our common framework for communications (Efficient Device Integration Platform or EDIP) we can offer hundreds of products that can talk on any field network, to any control system. But not just communicate via these systems, be configurable to deliver Asset Management, Advanced Diagnostics, Change-In-Run and Interoperability, all in order to deliver on the Industry 4.0 or IIOT demands we are already seeing from our customers. Bürkert works to support the integration of these features into our customer's systems or alternatively delivering such innovation ourselves as a service, right through to cloud-based analytics.

I believe the future for Bürkert is very bright. So much so, I think I will wear shades.

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“ I make
ideas flow ”



Chris Hoey / Managing Director / 31 years Bürkert

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THE NITRATE-BUSTING SUPERPOWERS OF STORMWATER BASINS

A team of US researchers has found that stormwater detention basins can do more than just control water flow. It looks as though they could play an important role in protecting the marine environment by removing nitrate.

Louisville, Kentucky, is home to countless stormwater detention basins, built near large construction projects with the intention of controlling the flow of rainwater and run-off. But these basins may prove to function in an additional, unintended, yet beneficial capacity.

According to Lauren E McPhillips, Assistant Professor of Civil and Environmental Engineering at the Pennsylvania State University (Penn State), the basins may help to control nitrogen run-off into rivers and lakes.

Speaking at the annual meeting of the Ecological Society of America on 12 August, McPhillips explained that, together with colleagues at Cornell University, she has been studying stormwater detention basins in urban and suburban areas in Ithaca, New York.

"Part of the goal for stormwater detention basins is to manage flow," said McPhillips. "Increasingly, we are trying to get more water quality goals out of them."

Targeting nitrogen

Controlling run-off from rain and trapping sediment has always been a goal of the basins, but new techniques may also make them suitable for removing nitrate from the water. Nitrate comes from sources such as atmospheric deposition on roads, car combustion and lawn fertilisers.

Nitrogen is a target because, although the atmosphere is composed of 78% gaseous nitrogen, other forms of the element such as nitrate cause overgrowth of algae in bodies of water. This eutrophication removes oxygen from the water and creates underwater deserts where fish and other organisms cannot live.

"These basins have always been treated as black boxes looking at water in, and percentage efficiency," said McPhillips. "However, different designs of these basins perform differently, and now we are looking at performance and specific mechanisms for removal of nitrogen."

Wet vs dry basins

In general, stormwater basins are either wet or dry. Water passes through dry basins in a few days, while wet basins have standing water for much longer. A variety of things can happen to the nitrate in

A wet detention basin contains a large amount of water after a storm, making conversion of nitrate to gaseous nitrogen more complete.



the basin. It can pass into the groundwater and then to rivers, streams and lakes; it can be taken up by vegetation; or it can be converted to other compounds by microbes living in the basins.

While decay of basin vegetation places the nitrate back into the basin and the groundwater, some microbial assemblages can convert nitrate all the way to gaseous nitrogen, thus removing it.

When sampling the basins, the researchers checked microbial DNA for a gene allowing conversion of nitrate to nitrogen gas. This gene produces an enzyme that can convert nitrate into gaseous nitrogen.

"Typically, the basins are designed to be dry, but as sediment from run-off and vegetation that grows in the basins builds up, they can become wet basins," McPhillips said.

The research team found that wet basins were more capable of producing gaseous nitrogen than dry basins. However, the researchers also discovered that partial conversion produced nitrous oxides and consumption of organic matter produces methane, both greenhouse gases. The wet basins showed higher levels of the gene that allows complete conversion of nitrate to gaseous nitrogen.

According to McPhillips, designing the basins to hold water from the beginning could decrease production of nitrous oxides, because the longer the basins hold the water, the more complete the conversion from nitrate to gaseous nitrogen.

As for the methane, McPhillips suggested that engineering the basins so that the water retention layer is below ground and not on the surface of the basin could prevent the methane from releasing into the atmosphere. Trapped in the soil, oxygen would degrade the methane.

McPhillips is now studying stormwater retention basins on Penn State's University Park campus to further the research.

UHF RFID SYSTEMS

The UHF RFID systems (865–928 MHz) from Pepperl+Fuchs are suitable for far-field applications requiring detection ranges of up to 6 m. Due to their compact design and integrated antenna, these devices are also suitable for use in confined spaces. Both series (F190 and F192) are available in the relevant frequency ranges for Europe, Asia and the Americas, which is especially advantageous for global companies.

Depending on the application, the antenna polarisation of the devices can be manually adjusted horizontally and vertically or switched automatically. This means that it is possible to adapt the device as closely as possible to a specific application without replacing the hardware, thereby ensuring that tags can be reliably identified and processes are kept free of interruption at all times.

The read/write heads in both are designed to reliably identifying multiple RFID tags in a single read operation. Information can therefore be transferred at a quicker rate, throughput times can be reduced and the efficiency of manufacturing and logistics processes can be increased.

Preassembled functional modules allow the devices to be integrated into systems more quickly, and preset parameters that are specific to each country make installation simpler. The devices are compatible with the IDENTControl system family, which means that users have the option of expanding their own systems at any time.

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HARRY MULDER

ENGINEERING MANAGER, OMRON ELECTRONICS

What key trends will have an impact on the growth of your industry in 2020?

We see three trends that will significantly impact growth in manufacturing in the coming years. Disruption due to digital transformation will continue full speed ahead, with greater adoption of IIoT to gather analytical data to improve production. Manufacturers are increasingly seeing the value of IIoT, with one IHS Markit report forecasting the total number of connected devices surpassing 302 billion by 2020. It also said many projects did not deliver expected value, indicating there is much unrealised potential within IIoT.

Production itself will be enhanced by greater utilisation of robots. While traditional pick-and-place applications will continue to be serviced by fixed robots, most growth will come from mobile robots and cobots. Mobile robots can transport heavy items, and do so autonomously — where each robot determines its most efficient route within the fleet. But cobots present the most exciting opportunities: they offer similar dexterity as articulated robots but can work beside humans without needing safety barriers. This is because their operational force is limited in such a way that it can detect collisions and stop movement. This groundbreaking technology offers new levels of flexibility in manufacturing.

But IIoT and, to a lesser extent, robotic systems, are only as good as their underlying sensing technology. Sensors are often described as the 'eyes' of production, but the demands placed on them has meant many applications have morphed into full-scale vision systems. Vision systems themselves have become faster and substantially more functional, and will no doubt be called upon to deliver ever more data, with greater accuracy.

What are the three biggest challenges facing your industry in 2020?

The continuing economic uncertainty across the globe has meant tighter management of capital investment. This lack of confidence in the immediate future has resulted in many projects being either delayed or postponed. The volatile nature of commodity prices for Australian producers has also tended to undermine the confidence needed for significant investment.

Cybersecurity is an ever-present and ongoing concern. Some of the apprehension to migrate to data-intensive systems can be justified by the high sensitivity of the information being exchanged — if it was ever compromised, considerable damage would result. However, if current technology is implemented properly, then even very sophisticated cyber attacks can be thwarted.

There is still some reluctance in certain sectors to adopt new technologies due to inertia to change from the old way of doing things. Some remain unconvinced about the true value of new technologies or still cannot see their ultimate benefits.

What difficulties has your business faced when implementing advanced manufacturing capabilities?

Two main difficulties faced when implementing advanced manufacturing are a reluctance to invest and the lack of qualified

staff, who need to be highly skilled. Coupled with this is the challenge of training staff to adequate levels to be able to handle advanced techniques.

The relatively small domestic market base in Australia presents a limitation because it restricts the economies of scale required for significant investment in advanced manufacturing. This reduces the opportunities for candidates to attain the experience necessary to become proficient in advanced manufacturing, which in turn makes finding qualified staff difficult.

The newness of the technology, as well as its ever-evolving nature, make training problematic. A good example is mobile networking technology — just as 4G has been understood and mastered, 5G emerges and offers game-changing performance. 5G has the power to make TSN (Time Sensitive Networking) over wireless connections a reality, but this also means an entirely different set of standards and totally new infrastructure. This in turn means a completely new skillset must be learnt by engineers in order to maximise the capabilities of the product.

How is your industry preparing for artificial intelligence (AI) developments?

Artificial intelligence (AI) is becoming more prevalent and has been implemented in Omron's standard ICS (Industrial Controllers Systems) platforms, including industrial PCs. These controllers reside on the factory floor and can 'learn' from past events and use this knowledge to adjust output accordingly. Because these controllers base their decisions on a wide range of data that's collated over a long period of time, AI can be more effective than human intelligence.

