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WORDS FROM THE EDITOR

With Australia's population projected to increase to over 24 million by 2020, innovation and efficiency adaptations are ever more important for the survival any industry.

The provision of wastewater infrastructure is one of the backbones for healthy growth in any large city. Wastewater treatment has continued to evolve and adapt since it was discovered in the 1800s that sand filtration and chlorination could prevent water-borne diseases such as Cholera.

In this issue we take a look at the history of wastewater treatment in Sydney, right through to some of the latest environmental advances. In one of Sydney Water's latest innovations, a trial is taking place using food waste sources to generate additional renewable energy production from the wastewater treatment process. Read more on page 8.

When it comes to energy security, at least the latest federal government budget did include some mention of the topic but it didn't seem to back this up with any focus on small-scale renewables and battery storage. Read more on page 12 about how customers could be set to drive the transformation of Australia's electricity sector as world-leading adopters of renewable energy resources.

The concept of the circular economy also continues to gain traction in Australia as landfill becomes more costly and resource recovery technology continues to evolve. Alex Serpo is a policy advisor to the National Waste and Recycling Industry Council (NWRIC), a new national body formed to represent the interests of waste and recycling companies across Australia. Find out more about what he has to say about effective planning for the circular economy on page 6.



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Effective planning is the key to a circular economy

Only through effective planning can policymakers unlock the power of the circular economy, writes Alex Serpo.



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to create a national resource recovery rate of 75% by 2040, we need to add a new recycling capacity capable of processing an additional 35 million tonnes per year – in 23 years.

The circular economy model has been adopted by leading international organisations such as the European Commission and the International Solid Waste Association. To underpin sustainable development, the circular economy is increasingly gaining traction with Australian leaders in both business and government.

Whilst volumes have been written on this new paradigm, in essence the circular economy means providing the material requirements of a society through recycling.

This concept is easy to understand but hard to implement. In the next two decades, moving towards a circular economy means Australia's resource recovery rate must grow enormously. It is currently estimated to be approximately 50% by the Australian Bureau of Statistics.

Australia today generates approximately 50 million tonnes of waste every year. Historically, waste generation has grown at rates as high as 7% per year. If the past is a guide to the future, then Australians

could generate as much as 80 million tonnes of waste materials by 2040, every year.

So to create a national resource recovery rate of 75% by 2040, we need to add a new recycling capacity capable of processing an additional 35 million tonnes per year – in 23 years. That's close to 1.5 million tonnes of new capacity every year, without pause. Plus, we will need to keep, upgrade and repair existing capacity.

The National Waste and Recycling Industry Council represents the majority of Australia's waste management and recycling companies. If the market conditions are right, these companies are ready to put their shoulder to the wheel and fund this new infrastructure.

However, today's market conditions are tepid. The biggest challenge is planning. The engine room of the circular economy is recycling infrastructure – which requires large capital investment – and secure markets. Recycling infrastructure needs to be built with a 15–25 year timeline, as this timeframe is necessary to depreciate the capital equipment required.

Therefore, policymakers need to create processing sites that are protected for up to 30 years. Protection means separation from development that might be sensitive to odour, dust and noise, plus frequent truck movements. Right now, policymakers aren't always ready to make this commitment, and this lack of commitment is holding back investment.

Worse still, in some cases policymakers are actively shutting down existing recycling infrastructure – sometimes due to reactionary, short-term thinking. This short-term thinking is harmful to Australia's long-term economic and ecological prosperity.

For example, in Victoria councils have been making zoning decisions which ignore state-level infrastructure plans. While such decisions may provide local benefit, forcing recycling infrastructure to relocate is a step backwards in terms of sustainable development for the whole state. Further, the planning provisions created by the EPA, local government and state government often don't align – creating a planning maze for potential new recycling initiatives.

This issue is not limited to Victoria. In Queensland, the creation of a landfill levy, and its subsequent rollback less than a year later, undermined recycling investments. One national recycling company complained of opening a recycling centre only to shut it down six months later, laying off 20 staff. The issue here is regulatory stability, another necessity for investment.

Australia's recycling and waste management companies have the capacity to create a circular economy to the benefit of all Australians, both present and future. However, the creation of a circular economy requires policymakers to commit to long-term, integrated planning that supports recyclers.



Alex Serpo is a policy advisor to the National Waste and Recycling Industry Council (NWRIC), a new national body formed to represent the interests of waste and recycling companies across Australia.

Sydney is located where it is today basically because of Captain Phillips' discovery of what he thought was a viable water source for the new colony — the Tank Stream.

For thousands of years the stream was also a place of cultural significance to the Gadigal, the original traditional owners of the Sydney Cove area. The Tank Stream provided Aboriginal people with an important source of fresh water, food and resources for stone tools.

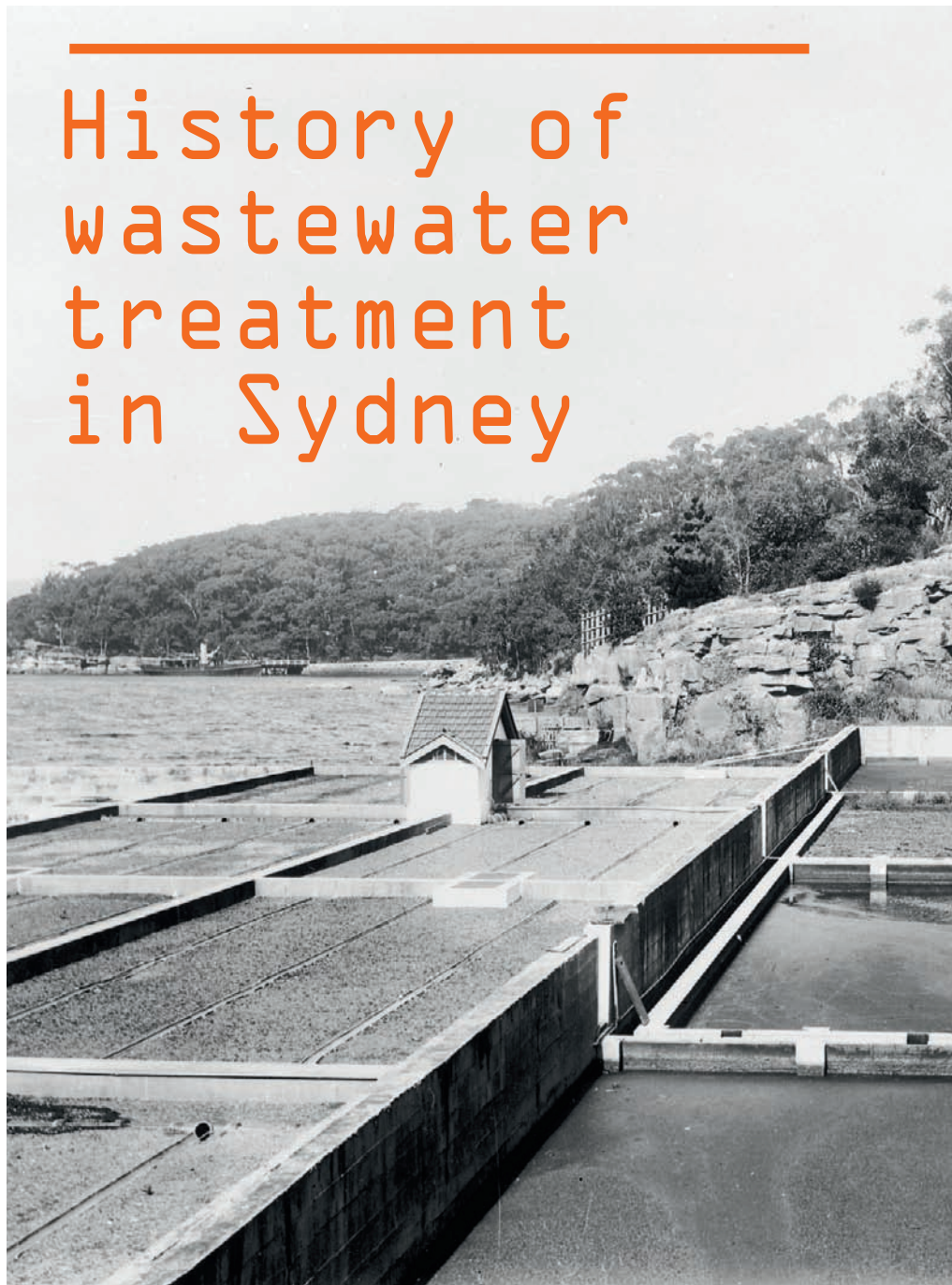
It took less than 40 years for the early settlers to pollute the Tank Stream so badly that by 1826 the colony was forced to find an alternative water supply. The settlers then used the Tank Stream as a drain and a sewer and in 1860 the pollution became so bad that the Tank Stream was covered in stone and the city grew up above it.

Until the late 1800s, Sydney's sewage was largely discharged straight into its harbour. At that time, the Botany Sewage Farm (later to become Malar Treatment Plant) and Bondi Outfall System were commenced to remove sewage from the growing city. The third part of the large ocean treatment and disposal system came with the construction of the North Head system between 1916 and 1930. Over this period, sections of Sydney's North Shore were sewered, providing for cleaner and safer local environments and providing marked property value uplift.

The three major wastewater ocean systems of Malabar, North Head and Bondi saw extensive sewage collection systems constructed. Today these systems collect and transfer almost 80% of Sydney's sewage from as far west as Blacktown and as far southwest as Campbelltown to the coast for treatment and disposal.

Only half of Sydney's households were connected to the sewer by the Second World War. This resulted in massive wastewater system investment in the second half of the 1900s.

History of wastewater treatment in Sydney



Top: Folly Point Septic Tanks. The main outfall sewer from North Sydney drained to these treatment works. The sewage was run into open septic tanks. The effluent flowed on to sand filter beds which were planted with crops.

Bottom left: Liverpool Sewerage Treatment Works — Trickle Filtration Plant.

Bottom right: Bondi Sewerage Treatment Works No.1 Sedimentation Tank.

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Prior to the commissioning of the deep ocean outfalls, near the old cliff-face outfalls, values of faecal coliforms were commonly in the range 10,000–10,000,000 colony forming units (cfu)/100 mL.

The Hawkesbury-Nepean catchment in Sydney's west saw a high number of intensive treatment plants built and modified to process sewage to remove nitrogen and phosphorus. Described as tertiary treatment, such plants required large footprints as well as high energy demand to meet stringent local discharge licence requirements.

As late as the 1950s the cliff-face discharge of sewage at Bondi, Malabar and North Head saw: poor beach water quality for swimmers, grease on the beaches, a significant visual impact of sewage, contaminants in seafood caught in the area and negative impacts on the near shore environment.

The state of Sydney's coastline was unacceptable and the public demanded action.

In the early 1960s a submarine sewage outfalls concept was proposed, with a new Trade Waste Policy developed in the early 1970s.

Deep Ocean Outfalls were commissioned at Malabar, North Head and Bondi to ensure that Sydney's beaches became some of the cleanest in the world. Malabar was the first to be commissioned in September 1990, followed by North Head and Bondi at a total cost to investigate, design, construct and commission of \$310 million.

At the time, the hydraulic design of the Sydney Outfalls represented the leading edge of development for high dilution, self-cleansing and essentially maintenance-free outfall facilities.

Prior to the commissioning of the deep ocean outfalls, near the old cliff-face outfalls, values of faecal coliforms were commonly in the range 10,000–10,000,000 colony forming units (cfu)/100 mL. After the decommissioning of these old outfalls, median values fell to less than 10 cfu/100 mL.

Long-term monitoring has shown no evidence of any measurable environmental impacts from the deep ocean outfall discharges or of any build-up of metal

concentrations in ocean sediments near the deep ocean outfalls.

A recent Deloitte Access Economics Report to assess both the economic and social value generated from improvements in water quality as a result of the deep ocean outfalls showed that:

- The Deepwater Ocean Outfall program delivered by Sydney Water 25 years ago has provided \$2 billion of social value to Sydney residents attributed to the improved coastal beach water quality.
- The total value of Sydney's coastal beaches to its residents is around \$1.3 billion per annum, of which \$130 million is attributable to water quality.
- The net value add associated with beach water quality is worth around \$332 million per year to the NSW economy through domestic and international tourism and the provision of 3500 jobs.
- The health benefits associated with beach water quality due to the avoidance of illness of beach users is estimated at \$140 million per year from avoided absenteeism, calculated from an estimated 180,000 sick days saved per year.
- In terms of biodiversity, the study suggests that changes in wastewater management, including the establishment of the Deep Ocean Outfall Program, have had a net positive impact on the biodiversity of marine communities along Sydney's coastline, although this is difficult to quantify.
- In terms of brand value, the study found that beaches ranked in the top three when visitors think of Sydney — alongside Sydney Harbour and the Sydney Opera House.

Today, Sydney Water operates 30 wastewater treatment and water recycling plants that treat over 1.5 billion litres of wastewater every day. There are over 25,000 km of wastewater pipes in Sydney Water's wastewater network.

