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WORDS FROM THE EDITOR

While most of us are still sorting our household waste into recycling bins, a University of NSW study has revealed that over 65% of us now believe our recycling ends up in landfill. The survey also found that over 72% of people would recycle more if the material was reliably recycled.

But how can the public's trust be regained after all the negative news associated with China's ban on accepting our recyclables?

There are certainly many ideas on how waste can be upcycled, and technologies available for improving recycling and converting waste to energy — many featuring in this issue. However, David Singh from Re.Group believes that we need to educate the public about the challenges being faced and make them realise that recycling is a resource shared between the community, governments and industry. Read more about his thoughts of moving to a re-usable society on page 6.

And as I'm sure all the Collingwood fans are still getting over the AFL grand final, we try to cheer them up by taking a look at how some sporting venues are turning to technology for sustainable results.

This issue also explores the smarter and more autonomous future for cities in the lead-up to Smart Cities Week.

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A 're-usable society' is just as important as a recycling one

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> **To survive in the medium to long term, recycling businesses need to move away from competing predominantly on price.**

We read with concern about man-made climate change and plastic waste that has formed a 1.6 million km^2 Great Pacific Garbage Patch between Hawaii and California.

However, practical action to help the environment stops for many of us on bin night. We venture out during the week (or once just before bin collection!) to drop plastic, paper, glass and aluminium waste into a yellow receptacle.

We do not consider what happens to that waste once it's picked up from kerbside bins.

Understanding the recycling challenge

At Re.Group, we believe the community needs to understand how the recycling sector operates and the challenges it faces.

This increased knowledge will help people to realise that recycling is a resource shared between the community, governments and industry. Only a mature, collaborative approach between all these groups will ensure the industry's long-term survival.

Businesses in the sector are struggling to invest in new technologies to improve recycling quality and value.

However, there is no shortage of innovation in the sector. Our senior leadership team recently visited IFAT — a trade fair for the water, sewage, waste and raw materials management sector — in Europe to review the latest developments.

At sessions and resource recovery facilities, we saw developments such as robotic sorters that can be deployed into quality assurance roles and new screens that can sort materials by size, shape and density.

Unfortunately, this new equipment costs money — and most recycling businesses are facing difficult trading conditions.

The era of robust global demand — powered primarily by China — has ended. Similar conditions are unlikely to return in the near future.

To survive in the medium to long term, recycling businesses need to move away from competing predominantly on price.

A price-based approach may have worked when nearly all recovered materials were saleable. However, in today's market, businesses face pressure to continue investing while accepting lower prices for end products.

This pressure comes from the need to improve the quality of materials processing so businesses can move up the value chain.

Overcoming the conundrum

So how do businesses address the conundrum of investing to deliver higher quality feedstocks (the raw materials used to manufacture products) that kick-start local remanufacturing options, while facing reduced cash flows?

We believe the answer lies in redefining the value equation for the recycling sector.

A more rational value equation can underpin a strategy that guarantees the long-term sustainability and performance of the recycling sector.

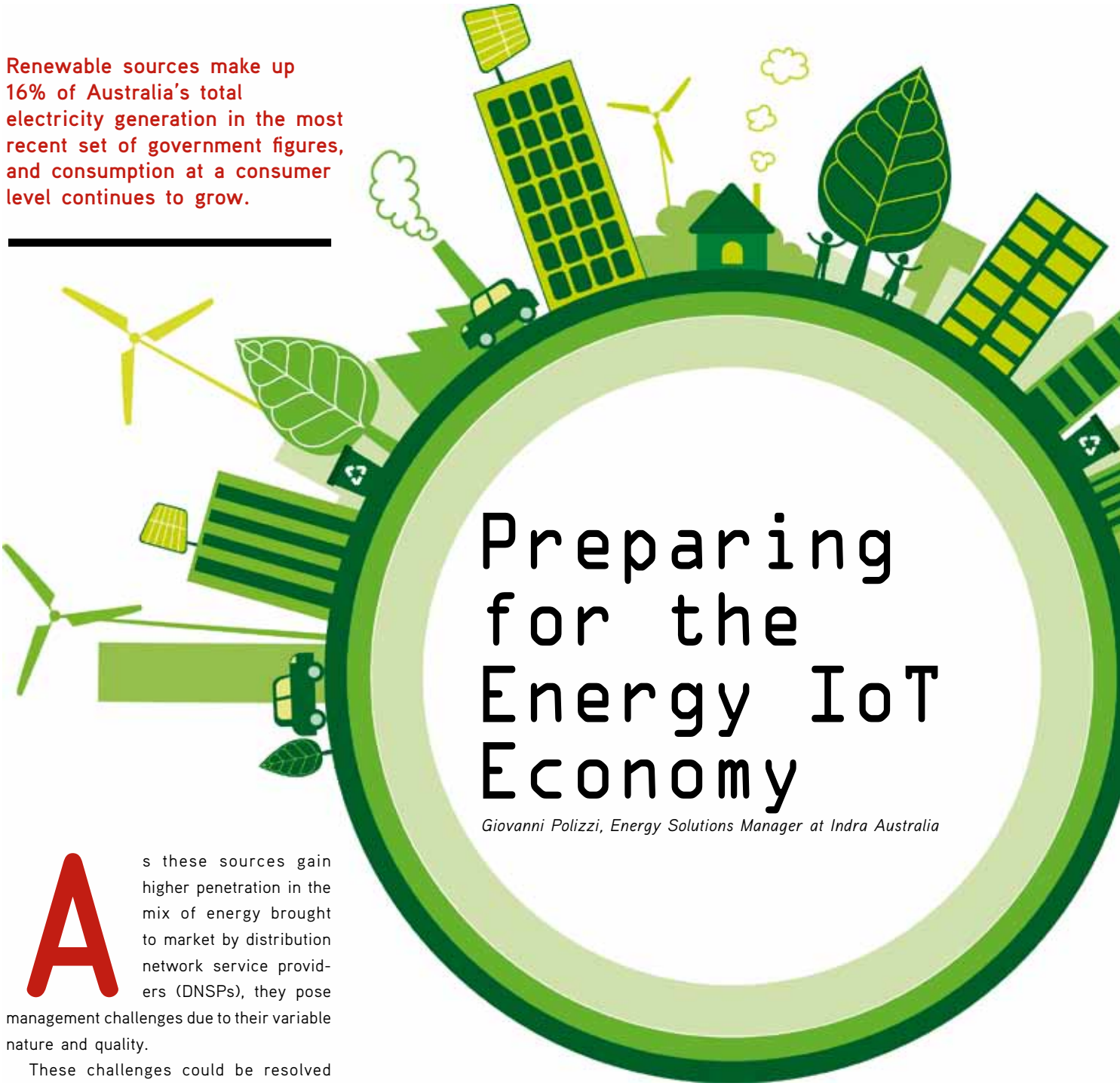
For example, the strategy needs to ensure processing fees reflect new market realities and ensure recycling businesses can continue to provide valuable services to the community.

This strategy should be developed — and owned — by government, industry and the community.

For Australians, this means coming to grips with the fact practical action to save the environment does not stop at dropping yesterday's empty milk carton into our yellow bin. It means supporting a sector that helps society re-use rather than dispose of resources that become waste.

David Singh is Chairman of Global Renewables and Managing Director of Re.Group. Singh is an industry veteran with over 18 years' experience in the waste recycling industry in Australia, the UK and Asia. In addition, he sits on the boards of the Australian Council of Recycling and Sustainable Business Australia.

Renewable sources make up 16% of Australia's total electricity generation in the most recent set of government figures, and consumption at a consumer level continues to grow.



Preparing for the Energy IoT Economy

Giovanni Polizzi, Energy Solutions Manager at Indra Australia

As these sources gain higher penetration in the mix of energy brought to market by distribution network service providers (DNSPs), they pose management challenges due to their variable nature and quality.

These challenges could be resolved by making it less difficult and costly for providers to capture data from renewable sources and bring it into traditional systems to properly understand how it is impacting their networks.

By combining Internet of Things (IoT), cloud computing and artificial intelligence (AI) technologies, renewable energy is becoming a more manageable and economically feasible input for the energy industry.

The business impact of IoT

IoT can be used to monitor any kind of connected asset with different levels of detail. Whether it is an inverter, a room's temperature, a current, an open door or the intensity of light, IoT is able to capture that information and make it available to other systems.

What in the past had to be wired to be monitored can now be connected to a relatively cheap IoT device, which not only will broadcast that data but can also process it locally to create actionable insight.

Setting alarms directly on electricity-generating or -consuming assets dramatically reduces the amount of data sent to a centralised system, and thus the cost of data transmission.

This is immediately allowing distributors and utilities to evolve their processes — in this instance, allowing them to get a better lid on the status and quality of power from renewable generation assets in the field.

In the mid-term, we will see new services and products emerge based on needs identified from these large volumes of data.

Eventually, anything we centrally control now — networks, buildings, manufacturing, industrial processes and so on — will be managed by hybrid systems, balancing actions taken by a central monitoring function and others taken where the asset is physically located using IoT. AI will increase that trend by allowing IoT systems to do much more 'on their own' without the influence of a centralised application or team.

Renewable generation assets could, in future, intelligently and dynamically adapt their regulation and management much more than what they are doing now.

> By combining Internet of Things (IoT), cloud computing and artificial intelligence (AI) technologies, renewable energy is becoming a more manageable and economically feasible input for the energy industry.

Different speeds

The energy sector is very broad and IoT is being implemented at different speeds.

Asset management is an obvious early candidate for IoT use. But while IoT has created the perfect conditions for much more thorough asset analysis to take place, work is required to achieve that vision.

Some fields such as power distribution networks still have a long way to go, as their assets are generally dispersed and installing IoT devices on them requires significant labour.

Additionally, the sector is very traditional when it comes to control systems, and these may no longer be up to scratch.

Existing systems are scoped to centrally manage data coming from a limited number of distributed measuring points. As those data collection points multiply with IoT devices and sensors, existing systems won't keep up. The logic and the architecture with which they were built was not designed with IoT in mind.

IoT will have most success when it becomes a core component of business processes. Importantly, it will make these core processes adaptable and aligned to customers' needs, changing dynamically as things occur.

Live experiments

Utilities supplying gas and water are already experimenting with IoT, and there are some very interesting solutions to reduce costs of asset inspection and increase the spectrum of monitoring, even if the vision of reshaping business processes through the extensive use of IoT is not there yet.

Electricity retailers are also moving really fast in trying new solutions and many attempts have been trialled especially in demand response or energy management, but the business model remains unclear and customers are yet to see a lot of value in IoT.

The best opportunity for a massive deployment of IoT appears to be offering it to customers as part of new services.

Can an industrial customer be advised on a more efficient use of energy once IoT is able to crosscheck their consumption data with production processes?

Can a manufacturing site be helped in scheduling the production cycles according to expected electricity prices?

Can the algorithms running over IoT gateways spot a faulty compressor, a leak in a pipe, an open coolroom door or unauthorised access to a property?

These are just some of the possibilities that are currently being explored.

Supporting innovation

IoT will be much more pervasive five years from now. Organisations will include IoT in the implementation of innovation, whereas today it is often part of a strategy but not necessarily in production in any great amount.

The consensus is that IoT will play a big part in the operation of the energy sector, but it will not be alone. The use of AI will increase in parallel to leverage this new data and reduce the time to act.

Start-ups will continue to drive some of the innovation in IoT, but scaling up these solutions to the large volumes required by the industry will require investments, partners and resources that a start-up may struggle to achieve. This is where the support of more traditional systems integrators that provide technological platforms of an enterprise-grade robustness and manageability will be important.

When an organisation is relying on hundreds of thousands of IoT devices to run their business, having a fine control over the functions performed by every device, the algorithms running and a robust cybersecurity framework also becomes essential to provide effective and secure services, and monitor functions and software maintenance. Additionally, it is of paramount importance relying on open source technology and market standards, because the IoT applications are ever growing in breadth and complexity and will require an ecosystem of providers to continuously keep updated the offer of solutions to customers.