But AI is also being progressively rolled out as an extension of the analytical tools offered by cloud service providers, like Azure, Amazon and the like. These vendors offer highly advanced AI tools, some of which are state of the art. These tools utilise the data already collected by IoT and while they're continuing to evolve, they already offer some very exciting opportunities.

The uptake rate of AI has hereto been limited. However, interest and enthusiasm remain high and as the technology and its applications become better understood, it seems certain that the adoption of AI will become more widespread.



Harry Mulder is Engineering Manager for Omron Electronics and has been working with industrial control systems for over 30 years. During this time, he has seen a great deal of change within the industry, especially over the last few years. He believes the recent developments have been the most exciting and offer the most potential.



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TIM KEECH

SALES AND MARKETING DIRECTOR, SMC CORPORATION

What key trends will have an impact on the growth of your industry in 2020?

The implementation of Industry 4.0 in manufacturing can have a major positive impact on the growth of our industry in 2020.

Manufacturing continues to be fiercely competitive. Not only are manufacturers competing locally, we are also competing on an international stage where many manufacturers are already advanced in the implementation of IoT solutions. Australia needs to continue to leverage the benefits of implementing Industry 4.0 solutions in order to remain competitive.

We will always have the challenge of reducing costs, maintaining high levels of safety, ensuring we comply with environmental initiatives and effective supply chain management. Industry 4.0 can help address these issues.

The more recent challenges being addressed by Industry 4.0 solutions are the evolving expectations of consumers, and smart manufacturing is helping to meet this demand.

What are the three biggest challenges facing your industry in 2020?

Access to skills remain a major challenge. Not only is production having to keep pace with the evolving technology, but so are the people in the business. We need people who can interpret and utilise the data that this new technology will bring, and this is not just a case of simply injecting STEM graduates into the workforce. This skill can only come through on-the-job experience, making it critical for our STEM undergraduates to be closely aligned and integrated with industry to achieve this.

Cybersecurity threats are the second major challenge. We have seen that no one company or even government is immune from attacks. Such risks may hamper the appetite for investing in Industry 4.0 technology. It is, however, a matter of educating customers with industry-proven solutions and processes that are available to limit exposure and protect their business.

A third challenge is access to reliable and low-cost infrastructure. In the face of increasing climate change, shrinking resources and the escalating cost of electricity, access to power and water can't be overlooked. Unplanned power outages have a real impact on business, and we are now finding that reduced access to reliable water is having impacts in the mining and manufacturing industries.

In terms of infrastructure, we have at times found it difficult to employ people of specific skills because of distance. Travelling from one side of the city to another may no longer be practical when having to manage the consistent congestion of roads and motorways.

What difficulties has your business faced when implementing advanced manufacturing capabilities?

Initial uptake on new technology is slower in the local economy, and Australia cannot afford a slow uptake! Compared to the international market, we are slower at implementing integrated automation, robotic technology and Industry 4.0 data analytics. There is often a fear of automation because of how it would influence the local workforce. The

reality is that automation brings more productivity, more output, more profits and this in turn results in the opportunity to create more jobs!

What is your industry doing to attract, upskill and retain talent?

SMC has developed a Cadet Program to attract and retain talent. We are taking in technical people and training them in sales, operations, logistics and administration to ensure they have a good overview of the business. These cadets are earmarked for future roles in the business and highly adaptable to changing economies.

We are moving with the times and the changing technology by, for example, placing more engineers in the field of energy-saving solutions, setting up digital transformation departments etc. We train and upskill these people to assist us in delivering not only value but real knowledge on these subjects.

SMC is continuing to invest in R&D on many applications, ranging from vacuum pads for robotics through to wireless applications in harsh environments. This requires high-calibre people that have both the technical ability to develop the technology and people who know how the technology needs to be applied across varying industries.

How is your business planning to help Australia meet the 2030 climate change targets?

SMC has been very active in the area of reducing energy consumption, specifically targeting inefficient use of compressed air. Manufacturers are beginning to realise the hidden costs of compressors running inefficiently throughout their plants. The recent success of SMC with several multinational manufacturers demonstrated real savings at the compressor.

We are employing engineers who take a very structured approach. They spend time onsite to understand the baseline of the current situation and then install measuring devices around the plant to measure air pressure and flow. Our engineers have the ability to identify areas of savings, from something as simple as identifying excessive leakage through to optimising the pressure and flow.

The benefits of this can vary. In addition to reducing the energy bill, benefits have been the deferring of capital equipment by fully utilising existing equipment to achieve the overall corporate target of reducing carbon footprint.



Tim Keech has worked for prominent industry brands throughout his career with extensive experience in industrial automation across various industries both locally and internationally. Skilled in process automation and control, drive systems application engineering, control systems design and SCADA, Tim combines a background in sales with an engineering degree from Sydney's University of Technology.

THE BATTLE FOR AIRSPACE IS WON ON THE GROUND

In landfilling, airspace is everything. For the waste management sector, 'airspace' — a landfill's capacity to accept waste — equates to revenue.

Because everyone is trying to maximise the remaining capacity of existing landfills, attention is turning to opportunities to claim fresh airspace by siting new landfills on brownfield sites such as disused quarries and mines.

It makes sense to use brownfield sites for the public's ever-increasing need for landfill. At many sites, pits already exist; however, these airspace opportunities come with risks, and it's vital to manage these properly for development to proceed, while also protecting the health of our land and water, and the safety of workers and the public.

A brownfield site such as a mining void or quarry brings a set of geotechnical challenges that must be addressed before landfill use can be considered. Underground tunnels and shafts, remnant highwalls, stockpiles of challenging and potentially combustible materials, large volumes of water in former open pits, as well as stability, seepage and safety are just a few of the challenges that must be considered. Yet, each of these challenges can be overcome when innovative and safe designs are applied that take full account of a site's unique geotechnical features and constraints.

Assess, address and communicate geotechnical risks

The first step in converting brownfield into airspace should be a geotechnical risk assessment that considers a site's history and its geological and hydrogeological settings. Some initial clues about legacy risks may be collected from plans and documentation of the former site workings, but can you be certain of the accuracy of the records? While a desktop study will identify potential risks and gauge their relevance to the project, relevant issues must be investigated more thoroughly with intrusive or non-intrusive methods.

Once the risks are better understood, preliminary approaches can be designed to mitigate the risk of geotechnical failure and optimise airspace. Mitigation measures must be considered both for the design and operational stages.

During the development of the design, maintaining a risk register will track that risks are safely mitigated to the extent practical, and that the owner and operator understand the design intent, how risk mitigation has been achieved and whether residual risks remain.

Get your lining right

An emerging opportunity to get the best results from brownfield landfill is through innovation in lining systems. Choosing the most appropriate and cost-effective lining system involves balancing risk (environmental and geotechnical) against airspace. Finding the best solution depends on understanding how individual components interact with the subgrade, with each other and with the overlying waste material.

Choosing a lining system requires a clear understanding of a site's geotechnical characteristics. It is also important to determine which lining option will deliver the best long-term performance as a barrier, for drainage, to manage seepage and the effects of groundwater, to minimise strain and to maximise stability. It is

important that the desire to maximise airspace is not placed before the need for stability and safety.

Many effective lining systems are available, and the most commonly used now are composite systems that comprise a geomembrane with an underlying material of low permeability, such as compacted clay or geosynthetic clay liner. However, these landfill lining systems are not impermeable, and designers need to estimate the potential seepage to assess the risk to the surrounding environment.

Potential changes to groundwater levels (due to seasonal, regional or operational factors) must be factored into the choice of lining system as well. Changes in the groundwater table could result in significant construction delays and operational complications, as well as risk of seepage and additional leachate generation. Any development of airspace below the long-term predicted groundwater table requires very careful consideration.

Don't analyse in isolation

Strain and stability will impact the choice of lining system as well. In former coalmines, the lining system may be placed under unacceptable strain if poorly backfilled materials subside or underground workings collapse. In the case of a former quarry or highwall with a near-vertical lining system, strain may be due to settlement of waste or the subgrade. Because the subgrade and lining system interact, their stabilities shouldn't be analysed in isolation. Geotechnical modelling of the subgrade in conjunction with the liner system and waste loads may be necessary to decide whether the lining system or subgrade should be reinforced. Strain may be managed by introducing an intermediary material between the waste and barrier, which also needs to be appropriately analysed and designed.

In former mines and quarries, the stability of highwalls and landfill lining systems needs detailed analysis. Steep wall lining systems pose significant health and safety risks during construction and operation. Technology such as photogrammetry can be used to develop a digital terrain model to identify and measure key geotechnical features — such as faults, toppling and rock wedges — that can affect the constructability and integrity of the lining system.