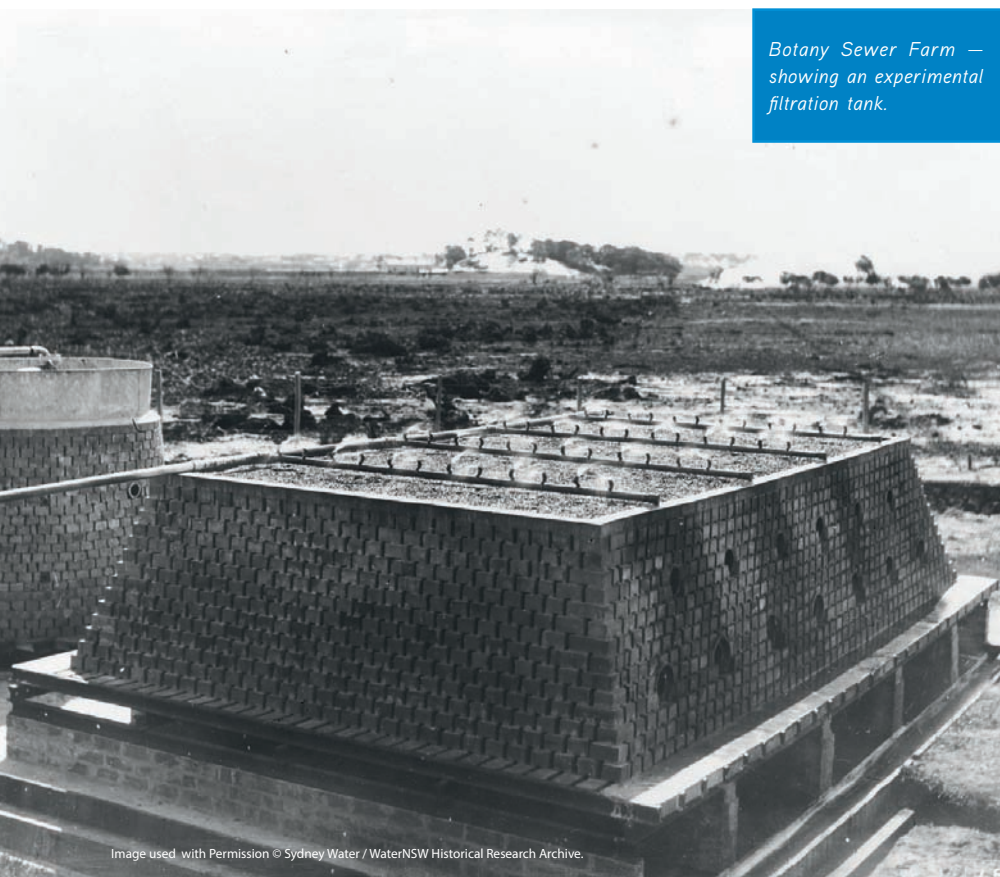


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The water recycling plants treat wastewater, which can then be safely used to water gardens, golf courses and parks, flush toilets, wash cars and fight fires. The recycled water can also be used for some industrial purposes and to supplement river flow in the Hawkesbury-Nepean River. This saves water stored in dams for drinking and keeps the river healthy.

Sydney Water has invested hundreds of millions of dollars in the recent past into its wastewater treatment plants to reduce odour for local residents and to improve environmental outcomes.

Environmental advances

Sydney Water extracts over 170,000 tonnes of biosolids fertiliser from the wastewater treatment process each year, which is provided to NSW farmers to improve soil condition and to fertilise animal feed crops.

Treatment of sewage creates methane gas, and through a process called anaerobic co-digestion, the obtained methane is used as fuel to heat anaerobic digesters and to produce electricity to power the plant. The entire process occurs in a contained system to eliminate any odours.

This creates a number of benefits by taking pressure off the electricity network and by reducing greenhouse gas emissions.

Sydney Water currently generates more than 20% of its total energy needs across its network. It also exports eight gigawatt hours (GWh) to the electricity grid over a year — which would power around 1000 homes.

Sydney Water is producing on-site across all its wastewater treatment facilities enough energy to power over 11,000 homes each year, reducing greenhouse gas emissions by over 70,000 tonnes a year — the equivalent of keeping 17,500 cars off the road for a year.

Sydney Water is aiming to keep its total electricity purchases below 1998 levels, even though it is servicing an increasing population and providing higher treatment standards.

Sydney Water's Bondi Wastewater Treatment Plant now produces 13% more electricity than it consumes each year, allowing the return of electricity to the grid.

Innovation

Sydney Water is also currently trialling the use of other organic waste products

to further increase the ability to produce additional power and to reduce landfill and costs for third-party stakeholders.

A trial is being conducted to use fruit and vegetable waste at its Cronulla Wastewater Treatment Plant, and in collaboration with the University of Wollongong, an innovative research project is being undertaken at the Shellharbour Wastewater Treatment Plant, investigating other food waste sources which can be used to generate additional renewable energy production.

"The first stage of the project is using waste from beverage production, so we are basically turning beer, wine and soft drink waste into power," at Sydney Water Principal Scientist, Treatment Dr Heri Bustamante said.

"Adding food waste like beverage waste to the wastewater treatment process provides a number of benefits:

- More power is able to be generated by the co-digestion process through additional biogas production.
- Food waste is diverted away from landfill.
- Greenhouse emissions are reduced.
- Producing green energy at the treatment plant keeps the operation costs of the treatment plant lower, which in turn puts downward pressure on water bills for customers.

"The research will enable us to determine exactly the correct amounts of different types of food waste to be added in a variety of mixtures, to maximise energy production and to ensure that there are no downsides to the process.

"Once products and methodologies are tested and proven, we will be able to roll out the processes at our other wastewater treatment plants, accepting a range of additional food waste products.

"Sydney Water's wastewater treatment plants are the bio-generators of the future, where waste is being turned into a valuable resource," Dr Bustamante said.

Providing the growth for Sydney

Provision of wastewater infrastructure has been the real backbone that has supported the healthy growth of all large cities over the millennia.

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The rise of rooftop solar in our carbon-free energy future

*John Bradley, CEO, Energy Networks Australia**

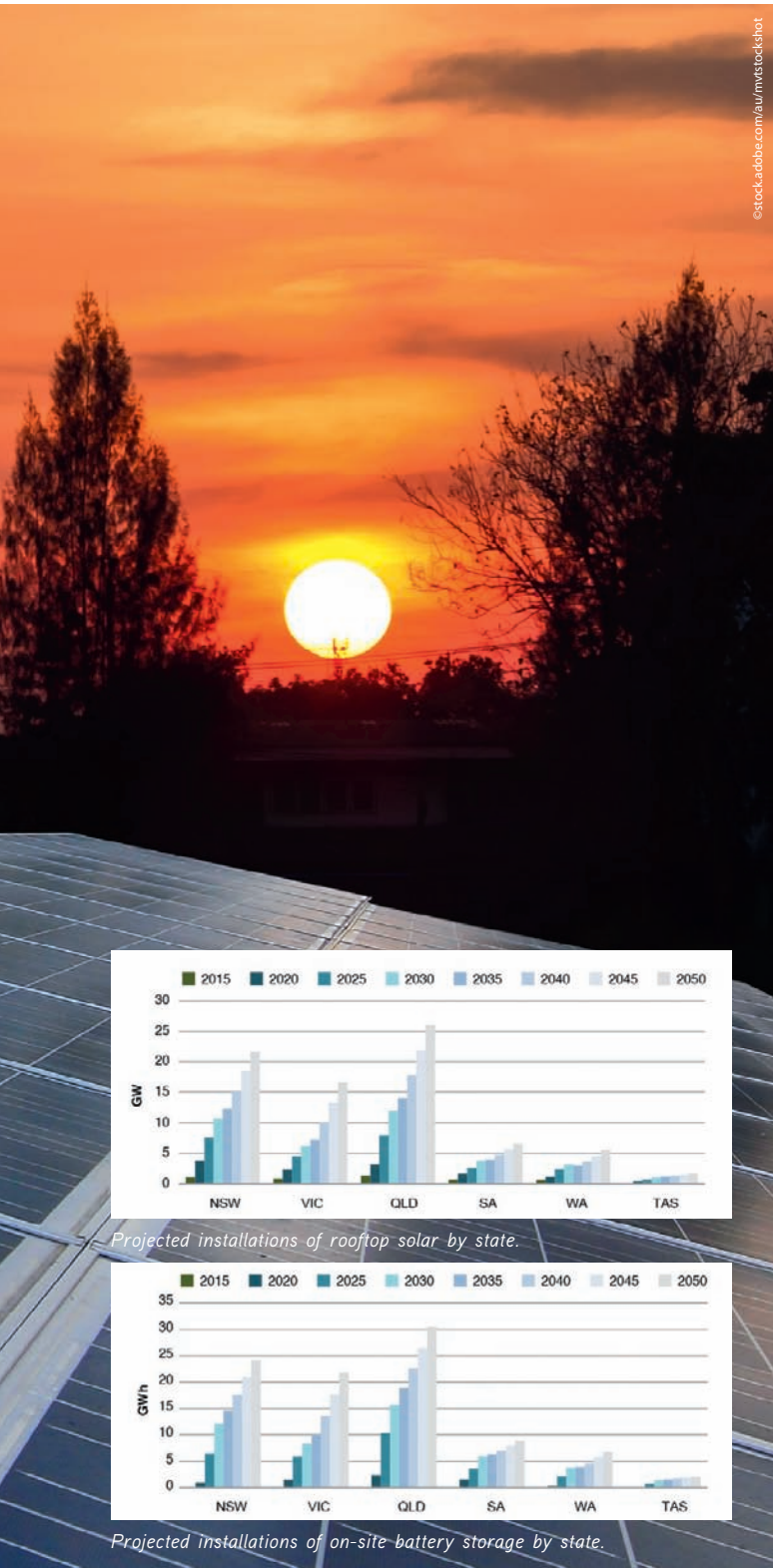
Customers will drive the transformation of Australia's electricity sector as world-leading adopters of renewable energy resources.

The story of the evolution of Australia's energy system often focuses on the role of large-scale wind and solar generation. While integrating large-scale variable renewable energy will be vital into the future, the rapid uptake of distributed energy resources such as solar and battery storage will be at the heart of this transformation.

The Electricity Network Transformation Roadmap developed by Energy Networks Australia and CSIRO is an evidence-based plan detailing what needs to be done during the next decade to provide Australians with secure and affordable energy and to decarbonise electricity by

2050. It forecasts up to 10 million Australian households and small customers will have distributed energy resources like solar, battery storage, smart homes and electric vehicles by 2050.

Analysis by CSIRO for the Roadmap shows that in Queensland, for example, rooftop solar panels are set to increase by more than 500% by 2030, with more than 10,000 MWh in small-scale battery storage. This means in 2030, just over a decade, Queensland's electricity system would need to integrate the equivalent of 760,000 residential battery storage systems. By the same time, the state's solar PV generation capacity would be almost as large as its current coal-fired generation capacity. This reflects both wider customer adoption of rooftop solar



PV and larger system sizes as costs continue to fall.

While South Australia already leads the nation in the installation of new large-scale renewable generation and is set to become a leading installer of large-scale battery capacity, small-scale renewables and batteries will also play an important part in the years to come. The Roadmap found that South Australia's rooftop solar panels will increase by more than 300% by 2030, with 4000 MWh of small-scale battery storage.

This incredible fleet of distributed energy resources would allow networks to buy grid support from customers instead of building their own infrastructure. The Roadmap forecasts the annual payments to

customers could be worth \$1.1 billion within 10 years. Orchestrating these new energy assets in the right place at the right time could save customers a total of \$16 billion in network costs by 2050. However, reforms to electricity pricing are needed now.

The Roadmap finds it critical to move to fair and efficient network charges for residential and small customers before 2021. Combined with other Roadmap measures, pricing reform could help the average Australian household to save \$414 per year in their electricity bills by 2050. Vulnerable customers would not be left behind. Tariff reform would be critical to ensuring a medium-sized family who can't take up solar and storage is \$350 per year better off in 2027.

Groundbreaking energy system analysis for the Roadmap found that, with the right policy settings and a national transition plan, Australia's electricity system could achieve zero carbon emissions by 2050. The final Roadmap report follows two years of collaborative work carried out by Energy Networks Australia and CSIRO with key stakeholders. More than 200 representatives of consumers, new market entrants, retailers, government bodies and regulators contributed in co-design workshops.

Now for the hard part. Network businesses are initiating the Roadmap's high-priority projects but timely action will also be needed by government if Australia is to keep the lights on and bills affordable as we transition to a cleaner energy system. A national approach to carbon and energy policy will support commercial investment as the household energy revolution continues to gather momentum. Australians are already playing their part by embracing new technologies and supporting action on climate change.

The final report of the Electricity Network Transformation Roadmap is available at www.energynetworks.com.au/sites/default/files/entr_final_report_april_2017.pdf.



*John Bradley is an experienced chief executive with diverse experience in the electricity, gas, water and resources sectors. Prior to his appointment as CEO of the Energy Networks Australia, he consulted to the International Monetary Fund on State Owned Enterprise reform. As the Director General of Queensland's Department of Premier and Cabinet until 2012, John was responsible for leading strategic management in the Queensland public sector. Previously, he was Director General of the Department of Environment and Resource Management, from 2009. John was also the CEO of the Queensland Water Commission during the Millennium drought.



Wastewater filtration with graphene oxide

Australian SMEs Clean TeQ and Ionic Industries have joined forces with a leading graphene researcher to develop next-gen water and wastewater filtration technology. The R&D team behind the project recently won funding through the Australian Government's Cooperative Research Centres Projects (CRC-P) program.

