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Closing in on
**recycling
targets**

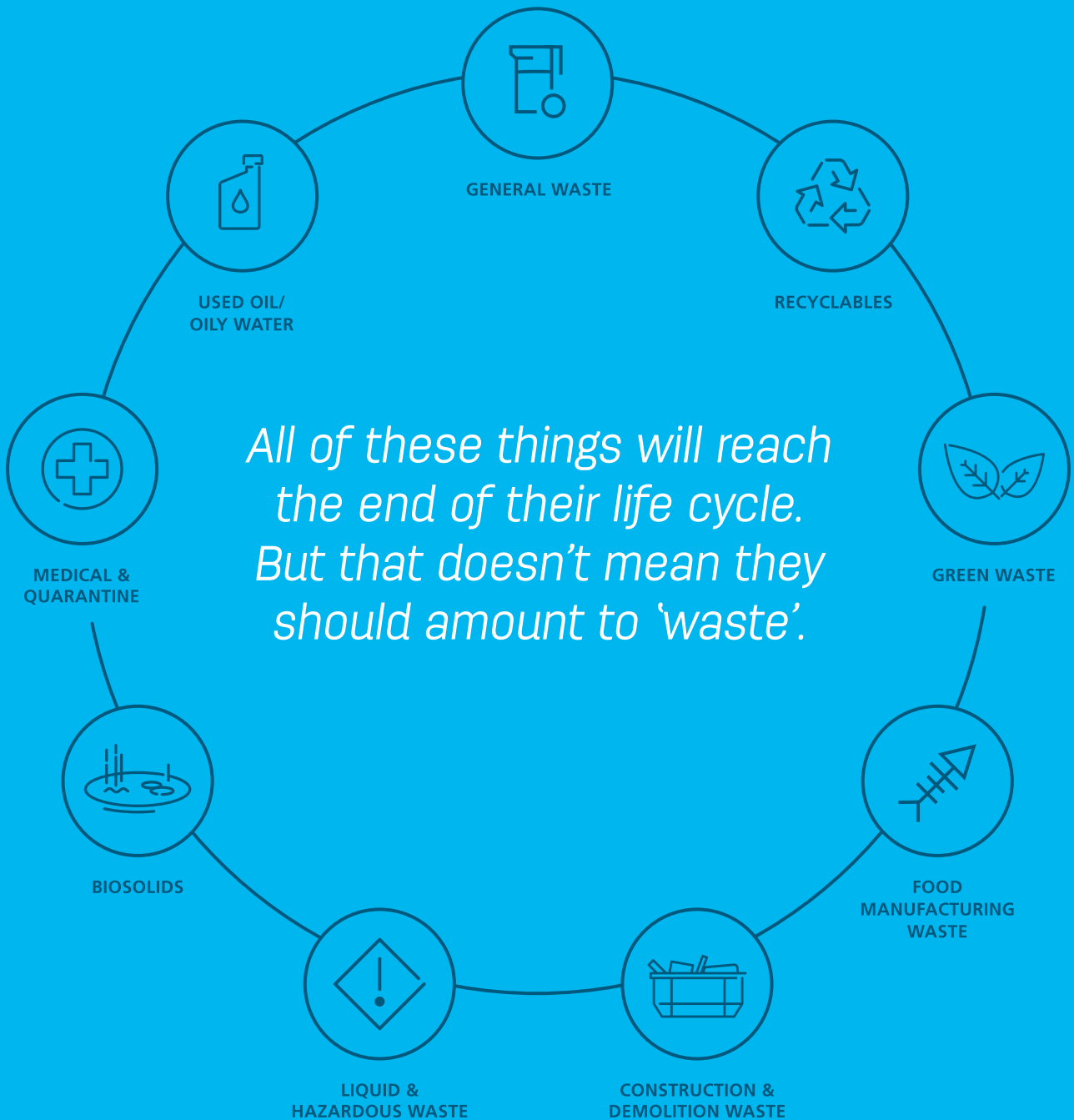
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Renewable integration



Waste management



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WORDS FROM THE EDITOR

Our consumer-driven, fast-fashion-loving, technology-focused society in Australia is driving a need for renewed focus on resource recovery and improving recycling rates. The recycling industry is developing innovative technologies that are capable of recycling and recovering more and more resources, but are government rules and regulations keeping pace? Prior to the recent federal election, the Advocate for the Australian Council of Recycling (ACOR), Grant Musgrove, released a report titled 'Australia is losing the recycling race'. The report said that although Australia is one of the richest countries in the world we don't rank highly in terms of recycling. It recommended government action on a number of issues including recommitting to the National Waste Strategy and enforcement of anti-dumping regulations, among others.

In another separate report by the University of New South Wales, details have emerged to indicate that Australia is also lagging behind on e-waste laws. The report says that in Australia the "management of electronic waste is poorly implemented, lags behind international best practice and is based on outdated recycling targets".

While the results of the federal election don't appear to be too promising, there has been some action on state-based waste levy. Increasing these levies is designed to encourage the diversion of waste from landfill and increase resource recovery. South Australian Treasurer Tom Koutsantonis has announced that as part of the 2016-17 state Budget, the solid waste levy will increase from \$62 per tonne to \$103 per tonne by 2019-20. And some of these funds will be invested back into the waste management and resource recovery industries.

Further details on how Australia can close in on recycling targets are on page 6 and details on some of the latest resource recovery technologies being developed are on page 48.

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We are still a long way from achieving each state government's recycling targets. This article details the key reforms required, as well as the role of government, in order to move closer to these targets.

The landfill price rises are driving resource recovery infrastructure investment.

For most states, the levies are now a significant revenue source. In NSW, the landfill levy raises more than \$600 million per year.

To its credit, the NSW Government has used these funds to establish the \$465.7 million infrastructure and recycling grants program. These funds are granted to private companies and councils (up to \$5 and \$10 million respectively) for new or improved recycling infrastructure.

The NSW levy, combined with the grant funding, is seeding a renaissance in the development of new recycling infrastructure and job creation. Victoria, South Australia and Western Australia all have similar schemes, though at a lesser scale. Tasmania is exploring a \$10/t levy, which in turn may be used to fund future grants.

There are plenty of infrastructure solutions to achieve our aims. The most important infrastructure opportunities in 2016 are:

- organics facilities that convert food and garden waste into compost or energy;
- dirty MRFs to recover recyclables from mixed commercial waste;
- automated C&D sorting platforms;
- energy from waste (EfW), including: pyrolysis, gasification, incineration and anaerobic digestion offering renewable energy solutions;
- processed engineered fuel for export; and
- improved household and business source separation such as 360 L recycling bins, '3 bin systems' for food and garden wastes, resident drop-off facilities and the like.

The most important issue in infrastructure provision is that governments recognise waste as an essential service like electricity or water. The 2016 Infrastructure Australia report on the needs for infrastructure plan-

Closing in on recycling targets

State of waste 2016 - Part 2

Mike Ritchie, Director, MRA Consulting Group





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The most important issue in infrastructure provision is that governments recognise waste as an essential service like electricity or water.

ning and funding did not mention waste/recycling infrastructure once. It is a challenge we must address.

