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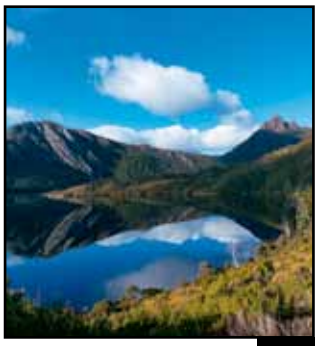
CONTENTS

REGULARS

14



20

26

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WORDS FROM THE EDITOR

As we gradually emerge from our COVID-19 pandemic isolation, many of us are rushing back to 'normal' life. While this is crucial for our economic recovery, we shouldn't forget all the lessons we have learnt during this crisis.

The pandemic has taught us that effective action is possible when politicians listen to scientific experts and act swiftly on their advice. Therefore, it is clear that a long-term solution that integrates our energy and climate change policy is possible.

The massive decline in energy demand during the pandemic has shown us how carbon emissions can be dropped by around 17% on a daily basis. If we looked at climate change as our next crisis, Australia could create a 'new energy normal' that was dominated by renewables — wind, solar and battery storage — which could keep the emissions on this downward trajectory while saving on energy costs. This vision is discussed further on page 6.

While the global decrease in emissions has resulted from grounded airline, it has also been associated with changes in numbers of cars and other vehicles on the road (the surface transport sector — which also includes shipping) leading to around a 36% decrease in emissions, equivalent to 7.5 megatonnes (5.9 to 9.6) carbon dioxide (CO_2). Now could be the perfect time to keep these emissions at bay by driving the switch to electric vehicles that are powered by renewables or even charged by the road itself. Read on page 10 how magnetism could be used to recharge an electric car as it drives.

Enjoy the read!

Carolyn Jackson

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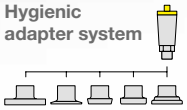

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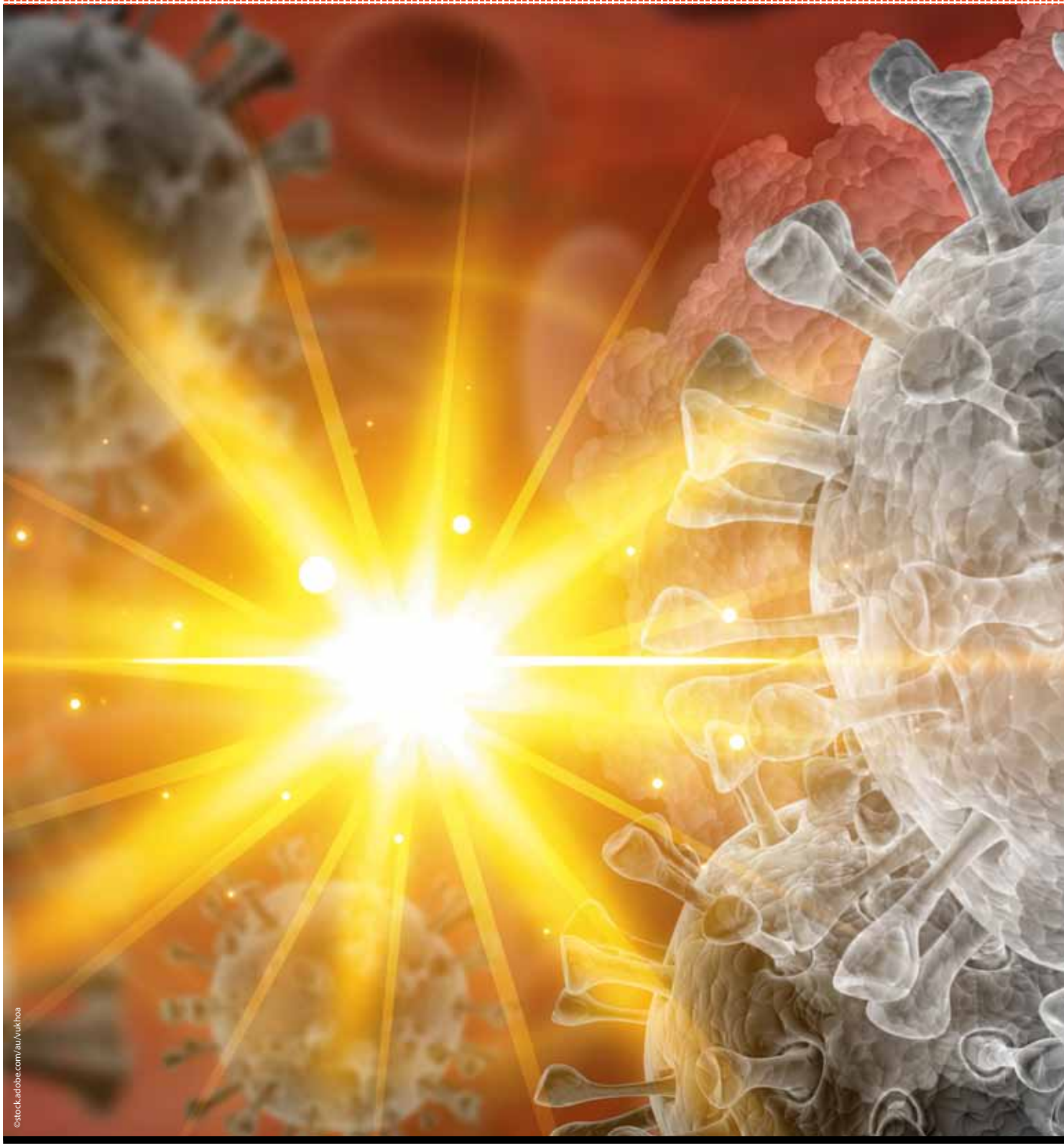
The post-COVID energy world

*Molly Jackson and Kim Middleton**



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> **Our energy laws are made up of a complex network of bandaid solutions that need urgent, wholescale reform.**

In the lead-up to the COVID-19 pandemic (COVID) we were still reeling from Australia's worst bushfire season in recent history. We had unprecedented public support for a targeted, national-level climate change policy in Australia. Coupled with outdated energy regulation, it seemed the perfect time to integrate our energy and climate change policy: complementary national laws which promote a sustainable and green future.

If you don't have time to read this article, the short answer is: we still don't have these — but the better answer is: COVID has shown us that we already have everything we need to make them happen.

The leap is there for Australia to take, but we need the certainty of the law to bridge that gap. Here we look at the state of the old energy world, lessons from COVID, what we can do to change our energy status quo... and our vision for the new normal.

The old energy normal

Pre-COVID we had (and we still have) lots of private commercial interest in climate action, driving dynamic changes in our energy sector: local and foreign private capital looking for sustainable ways to invest their money, start-ups developing innovative green technologies, a fast-growing energy storage sector, unprecedented uptake in rooftop solar, and a whole bunch of shovel-ready renewable and transitional energy projects.

We also had record levels of public support for a climate policy that would push Australia to reach net-zero carbon emissions by 2050; that is, to keep below 1.5 to 2 degrees of global warming as required by the Paris Agreement.

So, business and community have for a long time been overwhelmingly aligned on the financial and environmental imperative of greening our economy. But that's not the impression we've been getting from our federal government — which continues to treat green and transitional energy as a partisan issue, to the detriment of us all.

Federal government inaction and apathy meant that the Old Energy Normal was far from perfect. In fact, as we discuss below, it stood in the way of private companies progressing (or realising to their full potential) new green energy technologies.

The problems with the lack of appropriate energy regulation

Our biggest issue in Australia pre-COVID (and we can decide whether we want to change this post-COVID) is that, at the federal level, energy regulation is too restrictive and it is bordering on obsolete.

Our energy laws are made up of a complex network of bandaid solutions that need urgent, wholescale reform. Why? Because this system puts the National Electricity Market (NEM) at risk. The NEM is effectively what enables the transmission of electricity across the Australian grid (excl. WA).

These bandaid solutions leave private sector renewable development floundering in an unregulated — and therefore high-risk — legal vacuum. Lack of regulation discourages innovation in energy sectors and leaves projects siloed, with less transformational effects than may otherwise be possible if we had centralised and aspirational energy policy.

The net effect is that we are lagging dangerously behind our 2050 zero-emissions target: Australia is ranked as one of the worst-performing countries on climate change policy, and an "increasingly regressive force" globally.

Lessons from COVID

This gap between policy, practice and progress is a problem worldwide. What COVID has shown us is how quickly and effectively these three elements can be connected to fix a big problem.

When faced with an imminent threat to our national health, despite a few setbacks/cruise ships (whatever you want to call them), a number of really interesting things happened in Australia that we previously thought were impossible:

- Our government demonstrated it could act, through bipartisan and federal/state collaboration, quickly and effectively to implement policy based on the recommendations of experts.
- Stimulus packages turned out not to be so politically divisive: we recognise that we can step in to provide assistance to people and industries which become vulnerable as a result of policies implemented to aid the greater good. The public understands that short-term debt can have long-term economic benefits — and that being in the 'black' is not the only measure of success.
- When faced with legal changes and commercial incentives, businesses can and will pivot to meet the needs of a new way of life, as well as considering what they can do to help achieve a collective national goal.
- As a community we demonstrated we are adaptable, resilient and willing to transform the way we live in order to respond to needs of the vulnerable.

What does this demonstrate? It is a little bit like we have — and have always had — all the resources we need to revolutionise our energy sector and to combat climate change, because we're a modern economy with an informed public, and an engaged and responsible private sector.

Plus, even our government can be effective when it wants to be.

We've seen what the law can do — and how to apply it to energy and climate

The national goal post-COVID should be to create a better normal for future generations. We should do this primarily by replacing our outdated energy laws with modern umbrella regulations that meet the needs of a new energy world

(one that must heavily rely on renewable energy), provide transformational, whole-of-economy targets, and in doing so offer clear direction to business and consumers.

The removal of regulatory barriers to the reduction of carbon emissions has cross-sector support; it is even included as a legal policy objective in the International Bar Association's recently released Climate Crisis Statement.

A broad policy-level solution might be the proposed Climate Change Act currently before parliament, which does four main things:

1. It turns the Paris Agreement's 2050 net-zero emissions target into national law — rather than simply being a statement of non-binding intent.
2. It creates guiding principles for decisions made under the Act, which include: effective and equitable action, community engagement, informed decision-making, risk-based analysis of short- to long-term economic, environmental and community threats, fair employment transitions and national and international cooperation. Ironically (given the government's resistance to dealing with the threat of climate change) the very same principles which have been applied to Australia's response to COVID.
3. It creates an expert national Climate Change Commission (one could think of it as our 'Climate Chief Medical Officer') to research and advise on climate-related issues, including how Australia can meet its Paris Agreement obligations. The Commission's role includes preparing a national climate change risk assessment every five years.
4. It requires the Minister to create an adaptation plan setting out how Australia proposes to address the issues in the risk assessment, consistent with the guiding principles.

Concurrently with this kind of federal climate law, we also need wholesale reform to our energy laws to make the NEM more sustainable and adaptable to the uptake of new green energy technologies. This means going faster and further than the AEMO's current 20-year Integrated System Plan.

Australia has even more incentive to do this in the post-COVID context, because we need the investment in jobs and infrastructure, plus capital will be cheaper than ever.

Our vision for the 'New Energy Normal'

We have the impetus and the capacity to create a whole new energy world post-COVID, so there's no reason we can't be pushing ahead with a variety of renewable or transitional energy projects, like solar and wind farms, brown-to-green hydropower plants, while making long-awaited improvements to the NEM.

Australia also has untapped opportunities to export its renewables pipeline overseas.

