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Smart mobility



Dark side of solar



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Climate change

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WORDS FROM THE EDITOR

From droughts, bushfires and heatwaves to air pollution and the coronavirus, Australia has had a rough start to 2020 and all these events are expected to have long-term economic, environmental and social impacts for our country.

The thick eerie smoke haze that has defined our summer has been reflected in politics, with many frustrated by a lack of inaction on climate change issues.

In February, more than 250 scientists actively researching climate, bushfire behaviour and meteorology have signed a document that pulls together the peer-reviewed links between climate change and bushfires. The statement demands meaningful action by Australia's leaders to reduce 'total' national emissions and engage constructively with international negotiations.

The peer-reviewed research gathered by the scientists shows the multiple links between climate change and fire including: how fire seasons start earlier and last longer, particularly in southern and eastern Australia; how declining rainfall across southern Australia in the cooler months makes fire grounds drier, with rising temperatures also drying out fuel loads; and the future changes that will see more dangerous fire weather that will bring firestorms and make fire management even harder.

Hopefully this, together with rising public support, will ensure climate change issues will be pushed higher on the political agenda.

In this issue, we take a look at standards being developed for smarter cities, infrastructure shifting towards smarter mobility, smart energy and technology designed to save our sewers.

With the Tokyo 2020 Olympics fast approaching, we also take a sneak peek at Japan's zero-waste approach to the medal production (see page 38).

Carolyn Jackson

sm@wfmedia.com.au



Westwick-Farrow Media
A.B.N. 22 152 305 336
www.wfmedia.com.au

Head Office
Unit 7, 6-8 Byfield Street,
(Locked Bag 2226)
North Ryde BC NSW 1670,
AUSTRALIA
Ph: +61 2 9168 2500

**If you have any queries regarding
our privacy policy please email**

privacy@wfmedia.com.au

Editor
Carolyn Jackson
sm@wfmedia.com.au

Editorial Assistant
Jane Allman

Publishing Director / MD
Geoff Hird

Art Director/Production Manager
Julie Wright

Art/Production
Colleen Sam, Veronica King

Circulation
Dianna Alberry, Sue Lavery
circulation@wfmedia.com.au

Copy Control
Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

Industrial Group Sales Manager
Nicola Fender-Fox
Ph: 0414 703 780
nfender-fox@wfmedia.com.au

Sandra Romanin
Ph: 0414 558 464
sromanin@westwick-farrow.com.au

Tim Thompson
Ph: 0421 623 958
tthompson@wfmedia.com.au

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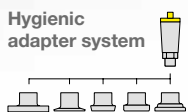
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Roadmap for smarter cities

Daniel Chidgey, Head of Stakeholder Engagement, Standards Australia

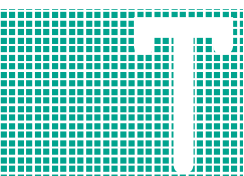
From regional townships to metropolitan hubs, understanding what standards are needed in Australia to help make our cities smarter is important — enter Standards Australia's Roadmap for Smart Cities.



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In 2020, Standards Australia is ramping up its work alongside government, industry, academia and relevant stakeholders to help make smart cities a reality.



The new decade is upon us and across the globe countries are exploring how to increase resilience in their cities through innovative technologies. 2019 saw exciting conversations around the growth of AI, blockchain, hydrogen and, of course, smart cities. However, for this exciting future to be realised, it is important relevant standards are developed, and a roadmap will help us steer this future development.

The development of the Smart Cities Standards Reference Group and Standards Australia's contribution to the inquiry into the Australian Government's role in the development of cities are just two examples of the steps Standards Australia has taken in this space. In 2020, Standards Australia is ramping up its work alongside government, industry, academia and relevant stakeholders to help make smart cities a reality.

Paving the way

Roadmaps help bring together a range of expert voices and considerations with the end result being a strategic plan, with both short-term and long-term goals outlined. Through the development of a Roadmap for Smart Cities, Standards Australia will be able to determine what standards need to be developed to support smart city initiatives in Australia.

Standards that could help guide smart cities could range from cybersecurity and data collection standards to those that help metropolitan hubs determine their sustainable development objectives. When developing the roadmap and discussing the positive impact of smart cities, standards that protect the public, their personal data and the transparent collection of that data will also be an important discussion point.

No two cities are the same, but as our population grows, standards that help support public transport, sanitation, energy,

education and water supply are all part of supporting urbanisation and making our cities as smart as possible.

Adopting ideas

There is a range of standards focused on smart cities that have already been developed internationally, and Standards Australia is currently in the process of adopting three of them. The ISO (International Organisation for Standardization) standards have been developed to support future smart city initiatives for countries across the globe.

The three standards being adopted will aim to assist the Australian Government, state and territory governments and local councils to understand and measure where cities can improve and how they can be smarter as they expand outwards and grow upwards.

ISO 37120 Sustainable cities and communities — Indicators for city services and quality of life

ISO 37120 has become an international reference point for sustainable city indicators — it outlines indicators that measure the performance of city services and quality of life. Indicators are an important tool that help cities establish a baseline to measure and evaluate performance.

The standard aims to provide a uniform approach to what is measured and how measurement is to be undertaken and can be utilised by cities regardless of size or location.

ISO 37123 Sustainable cities and communities — Indicators for resilient cities

This standard intends to set out requirements for cities to measure their responsiveness in recovering from either natural or human-made disasters. As Australia is often subject to extreme weather conditions, this standard has the potential to assist cities, regional hubs and other com-

munities with understanding and improving recovery processes.

ISO 37101 Sustainable development in communities — Management system for sustainable development — Requirements with guidance for use

Sustainability is an integral part of the management and development of smart cities and ISO 37101 aims to provide cities with the tools to become more sustainable.

The standard targets environmental, social and economic issues, including improved community services and socio-economic benefits, as well as supporting clear purposes for sustainable development in communities and encouraging sound planning systems to achieve them.

Outlined in the standard is a framework for the user to measure city services and quality of life performance against the United Nations Sustainable Development Goal 11 (Sustainable Cities and Communities).

Standards Australia is also contributing in the Smart City standards for technology and systems, via its membership of ISO/IEC JTC1 and IEC.

Smart chance of standards

The work that standards can do in supporting the sustainable and effective growth of smart cities is clear. In not only this new year, but also this new decade, Standards Australia is committed to working in this space to deliver standards and bring Australia a unified and consistent approach for more resilient cities.

Standards Australia looks forward to collating the views, ideas and needs of the diverse group of stakeholders invested in smart cities. This includes both developing Australian standards and adopting and collaborating on international standards.

If you have any questions, ideas or feedback, please reach out to Standards Australia's Stakeholder Engagement Management Team at SEM@standards.org.au.

Connected, autonomous, shared, electric (CASE) vehicle technologies offer exciting advantages for the future if transportation system owners and operators stay ahead of the curve.

A well-planned infrastructure will be the key to unlocking CASE's potential and meeting mobility challenges in Australian communities.

By 2056, the population of Australia will have hit 30 million people, with major implications for our transport systems. In Sydney alone, the NSW Government predicts there will be twice as many daily vehicle and public transport trips as today, and cars will account for around three-quarters of the growth.

With more vehicles on our roads, there are concerns about safety, the environment and congestion.

Nearly 1300 people die in vehicle incidents each year, and 36,000 are hospitalised. Transport is this country's third-largest and fastest-growing source of greenhouse gas emissions. Our annual congestion-related costs for the Australian economy will hit an estimated \$40 billion by 2031 — twice the 2016 figure.

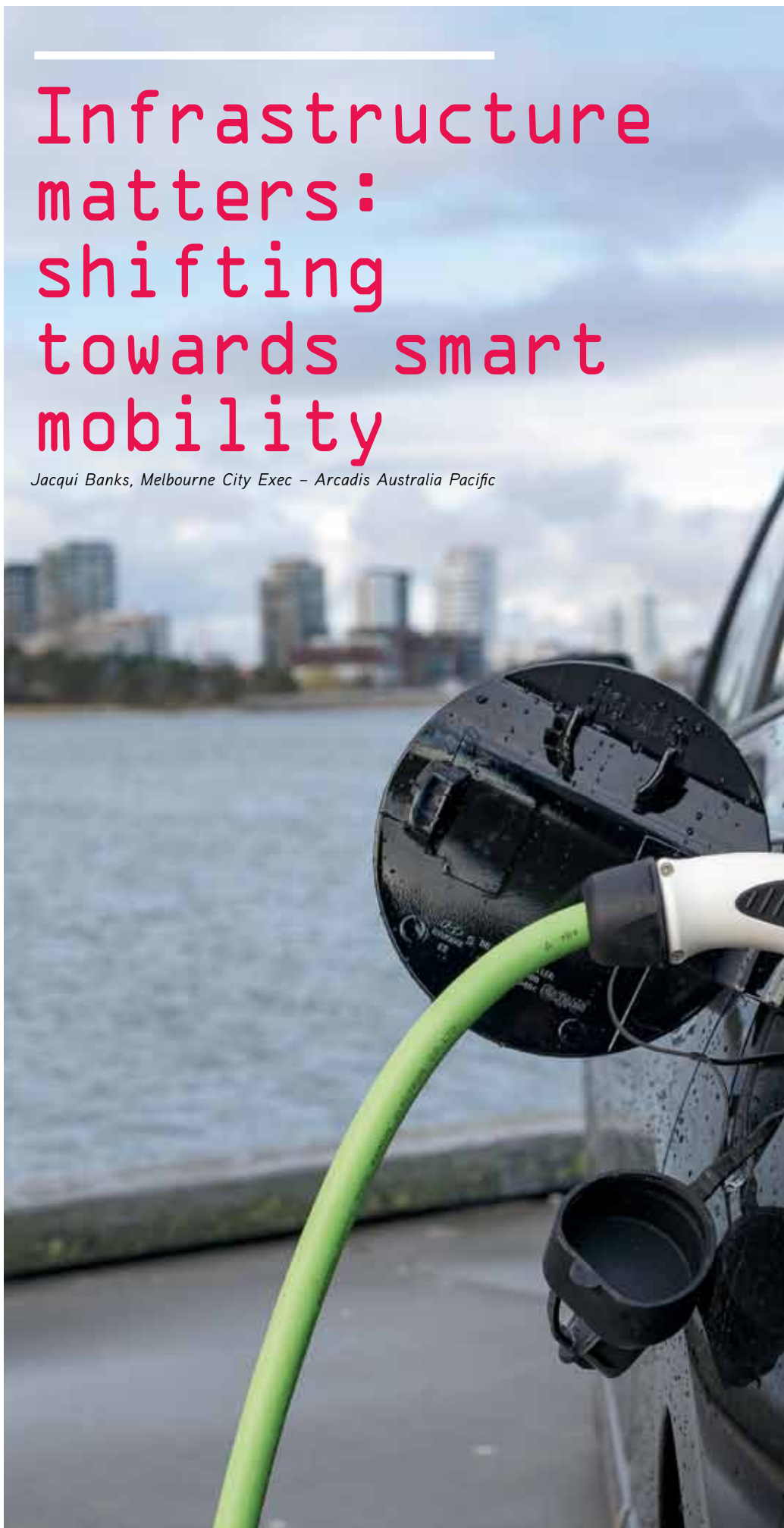
Fortunately, new modes and infrastructure advances are emerging that will innovate demand management, improve safety and reduce environmental impact. They present Australia with unparalleled opportunities to improve how people move around our cities and regions.