To summarise, the key reforms needed in the infrastructure space are:

- Better and faster planning processes that recognise the need for infrastructure.
- Dedicated waste zoning for infrastructure.
- Protecting buffers around existing facilities.
- Regulation of ‘cowboys’ operating outside industry standards.
- Recognition of the commercial imperative for investors including aggregation of waste supply, long-term contracts, land availability and an approval pipeline.

Without secured long-term waste supply contracts, companies cannot invest the millions in the advanced infrastructure that we need to further drive recovery rates.

If we wait for other forces such as innovation to lower the price below the prevailing landfill cost, then we are going to wait a long time. We must ensure that the market price signals reflect our strategic imperatives. That is the key message to governments and policymakers.

Landfills

While the total number of active landfills in Australia is unknown, Commonwealth Government data indicates there are at least 600 mid to large sites, while there could be as many as 2000 unregistered and unregulated landfills. The fact that we are unsure of the exact number of landfills in Australia requires immediate review. Small, unlined landfills can still have significant localised impacts and probably should be registered as contaminated sites on relevant registers.

For the foreseeable future, landfill will remain an integral part of the product/waste life cycle. Well-managed (best practice) landfills provide safe disposal of residual waste and average 50% gas capture (whole of life).

Many council-owned landfills do not price to cover the full cost of operation

and remediation. Often they have been ‘inherited’ as quarries and don’t include the cost of replacement in their pricing. This ultimately leaves an unfunded liability for residents to pick up. Similarly, the costs of rehabilitation and gas management are often left out of pricing. State governments are coming to the realisation that this needs to be remedied and have started to require landfill full life cost modelling for the setting of gate fees.

Importantly, landfills also provide space for resource recovery. In fact, one of the biggest beneficiaries of landfill levies and grants has been the landfill providers who, by the nature of their business, have land with appropriate licences for recycling.

The key reforms required in the landfill space are:

- Enforcement of minimum operating standards nationally (not just guidelines).
- A landfill accounting protocol (including post closure costs and asset replacement).
- Rationalisation of the small cut-and-fill trench ‘tips’ into well-run regional sites.
- Mandated gas capture for mid-sized landfills (or ERF funding).
- Licensing and registration of all landfills in Australia.

Energy from Waste (EfW)

The Clean Energy Finance Corporation in 2015 estimated that new EfW and biogas projects “could avoid 9 million tonnes of CO₂-e each year by 2020, potentially contributing 12% of Australia’s national carbon abatement”.

Let me repeat that. EfW can reduce Australia’s emissions by 12%. That is not including the recovery of embodied energy from recyclables nor the diversion of organics from landfill. Our agreement under the Paris Commitment (2015) was a 26% reduction in emissions by 2030. The waste and recycling sector could do most of the heavy lifting (at a low marginal cost).



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There are at least 40 biomass energy plants in Australia.

NSW, Victoria and Western Australia have given the green light to EfW via new policies. These generally have three preconditions:

- EfW must not cannibalise recycling.
- Plants must meet high air emission standards.
- Plants must be bona fide energy generators (not just waste disposal).

With the relaxation of state controls on EfW policies we are seeing the emergence of large-scale proposals for incineration and gasification of mixed residual waste. These will act as a competitor to landfill and will further reduce Australia's emissions. Eight large-scale proposals are currently before approval agencies, with many more under development.

It is quite reasonable to expect that EfW will progressively replace landfill as the final disposal option for residual waste. However, this will occur over a 40-year time horizon, not a 4-year horizon.

Jobs

Recycling jobs are largely recession proof. Recycling rates do not generally swing as high or as low as the broader economy and much less than sectors such as mining, tourism and construction.

There are over 50,000 people directly or indirectly employed in the \$14+ billion

waste sector. The more we grow recycling, the more we employ people at an average ratio of 3:1 recycling:landfill. It should be noted that this ratio jumps significantly in some recycling enterprises, with some tip shops achieving ratios of 30:1.

These are green, sustainable jobs covering technical (engineering, chemistry, science), commercial (sales, business) and operational skills. Recycling is one of the few manufacturing sectors still growing in Australia. We need to reinforce its job-creating potential.

Role of government

The role of government (particularly state government) is to clearly articulate where on the 'recovery spectrum' they intend to sit (low-cost landfill and lower recycling rates, or vice versa) and then to develop the appropriate policies, regulations and funding arrangements to make it happen.

It is clear that Australian governments are generally committed to a future of less waste to landfill and more resource recovery. However, there are significant disparities in effort and effectiveness between jurisdictions. Levies range from \$0-133/t in different states and licensing and approval processes are vastly different. Some states are pursuing bans on products, others extended producer responsibility and others grants and incentives.

The National Waste Policy provides an agreed overarching framework. It needs to be dusted off, strengthened and delivered by a partnership of federal and state jurisdictions. Progressive alignment of jurisdiction policy will facilitate reform. But ultimately, market intervention through regulatory or price signals at the state level is needed to drive large-scale reform and therefore to hit state targets.

MRA has worked with businesses and governments across Australia to create realistic waste strategies and action plans. In our experience, most businesses and households support higher recycling rates and somewhat higher landfill levies, but only where a significant amount of the levy revenue is hypothecated to recycling infrastructure and systems.

As one councillor put it to me, "No-one likes paying taxes, but better they be progressive taxes than not. Better that we tax pollution and improve recycling than tax payrolls and increase unemployment."

With that sentiment in mind, we are on the right path. Recycling rates are rising, alternative technologies are emerging, infrastructure is being built and with it jobs and economic returns. However, the fact is we are underperforming relative to state target expectations.

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Stormwater recycling project

with a winning design

Design, science and sustainability have come together at a Sydney Park stormwater project. The project has won the Museum of Applied Arts and Sciences category in the Good Design Awards — a prize given to products that have the potential to make a significant improvement to the quality of health, wellbeing or the environment.

The City of Sydney water re-use project harvests and treats up to 850 million L of stormwater from Newtown's Munnii Street catchment each year. The water is used to irrigate the 44-hectare parkland and supply water to a neighbouring depot.

The elevated terracotta pipes that release the cleansed water into the park's main pond are now a popular waterscape feature for visitors.

Under the water harvesting plan, stormwater is captured, stored and then treated to deliver a new sustainable water supply to the wetlands, Sydney Park, and potentially for nearby industrial use. There is also potential for other water users across the local area to access the clean water.

The \$11.2 million Sydney Park upgrade was co-funded by the City and the federal government. Work included:

- diverting stormwater through underground pipes;
- filtering water through a pollutant trap and series of bio-retention beds;
- revitalising the park's wetland system

to increase storage and improve water filtering;

- landscape improvement to create more recreation and play opportunities;
- connecting wetlands via a picturesque series of water cascades;
- improving the footpath network;
- installing new lighting, seating and picnic areas;
- installing a dog water station to keep dogs away from the wetlands and give them somewhere to cool off;
- installing an artwork comprising a series of elevated terracotta channels that reflect the site's history and aerate and distribute water throughout the wetland system; and
- providing information to park visitors about the water treatment and ecological function of the wetlands.