Bringing all these ingredients together will ensure that the powerful use cases being marketed to industry are as robust in practice as they are being presented, and can start to generate real value.

Indra

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IoT AS A SERVICE

The best opportunity for a massive deployment of IoT appears to be offering it to customers as part of new services.

- Can an industrial customer be advised on a more efficient use of energy once IoT is able to crosscheck their consumption data with production processes?
- Can a manufacturing site be helped in scheduling the production cycles according to expected electricity prices?
- Can the algorithms running over IoT gateways spot a faulty compressor, a leak in a pipe, an open coolroom door or unauthorised access to a property?

Sawmill residue could be turned into renewable diesel

The Australian Renewable Energy Agency (ARENA) has announced up to $500,000 in funding for Boral Timber, a subsidiary of construction company Boral Limited, to investigate the feasibility of building a 'second-generation' biofuels refinery using the waste sawmill residues from the Boral Timber Hardwood Sawmill at Herons Creek, near Port Macquarie on the Mid North Coast of NSW.

Under the $1.2 million study, Boral will explore the technical and financial viability of establishing a biorefinery using innovative technology, which would be located near the Herons Creek sawmill. The study will consider a mechanical catalytic conversion technology, developed by Spanish-based Global Ecofuel Solutions SL, combined with the potential biorefinery at Herons Creek and will be the first time the process would be used in a production-scale facility.

The sawmill's residue — which includes sawdust, remnant woodchips, shavings and offcuts — is currently used for lower value uses such as landscaping and boiler fuel. If the study is successful, the proposed biorefinery — which would cost an estimated $50 million to build — could convert up to 50,000 tonnes of waste sawmill residue produced each year into transport-grade renewable diesel and bitumen.

Boral is one of the largest consumers of bitumen and has one of the largest truck fleets in Australia, using approximately 100 million litres of diesel each year. Wayne Manners, Boral's Executive General Manager (Building Products), said the transport-grade renewable diesel produced at the potential new biorefinery could eventually account for up to 15% of the company's annual diesel needs.

"The application of this technology has the potential to transform the way we use low-value hardwood sawmill residues into a resource that could be highly valuable not just to Boral but to the industry more generally," he said.

ARENA CEO Ivor Frischknecht agreed, noting, "The transport sector is a significant user of energy in Australia, with liquid fuels a key long-term energy source for heavy-vehicle road and air transport since they cannot readily be electrified.

"Bioenergy comprises a growing proportion of Australia's energy mix, and this new technology could see residue from the production process be used to reduce Boral's reliance on diesel and bitumen derived from fossil fuels," said Frischknecht.

The news has also been welcomed by Bioenergy Australia, which noted that biofuels production results in significant positive impacts on the environment, reduced health impacts through reducing air particulate matter, increased jobs through regional development and enhanced fuel security through reduced reliance on imported fuels. With Australia currently lagging well behind other nations in production of biofuels, the company believes that a local biofuels industry could create over 8000 direct and indirect jobs, contribute over 1.1 billion annually to regional communities and reduce particulate matter in our air by 26%.

"If this groundbreaking technology is successful, we hope to see a transition to similar biorefineries by other companies which have a waste stream in forestry or agriculture," said Frischknecht.

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Stormwater recycling scheme gets underway in Sydney

One of Australia's largest urban stormwater recycling scheme has been switched on in the City of Sydney's newest town centre, Green Square, enabling thousands of residents to save tens of thousands of litres of precious drinking water.

Up to 320 million litres of polluted stormwater will be diverted from waterways each year as part of the $8 million scheme, before being treated and piped directly into residential, commercial and community buildings. Up to 900,000 litres of treated stormwater will be provided daily for use in washing machines, to flush toilets, and in parks and gardens.

"Once this scheme is up and running, we expect the area's consumption of drinking water will be reduced by half — a significant saving during this current drought," Lord Mayor Clover Moore said.

"Not only will we be saving water, but reducing costs as well — it's expected water bills will be cut for residents and businesses by 10 cents a kilolitre.

Positioned above a major stormwater flow path, the Green Square town centre is an ideal location for a recycled stormwater scheme. Stormwater will be harvested from the 2 km drain that runs underground from Epsom Road in Zetland to Alexandra Canal and pumped into a treatment plant at the former South Sydney Hospital site on Joynton Avenue.

The water will be treated by a combination of high-tech 'ultrafiltration', which removes solids and pathogens, and 'reverse osmosis', which reduces its salt concentration, before being sent to two 500,000-litre underground storage tanks. From there, the recycled water will be distributed around the town centre via a network of purpose-built purple pipes.

The scheme has been built by Flow Systems and will be operated by Green Square Water. Existing residential and City-owned buildings are already connected to the scheme, and new buildings throughout the area will be connected as they are completed.

"Growing populations and high-density living calls for an increased demand for water, not only to drink but to flush toilets, wash clothes, water gardens and irrigate parks," Moore noted.

"By treating polluted water so it can be used again, we are able to conserve our previous water supplies and prevent polluted water from flowing into our waterways.

"As well as providing recycled water to our community and cultural precinct, and the City West affordable housing development, residential buildings will also be connected to the network — which means for the first time in Australia, residents will be able to move into their new apartments and use recycled stormwater from their taps.

"It's a win-win for the community and the environment — combating the effects of our changing climate, improving stormwater quality across our city and helping residents and businesses manage water prices."

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New nanofilter rapidly cleans dirty water

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Australian researchers have designed a nanofilter that can clean dirty water over 100 times faster than current technology, filtering both heavy metals and oils at an impressive speed.

Simple to make and to scale up, the technology harnesses naturally occurring nanostructures that grow on liquid metals. It has been described in the journal *Advanced Functional Materials*.

Led by RMIT University, the research team began by creating an alloy by combining gallium-based liquid metals with aluminium. When this alloy is exposed to water, nanothin sheets of aluminium oxide compounds grow naturally on the surface.

These atomically thin layers — 100,000 times thinner than a human hair — restack in a wrinkled fashion, making them highly porous. This enables water to pass through rapidly while the aluminium oxide compound absorbs the contaminants.

Experiments showed the nanofilter made of stacked atomically thin sheets was efficient at removing lead from water that had been contaminated at over 13 times safe drinking levels, and was highly effective in separating oil from water. The process generates no waste and requires just aluminium and water, with the liquid metals re-used for each new batch of nanostructures.

"Our new nanofilter is sustainable, environmentally friendly, scalable and low cost," said RMIT researcher Dr Ali Zavabeti.

"We've shown it works to remove lead and oil from water but we also know it has potential to target other common contaminants.

"Previous research has already shown the materials we used are effective in absorbing contaminants like mercury, sulfates and phosphates."

Project leader Professor Kourosh Kalantar-zadeh, an Honorary Professor at RMIT and Professor of Chemical Engineering at UNSW, said the liquid metal chemistry used in the process enables differently shaped nanostructures to be grown, either as the atomically thin sheets used for the nanofilter or as nanofibrous structures.

"Growing these materials conventionally is power intensive, requires high temperatures, extensive processing times and uses toxic metals," he said.

"Liquid metal chemistry avoids all these issues so it's an outstanding alternative."

These different shapes have different characteristics — the ultrathin sheets used in the nanofilter experiments have high mechanical stiffness, while the nanofibres are highly translucent. The ability to grow materials with different characteristics offers opportunities to tailor the shapes to enhance their different properties for applications in electronics, membranes, optics and catalysis.

"The technique is potentially of significant industrial value, since it can be readily upscaled, the liquid metal can be re-used and the process requires only short reaction times and low temperatures," Dr Zavabeti said.

"With further development and commercial support, this new nanofilter could be a cheap and ultrafast solution to the problem of dirty water."

RMIT University

www.rmit.edu.au

A liquid metal droplet with flakes of aluminium oxide compounds grown on its surface. Each 0.03 mm flake is made up of about 20,000 nanosheets stacked together.

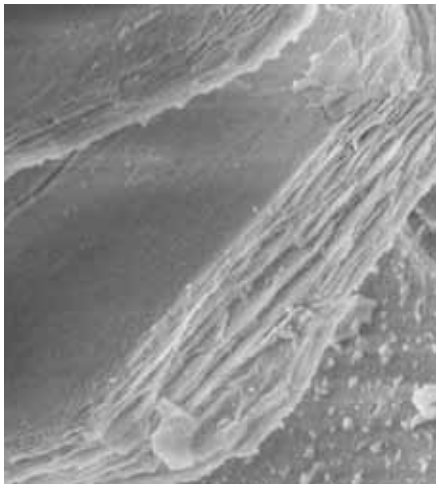


Image credit: RMIT University.

Microscope image of nanosheets, magnified over 11,900 times.

AERATION SYSTEMS

The 'bank-mounted' Venturi-Aerators are designed to minimise risks associated with the aeration of ponds and lagoons without reducing performance.

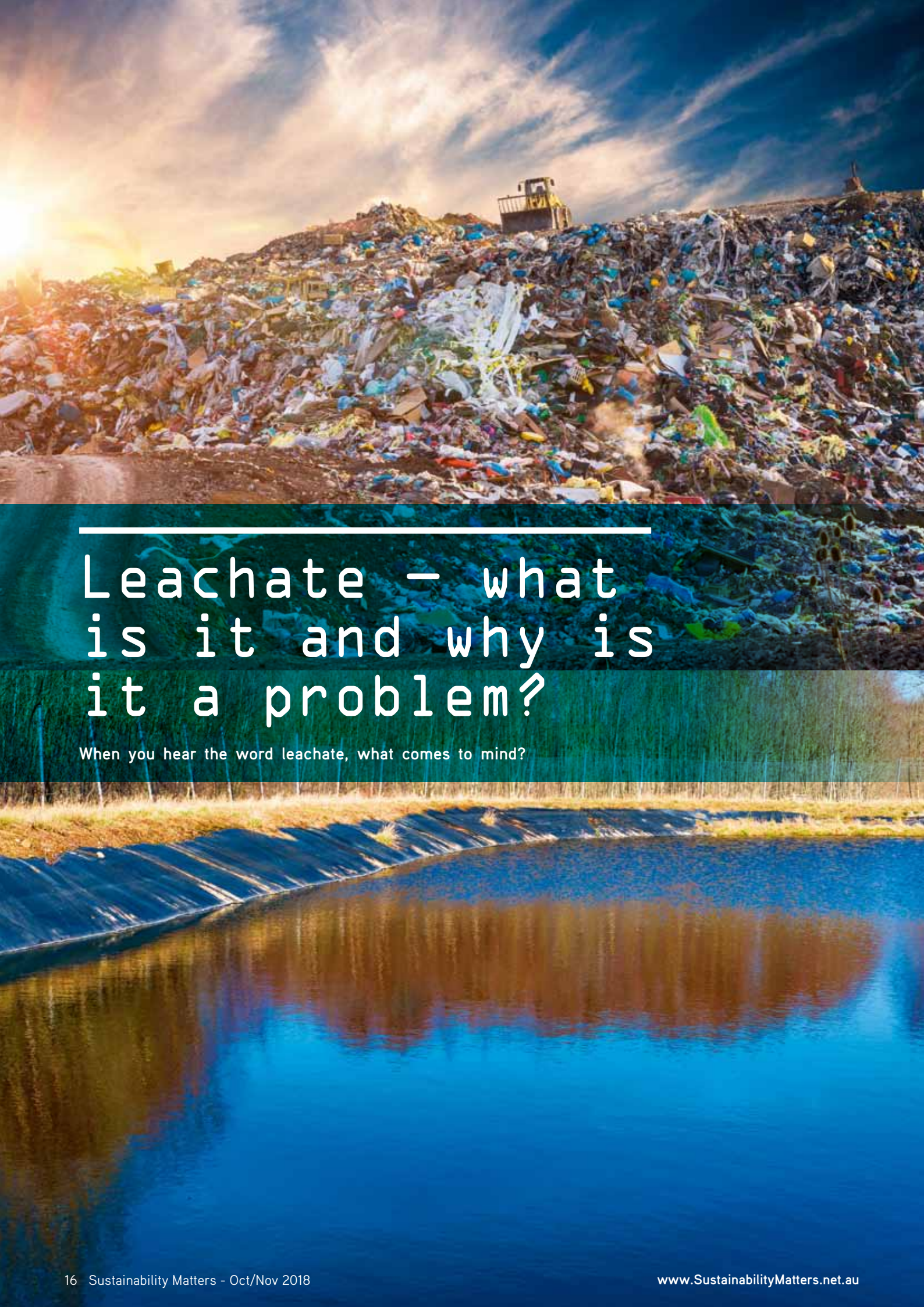
During maintenance and servicing, 'surface-mounted' aerators need to be accessed via floating walkways or some kind of vessel, which require operators to work over water. Alternatively, the aeration devices may need to be lifted out by the use of cranes or other lifting apparatus.