In the end, the battle for airspace won't be won out of a textbook, and it can't be copied and pasted from a previous design. Every site is different and will raise different geotechnical risks and challenges. The best result will come from a customised approach that addresses site and local challenges, drawing on the input of a range of specialist expertise.



**Nigel Ruxton is Golder's Waste Sector Leader in Asia-Pacific, based in Brisbane, Australia. He is responsible for the design, technical direction and management of solid waste management and civil infrastructure projects, including geosynthetic lined containment systems. Nigel was the recipient of the AGS Don Douglas Youth Fellowship Award in 2016 and a Golder Global Excellence award for Client Service and Technical Excellence in 2014. He is Vice President of the Australian Chapter of the International Geosynthetic Society and was the Conference Convenor for the 2019 Australian Landfill and Transfer Stations Conference.*



WIRELESS SMART BUILDING CANOPY

Cognian's Syncromesh is a wireless canopy that makes any building a smart building. Using the canopy, building owners can quickly and simply add a range of building management solutions to lower a building's carbon footprint and reduce energy costs, regardless of the building's size, location or age.

The smart canopy brings lighting control, location-based services, HVAC control and asset tracking

together wirelessly, with open standard interfaces and advanced services to enable the smart building retrofit market.

The technology is claimed to deliver an energy-efficient upgrade at a fraction of the cost of wired smart building alternatives and to improve the wellness and comfort of building occupants, lower a building's carbon footprint, reduce energy consumption and contribute to a more productive environment for tenants.

With its open platform, Syncromesh works with a number of manufacturers then connects all of the various control systems together. This means that lighting controls from one manufacturer can talk to HVAC controls of a different manufacturer. Each light contains a small Bluetooth beacon, which communicates to a gateway device. Syncromesh sits above this to control the system and allow each element to network.

Cognian Technologies
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Life Is On

Schneider
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MAURO DELLEMONACHE

VICE PRESIDENT, PACIFIC INDUSTRY BUSINESS, SCHNEIDER ELECTRIC

What key trends will have an impact on the growth of your industry in 2020?

Industrial automation market players are facing increasing challenges — from economic and geopolitical uncertainties to tightening regulations, ageing workforces and rapid changes in technology.

In addition, things like cloud, IIoT, big data analytics and cybersecurity are all changing trends that many companies say they don't know how to keep up with. We know from our own experience that a digital transformation can help to alleviate some of these challenges, by making businesses more agile and able to better respond to these types of changing environments.

Digitising machines and processes is the first step towards digital transformation. Known as Industrial Transformation (IX), this is the process of leveraging digital technologies to improve industrial operations.

What strategies are being implemented by your industry to improve resource recovery?

Schneider Electric is committed to supporting a circular economy. Many of our products are designed to be upgraded and refurbished, rather than simply put into landfill. For example, our global Industrial Repair Service Business Unit repairs motors, drives and control system components. Repairing, instead of scrapping, usable equipment conserves resources, which clearly supports a circular economy. Repairing existing equipment is also extremely helpful for our customers as they manage the staging of equipment upgrades and replacement.

Having this type of cyclical interaction also helps us to build long-term relationships with our customers. Contractors and electricians are choosing wisely for long-term serviceability, which, in turn, means they return to us for upgrades and servicing for many years.

How is your industry preparing for artificial intelligence developments?

Artificial intelligence is already a large part of many of our software solutions. At its basic level, we have invested in developing predictive analytics and condition management tools to enable customers to predict failure long before downtime actually happens. This is the case at Wilmar Sugar, where our upgrade of their control system has led to a robust and reliable solution for the site's boilers, bringing all control systems into one interface for a more efficient and productive solution. By bringing everything together we have been able to set alerts and offer predictive maintenance to ensure the likelihood of a costly emergency shutdown is minimised.

At the more complex end of the scale, AI brings a new approach to decision making that humans are not able to achieve. We can use clever technology to analyse and extract usable actions from hundreds of data points and inputs. We have demonstrated this with one of our transport infrastructure customers. The Eastlink freeway in Melbourne features twin 1.6 km tunnels which protect the environmentally sensitive Mullum Mullum Valley above. With Eastlink we were able to develop an efficient and self-regulating

ventilation system that uses automation, connectivity and software for real-time control and visibility. In addition to the upgrade of the tunnel ventilation system we helped to introduced partial tunnel portal emission during the day, using a purpose-built algorithm to ensure the portal pressure was 1.5 m/s over a 1-hour rolling average. This was particularly relevant to the sensitive environmental location.

What impact will technological developments have on your supply chain management in 2020?

In 2019 we successfully completed the digital transformation of our flagship Pacific SMART distribution centre (DC) in Ingleburn, NSW. The centre is the largest in the Pacific region, operating 24 hours a day, 5 days a week, and servicing 3500 customers. In undertaking the digital transformation, we used Schneider Electric's EcoStruxure technology, which drives end-to-end efficiency for the industrial environment. The centre also houses our industry leading Control Tower, which is an innovative leap ahead for supply chain management.

The technology at the SMART DC allows our teams to improve decision making, reduce downtime and improve safety, energy efficiency and reliability. Our supply chain visibility is improved and we can detect and mitigate supply chain issues and interruptions to significantly improve predictability and reliability for customers.

Bringing together logistics, customer care and personnel representing all our international and domestic transport carriers in one site means that information from global tracking dashboards can be openly and easily shared and discussed to quickly resolve queries and issues. The Control Tower approach has demonstrated a strong return on investment with a 65% reduction in time taken to resolve complaints.

These new technologies are already proving their worth, and we will continue to see improvements in this area through 2020.



Mauro is Vice President of Industrial Automation in the Pacific Zone, for Schneider Electric, and has over 20 years' experience in the automation industry. Mauro's career crosses both Canada and Australia, with exposure to the development of operational technologies and industries working with global players in this space. Starting in engineering Mauro has since held product management, sales and management roles; relocating to Australia in 2008. In 2015, Mauro joined Schneider Electric as Director, Industry Business to run the Industrial Products Division for Australia, and in 2019 took on the broader role of Industrial Automation Vice President for Pacific. Mauro is passionate about employee development, organisational evolution, digital transformation and how organisations are working to embrace the rapid advancement of technologies in a competitive globalised economy.

REMOTE MONITORING, ALARMING AND LOGGING SOLUTION

DeltaBlack is an easy-to-use cellular 4G/3G/2G remote monitoring, alarming and logging solution which is suitable for use in a range of industrial applications.

The Industrial IoT edge device is designed to work in the cloud with SCADA systems or via simple user-friendly SMS commands.

With multiple I/O channels, wide operating supply voltage, DIN-rail mount and integrated RE232 modem, the device includes various sensor types including temperature and humidity, level, flow, pressure, pulse meters — electrical, water and gas — and CT current transducers. Other features include: integrated 7-channel data logger including one relay output; customised SMS alerts; and LED indication for cellular signal quality and communication status.

The unit weighs 250 g and comes with a pre-provision SIM card. Users can remotely manage the device and access measured data anywhere by connecting the sensors and logging into ETM'S IoT Cloud Dashboard (EWO).

Suitable applications include: pump, fan, generator and motor; refrigeration and freezer systems; metering, HVAC and indoor climate; tank measurements; fire panels and intruder alarms; data centre monitoring; and agriculture.

ETM Pacific Pty Ltd

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NEW
PRODUCTS



THERMAL PROBE

The Ralston Field Gauge LC10-TA thermal probe is a battery-operated, general-purpose digital temperature probe with a wide temperature range of -30 to 150°C and an accuracy of IEC 60751 Class A ($\pm (0.15 + 0.002 \cdot |t|)$ °C).

Designed as a portable, easy-to-use device, the Field Gauge LC10-TA features a rugged stainless steel probe — a safe and practical alternative to glass thermometers.

With a large display, intuitive controls, a convenient high/low function and customisation options that allow the user to quickly and easily switch from among four standard engineering units, the LC10-TA Thermal Probe is a suitable choice for lab personnel, instrumentation and hydrostatic technicians, and anyone involved in temperature monitoring. It is also suitable for pressure logging during hydrostatic and leak testing, temperature measurement during pressure calibration in non-hazardous locations and the general monitoring of temperature wherever live reading and logging is required.

Transtek Pty Ltd
www.transtek.com.au



AGGLOMERATE SYSTEM

The agglomerate system from Avian generates granules of plastic from recycled plastic. The system converts recycled plastic into crushed powder, then uses high-speed operation to increase temperature and generate granules of plastic.

The granules of plastic are not completely melted, stabilising the molecule stage of the plastic to prevent degradation. This makes the product well suited to recycling applications.

The agglomerate system is used for plastic film polystyrene fibre, expanded polystyrene, polypropylene and polyethylene terephthalate (PET) recycling range.