The wastewater filtration products will be based on the latest advances in nanotechnology, using graphene oxide to dramatically improve performance and reduce current energy use. Their development will be led by Associate Professor Mainak Majumder from Monash University, who last year helped perfect a technique that could create graphene filters on an industrial scale.

"Graphene has special properties which could disrupt current commercial filtration techniques and significantly reduce the energy required to filter wastewater," Associate Professor Majumder said. Indeed, with incredible performance characteristics and a range of potential applications, graphene has long been lauded as something of a wonder material.

Clean TeQ Executive Director Peter Voigt said the CRC-P funding will support the delivery of low-energy, continuous flow processes for the water and wastewater treatment market — processes which will be critical to overcoming the freshwater scarcity that currently plagues the energy, food and industrial markets.

"Contaminated freshwater sources, such as ground and surface water and municipal wastewater, are excellent sources of fresh



water provided they can be economically treated," said Voigt. "We plan to be the first to take this breakthrough technology to market in Australia and in developing countries such as China, India, South America and South Africa, where access to clean fresh water is a significant issue."

Water researcher Professor Ana Deletic, director of Monash Infrastructure, said the new system will "modernise Australia's current wastewater management from the traditional treatment approach to a low energy consumption, resource recovery approach". She and her fellow team members aim to deliver working products in the next 2–3 years.

Monash University
www.monash.edu



Reshaping wastewater treatment using bacteria

Researchers have come across a type of bacteria that could fundamentally reshape efforts to cut the huge amount of electricity consumed during wastewater clean-up.

The serendipitous discovery was made by scientists working on the Healthy Drinking Water project, funded by the Engineering and Physical Sciences Research Council (EPSRC). The project is being led by the University of Glasgow, working in collaboration with the University of Michigan.

The newly discovered microorganisms, known as comammox (complete ammonia oxidising) bacteria, can completely turn

ammonia into nitrates. Traditionally, this vital step in removing nitrogen from wastewater has involved using two different microorganisms in a two-step approach: ammonia is oxidised into nitrites that are then oxidised into nitrates, which are turned into nitrogen gas and flared off harmlessly.

Research team leader Dr Ameet Pinto said the discovery of the bacteria in a US drinking water system "took us completely by surprise".

Wastewater treatment is a huge consumer of electricity, accounting for 2–3% of all power usage in western countries, and no less than 30% of its energy bill results from the need to remove nitrogen. Furthermore, most of the sector's efforts to reduce its energy use have focused on the two-microorganism approach. The discovery of a microorganism capable of full nitrification will therefore have a significant impact on efforts to manage nitrogen pollution, said Dr Pinto.

"The potential is there for the wastewater treatment sector to exploit this breakthrough, which other teams in Europe have made in parallel with us," he said.

"That would be an important step towards informing the development of robust approaches in terms of cutting costs and reducing carbon emissions associated with generating the huge amounts of electricity that the sector uses."





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Clogging solution is crystal clear

Crystal Lake City uses the latest technology to solve pump station clogging problems.

Crystal Lake, Illinois, is about 72 km northwest of Chicago with a population of approximately 40,000. The south-east portion of the Crystal Lake shore was first made available for general recreational use to the public in 1856. The Crystal Lake Wastewater Treatment Division is responsible for the operation and maintenance of two wastewater treatment facilities. Combined, the facilities process an average of 16 million litres of water per day or 6 billion litres annually. This produces an effluent that not only meets, but also often outperforms the National Pollution Discharge Elimination Systems (NPDES) permit requirements. Other functions of the division include laboratory analysis of samples required for NPDES reporting, plant process control, industrial monitoring and potable water analysis.

visibility with Crystal Lake because of its occasional operating issues. As a current owner of over 40 submersible pumps using both PLCs and SCADA, Crystal Lake turned to Xylem for a solution.

Faced with the occasional blockage problems at Lift 13 due to flows containing flushable wipes and miscellaneous debris, the manufacturer recommended its Xylem Concertor, a fully integrated system with high operational flexibility.

Concertor combines a fully integrated control system with IE4 motor efficiency, state-of-the-art adaptive N-hydraulics and intelligent functionalities. By integrating a control system that can automatically adapt to the changing wastewater environment, an optimal level of performance is delivered, while significantly reducing total cost of ownership.

The built-in intelligence makes it quicker and easier to set up and operate functions that would otherwise require a sophisticated monitoring and control system, all achieved with a significantly smaller footprint.

Solution

The Concertor system was installed and began operation in July 2015.

During installation, the city would not allow modification to the existing control panel. The existing motor starter and pump protection had to remain in place in the event the old pump had to be reinstalled. Concertor does not require these items to operate, so slight modifications were required to make it work with the existing station controls. Regardless, installation was smooth and it took only a few hours to install the pump and control. No consulting engineering firm was used.

The Flygt Engineering Group sized the new system based on information provided by Crystal Lake.

Results

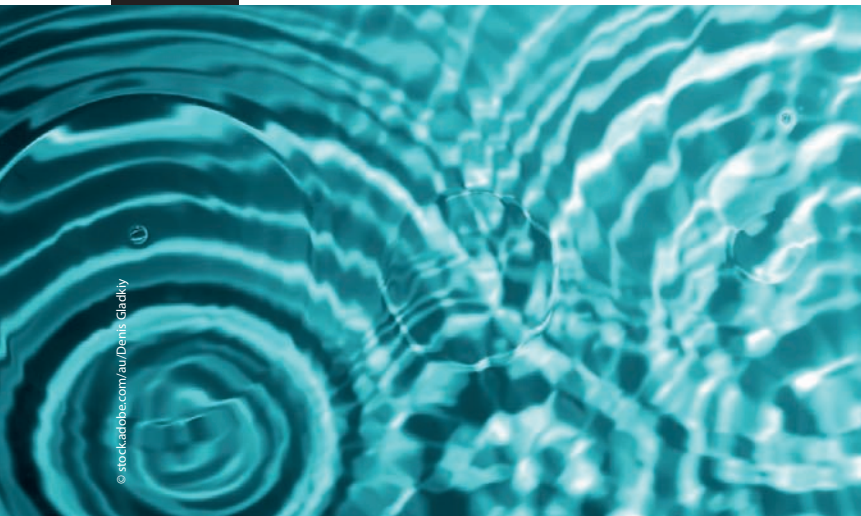
Since installation, inspections have revealed very little sediment and grit build-up. Also, varying start levels have prevented grease ring build-up in the station, a great benefit. Crystal Lake staff previously performed the onerous task of station clean-out every three to four months. The new system did not require clean-out for eight months.

Finally, all clogging issues have been eliminated.

Crystal Lake was able to turn a long-term solid relationship with a major pump manufacturer into a clogging solution for one pump station, cost-saving standardisation and reduced inventory across its remaining pump stations, and significant energy savings.

Scope

Sanitary Lift Station 13 experienced occasional clogging problems for a few years. Obviously, the station had high



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Self-priming sewage pumps installed at power station

The asset owner at the Mount Piper Power Station, Rainer Scheurer, was looking for a solution to the maintenance issues associated with his submersible sewage pump stations on the site. The problems were many and varied, including lifting chains breaking, pumps becoming stuck on their guide rails and general reliability issues. Even with everything going well, operators would be exposed to a 7 m fall into the pit while hoisting submersible pumps to the surface for maintenance.

Scheurer came to Hydro Innovations for some ideas on how he could get away from these issues. Hydro Innovations suggested the use of Gorman-Rupp self-priming sewage pumps, which would mean that only one operator would be needed for most of the maintenance issues and any work could be done without opening wet well covers. Scheurer liked the idea, but the pit was so deep that self-priming pumps could not be located at ground level.

Hydro Innovations suggested putting the pumps into the existing valve vault



in order to get pumps closer to water level, re-using the path the old discharge lines took and connecting directly into the existing rising main in the valve vault. Gorman-Rupp's V3B60-B pumps were chosen for the job, as they were capable of not only delivering the 15 L/s flow rate but also repriming the required 7.6 m suction lift — a tough ask for most self-priming pumps.

Hydro Innovations explained that most self-priming pumps with a full casing of liquid are capable of priming to this level, but repriming automatically, with only a partially filled casing (as casing siphoning can occur between pump cycles), is a totally different proposition. As Gorman-Rupp publishes guaranteed reprime lifts on its sewage pump curves, Hydro Innovations had no hesitation applying the pump on this suction lift.

Hydro Innovations was given the go-ahead on the project and set to work designing a piping and valve system that could comfortably fit in the valve vault. A compact but practical design was approved and the project was delivered. Mount Piper Power Station now has a sewage pump station that is undercover (inside the valve vault), is easily accessed without the need for lifting apparatus and can be safely maintained by one operator.

Hydro Innovations

www.hydroinnovations.com.au



Metals separator developed for very fine materials



Sorting specialist STEINERT has developed a non-ferrous metals separator for fine materials, which it supplied to metal recycler Galloo. The system's splitter can be set with millimetre precision, enabling non-ferrous metals such as aluminium, copper and zinc to be efficiently separated.

In 2013, Galloo began to look into more efficient ways of extracting non-ferrous metals from fine-grain material. Galloo contacted the engineers at STEINERT, asking them to develop a flexible machine concept for three different input materials: automobile shredder residue (ASR), incineration bottom ash and electronic scrap.

The challenge was that the input is extremely fine material, with grain sizes of 0.5 to 10 mm. The goal was to enable the

three different materials to be run through the system flexibly, without any drop in the separation rate. Engineers wanted to further optimise the separation of non-ferrous metals out of the fine-grain fraction and, at the same time, simplify operation and maintenance.

STEINERT developed a splitter that can handle the three different types of material. Fine gearbox adjustments can be made to the splitter to enable it to get to within a few millimetres of the material. The machines now run at Galloo for about 16 hours per day.

STEINERT's development and design team next began to work on additional features for the fine-grain sector, leading to the creation of the STEINERT EddyC FINES — a machine with a frame structure which allows the belt to be replaced in 10 minutes.

"Changing the belt of an eddy current separator often takes a company half a day, with up to three employees and heavy lifting equipment needed to perform this task," said STEINERT Technical Director Dr Nico Schmalbein. With the STEINERT EddyC FINES, two employees can carry out a belt change with nothing more than a spanner.

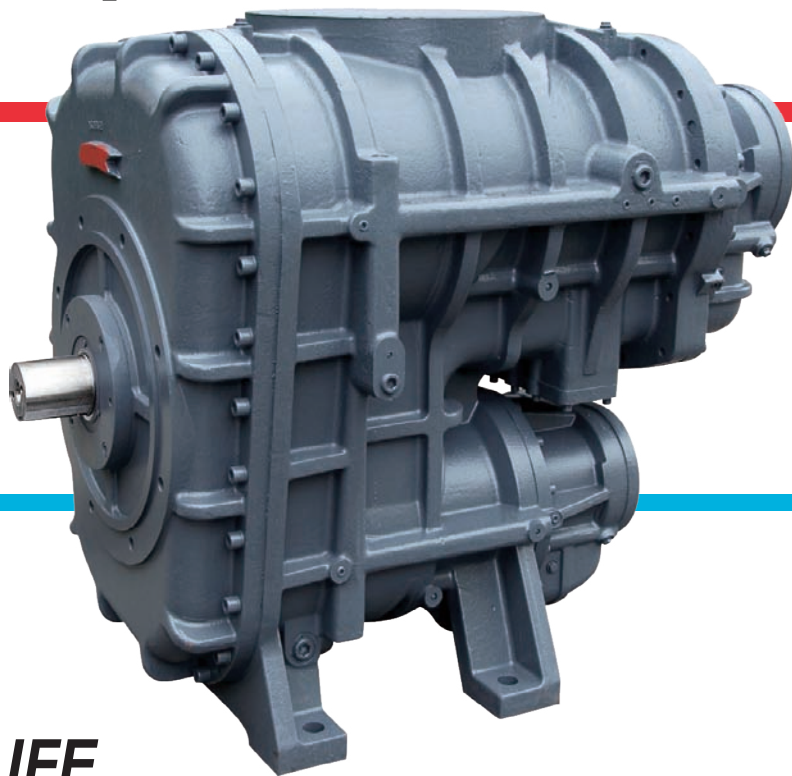
Galloo is now using the STEINERT EddyC FINES to recover non-ferrous metals from grate ash. Not only are the particles very small, measuring only 0.5 to 4 mm, but the system's splitter plate has to be precisely adjusted in order to separate the metals from the fine incineration bottom ash material.

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Heavy metal or hard rock – both sound good to us!

What do you think of heavy metal and hard rock? We're not talking music, but rather the two most problematic components of soil contamination. Whatever your musical tastes, in this case it's unlikely you're a fan. But as Diarmaid Connaire, Business Development Manager from waste management specialist CDEnviro, explains, his company doesn't have a problem with either.

Cleaning up, investing in and re-using contaminated brownfield sites — of which there are an estimated 80,000 to 100,000 in Australia — protects human health and the environment. It also improves the appearance of the area and reduces pressure to develop unspoiled green spaces.

With benefits such as the reduction in fuel consumption resulting from travelling within an urban area to a brownfield site rather than to a greenfield site further afield, and economic benefits including rising property prices nearby, you have a compelling argument for redevelopment.

However, from the first industrial revolution in Europe until as recently as the 1980s, chemicals used in industrial processes have led to widespread soil pollution. This is the result of spillages, mismanaged industrial sites and unforeseen consequences of using materials previously thought to be harmless. Often chemicals were simply poured down drains or onto land, where they leached into the soil and groundwater, resulting in long-term damage and leaving a toxic legacy.