"This is the City's biggest environmental project to date and brought together design, science and sustainability to create a significant new piece of green infrastructure," the Lord Mayor said.

"It not only improves overall water quality and habitat, it also educates residents and visitors on the importance of water

management by allowing park visitors to connect to the concept of water capture and cleansing in a beautiful setting."

Director of Museum of Applied Arts and Sciences, Dolla Merrillees, called the Sydney Park water re-use development a ground breaking project.

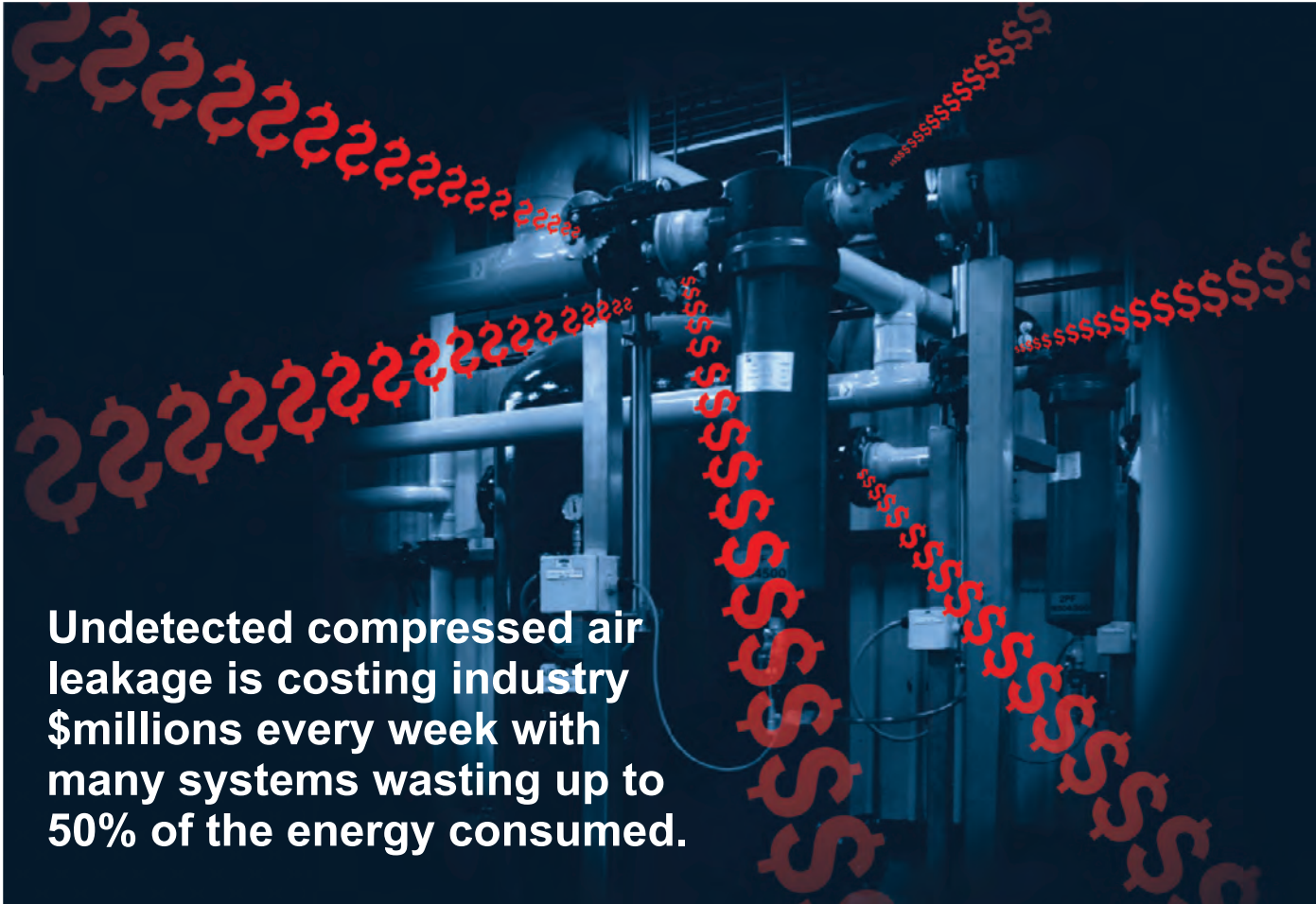
"We have selected a project which highlights important contemporary issues such as sustainability and social innovation, and addresses the increasingly critical issue of our natural resources," Merrillees said.

"This community-focused project illustrates how Australian designers are successfully responding to 'real world' problems, by planning our future cities and urban environment with a sense of social responsibility and purpose."

The City's water reuse project brought together Sydney firms Turf Design Studio, Environmental Partnership, Alluvium, Dragonfly and Turpin+Crawford Studio, who completed the two-year project in October 2015.

The project plans will be displayed in the Success and Innovation gallery at the Museum of Applied Arts and Science at Ultimo.

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Soil moisture monitoring for olives

Olives are a hardy, drought-tolerant crop that recovers quickly from water stress. So why use soil moisture monitoring on olives?

Californian research has shown that when

irrigation is applied above that of rainfall, olive and olive oil yields increase significantly.

It is not enough to have the trees survive for a business to do well. In drought

scenarios, like those currently being experienced in California, efficient application of water maximises the benefit of irrigation for olives.

Soil moisture monitoring with wildeye can help determine when irrigation is required

to minimise stress and maximise yields. The service uses crop and soil data from the Food and Agriculture Organization of the United Nations and the US Department of Agriculture to guide the placement of probes and give an estimate of your soil's water-holding capacity. The online and up-to-date graphs allow growers to make decisions about when to apply just enough water to fill the rootzone and minimise drainage.

Californian research also suggests that replacing up to 0.75 times evapotranspiration will result in maximum yields for olives. However, for oil production, reducing total irrigation applied by a further 30–40% results in oil that has a better balance of pungency and bitterness, has pleasant fruitiness, holds both ripe and green character, has more complexity and depth and boasts higher polyphenol content.

Grower John Copeland of Rancho Olivos in the Santa Ynez Valley installed a wildeye in August 2015.

"The unit is working great," Copeland said. "Wildeye really helps me keep an eye on our orchards and when to irrigate. We have experienced quite a lot of wind, which can quickly dry out the trees."

Maintaining good soil moisture is critical in three growth stages of most fruit trees. These include spring when the trees are in bloom, flowering and fruit set, then again during fruit ripening. When Rancho Olivos olives were in bloom, Copeland noted, "It is great being able to keep the trees from becoming stressed, and knowing when to provide them with a drink of water is extremely important at this point."

At the end of harvest, Copeland commented, "Our harvest has been a good one. Keeping track of the soil moisture has been really helpful during this part of the drought. It has helped us manage our water use more efficiently."

Outpost Central

www.outpostcentral.com



Wastewater plant to be powered by veggie scraps

NSW Minister for Primary Industries, Lands and Water Niall Blair has announced a trial to turn food waste into renewable energy to help power the Cronulla Wastewater Treatment Plant — claimed to be the first of its kind for a utility in Sydney.