Venturi-Aerators are powered by Gorman-Rupp self-priming centrifugal pumps, so they can be mounted on the banks of the lagoons. This means that operators can perform all required servicing and maintenance without having to work over water, work at heights or work with heavy swinging weights.

The bank-mounted aerators have been tested to produce as much as 1.86 kg/kW of oxygen transferred per kW per hour.

Maintenance of the units is simple and convenient so minor issues can be addressed before they become problems. With no moving parts in the aerator, one operator can safely adjust clearances in minutes and check and adjust seal and bearing oil levels quickly and easily.

Hydro Innovations
www.hydroinnovations.com.au



Leachate – what is it and why is it a problem?

When you hear the word leachate, what comes to mind?

Many, perhaps, would imagine a small polluted stream of water. Others might immediately think of landfills and the problems caused by the unsustainable disposal of waste material for decades.

The latter, of course, is correct while the polluted stream may be true sometimes. Leachate is the term used for any liquid produced by the action of 'leaching'. Leachate is the water that has percolated through any permeable material.

Government data suggests that there are around 500 officially registered landfill sites in Australia and although the number is declining, the average size of the landfill site is increasing. Approximately 75% of garbage in Australia goes to just 38 sites.

Thankfully, we are reducing our reliance on landfills, partly by recycling as much as we can and focusing more on the sustainable use of anaerobic digestion plants that are converting our waste to energy. We are also reducing the number of non-biodegradable products that we use. Coles and Woolworths implementing a ban on disposable plastic bags recently is one example of Australia's commitment to protecting our environment.

Released in 2016, the second edition of the NSW Environmental Protection Authority's 'Environmental Guidelines: Solid waste landfills' requires that (among many other regulations) all landfills are to have a leachate barrier to contain leachate and prevent the contamination of surface water and groundwater over the life of the landfill. However, even if all landfills met these requirements, leachate from old landfills still needs addressing as the problem lingers for many years.

And it is not only landfills that generate leachate. There are many other problems associated with contaminated land in general. There are numerous sites throughout Australia where developers need to overcome leachate problems caused by historical industrial activity. There are many infamous cases in Sydney alone, where over the last few decades we have had to deal with far more severe pollutants than those found in conventional landfill operations, and there will certainly be a lot more cases in future.

What are the options for handling leachate from landfill sites?

The options available include off-site disposal, discharge to sewers with or, possibly, without pre-treatment, or treatment on-site for environmental disposal or re-use. Off-site disposal is very uncommon due to prohibitive costs unless the landfill is very small.

Discharge to sewers may be possible, depending on the site location and infrastructure availability and capacity. The degree to which leachate has to be treated depends on local trade waste legislation.

Leachate from landfill sites contains a variety of different substances, although by far the most significant contaminant is ammonia. Ammonia and other forms of nitrogen occur naturally in the environment, but concentration levels in leachate are alarming. Decomposition of plant, animal and human waste produces ammonia and many household and industrial cleaning products, including disinfectants, also contain ammonia.

Ammonia levels for discharge to sewers vary across Australia. For example, Sydney Water requires an ammonia concentration of less than 100 mg/L for sewer discharge while Queensland Urban Utilities set 200 mg/L as a more lenient upper limit. However, with ammonia often present in concentrations in excess of 1000 mg/L in landfill leachate, discharging leachate to sewers will almost certainly require some form of pre-treatment anywhere in Australia.

Naturally, discharging into the environment has far more stringent requirements. Due to ammonia's environmental effects, discharge concentrations are very low. In fact, 0.3 mg/L for fresh water and 0.5 mg/L for marine waters are the trigger levels established by the Australian and New Zealand Environment and Conservation Council (ANZECC).

What leachate treatment methods are available?

Ammonia concentrations in leachate can be reduced by air stripping, chemical treatment or biological processes.

Air stripping is not common practice as stripping towers are expensive with high operating costs due to high alkalinity, strong buffering and the need for large volumes of alkali to enable the process to work. Air stripping also releases large quantities of ammonia into the air resulting in air pollution, which is another major concern.

> **Leachate is the term used for any liquid produced by the action of 'leaching'.**

Work and research has also been conducted on chemical precipitation with some success and, although sewer discharge limits may be achievable with this method, operational costs are also high.

Biological processes are the preferred means of treatment of leachate and there are several types of aerobic biological processes that can be adapted for ammonia removal: mixed bed biological reactors (MBBR), membrane bioreactors (MBR), activated sludge, various fixed film media processes and sequential biological reactors (SBR). The preferred option generally comes down to cost, space requirements or simply personal choice.

Hydroflux has extensive experience in treating wastewater sources containing high ammonia loads and is an expert in the fields of design, construction and operation of many different types of wastewater treatment plants.

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Solar cell efficiency increased using microwaves

In a world in need of cheaper, more sustainable energy solutions, a simple and fast microwave experiment with the chemical element phosphorus has opened the door to more affordable and effective super-thin solar cells.

Flinders University nanotechnology researchers made flakes of phosphorene, a 2D form of phosphorus only a few atoms thick, in the hope of boosting the energy capacity of dye-sensitised solar cells (DSSC) — an emerging field of thin-film, semi-flexible and semi-transparent solar cells which are simple to make but limited by quite costly components such as platinum and ruthenium. Sheets and flakes of this phosphorus, just a few billionths of a metre thick, could improve the efficiency of this and other types of photovoltaic cells, the research team claims.

Solar cells based on carbon nanotubes and silicon promise a cheaper and easier-to-manufacture alternative to crystalline silicon cells. However, one challenge with these new solar cells is to boost their ability to effectively convert sunlight into electricity.

One approach is to include a layer of ultrathin nanoflakes of phosphorene, with the researchers hopeful that phosphorene has all the right properties to make it suitable for increasing solar cell efficiency. They prepared their phosphorene by immersing phosphorus in a special liquid and exposing it to microwaves for 10 minutes — in contrast to previous protocols involving 15 hours of heating.

In a study published in the journal *Angewandte Chemie*, the team used the phosphorene to fabricate DSSC, which showed photovoltaic efficiency of 8.31% — outperforming expensive platinum-based cells and thus potentially removing the need to include their most costly component.

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In a second study, published in *Advanced Function Materials*, the team again used the microwave method to make phosphorene flakes and then added them to carbon nanotube–silicon solar cells to show a significant improvement in the cells' power conversion.

A third study, published in *Small Methods*, showed that the team's suspended phosphorus sheets showed good stability, while samples dispersed onto silicon from the suspensions exhibited low oxidation levels after several days in ambient conditions.

"With these promising early results, further studies with the microwave technique and other solvents will help improve stability and durability of phosphorene and allow us to look at ways to produce larger amounts of phosphorene for possible commercial applications," said Dr Christopher Gibson, a co-author on all three studies.

Flinders University
www.flinders.edu.au

Nanocrystals convert solar energy into hydrogen

Australian researchers led by Curtin University have developed a low-cost and environmentally friendly method to harvest energy from sunlight, using tiny nanocrystals as highly efficient catalysts to generate solar energy for the production of clean fuels such as hydrogen. Their work has been published in the journal *Advanced Materials*.

"Previously, in order to use catalysts to derive energy from sunlight and transfer it into clean fuels such as hydrogen, we would have had to use cadmium-based semiconductors in combination with expensive noble metals including platinum, iridium and ruthenium," said lead researcher Dr Guohua Jia.

"However, the high toxicity of cadmium and the high cost of noble metals are considerable obstacles to their widespread use."

Dr Jia and his colleagues have now developed a more efficient and greener alternative to use solar energy to produce clean fuels. He said, "Our research invented tiny crystals that do not contain any noble and toxic metals, which can be directly used as environmentally friendly catalysts to convert solar energy into hydrogen.

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"These nanomaterials may be of great interest to the energy industry, as they are made from cheap and near-abundant elements and offer industries a potential cleaner and cheaper fuel source."

Dr Jia said the new method offers environmental and economic benefits that make it attractive to industry involved in the production of low-cost and low-emission clean hydrogen, which is considered a key fuel in the transition to a low-carbon economy. Hydrogen and other clean fuels can be used to power cars and a range of industrial processes, he said.

Curtin University
www.curtin.edu.au

ONLINE OPTICAL SENSOR

LISA UV is an online optical sensor with measurement technology, using no reagents for measurement of CODeq in discharge water from food industry plants. The sensor also has the capacity to measure UVT (UV Transmissivity), SAC254, TOCeq and BODeq.

While a comparatively low investment, the long-lasting and energy-efficient UV-LED technology is coupled with a robust design to give the sensor years of service. Like all TriOS sensors, LISA uses a hydrophobic nanocoating on the optical windows, which may be combined with compressed air flushing or even automated brush wiper, to achieve low maintenance and long operating times without manual cleaning.

With the latest technology for UVT measurement, LISA UV gives a reliable output to optimise the UV disinfection plants without need of any calibration.

The innovative TriOS G2 interface allows quick and easy integration of the sensor into existing process control systems or an external data logger. With an Ethernet interface (Wi-Fi or LAN) the LISA can easily be configured through any standard web browser on a PC, tablet or smartphone. The sensor can also be used without a local display or controller and connected directly into a PLC or SCADA system with analog (4–20 mA) or digital (Modbus) outputs.

For changing conditions, the optical path length can be modified to suit the application by replacing the lenses, giving the LISA a broad range of detection limits and versatility. Turbidity compensation is automatically carried out within the sensor via a second measuring channel to ensure high accuracy.

Control Components Pty Ltd
www.controlcomponents.com.au

WA apartment building offers peer-to-peer power trading

A sustainable apartment project in White Gum Valley, Western Australia, is said to be the first residential development in the country where residents can trade renewable energy with their neighbours.

Yolk Property Group has partnered with Power Ledger to implement blockchain technology at its Evermore development — powered by solar photovoltaics and lithium battery technology — allowing residents of the 24 apartments to buy and sell solar power amongst themselves. It's the latest in a series of firsts that have been enabled by Yolk Property Group's technology trials at Evermore, according to Yolk Property Group Director Tao Bourton.

"Evermore was the first apartment development for sale in Australia to utilise solar and battery technology in a strata setting and now residents of Evermore will be the first in Australia to take advantage of peer-to-peer renewable energy trading and all of the associated benefits," Bourton said.

"Power Ledger's blockchain technology, paired with the other power-saving initiatives at Evermore, gives residents exceptional control over their power usage and power costs, with residents only paying for the energy they need and onselling excess energy to neighbours, always taking advantage of discounted rates."

It has been forecast the 53.6 kW solar system with 150 kW of battery storage at Evermore will produce approximately 80% of the apartments' power, with residents expected to benefit from a 30% saving on their electricity bills as well as less chance of being affected by fluctuations in energy prices. Power Ledger's blockchain technology will provide the transactive layer for discounted power to then be freely sold between residents, with those using less power able to sell to neighbours requiring more power. Real-time measurement and recording of water and power consumption will further give residents greater control over their energy usage and ensure energy efficiency.