Closer to home, we can also expect to see the relaxing of planning laws regulating the uptake of rooftop solar PV and storage solutions — and it should become commonplace to integrate green energy into the construction sector more broadly. For example, where possible there should be solar PV on all supermarket builds and other community infrastructure.

Heavy industry itself can and should be driven by renewables: Australia has electric commercial vehicle technologies and — because renewable energy is increasingly becoming the cheapest option — a number of Australia's mining towns are ironically (but positively) already powered exclusively by wind farms and solar panels.

Most importantly, post-COVID: we have to back ourselves. Change is never easy, but we've proven that when it matters and we're given the opportunity, we can do amazing things. In any case, the world is changing whether we like it or not and we have a once-in-earth's-lifetime opportunity to make it change for the better.

There is so much hope in the progress we have yet to make in Australia — we just have to get a move on now.

**Authored by Law Graduate (Commercial) at Marque Lawyers, Molly Jackson and Partner at Marque Lawyers, Kim Middleton; this article is edition two of Marque Lawyer's post-COVID playbook series. It has been republished with permission.*

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Charge as you drive

How magnetism might recharge an electric car as it drives

Imagine a futuristic freeway that charges electric cars wirelessly as they drive along it. While this may sound like science fiction, engineers are taking steps to bring this concept closer to reality.

Wireless charging pads already exist for smartphones, but they only work if the phone is sitting still. Using this technology for cars would be just as inconvenient as the current practice of plugging a car in for an hour or two at a charging station or overnight at home. So what if a car could recharge as it drives?

Engineers from the Stanford School of Engineering have demonstrated a practical way to use magnetism to transmit electricity wirelessly to recharge electric cars, robots and even drones.

Three years ago, Stanford electrical engineer Shanhui Fan and Sid Assawaworrarit, a graduate student in his lab, built the first system that could wirelessly recharge objects in motion. However, the technology was too inefficient to be useful outside the lab.

Now, in *Nature Electronics*, the two engineers demonstrate a technology that could one day be scaled up to power a car moving along a road. In the nearer term, the system could make it practical to wirelessly recharge robots as they move around in warehouses and on factory floors — eliminating downtime and enabling robots to work almost around the clock.

"This is a significant step toward a practical and efficient system for wirelessly recharging automobiles and robots, even when they are moving at high speeds," Fan said.

"We would have to scale up the power to recharge a moving car, but I don't think that's a serious roadblock. For recharging robots, we're already within the range of practical usefulness."

Wireless chargers transmit electricity by creating a magnetic field that oscillates at a frequency that creates a resonating vibration in magnetic coils on the receiving device. The problem is that the resonant frequency changes if the distance between the source and receiver changes by even a small amount.

In their first breakthrough three years ago, the researchers developed a wireless charger that could transmit electricity even as the distance to the receiver changed. They did this by incorporating an amplifier and feedback resistor that allowed the system to automatically adjust its operating frequency as the distance between the charger and the moving object changed.

But that initial system wasn't efficient enough to be practical. The amplifier uses so much electricity internally to produce the required amplification effect that the system only transmitted 10% of the power flowing through the system.

In their current paper, the researchers boosted the system's wireless-transmission efficiency to 92%. The key, Assawaworrarit explained, was to replace the original amplifier with a far more efficient 'switch mode' amplifier. Such amplifiers aren't new, but they are finicky and will only produce high-efficiency amplification under very precise conditions. It took years of tinkering and additional theoretical work to design a circuit configuration that worked.

The new lab prototype can wirelessly transmit 10 W of electricity over a distance of 0.5–1 m. Fan says there aren't any fundamental obstacles to scaling up a system to transmit the tens or hundreds of kilowatts that a car would need. He says the system is more than fast enough to resupply a speeding automobile. The wireless transmission takes only a few milliseconds — a tiny fraction of the time it would take a car moving at 110 km an hour to cross a 1.2 m charging zone. The only limiting factor, Fan said, will be how fast a car battery can absorb all the power.

Assawaworrarit explained that the wireless chargers shouldn't pose a health risk because even chargers powerful enough for cars would produce magnetic fields that are well within established safety guidelines.

Though it could be many years before wireless chargers become embedded in highways, the opportunities for robots and aerial drones are more immediate. It's much less costly to embed chargers in floors or on rooftops than on long stretches of highway.

"Imagine a drone that could fly all day by swooping down occasionally and hovering around a roof for quick charges," Fan said.

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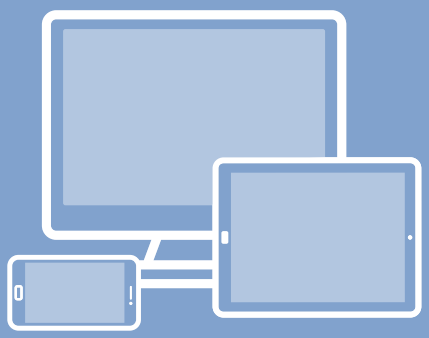

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FLUID CONTROL SYSTEMS

The future of recycling: 4 experts explain

Luisa Low, University of Sydney

Professor Ali Abbas at a paper recycling plant inspecting piles of plastic waste that have been separated from paper. Credit: Professor Ali Abbas, University of Sydney

The New South Wales Government recently conducted a survey on recycling and plastic waste. Ahead of its findings, to be released later this year, University of Sydney academics comment on research into recycling and the development of more advanced waste conversion technologies, as well as the future of recycling.

The University of Sydney recently placed first in Australia and second globally in the Times Higher Education Impact Rankings, which focus on protecting the environment while addressing inequality through sustainable development.

Despite greater awareness, use of plastic on the rise

Dr Lisa Heinze from the Department of Gender and Cultural Studies and the Sydney Environment Institute says that while there's greater public awareness of the issues caused by plastic waste, consumption hasn't dropped.

"Our landfills, landscapes and waterways are choking with plastic. Despite recent 'plastic-free' campaigns, global demand for plastic is on the rise, and nationally our plastic recycling rates are below 10 percent," she said.

"I welcome the NSW survey on the future of plastics including considerations of what types of plastics may be phased out in the short and long term.

"Addressing the environmental and health concerns associated with plastics will depend on all of us — individuals, institutions and governments — working together and alongside industry toward a truly petroleum-based plastic-free future."

Residue from a recycling plant showing mixed waste including plastic, glass, metal and other contaminants. Professor Abbas says this is an example of a difficult waste stream to work with. Credit: Professor Ali Abbas, University of Sydney.

Recycling still in 'single digit' percentages

Executive Director of The Warren Centre Ashley Brinson says rather than dealing with the issue of plastic through recycling, engineers must look at phasing out single-use plastic and packaging.

"Forward-looking engineers are working to design the problems out of short life cycle consumer products and wasteful single-use plastic packaging rather than merely apply end-of-the-pipe waste disposal and recycling," he said.

"After 70 years of modern plastics, most economies still only achieve single digit percentages of plastics recycling, and 'downcycling' cannot cope with enormous volumes of disused plastic."

Downcycling occurs when a recycling process creates a material that is lower in quality and functionality than the original product.

Plastic recycling now a state priority

Professor Ali Abbas from the School of Chemical and Biomolecular Engineering is an expert in the circular economy — an economic system aimed at eliminating waste and the continual use of resources — and the conversion of plastic materials.

"A key priority for all levels of government today is reducing plastic waste. A significant move towards addressing the challenge of plastic waste — and waste in general — was recently made by introduction of the circular economy policy in NSW," said Professor Abbas.

"This policy aims to facilitate as much recycling as possible, as well as minimise waste."

Circular economy 'must be measured'

"Although we have done a great job in Australia on recycling, to realise the full potential of the circular economy, we need to measure the recycling potential of individual products and track their pathways and reuse in the economy," Professor Abbas said.

"We also need to expand technology beyond traditional recycling methods, as some recycling processes cannot efficiently deal with difficult wastes and may in fact be harmful to the environment, all the while remembering that reuse, repurposing and remanufacturing are also important."

Technologies compatible with plastic recycling

"A system-wide analysis of plastic waste should be conducted. It could evaluate the role sustainable technologies, like chemical recycling and energy recovery (waste-to-energy), play in plastic value chains," Professor Abbas said.

"Waste-to-energy recovers energy from non-recyclable plastic and other materials that otherwise would end up in landfill. This is a mature technology and is safely applied around the world, particularly in places where environmental monitoring and regulation can be implemented stringently.

"Chemical recycling changes plastics back to fundamental chemical building blocks, which can then be used to make new plastic products, effectively displacing the need for raw resources."

Plastic waste should be seen as a great resource opportunity

Professor Thomas Maschmeyer from the School of Chemistry and the Sydney Nano Institute has commercialised, with his start-up, Licella, a new industrial process, Catalytic Hydrothermal Upgrading (Cat-HTR), that chemically recycles waste plastics to turn them into new products.

"Plastic waste is a serious environmental issue, but also presents a great resource opportunity," Professor Maschmeyer said.

"The water-based Cat-HTR process that I co-invented through my start-up, Licella, converts plastics into liquid (oil) and gas with a world-record 98 percent efficiency.

"The oil can be refined to new products, including chemicals, plastics and fuels, while the gas is used to run the conversion plant itself. This means no external energy input is needed other than electricity to run control systems and the waste feed system. Currently, large-scale commercialisation projects are underway in the UK and continental Europe.

"This technology will unlock the chemical recycling of plastics in an unprecedented way.

"We are also hoping to introduce the technology commercially into Australia — where it was created, after all — and we are currently looking at sites where we can get the licences to operate."

Demand will drive soft plastics recycling

Wendy Chapman, Clean Up Australia

One of the key unresolved issues in the war on waste is the recycling of household flexible (soft) plastics.

Soft plastics are currently not accepted at kerbside recycling, although a trial has been announced (*Sustainability Matters*, April/May 2020) and they can be deposited in bins at supermarkets through the REDcycle program. But once the flexible plastic has been collected, it cannot practically be made into more flexible plastic packaging material. It can only be turned into other things, but there is insufficient demand from end users for these products.

In 2018, all levels of Australian government came together to launch the 2025 National Packaging Targets. Its aim: "The whole packaging value chain collaborates to keep packaging materials out of landfill to maximise the circular value of the materials, energy and labour in the local economy."

Under the scheme, federal, state and territory governments agreed that 100% of packaging material must be either re-usable, recyclable or compostable, and that 70% of plastic packaging must be recycled or composted.

The National Packaging Targets are being driven by the Australian Packaging Covenant Organisation. APCO has been working with all parts of the packaging chain to establish both what currently happens and what is possible. One of its first projects was a survey to gather data on the scale and extent of the problem. It then set targets for recycled content in packaging, and in April 2020 APCO released 'Our Packaging Future', which sets out the steps to achieve the 2025 targets.

APCO wants to drive the use of recycled content by increasing the capacity for reprocessing locally and by increasing the number of premises recycling.

Pip Kiernan, Chairman of Clean Up Australia, says that to drive plastic recycling, there needs to be a market for the end product. "We need to build an inclusive, circular economy and work together to create a market for the material we recycle. It's very simple — if no one is buying products made with recycled plastics then the plastics go to landfill," she said.

One alternative is to re-use the plastic to make the same product again. But at present PET packaging (eg, soft drink bottles) contains an average of 12% recycled content, HDPE (such as milk bottles) contains only around 2% recycled content, and there is an insignificant amount in flexible plastics.

APCO's 2025 targets are 30% for PET, 20% for HDPE and 10% for flexible plastics.