The three-year trial will see seven local fruit and vegetable retailers contribute their food waste, to be collected by contractor Pulpmaster. The trial is being jointly funded by Sydney Water and the Office of Environment and Heritage's Sustainability Advantage Program.

treats and stabilises the solids in wastewater. The biogas allows Sydney Water to produce electricity, which is used to power the wastewater treatment plant.

"Adding food waste allows us to increase the amount of biogas and thus increase the amount of self-generated electricity produced," said Woods. He said Sydney Water expects to have "enough gas to run our 835 kW engine consistently at capacity at Cronulla", thus providing "over 60% of the electricity demand at the treatment plant" — or enough to power a third of homes in Cronulla for a whole year.

"If the trial is successful, we could potentially take more waste and produce more electricity," said Woods.

The trial is part of a push by the NSW Government to "lower the amount of electricity we use from the grid, not only to benefit the environment, but also to reduce operating costs of utilities and lower customers' bills", said Blair.

"Not only will the food waste help to generate renewable energy to power the plant, it will also save 150,000 wheelie bins of fruit and vegetables per year from landfill — that's 600 wheelie bins a day, five days a week," he continued.

"Fruit and vegetable waste which is typically driven many kilometres away for landfill will also now stay in Cronulla," added NSW Environment Minister and Member for Cronulla Mark Speakman. "This means fewer trucks travelling long distances and a saving of 90,000 km each year."

Sydney Water Corporation

www.sydneywater.com.au



As explained by Phil Woods, energy manager at Sydney Water, biogas is produced naturally as part of the wastewater treatment process. The gas is produced in an anaerobic digester, which

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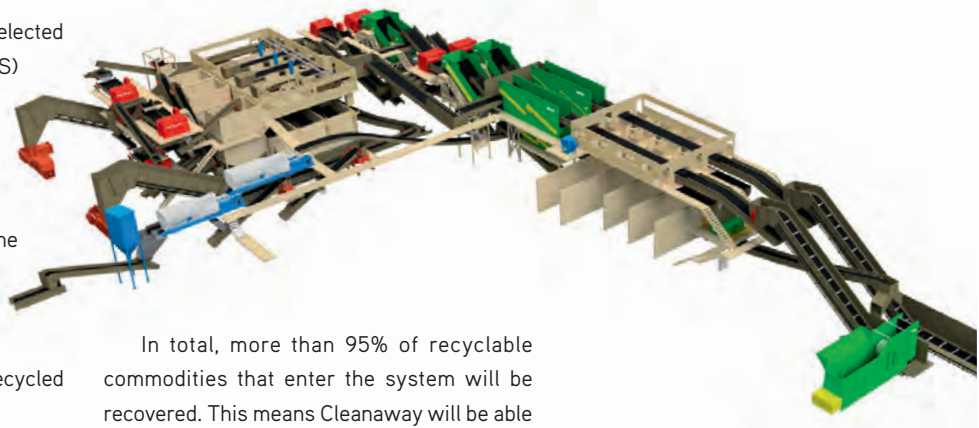
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'Super MRF' to process 50 tonnes per hour

Cleanaway Waste Management has selected US-based Bulk Handling Systems (BHS) to design, engineer, manufacture and install a 50-tonne-per-hour commingled recycling system at the company's new materials recovery facility (MRF) in Perth. The highly automated system applies a variety of recovery technologies to achieve high rates of throughput, increase the purity and recovery of recycled commodities, and minimise labour.

BHS Tri-Disc screens, including Debris Roll Screens, are deployed to quickly remove the material's high glass content, which is then purified by two Nihot Single Drum Separators. NRT optical sorters help maximise end-product quality. Two ColorPlus optical sorters remove any cardboard from the news stream, while six SpydIR optical units target containers to both capture and control the quality of PET, HDPE and mixed plastics.



In total, more than 95% of recyclable commodities that enter the system will be recovered. This means Cleanaway will be able to process more material and recover a higher percentage of recyclables than it is currently capable of achieving with two antiquated systems that will be decommissioned as the new MRF comes online.

"This project will see us replace our existing metro-based materials recycling facilities with a best-in-class 'super MRF', which will deliver a capacity and capability unmatched in the Perth market," said Bhavna Torul, Cleanaway's Perth Metro branch manager.

"This will be a world-class recycling facility providing unmatched capabilities not only for households, but also business and industry," added David Williamson, Cleanaway general manager, Western Australia.

The system is scheduled to begin operations next April.

Cleanaway
www.cleanaway.com.au

Bricks made of butts

Researchers from RMIT University have shown how fired-clay bricks made with cigarette butts can save energy and help solve a global littering problem. Their results have been published in *Waste Management*.

"The disposal and littering of cigarette butts (CBs) is a serious environmental problem," the study authors wrote. "Trillions of cigarettes are produced every year worldwide, resulting in millions of tonnes of toxic waste being dumped into the environment in the form of cigarette butts."

As CBs have poor biodegradability, it can take many years for them to break down. Meanwhile, heavy metals such as arsenic, chromium, nickel and cadmium trapped in the filters leach into soil and waterways.

Now, Dr Abbas Mohajerani and his team at RMIT have demonstrated that bricks with as little as 1% cigarette butt content can cut brick production costs and save the environment. The study represents something of a dream project for Dr Mohajerani, who has wished for many years to find sustainable and practical methods for solving the problem of CB pollution.

"In Australia alone, people smoke about 25 to 30 billion filtered cigarettes a year and, of these, about 7 billion are



Dr Abbas Mohajerani.

littered," Dr Mohajerani said. "This research shows that if just 2.5% of the world's annual brick production incorporated 1% cigarette butts, we could completely offset annual worldwide cigarette production."

Dr Mohajerani's team discovered that adding butts can cut the energy needed to fire bricks by up to 58%. During firing, heavy metals and other

pollutants in CBs are trapped and immobilised in the bricks, reducing problems caused by leaching.