"Through developments like Evermore we are completely changing the way we use energy, delivering a modern, decentralised and low-cost carbon structure that residents can take advantage of," said Power Ledger Co-Founder and Managing Director David Martin.

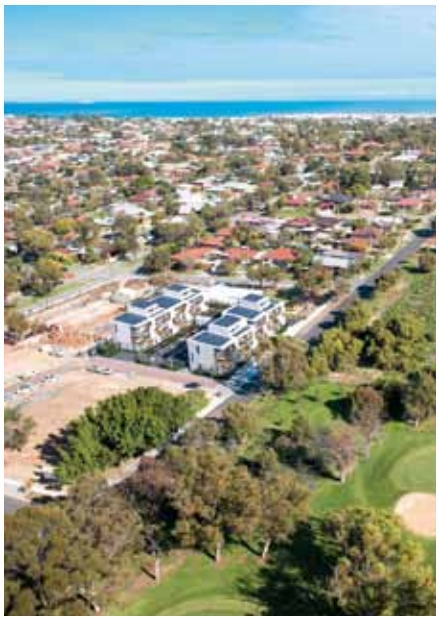
Other development initiatives include:

- real-time measurement and recording of water and power consumption to ensure maximum energy-efficiency;
- a dual-building design to deliver north-facing living spaces and balconies across all apartments, with passive design principles;
- a site-wide bore;
- an electric vehicle charging point;
- communal bicycles and a bicycle repair station;
- a three-bin (general waste, recycling and compost bin) system to divert an expected 60% of waste from landfill;
- communal compost tumblers and a communal vegetable garden.

"By using Power Ledger's energy trading platform, projects like this are paving the way forward for broader consumer access to cheaper energy, as we transition into a new consumer-driven energy demand paradigm."

Bourton said demand for this kind of product is strong, as evidenced by the interest in the project.

"Buyers are getting more discerning — looking for developments that offer more in terms of sustainability, a reduced carbon footprint, genuine cost savings and modern technology. Through this project, we've shown that sustainability and affordability can go hand in hand, delivering an apartment where it is easy, attractive and affordable to lead a sustainable lifestyle," Bourton said.



Evermore comprises 24 apartments powered by cutting-edge solar photovoltaics and lithium battery technology, with the project playing a role in a pilot program at WGV estate, led by Curtin University, examining usage of solar photovoltaics and battery in strata residential developments. The Australian Renewable Energy Agency (ARENA) provided a $280,000 grant to help Yolk Property Group deliver the project.

It is the first apartment development in Western Australia to be recognised by Bioregional Australia as a One Planet Community, making it the fifth One Planet Community in Australia.

Power Ledger
web.powerledger.io

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Getting ready for an

Are property and infrastructure owners ready?:

Stephen Taylor

Whether it's a report on the NSW Government's driverless vehicle trials, dire news about predicted job losses, Elon Musk's latest controversial tweet or someone's utopian vision of free, on-demand transport for all, it seems a day doesn't go by without automated vehicles (AVs) being in the news.

Yet for all the flurry of information on virtually every aspect of driverless technologies, there has been very little discussion about how Australia's major property and infrastructure owners are planning and preparing for AVs on our city's streets and roads.

What impact will AVs have on our cities' built form? In partnership with the Committee for Sydney, Arcadis interviewed some of Sydney's largest private owners of commercial, residential, retail and mixed-use properties, as well as representatives of local and state government. Through this process, we asked participants about their preparedness for the potential impacts of AVs and connected automated vehicles (CAVs) on the built form within our city, as well as what's blocking, what's supporting and what could support better preparedness. We also asked what, in their view, a successful autonomous future would look like. At a conservative estimate, those we interviewed manage assets worth in excess of AU$28 billion.

So, what did we find? Despite 100% of respondents believing that AVs will impact their assets, only 10% currently have a dedicated resource and formal plan in place. If they all know it is going to happen, what is holding the other 90% back?

Within private organisations currently discussing the autonomous future, the strategy to embrace it is being led by the Board (37%) and the C-Suite (45%). While this initially appears positive for organisations, only 26% currently have a business case for change (let alone a dedicated resource), a surprising statistic given 65% of respondents believe their assets will be impacted within 5 to 10 years.

The problem with parking

With 70% of research participants having one or multiple forms of parking infrastructure in their holdings, changes to future parking needs, as the proportion of AVs on our roads increases, loomed large in our discussions. Not surprisingly, most owners anticipate reductions in carparking requirements across asset types, including dedicated street parking, dedicated parking structures in urban areas and parking that serves residential and commercial properties, including major shopping centres.

What form this took was varied and uncertain. What was certain though was the need to rethink how assets are used, with 65% of respondents believing that they will need to repurpose their assets. Furthermore, 20% foresee a combination of 'knock-down/re-build', 'adaptive re-use' and/or 'sell-off'. That is a staggeringly large amount of public and private infrastructure.

The early movers we spoke to were already thinking and building their parking differently; for example, using larger ceilings so it could be transformed into commercial spaces. Some residential property developers were seeking council approval to build below the minimum parking requirements.

Is legislation really in the way?

When looking at this from the outside, it's easy to blame local government regulations for holding back progress; however, this view doesn't look at the full picture. From our respondents, 69% believe there were no legislative barriers in their way to make the changes they will need to make.

While some respondents cited federal and state government legislation — including some aspects of the Australian road rules, the Australian Design Rules, federal and state import legislation and the NSW Passenger Transport

Regulation that will need to be amended to accommodate high-level automated and driverless vehicles — change is well understood by government. For example, the NTC and Transport for NSW are largely aware of these issues — and, in many cases, they are actively seeking to address them, including through consultation, clarifications, new interpretations, and proposed and actual amendments.

In addition, the Australian Government is signatory to an international agreement, administered by the United Nations Economic Commission for Europe (UNECE), which provides a framework for ensuring that Australian Standards for vehicle design align with international standards.

However, in the words of one of our respondents: "We've found the strongest

autonomous future

research report

barriers to preparedness haven't been legislative, but our own capacity to imagine and expand our thinking."

The missing links

In the final stage of our interviews, we asked participants to discuss their perceptions around additional obstacles (ie, those not covered by previous questions) to the successful adoption and implementation of fully autonomous mobility in our cities. In response, many cited public and market acceptance, additional legal and current technological barriers, an absence of clear and visible leadership, and the need for community education and engagement.

A common thread across most interviewees was the legality of owning/driving analogue vehicles. The overwhelming view of respondents was that as long as analogue vehicles are still legal to drive in our cities, there is little incentive to change. The research indicates that we require a 'leaded petrol moment', a date after which the government legislates on analogue vehicles in our cities, such as phasing them out or restricting use.

Where to now?

The challenge now for property and infrastructure owners and governments of all levels is leadership, both individual and collaborative. We must envision the autonomous future we want so we can put the frameworks in place to deliver it.

The Australian and NSW state governments are already moving forward on many fronts. The House of Representatives Standing Committee on Industry, Innovation, Science and Resources has undertaken and handed down its investigation into the 'Social issues relating to land-based automated vehicles in Australia', and the federal government has responded. The NSW Government has passed enabling legislation and is collaborating with industry in real-world trials of Level 4 or 5 driverless technology; and both levels of government have established dedicated research bodies to help us prepare for future transport technologies, while also allocating significant funding to this issue.

Trials and investigations are currently ongoing — although it was reported in March that the Sydney Olympic Park trial will give rise to Sydney's first driverless bus route, which will run from Liverpool CBD to the new Western Sydney Airport at Badgerys Creek and will be up and operational in five years.

What appears to be lacking though is visible and effective industry and community engagement that is wider than the transport industry. If this was happening, we would — at least on average — have received broadly different responses to our survey and interview questions. From the property and infrastructure owners we interviewed, the strongest message we received is that there is an immediate need to formalise approaches to the autonomous future, including identifying what will be impacted and what value is at risk, and determining the timings to embrace this future.

The autonomous future is rapidly approaching, and what is needed is strong leadership, strong collaboration and coordinated planning. Creative thinking is also essential.

The full report, 'Are Sydney's property and infrastructure owners prepared for an autonomous future?', can be downloaded from www.arcadis.com/au.

Arcadis Pty Ltd

www.arcadis.com

Smart cities maturity still key to unlocking advancement

Spending on smart city technology is expected to reach US$135 billion by 2021, says analyst IDC. But if you think smart cities are all about tech, think again.

Two global megatrends — urbanisation and digitisation — are transforming cities around the world. By 2050, two-thirds of the world's population will live in cities. Population growth presents new challenges and exacerbates existing ones, like traffic congestion, pollution, energy consumption, circular economy and safety.

Enter the Internet of Things, which can enhance the delivery of everything from street and traffic lighting to garbage collection and crime prevention. Fifty billion IoT-connected devices are expected to be online by 2020.

Mark Saunders is global Director of the Centre of Excellence for Cities, established by urban and services infrastructure giant Ferrovial Services to pioneer innovative solutions and service delivery programs in cooperation with municipalities. Ferrovial Services' Australian business, Broadspectrum, has identified Smart Cities Week Australia as a strategic platform to build momentum in smart cities.

Saunders said many cities around the world are already running "exciting tests, trials, pilots and proofs of concept" using IoT technologies, and the time has come to scale and replicate deployment.

Saunders pointed to Ferrovial Services' pioneering work with Granada City Council and Cisco, which is using sensors and data to enhance waste collection services. Sensors in waste bins provide real-time data that enables Ferrovial Services to optimise and prioritise waste collection routes. Fill level data, when overlaid with information relating to weather, traffic and special events, enables predictions to be made and truck routes redesigned for maximum efficiency, Saunders explained.

But without the involvement of citizens, smart cities won't take off, Saunders added. It would be futile to install smart bins if people toss their rubbish on the street, for instance.

"Listening to people is central to smart city success," Saunders said.

Ferrovial's Citizéntrica project, implemented in the district of Chamberí in Madrid, offers solutions to street cleaning and littering problems by listening to the residents in a series of face-to-face interviews, Saunders added.

"The technology works. The challenge we have is to make it fit the specific operational context and then move it to scale. And it's only when smart cities technology is deployed at scale that it becomes interesting and delivers attractive business cases."

Billions of problem-solvers

Paul Francis, KPMG's Smart Cities Lead in Australia, said enhancing efficiencies through IoT offers "billions of dollars of potential" in Australia alone. But he warns local governments not to focus solely on the technology, nor get distracted by "shiny toys".

"Firstly, focus on gaining a better understanding of the problem space — the 'why' in the local context," he advised. He said that local governments must ask: "What challenges are we looking to solve, or opportunities are we seeking to capitalise upon? And then, of those, which might be accelerated, unlocked or better sustained through the deployment of emerging technologies such as IoT?

"The technology is a key enabler, in service of council and citizen outcomes."

Francis said local governments leading in the smart cities space are starting with the "low-hanging fruit" of operational efficiency.

"By digitising the physical world through the use of IoT sensors and similar, councils

can get data and therefore insights that help with things such as the efficient and effective utilisation of assets, power and resources," he explained.

"That's why we're seeing a lot of smart lighting, waste management and parking."

Data insights can also enable economic development — powering start-ups or university research, for example — or enhance citizen and stakeholder 'experiences'. Think digital wayfinding, personalisation of services and citizen democracy for example.

Francis said the rollout of IoT is " effectively a digital nervous system" that "unlocks data insights from physical infrastructure". When we look at IoT in these terms, we can "uncover insights and get a level of visibility right across the city" that is impossible when relying on anything other than real-time data.

Seizing the smart cities lead

How can local governments get ahead of the curve?

Saunders agrees that city decision-makers should focus on outcomes, not technology. "What do we want to achieve? What does success look like? This is what cities should be asking," he said.

He warned city decision-makers "not to buy something because it is smart or special. Instead, buy it because it's right for your city, plan for scale and seek to incorporate into service contracts for the best chance of success."