Arcadis' interactive Future Mobility experience details how evolving infrastructure and transport modes can make every journey seamless, efficient and safe. Most will be facilitated by CASE, supported by intelligent transportation systems (ITS) which, for example, enable innovative approaches to demand management.

Exciting times lie ahead for transport infrastructure owners, designers and operators. But the benefits are only possible if we invest in futureproofing state and national transport infrastructure so it supports smart mobility. This means focusing on three key

Infrastructure matters: shifting towards smart mobility

Jacqui Banks, Melbourne City Exec – Arcadis Australia Pacific





areas: communication systems, technology choices and shared learning.

Future Mobility will generate monumental levels of data exchange, so a strong communications backbone is essential, preferably using fibre optics or fibre-wireless systems — every road-widening project should include a fibre installation.

While public-private partnerships (PPPs) are useful for sharing the related risks and costs, it's important to remain technology and vendor agnostic. Interoperability and scalability are essential for long-term sustainability.

Learning from interstate and international case studies is also important. Pilots and studies are taking place all over the world, including Australia. Truck platooning, which uses connected and autonomous technology to improve freight transport safety and efficiency, is being seriously investigated in Western Australia in a government-private sector partnership.

Intelligent communications, electric vehicle (EV) and shared mobility infrastructure will ultimately make journeys safer, cheaper and more efficient, and integrating them into infrastructure planning will unlock their full potential.

New modes and network solutions will reshape environments according to citizens' specific needs and international enhancements will be adapted to suit Australian conditions. We should expect more innovative urban planning, such as fewer parking zones and more ridesharing vehicle pick-up and drop-off hubs. And as this is a long-term vision, new modes and network advances will probably be adopted incrementally, with interim changes such as dedicated lanes, striping and signing for connected and shared vehicles until every vehicle is fully automated.

It's a large-scale, fundamental and systemic revolution that will affect every Australian, with no one-size-fits-all approach. Despite the challenges, Australia must embrace smart mobility — it is the most exciting transport evolution in our lifetimes.

While advanced future mobility plans might not be in reach for every owner and operator today, starting preparations now will make it easier to seize the benefits more quickly in the future.

Proactive Future Mobility planning: six key steps

1. Create your vision and strategy

Identify your city, regional and state mobility needs and how emerging technologies and trends might support them, with a high-level, aspirational vision and specific objectives for smart mobility planning.

2. Assess your current ITS architecture, programs and projects

This will define realistic project scopes and establish consistency when expanding. Knowing your capabilities and opportunity areas allows for incremental implementations that maximise resources and eliminate redundancies.

3. Review industry initiatives

Assess plans from other organisations to see what you can use to enhance your area's mobility environments. Find plans with similar constraints or needs.

4. Determine Future Mobility opportunities

Consider how the latest mobility, safety and environmental applications might enhance mobility in your area's transport environments. Prioritise initiatives according to your needs and goals and their deployment status — there might be some low-risk, early-start initiatives for immediate action. Look for opportunities to engage the public, private and university sectors for potential partnerships.

5. Secure funding

Successfully integrating Future Mobility with infrastructure represents a big investment, so it is important to consider traditional and non-traditional funding sources for pilots and projects. Private companies, for example, might share deployment costs in exchange for data access.

6. Consider the wider impacts of smart mobility

View targeted projects through institutional, policy and technical lenses. Consider the need for staff training and potential policy, legal or legislative changes, such as revising road rules and associated laws.

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Making landfills a thing of the past

Waste-to-resource business Repurpose It is focused on converting waste, across a variety of streams, into valuable resources.

In March 2019 the company launched a construction and demolition washing plant in partnership with the Victorian Government, converting typically untreatable waste materials that end up in landfill into high-value resources.

Located in Epping, Victoria, the 60 ha facility is designed to recover and receive 500,000 tonnes of waste generated through construction projects across road and rail infrastructure, tunnelling operations, contaminated land remediation and other recycling operations, including waste glass.

George Hatzimanolis, founder and CEO, said, “At Repurpose It, we stand by the belief that landfills are a thing of the past. We have invested in innovative processes and advanced technology to convert construction and demolition waste to valuable resources.

“Since starting over a year ago, we’ve been fortunate to have had the opportunity to work on a range of projects and be recognised by key environmental thought leaders, including the Victorian State Government, for our commitment to the environment.”

The Repurpose It washing plant facility will focus on reducing its CO₂ emissions, saving more than 84,000 tonnes of CO₂ annually — the equivalent of planting 300,000 trees and 295 million km of car travel. This will be achieved through its process of washing and recycling the ordinarily difficult-to-recover materials through advanced screening, scrubbing and water treatment.



The company’s services extend beyond the washing plant. Since March 2018 the company has provided waste management consulting, organics and green waste processing, waste transport and collection, resource recovery, and bin supply and collection.

REPURPOSE IT

www.repurposeit.com.au



Adding a perk to concrete with coffee grounds

According to Close the Loop, the average cafe creates 60 kg of spent coffee grounds a week, more than 90% of which ends up in landfill. Looking to divert used coffee grounds from landfill, a coffee-loving engineering lecturer and his students from RMIT University turned to the construction industry. Perhaps spent coffee grounds could be used in concrete?

Most concrete mixes contain up to 80% sand, a resource that is under threat globally and cannot sustainably match current demand.

The research team found they could replace up to 10% of sand in a concrete mix with coffee grounds, producing ‘coffee bricks’ that will be on display at RMIT’s EnGenius event on Wednesday, 23 October.

Engineering students Senura Kohombange and Anthony Abiad worked with Senior Lecturer Dr Srikanth Venkatesan to test and develop the coffee bricks.

“It seems fitting than we’re working on this project in Melbourne, a city known for its great coffee culture,” Kohombange said.

“We are very excited to present the project, share the idea with others and showcase how some innovative thinking can turn a waste product into an everyday construction material.

Students Anthony Abiad and Senura Kohombange.



“The biggest challenge is ensuring the addition of spent coffee grinds does not lead to a reduction in strength of concrete, and this is the focus of further testing and development to make this product viable for use in real-world applications,” he said.

Distinguished Professor Adrian Mouritz, Executive Dean School of Engineering, said RMIT was proud to produce the next generation of engineers who were designing solutions to real-world problems.

“EnGenius takes engineering out of the classroom and brings it to life. Many of these projects focus on making our world a better place, be it more inclusive or more sustainable,” he said.



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Researchers tackle polyurethane waste



Polyurethane is used in a wide range of applications such as varnishes, paints, car parts, seat cushions and insulation. As polyurethane is a plastic material, its chemical compounds can be manipulated to create flexible, pliable products; rigid, durable products; or liquid finishing products.

In the US, a reported 1.3 million tons of polyurethane waste is generated each year, which usually ends up in landfill or is incinerated, a process requiring significant energy input and generating toxic by-products.

A research team from the University of Illinois has developed a method to break down polyurethane waste and turn it into useful products. The team will present their findings at the American Chemical Society National Meeting and Exposition.

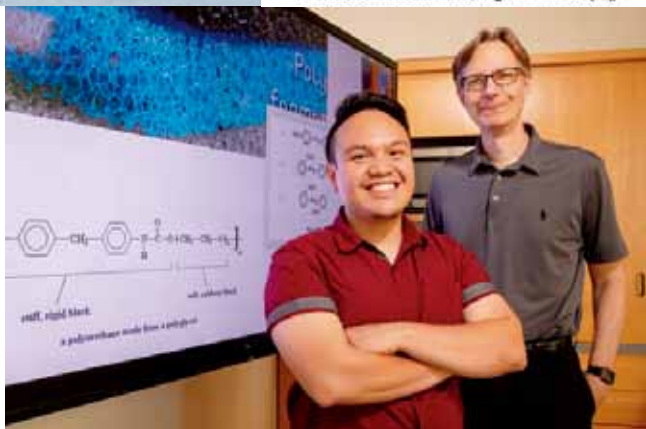
“We want to solve the waste problem by repurposing polyurethane,” said Ephraim Morado, a graduate student in the laboratory of Chemistry Professor Steven Zimmerman, who led the research.

Polyurethanes are made of two components that are hard to break down: isocyanates, composed of nitrogen, carbon and oxygen, and alcohol groups called polyols. Morado explained that polyol is usually petroleum based and is not degradable.

To address this difficulty, the team incorporated a more easily degraded chemical unit, an acetal, to the polyol. Because polyurethanes are water resistant, the researchers designed the acetal unit to degrade in solvents other than water.

“When we add a combination of trichloroacetic acid and dichloromethane, the material swells and rapidly degrades at room temperature,” Morado said.

The degradation products that are formed can then be repurposed into new materials. The researchers converted



University of Illinois Chemistry Professor Steven Zimmerman, right, graduate student Ephraim Morado, and their colleagues are inventing new ways to degrade polyurethane and re-use the waste.

elastomers — a type of polyurethane used in rubber bands, packaging and car parts — into an adhesive glue.

“One of the challenges with our approach is that the starting material is costly,” Zimmerman said. “We are trying to find a better, cheaper way to accomplish this. Our second hurdle will be to get a patent and find someone who is interested in commercialising it.

“The polyurethane materials have different properties based on the chemical structure of the isocyanate,” Zimmerman said. “We can change the structure of the acetal accordingly.”

The researchers are testing the same technique on other polyurethane materials. They hope to use milder solvents, such as vinegar, to carry out the degradation.

Beamex MC6-T

New revolutionary temperature calibrator



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The Beamex MC6-T is an extremely versatile portable automated temperature calibration system. It combines a state-of-the-art temperature dry-block with Beamex MC6 multifunction process calibrator and communicator technology.

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It offers versatility, that no other temperature calibrator can match.

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Smart bins of the sea

Following a successful trial last year, the City of Melbourne has installed five floating Seabins at Yarra's Edge Marina to help stop litter washing into the Yarra River at Docklands.