Avian Machinery Pty Ltd
www.avian.com.au

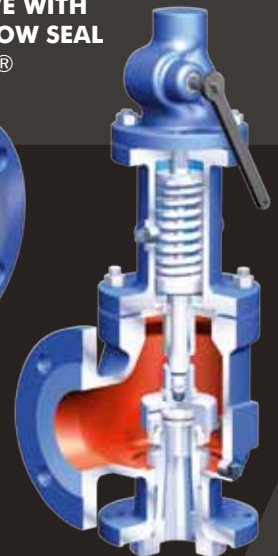
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ROTARY SCREEN

The Contra-Shear Milliscreen from Aqseptence Group is a self-cleaning, internally fed, rotary fine screen. The cylindrical drum screen can be constructed from Vee-Wire or perforated plate, ensuring a high level of solids capture compared to conventional screens.

As a core component of the food waste recovery process, solids separation and dewatering via trommel screens is critical for the delivery of high-quality outputs. When dealing with organics solid separation, operators require a very efficient trommel screen to facilitate high separation rates.

The shear force generated by the 'Contra-Shear' is the key to solids separation of the effluent. Screened effluent passes through the Vee-Wire slots into a tank from where it is pumped for further processing. The solids captured inside the screen drum are moved towards the discharge end by divertor plates. The section of the screen drum under the weir tank acts as a draining zone, whilst the discharge end section acts as the dewatering zone. Solids in the dewatering zone agglomerate and are continuously rolled on account of the rotation of the screen drum, resulting in further reduction of liquid content.

The Contra-Shear Milliscreen is Australian made and manufactured exclusively by Aqseptence Group.

Aqseptence Group

www.aqseptence.com



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ULTRASONIC HEAT AND COOLING METER

The Qalcosonic E3 Ultrasonic Heat and Cooling Meter from Axioma is designed for commercial accounting of heating and cooling energy when the heating media is water or glycol solution. The product is used in centrally heated objects in residential houses or heat supply facilities.



The Qalcosonic has flexible meter configurations, with users able to set metering parameters such as measurement units, configuration of input and outputs and control computing modules. The meters have the availability to register maximum and average monthly parameter values and the possibility of annual or monthly reports.

The units can be installed in any position and the mounting set for either return or supply. The heating and cooling energy is collected in different registers for easy reading. The Qalcosonic E3 has recently been LoRaWAN approved (EU868 MHz).

The product is available from AMS Water Metering.

AMS Water Metering
amswatermetering.com



INFRARED CAMERA

The Fluke Ti300+ infrared camera helps find issues before they are fully formed problems. With the resolution and accuracy needed to clearly reveal temperature differentials or demonstrate progressive heat changes over time, the Ti300+ features Fluke's LaserSharp AutoFocus technology which ensures images are focused.

One button press activates the built-in laser distance meter, calculating and displaying distance to the designated target on the camera screen. The image is snapped into focus, allowing a highly accurate temperature reading and enabling the user to access clear images while maintaining a safe distance from operating equipment.

The Ti300+ features 320 x 240 resolution and can measure up to 650°C using manual or automatic focus. It has been tested to a drop height of 2 m.

Fluke Australia Pty Ltd
www.fluke.com.au



HYBRID SOLAR BATTERY

SENEC has released a hybrid solar battery that offers households up to 90% solar power self-sufficiency.

The SENECE.Home V3 Hybrid delivers a range of benefits including a 20-year warranty, a combined PV inverter and battery inverter, PV overvoltage protection safety as standard, three-tier remote monitoring (every five minutes), unlimited solar recharging cycles and floor mounting rather than wall mounting for ease of installation.

The battery can also be retrofitted to existing solar-powered homes and does not require an additional PV inverter. Part of the storage system is a hybrid inverter, which converts both the current flowing from the PV panels into the storage system and the discharged current.

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FLUSH SMOKE ALARM

The PSA LIFESAVER SILHOUETTE 5800ACF is a flush-mounted smoke alarm designed to be small, unobtrusive and aesthetically pleasing. The 5800ACF is a photoelectric smoke alarm, mains powered with a 10-year battery backup.

Featuring dual insect screens to minimise nuisance alarms and a single test hush button for easy operation, the device measures 110 mm w and 29 mm h installed. The low-profile, single-piece design facilitates quick and simple installation.

Featuring a 90 mm cut-out and spring toggle clips, the 5800ACF is similar in size and mounting to a typical downlight fitting.

The 5800ACF operates as a standalone alarm or can be interconnected with up to 24 units. It also integrates with other PSA products, including heat, smoke and carbon monoxide alarms, and comes with a lifetime 10-year warranty.

PSA Products
www.psaproducts.com.au

RESIDUAL CIRCUIT BREAKER WITH OVERCURRENT PROTECTION

The SFRSE7 from CBI-electric is a DIN mount 3-pole 10 kA RCBO that comes in a compact 3-module width. At 54 mm wide, the SFRSE7 fits the existing CBI Advantage distribution board chassis while allowing for 3-pole MCBs to be interchanged with a 3-pole RCBO.

The SE7 is DIN mountable for use in enclosures for providing three-phase overload, short circuit and earth leakage protection. The SE7 RCBO range is available in C and D curves from 16–63 A. With the ever-increasing demand not only for RCBO protection but for compact protection solutions, the three-phase RCBO is a suitable addition to the CBI Advantage range of distribution boards and the CBI range of circuit protection devices.

CBI Electric Australia Pty Ltd
www.cbi-electric.com.au



DATA LOGGERS

Designed for companies in need of universal and low power data logging solutions, the DataTaker DT90 Series Data Loggers are compact and cost-effective, yet provide all the necessary features for logging data. Data retrieval and device configuration are available via USB interface for on-site communication. The automatic data delivery feature can also be used to send logged data to an FTP server at regular intervals.

The DT90 Series has been designed with an emphasis on low power, small size and ease of deployment. The logger is suitable for remote monitoring of environmental and industrial applications.

There are two models available — the DT90L and DT90N. The DT90N is designed for setting up small stations that require multiparameter sensors that only have a digital output. The DT90L is designed for multiparameter applications and can interface with both analog and digital sensors. Both options in this series share the same kernel board and core functionality.

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RECYCLING

BACK TO THE FUTURE

*Eric Love and Christopher Rochfort**



The recent global waste recycling crisis has focused us on the importance of developing localised markets for recyclable materials. After several years of product development in Australia during the '90s, recyclers and cities opted to ship materials offshore to markets that offered lower-cost alternatives compared to developing local markets, particularly for plastics manufacturing. This course of action has now come back to haunt us.

Paper was already going offshore. Glass was mostly going into new bottles but as waste generation continues to increase, glass has exceeded the limit for glass making and needs new markets. There are enormous stockpiles of glass all around Australia.

Investment was needed then to establish local manufacturing but shipping to Asian markets put an end to any prospects for investment in local plastic manufacturing. Many plastic products that were at proof-of-concept stage floundered because of lack of confidence in obtaining sufficient supply to justify local investment in manufacturing. Successful HDPE, PP, PET and mixed plastic products were becoming market ready but needed market support.

Moving forward we need to be careful to ensure that we aren't reinventing the wheel when it comes to developing recycled-content products. After four decades in the waste and recycling industry, we believe that sufficient value-added recycled content products for higher-value markets already exist. Many of these products and markets were originally developed in a localised strategic context and only need funding resources to resurrect them. Many of these strategies and technologies were forgotten, obscured by the passage of time.

While the dry recycling fractions were being shipped offshore, the recycled organics segment took a different route — localisation. This was primarily due to several key factors including transport costs for lightweight materials, biosecurity issues and the lack of perceived value in the products (there isn't a spot market for recycled organics).

Several market research and characterisation reports and field research studies culminated in a comprehensive marketing strategy. The strategy, developed by Centre for Organic Research and Education (CORE) in 2000, was influenced by direct input from an EPA NSW convened expert reference group consisting of LGAs, EPA NSW, Dept of Agriculture, processors and universities. This created a robust strategic context for sustainable market demand including for value-added products that can reduce reliance, and put downward pressure, on gate fees. The strategy is as applicable today as it was then, if not more so.

Careful not to put all the eggs in one basket by reliance on one market, the group advocated for pursuing a diversity of key market priorities based on robust research evidence including strong technical efficacy, innovation, receptivity and affordability. The landscape market was already well entrenched with strong demand, so the sectors selected for demand acceleration were



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agriculture, rehabilitation, environmental remediation and special projects. It seemed like organics was well set to create its own sustainable local markets.