Francis said he'd like to see IoT become "part of the DNA of councils when they are considering their strategic and operational plans".

"It's not an IT or a smart city department problem, while the rest of council continues on as normal," Francis said. Instead, advances in technology should become "part of the standard day-to-day toolkit".

The implications stretch far beyond technology, and will influence processes, culture and organisational structures, he said.

"It's a challenge. But establishing a vision and strategy and rallying around a stepped change to that 'light on the hill' is a good first step."

Broadspectrum (a Ferrovial company) and KPMG are sponsors of Smart Cities Week in Sydney from 29–31 October 2018. Tickets are available at https://www.smartcitiesweek.com/2018-australia/.

SMART E-WASTE BIN

Fujitsu's Smart eWaste bin is a total solution for the management of an organisation's e-waste. An attractive bin housing sits in an organisation's office and is equipped with IoT sensors that monitor the fill levels. When the bin is full, Fujitsu's recycling partner arrives on-site to swap out an inner bin and is gone again in moments, taking the e-waste away to be processed onshore in certified facilities that protect human health and the environment.

The result is no more storage or desk space given over to unsightly and unsafe piles of e-waste, risk reduction to an organisation and no hassle in selecting or organising a recycling service to collect. A certificate of recycling and quarterly reporting is provided so an organisation can track its disposals.

The IoT-enabled bins don't require connection to power or Wi-Fi — they are completely self-contained and arrive at an organisation's site ready to be used immediately. Subscription pricing models give businesses predictability for their e-waste disposal costs. The bin therefore offers a complete solution for an organisation's end-of-life ICT assets.

Fujitsu Australia
www.fujitsu.com.au

Climate action in Victoria could save billions

Greenhouse gas emissions in the municipality of Melbourne are generated from electricity, gas, transport and waste produced by daily activities. They are also generated by food and agriculture, goods and services, and the resources that go into packaging, clothes and building materials.

Preliminary estimates in research commissioned by the City of Melbourne found that inaction to reduce the impacts of climate change and missed economic opportunities of transitioning to a low-carbon economy will cost the Victorian economy $12.6 billion over the 2020–2050 period.

The $12.6 billion is calculated using the 'social cost of carbon' which is a measure of the health impacts, damage to infrastructure and lost jobs and economic opportunities resulting from high levels of emissions, and a failure to transition to a low-carbon economy.

The City of Melbourne has written a 'Draft Climate Change Mitigation Strategy to 2050' which sets out its commitment to science-based targets in the Paris Climate Agreement.

Endorsed by the city's councillors, the strategy prioritises actions to reduce emissions across electricity, gas, transport and waste.

Environment portfolio chair Councillor Cathy Oke said the strategy outlines the City's commitment to rapidly achieve zero net greenhouse gas emissions before 2050.

This commitment will be upheld by focusing on working with community, industry and government to make the switch to 100% renewable energy, working with building owners, developers, community and the transport sector to achieve zero net emissions building, precincts and transport, and reducing the impact of waste.

Proposed actions include: facilitating a virtual power plant for residents and accelerating corporate Power Purchase Agreements (PPAs).

"We've made some incredible achievements in progressing the switch to renewable energy such as leading the Melbourne Renewable Energy Project (MREP) to build a 39-turbine wind farm in regional Victoria," Oke said.

The MREP is claimed to mark the first time in Australia that a group of local governments, cultural institutions, universities and corporations members have collectively agreed to purchase renewable energy from a newly built facility. Under this project, the group has committed to purchase 88 GWh of electricity per year from the Crowlands Wind Farm under a long-term PPA. The agreement will now enable Pacific Hydro to progress financing and construction arrangements for the project; and because the wind farm will generate more than the purchasing group's needs, it will bring additional renewable energy into the market.

"We want to accelerate these kinds of initiatives going forward and work in partnership with the state and federal governments to increase uptake in clean energy initiatives," Oke said.

A final draft of the strategy is expected to go before the council before the end of the year.

Smarter than your average water infrastructure

Water pipes are an essential component of any city's infrastructure and need careful maintenance. Burst water pipes are an expensive bane for water utilities but it is both expensive and disruptive to assess the condition of water pipes, and as a result only 1% of the network is inspected a year.

CSIRO Data61's Smart Infrastructure Team is working to address this problem, with the development of an analytical tool that can make intelligent predications about water pipe failures so maintenance can be scheduled before they burst.

This gives the ability to better prioritise pipes for maintenance and in turn reduce costs and minimise disruption to water supplies. It has been validated worldwide through datasets coming from more than 27 utilities.

This project by scientists from CSIRO's Data61 group won the Excellence in Data Science category at this year's Eureka Prizes award, which was announced in August.

"Data is very powerful, and data science is building a smart brain for our society, for a better future," said Fang Chen, Research Group Leader, as she accepted the award.

The Smart Infrastructure team (known then as Enterprise Analytics) were part of the ON program, and graduated through Accelerate 2.

CSIRO Data61

www.data61.csiro.au

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Australian Museum Eureka Prizes © Photo by Salty Dingo 2018.

University of Technology Sydney Eureka Prize for Excellence in Data Science: Bin Liang, Dr Jianjia Zhang, Dr Fang Chen, Zhidong Li, Dr Yang Wang, Smart Infrastructure Team, CSIRO's Data61.

Jeans for joints — turning old jeans into artificial cartilage

Dr Nolene Byrne and Beini Zeng.

Image credit: Donna Squire.

Old denim jeans are set to find new life as artificial cartilage for joint reconstruction, thanks to advanced textile recycling methods being pioneered at Deakin University.

Dr Nolene Byrne and PhD candidate Beini Zeng have discovered how to dissolve denim and manipulate the remains into an aerogel — a low-density material with a range of uses including cartilage bioscaffolding, water filtration and as a separator in advanced battery technology. Dr Byrne said the process worked because denim was made from cotton, a natural polymer comprising cellulose.

"Cellulose is a versatile renewable material, so we can use liquid solvents on waste denim to allow it to be dissolved and regenerated into an aerogel, or a variety of different forms," she said.

"Aerogels are a class of advanced materials with very low density, sometimes referred to as 'frozen smoke' or 'solid smoke', and because of this low density they make excellent materials for bioscaffolding, absorption or filtration.

"When we reformed the cellulose, we got something we didn't expect — an aerogel with a unique porous structure and nanoscopic tunnels running through the sample."

Dr Byrne said the sticky nature of the denim cellulose solution is likely responsible for the unique aerogel structure that resulted — something ideally suited for use as synthetic cartilage. She said, "That's exactly what cartilage looks like — you can't 3D print that material — and now we can shape and tune the aerogel to manipulate the size and distribution of the tunnels to make the ideal shape."

Dr Wren Greene from Deakin's Institute for Frontier Materials (IFM), who assisted through testing the suitability of the aerogel materials as cartilage-like bioscaffolds, said the similarities are remarkable.

"The remarkable similarity in the pore network structure of these aerogels and cartilage tissues — even down to the dimensions, orientations and density distribution of pore channels

A sample of the aerogel material.

— enables these materials to replicate a special type of 'weeping' lubrication mechanism used by cartilage to protect against wear and damage," Dr Greene said.

Apart from its applications as a cartilage supplement, Dr Byrne said the denim recycling technique will also help contribute to the fight against textile waste — a global challenge her team has been working for more than four years to overcome. And while their previous textile recycling efforts have run into problems with cost-effectiveness, the IFM team's 'upcycling' approach ensured this wasn't an issue.

"One of the main drawbacks of textile recycling efforts is that any advanced technique requires the use of chemicals, which can then make the procedure less cost-effective," she said.

"We use environmentally friendly chemicals, and by upcycling our approach to create a more advanced material we can address the limitations affecting other less cost-effective methods.

"We are now entering pilot-scale trials and look to be at commercial scale within 3–5 years with industry support."

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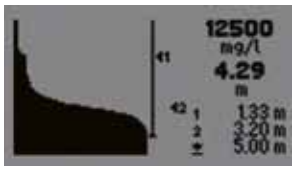

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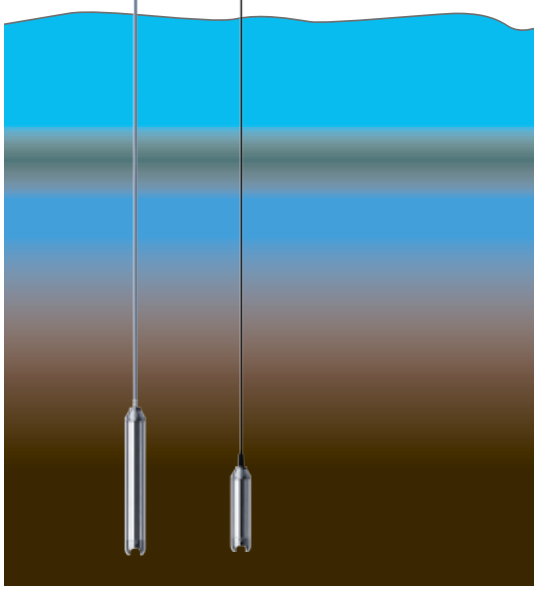

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Control Components

Richmond roads paved with plastic and glass

Alex Fraser Group, a provider of sustainable construction materials, was recently engaged by the City of Yarra to undertake some road resurfacing utilising its Green Roads PolyPave material — a high-performance asphalt product containing recycled materials, including plastic and glass.

Alex Fraser is responsible for diverting more than 3.5 million tonnes of waste from landfill every year to manufacture the sustainable construction materials needed to build greener roads. The company's PolyPave asphalt incorporates recycled high-density polyethylene plastic, which provides several benefits including:

- increased fatigue life;
- improved asphalt rut resistance;
- increased asphalt modulus/stiffness;
- increased wet tensile strength;
- a reduction in asphalt mix flow and creep;
- lessened ultraviolet radiation damage;
- less sensitivity to increased pavement temperature;
- a reduction in plastic to landfill and ocean ecosystems.

Roads in Stanley and Margaret Streets, Richmond, were repaved with PolyPave, containing recycled glass, asphalt and HDPE plastic (hard plastic/bottles), amounting to almost 100 tonnes of recycled waste. Approximately 7300 plastic bottles and 55,000 glass bottles were repurposed — equivalent to 1500 wheelie bins of waste glass and plastic, or the annual kerbside recycling collection for every household in Stanley Street.

The trial project reduced landfill by 97.3 tonnes and carbon emissions by 633 kg. The City of Yarra has since engaged Alex Fraser to repair and repave several more streets in the coming weeks, calling for an additional 1000 tonnes of the sustainable asphalt and saving another 25,000 plastic bottles from entering landfill.

"The City of Yarra's progressive approach to the use of sustainable material is an excellent illustration of how local councils can proactively re-use the waste generated in their communities to build and maintain their cities while reducing the carbon footprint of their projects by up to 65%," said Alex Fraser Managing Director Peter Murphy.

Mayor Daniel Nguyen said the City of Yarra has worked with Alex Fraser for many years to incorporate sustainable materials like glass, recycled concrete and brinl into its roadworks. "As a council with a strong focus on sustainability," he said, "we are excited about using recycled plastics in our latest roadworks for the wide range of environmental benefits it delivers."

Alex Fraser Recycling
www.alexfraser.com.au

MODULAR ANALYSER FOR MULTIPARAMETER AQUACULTURE MONITORING

Aquaculture operators in search of a better way to automate testing for dissolved oxygen (DO), pH, nitrate and other parameters will find the modular plug-and-play T80-S80 Analyser System from Electro-Chemical Devices (ECD) simplifies operations and lowers total operating costs.

In aquaculture, the detection of rising levels of DO, pH, nitrates and other parameters is essential to keep fish healthy. These parameters can reach toxic levels quickly or facilitate conditions that lead to disease affecting the health of fish, which requires additional treatments or can cause the death of the fish.

While many operators rely on portable sensors, they require staff time to manually complete the testing on a fixed schedule that can be hard to maintain consistently during their busy work day. The challenge and expense of dedicating staff time to testing becomes incrementally problematic in larger or remote operations.