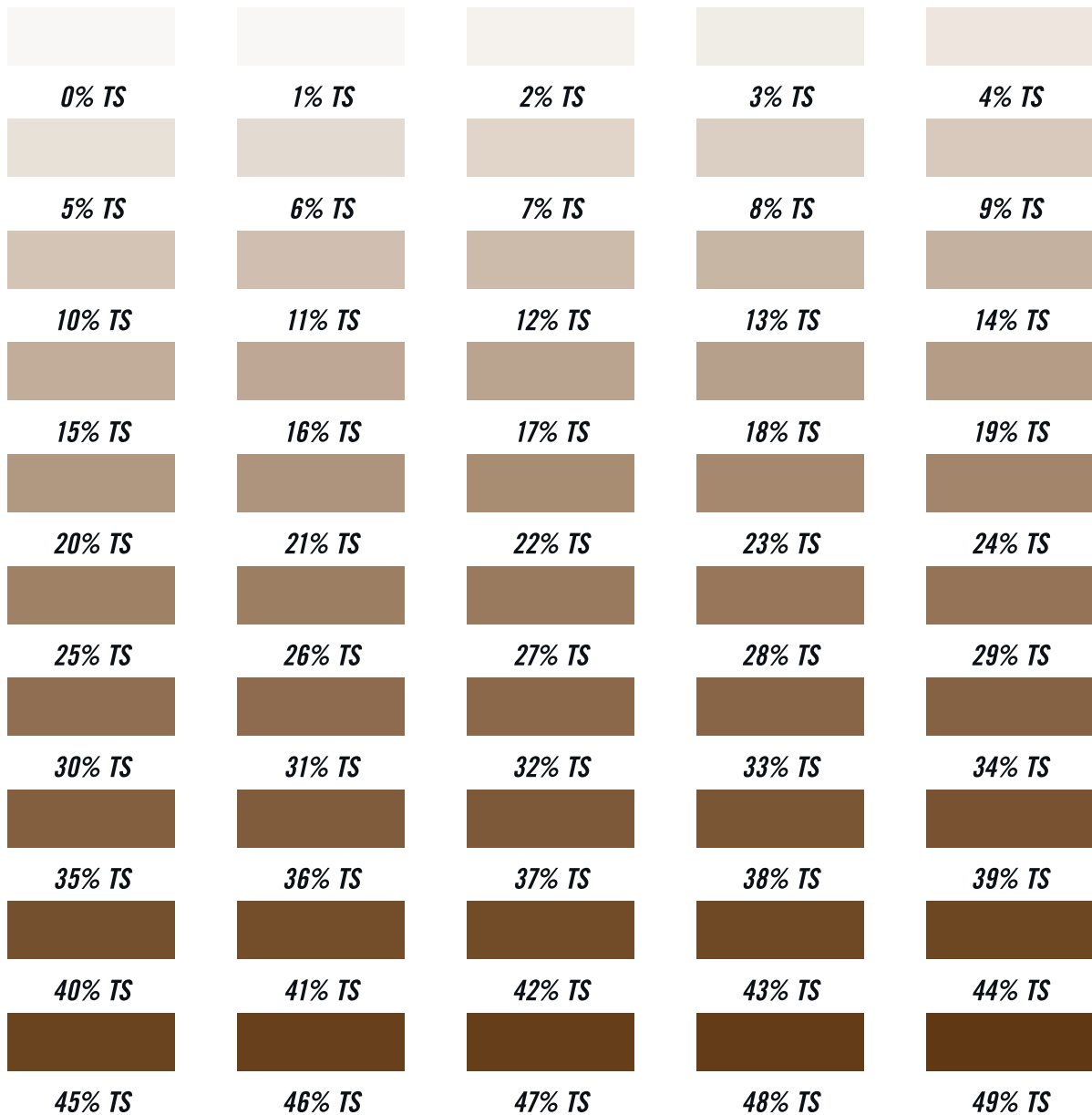
Fired-clay bricks incorporated with CBs were lighter with better insulation properties, meaning reduced household heating and cooling costs. Furthermore, bricks incorporated with 1% CBs maintained properties very similar to those of normal bricks.

"Incorporating butts into bricks can effectively solve a global litter problem as recycled cigarette butts can be placed in bricks without any fear of leaching or contamination," Dr Mohajerani said.

"They are also cheaper to produce in terms of energy requirements and, as more butts are incorporated, the energy cost decreases further."

RMIT University
www.rmit.edu.au

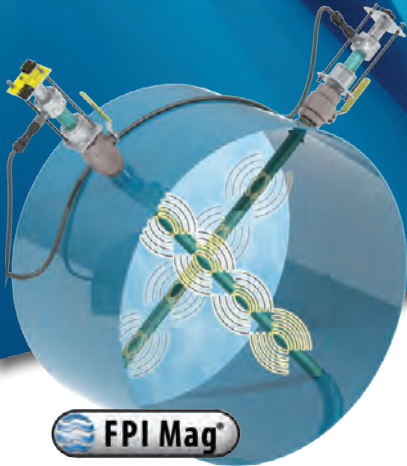
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Environmental impact of pork



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The Pork CRC has conducted what is claimed to be the first comprehensive study using life-cycle assessment (LCA) to benchmark greenhouse gas emissions from pork across the full production system.

Managed by Stephen Wiedemann of FSA Consulting (pictured), the project included emissions from feed production, housing, manure management and meat processing, and assessed 14 production units across different states and different production systems for at least 12 months.

Average emissions to the farmgate were 3.6 kg CO₂-e/kg live weight pork and 6.36 ±1.03 kg CO₂-e/kg wholesale (chilled bone-in) pork. The lowest modelled emissions were from a Queensland production farm using CAP-CHP systems (1.5 kg CO₂-e / kg LW), which is similar to Queensland chicken meat production (1.3 kg CO₂-e / kg LW).



Stephen Wiedemann

Pork CRC CEO Dr Roger Campbell noted that deep litter housing resulted in a 38% reduction in greenhouse gas (GHG) emissions compared to conventional housing, while biogas capture with heat and power generation resulted in a 31–64% reduction in emissions. Outdoor production in Western Australia also resulted in considerably reduced emissions.

“Also interesting was Stephen’s finding that for similar manure management systems, 88% of the variability in GHG could be predicted from differences in HFC (herd feed conversion), making it the most important production-related indicator of GHG emissions,” Dr Campbell said.

Across the farms, HFC ranged from 2.4 to 3.3 on a live weight basis (3.2 to 4.3 on a carcass weight basis) and feed wastage ranged from 5.5 to 7.5% of total feed used. These values represented 15.2 to 20.4 kg of feed lost per 100 kg of live weight produced. Individual units within farms had HFC values approaching 3.8 on a live weight basis.

“These results show that HFC also influences carbon emissions from pork production, so it’s a double whammy when also considering HFC’s profitability upside,” Dr Campbell said. “Clearly, more needs to be done to reduce feed waste and improve HFC.

“Based on these results, and those from Pork CRC’s benchmarking project, some producers have it under control and others have some way to go.”

Pork CRC’s Dr Rob Wilson said such a comprehensive attributional investigation of pork production from major production regions and different production systems demonstrates the potential for Australia’s pork industry to markedly reduce GHG emissions and move towards Pork CRC’s goal of 1 kg CO₂-e/kg LW.

On the road to a clean energy future: the integration of renewables into the grid

Simon Mouat, Vice President of Energy for Schneider Electric

Our most common and longest-running forms of energy — coal, oil, and gas — have effectively powered industry and civilisation for over 100 years. But as we know, these resources aren't finite and the unprecedented rate at which they are being released from the ground is breaking the delicate balance of our planet's climate.

To lower our impact on the environment and to secure an energy supply for generations to come, industry pioneers are striving to put renewable energy-powered technologies on equal footing with carbon-emitting fuel sources. With pressure from private and public groups as well as government regulators, the evolution to a renewable-only world seems all but inevitable. The question is no longer if we make this shift, but how and when.

We are already beginning to address the question of how: technologies exist today that capture the energy of our sun, wind and moving water. And we are making progress towards establishing a smarter energy grid — one which enables the flexible, reliable and sustainable management of energy and the advanced capability to incorporate renewables. The question of when is also being considered on a daily basis in boardrooms across Australia and the wider world, where key energy stakeholders make decisions and place investments.