S seabins were created by two Australian boat builders and surfers, Pete Ceglinski and Andrew Turton. Since 2017, their company The Seabin Project has sold around 860 units in more than 30 countries.

The Seabin unit acts as a floating garbage bin skimming the surface of the water by pumping water into the device. It can intercept: floating debris, macro and micro plastics and even micro fibres with an additional filter.

Lord Mayor Sally Capp said: "Unfortunately an estimated 1.4 billion pieces of rubbish flow into Port Phillip Bay from the Yarra and Maribyrnong rivers each year."

Each Seabin is capable of collecting around 1.5 tonnes of plastic per year — that's 90,000 plastic bags, 35,700 disposable cups, 16,500 plastic bottles and 166,500 plastic utensils per year. The Seabin V5 is easily equipped with oil-absorbent pads able to absorb petroleum-based surface oils and de-

tergent predominant in most marinas around the world.

"Using Seabins we can collect up to 200 kilograms of rubbish a day. The Seabin units catch cigarette butts and plastic packaging as well as oil, detergents and micro plastics that can't be seen by the human eye," Lord Mayor Capp said.

The Seabins are emptied twice daily and data is sent to Seabin Foundation's Pollution Index and Tangaroa Blue to help monitor the impact of debris along Australia's coastline as well as to inform City of Melbourne strategies for litter reduction. These include street-cleaning, litter traps, water-sensitive urban design and stormwater capture.

The Victorian Government also manages 18 litter traps on the Yarra River, nine of which are located within the City of Melbourne.

The Chair of the City of Melbourne's Environment Portfolio, Councillor Cathy Oke, said food wrappers, cigarette butts, polystyrene, plastic bottles and rubber are some of the items that have been collected in the Seabins at Docklands.

"Water quality begins with people disposing of rubbish more carefully in our streets and suburbs. The Seabins need to be seen as the last line of defence before waste enters the bay," Cr Oke said.

The Chief Executive Officer and Co-Founder at Seabin Project, Pete Ceglinski, said the 'smart bins' have collected an estimated 1,000,000 kilograms of plastic in the last 12 months from locations in the 52 countries.

"The global fleet currently filters 500 million litres of water each day for micro plastics, plastic fibres, oil and more," Ceglinski said.

"The deployment of the Seabin fleet with City of Melbourne is a critical first step in obtaining our objective of working with local, state and federal governments globally. Our ethos is simple, 'if we have rubbish bins on land, why not in the water?'"

"With a focus on smart solutions for smart cities, we feel that the Seabin technology coupled with prevention has a significant role to play in reducing the amount of floating waste entering our oceans."

City of Melbourne
www.melbourne.vic.gov.au

Smart solar townhome residents set to save

Woodlea, a master-planned community spanning 711 ha in Melbourne's western growth corridor, is launching a smart solar package across its townhouse offering, helping residents to save up to 80% on their electricity bills — some may never receive a power bill again.

Upon completion, Woodlea — delivered by Mirvac and Victoria Investments and Properties — will be home to over 20,000 residents, with the initial solar pilot to include a limited number of townhouses. These Mirvac-designed townhomes will include solar panels and batteries valued at \$20,000 at no extra cost to purchasers. If successful, the package is expected to encompass the majority of townhouses to be developed.

"Rising electricity costs is a concern for Victorians statewide and although solar usage is on the rise, it's not attainable for all households due to the hefty upfront cost of installation," Woodlea Project Director Matthew Dean said.

"We're aiming to unlock these benefits for everyday Australians by essentially offering a \$20,000 smart solar package as standard across our Mirvac townhouse offering."

Expected to provide annual savings to households of around \$1620, Mirvac's package includes a 5.1 kW solar panel system, 10 kW battery and 5 kW inverter. Web-enabled monitoring will track



a household's energy use pattern, allowing the system to be smart about when to store solar power and when to sell surplus energy back to the grid.

These homes are the first to be delivered as part of Clean Energy Finance Corporation's (CEFC) \$90 million debt commitment to Mirvac.

CEFC CEO Ian Learmonth said that the investment was designed to help battery storage technology gain traction in Australia.

"We'd like to see integrated solar and battery storage in all suitable Australian households so they can benefit from the energy savings that this technology can provide."

Canada Bay trials high-tech waste system

In partnership with Smartsensor Technologies, the City of Canada Bay in Sydney's Inner West has launched a smart waste network incorporating long-range wide-area network (LoRaWAN) technology. The pilot program will install 95 smart sensors to provide the council with important information, such as when a bin is ready to be collected, at the click of a button.

The real-time data from bin sensors will be delivered via LoRaWAN, managed by Meshed.

"We're committed to being at the cutting edge when it comes to smart city technologies like our bin-sensor pilot program," City of Canada Bay Mayor Angelo Tsirekas said.

"With our population only continuing to grow, the program will enable us to respond to increased demand and use our resources wisely, deploying bins and collection staff when and where they are needed most."

The wireless network enables information to be shared across long distances with minimal energy use, and is free for community use as part of the City of Canada Bay's Smart City Plan.

"We've been working with the City of Canada Bay to implement smart city technologies since 2015, starting with our Bigbelly Solar Compactors and now our world-first LoRaWAN ultrasonic



and laser sensors," said Leon Hayes, Smartsensor Technologies Managing Director.

"We look forward to our continued partnership with the City of Canada Bay and for assisting them in maintaining an optimised, smart waste management system for many years to come."

The pilot program will be evaluated in September 2020, with a view to installing further bin sensors throughout the city.



Tamworth marked for integrated smart city project

UNSW Sydney has partnered with Providence Asset Group and Tamworth Regional Council to trial what is claimed to be Australia's first test performance of a fully integrated smart city.

The trial will assess Internet of Things (IoT) technologies, encompassing applications for transport, energy, health, telecommunications and other community services.

UNSW Digital Futures Grid Institute Director Professor Joe Dong is leading the research at UNSW, explaining that the aim of the Tamworth Smart City project is to build IT systems that can monitor and control data flow through smart services using the wireless network.

Existing IoT infrastructure can be used to provide seamless integration of IoT devices, incorporating home appliances, utility monitors, council services such as waste management, lighting and parking, as well as asset security and health services like remote patient monitoring.

"Imagine having an app on your computer or phone that gives you your electricity usage and cost information in real time, and also tells you how some slight change of usage pattern of appliances such as the washing machine could most effectively save electricity bills," Prof Dong said.

"You could have other apps on the smart network for a variety of purposes — such as wearable health monitors that alert your medical practitioners should you need to go and see them or live transport and traffic monitoring to give you alternative routes as soon as a hazard occurs.

"If we can prove that our solution works, the potential benefits are endless," Prof Dong added.

"UNSW is very excited to trial these systems with Tamworth City and Providence and hopes it will provide a template for other smart cities in Australia in the future."

Providence Asset Group CEO Henry Sun said the partnership with UNSW underscored the potential for university and industry collaboration to bring new technologies and products to market.

"Providence realises Australia has global leading universities and talents," Sun said. "We want to bridge them with industry. On the other side, we are collaborating with world-class partners in the renewable field such as Risen Energy and Sungrow Power."

UNSW also announced its involvement in developing a large-scale national hybrid-energy storage system, using lithium batteries and hydrogen fuel cells, to be installed at a \$200m solar farm in south-east Queensland. The system, to be built by Providence Asset Group and Risen Energy, will store surplus electricity generated at the farm and discharge it when needed.

Professor Nicholas Fisk, Deputy Vice-Chancellor of Research at UNSW, said, "UNSW Sydney is already a world leader in renewable energy research. But the challenge to efficiently, stably and affordably generate, store and distribute sustainable electric power for all Australians in future cannot be achieved without significant investment and the contributions of our partner organisations."

Businesses need to take responsibility for their Expanded Polystyrene waste before 2025

The demand for Expanded Polystyrene is rapidly increasing, but businesses are failing to take responsibility for the recycling of this vital waste stream.

Businesses can no longer ignore Expanded Polystyrene (EPS) as a major waste stream. It is time that their social conscience drives the change needed to prevent EPS waste from continuing to fill Australian landfills.

Because of its excellent protection properties, Expanded Polystyrene (EPS) is the packaging material of choice for many businesses. Made of 2% plastic and 98% air, EPS reduces the cost of goods transported which helps to reduce greenhouse gas emissions. But it doesn't help with the volume of waste sent to landfill.

The volume of EPS waste entering landfill is a grave concern for Australians as it increases each year as the consumption of packaged goods increases. Once in landfill, EPS waste takes hundreds of years to break down, which places additional strain on the already limited landfill space.

The Australian Packaging Covenant has recognised EPS as a priority waste stream and mandated to remove all packaging from landfill by 2025 to reduce this strain.

"Businesses need to prepare for the packaging ban before they are caught out and left scrambling," said Chris Tangey, General Manager of Expanded Polystyrene recycler Ecycle Solutions.

South Australia has already implemented a landfill ban, with Victoria having confirmed

that a similar ban will be introduced in the near future. It is only a matter of time before other states follow this lead.

"The responsibility of recycling Expanded Polystyrene falls on businesses to drive change," said Tangey.

"By starting with businesses, a large percentage of EPS waste will be recycled, prompting customers who receive goods to follow suit."

In the 2018/19 financial year, Ecycle Solutions helped 299 retail stores recycle their EPS waste. The volume of loose EPS waste collected from these stores equalled the volume that would fill the Melbourne Cricket Ground.

Their simple yet sustainable solution for EPS waste removal and recycling aims to help businesses recycle right with no added effort or cost.

Ecycle Solutions has helped retailers to save up to 70% on retail packaging removal with EPS recycling.

"We have found by using [this EPS recycling service] we have reduced our skip bin [from being] emptied once a week to once a month resulting... [in] a saving of \$1902 a year," said Drew from Betta Home Living – a customer of Ecycle Solutions.

Once collected, Ecycle Solutions hot melts EPS waste on site, before sending it to be turned into a variety of household items.

"People and businesses don't realise that EPS waste can be turned into a range of



household items, from outdoor furniture and skirting boards, to picture frames and decking," said Tangey.

Products made from recycled EPS waste maintain their durability and have made Expanded Polystyrene a product of a Circular Economy.

"To sustain the use of Expanded Polystyrene by businesses, all it takes is for them to partner with a recycling company who offers a simple EPS waste recycling collection service, like Ecycle Solutions," said Tangey.

With no viable replacement for EPS packaging in sight, businesses must begin doing their part to reduce the environmental strain caused by EPS waste before they are caught out by the Australian Packaging Covenant's mandate.

#recycleATecycle

Ecycle Solutions

www.ecyclesolutions.net.au



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Eliminating medicines from wastewater

Jane Allman

Researchers from University at Buffalo, The State University of New York, have identified two wastewater treatment techniques that are particularly effective in removing medicines from water.

