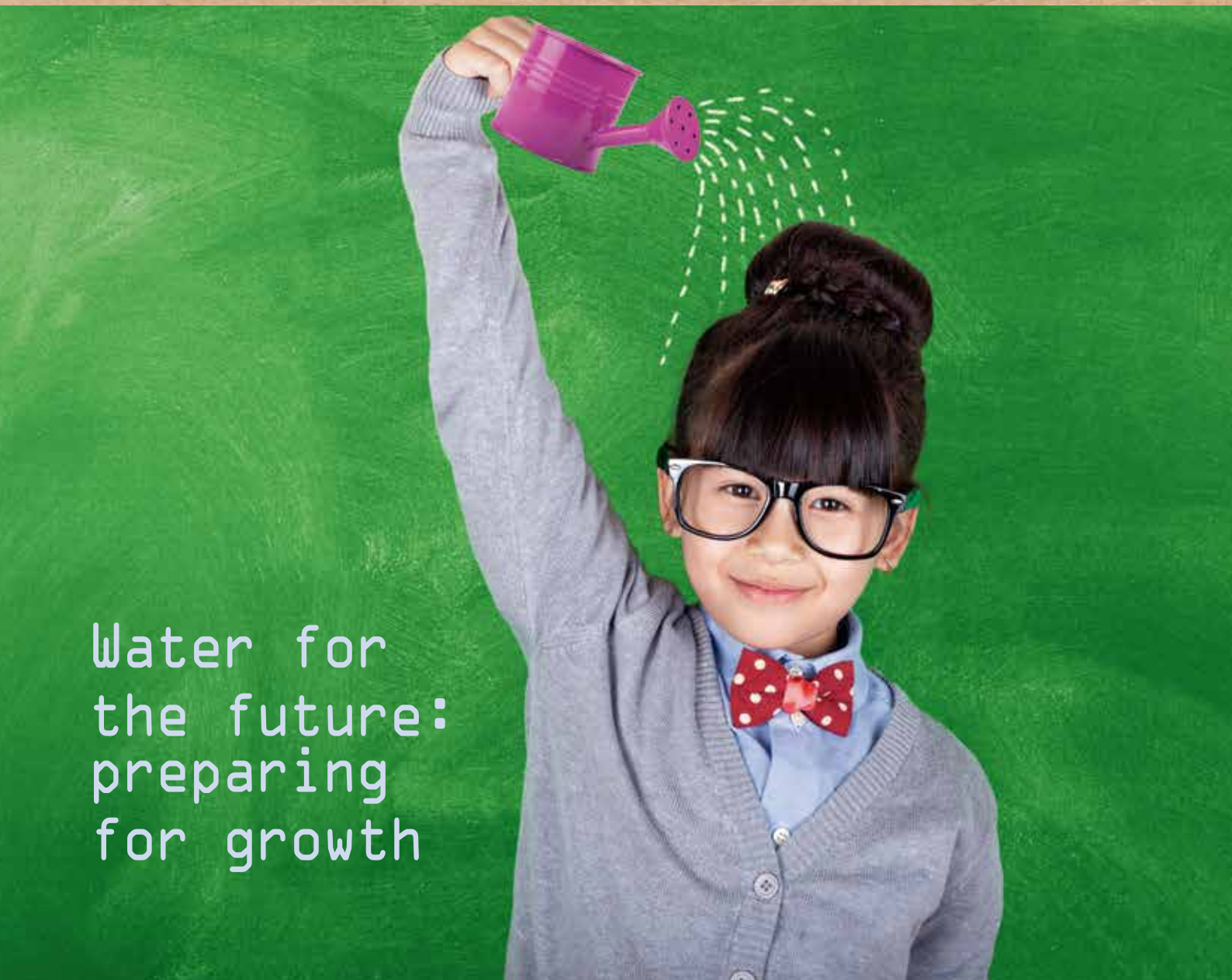


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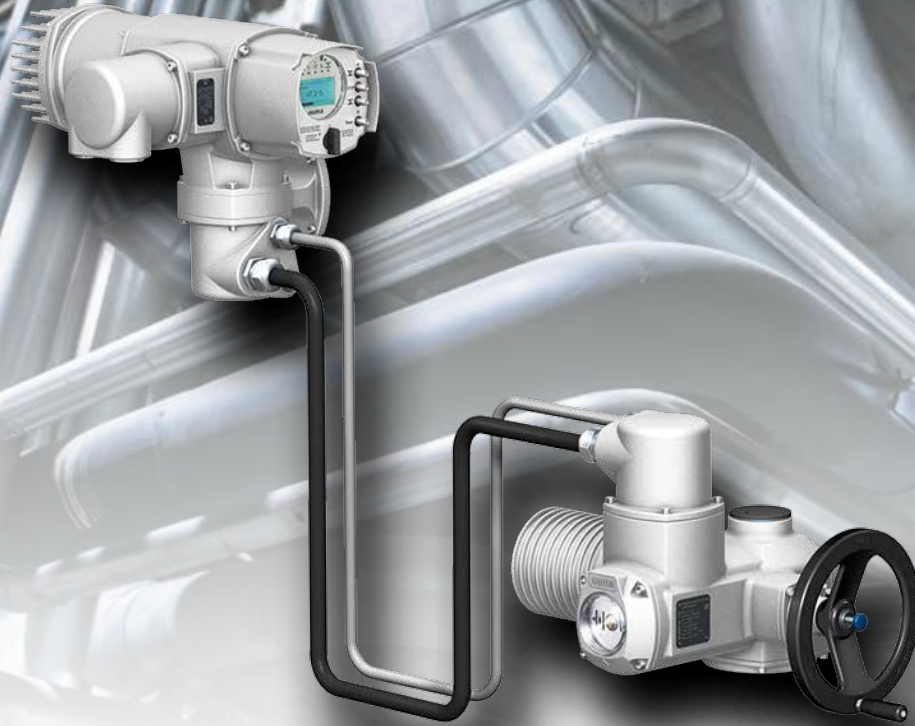
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contents

MARCH 2024



6 Five fundamentals: preparing for mandatory climate reporting

opinion

8 Strategic priorities for Australia's water utilities in 2024

water for the future

14 Thirsty emus look to smart solar for their daily drink

water supply

20 Could industrial digital technology make Australia's biggest cities better places to be?

urban development



23 Making light work!

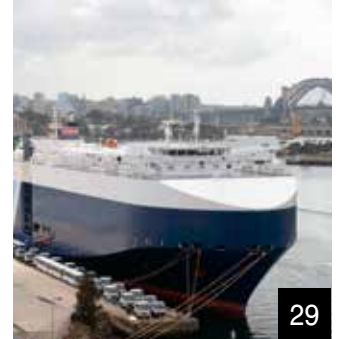
synthetic fuel

27 From waste into energy 'gold'

waste to energy

29 Shore power: a critical investment for the maritime industry

sustainable power



32 A sustainable second chance

leadership

34 The new science of waste

waste management

regulars

10 Case studies

19 Products & services

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WORDS from the EDITOR

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Australia's population of around 26.6 million is projected to reach between 34.3 and 45.9 million people by 2071, and temperatures are slowly and steadily on the rise.

While 2023 was globally the warmest year on record, it was Australia's equal eighth-warmest year on record with the national mean temperature 0.98°C warmer than the 1961–1990 average. Australia's temperatures have warmed by around 1.47 ±0.24°C since 1910, with 2019 recorded as our warmest year on record.

Our national rainfall was overall above the average in 2023, but the August to October period was Australia's driest three-month period on record.

With warming temperatures and such climate variability, water utilities face a tough task to ensure the delivery of high-quality water supply for our growing population in Australia. Peter Murphy, Head of Resources, Capability & Delivery for Atturra Advisory, provides his top five strategies that could be useful for forward-thinking utilities on page 8.

This water issue will also take a look at automating water supply for thirsty emus, a 'molecular trap' to remove sulfate from waterways and many other technologies being developed for the sustainability of water and wastewater.

On another note, we talk to an expert about the upcoming mandatory climate-related reporting and the practical implications for businesses being faced with this regulatory shake-up.

Enjoy the read!



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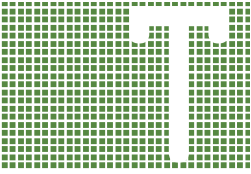
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Five fundamentals: preparing for mandatory climate reporting

Meg Fricke*

As Australia enters a new era of mandatory climate-related reporting, businesses nationwide are grappling with the practical implications of this sweeping regulatory shake-up.





The bigger picture is becoming clearer with the release of draft legislation from Treasury earlier this year. And while there are a few areas left to establish, such as specifying the pathway towards reasonable assurance of climate disclosures which will be determined by the Auditing and Assurance Standards Board, the new legislation will likely be in place by 30 June 2024. This means disclosure requirements will begin applying for very large companies for financial years beginning on or after 1 July 2024.

The overarching goal of the mandate is clear: to drive businesses to disclose financial impacts arising from climate change risks and opportunities.

Such requirements create better understanding of climate risks and opportunities to inform broader business strategies, risk management and target setting. Compliance goes beyond legislation, allowing businesses to build resilience in the face of emerging environmental considerations.

The realignment is a significant shift and will necessitate a comprehensive response from affected companies. Integration across governance, strategy, risk management and metrics and targets will be key to disclosures that provide information to assess the entity's performance in relation to its climate-related risks and opportunities.

As these reporting requirements apply to businesses ranging from very large corporations to small businesses with just 100 employees, a substantial proportion of Australia's business community must act immediately to satisfy impending legislation. Businesses that meet two of three criteria (100 employees, consolidated revenue of \$50 million, consolidated total assets of \$25 million) or smaller entities that are NGER Act reporters would be required to make these disclosures.