But what happened? A change of government that didn't see itself as having a key role in developing recycling markets stifled progress. Due to low policy support, much of the momentum was lost. It became quicker and easier to tender collection and leave the markets up to the waste processors to worry about. Ensuing mounting stockpiles have now provoked a response. Twenty years and many millions of dollars later, funds are being granted for market development because of a market failure to create sufficient markets for all recycling fractions including for the rapidly increasing quantities of organic waste being generated.

CORE, on behalf of, and in collaboration with, its members continued to pursue recycled organic markets on a shoestring budget derived mostly from member levies and small sporadic grants. Intuitively, it seemed obvious that because of the substantial technical benefits of adding organics to soils, peri-urban farmers would "lap it up". Experience revealed that, as good as the results were, many farmers did not have sufficient resources to pay for materials. After an early adopter burst flattened and drought set in, it was confirmed that agriculture

would not be the panacea expected, confirming the diversity pathway promulgated by the EPA Expert Reference Group in 2000.

Repeated experiential research conducted by CORE showed there were major affordability issues for farmers. Even with lower-cost farming system modifications introduced by CORE, most farmers simply do not have the money to purchase recycled organics, even at prices subsidised by gate fees.

CORE began to view the peri-urban agriculture sector as primarily a "contingency" market. When there's too much stockpiling in the system farmers can take the lower-cost "overflow" materials. Lower-cost farming systems with low processed but compliant products maximised demand in the sector but it is still falling well short of the demand needed for the volume of organic waste being generated.

This low-cost, low-processing approach was not viewed favourably by some public and private sector organisations who have different ideas about the organic processing and supply business model. The fact is that the "overflow" contingency model allows time to develop other markets as well as preventing dumping on existing markets that would have had a more catastrophic impact on industry pricing and bottom line.

The lesson to those dealing with the current waste crisis is to spend the time on identifying and assessing the markets before considering what products to "remanufacture". Consider customer affordability and chose demand led, not supply push strategies and tactics.

Our concern is that some public and private sector organisations don't understand fundamental marketing. It takes more than public relations exercises to create sustainable market demand. A few ad hoc projects do little to increase purchasing patterns, it's longitudinal campaigns based on solid market research that create sustainable demand. We hope that the lessons of the past will guide the allocation of funding that doesn't reinvent the wheel and avoids the mistakes of yesterday. Unfortunately, we have already seen very costly instances of this.

Nearly 85% of all recycled organics is marketed at the low price, highly processed end of the marketing matrix. This has led to an emphasis on high gate fees to subsidise manufacturing costs.

More emphasis needs to be placed on value-added applications for all quality processed recycled materials. There are many products already out there ready to go. Proper market analysis, product development and evidence-based marketing strategies need to be developed by experienced professionals.

CORE is now creating recycled content products, systems and markets for glass, plastics and organic recyclables. We reiterate our 25-year position of advocating market diversity as outlined in the 2018 Blueprint for Market Development. We urge decision-makers to support a shift to a portfolio of a "marketing mix" with low-, medium- and high-value products and markets. Well-developed strategic approaches can incentivise the waste and recycling industry to look for more, higher-value markets. This may even enable industry to invest in further R&D and marketing to make Australia self-sufficient in beneficially utilising its recycled materials and subsequently restore the confidence of the community.

**Eric Love, Chairman and Christopher Rochfort, CEO of Centre for Organic Research & Education (CORE) have experience spanning four decades. They are the originators behind many of the innovative technologies and practices in the recycling, waste, agriculture, landscape and stormwater markets that are now commonplace in the Australian community.*

NEW
PRODUCTS



VISION SYSTEM SOFTWARE

Wenglor's uniVision 2.1 allows two- and three-dimensional data from smart cameras, vision systems and control units with 2D or 3D profile sensors to be evaluated via a central software platform.

The parameterisable standard software is used to analyse images and height profiles in the field of industrial image processing. Users can achieve a finished vision application intuitively in a small number of steps and without programming knowledge.

The uniVision software is structured like an intelligent toolbox. The algorithms for images and height profiles are similar and can be used on different platforms. The measurement module runs on smart cameras, as well as vision systems, for example. In total, users have up to 25 different software modules available (eg, measurement, threshold value, cluster, OCR, pattern matching, tracking, etc), as well as 14 different templates (eg, read 1D codes, presence check, detect pattern or detect colour), depending on the hardware selected. There are also video tutorials available online, with detailed instructions on how to use the software. An assistant that guides users through the setting step by step is also available for smart cameras.

In order to simplify use of the software for newcomers, predefined projects (templates) can be selected and used for the most common standard applications. Images, coordinate systems or values can be combined with each other as desired, thus providing newcomers as well as experts with maximum possible application freedom.

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MACHINE VISION COMPUTER

System performance and reliability are critical factors for vision-based systems. In order to detect defects, vision systems need to perform fast and accurate analysis of objects. The Apex Technology AVS-500 Series machine vision computers are powered by 7th Gen Intel processors to provide a multicore processing platform with high-speed PCIe x16 expansion. High-bandwidth GPU data access is essential for reliable image processing performance.

The AVS-500 Series is equipped with two SODIMM sockets supporting up to 32 GB of DDR4 system memory, two Gigabit RJ-45 Ethernet connectors, four USB 3.0 ports, two USB 2.0 ports, four digital inputs, four digital outputs, two RS-232 ports, and one RS-232/422/485 and one RS-422/485 port for communication. Two easily accessible 2.5" SATA hard drives can be internally mounted for operating system and data storage.

While two full-size Mini-PCIe slots are provided on the motherboard, AVS-500 Series models are also available with two or four expansions card slots. Various PCIe x16, PCIe x4, PCIe x1 and PCI slot combinations are available.

The onboard Intel HD graphics engine provides VGA and HDMI output with support for 4K UHD high resolution displays.

The AVS-500 Series is capable of connecting to multiple GigE and USB 3.0 cameras, and also supports light source control ensuring that objects are correctly exposed during the imaging process.

Possible applications include automation, 2D/3D measurement, surface inspection, PCB inspection, robotic arm guiding, textile auto-inspection and label/barcode scanning.

Interworld Electronics and Computer Industries
www.ieci.com.au



MAGNETIC FLOW METER

The McCrometer FPI Mag flow meter can be used in a range of municipal and industrial applications. Available in battery- or solar-powered options for forward flow sensors, the product can be installed in remote applications without access to power. The new Smart Output feature allows the device to connect to AMI/AMR systems through an encoded digital output.

The multi-electrode device has no moving parts and a single-piece design, containing no parts to wear or break and making the product generally immune to clogging by sand, grit or other debris. The FPI Mag is available with forward-flow only or bidirectional measurement for line sizes from 100–3500 mm.

The sensor body is made from heavy-duty 316 stainless steel for maximum structural integrity and is hermetically sealed and protected by NSF certified 3M fusion-bonded epoxy coating. The insertion design allows for simple hot-tap installation.

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DEIONISING SALT WATER

Assistant Professor Kyle Smith's extensive research in the field of water desalination is exploring novel ways to deionise salt water, with a new research project funded by the US National Science Foundation.

With research published in the journal *Water Research*, the University of Illinois Mechanical Science and Engineering professor has generated promising results for energy-efficient desalination of alternative water resources. His newest work, spearheaded by his doctoral student Erik Reale, involves deionisation devices that can reversibly store and release cations using intercalation materials — a class of materials commonly used for rechargeable batteries. In particular, the study addresses the challenge of cycling intercalation materials with fast rates of electron, ion and fluid transport — features that are difficult to achieve simultaneously in a single system.

The research team fabricated optimised electrodes containing insulative Prussian Blue analogue particles and used them in an experimental cation intercalation desalination (CID) cell with symmetric electrodes. Compared with past CID demonstrations, the team witnessed a nearly 10-fold increase in the rate of salt removal at similar energy consumption levels.

"High salt removal rates are needed in electrochemical water treatment devices because smaller units can be constructed to achieve the same total production of treated water if salt can be removed faster," said Smith. "Following that line of thinking, the capital cost to construct a system will be lower for a fixed water productivity level."

In the new three-year National Science Foundation-funded research project, Smith will use battery materials to overcome the limitation in the volume of waste brine that is produced during water desalination using reverse osmosis (RO). Brine disposal has major environmental sustainability issues, including increased earthquakes when injected into the earth and danger to aquatic ecosystems when disposed of in bodies of water.

Although RO brine generation is dictated by the pressure driving force used (and thus imposes mechanical limitations), Smith plans to use electric fields to concentrate salt ions, which he said could concentrate salts to levels near saturation in solution.

Building on previous research

In 2016, the University of Illinois reported that Smith had discovered the technology that charges batteries for electronic devices could provide fresh water from salty seas. Smith developed a novel device — a saltwater-filled battery with electricity running through it — that deionised water using the least amount of energy possible at the time.