There is a significant difference between the targets for recycled content for plastic packaging (10–30%) and the National Packaging Target for plastic that needs to be recycled (70%). This difference represents the amount of recycled plastic packaging that needs to be turned into something useful that is not packaging.

This is where we need industry and governments involved. Mixed plastics (including flexible plastics) can be recycled into a variety of products. As an example, the flexible plastics collected through the REDcycle program are used by Replas in Ballarat to make bollards,


Image credit: Replas.


Image credit: Replas.

signage, wheel stops and furniture. Close the Loop in Melbourne uses the plastics as a component in an asphalt additive called Tonerplas.

As an individual you can buy shampoo or washing detergent in a bottle made of recycled plastic, but most people don't need the large-format outdoor products that are currently made from flexible plastics. If we are to meet our target of recycling 70% of plastic packaging, there needs to be demand for end products that are not packaging. This is where industry and government need to incorporate recycled content targets into their formal procurement policies.

Mark Jacobsen from Replas sees waste as a valuable resource and a way to make the world more sustainable. "Our driving focus is education and awareness around what is possible with soft plastic packaging. We work closely with schools, architects and councils to arm them with the knowledge to make informed decisions about the selection and procurement of recycled plastic products. Everyone touches plastic and we must be more accountable and responsible if we are to drive demand for recycled plastic products.

"When you purchase products made from recycled plastic, you become the true recycler," he said.

The bottom line is that soft plastics recycling (or any recycling for that matter) only works if there is a market for the product.

Elizabeth Kasell from REDcycle summarises it well: "The success of any economy relies on the balance of supply and demand. The recovery and flow of materials through a successful recycling model is no different. As a society transitioning to a circular and shared approach to our waste, it is vital that the demand for products containing recycled materials is raised to meet the supply. This can only be achieved if government and industry lead by example and drive the demand through the procurement of these products."

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Katronic adapt dual-channel flowmeters to make the best of the worst flow conditions.

One of the assumptions made when installing a flowmeter is that the instrument is in a location where there is a stable and undisturbed flow. The reality is though that accessing such ideal measurement conditions is often difficult, or impossible. Disturbances in the flow profile could be caused by numerous things but generally are a result in a change to the pipe through which the liquid is flowing. These changes in fluid condition cause the flow profile to shift with the point of maximum fluid velocity no longer being located in the centre of the pipe.

Localised flow profile changes resulting from these pipe modifications will cause problems for most flowmeters installed in the same area. The cause is that regardless of the measurement technique used, there is an assumption that the observed flow condition is happening at the point of fastest flow and that no other outside influences are in play. The initial question is therefore what can be done to identify when disturbances to the flow might be happening, and then secondly to offer an appropriate solution.

It should be mentioned at this point that certain measurement technologies are more immune to this effect than others. Coriolis flowmeters for example calculate flow and density based on the vibrations of the internal tubing within the meter body and as such are not constrained in the same way as other instruments. Users of clamp-on flowmeters, along with many other devices, need to take the flow condition into account looking at potential locations for meter installation.

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Luggage Point marked for organic wastewater treatment technology

Construction of a full-scale sidestream ANITA Mox treatment plant will commence later this year at Urban Utilities' Luggage Point Resource Recovery Centre in Brisbane. The plant will use Anammox bacteria to break down nitrogen in wastewater, requiring less energy and chemicals than traditional treatment processes.

Veolia Water Technologies and Urban Utilities will work together to install the technology in what is an exciting development for the wastewater treatment industry.

Once completed, the plant will treat 1 ML per day of high-ammonia sludge concentrate produced by the plant's main treatment processes. The project is expected to save up to $500,000 per year in operational costs at the plant.

Traditional wastewater treatment produces a liquid by-product with high nitrogen loads, which is returned to the head of the plant for treatment. This process contributes significantly to the plant's operating costs and requires a costly carbon addition and electricity for aeration. In contrast, the ANITA Mox solution is a robust, single-stage ammonia and total nitrogen removal biofilm process that utilises Anammox bacteria, offering a chemical-free treatment process that requires less energy.

Urban Utilities Treatment and Production General Manager Peter Donaghy shared that the company has been researching the use of Anammox bacteria with The University of Queensland's Advanced Water Management Centre for more than 10 years.

"Based on our preliminary research and work to develop Anammox bacteria seed, we made a decision in 2015 to work with Veolia to grow Anammox bugs into a booming farm at our Innovation Centre. This project is a great example of taking a new and innovative approach and making it part of our daily operations to help us cut costs, increase treatment capacity at the plant, and benefit the environment at the same time."

As the Anammox bacterium cannot be imported into Australia, the sidestream plant will operate as a biofarm, making it possible for Veolia to harvest the seeds for use in future ANITA Mox projects within Australia.

"This development signals a new chapter for the wastewater treatment industry in Australia and offers other municipal service providers the opportunity to see the positive impact this innovative and environmentally friendly solution can bring to their treatment plants," Veolia Water Technologies Client Manager Karen Shaw said.

Veolia Water Solutions & Technology
www.veoliawatertechnologies.com.au

ELECTRIC VEHICLE CHARGING SOLUTION

The Terra AC wallbox from ABB Electrification is designed for connected charging in homes and businesses, and supports the growing generation of renewable energy users who want to harness and manage the consumption of their own power.

The technology enables configuration and software updates via a dedicated app or remotely via the cloud.

Each charger is equipped with a revenue-grade energy meter that can be integrated with smart building energy management systems, allowing advanced load management features. This enables home and business owners to adjust the power of assets as needed to maximise charging power and cost efficiency.

Compatible with the majority of electric vehicles, the product is available in up to 22 kW variants.

Product features include a broad range of connectivity options including Wi-Fi, Bluetooth and Ethernet; a space-saving design that can accommodate two chargers back-to-back; and a dustproof and water-resistant design for harsh weather conditions.

The device has been independently third-party evaluated and tested. It has current-limiting protection to allow maximum charging power without nuisance tripping, with integrated ground fault and overvoltage protection.

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Carbon-neutral culverts

for rail infrastructure project

Carbon-neutral precast concrete culverts from Humes being installed on the Inland Rail Parkes to Narromine section.

Humes, in partnership with Inland Rail, has achieved an industry-leading sustainability milestone by providing 22,625 tonnes of carbon-neutral precast concrete culverts.

The carbon emissions of the products were reduced using supplementary cementitious material, with the remaining emissions neutralised via certified carbon offsets.

The 22,625 tonnes of carbon neutral culverts will save over 7250 tonnes of carbon emissions, which is the same as:

- removing about 1350 vehicles off the road for a year[1]; or
- the total energy usage of 1028 Australian homes for a year for all heating, cooling, cooking, hot water, appliances and lighting[2].

Inland Rail is a once-in-a-generation project that will enhance supply chains and complete the backbone of the national freight network between Melbourne and Brisbane via regional Victoria, New South Wales and Queensland.

Comprising 13 individual projects and spanning more than 1700 km, Inland Rail is one of the largest freight rail infrastructure projects in Australia and one of the most significant infrastructure projects in the world.

The culverts, which were manufactured at Humes' Tamworth-based facility, were installed on new rail track and road connections as part of the 103 km Parkes to Narromine section of the Inland Rail project.

Humes, a division of Holcim Australia, registered an Environmental Product Declaration (EPD) for precast concrete products manufactured at Humes Tamworth in early 2020. This followed what is claimed to be the world-first EPD for precast concrete pipes by Humes in 2017.

The EPDs quantify the greenhouse gas emissions involved in the creation of Humes precast concrete products through the entire supply chain, otherwise known as 'embodied carbon'.

Humes then purchased and surrendered a corresponding quantity of carbon offsets to achieve carbon neutrality.

Inland Rail's Parkes to Narromine project is claimed to be the first Infrastructure Sustainability Council of Australia (ISCA) project that has achieved a rating for the use of carbon-neutral precast concrete.

Inland Rail registered for an ISCA program rating under the voluntary scheme, which evaluates the sustainability of design, construction and operation of all infrastructure asset classes in all sectors.

The 13 projects of Inland Rail's program are being assessed against the ISCA framework, providing consistency and challenging the projects to deliver best practice outcomes.

"Inland Rail is committed to embracing sustainability innovation, providing lasting benefit to communities along the alignment and creating positive improvements across the entire rail supply chain," said Inland Rail Delivery Manager Brad Jackson.

"What Humes achieved shows that the supply chain wants to do better and they see the value in pursuing the reach for sustainability and carbon reductions. At Inland Rail we encourage, support and applaud the supply chain setting a new industry benchmark and this achievement is a real step change," Jackson said.

Holcim (Australia) Pty Ltd

www.holcim.com.au

[1] Based on 0.401 kg CO2-eq per km of car travel (AusLCI) and an average travel distance 13,400 km per car in FY17/18 (ABS: https://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0)

[2] Based on an average greenhouse gas impact of 7 tonnes CO2-eq for an Australian household per year from energy use (http://www.yourhome.gov.au/energy)

Environmental boost for Melbourne's AAMI Park

Pressure on heating, ventilation and air-conditioning (HVAC) equipment at Melbourne sporting and entertainment venue AAMI Park means that reducing CO_2 emissions (CO_2e) and running costs is an ongoing commitment of the venue's management, Melbourne & Olympic Parks (M&OP). To help meet operational growth targets, M&OP consulted technical partner Johnson Controls to identify the best way to optimise the venue's performance.

The Johnson Controls facility performance team partnered with M&OP's infrastructure team to identify initiatives that could be implemented immediately under the venue's existing service agreement.

A thorough review of AAMI Park's multiple mechanical functions began by analysing HVAC requirements for each tenant and event space, which included evaluating the energy management systems.

Performance was tracked at 72 electrical meters, 102 water meters and three gas meters to pinpoint exactly where energy-reduction improvements could be made without having to replace the existing plant equipment.

A key focus area was the mechanical plant's building management system and control strategies, which included isolating the HVAC equipment's operational zones. This resulted in greater comfort levels for tenants and patrons while minimising energy wastage.

Johnson Controls created a new HVAC scheduling methodology to help reduce energy outputs and wastage and extend the plant equipment's life cycle. The process encompassed both the air side (air-handling unit and associated plant) and the water side (which included both chiller and boiler plants) to ensure the most efficient overall outcome was achieved.

Substantial cost and CO_2e savings were achieved by assessing the stadium's mechanical plant operation. Energy outputs were reduced by 47% and 815 tonnes of CO_2 were removed from the atmosphere by optimising the existing HVAC operations and control functionality — an impressive outcome that has helped the venue exceed its sustainability targets.

The entire process included an initial site audit to identify sustainability opportunities; chilled water and heating/hot water system rebalancing throughout the venue; York Chiller operational software upgrade; plunge pool configuration; VCC HVAC configuration; and tenant plant equipment consolidation works. These initiatives resulted in mechanical plant electrical savings of 696,565 kWh since 2015, and running cost reductions of $129,359.

Johnson Controls Australia Pty Ltd
www.johnsoncontrols.com/

MODULAR I/O SYSTEM

Weidmüller's u-remote compact distributed I/O platform offers a streamlined design while providing features such as hot-swappable slices, an integrated self-configuring web server interface and simple plug-in connections.

The u-remote platform is a solution that's built for faster installation and set-up, and designed to improve performance and productivity. At 11.5 mm wide per modular slice, its slim design gives it a high-channel density.

Being vendor-neutral, it supports integration with all major fieldbus networks including EtherNet/IP, Profinet, EtherCAT and Modbus TCP for seamless compatibility with existing plant and machine networks.