I offer five crucial steps businesses can undertake in preparation today to ensure compliance tomorrow:

1. Map the gaps

The first port of call is to acknowledge and pinpoint the areas where your business may

fall short of the impending requirements. The key is to identify not just the disclosure gaps, but also the implementation and enablement gaps. Implementation focuses on the changes required in how the business integrates climate risk and opportunities into decision-making and enterprise risk management, with sufficient oversight and determination of current and anticipated financial impact. Common enablement gaps may include data governance, recruitment, upskilling and processes. Once those gaps have been identified, efforts to fill them can be concentrated on the areas of greatest need.

2. Start with governance

Establishing robust governance is critical, with multiple dimensions to consider. Governance of climate-related risks and opportunities must be established to demonstrate sufficient oversight. However, governance of reporting is also a consideration, and the channel for oversight of risk and oversight of reporting is not always the same.

The audit committee is increasing reporting governance, whilst oversight of climate risks and opportunities is likely to remain in sustainability or risk committee mandates. Governance should also be considered at the management level and faces the same complexity with CSOs, CFOs and CROs all sharing some responsibility.

3. Capability across borders

Companies should identify key personnel responsible for the implementation and maintenance of these new reporting standards from the outset. Key roles and responsibilities must be mapped across business functions with strong centralised leadership and oversight. The use of an RACI system is a salient way to determine who does what.

Significant expertise will need to be developed or recruited. However, if a business lacks these skills, they should consider consulting external help, especially in the early stages.

4. Financial impact logic model

Climate change risks and opportunities will have financial impacts, and entities will need to undertake challenging work to understand this complex intersection with their financial statements. Determining your organisation's

financial logic model to translate from climate risks and opportunities through to current and anticipated financial effects is a key step. Input and connectivity with climate and finance teams is critical.

5. Integrate with business functions

Comprehending the legislation's broader business implications will help position companies to better provide necessary disclosures when the requirements take effect. Dig deep into how these changes will affect your business and align your strategic operations accordingly.

These reporting requirements cannot operate in isolation, nor are they merely a box-ticking exercise. Reporting should drive a better understanding of climate-related risks and opportunities that are integral to enduring business and environmental sustainability.

By embedding climate risk into overall decision-making processes, companies can not only ensure compliance with new legislation but also consolidate business resilience in the face of potential environmental challenges.

In summary

Such seismic shifts in legislation provide a wake-up call for businesses of all sizes, but also offer an opportunity. Companies that adequately prepare, adapt and embrace the change will ultimately be better prepared to thrive in the advancing sustainable business arena. There's no time to waste — the time to prepare for the future is now.



**Meg Fricke is a Partner with EY's Climate Change and Sustainability Services team, leading sustainability and climate change advisory and assurance services. Before joining EY, she worked as an economic consultant across the energy and utilities industry with private sector and government clients. Meg has a Masters of Environment, Bachelor of Commerce (Economics and Finance) and Bachelor of Agricultural Science. Over 13 years of experience, with three years working in the US and Canada, have created a focus on the development of sustainability strategy and integrated reporting, sustainability risk assessment, and detailed assessments of environments, health, safety and community impacts.*



Strategic priorities for Australia's water utilities in 2024

Peter Murphy, Head of Resources, Capability & Delivery for Atturra Advisory

Facing a rapidly growing population and long-term climate change, Australia's water utilities are bracing for increased demand from both households and businesses in the years ahead. They understand that any supply restrictions or disruptions could have serious consequences.

For this reason, attention has turned to the issues and challenges that will be a priority in the coming year. Management teams need to ensure that resources are allocated where they will deliver the most value and keep operations fully functional. The top five areas of focus should be:

1. Undertaking ongoing strategic planning

During 2024, strategic planning will remain vitally important for water utilities of all sizes. As the sector grapples with aging

infrastructure, escalating urbanisation and ever-increasing regulatory pressures, the necessity to modernise infrastructure while ensuring efficient, sustainable service delivery becomes acute.

Forward-thinking utilities will put in place long-term strategies that encompass asset management, infrastructure investment and customer-centric approaches to ensure the delivery of safe, high-quality water. By carefully aligning these factors with overarching business objectives, utilities can achieve operational efficiency while also effectively managing costs.

2. Climate change and ESG will remain priorities

Climate change's pervasive impact is acutely felt in the water utilities sector. The unpredictability of weather patterns, longer droughts and intensified extreme weather events pose a considerable threat to water supplies.

Consequently, utilities will continue to face tremendous pressure to adopt environmentally sustainable practices and meet stringent ESG (environmental, social and governance) standards. Investments in water conservation, recycling and reducing overall carbon footprints will need to be fundamental pillars in the industry's strategic planning processes, whilst at the same time maintaining safe operations.

The incorporation of sustainable practices is not only an environmental and regulatory necessity but also a strategic move for utilities to ensure long-term reliability and efficiency. Transitioning to eco-friendly technologies, optimising water treatment processes and reducing wastage are imperative steps towards achieving both sustainability goals and compliance with increasingly stringent environmental regulations.



water for the future

become more interconnected and reliant on digital infrastructure, their vulnerability to cyberthreats escalates.

With critical infrastructure at risk, utilities face substantial pressure to fortify their systems against cyber attacks. The need for robust security measures is paramount to ensure the protection of data, prevent service disruptions, the confidence of customers and maintain public safety.

During the coming year, water utilities must embrace a comprehensive approach to cybersecurity, encompassing robust IT infrastructure, employee training, incident response protocols and regular security assessments. Collaboration with cybersecurity experts and government bodies to stay abreast of emerging threats and regulations will also be vital.

5. The skills shortage will remain

Water utilities will continue to grapple with the ongoing challenge of recruiting and retaining skilled professionals. The impending retirement of experienced personnel, coupled with the demand for specialised expertise in emerging technologies, poses a significant threat to the industry's future stability.

During 2024, the sector must invest in training and educational programs to bridge the skills gap and attract a new generation of talent. Efforts in educational partnerships, mentorship programs and the promotion of STEM (science, technology, engineering and mathematics) fields and vocational training are essential to nurture a pipeline of skilled workers. Additionally, reskilling programs for existing employees to adapt to technological advancements can serve as a bridge to address the skills deficit.

It's clear that 2024 will be an important time for water utilities to re-evaluate and recalibrate their plans in response to the multifaceted challenges they face. Strategic planning, fuelled by sustainability and innovation, is paramount to navigate the unpredictable terrain of climate change, technological advancements, cybersecurity threats and workforce scarcity.

It will be important for utilities to embrace change, adopt resilient methodologies and stay ahead in an ever-evolving landscape. Only through concerted long-term planning and adaptation can the sector ensure a sustainable, reliable and safe water supply for all.



Forward-thinking utilities will put in place long-term strategies that encompass asset management, infrastructure investment and customer-centric approaches to ensure the delivery of safe, high-quality water.

3. AI will become more widely used to aid network performance and maximise the value of customer datasets

The utilisation of artificial intelligence (AI) has become something of a game changer for water utilities. This is because AI tools are adept at proactively detecting and predicting issues in distribution networks.

By employing advanced algorithms capable of analysing large datasets, utilities can identify irregularities, leakages or inefficiencies within their water infrastructures. Armed with such tools, utilities will be able to minimise water

losses, optimise resource distribution and lower operational costs, to ensure a more sustainable and resilient water supply.

During 2024, the integration of AI and machine learning technologies will also increasingly streamline maintenance processes, enabling utilities to shift from reactive to proactive approaches.

4. Cybersecurity will remain a challenge

The increased use of sophisticated technology within water utilities brings with it a critical concern — cybersecurity. As systems

Remote control for water and wastewater in Hawke's Bay, NZ



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Hastings District Council and Napier City Council are both located in Hawke's Bay, on New Zealand's North Island. The two local authorities wanted a single, standardised remote telemetry solution to be deployed across all their water and wastewater treatment plants, pump stations and treatment plant infrastructure. To solve these challenges, the councils turned to Ovarro, a specialist in remote telemetry systems.

Ovarro's Kingfisher CP-35 remote RTUs were chosen for the two Hawke's Bay councils' needs. The RTUs had already been successful when implemented across the water infrastructure in the city of Auckland, over 400 km away from Hawke's Bay.

Supported by Ovarro's local distributor, CSE W Arthur Fisher (CSE-WAF), the Kingfisher RTUs were installed across the Hawke's Bay region's wastewater and water treatment sites, reservoirs and pump stations. The modular RTUs have replaced outdated PLCs with a uniform technology.

The Kingfisher uses Toolbox Plus v8.3 software that supports online changes during commissioning. Water- and shock-proof SD cards are installed in the RTUs' processors, safeguarding against the loss of critical data in the case of a catastrophic failure. The cards also allow quick cloning of the RTUs after environmental disasters like cyclone damage and flooding.

Replacing outdated PLCs

The new solution would replace the outdated programmable logic controllers (PLCs), aged remote telemetry units (RTUs) and analog radios installed across the sites, while also simplifying technological requirements for their maintenance teams. They also wanted to reduce the need to stock spare parts from multiple vendors.

The capabilities of the Kingfisher CP-35 RTU made it an easy choice to replace aging PLC assets. Parts of the Hawke's Bay's infrastructure already used Kingfisher RTUs including the PC1, CP-11, 12 and 21. This was an advantage, as the modules within its network — inputs / outputs (IO), backplanes and power supplies — were compatible and interchangeable with the new RTUs. This increased the speed of rollout, and reduced costs, when replacing the old PLCs.



Ovarro's Kingfisher CP-35 remote RTUs were installed across the Hawke's Bay region's wastewater and water treatment sites, reservoirs and pump stations.

Operational benefits

Kingfisher CP-30 RTUs were first standardised in New Zealand, in 2010, by Watercare Services Ltd, the local water authority in Auckland. The RTUs were rolled out across over 700 assets in the city.

Watercare then worked with CSE-WAF and Ovarro to develop the Kingfisher CP-35 with daughter cards that improved the RTUs' expansion and customisation capabilities, modularity and flexibility. The CP-35 was rolled out in Auckland and is now being used in Hawke's Bay.