In 2017, Smith and his team took salt water desalination a step further, focusing on new materials to improve the economic viability and energy efficiency of the process in collaboration with Wetsus, the European Centre of Excellence for Sustainable Water Technology. The team created a battery-like device that uses electrodes made from a material that removed sodium ions, as well as potassium, calcium, magnesium and others — an important technological improvement because salt water and brackish waters often contain a mix of other salts like potassium, calcium and manganese chloride. This work was published in the journal *Electrochimica Acta*.

The present experimental work follows that published by Smith and his students using computational modelling of electrochemical transport to guide the design of battery-based desalination cells. The group has recently used quantum mechanical modelling, combined with experiments and thermodynamic analysis, to understand how the battery materials used in their desalination cells absorb sodium, magnesium and calcium at the atomic scale.

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YOUR FUTURE WORKPLACE WILL BE AS SMART AS YOU ARE

Schneider Electric

Watch any modern spy movie and chances are there's a scene where the hero infiltrates an ultramodern office tower, manipulating biometric security scanners before hacking a terminal in a server room, which triggers an alarm and program to evacuate all the air from the room. Yes, your heart is racing just thinking about it.

The reality is, these buildings exist, but thankfully, their automated systems are far more benevolent than anything a Hollywood script-writer could come up with.

Say hello to the smart building and future workplace.

While the word 'smart' is thrown around with wild abandon these days, an easier way to think of it is as a 'connected and automated' building; one in which everyday functions — such as security, lighting and air conditioning control — are handled through a central gateway integrating multiple systems that monitor a collection of networked sensors that can trigger automated actions based on the data they obtain. For example, if the building detects a meeting room is vacant, it will shut off or lower the lighting, and the heating or cooling.

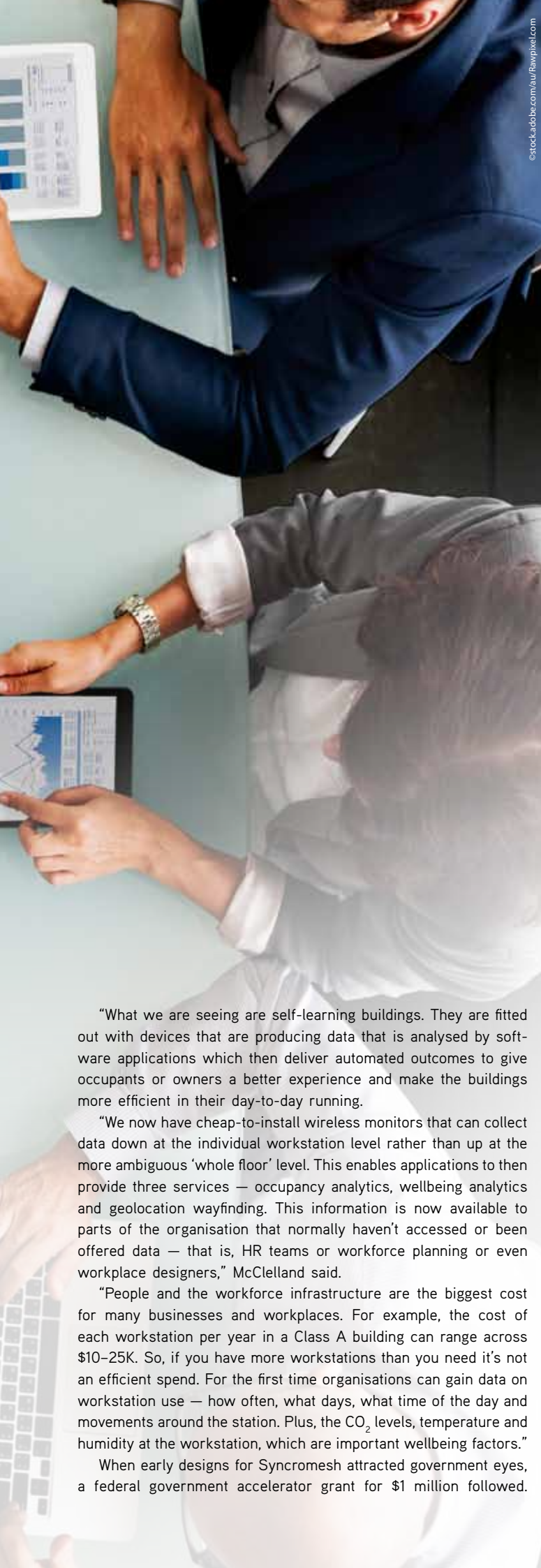
"It's no longer just words and hype," said Mark Blum, Co-Founder and CEO of Cognian Technologies. "In the IT space, computers in buildings have been connected for quite some time. But in the building operational space — it's now really starting to happen.

"Primarily, though, this has been happening in buildings at the top end of town; that's where a lot of the innovation is happening. What we're doing at Cognian is, we want to democratise the industry so it's not just large buildings that are smart, it's all buildings."

To that end, the team at Cognian have developed Synchronesh Wireless — a wireless IP 'backbone', built on Schneider Electric's open, IoT enabled EcoStruxure platform, which connects all building services into a central control system.

"What we're doing is figuring out ways to use mandatory infrastructure that can then offer more smart features and productive workplaces," said Gavin McClelland, Digital Buildings National Offer Manager with Schneider Electric.

"We can aggregate the data from connected machines or sensors and offer various Advisor packages that are applications which offer insights and enhanced management from the cloud, so a tenant or facility manager can control the building from anywhere you have phone or internet access.



“What we are seeing are self-learning buildings. They are fitted out with devices that are producing data that is analysed by software applications which then deliver automated outcomes to give occupants or owners a better experience and make the buildings more efficient in their day-to-day running.

“We now have cheap-to-install wireless monitors that can collect data down at the individual workstation level rather than up at the more ambiguous ‘whole floor’ level. This enables applications to then provide three services — occupancy analytics, wellbeing analytics and geolocation wayfinding. This information is now available to parts of the organisation that normally haven’t accessed or been offered data — that is, HR teams or workforce planning or even workplace designers,” McClelland said.

“People and the workforce infrastructure are the biggest cost for many businesses and workplaces. For example, the cost of each workstation per year in a Class A building can range across \$10–25K. So, if you have more workstations than you need it’s not an efficient spend. For the first time organisations can gain data on workstation use — how often, what days, what time of the day and movements around the station. Plus, the CO₂ levels, temperature and humidity at the workstation, which are important wellbeing factors.”

When early designs for Synchronesh attracted government eyes, a federal government accelerator grant for \$1 million followed.

It has since grown into an easily implemented and scalable system, appearing in smart buildings around the world.

“It has to be simple,” Blum said. “Simple to install, simple to configure, no troubles in maintenance — those factors are designed into both the way we handle wireless connections, to the way we configure and set it up. We make it very, very easy.

“There are wireless technologies out there that can service a small area, but really what you want is something that is ubiquitous and just works. Synchronesh is designed to scale up to entire floors and entire buildings.”

Far from offering mere functional features, a smart building also has the ability to not just enhance employee wellbeing, but also reduce its carbon footprint. International Energy Agency research shows that the combined buildings and buildings construction sectors are responsible for 36% of global final energy consumption and nearly 40% of total direct and indirect CO₂ emissions. Digitalisation of buildings is a critical element to overcoming this significant issue for owners and the community.

This was a pivotal concept when Schneider Electric technology played a large role in the design of The Edge in Amsterdam. Dubbed the ‘smartest building in the world’, The Edge is a net zero-energy building — it generates more solar power than it uses — and features functions to enhance employee wellbeing. The building can recognise your car when you drive up and direct you to a parking spot and then set your preferred room temperature and lighting as you enter the meeting room it has booked for you.

“Human beings weren’t designed to live indoors,” Blum said. “But we spend most of our waking hours in these buildings. Our bodies are attuned to natural light rhythms, but we’re subjected to non-natural lighting.

“By tracking movement and producing heat maps of where people are, you make sure that you’re only cooling, heating and ventilating where people are, not where it’s empty, and adjusting lighting to make the built environment match our circadian rhythms — the better we feel, the better our mood. Wellness, energy and utilities for the people within, it happens through connectedness.

“Our vision is to make every building a smart building,” Blum said. “It’s not just about the top, shiny glass, grade-A buildings; it’s about every building. It’s about creating an IoT, scalable system that will grow in the future.”

Thankfully, building designers are now combining simple use OT (operational technology) with IT to create a smart system that connects and exists between the two. That said, we’re still in the very early days of this growth, which some would say is the most opportune time to design and create the workplace of the future.

“If you’re a tenant, a building owner or a developer, you need to be really careful about the fit-out you’re doing,” McClelland said.