An integrated web server helps speed up installation and provides real-time diagnostic access to up to 64 connected I/O slices or cards. Its high-speed system bus also provides high performance and works with as many as 256 DI/DOs in a 20 μs cycle time.

Weidmuller Pty Ltd
www.weidmuller.com.au

FIMER's PVS 175 has recently been installed as part of a 4 MW project for a food and beverage manufacturer in Victoria.

The PVS-175-MVCS fits within a 20ft container

- Dedicated protected feeder for each inverter
- All auxiliares included
- Oil transformer
- Up to 6.7MVA
- Most cost efficient solution

HOW TO **MITIGATE RISK** AND **OVERCOME CHALLENGES** OF MEDIUM VOLTAGE EQUIPMENT IN **SMALL-SCALE UTILITY PROJECTS**

Network conditions have impacted the large-scale solar industry around Australia and have caused significant delays in the connection approval process for a large number of projects. As a result, more and more investors in Australia are seeing a surge of small-scale utility solar, particularly around the 5 MW mark which can fly under the radar of the electricity network's congestion woes.

However, most players in the small-scale utility sector with limited experience in dealing with large central inverters and medium voltage (MV) to high voltage (HV) equipment are marking these solutions as something that increases the risk profile of the entire project which can in some cases end up reflected in the Power Purchase Agreement (PPA) figures.

By having a suitably designed decentralised integrated system, you can improve the project's risk profile and remove the engineering pressure from your contractors.

The award-winning three-phase FIMER PVS-175/185 string inverter has the largest high-power density within the 1500 Vdc segment, delivers up to 185 kVA at 800 Vac and can achieve an ultra-high DC/AC ratio of 1.4.

The PVS-175/185 is ideal for small, medium and large-scale free-field ground-mounted solar installations from 800 kVA to 6.7 MVA per station.

The inverter is equipped with 12 MPPT and provides maximum PV plant design flexibility and enables increasing yields also in case of complex installations.

With quick and easy installation, thanks to plug and play connectors and the potential to use the existing PV module mounting systems to install the inverters, you can achieve significant savings in installation time, on-site preparation and hire of plant costs.

Standard wireless access from any mobile device makes the configuration of inverter and plant easier and faster. Monitoring your assets is made easy, as every inverter is capable of connecting to the free Aurora Vision cloud platform.

FIMER has designed this inverter to offer not only lower cost/watt but also other system benefits that will further contribute to the reduction of the overall system cost.

The FIMER PVS-175-MVCS solution.

The PVS-175-MVCS (Medium Voltage Compact Skid) is an integrated product specifically engineered for decentralised solar plants. The solution allows to connect up to 36 inverters for a maximum power of 6.7 MVA.

The MVCS includes an optimised MV oil-immersed transformer, MV gas-insulated switchgear, all the necessary low voltage protections and connections to attach the solar array and a set of available auxiliary services with independent auxiliary power and can fit within a 20ft container.

With many installations already around the world, this solution can offer reduced CAPEX with its ultra-high-power density and reduced OPEX through fast installation and easy configuration and asset management.

For more information or to discuss any specific project details, please contact Aaron Zadeh from FIMER Australia by email aaron.zadeh@fimer.com, or phone 0428 647 697.

Aaron Zadeh is a CEC accredited solar design engineer with more than 15 years of experience in product management, project realisation, sales and business development in the solar industry across Europe, UK, the Middle East and Australia.

Aaron is responsible for large scale solar and energy storage projects and EV chargers in Australia and New Zealand. Previously, he worked on the AGL's Virtual Power Plant project in South Australia.

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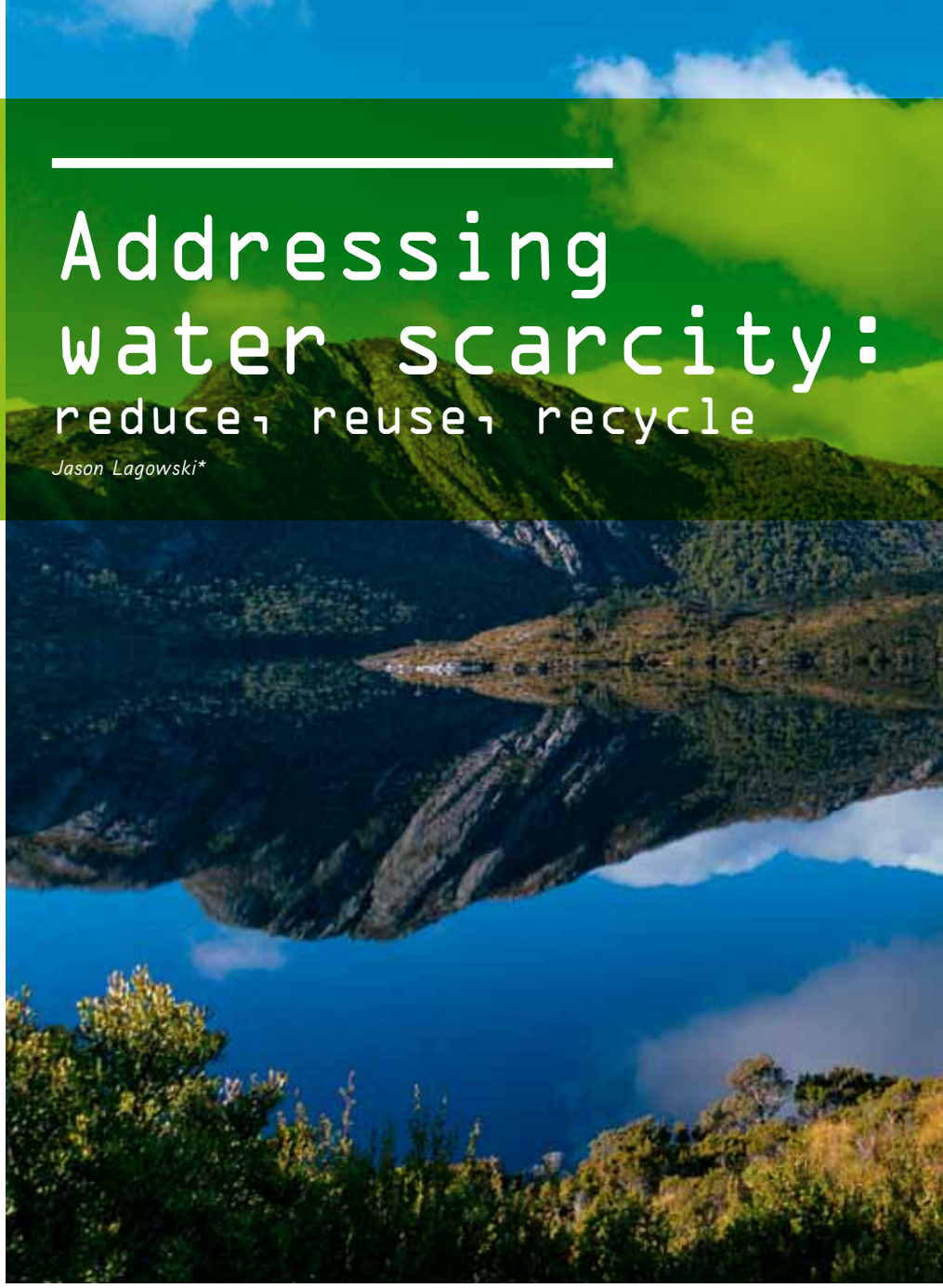
Addressing water scarcity: reduce, reuse, recycle

*Jason Lagowski**



Usable water is a precious commodity. The saying "without water there is no life" becomes very real in times of drought as individuals and communities are impacted by the scarcity of supply.

It is during these times that there is a greater focus on our water resilience. The remedy to these issues is often reactive, including the implementation of water restrictions and the identification of new drinkable water sources.

Ideas and strategies are divided between short-term emergency measures and longer-term infrastructure needs. In addition to water restrictions, short-term actions include supplying water to communities via truck or train. Longer-term strategies require the expansion of the pipeline network to support bringing and or building desalination plants online or conveying water from areas of surplus inventory to those areas in need.

With the rain we've experienced over the past few weeks, the focus has again shifted away from water scarcity and the solutions required to build water resilience for our communities.

To build resilience there needs to be a transformative approach to the way we store, manage, reduce, reuse and recycle this precious commodity. Our challenge is to implement systems that ensure water remains a sustainable and accessible resource for all, over the long term.

What's impacting our water supply?

Contaminants

When water is impacted by old or emerging contaminants, the available resource shrinks. Per- and polyfluoroalkyl substances (PFAS), for example, are a man-made class of chemicals that can affect our water supply. They have been used in thousands of commercial and industrial products for decades and can now be found throughout our environment, including remote areas around the world.

PFAS are persistent because they bioaccumulate in the environment, and as such, they have truly become a global problem. The health and ecological impacts of PFAS are still being evaluated. There are chemicals within the PFAS family that have some of the lowest exposure guidelines in the world. With PFAS becoming more widespread than previously envisaged, there is the possibility that all water catchments will be impacted over time.

Our approach to water management must therefore encompass every component of the process, from catchment, to storage, treatment and distribution systems.

An unpredictable economic model

Society tends to view water as an entitlement and less so as a resource using traditional economic criteria. Even though water is an essential ingredient to life, it appears decoupled from the laws of supply and demand. This is evidenced during times of drought, when water as a diminishing resource should experience exponential growth in its price — that is, demand exceeds supply. The rate of growth and the magnitude of price increase is not readily apparent and hence does not follow economic theory.

Society relies on water being transported in via truck and train to meet times of need. An alternative approach is to change the relationship we have with water and revalue water as the precious commodity it is. In doing so, the economic justifica-

tion to implement long-term sustainable infrastructure and solutions would be met.

These long-term objectives can be extremely expensive to implement. The solution then needs to shift to a local and regional level. Solutions to treatment, storage and distribution can then match the price end users are willing to pay; however, the relationship we have with water needs to be focused on 'reduce, reuse and recycling'.

So, what can we do?

We know that external economic and environmental factors will continue to impact our water supply and access to it.

To address these issues, there needs to be more work on water audits that look at reducing consumption, especially in water-intensive industries, losses during distribution leakage and evaporation, and recycling/reusing water to decrease demand and increase supply.

The harsh truth is that Australia is one of the driest continents on the planet. Industries that use a lot of water should be challenged to reduce demand on supply, whether in drought or surplus periods. All water consumers should take a holistic approach and consider reuse/recycling options before drawing on new fresh supply or returning water to the environment following treatment.

Ultimately, a better balance between the economy and the environment is needed, and the solution to that is two-fold:

Reduce demand

By adopting an approach that acknowledges water as an asset, better management of this precious resource can be achieved.

Our challenge is to reduce water demand by including water balance/requirements in development and planning approvals and look at holistic and sustainable approaches to water management.

Australians already tend to be water smart based on a long history of drought exposure. We have an opportunity to further improve our efforts through ongoing education focused on conservation strategies. As a country, we need to acknowledge that water is scarce, and not only just in times of drought.

A long-term, sustainable approach to water supply planning in both capital and regional locations will go a long way towards conservation efforts.

Increase supply

There are a number of strategies that we actively participate in on a regular basis. Expanding these efforts and implementing new ones will enable us to increase our usable water supply. These include:

- Recycling and reusing grey water: Greywater is relatively clean and comes from baths, sinks, washing machines and other kitchen appliances. When treated properly, greywater can be used for laundry, toilet flushing and irrigation around the house. Treated greywater can also be used to irrigate both food- and non-food-producing plants.
- Introducing new ways to reuse impacted water: Find new ways to cost-effectively treat impacted water so that it can be reused by promoting innovation and bring together land management practices that promote efficient and effective use of water.
- Auditing and eliminating water loss: Minimise system losses and work to eliminate losses of water through the conveyance system via evaporation, broken pipes and wasteful habits.