The Kingfisher has software for executing control algorithms and a graphical interface that displays SCADA control parameters. Both features have been shared with other regional water authorities to reduce development and rollout costs, and speed up standardisation processes. This makes it easier for Ovarro and CSE-WAF to support local communities and helps engineers familiar with Kingfisher RTUs work across different territories.

"With Ovarro's Kingfisher C-35 RTUs, a single, standardised remote telemetry solution has been successfully rolled out across the region," said a spokesperson for Napier City Council. "It was delivered on time, on budget and it continues to operate extremely well."

Ovarro

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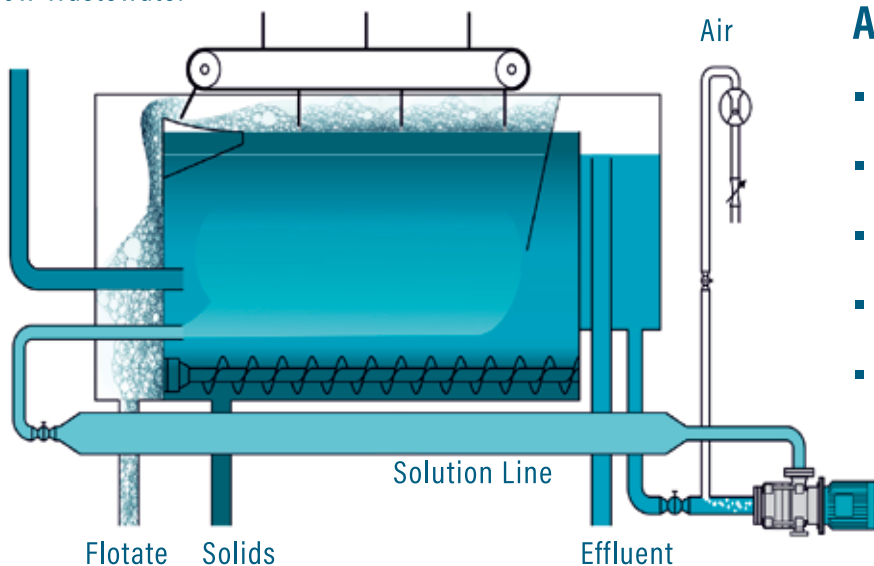
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Trial uses clay to combat algal growth



The Western Australian Government is putting clay to innovative use in a trial to improve water quality in the Peel-Harvey (Bindjareb Djilba) estuary catchment.

Many waterways in WA, such as the Serpentine River (Waangaamaap Bilya), can receive excess phosphorus from fertiliser use in their catchment. This potentially causes algal growth that can lead to fish kills and adverse human health impacts.

The Department of Water and Environmental Regulation (DWER) has been developing a novel clay known as

Hydrotalcite clay, or HT-clay. It is made from a natural bentonite clay modified with hydrotalcite: a phosphorus binding mineral. During the manufacturing process, several raw ingredients are mixed together, causing chemical reactions where the clay becomes coated in the phosphorus binding material.

When scientists from Healthy Estuaries WA applied the clay-based treatment to a drain in the catchment of the Peel-Harvey estuary, the clay successfully bound up to 95% of phosphorus at the treatment site, preventing it from fuelling algal growth in the downstream waterways.

“The phosphorus binding clay is a Western Australian invention and demonstrates the innovative new approaches our state government is taking to look after the health of our precious waterways,” said Water Minister Simone McGurk.

“The groundbreaking research in the Peel-Harvey estuary complements the important work Healthy Estuaries WA is doing to reduce the amount of fertiliser applied to farms.

“While there is much work happening in the catchment to reduce nutrient inputs for the future, this is showing promising signs of how to address the high levels of nutrients that are polluting some of our waterways right now.”

The clay production and distribution were funded by the WA Government’s Bindjareb Djilba Protection Plan and Healthy Estuaries WA program.

Healthy Estuaries WA is a \$25 million state government initiative focused on improving the health of Peel-Harvey estuary, Leschenault Estuary, Vasse-Geographe waterways, Hardy Inlet, Wilson Inlet, Torbay Inlet and Oyster Harbour.

Gippsland Water eliminates pump blockages at Morwell WWTP

Gippsland Water provides water and wastewater services to the Gippsland Region of Victoria. At its Morwell Waste Water Treatment Plant, Gippsland Water has used two Gorman Rupp Ultra V series 3” pumps as the inlet works pumps for the plant.

The reason why Gippsland Water selected the Gorman-Rupp Eradicator upgrade kit for this project: until December 2020, the inlet works had a muncher prior to the pump suction lines. Following multiple position changes and two catastrophic failures, the last being the bottom bearing failing, which resulted in one side slipping down and chewing out all the teeth, the decision was made to remove the muncher entirely from the inlet works. This meant the Ultra V series pumps were now being used to pump unscreened raw sewage. The first 12 months saw a total of 114 blockages across the two pumps, roughly 2.2 blockages per week with the inlet pump closest to the forebay inlet accounting for 64% of those blockages. The added vibrations caused by the raged-up pumps eventually led to cracking in the welds of the inlet pipework, so the plant technician, Scott Kitwood, reached

out to Hydro Innovations’ Regional Manager, Graeme Spence, looking for a solution.

The solution

The Ultra V series pump along with the Super T series pumps can be retrofitted with Gorman Rupp’s patented Eradicator solids management system.

The team at Gippsland Water took the opportunity to retrofit an Eradicator upgrade kit to the inlet pump with its suction line closest to the wet well inlet. Nine weeks after installation, the pump only experienced one blockage, almost completely reducing blockages.

The results

The plant operator said that since having the upgrade installed in Pump 1 during September 2023, they have left Pump 1 as the duty pump and have not experienced any pump blockages.

“Prior to the upgrade we would notice in the trends that the pump speed would drop off on occasion (due to ragging and the VSD protecting the pump), which would happen multiple times a day. This has since only happened once in the two weeks it has been running.



“As you may be aware, in early October, Gippsland was hit with extreme rainfall. There have also been two smaller events in November and December. There is a lot of data from the October event as well as the continued recovery and return to normal phase for each event over the past three months. However, the standout fact is that not once during the high inflow periods did Inlet Pump 1 fail or rag up, nor was there any reduction in flow or pump speed. This is an amazing outcome with multiple benefits; we are very pleased with the outcome and will look to upgrade the second pump in the near future.”

Hydro Innovations

www.hydroinnovations.com.au

Giving sewage sludge a second life



istock.com/Dmytro Falekivskyi

A team of scientists from the University of Córdoba (UCO) has given sewage sludge a second life by turning it into activated carbon.

Sewage sludge is the solid waste that results from wastewater treatment. According to data from Spain's Ministry for the Ecological Transition and the Demographic Challenge, 1.2 million tons of this waste were produced in Spain in 2021 alone, and its management is a growing problem. While some of the waste may have agricultural applications, such as being used as fertiliser after composting, its high concentration of metals limits its use, generating environmental problems.

By transforming the sludge into activated carbon, the researchers, from UCO's Inorganic Chemistry and Waste Bioengineering and Green Engineering groups, produced a material with useful industrial applications. The high porosity of activated carbon means that it can adsorb molecules on its surface, making it

especially suited to decontamination processes, such as water purification and gas treatment.

Transforming sewage sludge into activated carbon is not a new process, but the team's innovation lies in producing the carbon "under more favourable and sustainable conditions, and obtaining a high-quality product", according to María Carmen Gutiérrez, one of the authors of the study.

Compared to similar research carried out previously, this study managed to decrease the temperature required to carry out the process, leading to lower energy costs for the waste recovery procedure. The team also managed to reduce the amount of the activating agent – the substance that activates or accelerates the thermochemical reaction through which the waste becomes a useful product for society.

During the process, the sludge is initially dried before being mixed with the activating agent. The compound then undergoes pyrolysis (heating to high temperatures in the absence

of oxygen, which carbonises the residue) and a treatment that purifies and removes certain minerals.

"From a practical point of view, it is important to propose solutions that can then be carried out on an industrial scale," said María Ángeles Martín, a professor of Chemical Engineering at the University of Cordoba. In addition to using fewer resources, "it is one of the simplest procedures in the literature, and uses technologies that already exist on the market on an industrial scale", she added.

At this stage, the researchers' work, which originated from a doctoral thesis by researcher Hansi Martínez, has focused on verifying the quality of the activated carbon that can be obtained from sewage sludge. The next step, the research team explained, is for the group to develop applications appropriate for this material.

Emus, which cannot take a backward step, are one half of our national coat of arms. Typically fearless of humans, *Dromaius Novaehollandiae* is unique to Australia, where it has roamed our sunlit plains for millions of years, and is believed to be a survivor of prehistoric times, with similar bone structures to dinosaurs.

Solar energy and emus belong together.

These ancient birds — reaching between 1.6 and 1.9 m tall, and capable of sprints up to 50 kph — have pecked a living from grasses, fruits, native plants and insects as they have roamed our sunlit plains and woodlands for millions of years.

In the wild, they can survive extended periods between drinks, consuming up to 18 L of water when available. But they have a very high water requirement in very hot weather and also benefit from regular supplies of refreshment to attain ideal condition when farmed for their meat, skin, oil, eggs and feathers.

“The wild population of emus — estimated at a healthy total of more than 600,000 — is protected by law. All birds used for commercial emu farming must be derived from farm-reared or captive stock, with these prized creatures getting a generous diet of ideal foods and a regulated daily drink to ensure they are healthy,” said irrigation specialist Peter Kidgell of the Yarrawonga branch of the national Water Dynamics organisation.

Kidgell was involved in a solar-powered irrigation project in partnership with Damien Kennedy Irrigation near Mulawa in NSW to help ensure the sustainability and cost-efficiency of an emu farm at Mt Gwynne that stocks up to 300 birds.

The technology involved — which he says has performed outstandingly well in its first year of service — is of an automated, remotely controlled integrated installation of a type that can be customised to other poultry and livestock industries needing assured daily supplies of water, delivered as efficiently and as sustainably as possible.