Land is now considered contaminated when substances it contains could cause 'significant harm to people or protected species' or 'significant pollution of surface waters or groundwater'. This contamination is a particular problem when trying to bring brownfield sites back into use. Decontamination is therefore an important economic factor as well as an environmental one.

Emerging solutions for effective land remediation

The contamination includes heavy metals, such as cadmium, lead, chromium, copper and zinc — either on the soil or at elevated levels within it — which can result in problems with processing and therefore high disposal costs of waste materials.

In addition to this man-made issue — heavy metals are naturally present in soil, but rarely in more than trace amounts — remediating land is also complicated by hard rock which can be large, abrasive and difficult to process.

Neither of these issues are new, and there are solutions available, but it is unusual for heavy metals and hard rock to exist in



isolation. Options for dealing with them at the same time are extremely limited. Yet it is costly and time-consuming to deal with them separately.

'Big bruiser' equipment — such as a heavy-duty excavator, mounted breakers or a traditional crushing and screening plant — are able to deal with hard rock, but they are not equipped to deal with the chemical side of the problem. Likewise, where scientists have come up with a solution for the heavy metals, the machines all too often fall down as they aren't robust enough for oversized rock.

However, there is now an effective middle ground. Companies like mine are able to bring science and engineering together. This means there is a solution to brownfield remediation which finally bridges the gap between the scientific and the practical. Put another way, we like the sound of heavy metal and hard rock!

A site-by-site approach to assessing risk is always required and must take into account the individual environmental characteristics of soils and human activities that have taken place there or nearby.

Flexible approach

When looking to remediate land, look for a system able to cope with the contaminants in the available space. Innovative new crushing and screening technology is now available with a range of modular options, meaning they can move from site to site or be fixed turnkey installations for long-term projects. This gives the flexibility required whatever the location and contaminant.

When dealing with heavy metals, material scrubbing and recovery processes should be used. Additional water treatment also allows the re-use of water that becomes heavily contaminated in the recovery process.

Some more traditional soil remediation processes use chemicals like surfactants.

However, systems like ours provide efficient mechanical washing and scrubbing processes which reduce or even eliminate this requirement. This in turn generates a large saving on operating costs. The systems can also deal with organic matter and enable clean aggregate to be re-used within construction, and so offer an all-encompassing land remediation solution.

Hard rock and heavy metal no longer need to be treated as separate issues, meaning brownfield remediation just got more cost effective. Surely that's music to everyone's ears!

CDEnviro
www.cdenviro.com



There are 22 albatross species in the world, 17 of which are threatened with extinction. Scientists have linked the global albatross population loss to accidental bycatch of seabirds during the commercial longline fishing process.

Every year, approximately 3 billion hooks are set by the global longline fishing fleet. While setting the lines, albatross and other diving seabirds such as petrels can become hooked or entangled and drown as the longline sinks. As a result of this practice, up to 300,000 seabirds are killed annually.

Currently, longline fishermen set branch lines by baiting the hooks and hand casting them into the water, where they are an attractive, easy meal for seabirds. This is not profitable for fishermen as a high number of hooks lose their bait before reaching their target depth, and it is a deadly situation for the seabirds. And while a number of mitigation methods have been employed, no single one has been solely effective in preventing seabird bycatch and all of them make fishing more difficult.

The key to an effective solution was some type of device capable of releasing baited hooks underwater, out of the sight and diving range of the birds. If possible, it should not interfere with fishing or require the use of any additional seabird deterrent measures.

Queensland-based company Amerro Engineering began development of a mitigation device for the pelagic longline fishing industry back in 2006. Control Logic has been proudly involved with the project from day one, providing product and technical assistance with the system interface and control.

Known as the BS30 Underwater Bait Setter, Amerro's stern-mounted, hydraulically operated device deploys baits on a longline at predetermined depths, effectively setting baits out of the visual sight and diving range of seabirds. To operate the underwater setter, fishermen place a baited hook in a capsule held in a docking station. At the press of

a button, a series of hydraulic winches propel the capsule and the docking station down the track.

Once the docking station reaches the bottom of the track it releases the capsule, where it freefalls to a preprogrammed depth. At the end of the descent, the system reverses the hydraulics, flushing the baited hook from the capsule through a spring-loaded door. The capsule then returns to the docking station to be set again. The speed of this cycle depends on the preprogrammed depth and can be varied from 8–16 s/4–10 m.

At the heart of the bait setter is a Panasonic PLC, providing high-speed motion control and management of the set depth verses tow speed for the descent and recovery of the capsule. Logging features and operator interface are provided by a Red Lion HMI allowing for logging of the number, location and time of hooks set on a fishing trip. In port, this data can be downloaded to computer via USB providing a way for the skipper to automatically record and track fishing effort for future reference or meeting compliance when reporting to various fisheries managers.

At the time of writing the bait setter system had completed extensive sea trials and set thousands of hooks without a single seabird bycatch. It has significantly reduced bycatch within the pelagic longline industry worldwide and has increased catch potential as a result of eliminating seabird interaction and bait loss.

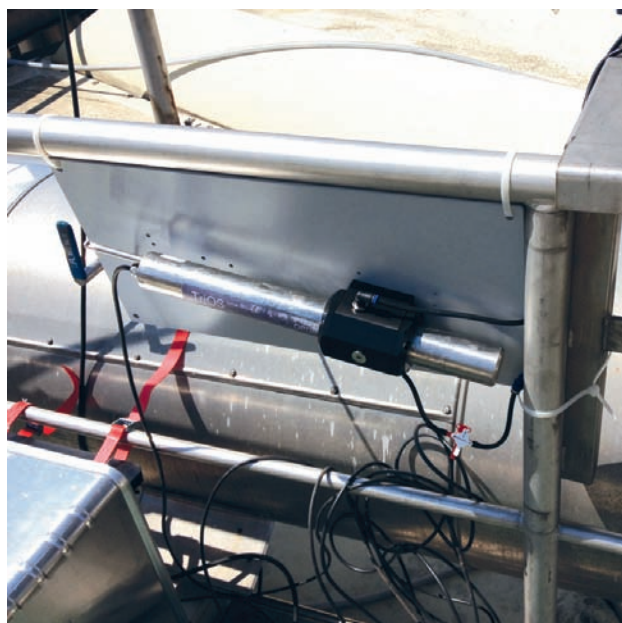
A commercialised version of the product is now in the marketplace and gaining widespread support from the longline fishing industry. From a commercial standpoint, early indications show that the benefits of getting all baits under the water where they can be effective will return dividends to the fisherman as reward for better ecological practices.

Control Logic Pty Ltd
www.control-logic.com.au

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In addition to the integrated network interface, LISA UV is available with digital or analogue output, meaning the sensor can be connected directly into the SCADA system without a controller. Through the TriOS G2 interface the sensor can easily be configured through any standard web browser on a PC, tablet or smartphone.

The optical path length can be adapted to the application at any time by various adapters which give a broad range of detection limits. Automatic turbidity compensation is carried out via a second measuring channel to achieve high accuracy. Through application-specific correlation LISA UV can be configured for direct output of BODeq, CODEq, TOCeq.



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matrixFlu FDOM, chlorophyll-a, phycocyanin, 4-parameter, rhodamine, tryptophan, turbidity, PAH	surFlu Oil-on-water	
VIPER Colour measurement	LISA UV Low Investment SAC 254nm sensor	
LISA color Low-cost state-of-the-art Colour sensor	NICO NO ₃ -N	
RAMSES Hyperspectral Radiance and Irradiance Sensors for the UV, VIS or UV/VIS range	OPUS UV spectral analyser UV/VIS spectral analyser	
TriBox3 Measurement and control system	TriBox-Mini Low-cost measurement and control system	HS100 G2 DIN rail interface module

Parameters

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- NO₂-N
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- COD
- BOD
- TOC
- DOC
- HS
- Phenol
- NH₄Cl
- Bacteria (Tryptophan)
- Radiance/Irradiance
- NH₄⁺
- TSS
- SAC254
- Colour
- Oil-in-water
- Oil-on-water
- PAH
- Algae
- Turbidity
- pH
- DO
- Conductivity



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Smart sensing network enables better monitoring



The NSW Smart Sensing Network (NSSN), launched in February at the Sydney Nanoscience Hub, will bring together smart sensing expertise in academia, industry and government to develop a collaborative and innovative network that is expected to deliver economic and social benefits for NSW.

The \$950,000 network is set to help tackle major challenges in agriculture, health, security, the environment and industry, supporting researchers working with futuristic sensing technologies ranging from mobile phone-enabled air and water sensors to skin patches for monitoring sun exposure and techniques for audio recognition of koala mating calls.

For example, air sensing research led by Professor Benjamin Eggleton is expected to enable air quality monitoring more cheaply and frequently, and over smaller distances, than previously possible. While current particle size and gas readings are taken at official monitoring stations which consist of large shipping containers full of complex equipment, breakthroughs such as those achieved by Professor Eggleton could lead to smartphone-sized measuring devices.

Other projects currently underway include:

- wildlife sensing capabilities led by Dr Zhe Xu, which will monitor iconic and ecologically important species including koala populations;

- water quality research led by Dr Alex Donald, which will see the development of a palm-portable device to monitor the toxic pollutants in NSW Central Coast groundwater that led to a fishing ban;
- biomedical research led by Professor Justin Gooding, which will detect clinically important biomarkers in blood and help pioneer work into UV-sensitive skin patches and sensors;
- wearables polymer fibre light guides research led by Professor Simon Fleming, which will sense changes in the body such as the movement of bedridden patients, bandage pressure and the metrics of elite athletes.



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Pipe unclogged at printing company

When a Queensland printing company found one of its drainpipes constantly clogging up with slime, NCH came to the rescue with its FreeFlow 25 biological drain and wastewater treatment system.

The print company makes use of chilled water, which is dosed in small amounts across the printing plates to aid in ink removal. Unfortunately, its chilled water drainpipe had been manually cleaned on a regular basis in order to keep it unclogged, which was a difficult and time-consuming task for this publisher of seven major newspapers and magazines. Seeking a solution, the company installed three FreeFlow 25 units on its print towers.

Utilising FreeFlow Liquid Concentrate, the latest bacterial liquid technology, FreeFlow 25 is an automated on-site delivery system for growing food-safe bacteria. Once dosed to a drain, the bacteria activate to form a biofilm inside the pipes. This creates a continuous working environment in the pipe that digests fats greases and other odour-causing materials. The product thus maintains free-flowing drains in an environmentally sensitive way without the use of harsh chemicals.

Since installation on the print company's towers, the FreeFlow 25 units have assisted in breaking down the materials that previously clogged the drains. With no more clogged drains, there has been no more need for continuous cleaning



and there has been a dramatic reduction in the odour in the collection pit. The company's sump pump will now last longer due to the continual cleaning from the FreeFlow 25 and the clean water being pumped through.

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Polymer additive to improve plastics recycling

Here's a question for you: what percentage of the >70 million tonnes of plastic used annually for packaging — for example, a 2 L bottle or a takeaway food container — actually gets recycled and re-used in a similar way?



If you answered anything higher than 2%, we've got some bad news for you.

According to the Ellen MacArthur Foundation, nearly one third of plastic packing is leaked into the environment, while around 14% is used in incineration and/or energy recovery. A whopping 40%, meanwhile, winds up in landfills.

One of the main problems with plastics recycling is that polyethylene (PE) and polypropylene (PP), which account for two-thirds of the world's plastics, have different chemical structures and thus cannot be repurposed together. Geoffrey Coates, from Cornell University, explained that if you "take a film of polyethylene and a film of polypropylene and you try to melt them together... it's really easy to pull that film apart".

Now researchers at Coates' lab have collaborated with a group from the University of Minnesota to develop a tetrablock (four-block) polymer. By adding a miniscule amount of this polymer to a mix of the two otherwise incompatible materials — with alternating polyethylene and polypropylene segments — the resultant material was found to have strength superior to diblock (two-block) polymers.

"People have done things like this before, but they'll typically put 10% of a soft material, so you don't get the nice plastic properties — you get something that's not quite as good as the original material," said Coates.

"What's exciting about this is we can go to as low as 1% of our additive, and you get a plastic alloy that really has super great properties."

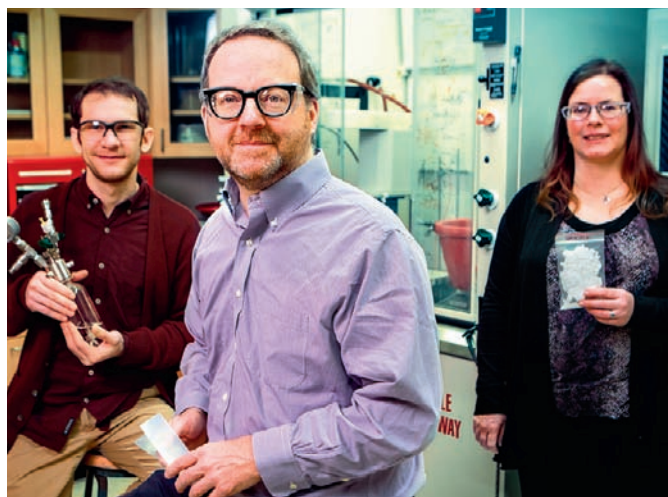
The researchers' study saw two strips of plastic welded together using different multiblock polymers as adhesives, then mechanically pulled apart. While the welds made with diblock polymers failed

relatively quickly, the weld made of the group's tetrablock additive held so well that the plastic strips broke instead.