Waterways in Australia and across the globe are home to a plethora of pharmaceutical compounds: painkillers, antidepressants, Alzheimer's medication. While some chemicals can be processed by bacteria and are fairly easily removed using water purification processes, others have a chemical structure that leaves them more challenging to remove, including codeine, as well as certain antifungal treatments, antidepressants and synthetic hormones.

Pharmaceutical compounds are discharged from wastewater treatment plants and enter the environment, where they are consumed by wildlife and may contribute to problems such as antibiotic resistance. A 2018 study by Australian ecologists — published in *Nature Communications* — detected more than 60 pharmaceutical compounds in aquatic invertebrates and riparian spiders in six streams near Melbourne. The researchers estimated that a platypus consuming invertebrates from Brushy Creek (one of the streams included in the study) would consume about one-half of

an average human daily dose of antidepressants by eating aquatic invertebrate prey from this stream.

Historically designed to remove organic matter and nitrogen from used water, wastewater treatment plants could be harnessed to remove a host of persistent pharmaceutical compounds.

A US study — examining technologies employed at seven wastewater treatment plants in the eastern United States, including six full-scale plants and one large pilot-scale plant — revealed varying results when it comes to removing medicines such as antibiotics and antidepressants.

The research, published in *Environmental Science: Water Research & Technology*, found that two treatment methods — granular activated carbon and ozonation — were the most promising. Each technique reduced the concentration of pharmaceutical compounds, including certain antidepressants and antibiotics, in water by more than 95%.

Activated sludge, a common treatment process that uses microorganisms to break down organic contaminants, serves an important purpose in wastewater treatment but was

much less effective at destroying persistent drugs such as antidepressants and antibiotics.

"The take-home message here is that we could actually remove most of the pharmaceuticals we studied. That's the good news," said Diana Aga, Henry M. Woodburn Professor of Chemistry in the University at Buffalo (UB) College of Arts and Sciences.

"If you really want clean water, there are multiple ways to do it. However, for plants that rely on activated sludge only, more advanced treatment like granular activated carbon and/or ozonation may be needed," she said.

"Some cities are already doing this, but it can be expensive."

Anne McElroy, Professor and Associate Dean for Research in the Stony Brook University School of Marine and Atmospheric Sciences, said, "Our research adds to a growing body of work showing that advanced treatment methods, including ozonation and activated carbon, can be very effective at removing persistent pharmaceuticals from wastewater."

Aga and McElroy led the project, with UB chemistry PhD student Luisa Angeles as first author. The paper was a partnership between researchers at UB, Stony Brook University, the Hampton Roads Sanitation District, and Hazen and Sawyer, a national water engineering firm that designs advanced wastewater treatment systems, including some of the systems studied.

Angeles explained that the study's findings could guide future decision-making, especially in areas where water is scarce and in cities that may want to recycle wastewater, converting it into drinking water.

In terms of environmental conservation, the study observed no change in the behaviour of larval zebrafish when exposed to wastewater discharged from the treatment plants. However, Aga stated that more work is needed to understand the impact of longer-term exposure on wildlife.

In 2017, Aga's team conducted a study, discovering high concentrations of antidepressants — or metabolised remnants — in the brains of numerous fish in the Niagara River. Aga highlighted that we still do not fully understand the behavioural and ecological consequences of long-term exposure to chemicals from human medicines that build up in wild animals over time.



WIRELESS WATER DETECTION SENSOR

The ALTA Wireless Water Detection Puck Sensor from Monnit can be deployed to detect water breaches. The puck sensor is designed to simplify water intrusion monitoring in crawl spaces, sub-floor areas, basements and elevator shafts, and locations where water damage is a threat to valuable materials, machinery or electronics.

The product detects when water is present by completing the circuit between two probe points on the bottom of the puck sensor. The integrated magnetic power switch enables the sensor to be turned off

when not in use, conserving battery life. The sensor can be set to detect either the presence or non-presence of water.

When water is present, the sensor will immediately trigger a text, email or call alert — based on user-defined settings. The data is stored in the iMonnit online system and can be reviewed and exported as a datasheet or graph.

The sensor is 7.62 x 2.54 cm, weighs 216 g and uses a 3.6 V 1200 mAh Lithium battery (non-replaceable, 12-year battery life). Security features include Encrypt-FF (256-bit key exchange and AES-128 CTR). The ALTA Wireless Water Detection Puck Sensor is available from Metromatics.

Metromatics Pty Ltd
www.metromatics.com.au

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Selectronic has added the SMPC480 3.5 kW model to its SP PRO Series 2i range to cater to the growing demand for smaller scale battery storage systems.

In addition to a 3.5 kW continuous output, the SPMC480 can deliver 5.25 kW for 30 min, 6 kW for 1 min and a peak output of 8.4 kW for 30 s. The model is capable of charging batteries from an AC source at up to 73 A DC or 3.5 kW. Up to 7 kW of managed AC-coupled PV can be connected, or an unlimited amount of DC-coupled PV.

The SPMC480 offers all the features of the SP PRO Series 2i range up to 20 kW, including Selectronic's AC Coupling Recovery mode, which allows a black start with AC-coupled PV. Dual-phase or three-phase systems can be achieved by adding units for off-grid or grid-connected applications, as well as catering for any battery chemistry, including lithium battery brands such as BYD, LG Chem and many more.

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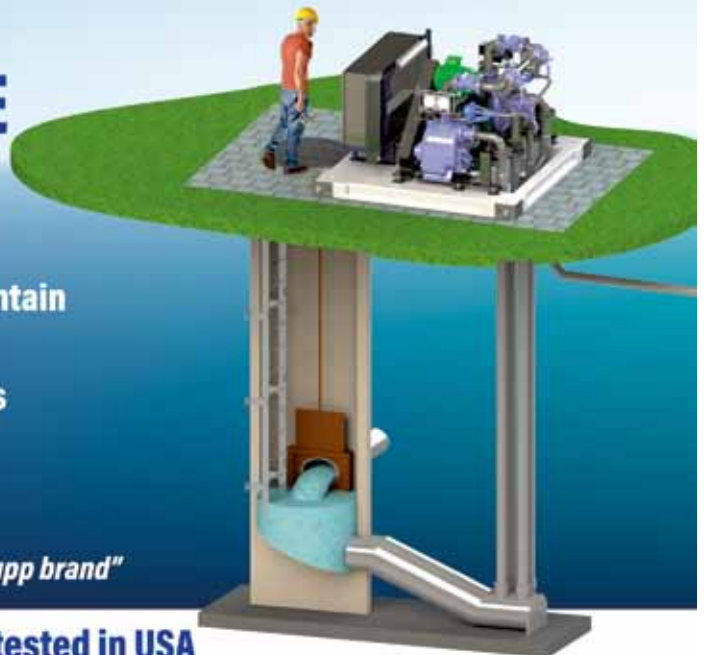
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**HYDRO
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Brewing is a traditional industry with an important economic contribution to the agricultural and food and beverage sectors. In fact, beer is the drop of choice for 9.1 million Aussies and domestic production of the tasty brew supports almost 103,000 full-time Australian jobs, generating \$16.5bn a year in economic activity.

However, there are several environmental factors associated with brewery operations including water consumption, energy use and emissions, hygiene and by-products. As a company committed to making positive impact within the communities it serves, 4 Pines Brewing Company is dedicated to the planet and addressing climate change and water use.

The brewery estimates it sells the equivalent of 20 million pints of beer annually. Without compromising on hygiene, 4 Pines sought to:

- reduce its resource dependency, particularly water, in the brewing cellar;
- lessen chemical exposure for its team and improve overall chemical handling;
- drive operational efficiency, with no impact to product quality.

Working together with Ecolab, 4 Pines has implemented a number of custom-built solutions to help reduce water and energy consumption, while positively impacting

overall operations by ensuring safety and hygiene are not compromised.

This includes a cleaning in place (CIP) solution that has the capabilities to recover, treat and re-use caustic and final rinse water to save both chemistry and water. To further conserve water (and chemicals), 4 Pines is also running inline treatments periodically to eliminate the need to drain and refill its caustic tanks. What's more, the CIP system is automated and incorporates wireless technology to control both the tank supply valve pulsing as well as the mobile CIP return pump, ensuring optimal water use at all times.

In a bid to reduce turnaround times on the fermenters for 4 Pines, Ecolab has also developed and installed a carbon dioxide (CO₂) extraction system to purge the gas from its tanks to improve operational efficiency and energy use. This process reduces the levels of caustic depletion during CIP, further saving chemical losses and downtime from rework. As a result, 4 Pines can improve tank availability and production output significantly.

Ale in a day's work

Chris Willcock, Chief Brewer at 4 Pines, said, "Ecolab's custom-built solutions helps us reduce our water and energy consumption, whilst ensuring our beer is produced and bottled as safely and hygienically as possible."

Working with Ecolab, over the last nine months, 4 Pines has experienced:

- A reduction of water use in the production of beer. An overall reduction from 3.8 L to 3.4 L per litre of beer produced which equates to water savings of up to 60,000 litres a week.
- In one particularly busy week, the team brought its water use down to 2.6 L of water per litre of beer.
- Increased health and safety. A safer system for cleaning and sanitising its fermenters and beer tanks, which reduces the exposure of its team to chemicals.
- Improved cleaning reliability and control. Trending data and automated systems mean that 4 Pines is confident that its process hygiene is as good as it's ever been.

4 Pines Brewing Company was established as a microbrewery in 2008 in Manly, New South Wales. It has a unique partnership with space engineering firm Saber Astronautics Australia (with whom it has developed a space-certified beer). The company is also focused on environmental and social sustainability and now resides within the Carlton & United family of breweries.

Ecolab Pty Ltd
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Scientists redesigning materials for circular economy

Materials scientists from Deakin University are working on several projects to help solve the global waste and recycling crisis. The projects, undertaken by a team from the university's Institute for Frontier Materials (IFM), explore a material's life from first to final use, which the researchers say is essential to redesigning materials for a circular economy.

IFM's Circular Economy Strategy Lead Catherine McMahon said Deakin's scientists are world leaders in their approach to materials design with their 'design out waste' ethos.

"We're in this recycling crisis because our current generation of materials aren't designed to be recycled or repurposed," McMahon said.

"We are a global leader in materials science because at IFM we're redesigning materials with waste eradication in mind. This is key to a circular economy approach."

McMahon said that when IFM scientists are creating a product for its initial purpose, they already know what it will be in its next life, too.

"This process involves the careful consideration of a material's next life. It's about ensuring that materials are always totally recycled without any environmental harm or waste, whilst maintaining their highest possible value during that repurposing process," she said.