The installation of fixed analyser systems, however, such as the rack-mount ECD T80 Universal Transmitter with S80 Intelligent Sensors, automates the measurement process. The T80-S80 Analyser System can be seamlessly integrated with popular control system communication protocols to provide a closed-loop water monitoring and treatment system that maintains water quality for optimum fish growing conditions.

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

Councils reinforce concrete with recycled plastic

Australian councils are increasingly replacing the traditional steel mesh used to reinforce concrete in footpaths with recycled plastic, which would otherwise be sent to landfill or end up in our oceans.

Polypropylene (PP) is the second most widely used plastic in the world, with the lowest recycling rate — the American Chemistry Council estimates a rate below 1%. PP is also one of only three plastic types which floats — forming a major component of the ocean gyres and estimated 8 million tonnes of plastic entering the ocean each year.

There are only three things which can be done with plastic waste: recycling, energy recovery or landfill. Humans have created 8.3 billion tonnes of plastics since large-scale production began in the early 1950s — roughly half was produced in just the last 13 years, and an estimated 79% now resides in landfills or the natural environment.

Fibercon CEO Mark Combe.

Now, thanks to Queensland engineering firm Fibercon and researchers from James Cook University (JCU), councils are using recycled polypropylene (PP) plastic waste in the form of 'Emesh' to reinforce concrete pavements and other infrastructure. Townsville City Council was one of the first in Australia to use Emesh, made of 100% recycled PP, for 3500 m^2 of pathway on Magnetic Island.

"There are the environmental benefits that come with the use of recycled plastic, but also the fact that it is easy to transport the fibres, especially to Magnetic Island," said Senior Project Manager Bob Hickey. "There are also no problems with corrosion in the saltwater environment. The result was an excellent product with no visible uncontrolled cracking."

In addition to reduced CO_2 outputs and preservation of fossil fuels from steel manufacturing, the Emesh innovation also creates a market for recycled PP. To date, 65 tonnes of plastic waste has been recycled via Emesh, with the potential to recycle 5000 tonnes of plastic waste annually. One tonne of plastic is equivalent to around 20,000 litre bottles, or 120,000 plastic bags.

"Recycling is not just putting materials in a recycling bin at the kerbside: collection is only the start of the process," said Fibercon CEO Mark Combe. "Markets must exist for recyclable materials and buyers must be found for products made with recyclable materials. With China drastically reducing its import of waste in 2017, finding new uses for recycled plastics is more important than ever.

"Simply by using our Emesh instead of steel reinforcement, councils can contribute significantly to cleaning up our plastic waste."

Unlocking the of your

Any facility that relies on compressed air as a source of energy will know that compressed air is a significant consumer of electricity. Not great news when you consider the heightened electricity costs we have all been faced with in recent years.

What many compressed air users do not realise is that their compressed air system may well be hiding an energy savings potential of 30% or more. Uncovering and realising these savings would assist them in reducing their associated electricity bill and therefore their carbon footprint.

Unlocking your energy savings potential

The key to unlocking hidden compressed air energy savings starts with a compressed air audit. By monitoring a compressed air system for a set period of time, computer aided audits (such as the Air Demand Analysis (ADA) from Kaeser) are able to determine precisely how much power and energy is being consumed by an existing compressed air system configuration. Where appropriate, this information can then be used to simulate alternative configurations

Identifying and repairing compressed air leaks can generate significant energy savings.

Compressors with IE3 and IE4 motors offer a high degree of efficiency and lower energy consumption.

Advanced master controllers such as the Sigma Air Manager 4.0 from Kaeser, can deliver an advanced energy management solution.

energy savings potential compressed air system

for optimum energy efficiency. Then tools such as the Kaeser Energy Saving System (KESS) enable efficiency comparisons and accurate predictions of the energy savings that other solutions could achieve.

Where can energy savings be made?

A compressed air audit may reveal simple improvements that could improve efficiency, such as fixing air leaks. It is estimated that compressed air leaks can squander up to 50% of the compressed air produced by a typical compressed air system. However, by identifying, repairing and implementing an ongoing leak detection management program, significant improvements can be achieved.

Reducing artificial demand and eliminating inappropriate use of compressed air may also contribute towards increased energy efficiency.

Energy-efficient compressed air technologies

A compressed air audit may also identify that significant savings can be achieved by replacing ageing or inefficient equipment. If we look at just the compressor, energy savings of approximately 10% can be achieved through the use of efficient airends, 1:1 direct drives and efficiency optimised IE3 and IE4 electric motors.

The airend of a compressor is essential to its overall efficiency. The specific power requirement of a rotary screw compressor is a direct result of the relationship between flow rate and power consumption. It will only reach its optimum specific performance at a certain pressure and speed. Advanced compressor manufacturers are able to make low-speed airends for every size range that work in their zone of optimal performance. They tend to be more efficient than compressors with higher speed airends or gearbox or belt transmission, and are able to deliver more compressed air for the same drive power, generating considerable savings.

The drive motor also plays a part in a compressor's overall efficiency. Direct coupled 1:1 drives offer the best efficiency with no loss in transmission efficiency and no maintenance requirements. Belt drives do require some maintenance but offer advantages such as flexibility in pressure selection. Automatic belt tensioning devices further ensure transmission efficiency while protecting bearings from excess stress.

The efficiency of the drive motor should not be overlooked either. The efficiency classes according to the International Efficiency (IE) Code for low-voltage AC motors describe the efficiency of motors in converting electrical to mechanical energy. The standard defines the minimum requirements on the energy efficiency of asynchronous motors. In addition to the classes IE1 to IE3, the most efficient class of the standard is IE4 ('Super premium efficiency'), which is — at this point in time — not yet legally binding.

In addition to the high degree of efficiency and lower energy consumption, the other benefits of optimised compressor drives are low operating temperatures and therefore a longer life. As an example, compare the energy costs of a 15 kW base load compressor where one has an IE1 motor and the other an IE3 motor. The performance efficiency of the compressor with the IE1 motor would be around 87%, with a power loss of around 1.95 kW, whereas the compressor with the IE3 motor would have a performance efficiency of around 92% and only a 1.5 kW power loss. The energy savings of opting for the compressor with an IE3 motor would therefore be 937 W. Based on the compressor running 8.760 h per year and a 0.15 $/kWh this would equate to AU$1231.00 of energy cost savings per annum.

Taking control of energy efficiency

Load optimisation and pressure reduction can also generate around 15% energy savings. This could be achieved by introducing a master controller which manages all of the compressors and the associated ancillary equipment within a compressed air system. At its basic level, a master controller switches each of the compressor units in the system on and off as required to most efficiently match the compressed air supply to the demand.

Advanced master controllers such as the Sigma Air Manager 4.0 from Kaeser can deliver an advanced energy management solution. By managing multiple compressors and selecting the right combination of compressors to meet the current demand requirements, the controller can reduce energy consumption, thereby improving the performance and efficiency of a compressed air system. It essentially achieves this by reducing compressor operating and idling times, reducing artificial demand and leaks and improving pressure performance.

It is therefore possible to improve the pressure stability and overall reliability of a compressed air system, thereby keeping associated energy consumption to a minimum.

Achieving ongoing efficiency

Maintenance and service should not be overlooked when it comes to operating an energy optimised compressed air system. It is important that a compressed air user follows the OEM's maintenance schedule in order to ensure the system operates reliably at all times. When a compressed air system operates reliably it is able to operate efficiently, keeping associated energy costs down. Opting for genuine spare parts will also impact the reliability and therefore efficiency of a compressed air system.

Energy costs account for around three-quarters of the overall lifetime costs of a compressor. As such a large consumer of electrical energy within a facility, operating an energy optimised compressed air system will therefore be an essential contributor in reducing a facilities overall carbon footprint.

Kaeser Compressors Australia

www.kaeser.com.au

Decarbonising the built environment

The 2018 Global Climate Action Summit, held in San Francisco from 12–14 September, brought together state and local governments, business and citizens from around the world to showcase action against climate change.

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As part of the event, the World Green Building Council (WorldGBC) officially launched its Net Zero Carbon Buildings Commitment with 37 founding signatories. Comprising 11 businesses, 22 cities and four states and regions, the 37 signatories gathered at a dedicated session to signal the start of a leadership movement towards a decarbonised built environment.

The Net Zero Carbon Buildings Commitment has been developed in partnership with a wide stakeholder group including Green Buildings Councils, The Climate Group and C40. It forms part of the WorldGBC global campaign Advancing Net Zero, launched in 2016, as well as EP100 — a global corporate leadership initiative for energy-smart companies delivered by The Climate Group in partnership with the Alliance to Save Energy. Businesses signing the Net Zero Carbon Buildings Commitment become EP100 members.

As part of the commitment, businesses throughout the building and construction supply chain have set ambitious targets to eliminate operational carbon emissions from their building portfolios of over 10 million m^2 by 2030, creating a wider market transformation to enable net zero carbon buildings by 2050. The WorldGBC definition of a net zero carbon building is a building that is highly energy efficient and fully powered from on-site and/or off-site renewable energy sources.

Leaders from some of the world's biggest cities have meanwhile committed to enact regulations and/or planning policy that will require all new buildings within their jurisdiction to operate at net zero carbon from 2030, and all buildings, including existing, to operate at net zero carbon by 2050. Some cities, along with state and regional governments, have additionally committed to ensure the municipal assets they own, operate and develop are net zero carbon by 2030.

WorldGBC welcomed the following founding signatories of the commitment:

- **Businesses, recruited from the Green Building Council network:** Middle Eastern property developer Majid Al Futtaim; global engineering firm Integral Group; lighting manufacturer Signify (formerly Philips Lighting); global engineering firm Cundall; real estate development trust Kilroy Realty; major developer Frasers Property Australia; property investment fund AMP Capital Wholesale Office Fund; residential property developer Berkeley Group; flooring manufacturer Shaw Contract - Commercial division; property investment fund GPT Wholesale Office Fund; and property developer Stockland.
- **Cities, recruited in partnership with C40:** Copenhagen, Denmark; Cape Town, Durban, Johannesburg and Tshwane, South Africa; London, UK; Los Angeles, New York City, Newburyport, Portland, San Francisco, San Jose, Santa Monica and Washington DC, USA; Medellin, Colombia; Montreal, Toronto and Vancouver, Canada; Paris, France; Stockholm, Sweden; Sydney, Australia; and Tokyo, Japan.
- **States and regions, recruited in partnership with The Climate Group as secretariat for the Under2 coalition:** Baden-Württemberg, Germany; Yucatan, Mexico; Navarra and Catalonia, Spain.

Collectively, these organisations are committed to eliminating a cumulative total of 192 million tonnes of carbon emissions equivalent (CO_2e) from their buildings by

> **...these organisations are committed to eliminating a cumulative total of 192 million tonnes of carbon emissions equivalent (CO2e) from their buildings by 2050**

2050. That is the equivalent of 41 million cars off the road for one year.

The aim of the commitment is to inspire industry and governments to develop aggressive strategies to start the actions necessary for change, and to fulfil their obligations within the commitment. Signatories are required to evaluate their current energy use and associated emissions across their portfolios; identify opportunities to reduce energy wastage and improve energy efficiency; power their buildings from renewable energy sources; and report on progress against decarbonisation targets. All signatories will be expected to meet high verification standards, in the lead-up to and in the year of achievement of net zero carbon emission buildings, and report annually on progress.

Business signatories also commit to further advocate through their operations to eliminate carbon emissions, becoming enablers to radically transform the wider supply chain. For example, the Berkeley Group, which builds 10% of London's homes, has already achieved its target of becoming carbon positive (beyond net zero) for its own operations in 2018 but has committed further to ensure that all its developments achieve net zero by 2030 through transition planning. AMP Capital Wholesale Office Fund, a $5.7 billion fund that invests in Premium and A Grade core office assets in Australia, committed to be carbon neutral across its portfolio of 13 buildings by 2030, which will reduce 70,000 tonnes of CO_2 emissions.