"That's the first sign that we've got a very good material to effectively glue together polyethylene and polypropylene," said Coates, who published the study results in the journal *Science*.

Lead author James Eagan, a postdoctoral researcher in Coates' group, said benefits of the tetrablock polymer are twofold. Not only does the polymer show promise for improving recycling, it could spawn a whole new class of mechanically tough polymer blends.

"If you could make a milk jug with 30% less material because it's mechanically better, think of the sustainability of that," he said. "You're using less plastic, less oil, you have less stuff to recycle, you have a lighter product that uses less fossil fuel to move it."



Geoffrey Coates (centre) in his lab with James Eagan, a postdoctoral researcher in Coates' group, and researcher Anne LaPointe. Image credit: Robert Barker/University Photography.

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Wastewater treatment for winemaker

Helen's Hill Estate, producer of Helen's Hill Wines and Ingram Road Wines, is located in the picturesque Yarra Valley. The company's winemaking process generates high-strength wastewater, requiring robust and highly efficient treatment.

In planning for increased production to keep up with ever-increasing demand, Helen's Hill Wines realised its existing trickling filter system could not cope and that an upgrade was necessary. The company turned to wastewater treatment company Hydroflux Industrial for the design and supply of a new wastewater treatment plant.



Utilising the latest Australian technology, Hydroflux is supplying its HySMART SBR system, including AEROSTRIP Fine Bubble Diffuser technology, to provide a robust, compact and sustainable low-energy solution for the high-strength waste. The sustainability advantages of the system made the choice easy for Helen's Hill.

"The HySMART system showcases the sustainability of energy efficiency in aerobic reactors," said Mitchell Hastings, Hydroflux's Victorian manager. "The HySMART SBR system uses about 40% of the energy that conventional SBR systems need to treat this type of wastewater."

The system is based on a modular, deployable system, making it simple to install on-site. Hastings noted, "The modular design means Helen's Hill can double the plant capacity in future, simply by installing a second reactor."

The wastewater plant also includes a control system with HyCONNECT. The remote access provided by HyCONNECT allows Hydroflux specialists and Helen's Hill staff to remotely monitor the plant with minimal operator input.

Hydroflux Industrial Pty Ltd
www.hydrofluxindustrial.com.au



Renewable oil produced in plant leaves

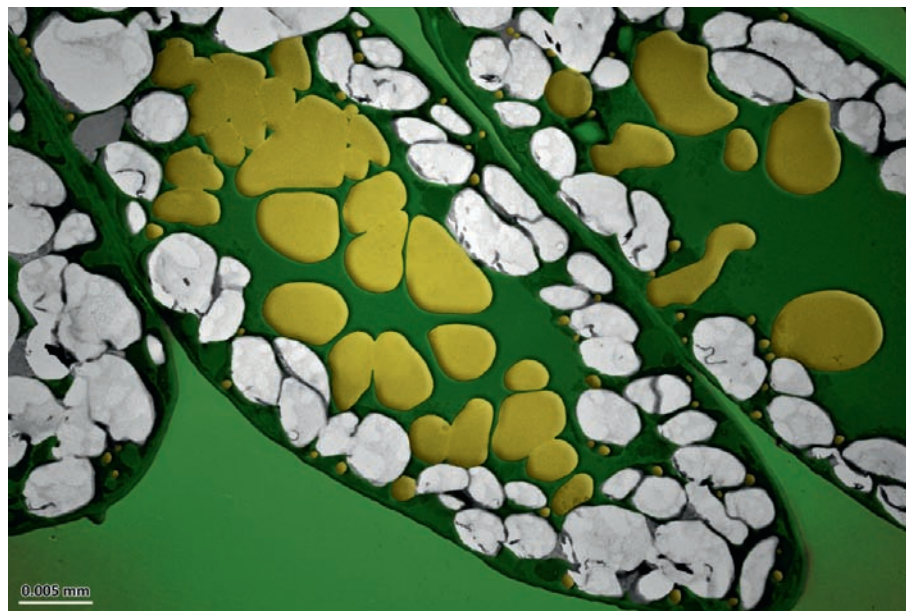
CSIRO researchers have made it possible to produce oil in the leaves, stems and seeds of plants, in a breakthrough which could mark a milestone for the renewable oils industry.

"Previously it has only been possible to extract oil from the oil-rich seeds and fruits of some specialised plants, such as canola, soybean, sunflower, coconut and oil palm," said Dr Allan Green, innovation leader with CSIRO Agriculture and Food.

"What we have been able to do is switch on this high-level oil production in vegetative tissue, such as in stems and leaves, as well."

Dr Green explained that the researchers are using solar energy captured by plants to convert their leaves' starch reserves into more energy-dense oil molecules, which increases the energy value of the vegetative tissue where the oil accumulates. In some plants the research team has been able to get around 35% oil content into vegetative tissue — the same amount as in many oilseed crops.

"If the technology were applied to existing oil crops it could potentially treble oil productivity and greatly expand renewable oil production worldwide," Dr Green said.



CSIRO recently signed an agreement with US-based company Amfora, which will see the start-up advance development and commercialisation of the technology to produce energy-rich feed for livestock. Amfora will use the technology to develop oil content in the vegetative tissue of corn and sorghum, meaning they can market a feed for dairy farmers that does not require them to purchase additional oils to supplement feeds.

The agreement with Amfora provides a direct path to market, as the oil does not need to be extracted from the leaves before it is fed to cattle. Future applications, such as the production of industrial oils and bio-based diesel, will require further industrial supply chain development to customise techniques for extracting the oil and converting it to suitable products.

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Located in regional setting of Ballarat, Ballarat Regional Soccer Facility provides sporting and social facilities for A-level as well as international-level games. The facility holds sustainability at the core of its DNA — in fact, sustainable innovation was intrinsically linked to its design.

Discussions between the City of Ballarat and k20 Architecture about a new soccer stadium were first broached in 2010. What council originally set aside was a relatively healthy budget that would appease most architects; however, at the first meeting, the architects were presented with a budget of almost 25% of the original figure. While some architects would have been disinterested in taking on this project, k20 Architecture saw this as a challenge.

Coming up with a scheme that would meet the revised budget, k20 Architecture followed up on its aim to use local materials and trades wherever possible (at least 80% was achieved) to create a sustainable outcome. As noted by k20 Architecture Director Theodore Kerlidis, “We weren’t interested in transporting materials from the other side of the world when you can find suitable materials in the immediate vicinity.”

A high level of environmentally sustainable materials and fittings were incorporated, including low-energy light fittings, reduced water-use fittings and operation, low VOC paint, durable finishes for low maintenance and longevity, and a carpet with 40% recycled content and end-of-life recyclability. The grandstand seating is made of recycled plastic while the timber is used from shading to external glazing. The grandstand was manufactured using off-the-shelf prebuilt concrete construction planks.

Passive solar design features include high-level extended eaves to reduce heat load on the building, double glazing throughout and high levels of insulation. The west facade is protected from solar gain through a ventilated facade and reduced glazing. The roof was designed for solar photovoltaic collector installation and for rainwater collection for use in toilets.

Natural ventilation is maximised via the inclusion of thermal chimneys, providing stack effect cooling and natural ventilation to change rooms and mixed-mode heating and cooling through an underfloor air-plenum to the first floor. k20 Architecture sourced recycled and local timber to assist with carbon sequestration, resulting in a reduced carbon footprint.

With Ballarat’s rich cultural heritage in mind, the concept of the Eureka Stockade wall emerged as the leading design principle. Intended to mirror the structure erected by miners during the Battle of the Eureka Stockade in 1854, k20 Architecture’s stockade wall by is designed to protect the building’s program and playing field from the prevailing winds and harsh western sun.

The wall emerges from the landscape and is made up of equal proportions of grey ironbark, spotted gum and stringy bark. Its curvilinear form in plan is the starting point for the stadium, which contains the grandstand with 500-seated capacity, conference and catering facility for 200 people, external viewing decks and players’ change rooms, media rooms and sports administration facilities.

The project has already achieved an exemplar rating using the Sustainable Tools for Environmental Performance Strategy (STEPS) scorecard. k20 Architecture is currently working on Stage Four of the Stockade Stadium, with the architects saying they have enjoyed seeing the project progress.

“One of the most rewarding aspects of delivering this project is seeing the locals using the grounds and spaces and knowing the project has been designed in the most sustainable way,” said Kerlidis.

k20 Architecture
www.k20architecture.com

Alternative fuel plant under construction

The Clean Energy Finance Corporation (CEFC) is working with resource recovery company ResourceCo to deliver an innovative alternative fuel plant in NSW.

The CEFC is lending \$30 million to ResourceCo to build two new plants that will transform selected non-recyclable waste streams into solid fuel, known as processed engineered fuel (PEF). The first plant is to be built at Wetherill Park, Sydney, while the second will be in an Australian state yet to be announced.

PEF is used in cement kilns, reducing the reliance on coal and other fossil fuels. The fuel will initially be used locally, but will also be exported as an alternative to coal and gas for cement kilns in Asia.

As noted by CEFC Bioenergy and Energy from Waste Sector lead Henry Anning, the fuel demonstrates the potential to transform waste that would otherwise go into landfill into a baseload energy source as part of Australia's future clean energy mix, while also lowering emissions.

"This investment is expected to abate over 8 million tonnes of CO₂e over the expected lifetime of the equipment," he said.

The CEFC finance will help accelerate the development of the Wetherill Park plant and proceed with the second facility. The company's managing director, Simon Brown, said the plants will help ResourceCo in its mission to help achieve federal environmental targets, including waste reduction and carbon emission avoidance.

"Our vast knowledge of both the waste and alternative fuel industries means we are well positioned to help lead the way in reducing society's reliance on both landfill disposal practices and fossil fuels," Brown said. "By achieving this we help reduce greenhouse gas emissions, avoid soil and water contamination, and conserve resources.

"Our business operates across both Australia and South East Asia, which places us in a prime position to drive this new initiative forward and make a real difference in the way in which these communities view and deal with waste."



When operational, the Wetherill Park plant will process around 150,000 tonnes of waste a year to produce PEF and recover other commodities such as metal, clean timber and inert materials. It has already secured \$5 million in grant funding from the NSW Environmental Trust under the Waste Less, Recycle More initiative, and is also eligible for Australian carbon credit units (ACCUs) due to the diversion of waste from landfill.

Anning noted that generating heat and electricity from bioenergy and waste resources is cost-competitive with other new-built energy generation, though sadly the technologies are not yet widely deployed in Australia.

"Re-using waste not only makes economic sense, it makes good environmental sense, through the reduction of landfill and landfill gases and, in the case of fuel production, the ability to replace fossil fuels," he said.

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Identifying the best algae for biofuels

Discovering which algae species is best suited to make biofuel is no small task. Researchers have tried to evaluate algae in test tubes, but often find lab results don't always mirror what happens when the substance is grown in outdoor ponds.

The Algae DISCOVER (Development of Integrated Screening, Cultivar Optimization and Validation Research) Project is now trying out a new approach that could reduce the cost and the time needed to move promising algal strains from the laboratory and into production. At the end of the three-year pilot project, scientists hope to identify four promising strains from at least 30 initial candidates.

"Algae biofuel is a promising clean energy technology, but the current production methods are costly and limit its use," said lead researcher Michael Huesemann of the US Department of Energy's (DOE) Pacific Northwest National Laboratory (PNNL). "The price of biofuel is largely tied to growth rates. Our method could help developers find the most productive algae strains more quickly and efficiently."

Led by PNNL and including three other DOE labs, as well as the Arizona Center for Algae Technology and Innovation, the project's work relies on PNNL's Laboratory Environmental Algae Pond Simulator (LEAPS) mini-photobioreactors. This system mimics the frequently shifting water temperatures and lighting conditions that occur in outdoor ponds at any given place on Earth.

The LEAPS glass-column photobioreactors act like small ponds and are placed in rows to allow scientists to simultaneously grow multiple



PNNL scientists Michael Huesemann and Tom Hausmann.



PNNL biochemical engineer Mattias Greer examines algae samples for their suitability to make biofuel.



LEAPS mimics the frequently shifting water temperatures and lighting conditions that occur in outdoor ponds at any given place on Earth.

different types of algae strains. Each row is exposed to unique temperature and lighting regimens thanks to heaters, chillers and heat exchangers, as well as coloured lights simulating the sunlight spectrum — all of which can be changed every second.

The first phase of the team's screening process uses the photobioreactors to cultivate all 30 algal strains under consideration and evaluate their growth rates. Strains with suitable growth will be studied further to measure their oil, protein and carbohydrate content, all of which could be used to make biofuels. The algae will also be tested for valuable co-products such as the food dye phycocyanin, which could make algae biofuel production more cost-effective. This phase will also involve evaluating how resistant strains are to harmful bacteria and predators that can kill algae.

Next, the team will look for strains that produce 20% more biomass than two well-studied algae strains. The top-performing strains will then be sorted to find individual cells best suited for biofuel production, such as those that contain more oil. Those strains will also be exposed to various stresses to encourage rapid evolution so they can, for example, survive in the higher temperatures outdoor ponds experience in the summer.