These are just a few of the many ways we can be working to preserve our most precious resource. Long-term success will rely on a collective commitment to reduce, reuse and recycle.

**Jason Lagowski is Director Remediation Technologies at Arcadis.*
Arcadis has partnered with software and analytics firm SEAMS to provide even quicker, more detailed expert analysis within its consultancy. By combining its deep knowledge, industry insight and data analytics with SEAMS, the company can provide a service that helps its clients build effective water management systems.

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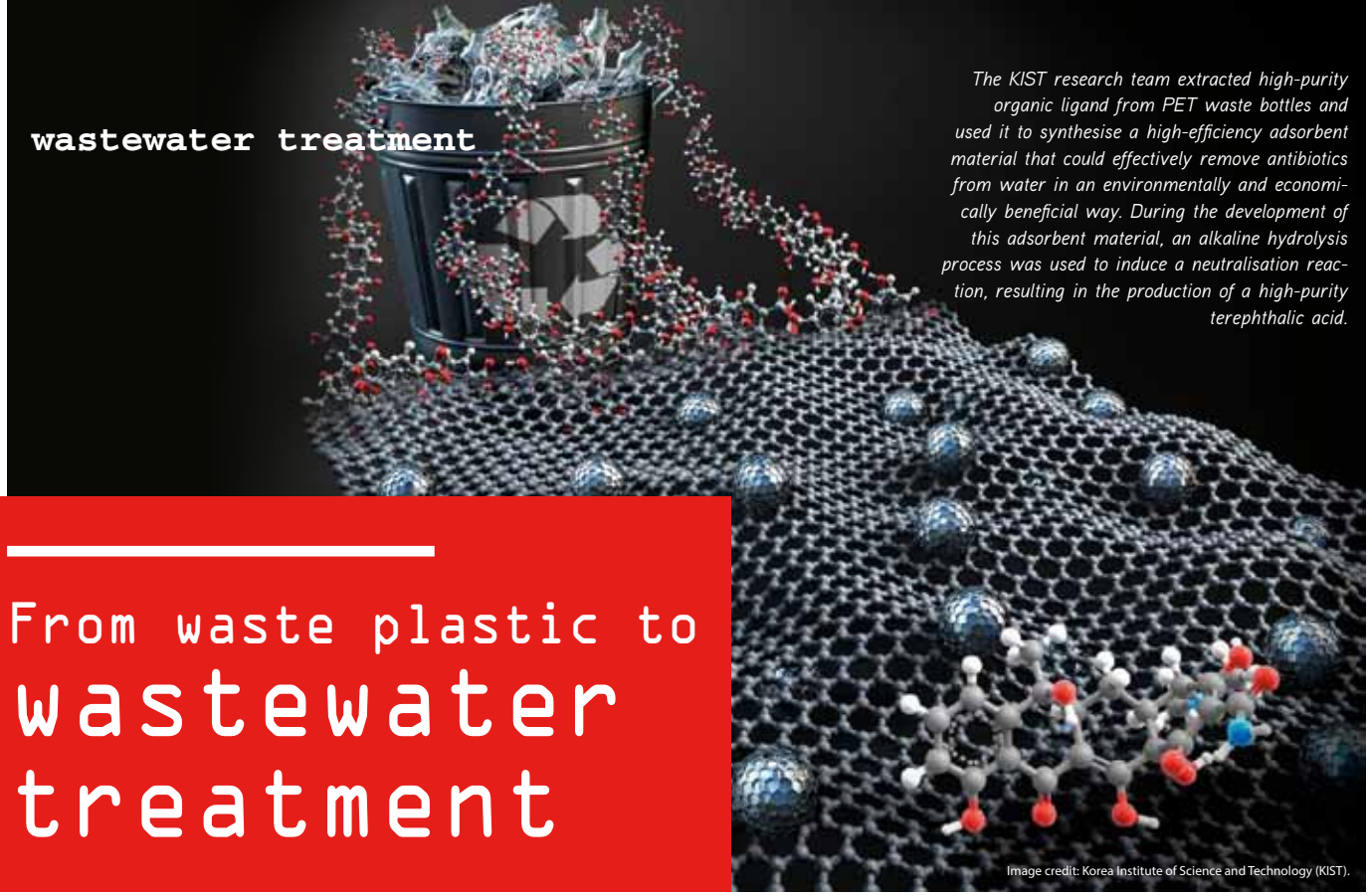

wastewater treatment

The KIST research team extracted high-purity organic ligand from PET waste bottles and used it to synthesise a high-efficiency adsorbent material that could effectively remove antibiotics from water in an environmentally and economically beneficial way. During the development of this adsorbent material, an alkaline hydrolysis process was used to induce a neutralisation reaction, resulting in the production of a high-purity terephthalic acid.

Image credit: Korea Institute of Science and Technology (KIST).

From waste plastic to wastewater treatment

Appropriating waste PET bottles may help to remove antibiotics from wastewater.

A research team from the Korea Institute of Science and Technology (KIST) Water Cycle Research Center has developed a high-efficiency, adsorbent material using PET waste bottles. The new material is expected to help solve the problem of environmental toxins and antibiotic-resistant bacteria caused by leaks of antibiotics into water.

Due to high rates of antibiotic use, South Korea is categorised as a country at high risk of the emergence of multidrug-resistant bacteria, or so-called 'super bacteria'. According to the Ministry of Environment, antibiotic substances have been detected at livestock wastewater treatment facilities, at sewage treatment plants and in rivers.

Currently, the most well-known method of effectively removing antibiotics from water uses porous carbon composite, synthesised by pyrolysing metal–organic frameworks (MOF). Porous carbon composites adsorb antibiotics in the water, thereby removing them. However, since the organic ligand generally used to synthesise MOF is very expensive, the cost is a major obstacle to this method's widespread, practical application through mass production.

Looking to develop a more cost-effective solution, the KIST research team — led by Jung Kyung-won and Choi Jae-woo — turned to the PET bottles that people use in their everyday lives.

PET is a high-molecular compound obtained by polymerising ethylene glycol and terephthalic acid, the latter of which is used as organic ligand for the syntheses of MOF. The KIST research team extracted high-purity organic ligand from PET waste bottles and used it to synthesise a high-efficiency adsorbent material that could effectively remove antibiotics from water in an environmentally and economically beneficial way.

During the development of this adsorbent material, an alkaline hydrolysis process was used to induce a neutralisation reaction, resulting in the production of a high-purity terephthalic acid. To maximise the efficiency of the alkaline hydrolysis process, the research team incorporated an ultrasound-assisted phase transfer catalyst process. By optimising this process, the team was able to extract 100% high-purity terephthalic acid, which was used to develop a porous carbon composite.

Iron-based MOF was used as a precursor in order to impart magnetism to the adsorbent material. In this way, the team was able to develop an eco-material that can be easily separated from the mixture after the adsorption process, using an external magnetic field.

The KIST research team tested the efficiency of the porous carbon composite in terms of its ability to adsorb tetracycline — the antibiotic used to treat bacterial infections — from the water. Tests showed that the newly developed material was able to remove 100% of the tetracycline in about 90 minutes under general water conditions (pH 6), with an adsorption rate of 671.14 mg/g, which is a rate superior to that of previously developed adsorbents.

To assess the re-usability of the porous carbon composite, the adsorption–desorption process was conducted five times. Even after repeated use, the material maintained 90% of its adsorption properties, indicating a high degree of stability and wide applicability for water treatment.

"This porous carbon composite is applicable to a wide range of water treatment areas as it uses waste plastics to prevent environmental pollution and maintains its high adsorption properties even after repeated use," Dr Jung Kyung-won said.

Dr Choi Jae-woo added, "The porous carbon composite developed through this research is applicable to various fields, ranging from eco-materials to energy materials, and I expect that it will soon be highly regarded as a value-added eco-material."

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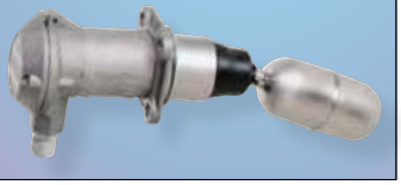

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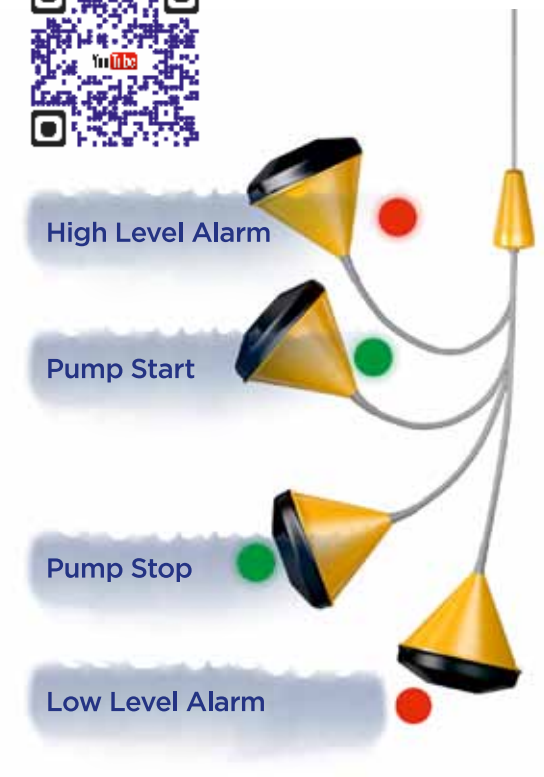

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Novel wastewater treatment removes chemical contaminants

The Theme-based research team.

Sewage effluents are a significant source of chemical contaminants, releasing trace-emerging contaminants such as retinoids and oestrogenic endocrine-disrupting chemicals (EDCs) into aquatic environments. Elevated levels of retinoids have been shown to cause abnormal morphological development in amphibians, fish and snails, while oestrogenic EDCs can induce feminisation of male fish and abnormal development in aquatic organisms.

In a bid to address this problem, a team led by The University of Hong Kong (HKU) has conducted a series of tests to determine if a novel wastewater treatment system could effectively remove trace-emerging chemical contaminants, developing a system that removes conventional pollutants while recovering resources such as phosphorus and organic materials like carbon fibres and volatile organic acids. The results are published in *Water Research* and *Environment International*.

The system combines chemically enhanced primary sedimentation (CEPS) of sewage with acidogenic fermentation of sludge in tandem.

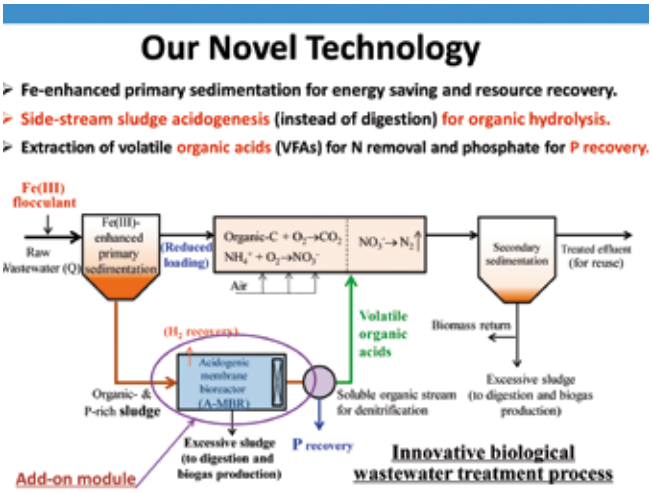
The team found that sewage treatment plants (STPs) removed an average of 57% of retinoids and 54% of oestrogenic EDCs from wastewater influents. The CEPS process alone was 16–19% more effective than the conventional STPs, removing 65–80% of retinoids and 72–73% of EDCs.