"While many materials, like a poly-cotton blend, can be partially recycled, the process leads to waste and devalues the material. At IFM, our scientists are designing materials that are made to separate so that all of the materials are easily re-used or biodegrade. This maintains the highest possible value of the material."

McMahon said IFM researchers are also examining ways to maximise value from waste. "Some of the ways

our world-leading scientists are doing this is by looking at turning end-of-life textiles into bone repair systems, used silk material into artificial blood vessels, textile fibres into vaccines and usually discarded textile waste into leather interior alternatives for cars," she said.

Biowaste is another material that Deakin scientists are working to repurpose as part of the circular approach. During the sugarcane milling process, almost 20% ends up as biowaste that's often disposed of by burning.

"We have researchers working on how waste from sugarcane production can be turned into capsules for medicine delivery. We must be smarter with the waste that comes from basic production, too. All waste, and its potential use, must be considered if we're to be truly circular," McMahon said.



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Pumping piggery waste for recycling



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Midwest Piggery has been breeding pigs for over 30 years. A mid-size enterprise, the piggery raises the animals and then sells them to market.

As part of the piggery's recycling philosophy, all pig waste is collected and broken down before being used as fertiliser on the grounds.

"We collect the pig waste in what we call sump pits," explained Mat Collier, Principal Partner and Manager of Midwest Piggery. "The effluent is then pumped from the sump up to a holding dam. It then moves progressively through a series of dams before the effluent is eventually ready for use as a fertiliser."

The problem

To move the pig waste from the sump to the holding dam, the piggery was previously using three helical rotor pumps (also known as progressive cavity pumps). Located at ground level and attached to a suction lift, the pumps were proving increasingly inefficient and costly to maintain.

"After we bought the helical rotor pumps we quickly discovered that they have a very fine tolerance. The suction hose started to block continuously and if the pumps ran dry, the motor would burn out and the rubber stator melted.

"Not only did we have to remove the choke, we had to replace the stator, which was incredibly awkward and frustrating. Getting to the stator is difficult enough, and then we had to literally peel away the melted rubber which had stuck to the equipment. Every time we had to clear the choke and replace the stator, it took a good 3–4 hours of our precious time," Collier said.

The process not only proved time intensive, it was also very costly.

According to Collier a new stator costs about \$1000, and because the pumps were choking and burning out with increasing regularity the cost to replace the stator was also growing. In one year alone, the piggery had spent about \$10,000 on new stators.

The solution

Fed up and frustrated with the helical pumps, Collier started to search for a far more efficient solution.

Coincidentally, Collier's father-in-law had just read an article on Hydro Innovations and the Gorman-Rupp pumps that they supply and drew Collier's attention to it. After reading it, what particularly

appealed to Collier was the fact that Hydro Innovations was happy to provide prospective customers with a trial period.

"Having paid and used a series of pumps including submersible ones in the past, I didn't want to spend any more money on pumps that could not do the job. So, coming across a supplier who was happy to let the pump prove itself before I bought it was great," Collier said.

After reviewing the piggery's requirements, Hydro Innovations suggested the installation of a Gorman-Rupp T2A3-B wastewater pump fitted with a 4 kW motor — a compact model that would provide both the flow and the pressure required.

According to Garry Grant, General Manager of Hydro Innovations, the Gorman-Rupp T2A3-B is a rugged, self-priming centrifugal solids-handling pump. Very easy to maintain, the pump has an external removable flap valve that can be removed and inspected without the inconvenience of disconnecting the piping or draining the pump casing. In addition, if any choking does occur, the pump can be easily and quickly unclogged via the removable cover plate.

The design of the pump also allows users to adjust the clearance externally to ensure optimum performance without having to pull it apart. The removable rotating assembly lets the shaft be inspected or replaced by simply loosening four bolts from the drive end of the pump, eliminating the need to disturb the pump casing or piping.

The results

A trial of the pump was organised for 90 days, but within 60 days Collier was convinced that the Gorman-Rupp T2A3-B could effectively do the job and purchased the pump.

"Within two months of having the pump installed at the piggery, I knew that it was capable. It moves more liquid than the previous pump and it's extremely easy to maintain, which for me is the major bonus. The open impeller design makes it very simple to remove any blockages. I only have to loosen two bolts to get inside the pump and clear it, which takes me just 15 minutes," Collier said.

"And, of course, an added bonus is that we no longer have to waste money purchasing stators," he said.

Collier was so impressed he purchased a second pump and is now considering a third pump.

Hydro Innovations

www.hydroinnovations.com.au

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Saving our sewers

An Australian innovation is designed to prevent the spread of offensive odour from our sewer pipes and improve environmental management.

Envirosuite has entered into an agreement with the University of Queensland which will see the SeweX modelling tool for wastewater management embedded into Envirosuite's wastewater solutions.

The SeweX technology uses mathematical modelling to predict odour and corrosion hotspots and to optimise mitigation strategies in sewer mains, and was developed by researchers from UQ's Advanced Water Management Centre (AWMC).

The addition of SeweX to Envirosuite's existing wastewater solutions extends the real-time monitoring and predictive capabilities across the entire wastewater system. It will ultimately enable wastewater operators to better manage performance and environmental impact of their sewer systems, while extending the life of these critical infrastructure assets.

Sewer corrosion is not something most people think about, but it is critically important to public health and wellbeing and is a hugely expensive problem. Corrosion in

sewer systems and drinking water systems is estimated to cost close to AU\$1bn in Australia^[1] annually and US\$36bn^[2] in the US.

The new technology could help wastewater operators save millions of dollars every year in operational and capital costs and consumer complaint management.

Robin Ormerod, Chief Scientist at Envirosuite, explained: "Globally, more than 4 billion people live in urban areas, most of which have sewer systems, and this figure is increasing every year as populations grow and cities extend their footprint. As



The new technology could help wastewater operators save millions of dollars every year in operational and capital costs and consumer complaint management.

chemical and biological processes in sewers. It was developed by AWMC in response to a request for help from the City of Gold Coast to investigate corrosion problems in its sewer pipes.

The SeweX solution has saved \$30 million in capital costs for City of the Gold Coast. It has also saved several hundreds of thousands of dollars annually in operating costs, while odour complaints from the public stopped completely.

The new solution enables users to:

- make real-time and predictive dosing decisions to avoid corrosion and odour issues,
- identify corrosion and odour risk priority areas,
- pinpoint the source of pollution events in real time,
- use a digital twin solution to test the efficacy of different operating scenarios to solve those issues.

AWMC Director Professor Zhiguo Yuan AM said the technology was developed in response to needs identified by the water industry. "Corrosion and odour problems in sewers are most often caused by sulfate-reducing bacteria in sewer biofilms that produce hydrogen sulfide," Professor Yuan said.

"Hydrogen sulfide is released into the atmosphere above the wastewater, causing odour problems, and is converted by sulfide-oxidising bacteria into sulfuric acid, which is corrosive to concrete sewer pipes.

"Sewer networks can include many kilometres of sewer pipe and various topographical elements, such as rising mains, gravity mains, pumping stations and manholes. It is practically difficult to physically inspect all these structures to identify corrosion issues, making modelling a more efficient and cost-effective alternative."

Ormerod added: "Water is in crisis. Natural and man-made water systems across the globe are under increasing stress

and it's not just about water supply; we need solutions to all aspects of the water ecosystem, and that includes how we manage wastewater. The potential to greatly reduce wastewater system costs can free up finances to tackle other urgent issues.

"Bringing tools like SeweX, which have sprung from some of the greatest academic minds in the water industry, together with our strength in technology and focus on digitising wastewater management is hugely powerful.

"Insightful real-time and predictive information means easier, better management of water quantity, water quality and physical assets. A digital water industry means the big challenges become less daunting."

UQ's technology transfer company UniQuest negotiated the licence agreement with EnviroSuite.

UniQuest CEO Dr Dean Moss said SeweX incorporated complex algorithms into its model to cleverly predict odour and corrosion hotspots across sewerage networks.

"It is fantastic to see UQ research helping an Australian company like EnviroSuite to drive key improvements to the way water utilities manage wastewater to benefit communities right across the country, and even globally," he said.

EnviroSuite will integrate SeweX into its product suite for real-time and predictive environmental technologies for release in early 2020.

References

- [1] ACA (2010) The Australian Corrosion Association Inc. Corrosion Challenge Project, Australian Corrosion Association, in DNV GL – Report No. OAPUS310GK0CH (PP110272)-1, Rev. 3, Accessed 08/11/2019: <http://impact.nace.org/documents/appendix-a.pdf>
- [2] FHWA (2002) Corrosion Costs and Preventive Strategies in the United States, Summary of Federal Highways Administration Publication FHWA-RD-01-156 Accessed 08/11/2019: <http://impact.nace.org/documents/ccsupp.pdf>

EnviroSuite Pty Ltd
www.envirosuite.com

sewer systems get older or the capacity increases, the chances of issues such as odour leaks and the need for reconstruction of corroded sewers increase exponentially.

"Innovations like SeweX are critically important as they help identify issues before they arise, extending the lives of sewer systems, more efficiently managing corrosion control systems and reducing the chances of offensive odours wafting around our streets."

SeweX is an advanced mathematical modelling tool that describes the physical,

What would a national Climate Change Act mean for Australia?

Kiera Peacock, MARQUE Lawyers

Independent MP and climate crusader Zali Stegall has announced that she will be introducing a private Climate Change Bill to the parliament.

The Bill hasn't yet been released, but its key terms have. While the Bill (if passed) will be groundbreaking at the federal level, we can look to examples from the UK, New Zealand and Victoria for guidance on its possible consequences for government and business.

The key terms of the Bill

The proposed Bill looks to legislate for:

1. setting statutory targets of net zero emissions by 2050;
2. five-yearly, economy-wide carbon budgets to meet the 2050 goal;
3. establishment of an independent and non-partisan expert body, the Climate Change Commission, to advise on climate policy and assess government

proposals, including the transition to a decarbonised economy and long-term adaptation measures;

4. Climate Change Risk Assessment for all sectors, including health, agriculture, energy and transport.

The UK Climate Change Act 2008 — guidance for Australia

The UK passed its own Climate Change Act (on which this Bill is modelled) in 2008. The Act legislated a long-term objective of an 80% reduction in greenhouse gas emissions by 2050. It has a process for setting multi-year targets to meet that objective; without dictating how the government was to meet that target the government remains free to develop its own policies.

The Act led to significant changes in government policy, including the implementation of minimum pricing on carbon, reverse auction schemes and government determined renewable energy targets.