Central to the project is a PC-controlled array of 10 solar sets powering the 10 Grundfos Solar Q Submersible Solar Pump installations which draw water from a dam supplied by the Murray River. Each set is complete with six panels (max 150 LPM/500 kPa) powering the



Thirsty emus look to smart solar for their daily drink

Water Dynamics

submersible pumps, which are of a range that can be automated for solar or wind power, depending on the location and type of installation.

These pump and solar array sets automate water supply to stock troughs in six paddocks, each of which also features an integrated and automated hydrant to supply water at zero running cost, Kidgell said. Excess water

supply from the Solo system feeds back to the farmer's dam, where a Grundfos Hydro Solo E system drives another pump set.

The system delivered is a complete package, extending from pumps, array frames, mounting poles, long-life polyethylene pipes and risers, and plug-and-play connections. It includes a Grundfos CU 200 SQ Flex controller incor-



automated water supply



Grundfos Solar Q pumping technology.

with local onsite service as required and as the opportunity arises, a system can be upgraded in line with the onward march of technology. This is important, because irrigation technology is evolving as farmers of all types adapt to national imperatives, including metering requirements, and the business needs to get more productivity and sustainability out of less water,” Kidgell said.

Water Dynamics sees efficient irrigation as a critical input for agricultural production, playing an important role in food security in Australia and abroad.

“Given population growth and the need for food export growth in Australia, it is widely expected that the agricultural sector here will have to expand the use of irrigation over the years ahead,” Kidgell said. “This will become even more important as we have entered the *El Niño* drier phase of our climate patterns, which is expected to have a rising impact in the years ahead on this, the driest inhabited nation on earth.”

Even the hardiest of creatures — and emus have survived here for up to 80 million years — need their share of available water.

“These are big birds — the second biggest on earth behind their close relation, the ostrich — and at just a year old typically reach between 30 and 40 kg each. At that size, these ancient creatures really do appreciate the regular drink that modern technology can deliver.”



An automated solar array that delivers the right amount of water at the time it is needed, with PLC control allowing this to be remotely adjusted according to conditions.

porating status and simply operated control arrows for the power supply and float switch connection for the connection used to detect the level of a liquid in 18 L pressure tanks. The system can be programmed to send an alarm if the liquid level becomes too high or low.

“The beauty of a complete package such as this is that everything in it is optimised

to work best with everything else on the particular system involved. With irrigation, one size or package type definitely does not fit all.

“A complete integrated and customised package takes full account of a host of factors, including site conditions and varying operating needs, and simplifies the skills needed to operate it. It also needs to be backed up

'Molecular trap' can remove sulfate from waterways

Scientists from The University of Queensland and Xiamen University in China have hit on a way to remove sulfate, a naturally occurring ion, from water.

In a development that could lead to cleaner waterways and more effective nuclear waste treatments, the collaborative team designed a cage-like molecule to trap sulfate. The molecule measures and traps sulfate in water with a high degree of selectivity and can be prepared inexpensively from off-the-shelf chemicals.

Professor Jack Clegg from UQ's School of Chemistry and Molecular Biosciences emphasised that being able to monitor and completely remove sulfate in water had great potential across many areas.

"Sulfate is a very common and important ion," Clegg said.

"In low quantities in the human body, sulfate has diverse metabolic roles such as eliminating toxins and helping drugs work effectively," he continued.

"But in the environment, too much sulfate can pollute drinking water and accelerate the corrosion of pipes. The presence of sulfate also causes problems when immobilising radioactive wastes."

Dr Xin Wu, a former DECRA fellow at UQ now based at Xiamen University, said while there were significant benefits from cheaply and easily measuring sulfate levels, the molecular trap's ability to capture negatively charged chemicals from water is also valuable.

"Being able to stabilise a highly negatively charged chemical such as sulfate inside a charge-neutral cavity is a remarkable



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feature of our molecule," Wu said. "This mimics the function of naturally occurring sulfate-binding proteins."

Wu said that the technology could have applications in medicine, such as helping to funnel chloride and bicarbonate ions through cell membranes to treat diseases that involve defective ion transport such as cystic fibrosis.

"This is just the beginning — we're excited to see how this fundamental science can be applied in all sorts of fields," Wu said.

The research paper is published in *Nature Chemistry*.

SA poo plant undergoes historic upgrade

More than 310 cubic metres of concrete was poured into the steel-lined base to create the inlet's foundation across the 15-hour operation.



SA Water has just completed the single largest concrete pour at South Australia's Bolivar Wastewater Treatment Plant — part of a \$64 million upgrade that will create a new inlet structure at the facility.

More than 310 cubic metres of concrete was poured into the steel-lined base to create the inlet's foundation, involving the coordination of around 50 mixing trucks across the complex 15-hour pour.

Bolivar's new inlet is being built to increase the plant's capacity to receive and process higher projected flow rates of sewage as Adelaide's population grows.

SA Water's Senior Manager of Capital Delivery, Peter Seltsikas, said along with the slab pour, the project has achieved a number

of other milestones, including delivery of new screens that will be retrofitted on the inlet and act as the plant's first line of defence, capturing and removing inorganic material.

"We've also recently started replacing three of our existing inlet pipes — which transfer raw sewage from across metropolitan Adelaide to the plant — while they remain temporarily connected to the existing inlet structure," Seltsikas said.

A 20-tonne tower crane was deployed next to the inlet's concrete slab to help crews lift equipment and pipes into place, along with large panels to facilitate concrete form work.

"Once the new inlet is complete, we'll change the connections over and construct an additional three inlet pipes to accommodate increased flows that will come into the plant as the local population grows," Seltsikas said.

"Despite ticking off the project's single largest concrete pour, we anticipate we'll need a further 1990 cubic metres, with our team now working on forming the concrete roof structure, overflow channels and walls."

Seltsikas said SA Water hoped to begin installing the inlet's mechanical equipment in the next few months. This process will involve eight customised screens, major support steel structure and ancillary items such as penstocks and stoplogs that control and isolate the flow of sewage.

To accommodate future projected flows, Bolivar's capacity to receive sewage from the network will more than double to around 630 million litres per day once the new inlet is operational.



SYDNEY WATER REPLACES ACTUATORS TO ENSURE CLEAN DRINKING WATER

By replacing hydraulic actuators with AUMA electric actuators, the supply of water from the Potts Hill Outlet Works to the City of Sydney's drinking water supply network can be guaranteed to be free of contamination from leaking oil.

Conversion to electric drive technology

An existing hydraulic actuation system has been replaced with advanced electric actuators from AUMA at Potts Hill Outlet Works in Sydney. The actuators automate three large penstocks that control the water flow from a set of three pipelines into the city's network of pipes and reservoirs. The installation is part of a major pipeline network operated by Sydney Water Corporation that handles approximately 80% of the city of Sydney's drinking water supply.

The main reason for replacing hydraulic with electric actuation technology was concern that the hydraulic oil might leak and mix with the drinking water.

Clean drinking water with modern actuators

The AUMA solution consists of SA 14.2 multi-turn actuators equipped with GST 25.1 spur gearboxes and AC .2 actuator controls. The actuators were delivered in the extra-robust STW version that is particularly suited to penstocks and other civil engineering constructions for water applications.

A key reason for choosing AUMA was Sydney Water's positive experience with AUMA actuators that have been operating reliably

for several years in other installations. Additional reasons include the modular design that made the actuators easy to adapt to the application's requirements, the advanced data logging features of the AC .2 actuator controls, and the special long-runtime motors suitable for short-time S2 (30 minute) duty.

Sydney Water appreciated AUMA's long experience and deep knowledge of the water industry, as well as the comprehensive aftersales service. Experts from AUMA's local Australian subsidiary, Barron, completed the selection and sizing of the actuator/gearbox combinations. Barron also supplied three 4-metre custom-made linear thrusters needed to replicate the operation of the old hydraulic system and to provide the required stroke of 2.4 m. Barron service engineers provided supervisory help on-site during mechanical installation, commissioning and site acceptance test.

"The AUMA actuators installed in the Potts Hill Outlet Works have now been in use for almost ten years without any incidents. We greatly appreciate the reliability and longevity of AUMA products," said Hieu Pham, Lead Networks Operations Engineer South, Sydney Water Corporation.



Barron GJM
www.barron.com.au

The feasibility of turning food waste into energy



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Food waste is a major environmental and economic issue around the world. In the United States, an estimated 30–40% of edible food is lost or wasted, costing billions of dollars each year. One solution is to divert food waste from landfills into renewable energy production, but this is yet to be done on a large scale. A study from the University of Illinois Urbana-Champaign has investigated the feasibility of implementing energy production from food waste in the state of Illinois.

Jason Uen, a doctoral student in the Department of Agricultural and Biological Engineering (ABE), the lead author of the study, said there is a lot of organic waste in the US which eventually enters landfills and emits greenhouse gasses. Anaerobic digestion is a potential solution to deal with excess food and contribute to sustainable energy production.

The researchers conducted an analysis of supply chain logistics to determine if an anaerobic digestion system would be profitable in Illinois, using geospatial data to identify potential sites and analysing technological and economic factors.

Luis F Rodriguez, associate professor in ABE and co-author of the paper, said, “Anaerobic digestion is not a new technology, but if it were profitable, I would expect it to be more widely implemented. That’s why it was quite surprising that our study showed promising results despite the very conservative assumptions we put into the analysis. There are some sectors that really ought to consider this as a potentially viable technology with an attractive return on investment.”

Anaerobic digestion is a process that decomposes organic feedstock using organic materials such as wastewater sludge, animal

manure or yard waste. This can be accomplished at standalone facilities or wastewater treatment plants for a co-digestion process. The biogas can be used to produce electricity. The process yields additional bioproducts, including biofertiliser and animal bedding materials that can be sold to agricultural producers.