After acidogenic fermentation of the CEPS sludge, 50–58% of retinoids and 47–50% of EDCs were further removed from the supernatants of sludge.

"We are very pleased to gather evidence for supporting our hypothesis that our novel sewage treatment system can effectively remove the emerging chemical contaminants," said Professor Leung Professor Kenneth Leung from HKU School of Biological Sciences and the Swire Institute of Marine Science.

"With the scaled-up pilot plant in Shenzhen, we will further investigate the removal efficiency of other classes of common pollutants by this novel treatment system."

Study lead Professor Xiao-Yan Li of the Department of Civil Engineering said, "When the pilot wastewater treatment system in Shenzhen comes into operation and testing, we hope to demonstrate that this innovative technology will use less energy, generate cleaner effluent and recover more useful materials from the sludge."



The novel wastewater treatment system developed by the Theme-based research team led by HKU: Fe-based CEPS with side-stream sludge acidogenesis in relation to the conventional wastewater treatment process.
Images: ©HKU.

MOBILE MULTIPARAMETER MEASUREMENT TOOL

The Multiparameter handheld Liquiline Mobile CML18 from Endress+Hauser is a mobile device for pH/ORP, conductivity, oxygen and temperature measurement, which allows users to check any measuring point in a plant with Memosens sensors with inductive coupling. Using identical sensors to those already installed at fixed measuring points in processes, the device is designed to ensure full data consistency between measurements.

Users can transfer sensor data and measured values to a tablet or smartphone via a secure Bluetooth connection, making documentation, sensor adjustment and data transfer secure and simple.

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UQ becomes an energy 'gensumer' using Tesla battery

Installing a 1.1 MW Tesla Powerpack behind-the-meter battery system has saved The University of Queensland almost $74,000 in electricity costs in three months.

UQ Energy and Sustainability Manager Andrew Wilson said savings from the university's solar panel installations had fully funded the $2.05 million battery system. The battery was a key step in allowing UQ to start trading directly in the national wholesale electricity spot market this year, with the commissioning of the $125 million, 64 MW Warwick Solar Farm this year completing UQ's transition into an energy market player that is both a large energy generator and consumer, known as a 'gensumer'.

"We developed a custom-control algorithm for the battery that enables us to automatically buy and sell power 24 hours a day," Wilson said.

"It charges our battery when clean energy is abundant and prices are low, and discharges when prices are high — often during the evening peak.

The university has published details about the savings achieved in the battery storage system first quarter of use in a report titled 'The business case for behind-the-meter energy storage — Q1 report on UQ's Tesla Powerpack battery', which can be downloaded from https://sustainability.uq.edu.au/.

The University of Queensland
www.uq.edu.au

When charging, UQ's battery bank is lit green. When discharging, it lights up blue. Image courtesy The University of Queensland.

Sewage surveillance

to support COVID-19 response

An Australia-wide initiative aims to integrate sewage testing results for SARS-CoV-2 with national COVID-19 health data to inform where the disease is present in the population.

Led by Water Research Australia (WaterRA) with the support of the Water Services Association of Australia (WSAA) the ColoSSoS Project — Collaboration on Sewage Surveillance of SARS-CoV-2 — will track and monitor the presence of the virus that causes COVID-19 and its persistence in the Australian sewerage network.

The collaborative effort will involve experts in health, microbiology, laboratory testing, wastewater-based epidemiology and policy communication across water utilities, health departments and researchers.

"Results from similar efforts in the Netherlands (and more recently in Australia) have shown that sewage analysis can potentially detect community spread of COVID-19, even before cases are found through the testing of individuals, which makes us confident of our project's success," Project Manager Dr Dan Deere said.

According to WaterRA CEO Karen Rouse, "The next step is for our project team and partners to develop and apply sensitive and robust methods that deliver results governments and the community can have confidence in.

"We have already started collecting and analysing sewage samples nationally and will be integrating these results with health data to help guide and optimise direct management of this COVID-19 pandemic, and ensure we are well prepared for future outbreaks."

Dr Dan Deere said, "ColoSSoS aims to provide a powerful tool for decision-makers. The data it generates will potentially reveal cases in areas previously thought to be free from COVID-19; identify the extent of asymptomatic infections within communities; better characterise trends, peak infections and the persistence or

Dr Warish Ahmed, CSIRO Land and Water.

re-emergence of disease; and verify whether COVID-19 has been eradicated in local populations."

The immediate practical application of project findings could inform policy regarding tightening or loosening of disease control measures such as limits on gatherings and travel, and could enable effective targeting of investment and pandemic control efforts.

WaterRA is working with state and health authorities through the Environmental Health Standing Committee (enHealth) to ensure that project results can readily inform national COVID-19 control efforts.

Tracing SARS-CoV-2 in sewage

In a separate initiative, University of Queensland (UQ) and CSIRO researchers have achieved the first step in developing an early warning surveillance system to track COVID-19 prevalence in the community through tracing the presence of the novel coronavirus gene in raw sewage.

The researchers found RNA fragments of SARS-CoV-2 in Australian untreated wastewater samples from two wastewater treatment plants in South East Queensland, representing populations living in the Brisbane region. The RNA fragments would have been shed in the wastewater stream by people infected with COVID-19.

A paper outlining the proof of concept has been accepted for publication in *Science of the Total Environment*.

Director of UQ's Queensland Alliance for Environmental Health Sciences, Professor Kevin Thomas said the validated method built on work by research groups in the Netherlands and the United States of America.

"This is a major development that enables surveillance of the spread of the virus through Australian communities," Professor Thomas said.

CSIRO Chief Executive Dr Larry Marshall said the testing would help Australia manage COVID-19.

"The hope is eventually we will be able to not just detect the geographic regions where COVID-19 is present, but the approximate number of people infected — without testing every individual in a location.

"This will give the public a better sense of how well we are containing this pandemic," Dr Marshall said.

CSIRO Land and Water Science Director Dr Paul Bertsch said the project showed Australia had the capability to deliver timely COVID-19 wastewater surveillance data to inform decisions, response actions and public communications.

"These data will be particularly useful for catchments with vulnerable populations where testing using other methods may not be feasible," Dr Bertsch said.

"An early warning detection system like this would also be incredibly useful for monitoring and response in the recovery phase."

Professor Thomas said the research used systematic sampling and analysis of wastewater for SARS-CoV-2 using a standardised, coordinated approach based on refined analytical methods.

"The wastewater samples were analysed for specific nucleic acid fragments of the virus using RT-PCR analysis, which is used to identify a gene fragment from SARS-CoV-2," he said.

"The presence of SARS-CoV2 in specific wastewater samples was then confirmed using sequencing techniques."

IIoT SOLUTION PLATFORM

Endress+Hauser's IIoT solution platform, Netilion, is an ecosystem combining digital services and system components to improve the lifecycle and asset management, maintenance and support of instruments and analysers.

Netilion enables users to keep track of their installed base, documentation and data management, and instruments' performance and health status. Netilion's digital services — Scanner, Analytics, Health, Library and Value — can be used separately or in concert.

Netilion Scanner is a free smartphone app that captures field instrument asset data, utilising QR code or RFID tag. It can store images and instrument location and accessibility. Critical and quality-relevant information can also be saved.

Netilion system components such as field gates and edge devices can be used to upload installed base information and create lists of the instruments, without having to interact with the control system. The installed base information in the digital service Netilion Analytics can be used to create a digital twin of the system and analysed with the help of dashboards to initiate proactive maintenance measures for critical instruments or swap out discontinued instruments.

Netilion Health visualises diagnostic data provided by an instrument and receives instructions to address the issue. It can track the condition of the instrument so that other maintenance optimisation measures can be initiated.

Netilion Library helps users organise working files and documents. It is a file sharing and data management service for the complete lifecycle of an instrument.

Netilion Value collects process data from the field, making it accessible anytime and anywhere. It displays the values in various features such as the dashboard, history and tracking map.

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SHREDDERS AND GRANULATORS

Genox Recycling Technology's range of shredders and granulators is designed for reprocessing waste material for direct input into closed-loop manufacturing, secondary processing or volumetric savings in recycling skip bins.

The range of shredders and granulators is suitable for a variety of waste products. The Vision series comprises high-quality, cost-effective shredders; granulators from the Gran-Calibur series offer defined size reduction of various materials in a single pass.

The range of products that can be size reduced and then recycled is extensive and includes soft and rigid plastics, plastic film, general plastics, wood, metals, textiles, tyres, e-waste and more.

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INSERTION THERMAL ENERGY METER

The Series IEFB Insertion Thermal Energy Meter from Dwyer Instruments Australia uses electromagnetic technology to measure fluid velocity and energy consumption. The high-accuracy IEFB is adjustable to fit pipe sizes from 4 to 10″ (100 to 250 mm), while the standard-accuracy IEFB fits pipe sizes 4 to 36″ (100 to 900 mm).

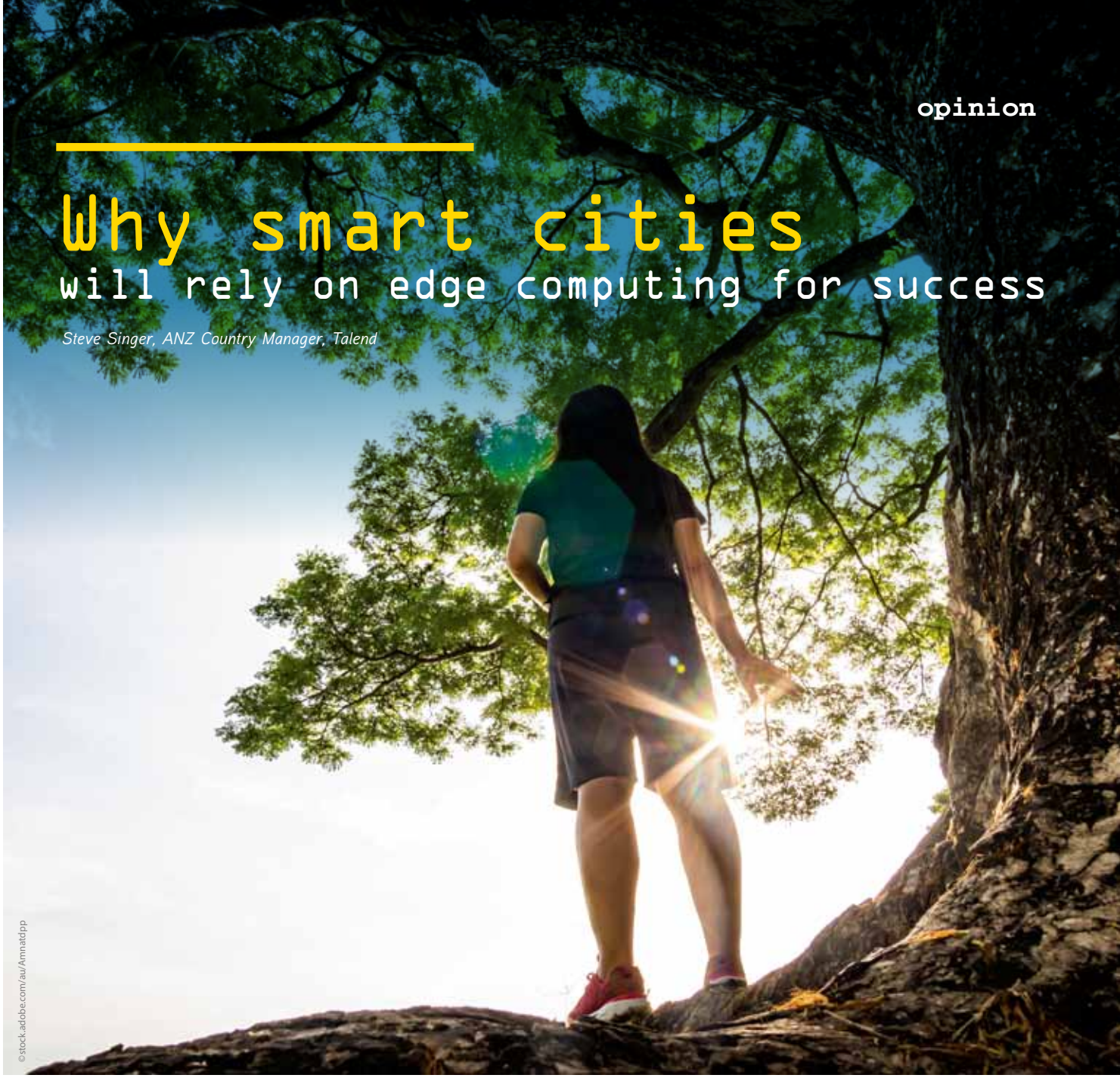
Designed for installation on chillers, boilers and other heating and cooling applications, the device incorporates a temperature meter and a calculator into a single unit. The LCD display provides clear readings of the meter's values, including temperature and energy consumption.