While our shift in attitudes and progress towards a greener future is promising, in reality the delivery of an all-renewable-driven world will not be easy. High costs, complex technology and operations, variable supply and the inversion of the utility model as we know it — all have a role to play. And as with game-changing innovations in other industries, traditional interests tend to protect an outdated model while new interests often rush in without fully realising the consequences of their actions.

If we are to truly commit to delivering a 100% renewable model, we must acknowledge the barriers holding us back and actively develop new ways to move forward.

Bringing down the price tag

If more and more nations, governments and people are demanding a definitive shift to renewable power, why isn't it happening faster? It is a complicated question that requires an equally complicated answer. But historically, one main barrier has been the price tag. Renewable energy technologies simply could not compete with fossil fuels due to government subsidies that had been in place

long before. However, traditional barriers to renewable adoption, such as cost, are beginning to disappear. Continuous innovation and economies of scale have driven cost down to the point where it is near parity with other ways of producing electricity. As a result, political incentives to accelerate renewable penetration will no longer be required as the economic business case simply begins to make sense.

The variable nature of renewables

Nature's most abundant and precious energy sources — sun, wind, water — are virtually everywhere. But we are currently limited in how much or how often we can extract that energy to supply our energy demand. Most renewable energy sources are very diffuse and scattered, while energy demand is more intense and load centres are more concentrated — for example, in cities. Moreover, unpredictable factors, such as cloud coverage, wind speed and water flows, have complicated the production of renewable-based electricity for utilities.

Effective 'Demand Management' offers a way to overcome these challenges. The goal

renewables

of demand management is to provide utilities with an alternative to building more power plants to meet capacity needs. By having the ability to modify energy usage on the demand side through smarter technology, education and energy-efficiency improvements, utilities can both save money and accommodate the demands of the prosumer movement. For example, a grid operator could switch off a piece of equipment at a factory for a few seconds in order to thwart the need for bringing a marginal peaking unit online. The trick is to do this in real time, and not only using day-ahead or hour-ahead signals for voluntary load reductions.

Renewable power operations and maintenance

A renewable power plant requires superior operations and maintenance practices to achieve optimal profitability. The moving parts in wind turbines are subject to wear and tear, especially when they are exposed to harsh conditions. Although static, inverters in solar farms need some software and hardware maintenance to avoid any drift in settings that could hinder output.

However, new technologies, including weather forecasting software and remote management, are redefining the impact of renewable energy sources. A grid operator can now evaluate the performance of an individual wind turbine and make adjustments from a control centre thousands of kilometres away. Improved operations management and streamlined maintenance plans are also yielding a greater return on investment.

Integrating renewables into the grid

The advancement of technology and the accessibility of renewables have prompted the rise of the prosumer: consumers and businesses alike who want to take a more active role in generating their own energy. In fact, more than 2 million Australians have now embraced solar power by installing their own solar photovoltaic (PV) systems. However, as new sources of local production come online, utilities are struggling to find effective ways to combine traditional power sources with renewables, without compromising the way the network operates.

New targets for renewable energy source deployment must be met with accurate and

highly networked sensors, actuators and management systems. Poorly or partially instrumented networks downstream of secondary substations will need to be upgraded. Network architecture designed when management and integration of renewable energy sources generation was centralised and at times when there was little if any communication and intelligence in networks must be reinvented to accommodate for dispersed production not necessarily close to the new load centres. And the variable nature of most renewable generation, as well as the emergence of significant new loads like electric vehicles, can complicate load balances on lines, leading to voltage instability and even failures.

The new business model that utilities will need to integrate renewables will have at its heart a centralised intelligence system: a 'smart' system that integrates and manages devices — collecting data, analysing loads and capacities, sending out intelligence — but also secures the energy transactions between prosumers and markets.



It's no surprise that we are seeing strong interest from both government and industry in smart grid initiatives here in Australia. Research published by the University of Sydney in partnership with an industry consortium found potential for a net economic benefit of up to \$28 billion (\$2014) over the next 20 years from the deployment of smart grid technologies in Australia.

Tipping the balance in favour of renewables

Over the last decade, we have seen a rise in investment in renewable technologies and associated renewable uptake here in Australia, with green energy sources now comprising

14.6% of all energy produced. But with a national renewables target of 23.5% by 2020, we still have a long way to go.

While change can be uncomfortable, in the case of shifting to renewables it is critical. As we overcome the barriers to creating a more sustainable energy supply, there are four key factors that will ultimately drive industry to wholeheartedly adopt a cleaner mix:

- Distributed renewables are where the humans are. While fossil fuels are often sparsely populated, solar, for example, is available everywhere, and is cost-effective in between 55°N and 55°S, where 98% of the world's population lives comfortably, including Australia.
- Renewable generation installation is simple and can be physically placed where the consumption is. This has a number of consequences: consumers can make their own energy, competitors to the traditional utilities could trade energy between themselves; and utilities will see a decline in the need to build new infrastructure.

- Renewables are modular. Starting small and extending the capacity with the development of the demand avoids having to generate high upfront costs.
- Installation and maintenance can be simpler than the maintenance of other power generation sources.

While the path towards an all-renewable future may be paved with uncertainty and challenge, it is clear with the support of experienced intermediaries and the right technology mix that the transition is achievable and favourable.

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Leak detection — a dam good idea

Andrew Spence

South Australian company Zonge Engineering created Liquid Integrity Systems after it was asked by a coal seam gas supplier in Queensland to develop something to help it meet its EPA guidelines.

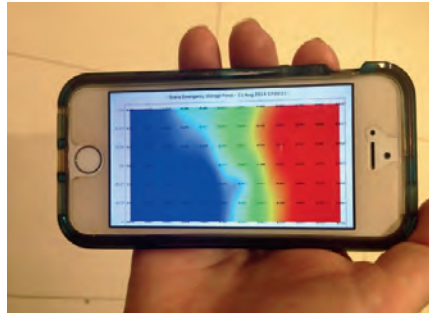
Its wireless solar-powered electronic leak detection system features electrodes that sit on or below the pond liner. An electrical current runs through the electrodes once a day to detect leaks.

Changes in the current are mapped to pinpoint leaks, which can be detected down to breaches as small as one millimetre.

The standalone cyclone-proof control box on the side of the pond sends the daily results remotely to a smartphone, tablet or a computer.

The device also measures pond telemetry including temperature, depth and salinity. Systems can be installed at the time of pond construction or retrofitted to an existing pond.

"Most current systems don't have anything like that, they have bores around the edges that might be checked every so often," Zonge Engineering Managing Director Kelly Keates said.



"But the issue with that is it's not giving immediate results and also not finding out what potentially is leaking straight down.

"Our system will reduce potential pollution to the surrounding environment with instant detection so pond owners can act immediately.

"Our vision is to change the reliability and community trust of liquid waste facilities and create a new way to improve environmental compliance and best practice for the future."

Adelaide-based Liquid Integrity Systems has so far installed four systems in coal seam gas ponds in Queensland but is also building demonstration models for use in gold and copper mines in Western Australia.