According to the study, installing anaerobic co-digesters at wastewater treatment plants with a total annual capacity of 9.3 million metric tons could generate an 8.3% return on investment while reducing carbon dioxide by approximately one million metric tonnes annually. These results are influenced by capital investment, operational costs and tipping price, a service charge for waste disposal.

Food waste availability is an important factor, including the challenge of sorting and transporting food waste from households. The study assumes food waste amount is directly related to population density distribution, meaning facilities would be collecting waste within a 10-mile radius from residential areas. To estimate revenues, the researchers included wholesale electricity price and current fertiliser prices.

According to Uen, there is still a gap between market demand for bioproducts and the amount of food waste there is. Expanding the marketability of those products will increase profitability. Government policies such as higher incentives for carbon reduction could also make it more attractive to implement these technologies.

The next step of the study would be expanding to a nationwide analysis. To improve food waste utilisation and the circular bioeconomy in agriculture, it is essential to estimate food waste availability on a larger scale and determine bioprocessing techniques.

ELECTRO-PNEUMATIC PRESSURE REGULATORS

Electronic air pressure regulators or electro-pneumatic pressure regulators control and maintain pressure within a system using electronic controls and sensors to control solenoid valves. ControlAir's Electro-Pneumatic Pressure Regulators are devices that combine electrical control with pneumatic pressure regulation. The advantages of these regulators include their accuracy, flexibility and ability to integrate into automated systems. These regulators are designed to contribute to improved efficiency, reduced waste and enhanced quality control in various applications where compressed air is used.



Some industry applications include: industrial automation to maintain consistent pressure levels for pneumatic actuators, grippers, and other devices; pneumatic actuation to control the pressure applied to pneumatic actuators in robotics, conveyor systems and automated manufacturing lines; laboratory equipment for accurate pressure control in gas chromatography, mass spectrometry and other analytical instruments; semiconductor manufacturing for control of gas pressures to maintain the quality of the produced chips; and medical devices for controlled air pressure in ventilators, anaesthesia machines and diagnostic equipment.

Other industry applications include: food and beverage for controlling the pressure in pneumatic systems used in packaging, bottling etc; automotive assembly lines for welding, handling components and operating pneumatic tools; aerospace for testing and calibration of aircraft components, pneumatic actuation in control systems and more; textile industry to control the pressure in pneumatic systems used for yarn handling, weaving and other processes; energy industry for controlling pressure in pneumatic systems for gas turbines and other power generation equipment; research and development for precise control over pressure conditions for experimentation and testing purposes; and environmental monitoring to control pressure in pneumatic systems that are part of air quality monitoring and pollution detection equipment.

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Could industrial digital technology make Australia's biggest cities better places to be?

Christine McNamara*

A

s the population continues to grow, we need to get smarter about how we manage our major urban centres.

Late January saw the country's population hit 27 million, more than 30 years earlier than was predicted in the federal Treasury's 2002 Intergenerational Report.

By 2071, though, our numbers will have swelled to somewhere between 34.3 and 45.9 million people, the Australian Bureau of Statistics estimates.

Our big cities are getting bigger apace — Sydney's and Melbourne's populations should reach 6 million and 6.2 million respectively by 2031, according to the 2020 Population Statement.

Planning for a bigger future

Rapid growth can bring with it an array of issues, as McCrindle social researcher and demographer Mark McCrindle has pointed out.

"Road and public transport planning, land release, housing developments and infrastructure decisions are made with a view 20 years into the future. The problem of Australia's population increases massively outstripping the predictions is that housing supply has been based on the wrong numbers. With the current growth, Australia will reach 50 million by 2054, 23 million more than forecasted just 22 years ago, and this highlights the significant challenges we face for infrastructure, resources and city planning," he commented in a statement, following the announcement of the 27 million population milestone.

Rising to the planning challenge

Elected leaders and civic planners are on the frontline of both social evolution and the climate



crisis; required to contend with the upscaling of our capital cities and major urban centres, and the enormous environmental challenge that represents, in intelligent, far-sighted ways.

Globally, cities account for 70% of emissions, with transport and buildings the biggest contributors, according to the World Economic Forum.

Containing and reducing those emissions is an urgent imperative, given the quality of life of millions of Australians is at stake and making smart, data-driven decisions is essential.

Little surprise, then, that a growing number of urban authorities are becoming alive to the fact that digital insights can, and should, be used to help manage complex interdependencies and deliver outcomes that benefit all segments of the population.

Tools to make the task easier

Deploying advanced industrial software makes the task of delivering urban development

outcomes easier. The software can be used to create city planning and management ecosystems that minimise energy consumption (a must, given Australia's ambitious Net Zero Emissions by 2050 target), improve efficiency and control maintenance expenses.

Intelligent, data-led tools make it possible to collate, visualise and analyse data from a wide range of civic services onto a single, unified backbone.

Having this holistic view allows planning teams to spot trends and predict operational challenges, while improving situational awareness and crisis responses, all from a single portal.

Together with other strategic measures — think community engagement, apposite policy settings and investment in critical infrastructure — it can help ensure our famously livable cities remain that way, even as they evolve and expand.



istock.com/Adam Galatius

Putting vision into practice

Elsewhere in the world, forward thinking metropolises are already reaping the benefits of a data-first approach.

In Barcelona, a centrally coordinated control platform functions as a neural system for the city. Information is transmitted and received from a network of sensors, allowing planners to monitor and optimise urban operations in real time; switching off the irrigation systems in public parks, for example, when it begins to rain.

Closer to home, the Pimpri Chinchwad Municipal Corporation, in the Indian state of Maharashtra, has reduced its carbon footprint and improved the safety and well-being of the city's two million residents by introducing smart metering across public facilities. Energy usage and emissions have dropped by between 15 and 20% as a result. Meanwhile, the syncing of traffic lights has reduced intracity congestion by up to 25%

— a boon for pollution-conscious residents and for those seeking to get from A to B a little more quickly.

And in Seoul, home of the world's longest metro system, a digitally driven predictive maintenance system is helping keep the trains running on time and the citizens out of private vehicles. Given transport comprises the largest share of energy-related emissions for nearly half the world's countries, it's a highly worthwhile investment in industrial technology that's delivering for the residents of that city and the global community too.

Thinking big and doing more with data

Here in Australia, there are opportunities aplenty for public sector decision-makers to instigate similar initiatives; leveraging industrial big data, AI, the internet of things (IoT) and the cloud to solve our own urban

challenges and ensure our big cities are sustainable and livable.

Creating powerful, connected industrial eco-systems is the first step towards optimising operations, reducing waste and enabling innovation to occur on the fly. Doing so may also help foster innovative public-private partnerships to develop civic infrastructure that enhances quality of life for Australia's urban population.

If we're serious about delivering a sustainable, low-carbon future for all Australians, it's a journey our country can't afford not to take.



**Christine McNamara, Director of Sales, Pacific at AVEVA*



FLOW CONTROL FOR COMPRESSED AIR

EXAIR EFC Electronic Flow Control for compressed air is designed to minimise compressed air use on blowoff, drying, cooling, conveying and static elimination operations. It combines a photoelectric sensor with a timing control that limits compressed air use by turning it off when no part is present. With eight programmable on and off modes, the timing control permits easy tuning to the application requirements.

For most companies, air compressors use more electricity than any other type of equipment and can waste thousands of electricity dollars per year if not properly controlled. By turning on the air only when a part is present, the EFC provides just enough air to complete a specific task or operation, minimising compressed air use and resulting in reduced compressed air costs.

The polycarbonate enclosure of the EFC is suitable for use in a wide range of applications including those located in wet environments. The compact photoelectric sensor has a sensitivity adjustment with the ability to detect objects up to 1 m away. It has good immunity to noise and inductive loads common to industrial environments.

Compressed Air Australia Pty Ltd
www.caasafety.com.au

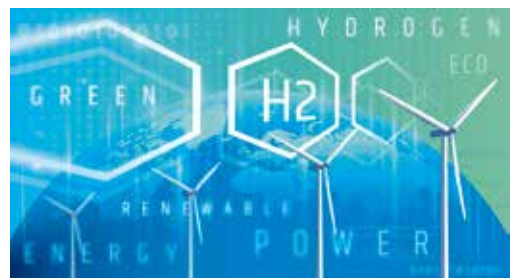
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Emerson solutions and capabilities are used across the hydrogen fuel value chain in electrolysers, fuelling stations, fuel cells and industrial applications using hydrogen. Its product brands in natural gas distribution include ASCO, Bettis, Fisher, Micro Motion and Rosemount.

The hydrogen portfolio allows users to identify products or integrated solutions to suit specific natural gas/hydrogen blended applications in partnership with Emerson. Users can consult with engineering technologists, metallurgists and R&D personnel to select the right solution and apply technologies that provide real-time insight and safety.

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Making light work!

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A team of researchers from UNSW Sydney has come up with a novel way to produce synthetic fuel – directly from sunlight. The process involves using light and heat to induce a reaction that creates synthetic methane from CO₂.

By leveraging renewable energy to power the conversion process, this method could help to reduce reliance on fossil fuels.

The research was led by a team from UNSW's School of Chemical Engineering: Professor Rose Amal, Dr Priyank Kumar, Dr Emma C Lovell, Yi Fen (Charlotte) Zhu, Associate Professor Jason Scott, Dr Bingqiao Xie and Dr Jodie A Yuwono. It has been published in *EES Catalysis*.

"Methane is the major component of natural gas, and already widely used as a source of fuel, but is also a powerful greenhouse gas. Creating synthetic methane using only the natural resource of the sun is a cleaner and greener alternative for usage in heavy transportation, shipping and other specific industries where gas usage is essential," Lovell said.

"By employing specific catalysts and support materials, we have demonstrated a new pathway for visible light to drive the conversion of CO₂ into methane. This not only contributes to the reduction of carbon emissions, but also adds value to the captured CO₂ by creating a valuable chemical product."