The product offers several output options, including selectable BACnet MS/TP or Modbus RTU communications protocol over 2-wire RS-485 and standard analog, frequency and alarm outputs.

Dwyer Instruments (Aust) Pty Ltd
www.dwyer-inst.com.au

Why smart cities will rely on edge computing for success

Steve Singer, ANZ Country Manager, Talend



Despite living in a country full of wide-open spaces and beautiful rural landscapes, most Australians opt to live in cities. Indeed, even if the COVID-19 pandemic and the confinement of populations around the world makes it difficult for some people to live in cities, urban populations will continue to grow at such a rate that only a smart city strategy will improve the lives of all residents.

According to the ABS[1], 71% of people live in our major centres while just one in 10 live in towns with fewer than 10,000 residents. As a result, the nation's cities are struggling to keep up with demands for housing, transportation and support services.

With this urbanisation trend showing no sight of slowing, city planners are having to adjust their thinking. They need to figure out how cities can cope with rising populations while avoiding any detrimental impacts for those already living there.

The challenge is exacerbated by issues such as air pollution. Sprawling suburbs and a heavy reliance on cars for commuting are degrading air quality and reducing the livability of urban centres.

On a more positive note, new technologies and data sources are helping planners and urban authorities take a new approach to the issue. They're helping make the concept of a smart city a reality. However, Google Sidewalk Lab's recent departure from its grand-scale Toronto waterfront smart city project would suggest that investment should be made incrementally and ensure the wider community is onside from the outset.

Making cities smart

Creators of smart cities have a goal of optimising everything from transportation and energy distribution to the services provided to residents. This is achieved by installing sensors in places such as parking lots, public transport hubs, rubbish trucks and streetlights. The data collected provides vast amounts of information on the behaviours, habits and needs of inhabitants.

Lying at the heart of smart cities are the digital technologies that use the collected data to support transformation. One of the most important of these technologies is edge computing.

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Unlike more traditional, centralised systems, edge computing presents a new decentralised way to tackle the challenges of urban growth. It allows large amounts of data to be processed and analysed instantaneously on the collection devices themselves rather than having to be sent to a central data centre.

This is important because traditional data centres were not designed to handle the volumes of data generated by large sensor networks. As connected devices and services grow, there is a risk of network congestion and degraded performance. Edge computing overcomes this challenge.

One example of edge computing at work can be seen in traffic management. A range of companies are using the approach to generate real-time views of traffic patterns and create intelligent rerouting services for vehicles. City congestion is reduced and citizens' lives run more smoothly.

When putting edge computing to use, data security becomes an important consideration. City planners and designers need to build an extendable, scalable and secure architecture in the cloud to ensure data remains secure and is effectively managed. In this way, edge systems can perform the initial processing and analysing of data, with further analysis taking place in data centre or cloud platforms. Security is maintained at all times.

Open data access

Once data is being collected within a smart city infrastructure, access needs to be provided to other organisations involved in planning and rolling out infrastructure and services. The digital platforms deployed need to be able to collect data at scale and create a single point of trust where that data can be quality-proofed, categorised and protected.

The platforms must also provide integration, sharing, discovery and governance. With data rapidly becoming one of world's most valuable commodities, ensuring its quality is maintained at all times is vital.

For a smart city strategy to succeed, authorities will need to commit to a comprehensive data strategy. This will ensure the correct types of data are being collected, processed and shared with interested parties.

Australia's urban lifestyle has brought significant value to citizens for many years. By embracing the concept of smart cities and improving their efficient functioning, they will remain desirable places to live for decades to come.

Talend
www.talend.com

ENERGY STORAGE SOLUTION

FIMER's REACT 2 is a residential energy storage solution that includes a hybrid single-phase inverter available in power ratings of 3.6 and 5.0 kW. The system is claimed to have one of the industry's highest energy efficiency rates, providing up to 10% more energy than lower voltage battery systems.

With the possibility of both AC and DC side connection, REACT 2 is designed for new systems or the retrofitting of existing ones, allowing homeowners to improve their energy self-consumption and save on their energy bills.

REACT 2 offers flexibility with a wide storage capacity, which can be expanded from 4 to 12 kWh, depending on the number of batteries used, and can achieve up to 90% energy self-reliance.

Futureproof technology enables a full smart home experience with advanced communication features and load management capabilities.

The embedded data logger and direct transferring of data to a secure cloud platform allows customers to monitor and keep their system under control through the dedicated mobile app.

The advanced communication interfaces combined with a standard Modbus communication protocol, Sunspec compliant, allow the inverter to be easily integrated within any smart environment and with third-party monitoring and control systems.

The FIMER REACT 2 is now available on the SA Home Battery Scheme.

FIMER
www.fimer.com

STRUCTURAL CONCRETE REPAIR AND PROTECTION

Concrete is a strong and versatile construction material used across a range of industries, from infrastructure and mining to power generation and the treatment of water and wastewater. However, it can be vulnerable to damage and degradation, especially in harsh conditions, and may require protection, maintenance or repair solutions to achieve its full specified lifetime.

Intercrete offers engineering-quality concrete repair and protection systems, including technical mortars and high-performance protective coatings. Innovative technologies and proven formulations offer long-term protection for concrete assets, backed by extensive testing and approvals.

The products can protect assets against carbonation, chloride attack, low cover protection to reinforce steel, positive and negative water pressure in damp/wet concrete, chemical attack, and impact and abrasion.

Durable protective solutions are also available for: structural waterproofing and tanking; coating of freshly poured (green) concrete; approved coating systems for potable and wastewater storage; hygiene-sensitive environments; asbestos encapsulation; heritage structures; and new-build construction.

AkzoNobel Pty Limited
www.akzonobel.com

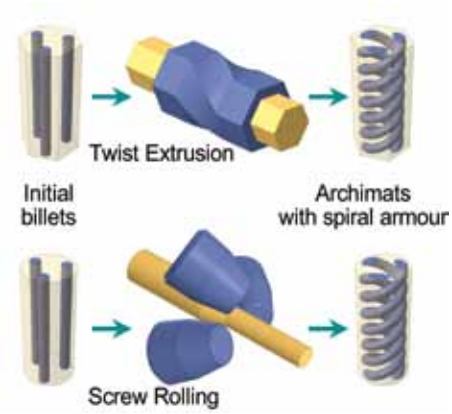
Archimats could revolutionise the construction industry

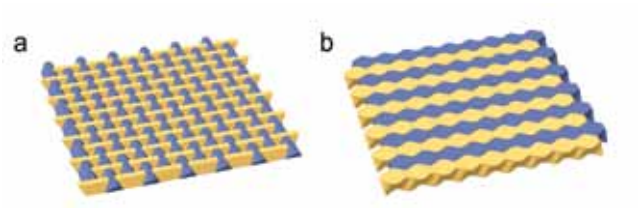
Archimats are 'architectured' materials that have an organised intertwined or interlocking inner architecture that can be engineered to have superior strength, a high tolerance to damage and good thermal insulation compared with other conventional composite materials such as concrete. Archimats can also better absorb energy and provide improved compliance and flexibility.

Led by Monash University, an international research team is now pioneering these recyclable materials, which could revolutionise the building industry. Their research is published in *Advanced Engineering Materials*.

One way to achieve this superior property profile is via severe plastic deformation (SPD) — a technique that results in an ultrafine grain size or nanocrystalline structure. The structural patterns caused by SPD processing can improve the mechanical characteristics and physical properties of materials.

Project lead Professor Yuri Estrin, an Honorary Professorial Fellow in Monash University's Department of Materials Science and Engineering, said a further benefit of archimats is the ease of assembly and disassembly it provides a structure, as well as the nearly full recyclability of the elements involved.





Mortarless construction, rapidly deployable pavements composed of interlocked tetrahedron-shaped blocks or wavy blocks.

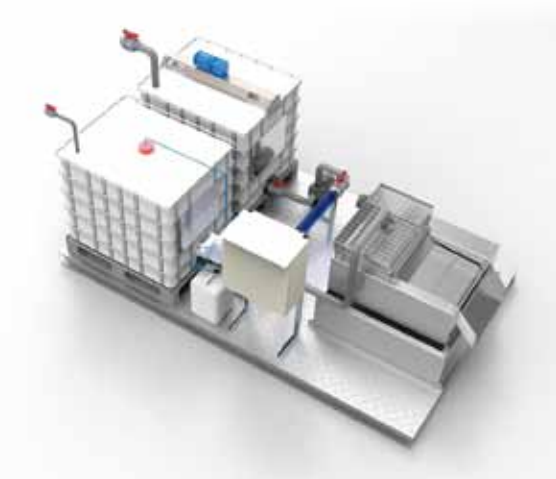
"Archimats therefore offer smarter, safer and more sustainable materials for use in manufacturing and industrial design, with the building industry being arguably the greatest potential beneficiary of this design concept," Professor Estrin said.

"Archimats are also suitable for micromanufacturing. They can be produced using desktop or benchtop manufacturing processes, without the need for heavy equipment and large amounts of material.

"This opens up new possibilities for industry to explore the use of archimats for application in smart manufacturing; in particular the development of gear for microelectromechanical systems, micro devices and miniaturised drones, as well as superior structural materials for the automotive and aerospace industries."

Use of archimats in the construction industry could help to reduce the use of concrete and cut carbon dioxide emissions associated with its production. The material could also be used to build or rebuild in arid or disaster-affected zones. This includes rapidly deployable and removable structures in danger areas, such as a town or city impacted by fire, for first responders and displaced citizens.

SLUDGE DEWATERING TECHNOLOGY



The KDS Multidisc Roller system from CST Wastewater Solutions is a compact and cost-efficient alternative to conventional sludge dewatering technologies. The system is engineered to overcome the limitations of technologies such as screw presses, belt presses and centrifuges.

KDS technology incorporates automatic liquid-to-solid waste separation that removes more than 50% of the water from wastewater sludge to provide a 50% reduction in transportation costs.

Used for thickening dissolved air flotation sludge — a common application throughout wastewater operations — the system achieves solids capture of 97% thickened sludge at a dryness of 17%.