If passed in Australia, a Climate Change Act would impact on government procurement and funding, and likely become a key consideration in its administrative decision-making process. For businesses, the flow-on effects will undoubtedly stimulate renewable energy markets, carbon offset programs and transition assistance.

Will it get passed?

Private members Bills can be difficult to get through the parliament when the government has a clear majority, as the LNP presently does. Kerryn Phelps' medevac legislation passed when the LNP formed a minority government (so couldn't vote it down) and Phelps was able to rally cross-bench and Labor support. Those circumstances don't exist now, but the shift in the national psyche following the catastrophic bushfires means the LNP's response to such a Bill will come under significant moral and political scrutiny. That may just help get some form of the Bill through.

Coffee lovers swap and go in Western Sydney

Seven councils in Western Sydney are participating in the Green Caffeine initiative — a swap-and-go coffee cup scheme that could benefit cafes, coffee lovers and the environment.

The Green Caffeine rollout is part of a broader 'Refill Don't Landfill' campaign, encouraging Western Sydney residents to adopt alternatives to everyday disposable items. The Western Sydney Regional Organisation of Councils (WSROC) joins other government organisations such as the ACT state government, Inner West Council, Wollongong City Council, Kiama Municipal Council and Port Macquarie-Hastings Council in bringing a cost-saving and waste-reducing initiative to local businesses and consumers.

To take part in the re-usable cup scheme, consumers simply download the Green Caffeine app, sign up, then collect their re-usable cup from a participating cafe. The coffee cup can be returned to any Green Caffeine cafe and — as long as it's returned within 30 days — is completely free to use.

The scheme is also free for participating cafes. With over 11,000 people already using it across 420 cafes Australia-wide, Green Caffeine is reported to be the biggest rollout of a re-usable system anywhere in the country.



"The waste reduction of re-usables isn't to be sniffed at," Green Caffeine Co-founder Damien Clarke said.

"A small trial held last year at Good Fella Coffee in Bella Vista and The Tuckshop at Glenhaven saw them prevent the use of over 5000 single-use cups over just three months. The Green Caffeine re-usable cups make it easy to choose the eco-friendly option without sacrificing convenience."

With the average takeaway customer consuming 500 cups per year, 7.5 kg of unnecessary single-use rubbish is generated. Over a billion disposable cups are thrown away each year in Australia, many of which end up in the sea, polluting the ecosystem and destroying marine life. Changing our takeaway coffee habits is one simple step that can have a big impact.

"Green Caffeine saves cafes the cost of single-use packaging as well as saving the environment, so it's a real no-brainer for them to jump on board," Clarke continued.

"Green Caffeine was deliberately designed with cafes in mind to help reduce environmental footprint and increase their bottom line — that's the secret to our success."

For more information: <https://greencaffeine.com.au/cafe-join/>.

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Purifying water

Exploring emerging membrane distillation technologies

Using membrane distillation to purify water presents a challenge: membranes must be designed to purify water efficiently while ensuring zero contamination of the clean water. Engineers from Colorado State University (CSU) have investigated this challenge and offer insight into why certain membrane designs work better than others.

Global water scarcity means that scientists and engineers are investigating new ways to harvest purified water from unconventional sources, like sea water or even wastewater.

Along with a team of research engineers, Tiezheng Tong, assistant professor in the Department of Civil and Environmental Engineering at CSU, is studying an emerging technology called membrane distillation.

Membrane distillation involves a thin, water-repellent membrane that exploits vapour pressure differences between hotter impure liquid, called 'feedwater', and colder purified water called 'permeate'. During the process, water vapour passes through the membrane and is separated from the salty or dirty feedwater. According to Tong, membrane distillation works better than other technologies like reverse osmosis, which can't treat extremely salty water such as desalination brines or produced water from hydraulic fracturing.

Tong and materials scientist Arun Kota in the Department of Mechanical Engineering joined forces to uncover the science behind designing the ideal membrane. In experiments described in *Nature Communications*, the CSU researchers investigate why certain membrane designs used in membrane distillation work better than others.

"The fundamental knowledge from our paper improves mechanistic understanding on the water-vapour transport within mi-

croporous substrates and has the potential to guide the future design of membranes used in membrane distillation," Tong said.

In membrane distillation, feedwater is heated to separate the pure and impure components by differences in volatility. The microporous membrane is a key component of the set-up because it allows water vapour through, but not the entire impure liquid. Typically, the membrane is made of a hydrophobic material in order to let only the water vapour pass through but maintain a barrier for the feedwater.

However, these hydrophobic membranes can fail because the feedwater, such as shale oil-produced water, can have low surface tension. This low surface tension allows the feedwater to leak through the membrane pores, contaminating the pure water on the other side — a phenomenon called membrane wetting.

Hydrophobic vs omniphobic membranes

Previous research found that using omniphobic membranes — membranes that repel all liquids, including water and low surface tension liquids — keep the vapour/water separation intact. But, omniphobic membranes typically slow down the rate and amount of water vapour passing through the membrane, dramatically reducing the efficiency of the entire process.

The CSU researchers set out to explain the tradeoff between hydrophobic and omniphobic membranes. Through systematic experiments,

led by postdoctoral researchers Wei Wang in Kota's lab, and Tong's graduate student Xuewei Du, they found that conventional hydrophobic membranes create a larger liquid-vapour interfacial area. This increases the amount of evaporation taking place. With the omniphobic membranes, they saw a much smaller liquid-vapour interface. This explains the difference between the membranes' performances.

The omniphobic membranes used in the experiments were made without depositing extra particles so the researchers were able to determine that their observations weren't the result of structural changes to the membranes.

Despite no solution to the tradeoff, the researchers' insights reveal the core challenge around making membrane distillation a successful technology.

"If you understand the problem thoroughly, then there is scope for solving it," Kota said. "We have identified the mechanism; now we have to solve the tradeoff problem."

For example, smart membranes with exceptional omniphobicity and a simultaneously large liquid-vapour interfacial area can render membrane distillation a robust and cost-effective process for water purification. More collaborative research has been initiated by the team to design such smart membranes, with the goal of increasing the efficiency of membrane distillation.

Tong added that the research happened at the interface of two disciplines: surface science and membrane technology.

Source: Colorado State University.

Washing and recycling PET and PO plastics

Transparent PET is primarily used for producing beverage bottles, whereas hard-wearing polyolefins (POs) are used to make sturdier containers, toys, pipes and household goods. Because of their wide dissemination, it is essential to recycle the end products after use and recover the plastics they are made of.

For PET, Kronos closes a beverage bottle's lifecycle using its MetaPure technology, with the portfolio including the company's own modules for washing and decontaminating. The flakes are washed in the MetaPure W-PET, where they pass through a number of process steps including pre-treatment, caustic washing and hot post-washing. Through this process, pure flakes are obtained that can be turned into fibre or film.

PET flakes that are to be re-used in the beverage or food industries are passed to the MetaPure S, as the decontamination module treats the washed flakes so they can be turned into food-grade pellets, preforms and film. Solid state polymerisation (SSP) can be used to increase the intrinsic viscosity and match it to suit the end product into which they will be made. The process of decontaminating flakes is faster than decontaminating pellets, and it is facilitated by the MetaPure S, which provides low energy consumption and gentle material handling.

Recycling PO (eg, HDPE or polypropylene) presents many challenges for the treatment process, one of which is how the material



is returned, with the associated side effects. For packages collected from household garbage, the material obtained is usually not cleaned before recycling, meaning the polyolefins have been in contact with organic residues like tomato sauce.

The physical properties of PO present another challenge. Exhibiting a density lower than one gram

per cubic centimetre, plastics often float on the water's surface. This is advantageous when washing PET plastics, as the closures and labels made of PO can be skimmed off the surface and removed, leaving the PET to sink to the bottom. Conversely, when washing PO by itself, it is essential to adjust the process appropriately. It is this step in the process, especially, that is of crucial importance as far as the recycle's quality is concerned. Inferior washing quality cannot be compensated for during further processing of the washed flakes.

To avoid impurities caused by a wrong colour and residual soiling, the simplest solution is to add colour, then manufacture downcycled plastic products. There are plans to recycle polyolefins (such as polypropylene and polyethylene) and render them amenable to top-quality re-use. To achieve this, Kronos has modified the procedural approach for its MetaPure W-Po washing module and developed a recycling technology fine-tuned to the requirements posed by PO.

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Unlocking the dark side of solar

Next-generation bifacial solar

Most of today's solar panels capture sunlight and convert it to electricity only from the side facing the sky, but there is a limit to their efficiency. If the dark underside of a solar panel could also convert sunlight reflected off the ground, even more electricity might be generated.

Experts estimate that by 2030, bifacial solar cells will account for nearly half of the market share for solar panels worldwide. Now a new formula developed by two Purdue University physicists reveals exactly how much more electricity double-sided panels can generate compared to conventional single-sided panels.

The new thermodynamic formula reveals that the bifacial cells making up double-sided panels generate on average 15–20% more sunlight to electricity than the monofacial cells of today's one-sided solar panels, taking into consideration different terrain such as grass, sand, concrete and dirt.

The formula is designed to be used for calculating, in minutes, the most electricity that bifacial solar cells could generate in a variety of environments, as defined by a thermodynamic limit. It is hoped that this formula will help solar designers take full advantage of bifacial cells.

"The formula involves just a simple triangle, but distilling the extremely complicated physics problem to this elegantly simple formulation required years of modelling and research. This triangle will help companies make better decisions on investments in next-generation solar cells and figure out how to design them to be more efficient," said Muhammad 'Ashraf' Alam, Purdue's Jai N. Gupta Professor of Electrical and Computer Engineering.

In a paper published in the *Proceedings of the National Academy of Sciences*, Alam and co-author Ryyan Khan, now an assistant professor at East West University in Bangladesh, also show how the formula can be used to calculate the thermodynamic limits of all solar cells developed in the last 50 years. These results can be generalised to technology likely to be developed over the next 20–30 years.

The researchers use the formula to recommend better bifacial designs for panels on farmland and the windows of buildings in densely populated cities. Transparent, double-sided panels allow solar power to be generated on farmland without casting shadows that would block crop production. Meanwhile, creating bifacial windows for buildings would help cities to use more renewable energy.

The paper also recommends ways to maximise the potential of bifacial cells by manipulating the number of boundaries between semiconductor materials, called junctions, that facilitate the flow of electricity. Bifacial cells with single junctions provide the largest efficiency gain relative to monofacial cells.

"The relative gain is small, but the absolute gain is significant. You lose the initial relative benefit as you increase the number of junctions, but the absolute gain continues to rise," Khan said.

The formula, detailed in the paper, has been validated and is ready for companies to use as they decide how to design bifacial cells. This research was partially supported by the National Science Foundation.