A closed-loop system

The transformation of waste CO₂ into synthetic fuel creates a circular fuel economy – a closed-loop system that addresses environmental concerns while lessening reliance on fossil fuel extraction. The process also has the benefit of being relatively cheap, as the efficient utilisation of sunlight offsets power consumption and associated overhead costs for the reaction. This leads to reduced production costs for synthetic fuel, making it more economically viable and accessible.

"Being able to directly use sunlight reduces the costs required for energy generation to facilitate the reaction. This alleviates one of the major challenges in the pursuit and application of CO₂-derived fuel, which is contingent on the availability of low-cost, low carbon energy inputs," PhD candidate Zhu said.

Beyond fuel production

The team is currently applying their research to the creation of other high-value chemicals, potentially benefiting a wide range of industries from fuel production to pharmaceuticals.

"One of the most promising aspects of this research is its potential impact on industries like fuel production, cement manufacturing, biomass gasification and pharmaceuticals. I would say it represents a more sustainable fuel alternative by closing the carbon loop," Scott said.

"In terms of converting the CO₂ into value-added products, this represents a much cleaner alternative than products which currently rely on fossil fuel-derived precursors for their manufacture.

"Looking ahead, we are already envisioning a new future direction."

Scott added that the biggest challenge lay in being able to effectively introduce the light into a larger-scale system to illuminate the particles completely. "We are exploring methods such as harnessing sunlight to drive multiple phenomena simultaneously, like solar-thermal alongside light assistance," he said.

"Currently, we are conducting experiments at the lab scale, aiming to advance to demonstration/prototype scale within approximately a year. Following that milestone, our goal is to transition to pilot scale and ultimately to commercial/industrial scale."

The research resulted from a collaboration between the UNSW School of Chemical Engineering and School of Photovoltaic & Renewable Energy Engineering, the University of Adelaide and CSIRO.



The Southern Cross Healthcare team is continuously looking across their business for ways to reduce their environmental impact. The team is excited to have successfully launched an initiative at Southern Cross Christchurch Hospital in partnership with Johnson & Johnson.

In the recYEcle project, the ophthalmology team now recycles Johnson & Johnson Tecnis Simplicity intraocular lens loaders in a specially designed and supplied box in ophthalmic surgical suites.

Previously destined for medical landfill, as they come into contact with patients' eyes, the Tecnis loaders can now be sterilised and the different plastic components shredded and repurposed to make decking, bench seating and even watering cans.

David Simpson, Chief of Strategy and Partnerships at Southern Cross Healthcare, said, "The work we do to support human health can sometimes have a negative impact on the environment, through waste, packaging and the production of greenhouse gases for example. And the impact isn't only felt in hospitals or GP surgeries, but everywhere in our environment.

"While the use of face masks to reduce the spread of airborne viruses like COVID is absolutely proven, all of us have seen multiple masks discarded in streets, parks and drains taking stormwater to our oceans, even as we move beyond the height of the pandemic.

"Caring for and restoring health to Papatūānuku is about more than making sure we dispose of waste thoughtfully and reducing emissions. We've always cared about the safety of our patients and our team — protecting them from disease and infection. The way we focus on that must extend to doing the

same for our surroundings, with affordable, realistic, long-term positive objectives and outcomes."

Simpson is clear that sustainable change means every team member plays their part.

"Our hospital sustainability committees contribute to a nationwide team focused on a range of initiatives to reduce our footprint, with some good results already achieved. We're pleased with the work we've done but there is more to come."

Key outcomes achieved at Southern Cross Healthcare:

- The recYEcle project — diverting plastic waste from landfill.
- Recycling 3.75 tonnes of PVC IV bags.
- Diverting 3.5 tonnes of plastic from landfill by deploying reusable sharps collectors throughout their hospitals.
- Decarbonisation projects and energy savings achievements resulting in a reduction in carbon of 170 tonnes.
- Reduction of nitrous oxide (laughing gas) — which is nearly 300 times more effective at trapping heat than carbon dioxide.
- An 87% decrease in desflurane over last year, removing its use in operating theatres, providing a saving of 540+ tonnes of CO₂ year on year.
- Increased use of digital services and increased flexible working options, saving in excess 50 tonnes of CO₂ emissions from reduced air and road travel.
- The transitioning of fleet vehicles to hybrid vehicles.
- Changes in procurement, switching to sustainable products, reprocessing single-use devices, such as DVT sleeves and air transfer mats; saving 2 tonnes of waste being sent to landfill.



STATIC VENTURI AERATION DEVICE RANGE

The EchoStorm, by Gorman-Rupp, is a range of static venturi aeration devices installed inline on the discharge side of self-priming pumps to introduce dissolved oxygen into the liquid being pumped. The liquid is moved through the internal nozzle creating a Venturi Effect. Air is drawn into the body of the EchoStorm, which mixes and oxygenates the liquid.

As these units are mounted on the bank (instead of floating on the water or being submerged in it), access is less complicated and safer, while delivering oxygen transfer outcomes. Unlike other methods of aeration, no rowboats, cranes or tethers are needed by operators to access them for monitoring, maintenance or repair.

EchoStorm units are used to reduce BOD, COD and NH_3 , and also used to control/eliminate algae growth and to strip substances with low Henry's Constants such as CO_2 and VOCs.

The aerator is available in a range of sizes to meet the aeration needs of multiple industries including municipal wastewater treatment, industrial wastewater treatment and potable water treatment.

Hydro Innovations
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GRID MANAGEMENT SOFTWARE

Siemens has announced the launch of Gridscale X, which is designed to support autonomous grid management and accelerate digital transformation for grid operators at speed and scale.

The software is designed to help grid operators increase their distributed energy resources (DER) visibility, supporting grid decarbonisation and the transition to net zero. It is part of the Siemens Xcelerator portfolio, complemented by its extensive and open partner ecosystem.

The software is developed with the core design principles of interoperability, flexibility, openness, availability as a service and the highest level of cybersecurity. It enables utilities to scale grid capacity and increase DER visibility, essential for grid decarbonisation.



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With a modular design with easy-to-assemble components, the Quick-Fit (QF) Ducting can streamline installation and reduce downtime associated with other systems.

The ducting's robust materials and modular design also reduce the need for frequent maintenance. Moreover, its energy-efficient features can help to reduce energy consumption.

Customisable to meet users' requirements, the ducting is suitable for a variety of spaces from a small office to a large manufacturing facility. Additionally, the ducting allows for seamless scalability, which can ensure the ventilation system evolves with the company's demands.

Other features include advanced filtration and air purification.

The ducting is designed to benefit businesses with streamlined installation, improved air quality, sustainability and operational efficiency.

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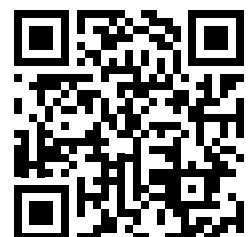
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From waste into energy 'gold'

An Australian-made innovation uses high temperatures without oxygen to make a carbon-rich product called biochar, which can be used in carbon electrodes for batteries and other advanced energy storage devices, or can act as a fertiliser or soil amendment.



petra g. murphy

The pyrolysis technology, known as PYROCO, thermally processes materials from waste streams, including treated sewage (biosolids) and food and garden organic materials destined for landfill, to remove pathogens, PFAS and microplastics, which can cause harm to humans and the environment. RMIT has filed patent applications to protect the technology that the team has developed.

Project lead Professor Kalpit Shah, from RMIT University, said the technology could help make the management of biosolids and other waste more environmentally sustainable and cost-effective.

"Around 30% of the world's biosolids are either stockpiled or sent to landfill, which is a big challenge that PYROCO aims to address," said Shah, Deputy Director (Academic) of the ARC Training Centre for Transformation of Australia's Biosolids Resource.

RMIT and project partners South East Water, Intelligent Water Networks (IWN) and Greater Western Water have just completed the latest series of trials of the technology at the Melton Recycled Water Plant.

"The latest trials validated results of the first trials and showed further improvements," Shah said.

During the first trials in 2021, the PYROCO demonstration unit turned biosolids into biochar and removed all pathogens, PFAS and microplastics.

The latest trials for PYROCO Mark 2 went further by using materials from other waste streams, and demonstrated enhanced safety features and automation.

"The Mark 2 unit processed food and garden organic waste as well as canola straw co-mingled with biosolids to create biochar," Shah said.

"The trials we've just completed are an exciting step towards scaling up this innovative pyrolysis technology to prove the findings and operationalise it — this represents a real step-change in the field."

Following the latest trials, the partners are now progressing towards commercialisation.

South East Water General Manager Research, Innovation and Commercialisation Daniel Sullivan said the project could potentially address the water industry's challenge of biosolids disposal, while also removing carbon from the atmosphere.

"We believe that this exciting technology has the potential to transform

by-products of the wastewater process into a valuable resource, in a way that is the most carbon-efficient while maximising the quality of the biochar," he said.

The Deputy Director (Industry) of the ARC Training Centre for Transformation of Australia's Biosolids Resource, Dr Aravind Surapaneni, said the technology could help achieve progress towards Victoria's net-zero carbon pledge.

"The European Union has highlighted the potential of biochar in breaking the carbon cycle, and we see this technology as an opportunity for the water industry to support the Victorian Government's path to net-zero emissions by 2045."

The Victorian Government, through the Department of Environment, Energy and Climate Action (DEECA), contributed \$100,000 to the \$1 million project. RMIT University, South East Water, IWN, Greater Western Water, Barwon Water, Westernport Water and East Gippsland Water co-funded the remainder of the project.

The PYROCO Mark 2 pilot unit was commissioned and installed at the Melton Water Recycling Plant. It was built using the funding received from Victorian Higher Education State Investment Fund (VHESIF).

Oxygenation trial to restore Darling River biodiversity

In recent years, mass fish deaths have occurred in the Darling River as a result of low dissolved oxygen levels caused by weather conditions and changes in local waterways.

Gas and engineering company BOC, a Linde company, is embarking on an oxygenation trial with WaterNSW in Menindee, NSW, in order to address this problem.