The Japanese-manufactured technology uses minimal energy, consuming as little as 0.06 kWh of electricity; operates at low (63 dBa) non-intrusive noise and vibration levels; requires minimal daily maintenance, saving cost and enhancing OHS performance; and typically occupies half the space or less of conventional dewatering plants.

The lighter, dryer waste reduces the need for manual labour in cleaning and transport operations and curtails the need for staff to handle sloppy heavy waste potentially hazardous to health.

The self-cleaning dewatering and conveying system features an oval plate separation and transfer structure that prevents clogging and permits automatic continuous operation that handles oily and fibrous material with ease.

CST Wastewater Solutions
www.cstwastewater.com

From a PC, laptop, tablet or smartphone - the SAM 4.0's integrated web server provides a visual display of all compressed air system data in the form of HTML pages.

How a networked compressed air system works – a well-orchestrated symphony

Kaeser Compressors explains how a fully networked compressed air system works and the benefits this brings to the end user in terms of complete life cycle efficiency, and most importantly right now — being able to remotely and in real time view key information and diagnostics, for maximum compressed air supply reliability.

Every part of a compressed air station, whether it be the compressors, compressed air treatment components or distribution system, should operate as efficiently as possible for its own sake. Modern compressors and compressed air treatment components are therefore equipped with internal controllers based on industrial PC technology. But these components are not individual players — they must act together as a team, and a team works best when it is perfectly coordinated. A sophisticated compressed air management system is therefore required to perform this particular function.

The Sigma Air Manager 4.0 (SAM 4.0) from Kaeser is an example of a progressive and Industrie 4.0-ready compressed air management system that binds all individual components into a complete team, monitoring and controlling them so that the required volume of compressed air is available at all times, at the required quality.

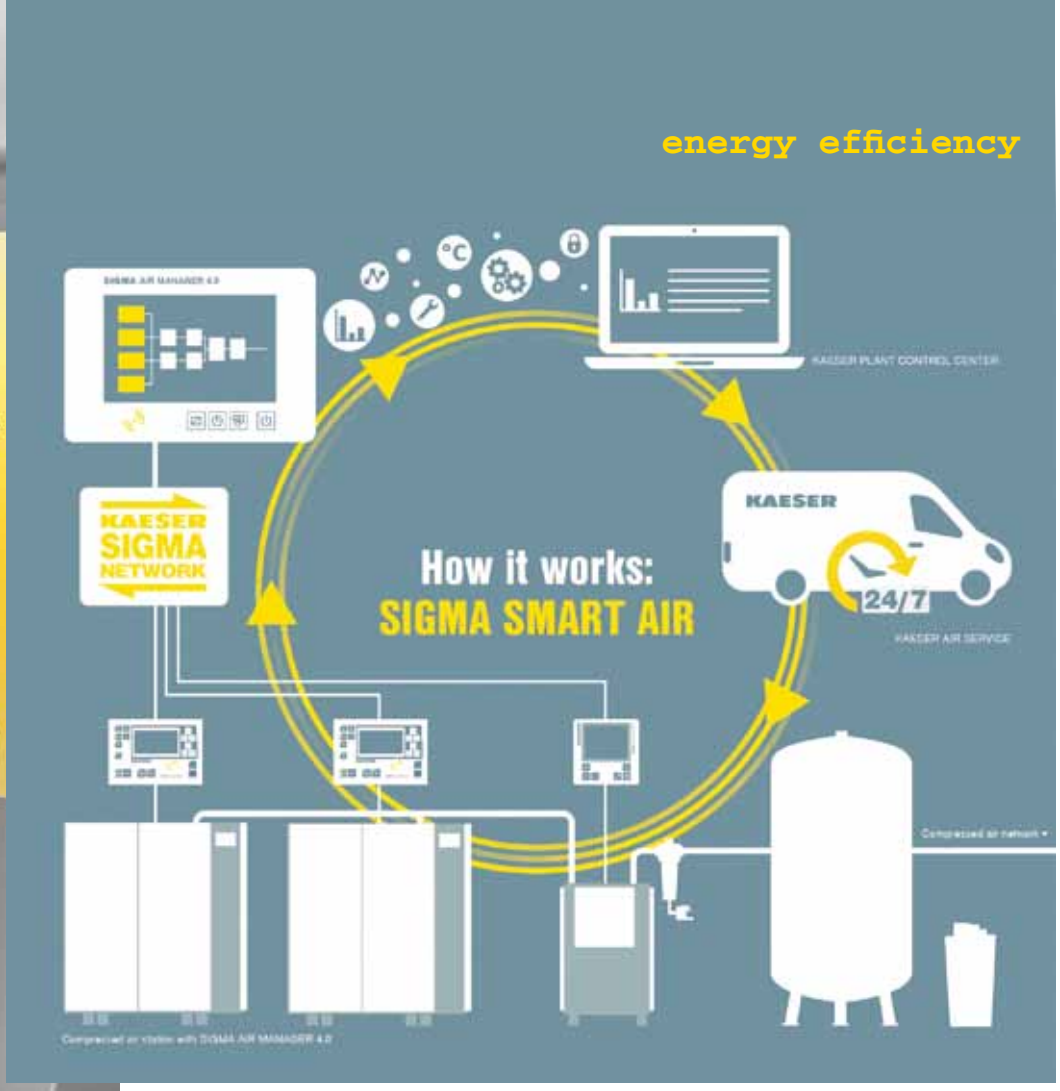
Advanced management systems must successfully meet some highly demanding challenges. Not least, they must be capable of predictive compressor control, taking into account a range of contributing factors, such as switching losses, control losses, etc. However, modern master controllers are now expected to do far more than optimise compressor operation according to current demand. Efficiency is playing an ever-increasing role.

Here, through the development of a patented, simulation-based optimisation process, the SAM 4.0 is meeting these requirements by predictively selecting the most efficient switching operations based on compressed air consumption profile analysis and equipment and system behaviour, in relation to the prevailing technical operating conditions. Decisions are no longer dictated by a narrow pressure range. Instead, the key is to achieve the lowest possible compressed air production costs through intelligent, energy-saving switching strategies.

Predicting service requirements

Such advanced controllers like the SAM 4.0 also allow for varying levels of involvement by external service providers. The end user can therefore still choose to perform all of the maintenance, evaluation and servicing of the system themselves (the SAM 4.0 will

Image credit: Kaeser Compressors



send the end user notifications when service is required). Or, the end user can choose a predictive maintenance service model with remote diagnostics.

Here, the physical meets the virtual world within the framework of a structural model such as Sigma Smart Air from Kaeser, in which the specific compressed air system — configured according to the operator's requirements — is represented virtually by a digital twin. Operating data from the compressed air station is securely transmitted to the Kaeser Data Center, where it is analysed in real time. Such real-time availability of operating data makes it possible to monitor the health status of a compressed air station. This means that maintenance is carried out precisely as needed, potential faults can be detected in advance and appropriate maintenance measures automatically initiated at the right time. Ultimately, the end user benefits from significantly reduced compressed air production and operating costs, as well as improved compressed air availability.

The combination of remote diagnostics and demand-oriented predictive maintenance ensures maximum compressed air supply availability and complete system effectiveness; preventing unplanned downtime, increasing energy efficiency, reducing service costs by up to 30% and delivering demand-optimised compressed air system control throughout the system's entire life cycle.

Remote and real-time monitoring

Probably one of the greatest advantages of such advanced compressed air technology in the current coronavirus situation — where facilities now have many staff working remotely, where the number of people in a facility has been reduced and where many facilities are now limiting access to suppliers — is the ability to remotely monitor a compressed air system in real time.

From a PC, laptop, tablet or smartphone, the SAM 4.0's integrated web server provides a visual display of all compressed air system data in the form of HTML pages. All operational and energy consumption data, as well as cost information, can therefore be called up on any network-compatible device anytime, anywhere. In addition, the end user can choose to configure the system so they receive alarm and maintenance messages for individual components as well as timely warnings or service requirement notifications via email or text message.

And, where the end user integrates an advanced compressed air management system with a service model such as Kaeser Sigma Smart Air, they have the added peace of mind that a team of compressed air experts are also monitoring the real-time data from their compressed air system and acting accordingly.

Conclusion

At the best of times a fully networked compressed air system offers the end user numerous benefits. However, many of these benefits — from remote monitoring and diagnostics, to achieving the lowest possible compressed air production costs through intelligent, energy-saving switching strategies — are even more advantageous in the current climate.

As the fourth utility to industry, many businesses rely on their compressed air system and will now more than ever demand maximum compressed air supply reliability.

Kaeser Compressors Australia

au.kaeser.com

Electricity-generating windows follow solar cell breakthrough

A semitransparent perovskite solar cell with contrasting levels of light transparency. Image credit: Dr Jae Choul Yu.

Australian researchers have revealed that 2 m^2 of solar window will generate the same amount of power as a standard rooftop solar panel.

Semitransparent solar cells incorporated into window glass have been tipped by Australian scientists as a game changer that could transform architecture, urban planning and electricity generation, as outlined in a paper published in *Nano Energy*.

Led by Professor Jacek Jasieniak from the ARC Centre of Excellence in Exciton Science (Exciton Science) and Monash University, the researchers have produced next-generation perovskite solar cells that generate electricity while allowing light to pass through. The team is now investigating how the technology could be built into commercial products with Australian glass manufacturer Viridian Glass.

The idea of semitransparent solar cells is not new, but previous designs have failed because they were very expensive, unstable or inefficient. Professor Jasieniak and colleagues from Monash's Materials Science and Engineering Department and Australia's national science agency, CSIRO, used a different approach.

Using an organic semiconductor that can be made into a polymer, the team replaced a commonly used solar cell component known as Spiro-OMeTAD, which shows very low stability because it develops an unhelpful watery coating. The substitute produced astonishing results.

"Rooftop solar has a conversion efficiency of between 15 and 20%," Professor Jacek said. "The semitransparent cells have a conversion efficiency of 17%, while still transmitting more than 10% of the incoming light, so they are right in the zone. It's long been a dream to have windows that generate electricity, and now that looks possible."

Co-author and CSIRO research scientist Dr Anthony Chesman said the team is now working on scaling up the manufacturing process.

"We'll be looking to develop a large-scale glass manufacturing process that can be easily transferred to industry so manufacturers can readily uptake the technology," he said.

Professor Jasieniak explained that there is a trade-off: "The solar cells can be made more, or less, transparent. The more transparent they are, the less electricity they generate, so that becomes something for architects to consider," he said.

He added that solar windows tinted to the same degree as current glazed commercial windows would generate about 140 watts of electricity per square metre.

The first application is likely to be in multistorey buildings. Large windows deployed in high-rise buildings are expensive to make. The additional cost of incorporating the semitransparent solar cells into them will be marginal.

"But even with the extra spend, the building then gets its electricity free!" Professor Jasieniak said.

"These solar cells mean a big change to the way we think about buildings and the way they function. Up until now, every building has been designed on the assumption that windows are fundamentally passive. Now they will actively produce electricity.

"Planners and designers might have to even reconsider how they position buildings on sites, to optimise how the walls catch the sun."

Lead author Dr Jae Choul Yu, also from Exciton Science and Monash, added that more efficiency gains would flow from further research.

"Our next project is a tandem device," he said. "We will use perovskite solar cells as the bottom layer and organic solar cells as the top one."

As to when the first commercial semitransparent solar cells will be on the market, Professor Jasieniak explained that it will depend on the success of scaling the technology.

"We are aiming to get there within 10 years," he said.

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