All city signatories have committed to enacting pioneering regulations and/or planning policy, following the example of cities such as Vancouver's Zero Emission Plan launched in 2016 which required all new buildings to have no operational greenhouse gas emissions by 2030. The plan was developed specifically to ensure comfortable and healthy indoor environments, maximise local economic development, ensure long-term building resilience and protect housing affordability. The plan will facilitate Vancouver's Renewable City Strategy, which aims to ensure all buildings use only renewable energy by the year 2050.

To enable all those who own, occupy and develop buildings to act on the commitment, WorldGBC's network of almost 70 Green Building Councils (GBCs) will continue to provide a range of transformational and capacity building support including advocacy, policy development, education and certification. Seven GBC net zero carbon buildings certification schemes have been launched, with a further six due to be released by 2019, helping to deliver local solutions to a global issue under a common WorldGBC definition.

"We are delighted at the ambition being demonstrated by this group of climate leaders," said WorldGBC CEO Terri Wills. "Our new partnerships with C40 and The Climate Group have enabled us to convene the world's most pioneering organisations in net zero carbon buildings, and bring company CEOs, city mayors and state governors onto the same stage, committing action towards a common cause. Our vision of a net zero emissions future is within reach, if we all work together to overcome the challenges.

"Taking this leap has taken a phenomenal effort from the founding signatories, and we applaud them for their leadership and compel others to join us on this exciting journey. Our Green Building Councils are ready to support each and every signatory as we work together to towards decarbonising the built environment."

WorldGBC

www.worldgbc.org

Sydney venues go green

The operators of some of Sydney's most popular venues have caught the sustainability bug, implementing technologies and procedures to reduce waste, emissions and costs.

Lauren Davis

ICC Sydney

Take a walk along Darling Harbour and you'll find it difficult to miss the International Convention Centre Sydney (ICC Sydney). Still a relatively new development, ICC Sydney opened in December 2016 after the demolition of the old Sydney Convention and Exhibition Centre. Significant efforts were made to ensure the rebuild was as sustainable as possible; over 90% of the original convention centre was repurposed for the new centre, with fixtures and fitouts — including timbers — locally sourced within NSW.

ICC Sydney

Image courtesy of Philip Terry Graham under CC BY 2.0

One feature that certainly wasn't part of the old centre is the 520 kW photovoltaic (PV) array, said to be the largest in any Australian CBD. Used for hot water and electricity generation, the array produces 545 MWh/year, which is enough energy to power 100 homes — or 5–6% of the 240,000 m^2 venue's baseload power. And because the solar panels can heat water up to 70°C, it often doesn't even need to be topped up with gas power before being sent to the kitchens.

Other heating and chilling is run through a single central energy plant (CEP), which serves all three ICC buildings and is expected to save 20% of greenhouse gas emissions compared to the Building Code of Australia standard. This plant includes two baby chillers and four larger ones, all of which are designed to last for 25 years in any weather condition. The plant operates for most of its annual hours at low to medium capacities, enabling the individual chillers to operate close to optimal levels — resulting in significant energy savings. For example, on one of the hottest days so far (41°C), the venue had the four large chillers running, while on a winter's day with the venue half full, only one baby chiller needs to run.

ICC Sydney's solar PV array.

A major venue such as the ICC goes through quite a bit of food on a daily basis, much of which is sourced locally from regional NSW. The venue also works on occasion with food charity partners such as OzHarvest and all kitchens have their own organic waste bins to ensure it goes into the correct stream. Waste management company Cleanaway is tasked every day with taking these organics off-site to food waste-to-energy facility EarthPower, where it is turned into fertiliser via aerobic digestion.

Other highlights include rainwater harvesting, which provides 100% of irrigation demands and 63% of toilet-flushing demands; innovative window glazing to allow natural light into the pre-function areas; automatic lighting controls and more. The result of all this is that ICC Sydney has been certified as LEED Gold for Sustainability.

Image credit: SCG Trust/Hamilton Lund.

The only two bins in an SCG corporate suite.

SCG Venue Manager Alex de Graaf operates the venue's co-mingled compacter.

Sydney Cricket Ground

Venture a few kilometres south-east of Darling Harbour and you'll find yourself in Moore Park, home of the Sydney Cricket Ground (SCG). Commercial cleaning company Quayclean has been working with the SCG Trust since 2010, providing a suite of cleaning and waste management services with a focus on sustainability.

The first thing you'll notice about the SCG is that there are no general waste bins in either the public areas or the corporate suites — instead, everything is either recyclable or organics. As explained by Quayclean CEO Mark Piwkowski, "We took the view that just about everything here is recyclable in some form — it just comes down to the quantity."

Around the more open areas, recycling is handled by solar compacting bins, which compact up to seven times the volume of a standard 240 L bin. There are around a dozen of these bins on-site, each of which is able to sense how full the bin is at any point and whether it needs emptying — information that can be tracked via an app and map of the bin's location. This means labour is never deployed unnecessarily, and waste trucks do not need to come as often either.

The venue also has its own cardboard baler, as well as three glass-crushing machines — again meaning that more product can fit in a single bin and, by extension, in a single truckload. Quayclean eventually plans to introduce glass-crushing machines in all the venue's bars, with Piwkowski explaining, "That way, we're actually dealing with the problem at source, rather than filling up bins full of glass that we have to move every time."

As for food waste, the Quayclean team are reasonably confident that event attendees will eat most of what they purchase. So like the ICC, most food waste comes from those serving the food, with all retail outlets equipped with one or two 120 L organics bins — and regularly educated on what to put in them. Quayclean currently disposes of its food waste via EarthPower, which turns it into three by-products: greywater, which goes to the sewer; compostable material for the gardens; and power, which goes back into the grid.

Excitingly, the company plans on deploying its own dehydrator before the end of 2018, which will take up to a tonne of food per day and 'cook' this material down to an organic compound, taking it down to about 15% of its volume. This product, which is "effectively the consistency of blood and bone", according to Piwkowski, will be mixed with grass clippings and potentially used as an organic fertiliser at the nearby Centennial Park.

What's next?

Now another major Sydney venue is getting the sustainability treatment, with Quayclean recently awarded a presentation and cleaning contract to service one of Australia's most popular tourist attractions: the Sydney Opera House.

The Sydney Opera House has made significant efforts to incorporate sustainability elements ever since it opened in 1973, starting when original architect Jørn Utzon implemented a seawater-cooling system. Today it is proudly carbon neutral, thanks to initiatives such as LED lighting upgrades, implementing a building management system and increasing its recycling rate from 25 to 60%.

Piwkowski would like to improve the venue's waste management efforts even further, saying his team will "work closely with the Opera House to develop and initiate environmental technologies which will increase recycling targets while substantially reducing costs". For a site that welcomes more than 8.2 million visitors a year, that's likely to make a huge impact on Sydney's sustainability efforts — and it surely won't be long until another major venue follows in its wake.

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Reducing the carbon footprint at MCG

Affectionately known as "The G", the Melbourne Cricket Ground (MCG) has been part of Victorian and Australian heritage since the mid-1800s. The role in protecting the heritage of this venue is taken very seriously by General Manager – Facilities, Melbourne Cricket Ground, Peter Wearne.

"The Melbourne Cricket Club (MCC) and the MCG is such an iconic venue and iconic club, we have the responsibility to all Victorians to ensure that we're doing the right thing environmentally," said Wearne during his presentation at the Siemens Digitalize 2018 event in August, which was held at the MCG.

Wearne and his team decided to embrace digitalisation and partnered with Siemens to improve efficiency of the facilities and as a result its environmental performance.

Efficiency improvements have included replacing legacy lighting with LED technologies; implementing a 'smart' air-conditioning system that adjusts output based on the number of people in a room and as a result improves comfort levels; and installing Siemens' building management system, which allows the MCC to automate room bookings and functions.

"The results we've seen from the MCC include a significant reduction in greenhouse gas emissions and utility costs," said Wearne. "We've saved roughly 20% of the overall utility bill, which includes CO_2 emission savings, and we've overachieved on our guaranteed performance by roughly 20% per annum."

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Other sustainability improvements at the facility include an underground water recycling facility, which is designed to provide secure, long-term sustainable water supply to Yarra Park and the MCG. The MCC has also made improvements in recycling activities at the stadium, with the venue now recycling around 85% of waste produced during events — compared to just 10–15% a decade ago.

Siemens Ltd

www.siemens.com.au

WATER QUALITY ASSESSMENT

Bestech Australia introduces water quality measurement systems from Ahlborn Sensors. The measurement systems consist of physical sensors and a data acquisition instrument with a data logging function.

The latest measuring instruments from Ahlborn include the Almemo 710 data logger and the Almemo 202 handheld data logger. For more sophisticated measurement, the Almemo 710 offers a high-resolution display of a 5.7″ colour graphic and is compatible with all sensors from Ahlborn. It also comes with 10 measurement channels that can be easily configured and operated via a touchscreen function.

For daily measurement, the Almemo 202 offers good mobility with a similar capability to the Almemo 710 instrument. It offers an illuminated graphical display and can be easily operated through four soft keys and a cursor block. The menu guidance is also easily structured and easy to understand. In comparison to the 710 instrument, the 202 device offers two measurement channels and is only compatible with the latest D6 or D7 digital sensors from Ahlborn.

The electrical conductivity sensor probes are available in analog and digital probes, FYA 641LFP1 and FYD741. They are suitable for measurement in concentrated wastewater, emulsions and alkaline and corrosive mediums. The digital probe FYD741, in particular, is able to measure conductivity from 10 μS/cm up to 500 μS/cm. It also offers good linearity and temperature compensated measurement and is compatible with both the Almemo 710 and 202.

Sensors to measure other physical parameters, such as oxygen concentration and pH, are also available.

Bestech Australia Pty Ltd
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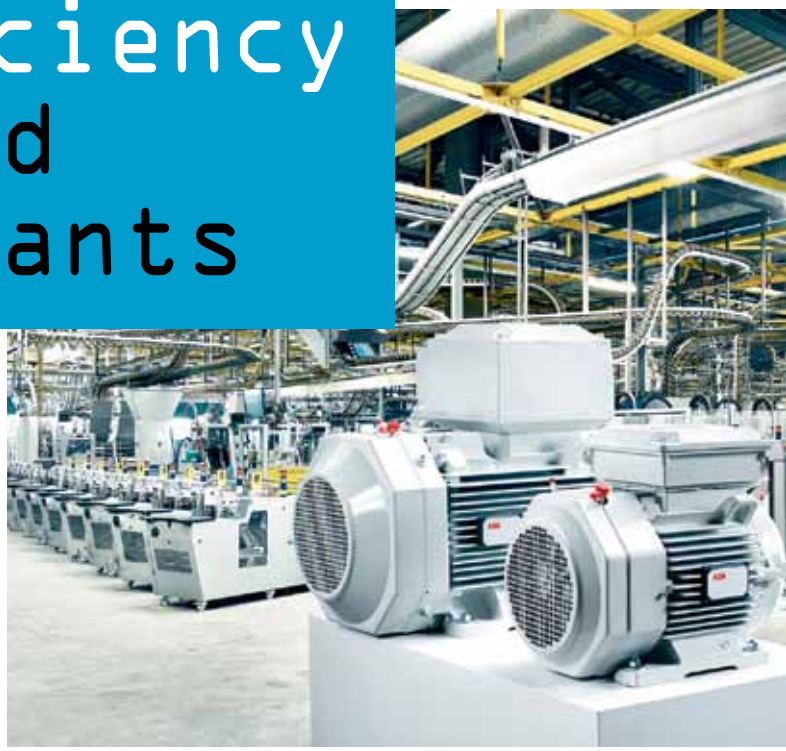
Energy efficiency for food and beverage plants



Food and drink manufacturers alone account for over 5% of industrial energy use globally and around 14% of energy consumption within the Australian manufacturing industry. John Rieusset, ABB's food and beverage leader in Australia, looks at how plant manufacturers can improve energy efficiency in their plant, while saving costs and improving overall equipment effectiveness (OEE) at the same time.