After passing those tests, the remaining strains will be grown in large outdoor ponds in Arizona. Researchers will examine how algae growth in the outdoor ponds compares with the algal biomass output predicted in earlier steps. Biomass will also be harvested from outdoor-grown algae for future studies.

Finally, the team will further study the final algae strains that fare best outdoors to understand how fast they grow in different lighting and temperature conditions. That data will then be entered into PNNL's Biomass Assessment Tool, which uses detailed data from weather stations and other sources to identify the best possible locations to grow algae. Data and strains will be made public in the hopes that algae companies and other researchers will consider growing the most productive strains identified by the project.



Rowing club goes solar

Redback Technologies' Smart Hybrid Solar Inverter System has been selected to optimise the energy use of Torrens Rowing Club as part of the club's long-term strategy to operate sustainably in the future.

The Adelaide-based rowing club has promoted amateur rowing at all levels for over 110 years and boasts over 150 members, from beginners through to Olympians. It has also spent several years considering a solar installation, which will now become a reality thanks to a \$5000 grant as part of Adelaide City Council's Sustainable City Incentives Scheme.

The Redback system was selected over several other options by solar installer Keystones Solar Group. According to Keystones Partner and Consultant Ross Hendry, "We chose Redback's system because it is upgradeable for future innovations.

"Its features enable the club to optimise self-consumption, it is easy to install, integrates with the battery technology we selected and qualified for the Adelaide incentive scheme."

Launched in October 2015, the Smart Hybrid Solar Inverter System is based on the Microsoft Azure IoT Suite. Mike Haines, general manager of sales and



Ross Hendry and Adelaide Lord Mayor Martin Haese

marketing at Redback, said the product will "remain relevant no matter the innovations that develop down the track".

"Redback is building the infrastructure for the next-generation grid, investing in an upgradeable solution that places the power in the hands of Australians who generate it and giving them control over how it's used," he said.

City of Adelaide Lord Mayor Martin Haese, who was instrumental in initiating the Sustainable City Incentives Scheme, said the initiative is "all part of our

ongoing commitment to make continuous availability of carbon-free renewable energy a reality".

"The Torrens Rowing Club, Redback Technologies and Keystones Solar Group partnership is contributing to the community reduction of carbon emissions and is a great example of how adoption of emerging technologies in renewable energy can have a big impact," he said.

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Compostable food packaging trialled in Christchurch



An environmental trial that took place in New Zealand in February has proved successful, with 61% of waste from three major summer events diverted from landfill. The trial was conducted by Christchurch City Council, in partnership with sustainable packaging business Ecoware, with the goal of maximising the positive environmental, social and economic legacies from events held in Christchurch.

"We started this trial as part of our program to run more sustainable events," explained Christchurch City Council Manager Events and Arts Karena Finnie. "It was a huge undertaking, with more than a year's work going into finding manufacturers and suppliers of a compostable product, providing education workshops for food vendors, organising the dozens of waste sorters at the event, and educating the public on what we were trying to do."

Three major events were selected for the trial — the Night Noodle Markets,

Sparks and the Christchurch Lantern Festival — which attracted a total of over 190,000 people to Hagley Park. Food vendors at these events were required to use Ecoware's fully compostable utensils and packaging, which had previously been approved by a local composting facility and the council.

"Until now, we have not been able to put packaging and cutlery in the green bin or even recycling because they contain plastic coatings," said Finnie. "In Christchurch our recycling and composting facilities don't currently accept products with a plastic coating. We wanted to trial a range that didn't have a plastic coating and see just what difference it would make to the amount of waste going to landfill at events."

The results find that the Sparks event was the most successful, with 75% of its total waste diverted from landfill (compared to 51% last year). The Christchurch Lantern Festival had 58% of waste diverted from landfill (up from 22% last year), while the Night Noodle

Markets had 61% of waste diverted from landfill. An average of 61% of waste from the three events was diverted from landfill over the three events, which equates to 12 tonnes of packaging.

"It has been a huge success — in the case of one of the events, the amount of waste diverted from landfill more than doubled this year," said Finnie. "We had fantastic feedback from the public in terms of their support for what we were doing."

"Of those who completed surveys at two of the events, 89% of respondents thought that environmental sustainability initiatives at events were good, and importantly, 33% of those who were aware of the trial said that seeing it in action would change their recycling and composting behaviours at home."

Christchurch City Council is now looking into phase two of the trial, with around 30 events over the next 18 months set to use the compostable packaging.

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Rooftop solar comes to Ronald McDonald House

A gift has been delivered for the families of sick kids in western NSW thanks to the donation of a rooftop solar installation at Ronald McDonald House in Orange by four solar energy companies.

Since Ronald McDonald House Orange opened its doors in April 2015, more than 165 families have made the house their home while their child is receiving treatment at Orange Health Service; prior to this, families had to provide their own accommodation. The house is in operation 24 hours a day, seven days a week.

Now Trina Solar, Tigo Energy, Solar Juice and Dynamic Solar have come together to provide the house with an 8.32 kW grid-connected solar system worth \$24,000. The project is being led by Dynamic Solar, based in the nearby village of Lucknow and operated by Craig and Leah Tinson.

"Leah Tinson from Dynamic Solar has been the driving force behind the project and has been instrumental in bringing all the companies together for this important contribution to our community," said Ronald McDonald House CEO Rebecca Walsh.

The project sees Trina Solar supplying the solar panels, Tigo Energy the DC optimisers and Solar Juice the SMA inverter home manager, energy meter and rails. All installation is being carried out by Dynamic Solar, also the designer of the system.

"The installation of the solar panels will make a marked difference to our electricity costs and energy efficiency," Walsh said.



Left to right — Craig Tinson, Dynamic Solar; Rebecca Walsh, General Manager of Ronald McDonald House Orange; and Harry Chani, Solar Juice.

"It is expected we will save thousands of dollars a year in power costs, which can now be redirected to services to support our families on a daily basis."

Trina Solar

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How to create a 21st-century city

James A Moore, Principal, Jacobs



What ideas and approaches are proving successful around the world when creating a 'great 21st-century city' and what can Australia learn? James A Moore, Principal, Jacobs, was recently challenged with this thought-provoking question for a presentation at a recent Sydney conference. In this article, he explains what he answered.

Even leaving aside the issue of defining a 'great city', generally, or a '21st-century city' in particular, this was an interesting challenge.

Cities around the world vary significantly by geography, climate, history and economy, as well as social, cultural and political contexts. On the other hand, there are constituent issues and problems that all cities grapple with — moving people and goods; housing; matching services to needs; planning for growth; and more.

My presentation spoke to 10 broad 'themes' winnowed from an initial list of almost 20, as certain items seemed to be more generally or widely applicable. They are not presented here in any particular order, nor are all given equal emphasis by the cities applying them. In addition, at the end, I highlighted an emerging 'big idea' — the ongoing fascination with the 'smart city'.

1. Work with nature

Cities can no longer afford to ignore, let alone destroy, their natural settings. Events such as hurricanes, floods and droughts, as well as the emerging impacts of climate change, are pushing cities to recognise the need to respect and work with their underlying ecosystems. This is particularly evident in two emerging movements — the push for resilience and the increasing use of green infrastructure. Optimally, both of these lead to situations in which urban systems and underlying ecosystem services begin to align.

2. Use infrastructure to organise the region

For too long, cities and the residents of cities have regarded infrastructure primarily as a service provider. This is particularly true of transport, which is viewed fundamentally as a way of moving large numbers of people. But infrastructure, especially transport, comprises the essential structure of a region. Optimise



Walking is the most ancient, accessible and affordable mode of mobility. Almost every trip we take begins and ends with a walk.

places that have significant capacity and downplay places that don't. Put more people and uses around stations and access points, and fewer people and uses further away. Provide multiple forms of transport, interconnect them and optimise their capacities. Approach the region as a hierarchical interconnected network of services rather than as a set of extensive but effectively disconnected systems.

3. Develop around anchor institutions

Historically, cities emerged around major functional, social or civic institutions: harbours, factories, government buildings and churches. The dominant institutions of the modern world are often private or non-profit, focused on 'knowledge industries' such as education, health and/or research — universities, hospitals, labs and other 'creative' industries. Historically, these uses have not engaged with their surroundings, but increasingly cities are recognising these and other 'high-tech' entities, including corporations, as the 'innovation engines' that power the 21st-century economy.

4. Mix uses

Our day-to-day activities are inherently about a mix of uses — residential, commercial, retail, civic and recreational. This should be reflected in the organisation and character of our cities. The unnecessary segregation of our lives and our physical environments is inefficient, ineffective, costly and time-consuming. Our lives are mixed-use; our cities should be as well — both horizontally and vertically.

5. Provide a wide range of residential options

The demographics of cities are becoming increasingly diverse — ethnically, culturally, socially and institutionally. In many cities, however, there may be only three

or four widely produced options for new housing: high-rise condos or apartments, single-family houses, mid-rise apartments. The inherent diversity of cities should be reflected in a diversity of housing types. This includes studying the very rich history of 'missing middle' residential types found in most cities (19th-century terrace housing in Sydney, for example), and figuring out how to reproduce them under today's conditions.

6. Make places walkable and bikeable

Walking is the most ancient, accessible and affordable mode of mobility. Almost every trip we take begins and ends with a walk. Biking is the most energy-efficient form of human movement. In dense, mixed-use urban environments, a walk or a bike ride is often ideal to get from one venue to another. Both modes are very good for people's health. Both enable extremely high levels of interaction with one's community. Both thrive in environments that have been designed and set up to support them.

7. Create dynamic, attractive and safe public places

Most people today spend far too much time indoors. They need excuses to go outdoors, and great public spaces provide reasons to do so. However, the goal is not simply to provide outdoor space but to create well-designed civic 'places'. These places need to be accessible — near at hand and easy to get to. They need to be safe. They need to be comfortable. And, ideally, they need to be exciting, or at least interesting.

8. Rethink streets

Streets are the largest form of publicly owned space in every city, often accounting for a third of the overall area. This land should not be dedicated only to motor vehicles. Look to take back all, or parts,

of street right-of-ways, where possible. Design future streets as 'complete' systems providing equitable facilities for pedestrians, bikes, transport and cars. Treat the street as a civic place, as well as a utility.

9. Insist on high-quality physical design

The denser the environment and the closer we are together, the more imperative good design becomes. At the pace of an automobile, details get blurred and lost. At the pace of the pedestrian or even the cyclist, details resonate. Think of everything in the city, particularly those items and places most easily seen and used, as an opportunity to provide high-quality physical design.

10. Program cities for success

Recognise that cities are not just hardware. They are also the myriad daily, weekly and seasonal activities that take place within them. Formal, quasi-formal or even informal activities that give cities life and vitality often need to be deliberately planned, organised, programmed or sustained. Make sure the urban hardware has the necessary software to function optimally.

As mentioned, my presentation ended with a brief discussion of the smart city, an idea that is being pursued avidly by private corporations and municipalities, worldwide. As with many emerging topics, there is little agreement yet as to what a smart city is and few comprehensive examples of such ideas in operation. While the discussions surrounding the benefits potentially inherent in this new ideal are both stimulating and substantial, in ways, they echo the rhetoric of urban theorists and transportation engineers after the Second World War, a period in which the headlong pursuit of new ideas and untested theories arguably did as much damage to cities as good.

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The product has no metal electrode on the front of the module, but has 30 multiribbon busbars at the rear of the module. This also allows the panel to perform at a higher efficiency when the temperature is higher.

The unit has shown stable performance in the internal damp heat and thermal cycle test, which are two times longer than IEC standard. With its reinforced frame design, the panel can endure static front load up to 6000 Pa and rear load up to 5400 Pa, which is twice the wind-load of standard panels.

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The major industry sectors are utilities and public works, oil and gas, natural resources, government, engineering and construction, healthcare, manufacturing, biotech and pharma, transportation and logistics.

The product range includes a mobile phone app, man-down devices and a combination of gas-detection/man-down devices.

Thermo Fisher Scientific
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PARTICLE SENSOR

Honeywell has announced a particle sensor designed to help building owners and consumers monitor the air for potentially harmful particulate contaminants caused by dust, soot and smoke.

The HPM series particle sensor is designed to work in heating, ventilation and air conditioning (HVAC) systems, and consumer products such as air purifiers, to measure air quality in homes, buildings and public spaces. It uses laser technology to monitor for fine inhalable particles that are $2.5\text{ }\mu\text{m}$ in diameter or smaller. It can be used in a range of consumer products such as air purifiers, automotive air systems and mobile air quality detectors.

The sensor outputs an electrical signal that can be fed into HVAC control systems in buildings and homes or into other air monitoring devices. This information can alert building operators that air purification systems should be activated or if outdoor air could be used to improve indoor air quality, or when an air filter needs to be changed or early maintenance should be performed on indoor air delivery systems.

The laser-based sensor uses a light-scattering method to detect and count particles in the concentration range of $0\text{--}1000\text{ }\mu\text{g}/\text{m}^3$ in a given environment. The sensor then analyses the particulate size and concentration in real time to enable systems to provide alerts and allow operators to take remediation actions.

With its heavy industrial-level electromagnetic compatibility, the sensor performs in harsh, challenging environments. Building operators benefit from the sensor's long life of 20,000 h, which allows for stable operation and continuous use.

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The BioAmp biological wastewater treatment system, from NCH Australia, combines microbiology and engineering. FreeFlow tablets and the BioAmp system work together as a successful remediation program.