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Recovering phosphorus from sewage sludge

Phosphorous is a key component of fertilisers, detergents and food additives, but is a limited resource. Currently obtained from phosphate rock, investigations are underway to recover phosphorus from sewage sludge in a straightforward and cost-effective way.

All living organisms need phosphorus in the form of phosphate. Plants, animals and humans obtain it from soil — depleted farmland is usually replenished with fertilisers. Problematically, fertilisers are produced using mineral phosphorus resources that are finite, non-renewable and increasingly contaminated with cadmium and uranium. The largest deposits are found in just five countries, mostly in Africa. Mining pollutes the environment and consumes a great deal of energy. Dependent on offshore sources, the EU has to import this critical resource, which is so vital to the economy.

Sourcing phosphorous from sewage treatment plants

The Centre for Solar Energy and Hydrogen Research Baden-Württemberg (Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg, ZSW) is embarking on a three-year research project to develop a way to extract phosphorus during the incineration phase of sewage sludge treatment. To facilitate the research, a testing plant was established in early 2019.

The sludge produced by sewage treatment plants is an alternative source of phosphorus. Sludge is where the substance ends up in the form of phosphate, carried there with the wastewater of households and industry.

Experts believe that up to 50% of Germany's demand could be recovered by recovering it from sewage sludge.

Sludge incineration is a common treatment process that generates thermal energy via sewage treatment plants. Currently, sewage sludge containing phosphorus is incinerated. The ash is disposed of in landfills and mines, or mixed with cement during the production process, wasting a valuable resource that could be put to productive use.

Extracting phosphorous from ash

Business prospects for phosphorus recycling look promising in Germany, where all large wastewater treatment plants will be required to recover the chemical element by 2029.

Recycling processes have been in development for 15 to 20 years. There are two competing methods: wet chemical processes that extract phosphorus from the sewage treatment plant and sewage sludge incineration. The advantage of the latter option is that it is well established.

Fluidised bed reactors have been burning sludge at large sewage treatment plants for decades, producing ash free of pollutants — processes are being developed to extract phosphorus from this ash. ZSW is aiming to start a step earlier by extracting the ash during the incineration process. If this concept proves to be viable, it will be

possible to retrofit existing sewage incineration plants with the technology.

The new process in development

ZSW is testing and further improving the phosphorous recovery process on a test plant in the Stuttgart lab. A material containing calcium binds the phosphorus as calcium phosphate during incineration. The reactive limestone has proven to be sufficiently resistant to abrasion both in the lab and on a technical scale, making it an economical, non-toxic and locally available resource.

The mechanical shocks of particles colliding with one another, and with the wall of the reactor, produce finely abraded particles containing phosphate. A hot gas cleaning process separates them from the flue gas stream via a candle filter. Pollutants are gaseous at these temperatures, so scientists can obtain a stream of phosphate-enriched recyclable material that is practically pollutant-free. This phosphorus is then returned to the material cycle.

The results of the tests conducted so far on the ZSW lab's fluidised bed system have been promising, with a successful trial to test the system in continuous operation. Researchers are now optimising the system by varying individual parameters of the fluidised bed process and the amount of additives. The ZSW researchers are aiming to produce an ash that is rich in phosphorus and ideally suited for subsequent use.

Smart energy on show in 2020

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The Smart Energy Conference and Exhibition trade event for solar, storage and energy management is designed, delivered and hosted by the Smart Energy Council — the peak independent body for smart energy.

Featuring a multi-stream conference program with over 130 speakers and a 9000 m² exhibition area with over 120 exhibitors and partners, the industry event will be held from 7–8 April 2020 at the International Convention Centre, Sydney.

The conference program covers smart energy solutions, applied energy solutions, installer professional development and, new in 2020, delegates can also attend the co-located Hydrogen 2020 Conference.

Program content (subject to change) features leading experts such as: Minister Shane Rattenbury, Energy Minister, ACT; Vincent Dwyer, Energy Estate; Oliver Yates, Bronze Boar Investments; Kobad Bhavnagri, Bloomberg New Energy Finance; Mark Williamson, Clean Energy Regulator; David Leitch, ITK Services; Tristan Edis, Green Energy Markets; Ian Learmonth, CEFC; Tim Washington, Jet Charge; Simon Holmes à Court, Melbourne University, Energy Transition Hub; Stephanie Moroz, Davanz; Claire Johnson, Hydrolytics; Craig Knight, Horizon Fuel Cell Technologies; Keshia Noronho, Fronius; and Alex Hewitt, CWPR.

There will also be speakers from the Energy Security Board, Macquarie Capital, Total Environment Centre, CleanCo, Rystad Energy, Alpha ESS, ACCIONA, Evergen, New Energy Ventures, Energy Transition Hub, ITK

Services, Energy Estate, Siemens, Schneider Electric, Power Ledger, Ikea, Origin Australia, Sonnen Australia, Clean Peak Energy, Wat-twatchers, ANU, Monash University, University of Auckland and many more.

The exhibition includes products from Alpha ESS, 1 Stop Warehouse, Longi Solar, Growatt, Pylontech, Huawei, Delta, Enphase, Fronius and AC Solar Warehouse.

The two-day event is free to attend and is expected to attract more than 5000 visitors from across Australia and overseas including suppliers, financiers with projects, entrepreneurs, media, government and academics from the solar, storage, energy management, hydrogen, wind and zero-emission vehicles sectors.

What: Smart Energy Conference & Exhibition
When: Tuesday, 7 and Wednesday, 8 April 2020
Where: International Convention Centre, Sydney
Web: www.smartenergyexpo.org.au



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Australian cleantech industry tackles the climate crisis

The 2nd annual National Cleantech Conference & Exhibition (NCTCE2020), being held in Brisbane on 3–4 August 2020, will bring together the innovators and investors as well as the suppliers and commercial end users of the technology that will make a difference to climate change.

The development of clean technologies is key to mitigating the impact of climate change, while creating new economic opportunities for our country. Peta Moore, NCTCE2020 Event Director, said: “I, like so many, am filled with horror as I watch the fires destroy so much of our country. While I am one of the lucky people not personally affected by the flames and smoke, it has still been an emotional time, a time of despair and frustration.

“With years spent working in the cleantech sector we know that there are so

many incredible organisations, businesses, start-ups and innovators who have developed and implemented cleantech solutions in this country. So as a team of conference organisers, my business, Nectar Creative Communications, is doing what we know how to do best. We are putting on NCTCE2020 and are determined to make a positive impact on this issue by supporting the sector’s growth and commercial implementation.”

NCTCE2020 is a national platform that will bring together all the major players of the cleantech sector to showcase new technology and research, educate and collaborate.

Tiffany Bower, the Program Director, said: “The conversations at the event will encompass energy, water, waste, built environment, transport, agriculture and manufacturing, because these days, projects aren’t just an ‘energy’ project or a ‘water’ project — they are often across all of these sectors. We believe the benefits of this cross-sector collaboration will bring new opportunities, new

partnerships, new jobs and new solutions.”

At a time when people are asking “what can be done?”, this national conference will provide an insight into the solutions that exist today or are in the start-up phase ready for investment. Its aim is to bring this community together so that government and business can understand the benefits, and importantly, how to implement the many cleantech solutions available.

One of the key topics will address investment opportunities and access to funding. “Many people don’t realise there are government agencies at all levels already doing great work in this area. There is funding available and resources they can access to help build their cleantech innovation and business. Our speaker program aims to spotlight the best-practice case studies, the innovative partnerships and new business models to help delegates navigate their way through the implementation process,” Bower added.

Dr Tim MacTaggart, Chief Deployment Officer, Redflow Sustainable Energy Storage, is a keynote speaker and a member of the 2020 advisory panel for the event. “Cleantech has now moved beyond being a ‘science experiment’; however, to fully realise the transition to a clean economy, we need to build the human infrastructure to support technological innovation. This is where an event like NCTCE2020 comes in; it helps to spread ideas and create the connections which really drive the changes we need to happen,” Dr MacTaggart said.

The event has industry support from Climate-KIC, EnergyLab, Cities Power Partnership, Brisbane’s CitySmart and The Australian Electric Vehicle Association. In addition, it has sponsorship support from Sunshine Coast Council and Brisbane Marketing.

NCTCE is currently seeking expressions of interest from event sponsors and exhibitors who are looking to showcase to this audience of cleantech producers, users and policymakers.

What: NCTCE2020
When: 3–4 August
Where: BCEC, Brisbane
Web: <https://nctce.com.au/>

Nectar Creative Communications
www.nectarcc.com.au



How industry can turn waste into biogas

Andrew Okely, General Manager – Strategy and Commercial

Many industries create substantial amounts of organic waste, much of which can be detrimental to the environment as well as difficult to dispose of.

In many cases, the waste comes with an unpleasant odour, which can result in complaints from nearby residents and affect working conditions for employees. However, it is possible to turn organic waste into biogas to offset energy costs and even create a new revenue stream for businesses.

Transforming waste into biogas works by treating wastewater streams through an anaerobic process in which bacteria breaks down microorganisms in the wastewater stream. This process — similar to fermentation — creates biogas, which mainly consists of methane and carbon dioxide, and may include small amounts of hydrogen sulfide, giving it a distinctive rotten egg smell.

Biogas needs to be combusted or oxidised with oxygen to convert it into energy, at which point it can replace diesel in generators, for example, or create electricity that can be fed back into the grid.

This process can help reduce the amount of industry waste going into the environment, making businesses more environmentally sustainable. It can also reduce the cost of energy because a business can use biogas to replace energy from the electricity grid (or coal-fired or diesel generators). And, if the process creates more energy than the business can use,

that energy can be fed back into the electricity grid, yielding an additional source of income.

Hydrogen sulfide and the importance of pH

Without the right systems in place, organisations can fail to create enough biogas to make a difference. When anaerobic mechanisms take place at low pH levels they release more hydrogen sulfide gas, which is toxic and foul smelling — and can corrode assets when converted into sulfuric acid.

Organisations that create too much hydrogen sulfide will reduce the lifespan of their equipment as well as produce less biogas. Therefore, it's essential to maintain the pH within the optimum range by dosing an alkali into the water.

A Queensland-based rendering plant was able to save more than \$1.5 million in energy costs by improving its biogas production. The plant processes four million kilograms of animal waste each week, using approximately \$130,000 of electricity each month as well as 24,000 tonnes of coal each year. In a bid to reduce its energy usage, the business wanted to improve its biogas yield and turn its wastewater treatment process into an energy source rather than a cost centre.

The plant applied a concentrated, stabilised suspension of magnesium hydroxide to man-

age alkalinity and control pH in the anaerobic process. This approach is more effective than hydrated lime and caustic soda, reducing the amount of chemicals that businesses need to apply. The approach is claimed to be non-toxic and environmentally friendly, providing up to 30% faster neutralisation of acidic waste streams as well as reducing sludge generation for easier disposal.