“You need to ensure it’s not going to get ripped out and replaced in a couple of years. If you’re smart you can futureproof your asset for many years to come — through your IP backbone, down to the types of sensors you install now.”

For the team at Cognian, the growth of Synchronesh throughout the world will improve workplaces to nurture happier, healthier and more productive employees.

At Schneider Electric, Gavin McClelland said the smart building team is focusing on educating developers, architects, system integrators and contractors on what out-of-the-box technology is on offer today, so their mindset is focused on developing Australia’s and New Zealand’s next generation of smart workplaces.

For more information on Schneider Electric’s smart building solutions, visit se.com/au/buildings.

JUDGING SLUDGE

A trial study of sensor-based technology at Unitywater's Kenilworth Sewage Treatment Plant has revealed an accurate, time- and cost-saving method to measure sludge.

Effective measurement of in-situ sludge is key in the operation and maintenance of waste stabilisation ponds in sewage treatment plants (STPs). Although pond-based systems provide robust treatment, they are associated with a large carbon footprint, effluent volume and sludge build-up, requiring effective monitoring to maintain operational efficiency.

The process of sludge formation and its rafting at the base of stabilisation ponds is not well understood and is often difficult to predict. Plant operators often find themselves in a 'blind spot' as its occurrence is invisible, well below the pond water surface. While the accumulation of sludge is a slow process, efforts to remove the accumulated sludge are time consuming. De-sludging is an expensive, messy process that can lead to lengthy disruptions of the process treatment. The rate of sludge accumulation and volumetric measurements are therefore essential from a maintenance and budget perspective.

Despite the existence of several methods to measure sludge, such as use of a 'Sludge Judge', effective monitoring is time consuming and can yield inconsistent results.

Kenilworth STP trial

In October 2018, Kenilworth STP — a small-capacity Unitywater site in the Sunshine Coast hinterland — conducted a sludge survey to improve the efficiency and accuracy of sludge measurements, which were hoped to result in operational benefits and assist in the decision-making process on the timing of sludge removal.

The project trialled sensor-based technology using Cerlic's Multitracker and Blanko, an optical sensor designed to measure suspended solids, temperature and sludge blanket level.

Kenilworth STP's passive treatment stream utilises three ponds (two facultative ponds and a maturation pond) operated in series, with the resulting effluent applied to land cultivation of Vetiver grass.

The ponds were desludged and re-lined in October 2010, with approximately 6600 m³ of sludge removed at a cost of \$540,000 (inflated to 2018). Significant discrepancies were apparent between the surveyed sludge volume and actual volume removed (38% increase).



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Given the discrepancies in sludge volumetric measurements, as well as inefficiencies associated with the physical measurements, Unitywater was keen to trial the sensor-based technology.

Sensor-based sludge measurement

Using Cerlic's Multitracker and Blanco Sensor, a profile of mixed liquor suspended solids (MLSS) was logged versus pond depth. Two MLSS setpoints were adopted: one for the fluff layer (500 mg/L threshold concentration) and another for the top of the sludge blanket (5000 mg/L).

The sludge blanket threshold concentration was considered most important in the trial, representing the top of the sludge layer. The lower 'fluff' concentration was generally representative of the water column (usually 200 to 400 mg/L above the sludge blanket).

A maximum depth of 2 m was set to ensure that all the data was captured, with a maximum of 64 data points recorded as the sensor was lowered through the water column. The Multitracker emitted audio and vibration alerts when the two different concentration points were reached, logging depth and concentration values.

Survey methodology

Measurements were taken at even intervals spanning the pond surface, resulting in 78 measurement locations covering about 70% of the pond's 5400 m² surface area. While the distance between survey points was not exact, this was acceptable because curtain anchors provided the only way to geo-reference the survey results using 'ArcGIS' (without GPS coordinates). Each 'zone' between curtain anchors was evenly divided, resulting in grid intervals that were approximately 6–7 m.

The sensor was steadily lowered through the water column at each location until it reached the pond floor. Readings were periodically checked against readings from a 'Sludge Judge' to verify the depth of sludge accumulation and to ensure the digital readings were reliable and accurate.

Trial results

The average sludge accumulation across the survey grid was 340 mm, with the maximum depth of sludge at a single point being recorded at 520 mm. These depths represent sludge with an MLSS concentration above 5000 mg/L.

The average depth of sludge was much higher on the eastern side (428 mm) versus the western side (255 mm) of the pond, which followed the slope of the pond bottom. On average, the sludge depth was equivalent to 26% of the total water column depth, with a maximum of 32% at a single point. This means that the pond is currently at approximately 75% of its hydraulic capacity — a significant reduction in operating/working volume.

The total volume of sludge in the pond was estimated using two different methods:

1. ArcGIS and geographic referencing of the survey locations against the baffle curtain anchors. This made it possible to extrapolate across the entire surface of the lagoon to estimate sludge depth at any given point. Knowing the surface area and depth at all points, ArcGIS was used to estimate the in-situ sludge volume in the maturation pond.
2. The Trapezoidal Rule was used as a spot check to validate the results produced using ArcGIS.

The above methods resulted in two different sludge volumes: 1600 m³ from ArcGIS and 1360 m³ from the Trapezoidal Rule. The discrepancy is likely because the latter method does not take into account extrapolation of data points outside of the survey grid such as pond embankments and slope, which resulted in the estimated sludge volume being lower.

The rate of sludge accumulation, since late 2010, was estimated as ranging between 31–37 mm/year averaged across the pond surface area.

Key messages

The trial study found that the pond was experiencing a 25% reduction in its operational capacity due to sludge accumulation over an eight-year period. The rate of accumulation was on par with expectations (25–50 mm/year) but the variance in the sludge distribution pattern was not anticipated and was largely attributed to the improper pond geometry. The trial also identified error in the as-built versus in-situ measurements.

The trial highlighted the potential of using sensor-based technology for studying sludge characteristics and settling patterns within maturation ponds. Due to the ease of obtaining MLSS results in a fraction of the time, and the simple testing method involved, it was easy to identify the fluff layer and sludge blanket layer effectively.

The combination of the Multitracker and Blanco provided measurable benefits over physical sampling methods such as 'Sludge Judge,' including highly accurate results with less opportunity for errors, ease of data storage, as well as reduced reliance, time and labour. This is especially true if operators are interested in the stratification of the MLSS concentrations, where the time and cost associated with determining the solids content in the pond becomes significant. Taking 78 samples with high resolution data in an eight-hour period would not be feasible with other methods. It appears the sensor-based technology brings in accuracy to the supervision process.

One foreseeable challenge, however, is determining the necessary resolution of data required to obtain the desired results. This is a particular challenge to STPs with a significantly greater pond surface area to cover — this work is a step in the right direction with results that satisfy time, quality and cost.

Study authors: Cale Maclean, Graduate (Engineering); Anthony Smith, Treatment Plant Operator; Ramraj Kulkarni, Treatment Services Planning Engineer, Unitywater; Jennie Metman, Sales Manager, Control Components; Phil Bolger, Sales Manager, Marcon Agencies.

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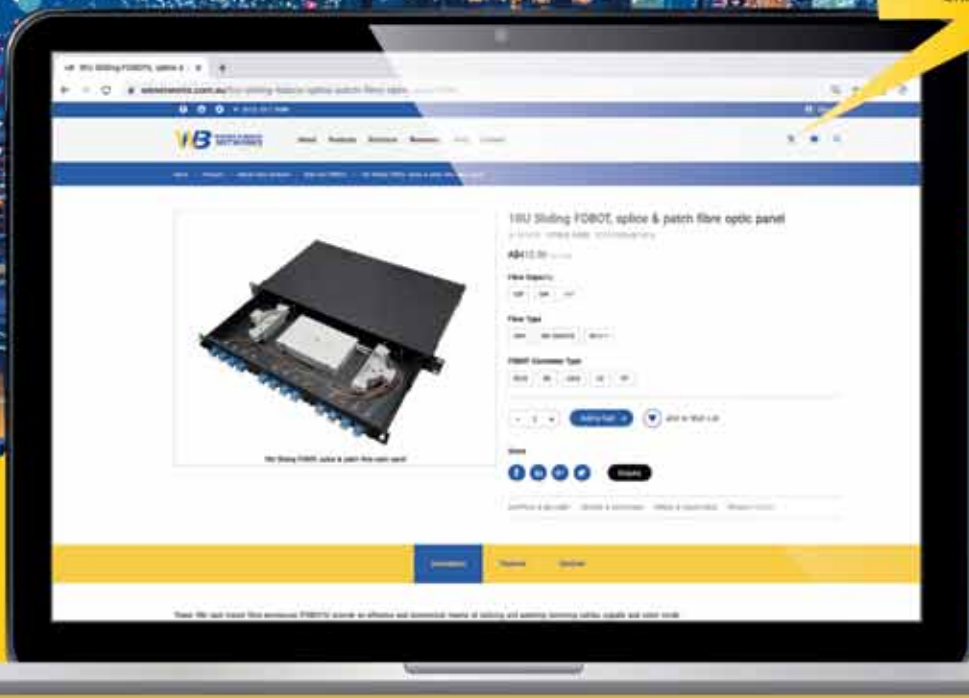


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RISING FROM COAL ASH WASTE TO CURE CONCRETE

A by-product of coal-fired power plants is the tens of millions of tons of coal ash that ends up in landfills each year. Now researchers from Drexel University, the National Institute of Standards and Technology and the University of Antwerp have developed a way to turn this waste ash into a lightweight aggregate that can speed up the curing process for concrete and make it more durable and crack-free. Their discovery was recently reported in the journal *Cement and Concrete Composites*.