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The system is suitable for industries such as hospitality, food and beverage, and commercial/retail/entertainment facilities. Foul odours throughout the drain network are also eliminated, along with any high reading of FOG that exceeds permitted levels.

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The product consists of a flat diaphragm (magnetically permeable) supported between two coils which produces a magnetic field when an AC excitation is applied. The opposition to the lines of flux (called the reluctance) is determined by the air gap present between the two coils and the diaphragm. The coils are wired electrically as an inductive half-bridge.

Built with flexibility in mind, it provides wet/wet differential measurements and accepts liquids and gases on both sides of the diaphragm. In addition, a small internal pressure cavity volume ensures fast response to pressure variations.

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The MULTICAL range of smart energy meters, by Kamstrup, is used to meter and submeter water and thermal energy use in large residential and commercial buildings.

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Using the power of ultrasonic sensors, 3G communication, dynamic dashboards and fullness level alerts, Smartsensor has been created to provide users with deep insights to every rubbish bin deployed in an area, town or city.

Features include: reduce both time and cost in waste management; know the fullness level of all bins, at every moment; monitor rubbish bins and plan routes, no overflowing bins; send up-to-the-minute reports and directions to drivers; comprehensive reporting and analytics tools; software as a service, cloud hosted, scalable and secure; access detailed and historical reports; access from any web-enabled browser or via the app; and Australian-based support and help desk.

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Compressed air – is it a sustainable power source for industry?

With the rapidly rising cost of electricity, the answer to this headline question is complicated, with many variables affecting the real efficiencies relating to cost versus application.

Most industries in Australia and throughout the world rely on compressed air as a major source of energy to operate equipment such as pneumatic controls, air tools, pumps, valve actuators, pistons and large-scale processes. Compressed air is used because it is a clean, safe and convenient energy source, but compressed air is also an expensive energy source. In fact, approximately 10% of the electricity supplied to Australian industry is used to compress air.

The continued effectiveness of compressed air as an industrial power source lies in today's technological advances in compressor design, control methods, reticulation design and the maintenance of

systems to ensure optimum operational effectiveness.

In existing installations, we need to completely and accurately review and assess the efficiencies in the compressor itself and ancillary equipment in relation to the nature of the demand. Today's systems need to be flexible and adaptable to meet current and future requirements.

Below are some questions that should be asked in order to optimise the efficiency of your compressed air system:

Is compressed air the most efficient power source for the application?

Analysis of the cost per application needs to be determined to identify the most cost-effective and efficient method of running that

process. Compressed air may not always be the optimum solution. For example, today's rechargeable, battery-operated power tools are in many cases more convenient and cheaper to run than compressed air equivalents.

Is the system supplying the minimum appropriate air pressure for the required task?

Use of the minimum appropriate air pressure for the required task can save considerable energy as the work required to compress air is a factor of both pressure as well as volume. Many procedures do not require air at the maximum pressure that the compressed air system can produce. Delivering a higher than necessary pressure results in excessive energy use, excessive equipment

compressed air



wear, artificial demand and higher, long-term maintenance costs.

Are there leaks in the system?

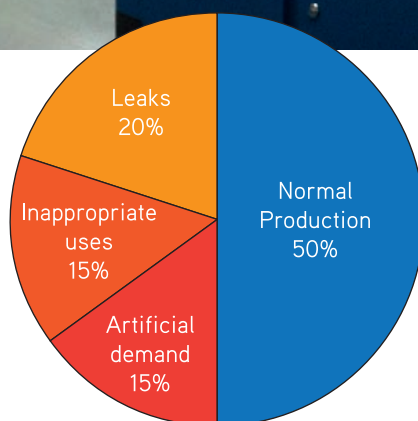
Up to 50% of generated air is frequently lost through leaks. These leaks not only waste energy, but they can also make the compressor work harder to meet the higher demand. This can shorten equipment life, increase maintenance needs and create unnecessary downtime. A proactive leak repair and maintenance program will help to maintain system efficiency and can significantly reduce energy consumption.

Can the air be varied?

In situations where demand varies frequently and rapidly, variable speed drive control (VSD) allows the compressor to automatically adjust its output to meet demand. This minimises energy usage proportionally with demand, which can result in significant power cost savings.

Can pressure drop be reduced?

A typical system should maintain a pressure drop of less than 3% between the compressor's output pressure and the point of use. Pressure drop occurs due to friction throughout the reticulation system and is generally a result of poor system design. Unnecessary bends and small capacity piping also cause friction. Improving the layout, increasing piping diameter and



Inefficiencies of compressed air systems.

installing smooth bore piping can greatly lower friction and minimise pressure drop. Reducing operating pressure by 100 Pa will save around 8% of required input power.

Are system ancillary components doing their job?

Ancillary components such as coalescing filters, air dryers and moisture separators should be specified and installed to match the air quality requirements for the application, otherwise contaminants such as water, dust, dirt and residual hydrocarbons can cause damage to system components and can also cause product spoilage.

Is an adequate preventive maintenance program in place?

Regular checks and maintenance of compressed air systems are essential for continued efficient operation and minimisation of

downtime. Like any other piece of expensive machinery, well-maintained systems will give the user many more years of operating life with lowest possible cost. Leading suppliers offer tailored maintenance programs to suit individual customer needs.

Is it time to upgrade the system?

With great advances in compressed air technology today, there is a wide choice of compressor type and size to fit every application; however, it requires expert assessment to match a compressed air system to cater for a given application and ensure it will provide for current and future demands.

New compressed air systems

Much of the criteria as applied above to upgrading an existing system must also be applied to the selection of a new system installation to fit a specific or varied task. Installing the right compressed air system for your particular application is fundamental to minimising the cost of energy. There's a lot to consider when selecting and installing the right compressor. What volume flow rate output do you need? Should we install one or multiple compressors? Is a single- or two-stage compressor right for the task? What discharge pressure do you require? Do you have a fixed or varying demand? Do you want a compressor that will cater for future growth?

Selecting the right system or upgrading current systems to more sustainable levels of power usage can, in many cases, be cost negative when consideration is given to the energy cost savings achieved.

Southern Cross Compressors (Australia) can provide Australian industry know-how and service with the latest innovations in products covering every conceivable compressed air need. It also provides a free compressed air assessment service to recommend the right system or upgrade to achieve your specialised needs. In many cases where the existing system is running inefficiently due to leakage, restriction and or wear and tear, the company can clearly demonstrate the savings to be achieved through repair or upgrading of the system.

Southern Cross Compressors (Australia) Pty Ltd
www.southerncrossaircompressors.com.au

ELBOW FLOW CONDITIONER

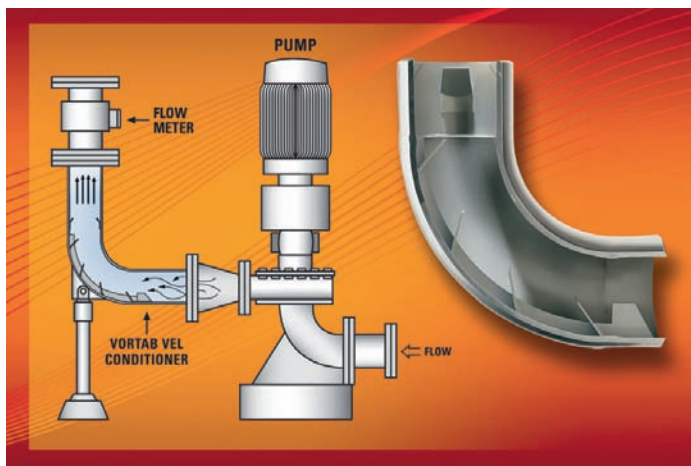
Process and plant engineers who can't find room for the recommended straight pipe run required by liquid flow meters in their municipal water treatment plant retrofit projects will find the Vortab Elbow Flow Conditioner eliminates the problem by removing swirl and asymmetric velocity profiles caused by pumps, valves and other equipment placed too close to the meter.

The flow conditioner nearly eliminates flow meter upstream piping requirements by conditioning the flow stream into a flow regime, mimicking adequate straight run. In addition to conditioning the flow stream, the 90° angle tab-type flow conditioner eliminates the pipe cost and technician labour for the 5–10 upstream and 3–5 downstream pipe diameters required by many types of flow metering technologies.

The product isolates the flow irregularities and conditions the flow stream into a swirl-free and symmetrical velocity profile. Swirl reduction and velocity profile correction occur naturally in long lengths of straight pipe due to diffusion and turbulent mixing. Vortab's anti-swirl and inclined vortex generating profile correction tabs, projecting from the inside pipe surface, generate vortices that accelerate these natural pipe effects to create a uniform, non-swirling, symmetrical flow profile in a shorter section of pipe.

The simple, flexible design provides a solution to crowded installations for flow meters and other critical process equipment. Vortab provides effective flow disturbance isolation, low pressure drop and claims to be the least affected by fouling of any of the flow conditioners available.

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AUSTRALIAN INDUSTRIAL ECOLOGY CONFERENCE

2017 | 6 - 8 September 2017
Crowne Plaza Hunter Valley

*"Innovation, materials
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circular economy"*

aien.com.au/conference

The Australian Industrial Ecology Conference aims to highlight industrial ecology projects currently being implemented and to inspire innovation in Australia.

Government, industry and individuals will be able to learn, network and discuss practical outcomes and solutions for managing resources in an open forum with like-minded and interested companies and individuals.

Registration opens June 2017. Further details at aien.com.au/conference

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EVENT DETAILS AT A GLANCE: foodpro 2017

16–19 July 2017
International Convention Centre
Sydney, Darling Harbour
Register online: foodproexh.com



Waste management at foodpro 2017

2017 is certainly proving an auspicious year for the food manufacturing and processing industry — global changes are affecting the way we work, 'new age' technologies like 3D printing are becoming the norm and the issue of food waste is ever more perennial with each day.

2017 is also the 50th anniversary of foodpro, the food processing and manufacturing industry event that has been serving as a meeting place and opportunity for industry members to network and engage for decades. This year's event, set to be the largest ever staged, will host over 360 exhibitors while also providing education content.

One business showcasing its latest innovations is CST Wastewater Solutions, with its GWE anaerobic digestion technologies on display. The technologies extract biogas from food, crop and livestock processing wastewater streams to simultaneously raise water quality while generating methane to replace fossil fuels such as coal and gas used in production processes.

Along with the extensive range of exhibitors across the show floor, a line-up of education opportunities also provides reason to attend the foodpro 2017 event. Ron Cotterman of Sealed Air continues the theme of waste challenges, speaking about taking action to tackle food waste challenges.

One-third of all food produced — nearly 9 million tonnes — ends up in garbage bins across Australia and New Zealand, only to make its way to landfills where it rots and emits greenhouse gases. It's a shocking trend that this level of waste has continued to grow in recent decades and has reached unprecedented levels with enormous implications for business, for the environment and for society. To address the issue of food waste as it impacts our future, the environment and the long-term profitability of our industry, Sealed Air commissioned a two-year study to capture both consumer perceptions about food waste and food loss results within the retail environment. For the first time, recently collected results for Australia

and New Zealand will be presented; key findings will be compared and contrasted to a comprehensive global survey of 11 countries spanning four continents.

The conclusions from this research provide valuable insights on how to help ignite and guide the development of food waste prevention and sustainability strategies across the food supply chain. Results demonstrate a clear business case for food brands and grocery stores to not only manage food waste, but to prevent food waste from occurring in the first place while improving their own customers' retail experience.

Clear action steps are identified that leverage innovation, education and collaboration to bring sustainability benefits to consumers. Discussed are practical solutions, based on food packaging, storage and distribution, that can be implemented to reduce the economic, environmental and social costs of food waste.

Seminar topics, such as the integration of hygienic drainage systems into food processing designs; gaining more refrigeration capacity while using less energy; and a look at how technology has advanced mobile robots and how they can improve food processing, are just a few others on offer.

The event co-locates with the annual AIFST (Australian Institute of Food Science and Technology) Convention. Over 600 delegates are expected to attend the convention's 50th year to hear about topics such as the future nutritional needs, technology driving innovation, regulations related to imports as well as a roundtable discussing financing innovation and growth in the food industry.

foodpro 2017 is the event for those in the industry wanting to find out about the latest global innovations and trends, and stay competitive and efficient.



ROTARY SCREW COMPRESSORS

Kaeser Compressors has announced the launch of its latest generation FSD series rotary screw compressors, enabling air cooling of rotary screw compressors for larger drive powers over 250 kW.

The radial fan in Kaeser's cooling system draws in ambient air directly through the cooler without being pre-warmed to ensure optimum cooling performance. FSD compressors can therefore be used in ambient temperatures as high as 45°C. FSD models are also optionally available as water-cooled versions.

The radial fan is integrated into Kaeser's Electronic Thermo Management (ETM) system, which regulates oil temperature to ensure a safe and consistent differential from the dewpoint temperature. With the heat recovery option, a second ETM system assures optimised and even more efficient usage of the available heat energy. This optimised efficiency results from the refined screw compressor blocks equipped with high efficiency and flow-optimised Sigma Profile rotors, achieving power savings of up to 15%.

The screw compressor block is directly driven by an energy-saving motor that operates at a low speed of 1490 rpm. Direct drive not only eliminates the transmission losses associated with gear drive, but also reduces energy consumption, maintenance requirement and sounds levels.