It will come as no surprise that large companies are under pressure to reduce their energy usage. The Australian Government Department of the Environment and Energy (DoEE) gives tips on energy management and demonstrates best practice for Australian companies through its site Energy EXchange. The Australasian Emissions Reduction Summit 2018, run by the DoEE, recently engaged many high-profile businesses, highlighting that Australia needs to improve its performance with regards to reducing its carbon emissions.

While many plant managers will no doubt be happy to play their part in such initiatives, they are often under pressure from their management to reduce costs and increase output. The good news is that energy efficiency improvements often pay for themselves while helping increase output and reduce operating costs.

Look at your motors

During an energy assessment of a particular plant, ABB discovered that the plant's motor maintenance program involved rewinding motors in order to help extend the life of those assets. Some motors were rewound up to five times, and as a consequence, the energy efficiency of the rewound motors had fallen. As a result, there was additional loading placed on the transformer. This amounted to a significant amount of wasted energy.

By replacing these motors with higher efficiency IE3 motors, the plant immediately started to save energy. The payback period for the investment in higher efficiency motors was less than two years, which was a vital factor in the plant manager's decision to invest in the IE3 motors.

The plant has since adjusted its motor maintenance policy to look at replacing older IE2s with higher efficiency IE3 motors, rather than rewinding the old motors.

When considering the purchase of higher efficiency motors, there are various online tools and calculators available that help you understand the payback time for the investment.

Look at your refrigeration

Cooling is a critical function in many food and beverage processes and also one of the largest consumers of energy, as compressors, pumps and fans are often in use extensively throughout the plant. Plant managers can assess how this equipment is performing versus the actual demand, which can help them to home in on potential energy-saving opportunities. Refrigeration processes use some of the largest motors found in a food and beverage plant, where ammonia compressors use, on average, a 300–450 kW motor, and pumps averaging between 35–55 kW.

Many of our customers often have their own energy efficiency goals to meet. In one plant, applying variable speed drives on two compressors (450 hp and the other at 350 hp) and improving compressor control saved up to 30% energy use between the compressors, resulting in an overall plant energy reduction of 4%.

Looking at power quality

With a wide range of motors, drives, compressors and other equipment which is inductive, the overall power factor of the plant may be reduced. The lower the power factor, the less efficiently electricity is used throughout the plant. Utilities may impose extra charges or penalties for poor power quality, so this is an area that plant engineers should take into consideration.

At a bottling plant for one of ABB's customers in India, we installed a step less reactive power compensation system to provide dynamic reactive power, thereby compensating for unbalanced electrical loading. This improved the power factor from 0.94 to close to unity (1). It also translated

to a 10% reduction in their annual electricity spend, with the investment delivering a payback of less than two years.

Plant engineers may also wish to consider using low harmonic variable speed drives as well, which help improve the power quality within the plant.

Plant assessments offer insights

Being able to identify energy-saving opportunities across a manufacturing plant can be a complex task. ABB has developed a plant assessment service that takes a comprehensive look across a plant, working in conjunction with the plant engineers. Together with conducting walk-throughs and focused workshops, the output is a comprehensive report and improvement plan tailored for that plant.

There are certainly many ways to look for energy savings, and each improvement makes a difference. By having a better awareness of the plant's energy usage, plant managers can identify key areas where energy is being wasted. Not only will investing in newer, more energy-efficient equipment help them to meet government emissions targets, it will also reduce costs in the long term and also help them to reduce the cost of downtime.

ABB Australia Pty Ltd
www.abbaustralia.com.au

PORTABLE ULTRASONIC FLOWMETER

The Series PUF Portable Ultrasonic Flowmeter Kit utilises the transit-time difference for measuring flow rates in pipes non-invasively.

It is a compact and lightweight instrument incorporating the latest electronics and signal processing technologies, realising high performance and easy operation. The device is capable of 20 h continuous operation with its built-in battery.

The PUF comes with an IP67-rated carrying case with moulded foam inserts to hold and protect all equipment against dust and water. The screen offers easy-to-read text with a convenient backlight for visual comfort. The efficient layout of the function keys adds to the unit's easy-to-use programming. It comes with RS232 and USB connections to allow for easy connection to any personal computer or printer.

To operate the product, place two sensors on the exterior of the pipe; each transmits an ultrasonic pulse through the pipe and fluid to the other. The velocity of the liquid flowing through the pipes causes the pulse to accelerate or decelerate. The difference in the transit times of the two pulses is used to calculate the flow rate. The use of transit time allows the flowmeter to be unaffected by pressure or temperature changes.

Product applications include treated water, river water, sea water, potable water, demineralised water, glycol/water mix, hydraulic systems and diesel oil. For the non-data logging version, see the Series PUB.

Dwyer Instruments (Aust) Pty Ltd
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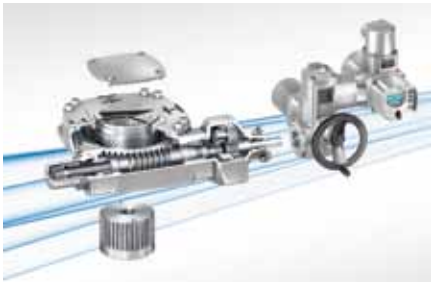
ACTUATOR



AUMA is now producing the SAC actuator in a variable speed version with an onboard inverter.

This inverter allows starting and speed regulation of the actuator without the problem of 'locked rotor current', which is fundamental for direct on line motors. The only current drawn is the nominal current, which is much lower.

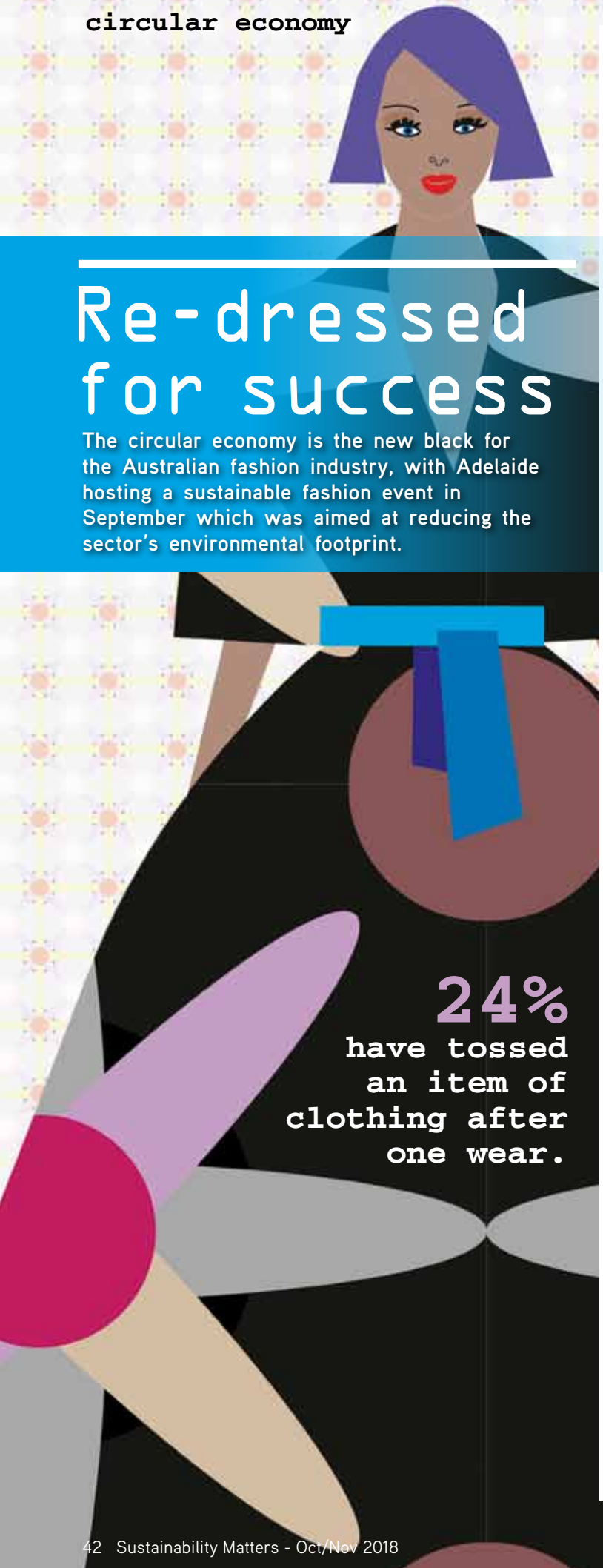
The benefits of this inverter drive technology are twofold. Firstly, the actuator may be driven from solar panels and batteries by using a readily available power supply or UPS (uninterruptible power supply). This makes it suitable for remote areas, irrigation canals, dams, rivers and critical services.

Secondly, the actuator AC controller may be programmed to have a variety of speeds during travel. This is useful for water transmission pipelines where energy control and water hammer avoidance is necessary.

Additionally, the actuator may be supplied to the highest water level integrity. Standard products are IP68 to 6 m submersion, but an optional AUMA version can be supplied for permanent submersion (like a submarine).

If a corrosive environment is encountered, the already durable KS double powder coating may be augmented by an overpaint such as the Dulux Ferreko EK3, for example.

Barron GJM
www.barron.com.au



Re-dressed for success

The circular economy is the new black for the Australian fashion industry, with Adelaide hosting a sustainable fashion event in September which was aimed at reducing the sector's environmental footprint.

Hosted by the University of South Australia (UniSA), the Redress Design Award Fashion Academy focused on ways to reduce clothing and textile waste and help stem the 'disposable' throwaway culture endemic among clothes buyers.

Fashion students and emerging designers from across Australia spent the day workshopping ideas and techniques to combat the mountain of material waste that ends up in landfill, according to organiser Dr Alison Gwilt.

Dr Gwilt, an Adjunct Senior Research Fellow in UniSA's School of Arts, Architecture and Design, said the global focus on the environment and the rise of the circular economy is helping to reshape the fashion world.

"The 'take, make and dispose' model of production is no longer fit for purpose. Instead, we are now adopting a circular economy that is economically and environmentally sustainable and where we can regenerate and recycle products and materials," Dr Gwilt said.

The event organiser, Redress, is a Hong Kong-based not-for-profit company that has spent the past decade working with fashion designers to reduce product waste. Initially focused on Asia, it is now a global enterprise and this year has opened its sustainable fashion competition to Australian designers for the first time.

"The challenge is to design a fashionable garment that has no waste involved in producing it," Dr Gwilt said. "This entails engineering their patterns to use as much of the material as possible."

A 2017 YouGov report found that 40% of Australians have thrown away unwanted clothing rather than trying to repair or recycle the garments and 75% have tossed out clothes in the past year.

The throwaway culture is harming not just the environment — with 500,000 tonnes of textiles and leather sent to landfill in Australia — but creating a huge economic cost, with 10% of materials wasted, Dr Gwilt said.

The good news is that some global clothing retailers are heeding the environmental message and embracing the 'slow fashion' movement. Patagonia, an outdoor clothing designer, was one of the first to produce fleeces made from recycled plastic water bottles, which involves crushing the plastic into chips and heating it to form a yarn that is knitted into a fleece material.

Meanwhile, the Swedish multinational clothing store H&M encourages its customers to drop off unwanted clothes for recycling in return for a voucher. To date, they have collected more than 17,771 tonnes of textiles — the equivalent of 89 million t-shirts. These clothes are recycled as insulation material, carpet underlay, stuffed toys or even shoe insoles, among many other things.

"There are a whole lot of business models coming out of the global fashion industry and Australia is starting to catch on," Dr Gwilt said.

"As an educator, my job is to interrupt the linear model and produce graduates who are focused on eliminating waste in the fashion industry."

24%
have tossed an item of clothing after one wear.

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