Concrete is made from a mixture of fine powder and coarse rock particles, called aggregates, bonded by a mineral glue called a 'cementing matrix' made of cement and water. The aggregates form the strong internal structure of the concrete as the cementing matrix hardens to bind the ingredients together in a process called curing. For concrete to reach its maximum durability, the cement must mix thoroughly with water during the curing process so it all dries — and cures — at the same time.

"This is a very important part of the process because if the concrete dries too quickly during its curing, due to added water shortage, it can form cracks and other flaws. These drying shrinkage cracks cause the surface to be susceptible to aggressive fluid ingress, creating concrete durability problems such as corrosion, salt damage or freeze-thaw damage," said Yaghoob Farnam, PhD, an assistant professor in Drexel's College of Engineering and principle investigator of the research.

To ensure even curing there are a number of things concrete contractors might have to do, including constantly spraying the concrete, covering it with a membrane to keep it moist, submerging it in water or creating pools of water on its surface. All of these strategies consume time and resources and are complex enough that flaws could creep into the process. To help prevent this, in the last decade researchers have developed an internal curing concept that uses porous lightweight aggregate to aid the curing process. The aggregate can maintain a consistent level of moisture inside the concrete to help it cure evenly from the inside out.

"The solution we came up with involved recycling this waste product, coal ash, into a porous, lightweight aggregate with excellent performance characteristics that could be produced at a lower cost than current natural and synthetic options," Farnam said. "This material and process would not only benefit the concrete industry by improving the quality of their products, but it could also help keep coal ash out of landfills."

The material the researchers came up with is called 'spherical porous reactive aggregate' — SPoRA for short. It is made by combining the ash with chemicals that facilitate aggregate sintering and bonding, forming them into tiny spheres and then baking them at 1160°C for a few minutes.

The end product is an aggregate pellet that can hold almost half its weight in water, which is better than traditional lightweight aggregates. And, as importantly, it can release that water at a regular rate from inside to the cementing matrix as it cures.

In the paper they report that two types of SPoRA perform better than some traditional lightweight aggregate materials — shale, clay and slate, and foamed glass — on measurements of shape, porousness, relative weight, and ability to absorb and release water. These are all key metrics related to its ability to integrate with the cement mixture and release its moisture at the right time and in the right part of the structure as it forms.

"As the concrete begins to cure on the outside, the aggregate pellets are also releasing their moisture to help it cure from the inside out as well," said Mohammad Balapour, a doctoral researcher in Farnam's lab and lead author of the paper. "This approach can help to maximise the durability of the concrete. And the SPoRA-making process is simple enough to produce aggregates of any size and water capacity, so we believe it could be used for a number of applications in the construction industry."

Recycling a waste product like coal ash not only reduces the cost of making lightweight aggregate, it also ensures that concrete producers will have access to it.



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The VEGAPULS WL S 61 radar sensor is designed for all simple applications in the water supply and sewage sectors. Featuring a wide range of mounting options, it can be readily integrated into existing infrastructure.

Radar technology offers numerous advantages compared with ultrasonic sensors, which used to be standard in this sector; radar is independent of weather influences, strong sun, wind, fog or rain. In addition, no compensation is needed for variations in the signal transmission time due to air temperature fluctuations. With an accuracy of ± 5 mm, the product covers a wide range of applications.

The sensor is particularly suitable for level and flow measurement in water treatment plants. Its fine focusing enables its use in pumping stations and rainwater overflow basins, for flow measurement in open channels, and for level monitoring.

The sensor's robust housing is wear- and maintenance-free, and its high degree of protection, IP68 (2 bar), also makes it suitable for applications where the sensor may be temporarily submerged. The unit complies with the latest LPR standard (level probing radar) and is approved for open-air use without restrictions or special attachments.

Bluetooth permits wireless operation from a smartphone or tablet (or a PC with PACTware), making commissioning and diagnosis simple. Corresponding display and signal processing units enable the display of measurements and provide the relay outputs needed, for example, to control a pump.



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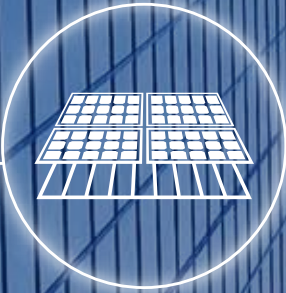
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COULD A NEW BATTERY CONCEPT REPLACE LITHIUM ION?

An aluminium battery with twice the energy density as previous versions, and potential for large-scale applications such as storage of solar and wind energy, is being developed by researchers from Chalmers University of Technology, Sweden, and the National Institute of Chemistry, Slovenia. Compared with today's lithium-ion batteries, the new concept could result in markedly lower production costs and environmental impacts.

The most energy-dense batteries currently available contain lithium. But lithium is expensive, and it is expected to become even more so, with growing demand leading to scarcity. Furthermore, lithium-ion batteries often contain cobalt, which is mined under dangerous working conditions and can fuel conflicts in the countries where it is extracted. Studies at Chalmers are aiming to develop more sustainable energy storage alternatives.

"The material costs and environmental impacts that we envisage from our new concept are much lower than what we see today, making them feasible for large-scale usage, such as solar cell parks or storage of wind energy, for example," said Patrik Johansson, Professor at the Department of Physics at Chalmers.

"Additionally, our new battery concept has twice the energy density compared with the aluminium batteries that are 'state of the art' today."

Previous designs for aluminium batteries have used aluminium as the anode (the negative electrode) — and graphite as the cathode

(the positive electrode). But graphite provides too low an energy content to create battery cells with enough performance to be useful.

In the new concept, graphite has been replaced by an organic, nanostructured cathode made of the carbon-based molecule anthraquinone, which has been extensively developed by Jan Bitenc of the National Institute of Chemistry in Slovenia. The results are published in the journal *Energy Storage Materials*.

An organic molecule in the cathode material enables storage of positive charge-carriers from the electrolyte — the solution in which ions move between the electrodes — which makes higher energy density possible.

"Because the new cathode material makes it possible to use a more appropriate charge-carrier, the batteries can make better usage of aluminium's potential," said Chalmers researcher Niklas Lindahl.

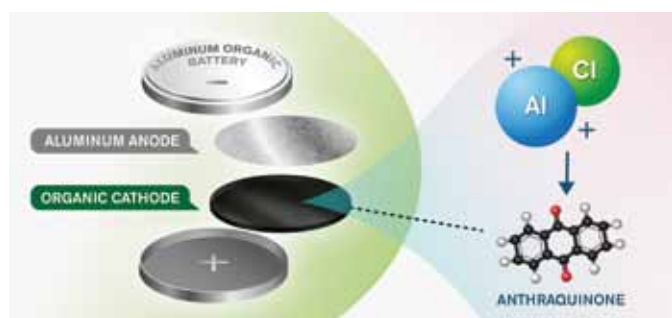
"Now, we are continuing the work by looking for an even better electrolyte. The current version contains chlorine — we want to get rid of that."

Aluminium batteries are currently not commercially available — even in the research world they are relatively new. The question is, could aluminium batteries eventually replace lithium-ion batteries?

"Of course, we hope that they can," Johansson said. "But above all, they can be complementary, ensuring that lithium-ion batteries are only used where strictly necessary."

"So far, aluminium batteries are only half as energy dense as lithium-ion batteries, but our long-term goal is to achieve the same energy density."

"There remains work to do with the electrolyte, and with developing better charging mechanisms, but aluminium is in principle a significantly better charge carrier than lithium, since it is multivalent — which means every ion 'compensates' for several electrons. Furthermore, the batteries have the potential to be significantly less environmentally harmful," he said.



The battery concept consists of an anode and cathode made of aluminium and an anthraquinone-based organic material.



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