The unit's environmentally friendly fluid filter cartridges no longer have a permanently attached sheet metal housing, but rather are simply inserted into an aluminium housing. The cartridges themselves feature a metal-free design and are suitable for thermal disposal at the end of their service life without additional pretreatment.

The rotary screw compressors are service friendly, with good accessibility to all maintenance components. The user-friendly Sigma Control 2 compressor controller provides additional energy savings, reduced maintenance requirements and compressor availability by dynamically adjusting the flow rate to match actual compressed air demand.

The large display makes it easy to view key information. Including RFID technology assures safety of data and login, meaning service work and system changes to the compressor can only be performed by authorised personnel.

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The circular economy of plastic

A park bench made from beach clean-up waste — this is one of the results of a technology that was designed for the realisation of the circular economy. The technology effectively recovers resources from low-grade plastics, low-value plastics, plastic film and contaminated plastics that in the past were destined for landfill.

A significant component of Moama-based inventor Ross Collins' working life was devoted to developing improved systems and techniques for the recycling of both hard and soft plastics. The PolyWaste plastic recycling technology was his brainchild. He built and commissioned the prototype PolyWaste melter during 2014 and 2015. Sadly, Ross succumbed to illness in August 2016 but his work will be a long-lasting legacy thanks to the team at Newtecpoly Pty Ltd, which is now the sole existing licensee of the technology.

Newtecpoly Technical and Administrative Director Colin Barker said the PolyWaste plastic recycling technology isn't predicated on processing 'waste' plastic in order to emulate a virgin bead, as used in almost all existing plastics manufacturing processes. Rather, he said the technology eliminates the requirement to:

- **Segregate different polymers** — as they are equally useful in the co-mingled state.
- **Shred, wash and dry the input plastic material** — the technology can tolerate comparatively high levels of contamination given the unique mix and melt action distributes contaminants uniformly and

homogenises the blend. In effect, contaminants become fillers in a co-mingled and homogenised plastic matrix.

- **Heat the input plastic material multiple times** — the plastic feed material (including any contaminants) is melted only once prior to being formed into products. This reduces the carbon footprint significantly relative to the footprint associated with other recycling technologies. The products produced using the technology are claimed to have less than 2% of the carbon emissions associated with products produced from virgin polymer and less than 50% of the embodied energy of products resulting from the application of other recycling technologies.

"The technology is not only important due to its lower operating cost and savings in carbon footprint, but also in the realisation of

the circular economy due to its low capital cost and subsequent viability/relevance at a regional and local level," said Barker. "These latter considerations are particularly important for applications in small and/or developing countries/economies."

Newtecpoly has demonstrated many applications of the technology. For example, the company produced the planks for a park bench-style seat, which was made from co-mingled plastic waste



Park bench produced from the beach clean-up waste at Noosa.

collected from Noosa Beach. In conjunction with the Surfrider Foundation – Sunshine Coast, the company donated the park bench to Noosa Council on the weekend of Clean-Up Australia Day 2017.

Newtecpoly has also undertaken work on behalf of the Plastic Police Partnerships pilot program to produce planks from domestic waste. The soft plastic packaging waste was aggregated at the Biddabah Public School (near Newcastle NSW) through the dedication of its staff and students. Once again, Newtecpoly produced the planks from the aggregated waste (with the sponsorship of the NSW Office of Environment and Heritage Sustainability Advantage program) for the manufacture of a ‘buddy bench’ to be located within the school grounds.

The existing prototype PolyWaste melter is of commercial scale and is capable of processing between 3000 and 3500 tonnes of mixed plastic waste per annum. “Given Australia landfills around 1.2 million tonnes of plastic waste per annum, there is no shortage of waste plastic available,” Barker said.

Newtecpoly will additionally be sourcing plastic from municipal waste separation centres, agricultural applications and industrial sources.

As an important element of its licence agreement, Newtecpoly is also required to support future licensees of the PolyWaste technology by:

- undertaking R&D activities and confirming the suitability of their

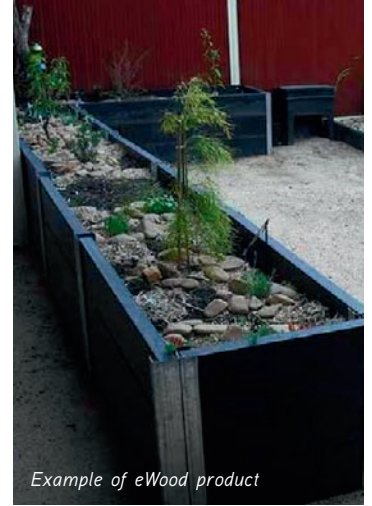
proposed waste plastic feedstocks;

- providing training to its operational personnel; and
- providing ongoing operational and/or technical support.

The PolyWaste technology is one of a raft of disrupter technologies currently being commercialised in Australia. Each technology is exciting as it seeks to maximise the economic/resource value of the hitherto waste stream/component. Each technology has had the input/involvement of one or more of the NSW Office of Environment and Heritage, the Australian Industrial Ecology Network (AIEN) and the Business Innovation Group (BIG Enviro) in their development.

Barker said the AIEN is expecting to showcase the PolyWaste technology among the presentations scheduled for its ‘Circular Economy’ themed conference scheduled for the NSW Hunter Valley between 6 and 8 September 2017.

Newtecpoly also makes a plastic wood product called eWood. It is made in Moama using recycled materials from a variety of mixed plastics previously destined for landfill. These plastics could be sourced from such items as computers, printers, toner cartridges (through Planet Ark), televisions and other electronic equipment.



Example of eWood product

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AWRE returns to Melbourne for 2017



Off the back of a record Sydney show in 2016, the Australasian Waste & Recycling Expo (AWRE) will return to Melbourne from 23–24 August 2017 at the Melbourne Convention & Exhibition Centre.

In recent years AWRE has cemented its reputation as a key meeting place for the wider waste and recycling community to come together and not only discover new business opportunities, but also discuss the direction of the industry and learn more about the latest innovations and technology.

“As well as being a fantastic conduit for the sharing of knowledge and for promoting new technologies, AWRE also provides a unique opportunity for the exhibitors and visitors to make critical contacts and, in a way, test the water, and that has been a major attraction throughout the history of the event,” said AWRE Event Manager Michelle Patterson.

“And that goes for local and interstate companies as well as the international ones. With big names such as Mercedes-Benz, Palfinger, Liebherr and Superior Pak, to name a few, already on board, we are expecting a big show floor in 2017 at the MCEC.”

AWRE 2017 will feature a series of new features and activities that will ensure the expo will once again be a key event for exhibitors and participants in the waste and recycling sector. Industry professionals can now register for free AWRE visitor entry at the event website.

What: Australasian Waste & Recycling Expo
When: 23–24 August
Where: Melbourne Convention & Exhibition Centre
Web: www.awre.com.au

The Internet of Energy

The automation of networks as part of the Internet of Energy has the potential to change the way energy is produced and consumed, said Ilén Zazueta-Hall ahead of her upcoming presentation at the 2017 Australian Energy Storage Conference.

Zazueta-Hall is responsible for advancing technology solutions and software at Enphase Energy, a producer of AC batteries, energy management systems and early pioneer of the microinverter. Similar to the Internet of Things (IoT), she said that automating physical assets can enhance capabilities and could produce a more user-focused business model.

“With the Internet of Things, we saw how connecting physical devices to the cloud to harness additional computing resources can enable automation and enhanced capabilities that are not possible otherwise,” Zazueta-Hall said. “When we apply this same thinking to distributed energy systems, we are creating the Internet of Energy (IoE).”

Zazueta-Hall will be exploring this concept in her presentation ‘Are we ready to roll with the Internet of Energy?’ at the Australian Energy Storage Conference in

June. She said these technological advancements will enhance the use of storage and energy in Australia.

“Solar or solar plus storage systems have the smarts to automate their interaction with the electricity grid with the view of supporting the stability of a national electricity network’s supply and for home owners to achieve a better return,” she said.

“This will create a whole new ecosystem of products or services and potentially redefine the existing relationship home owners have with their utility companies.”

Zazueta-Hall said the industry can learn from other sectors such as the telecom

industry on how to adapt to these technological disruptions and make them beneficial.

“In that shakeout, companies that evolved and learned how to deal with innovation at the network edge thrived. The same will be true with energy.

“The lessons we’ve seen from the rise of collaborative consumption have made an impact on many traditional industries we never thought would be disrupted.”

With a theme of ‘Investment in Australia’s Energy Future’, the conference will feature more than 50 Australian and international speakers presenting on the possibilities of energy storage.

To register for the free exhibition or for more information, visit www.australianenergystorage.com.au.



Ilén Zazueta-Hall, Director of Product Management at Enphase Energy.

What: 2017 Australian Energy Storage Conference and Exhibition
When: 14–15 June
Where: International Convention Centre, Sydney
Web: www.australianenergystorage.com.au



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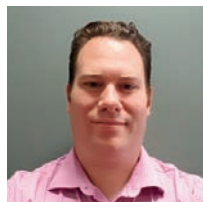
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Renewable Cities Australia Forum

Emergent technologies, plans, challenges and achievements



Professor Ross Garnaut AO.

With some of the world's leading cities planning for 100% renewable energy, the Renewable Cities Australia Forum looks at how to increase clean and renewable energy uptake in Australian cities and towns.

Through the forum's theme of 'Plan, Innovate, Lead', business and government experts will share their plans, achievements and challenges in moving to renewable and innovative energy systems for electricity and public transport.

Across the two-day forum, over 25 speakers will detail the latest technologies and case studies of leadership for going 100% renewable in Australia, sharing their progress and market understanding, challenges and opportunities.

Professor Ross Garnaut AO, chairman of ZEN Energy Technologies, and the Right Hon Martin Haese, Lord Mayor of the City of Adelaide, will give the plenary keynote presentations. Dr Stephen Bygrave, executive director of climate change and sustainability for the ACT Government, will meanwhile be speaking on Canberra as a 100% renewable city.

Day 1 themes include:

- Updates from Australian city and business leaders on their progress
- The corporate world's role in growing renewable cities
- Case studies on planning for 100% renewable

Day 2 features the inaugural Electric Vehicle workshop, including:

- EV Council update on the path forward for Australia
- Planning for an EV Future
- Case studies of industry embracing electric vehicles

Key speakers

Professor Ross Garnaut AO is well known to many Australians for his work on climate change. He's the author of numerous influential reports to government (including The Garnaut Climate Change Review) and many books, monographs and articles on international economics, public finance and economic development. A Professorial Research Fellow in Economics at the University of Melbourne, Professor Garnaut has held distinguished high-level positions and chaired the boards of major Australian and international companies and organisations. In 2015 he became chairman of ZEN Energy Technologies, which seeks to integrate optimal combinations of renewable energy and storage to minimise the cost of supplying zero-carbon electricity to Australian users.

The Right Hon Martin Haese has been Lord Mayor of the City of Adelaide since 2014. With an MBA and having lectured for MBA students, Haese has served on several boards and was chairman of the world's largest historic motoring event (The Bay to Birdwood). He believes technology will provide solutions for many of today's problems and opportunities and his immediate goal is for Adelaide to become a smart, green, livable and creative city, and ultimately the world's most liveable city. South Australia plans to have more than 50% renewable energy by 2025.

Dr Stephen Bygrave has worked on climate change for more than 20 years with international organisations, academia, government, community and the non-government sectors

in a myriad of roles. Before he was executive director climate change and sustainability in the ACT Government, Dr Bygrave was CEO of Beyond Zero Emissions. He has led significant Australian climate change initiatives including the mandatory renewable energy target, the carbon price and the National Framework for Energy Efficiency. A Visiting Professor at the Global Change Institute at the University of Queensland, Dr Bygrave has also implemented renewable energy projects in the Pacific Islands and with the OECD (Paris).

"Last year's forum enabled both speakers and attendees to share their experiences at informal sessions," said Mary Hendriks, convenor and program manager of Renewable Cities Australia Forum. "Open discussions included the challenges and opportunities in changing to low-carbon systems and enabled new relationships with government, community and business to be formed. With the added benefit of networking drinks at the end of day one, the 2016 event was a resounding success. This year will build on that formula and we are excited with the range and depth of speakers who will present at Renewable Cities Australia Forum."

The Renewable Cities Australia Forum will again be co-located with the Australian Energy Storage Conference and Exhibition and will feature a new Renewable Cities Zone on the shared exhibition floor. The forum will showcase how cities and regions are transforming their energy systems.

What: Renewable Cities Australia Forum

When: 14-15 June

Where: International Convention Centre, Sydney

Web: www.renewablecities.com.au



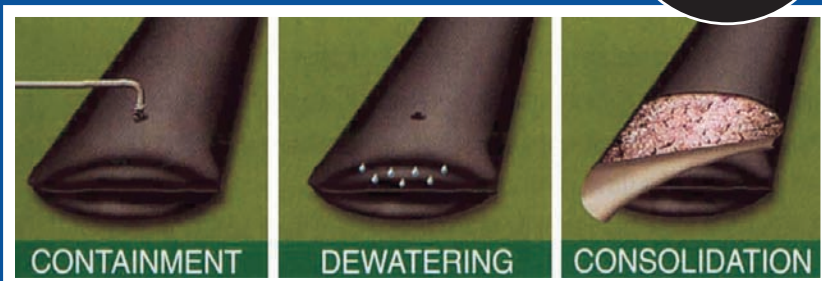
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