The technology is applicable to any new or existing lined liquid or solid waste facility including tailings dams.

Keates said while it had so far been targeted at the mining industry, the device could also be used for holding ponds in the wastewater, agriculture and wine industries.

She said typical ponds ranged in surface area from about 15,000 to 120,000 m².

"It's a unique system that can help protect the environment and is more cost-effective than the current systems," Keates said.

"The cost on a big pond is about \$2.50 a square metre whereas a double-lined system is about \$20 a square metre, so it's much more cost-effective."

Liquid Integrity Systems
www.liquidintegrity.com.au

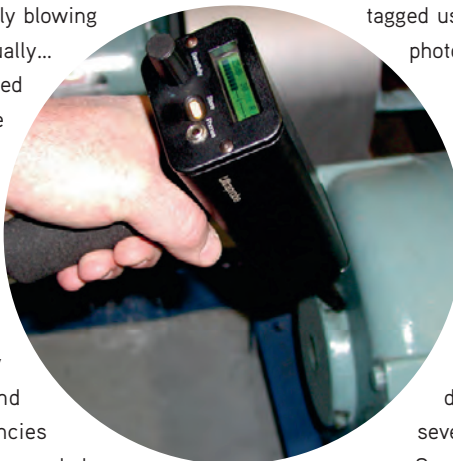
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An Australian food manufacturer was literally blowing over \$55,000 in wasted energy costs annually... and didn't know it! The manufacturer believed the efficiency control and maintenance regime for its sizeable compressed air system was entirely adequate.

As a matter of energy-use review, the manufacturer called Southern Cross Compressors (Australia) Pty Ltd to carry out the thorough air audit.

Using the latest leak detection technology (UE Ultraprobe 9000), which detects and records the decibels at the natural frequencies of air leaks, accurate leak detection can be recorded from up to 10 m away from the probe. This ensures detection of even the smallest leaks throughout the compressed air system. While most leaks were easy to repair, according to Southern Cross Compressors, they would not have been discovered without the use of this advanced leak detection technology.

Using a calibrated chart, the detected sound level (dB(A)) then converted to a volume flow rate (m³/min), which in turn is converted to power (kW) to calculate annualised costs, determined on running hours and electrical supply costs. All leaks were individually



tagged using colour codes based on severity and then photographed for a customised report.

The comprehensive, 50-page audit report, which was presented to the customer, included highly critical data such as: individual leak volume, equivalent power, annualised cost, equivalent CO₂ emissions as well as a photo of the colour-tagged leak. The report also provided a comprehensive summary of the potential savings opportunity, which has enabled the customer to make informed decisions and prioritise leak repairs based on severity, energy loss and repair costs.

Southern Cross technicians were able to find over 50 significant leaks with a total air volume well over 10 m³/min, representing an annualised wasted energy cost of approximately \$55,000.

In today's efficiency-driven age where energy costs are fundamental to business sustainability, this type of audit and reports advice can lead to significant cost savings. For the relatively low cost of the air audit, potential returns can far outweigh expense.

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With many existing water treatment plant control systems using aging equipment and operating beyond recommended life expectancy, new upgrades are often required to avoid costly breakdowns and loss of service. However, deciding when to upgrade and indeed to upgrade at all is an important decision that can at times be overlooked and considered too difficult, placing unnecessary risk on equipment and personnel.

One of the main factors for determining when to upgrade your plant is the motivation generated by the increased performance and reliability that operators can experience and come to expect from a new control system.

Water industry authorities are continuing to face major challenges including reduced operating and maintenance costs, increased security, government regulations and regulatory compliance. By implementing an enhanced process control system with advanced networking and diagnostic capabilities such as Rockwell Automation's PlantPAx solution, you can now tackle all of these challenges whilst providing sufficient return on investment to justify your upgrade.

Plant wide access to process data and secure remote access solutions are just some of the features that will enable superior visibility and control for better preventive and predictive maintenance. Further, the reliability and efficiency of your plant can be significantly improved through the real time access to data and intelligent motor control solutions. These features allow users to identify operation and performance trends to ultimately make better use of assets all while reducing energy consumption. In addition to this superior performance and efficient modernisation of control assets, system upgrades will also result in lower overall plant operating costs, minimised downtime and reduced maintenance costs.

However, the performance of your automation solution is only as strong as the weakest implemented link. Further, the means of enclosing and protecting your field equipment is just as important to ensure critical systems such as pumping stations, treatment plants and remote access services continue

uninterrupted. In a harsh corrosive environment, enclosure solutions have typically been constrained by a trade-off between high initial investment such as stainless steel or cheaper alternatives but with shorter lifetimes and increased maintenance.

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Australia's lagging e-waste laws

Australia's management of electronic waste is poorly implemented, lags behind international best practice and is based on outdated recycling targets, according to researchers from the University of New South Wales.

Writing in the *Journal of Environmental Management*, honours student Ashleigh Morris and Professor Graciela Metternicht stated that Australia is one of the top 10 consumers of electrical and electronic products in the world, yet legislation for the management of WEEE (waste electrical and electronic equipment) is in its infancy. Comparing Australia's e-waste laws to those of two international leaders in the field of e-waste recycling, the study authors found Australia's approach is ineffective and requires greater compliance measures to prevent hazardous pollutants from ending up in landfill.

"What is worrying is that our legislation is unable to keep pace with the amount of e-waste we're now generating," said Professor Metternicht. "Our recycling targets may have been good 10 years ago, but they are ineffective today. We recommend the targets be revised."

The UNSW team analysed four key pieces of legislation, including the National Waste Policy 2009 and the National Television and Computer Recycling Scheme 2011, and established 'indicators of effectiveness' by which to evaluate them. They surveyed stakeholders and experts to validate these

indicators, and compared Australia's legislative environment and waste management practices to those of Japan and Switzerland.

While the introduction of e-waste laws in Australia resulted in an overall increase in recycling, the researchers identified major flaws, claiming that the "rate and types of WEEE generated in Australia far exceed the measures prescribed in legislation to address or even curb the problem". The authors state:

- The scope of what is considered e-waste under Australian law is not broad enough and that new categories of e-waste legislated for recovery and recycling would reduce public confusion and help meet the objectives of the laws.
- There is a lack of clarity over the role of stakeholders including consumers, retailers and local governments, which are responsible for the majority of e-waste collection. More effective waste management hinges on more clearly defined roles.
- There are education and accessibility issues, with consumers in some regional locations in Australia needing to travel more than 100 km to recycling depots or drop-off sites. Local councils need additional support to improve access.
- Auditing, compliance and reporting measures are weak in every stage of the e-

waste recycling system in Australia and need to be improved.

- Australia needs to reassess its recycling target and associated time frame in a holistic manner if it is to address the increasing e-waste generated by our society. "We're not saying the rules need to be completely overhauled or rewritten, but compared to other countries, our auditing and compliance measures certainly need to be enhanced," said Professor Metternicht.

"We can have the most ambitious targets in the world, but without the necessary enforcement and compliance measures these would be meaningless."