Using this approach, the rendering plant dramatically increased the amount of biogas it could convert into energy, saving \$1.5 million and increasing the lifespan of its assets. The same approach can also reduce the odour from hydrogen sulfide by as much as 70%, which can reduce industry's impact on neighbouring businesses and residents.

A solution for the environment

Biogas is a viable alternative to traditional waste management approaches. It's a clean, renewable energy that's created from materials that would otherwise be wasted. Biogas production from organic waste can reduce the greenhouse gas emissions of energy by over 20 times and prevents methane from escaping in an open environment directly into the atmosphere. Creating energy through biogas is considered carbon-neutral, so it's a genuine solution to excess emissions.

With growing concern about the impact of industry and agriculture on Australia's greenhouse gas emissions and the environment in general, biogas is swiftly emerging as the most attractive, affordable and logical waste management solution available.

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\$15m in funding to address solar panel end-of-life issues

On behalf of the Australian Government, the Australian Renewable Energy Agency (ARENA) has announced up to \$15 million in funding to support research that aims to address end-of-life issues for solar PV panels — a first for the agency — as well as increasing their efficiency and lowering their cost.

As the rate of solar PV deployment increases, innovations that can reduce the cost of sustainably managing panels at the end of their life will become more important. The round is seeking to fund projects that can improve the economics of recycling, such as with better upfront design, increasing the value of recovered materials, or even innovations to include re-used or recycled components in new panels. Cost savings will enable both large-scale solar PV projects and rooftop PV customers to responsibly manage their waste, without significantly impacting the overall cost of renewable electricity generation.



The new funding round seeks to strengthen the world-leading solar PV R&D sector that ARENA has helped to establish through the >\$290 million it has provided to around 300 solar R&D projects since 2009. It will support solar PV in the following areas:

- **End-of-life:** New solutions, including upfront solar PV panel

designs and end-of-life processing, that increase the cost-effectiveness of sustainable end-of-life management of solar PV panels.

- **Advanced silicon:** Improvements to the overall cost-effectiveness of silicon-based panels already in mass market production, and their production processes.
- **Tandem silicon:** Increasing the cost-effectiveness of silicon-based solar PV through the use of tandem materials.
- **New materials:** Development of new materials with the potential to either reach breakthrough cost-efficiencies, or the potential for new deployment applications.

“Currently, solar PV panel recycling adds a cost to the supply chain,” said ARENA CEO Darren Miller. “R&D can help find innovative solutions to reduce this cost, enabling sustainable and cost-effective management of solar panels at the end of their life.”

“The funding round also aims to build on Australia’s excellence in solar PV R&D, to increase efficiencies and drive down costs even further and help bring about the next generation in solar technology. More efficient and lower cost solar PV can underpin the growth of a renewable hydrogen industry, can drive the electrification of transport and industrial processes, and can reduce the costs of delivering secure and reliable renewable electricity.”

Australian Renewable Energy Agency (ARENA)
www.arena.gov.au



Potassium’s potential in rechargeable batteries

Scientists from Tokyo University of Science have conducted extensive research on potassium-ion batteries (KIBs), finding that the batteries are a better-performing, lower-cost and more sustainable candidate than lithium-ion batteries (LIBs). Replacing lithium in rechargeable batteries with a more abundant material like potassium could result in a more environmentally friendly energy source.

The team’s paper — published in *Chemical Reviews* — discusses the development of KIBs and compares the different materials used in lithium-, sodium- and potassium-ion batteries.

Rechargeable batteries are used in most portable electronic devices, electric and hybrid vehicles and renewable power-generation systems due to their low-cost, recyclable technology. They are also an essential tool in systems that harvest renewable energy from fluctuating sources such as wind and solar, allowing energy to be stored and dispatched when needed.

LIBs have been the rechargeable battery of choice owing to their excellent performance. However, spikes in demand, coupled with limited availability of lithium and cobalt (another necessary element for LIBs), means that using LIBs may soon become a major problem.

To tackle this challenge, Tokyo researchers led by Professor Shinichi Komaba have focused on replacing lithium with alternatives such as sodium and potassium.

Sodium and potassium are in the same alkali metal group in the periodic table of elements, and their chemical natures are, therefore, quite similar. But, unlike lithium, these elements are widely

abundant on Earth, and using them to develop high-performance rechargeable batteries would be a breakthrough towards creating a more sustainable solution.

Demonstrating comparable (or even better) performance to LIBs, KIBs look promising. The materials necessary to build KIBs are non-toxic and much more abundant than those required for LIBs.

“By studying new materials for applications in lithium-, sodium-, potassium-ion batteries, we wanted to develop an energy-efficient and environment-friendly technology,” Prof Komaba said.

“As evidenced by recent intensive research, KIBs are recognised as promising next-generation battery candidates owing to their unique characteristics, such as cost-effectiveness, high voltage and high-power operation.

“Further improvements to the performance of KIBs would pave the way for their practical application,” he explained.

Additional research on the safety of KIBs is needed — the researchers also emphasised that a focus should be placed on exploring what’s going on physically and chemically between the different components and elements.

“Research on KIBs, including electrode materials, non-aqueous/solid electrolytes and additives, will provide new insights into the electrode reactions and solid ionics, opening up new strategies that would allow for the creation of next-generation batteries,” Prof Komaba said.



What if we reversed rising temperatures?

Mitigating climate change and income inequality via solar geoengineering



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Solar geoengineering could play a key role in reducing income inequality between countries, according to research undertaken at the University of California San Diego (UC San Diego).

Solar geoengineering — also known as solar radiation management — is a process that intentionally reflects sunlight away from the Earth's surface to mitigate global warming.

A team of researchers from UC San Diego have examined the impacts of solar geoengineering on global and country-level economic outcomes, publishing their paper in *Nature Communications*. The analysis follows the response of gross domestic product (GDP) to the specific pattern of cooling that solar geoengineering produces.

The methodology estimates the historical relationship between climate, represented as mean annual temperature and precipitation, and country-level growth in economic production, measured as GDP per capita. This estimated climate–economy relationship is then applied to project and compare economic outcomes across four different climate scenarios for the next century: if global temperatures stabilise naturally; if temperatures continue to rise; if temperatures were stabilised as a result of geoengineering; and if temperatures were over-cooled from geoengineering efforts.

“While precipitation has little to no effect on GDP growth in our results, there is a relationship for temperatures,” said lead author Anthony Harding, a visiting graduate student with UC San Diego’s School of Global Policy and Strategy from the Georgia Institute of Technology.

“Applying these historical relationships for different models, we find that if temperatures cooled there would be gains in GDP per capita. For some models, these gains are up to 1000% over the course of the century and are largest for countries in the tropics, which historically tend to be poorer.”

In an economic model projecting a solar-geoengineered decrease in the average global temperature of around 3.5°C, the cooler climate would increase average incomes in developing tropical countries, such as Niger, Chad and Mali, by well over 100% over the course of the century, compared with a model where warming continues to occur.

For the US and countries in southern Europe, the same model showed a more moderate increase of about 20%. While the effects for each individual country can vary across models, the changes in temperature associated with solar geoengineering consistently translate into a 50% reduction of global income inequality.

“We find hotter, more populous countries are more sensitive to changes in temperature — whether it is an increase or a decrease,” Harding said.

“Those hotter countries are typically also poorer countries. With solar geoengineering, we find that poorer countries benefit more than richer countries from reductions in temperature, reducing inequalities. Together, the overall global economy grows.”

Understanding the risks and rewards of solar geoengineering

Harding and co-author Assistant Professor Kate Ricke from UC San Diego’s School of Global Policy and Strategy and Scripps Institution of Oceanography highlighted that there are many unknowns about the impacts solar geoengineering intervention efforts would have on the Earth’s atmosphere, a cause of concern for scientists and policymakers.

However, predicting the economic impacts of solar geoengineering is a fundamental step towards understanding the risk trade-off associated with the new field of study, which is advancing rapidly. Many emerging technologies have recently been developed to manipulate the environment and partially offset some of the impacts of climate change.

“There is a problem with solar geoengineering science in that there has been a lot of work on the physical aspects of it; however, there is a gap in research understanding policy-relevant impacts,” Ricke said.

“Our finding of consistent reduction in inter-country inequality can inform discussions of the global distribution of impacts of solar geoengineering, a topic of concern in geoengineering ethics and governance debates.”

The authors explained that their findings underscore the necessity of a robust system of global governance to ensure that any future decisions regarding solar geoengineering deployment are made for collective benefit.



Japan recovers metal to make Tokyo 2020 medals

Tokyo 2020 Olympic champions will be awarded sustainably produced medals thanks to the Tokyo 2020 Medal Project. The zero waste approach to the Olympic medal production is part of the sustainability concept for the 2020 Games: 'Be better, together — For the planet and the people'.

Five thousand medals are expected to be produced for next year's Games — all manufactured from gold, silver and bronze collected and recycled from mobile phones and other small electronic devices donated by the public. Coordinated by the Tokyo Organising Committee of the Olympic and Paralympic Games, the project has reached its target of collecting enough precious metal from recycled products to manufacture the medals.

The Olympic organising committee has recognised the huge effort made by the community in donating their used devices. More than 90% of local authorities in Japan supported the initiative, as well as Tokyo

2020 partners and the general public. Several athletes from Japan and overseas also called for action and donated their own used devices.

The collection period running from 1 April 2017 to 31 March 2019 mustered approximately 78,985 tons of used small electronic devices including mobile phones (collected by municipal authorities across Japan) and approximately 6.21 million used mobile phones from NTT docomo shops

across Japan. This led to the total collection of 32 kg of gold, 3500 kg of silver and 2200 kg of bronze.

Tokyo 2020 is also planning to recycle household plastic waste and marine plastic waste to create podiums for medal ceremonies. In addition, part of the Tokyo 2020 Olympic Torch Relay uniforms will be produced from recycled plastic bottles.

Tokyo 2020 will continue its campaign for recycling and circular economy goals by calling on the same groups of people and organisations to support its sustainability initiatives. The metals to be recovered are planned to be re-used for community purposes, including creation of medals for local sports events across Japan.

The Tokyo 2020 Summer Olympics, officially known as the XXXII Olympiad, will be held in Tokyo from 24 July to 9 August 2020.



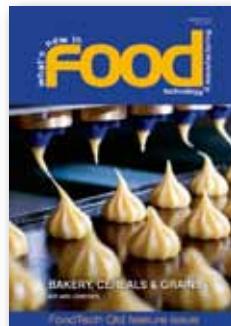
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