During the trial, BOC will use patented Linde SOLVOX technology to pump oxygenated water into one section of the river with the aim of boosting dissolved oxygen levels downstream. Early data has already indicated positive changes in downstream dissolved oxygen levels. There are plans to expand the trial if it proves successful.

Linde SOLVOX is a microbubble oxygenation system that can be used flexibly in open and closed aquaculture systems. Oxygen flow rates and operational modes can be controlled remotely, significantly improving the ability to respond to real-time changes in water quality to reduce risk to fish health.

BOC has a 20-year history of oxygenating river systems in Australia to enhance water quality and biodiversity, including the Swan and Canning Rivers in Western Australia and the Murray River in South Australia. BOC UK has also previously provided oxygenation solutions for the River Thames.



istock.com/JohnCarmella

Head of BOC Australia Theo Martin said BOC was proud to work with WaterNSW on this NSW-first trial and deploy its Linde SOLVOX drop-in oxygenation technology along one of Australia's longest rivers.

"BOC is committed to delivering sustainable solutions for our customers and the community. The Darling River is a crucial part of our state's biodiversity, and it's exciting BOC expertise is helping to boost biodiversity in regional NSW. We are working closely with our communities, including WaterNSW, to ensure this innovative trial delivers significant improvements in oxygen levels at Menindee," Martin said.

Linde Australia
www.linde.com

Dual-sided solar panels could improve energy in homes



Image credit: ANU

Dual-sided solar panels have the potential to produce 20% more energy than traditional one-sided systems if used properly on residential rooftops, according to research from the Australian National University (ANU).

Dual-sided or bifacial solar cells allow for both the front and back of the solar panel to generate power. The back of the panel collects energy reflected from the roof. Bifacial panels are used in commercial solar power systems but remain underutilised in the residential solar market, where monofacial modules are more commonly used.

Monofacial modules generally have a white or black backsheet compared to their bifacial counterpart, which is made with glass on both sides.

Dr Marco Ernst from ANU, lead author of the study, said the findings show the benefits of dual-sided systems, while addressing a gap in understanding the viability of bifacial technology on rooftops.

"We conducted detailed optical and electrical modelling to assess the potential energy gains of bifacial rooftop PV systems compared to monofacial arrays.

"Bifacial solar modules on flat rooftops have demonstrated the potential to generate up to 22.6% more energy compared to monofacial solar modules," Ernst said.

Rooftop colour is a key factor in increasing a bifacial solar power system's performance, and system and module design should also be carefully considered. Lighter colours typically have higher solar reflectivity.

This is a critical factor in maximising the potential of bifacial solar panels, emphasising the importance of considering the specific characteristics of rooftop surfaces, according to Ernst.

"For example, light-coloured roofing is crucial for creating optimal reflectivity and is in line with NetZeroCities approaches."

As record heatwaves sweep the globe, cities are tackling the problem with innovative solutions, such as painting white roofs to lower soaring heat.

In 2021, the New South Wales Government introduced a dark roof ban for new homes to reduce heat and energy costs, but this was scrapped a year later as the policy was unpopular with property developers.

According to Ernst, cool materials such as light-coloured roofing can radiate heat rather than absorb it, and the mainstream adoption of this would reduce heat in urban areas, as well as energy consumption and costs, helping Australia reach net zero by 2050.

The International Technology Roadmap for Photovoltaic (ITRPV) estimates that the world share of bifacial modules by 2033 will be 70%.

"It would be in Australia's best interest to act quickly and incentivise the use of light roofs to fight climate change and to futureproof the industry for what's coming," Ernst said.

The research has been published in *Energy Conversion and Management*.



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Shore power: a critical investment for the maritime industry

By Johnson Luu, Director of CHINT APAC

The maritime industry plays a crucial role in the overall fight against the climate crisis. Responsible for transporting around 90% of the world's trade, international shipping contributes to approximately 10% of global CO₂ emissions. In July 2023, the International Maritime Organization (IMO) adopted a new strategy with enhanced targets to reduce GHG emissions from ships. This important decision sent a powerful message – the industry must make needle-moving decisions to adopt technologies and initiatives that will drive sustainability goals.

Reducing maritime emissions has always been a multi-layered challenge, involving many variables including ship type, fuel choice and ports. When it comes to ports, infrastructure efficiency, renewable energy integration and shore power availability are crucial to boosting environmental sustainability. Green ports that effectively leverage shore power are a key part of the shipping

Sustainable power

industry's green transition. In 2022, the Port of Rotterdam reached a 20% utilisation of shore power and saw a 14% reduction in port-related CO₂ emissions compared to 2008.

While shore power was first introduced to the maritime industry more than two decades ago when cruise line Princess Cruises began operations of its shore power program in 2001, widespread adoption of the technology never quite took off. Progress of adoption has been slow and with limited reach largely due to upfront costs and time required for implementation, particularly pertaining to shore power infrastructure. Only recently – as decarbonisation began to take centre stage globally – did the industry start revisiting their benefits of reduced emissions, improved fuel efficiency and overall viability.

Today, the renewed vigour to decarbonise the maritime industry has resulted in a new conversation focusing on shore power.

Shore power infrastructure

Ships by nature, like airplanes, consume large amounts of fuel when in operation. Studies show that the cost of refuelling a sizable container vessel ranges from AU\$12 to 25.3 million, which can account for a significant 50 to 60% of a ship's overall operating costs. While the industry continually finds ways to reduce fuel reliance, such as using dual-fuelled vessels, another option is for vessels at berth to obtain power source from land. With shore power, vessels can shut down their main and auxiliary engines, which consume fuel even when they're docked, thereby reducing their

greenhouse gas emissions and air pollution.

Shore power enables ship operators to see as much as a 10% reduction in fuel consumption and emissions, depending on the vessel type and trade. Connecting to shore power also enables ships to reduce the wear and tear on auxiliary engines. With the reduction in frequency of maintaining auxiliary engines, ship operators can focus on other core operations or revenue-generating tasks on board.

However, despite the numerous benefits that shore power could bring, the rate of adoption of shore power infrastructure is still relatively low. This could be due to high costs of installation and operations. Dan Stahl, CEO at the Port of Longview in the US state of Washington, suggested that shore power was only viable if its installations are subsidised by the government.

That being said, in the near future, we expect that more vessels equipped with the technology to receive and use shore power will enter the market. This can be due to factors such as stricter environmental regulations and more supportive government policies, rising fuel prices and rapid technological advancements. When we drill down to the core benefit of energy efficiency, the numbers are incredibly promising. Compared to a diesel engine, fuel savings of approximately 17% can be observed by using a hybrid engine. For traditional ships, cold ironing – where the ships turn off their engines while berthed and plug into an onshore power source to keep onboard services running – can save over

30% of CO₂ emissions and more than 95% of nitrogen oxides (NO_x) and particulates.

In tandem with this positive outlook, the global Shore Power Market is forecasted to reach close to US\$4 billion (AU\$6bn) by 2030. The Asia-Pacific (APAC) region, which houses some of the largest and busiest ports in the world, currently holds the leading position in this growing market. It is forecasted to maintain this lead with an attributed value of US\$1.415 billion (AU\$2.15bn) by 2030.

Adoption of shore power systems in APAC

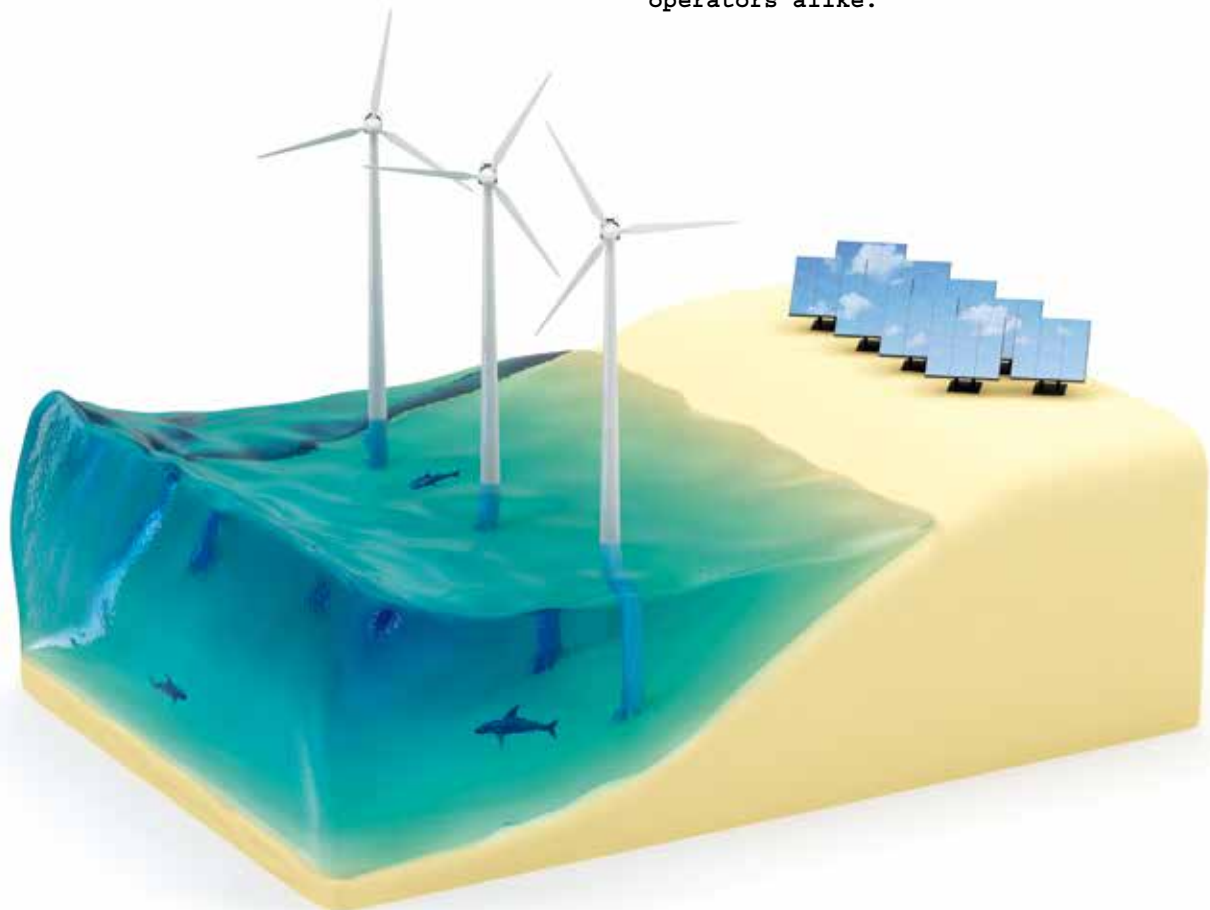
In line with the IMO's greenhouse gas strategy, countries in the region are increasingly taking action against ship emissions violations. In 2023 alone, several enforcement actions were taken:

- February 2023 – The Indonesian Directorate General of Sea Transportation (Hubla) imposed penalties on several domestic shipping companies for failing to comply with sulfur oxides (SO_x) emission limits. The penalties included warnings, fines and temporary suspension of permits.
- April 2023 – Maritime and Port Authority of Singapore (MPA) fined a Singapore-flagged container ship S\$450,000 and reprimanded its operators for exceeding SO_x emission limits while at port.
- May 2023 – The Malaysian Maritime Enforcement Agency (MMEA) detained a Panamanian-flagged general cargo ship for exceeding NO_x emission limits while berthed in port. The ship was released after rectifying the issue and paying a fine.





The stricter enforcement of emissions limits and financial penalties for infractions are likely to make shore power more attractive to port operators and ship operators alike.



The stricter enforcement of emissions limits and financial penalties for infractions are likely to make shore power more attractive to port operators and ship operators alike. Growing public awareness of the importance of sustainability may also drive increased collaboration between the government and the private sector to implement shore power systems. This is especially important given the scale and cost of such projects, which make government support a non-negotiable. So, what do governments need to consider before investing heavily in shore power?

When forging a private-public collaboration, governments must first assess a company based on its portfolio of past projects. One successful case study involves the projects by National Grid Corp. of the Philippines (NGCP), a grid operator that has been rapidly modernising

the country's transmission network without compromising sustainability. Since 2009, the NGCP has been efficiently rolling out critical grid projects, completing a total of 56 significant projects in less than 20 years. To do so, NGCP actively collaborates with various private and public stakeholders focusing on smart energy solutions such as CHINT. If the company checks the box of having a strong portfolio in working with governments, it also means that they are well versed in navigating bureaucracy while adhering to deadlines.

The next box to check would be the suite of services that the company can provide versus its price tag. Shore power projects are often large in scale, meaning that companies bidding for the projects must also be able to counsel the government on the feasibility of their tender specifications. In projects this large, a holistic approach

led by a team of experienced engineers is required. On top of installation and the supply of products and equipment, consultations are critical to finding the most fitting and sustainable solution.

There have been cases of shore power infrastructure projects that have failed and the industry looks at them as cautionary tales. As such, their selection process has understandably become more stringent.

However, government and industry players should continuously collaborate to identify opportunities to overcome adoption challenges. When implemented, all stakeholders can reap the benefits of shore power, which would be a key driver of sustainability and economic resilience in the maritime sector.

CHINT Global
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A sustainable second chance

By Laini Bennett

Alison Covington, AM, overcame a life-threatening illness to launch a not-for-profit that is not only helping millions of Australians every year, but also protects the environment. Here, the Good360 Australia Founder & Managing Director shares her inspiring journey.



When Alison Covington AM received her Order of Australia in 2022 for significant service to social welfare and sustainability programs, it would have come as no surprise to those who knew her. For a decade, the inspirational MD of not-for-profit Good360 has been transforming the lives of 15,000 Australians a week thanks to her organisation's incredible work. Since its formation, Good360 Australia has rescued \$400 million RRP of unsold, brand-new goods from landfill, redistributing them to 4000 charities who pass them on to people in need.

A matter of survival

Covington launched Good360 Australia after battling a rare, life-threatening illness for several years. Having been given a second chance at life, she wanted to use her skills and experience to help others.

Covington was in her early 30s, married with two young sons and working as the Managing Director for Transdev when her vision suddenly blurred. She'd been struck by cerebral vasculitis, causing a lack of blood flow to her brain, causing her life to change instantly.

"My brain was shutting down. I went from a very high-level role — to just functioning in society," she said. She struggled to think and

speak. She became sensitive to noise and bright lights, making leaving the house challenging.

It was six long years before Covington could function in society again, supported by her husband, brother and close friends. While she recovered, Covington started an online business selling children's clothing, which she could do from home. But she wanted to do more.

A concept that ticked all the boxes

In 2012, Covington encountered the US-based organisation Good360 while reading *Pro Bono News* and loved the concept of redistributing unsold goods to people in

need. The sustainable model would leverage her business skills and her logistics and tech experience.

Covington couldn't stop thinking about all the unsold goods in Australia going to landfill instead of helping people in need.

Eventually, her husband told her to stop talking about it and take action. Covington prevaricated, worried that she should get a 'proper' job to help support the family after all her years of not working. But, with her husband's support, she approached the Good360 US office and put forward a case for launching the not-for-profit in Australia. Before long, she had received the green light to move forward.

An uphill journey

It's one thing to want to do something; it's another entirely to get it off the ground. The next few years were a hard, lonely slog: rais-

ing money, building technology and convincing others to join her on the journey.

But Covington persisted, and within four years, Good360 had received over \$100 million of donated goods and connected over 10 million items to Australians who needed them most.

Unlike food rescue charities, Good360 does not receive any significant government funding, so Covington relies largely on generous philanthropy and corporate partners. Nonetheless, she is determined to reach their goal of \$1 billion of goods distributed to Australians who need them most by 2025.

A passionate team

Today, Covington says one of Good360's greatest successes is her team of 35. "We now have a team of passionate people, creating that ripple effect. We have an enduring concept and purpose now, with so many more people taking it forward," she said.

She regards her role as a leader to build her team's self-confidence and self-belief, helping them realise their potential to step up and take on more responsibility. "I think many people don't believe in themselves as much as they should. That's really important," she said.

For this reason, Covington encourages female leaders to surround themselves with people who support them in their personal and professional lives; she feels fortunate to have her husband as her greatest champion and believes it is essential to have someone enabling and empowering you, whether it's your life partner, your friends or your family.

"If people are not empowering you to be your best self, why are they in your life?" she said.

Laini Bennett interviews successful career women about their leadership lessons learned. Visit lainibennett.com to read more stories about inspiring women.

Good360's sustainability impact

More than \$2.5 billion of unsold new products are wasted each year, yet 1 in 8 Australians who could benefit from these goods currently live below the poverty line.

"If you feed somebody, they're hungry again a few hours later. But if you clothe people, give them toiletries, give them furniture, it changes the outcomes," Covington said.

Since its launch, Good360 Australia has helped almost 4 million Australians, saved 6617 tonnes of goods from going to waste and connected nearly 40 million new items with people in need. Donated new goods saved from waste include:

- Clothing — 25%
- PPE — 24.7%
- Toiletries — 13.7%
- Toys — 13.4%
- Homewares and furniture — 11%
- Office and school supplies — 10.1%
- Other — 2.4%



The new science of waste

In our rapidly urbanised societies, waste is driving a mounting worldwide crisis. The authors of a new paper use scaling theory to study how three types of waste production — municipal solid waste, wastewater and greenhouse gas emissions — grow in relation to city size. The results emphasise the need for a new science of waste that can help predict the future state of urban ecosystems and inform policies.



istock.com/petovanga

Waste is a natural by-product of life on Earth and of productive human economies. Living systems have evolved to re-constitute waste — creatures like dung beetles fill an ecological niche of breaking down other organisms' faeces — but waste is a problem that still plagues human systems.

"We as a society tend to ignore the unpleasant side of our production," said Mingzhen Lu, an Assistant Professor at New York University and former SFI Omidyar Complexity Fellow.

Lu and SFI Professor Chris Kempes are co-corresponding authors on a new paper published in *Nature Cities* that explores waste production as a function of urban systems.

"The key question is whether waste is produced more or less efficiently as systems scale up, and how big a recycling burden there is as a consequence," Kempes said.

To address this question, the authors used scaling theory to analyse waste products — municipal solid waste, wastewater and greenhouse gas emissions — from more than one thousand cities around the world. Scaling theory has been used in biology to describe how organism physiology changes



Bigger cities contribute disproportionately more liquid waste than smaller cities, but expel fewer greenhouse gases. The results suggest an economy of scale for emissions as growth typically brings more efficient energy and transportation infrastructure, but a diseconomy for liquid waste.

with body mass, and it proved relevant for understanding how waste production scales with the growth of a city.

"Scaling theory allowed us to extract overarching broad stroke patterns and transcend the individuality of each city," Lu explained.

The resulting patterns show distinct differences in waste production as cities grow. Solid waste scales linearly — because it is tied to individual consumption, it increases at the same rate as population growth. In contrast, wastewater production scales superlinearly while emissions scale sub-linearly. In other words, bigger cities contribute disproportionately more liquid waste than smaller cities, but expel fewer greenhouse gases. The results suggest an economy of scale for emissions as growth typically brings more efficient

energy and transportation infrastructure, but a diseconomy for liquid waste.

Cities tend to deviate from the universal scaling law as they grow wealthier. Cities with higher per-capita GDP generate more waste across the board, which underscores the relationship between waste generation and economic growth.

The findings emphasise the need for a new science of waste that can help predict the future state of urban ecosystems and inform policies to reduce waste and enhance sustainability.

"Fungi figured out how to decompose lignin waste from trees and created sustainable ecosystems that have lasted hundreds of million years," Lu said. "We take it in and throw it away — we can no longer overlook waste from our societies."

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