Morris stressed that the legislation needs to better support local councils, saying, "The current legislation places no responsibility on consumers to dispose of e-waste, and the councils who manage the largest volumes of this hazardous and valuable form of waste are not supported to do so."

She added that the problem is as much a social issue as an environmental one, with Australians currently the second largest producers of waste per person in the world.

"This is a culture that we need to move away from, but until Australians stop seeing waste as an 'out of sight, out of mind' problem, the issues with e-waste will continue to grow exponentially," she said.

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Industrial contamination in Australia's backyards

Industrialisation has left much of the urban environment contaminated with a variety of heavy metals, chemicals and pesticide residues. Macquarie University researchers have produced a series of maps that plot the concentrations of metal pollutants across cities like Sydney and Darwin, and towns such as Mount Isa and Port Pirie.

Results of the survey indicate the spread of contamination in many ways reflected the growth of major cities, with the highest concentrations in older suburbs. The contaminant of most concern across Sydney backyards is lead. It would be expected that there would be contamination in a major city, explained the director of the Macquarie team, Professor Mark Taylor. "We live in an industrial environment. We have used lead-based petrol and paint for most of the 20th century."

One technique for measuring levels of contaminant metals that is key to the work being conducted by the Macquarie team is X-ray fluorescence spectrometry (XRF). Simple screening for toxic metals is performed by placing an analyser directly onto soil or dust. The analyser provides detection of metals for site characterisation, contamination tracking, remediation monitoring and property evaluations.

The latest portable X-ray fluorescence (pXRF) analysers, such as the Delta Premium from Olympus, have been developed specifically for complete environmental investigations of metal contaminants in a wide range of industrial and domestic materials. The high-power, high-performance, rugged unit allows in situ analysis in a wide range of harsh environments from remote mining and exploration sites to backyards in major urban centres.

The latest model Delta unit offers increased speed and improved sensitivity. It also lowers the limit of detection (LOD) for challenging elements such as cadmium, barium, lead, mercury and tin.

According to Andrew Saliba, regional sales specialist with Olympus, the traditional use of pXRF has been for alloy identification, grading ore, mineral exploration, metallurgy and mine site remediation. "The technology has been refined and is now often used by environmental consultancies specialising in contaminated land remediation and recycling

companies needing to determine what materials are in waste products," he said.

Macquarie researcher Marek Rouillon has been working to evaluate the reliability and repeatability of XRF analysis on environmental samples. Professor Taylor and Rouillon regularly present their findings at seminars, outlining the spread of heavy metal contamination in suburban gardens in addition to explaining the application and relevance of the pXRF instrument for this project.

Typical 'natural' or 'background' concentrations of lead for the Sydney region are in the range 20–30 mg/kg or parts per million (ppm). However, due to the intense use of lead-containing products, much of Greater Sydney has been contaminated with the metal. Their results indicate Sydney residences have a mean soil lead concentration of 220 mg/kg, which is approximately 10 times the typical natural background for Sydney's soils and rocks.

In 2012, the Centres for Disease Control and Prevention in the USA stated that there

is no safe blood lead level for young children. Prior to this, health authorities around the world had issued guidelines for 'acceptable' levels of lead contamination, but surveys and reports have shown that even at the lowest levels there were health effects in children, including impaired brain development and behavioural disorders.

In conjunction with the contamination mapping, Macquarie researchers also run the community-orientated VegeSafe program. This is the largest study of its kind in the country and has provided information about metal contamination levels to more than 500 households across Sydney, and over 1000 households across Australia.

VegeSafe seeks to inform people about metals and metalloids in their garden soils and provides a free sampling program for domestic and community garden soils. Participants submit soil samples from private or community gardens and receive a formal report and links to information and advice

about 'what to do next' if the soils contain elevated concentrations of metals and metalloids. "The VegeSafe motto is 'Carry on Gardening'," Professor Taylor said, "because this is exactly what we want people to do knowing that their soils are metal-free as is the produce from their gardens."

According to Rouillon, the simplest mitigation technique for householders would be to cover the contaminated soil with either grass or mulch, to effectively reduce the potential generation of dust if the soil is dry and gets picked up by wind.

In contaminated suburbs where vegetables will be grown, the Macquarie team recommends growing produce in above-ground vegetable plots, using fresh clean topsoil. "Typically, undisturbed soil in urban areas accumulates contaminants over long periods of time and should be avoided when growing home produce," Rouillon stated.

"Our recommendations are determined by different scenarios and contaminant concen-



A technician analysing soil samples in a public park.

trations," Rouillon said. "VegeSafe provides specific recommendations and advice to a gardener for their particular situation."

Other uses of pXRF analysis include extreme-weather debris migration studies, agriculture soil inspections, and construction and demolition waste sorting. A further use is as part of hazardous waste screening for disposal classification.

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The future of sludge dewatering in Australia

Every year in Australia, over 85 million tonnes of biosolids (sludge) are dewatered at municipal sewage treatment plants (STPs) into around 1.65 million tonnes of dewatered biosolids, which is trucked off-site for mainly re-use in agriculture and composting. Biosolids dewatering takes place in most of the 2400 STPs in Australia.

Dewatering takes place via a variety of methods, with centrifuges being most commonly used at 39%, followed up closely by belt filter presses and drying beds at 24% and 23% respectively. Regionally there have always been trends in dewatering technology, with centrifuges favoured by most large NSW utilities and belt filter presses being favoured in Queensland and Victoria, along with rural NSW.

There is, however, a new trend emerging that has become the primary choice of major utilities in Brisbane and Western Australia – dewatering via screw press.

This is an interesting development as, like most of the dewatering technology used, screw presses are not new and in fact may well be one of the oldest technologies. Indeed, while the first centrifuges were used to separate dairy products around

1860 and belt filter presses were originally used in Europe in the early 1900s for pulp and paper, screw presses were first used in Roman times for pressing wine.

This new trend is being driven by changes in our economy and concerns over

generation, either around the dewatering process or in the dewatered biomass, noise and other environmental concerns, and the reason for the trend away from belt filter presses and centrifuges to screw presses becomes patently obvious.



There is, however, a new trend emerging that has become the primary choice of major utilities in Brisbane and Western Australia – dewatering via screw press.

the environment and sustainability, as well as a need for municipalities to continually improve their efficiency and operating costs.

Large increases in operational and maintenance labour and power costs, as well as the unsustainability of processes that use large quantities of wash water, have certainly forced municipalities to look seriously at their current dewatering technology and search for better alternatives. Add odour

Add to this the major advances in screw press technology in the last 10 years, enabling screw presses to now successfully dewater waste activated sludge (WAS), and the trend becomes one that is certainly here to stay.

In fact, it is safe to say that we can expect that most medium to large municipal dewatering facilities will make the change to screw press-based dewatering in the near future.



John Koumoukelis is the Director of Hydroflux. Solely dedicated to the water industry with a career spanning over 16 years, Koumoukelis' professional roles are based on business development and technical sales management for process equipment and design/build contracts within the wastewater sector. His goals are to provide energy-efficient and high-performance process equipment and treatment solutions to a variety of clients within the wastewater industry in order to allow them to meet their sustainability targets.

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Recycle your beauty product packaging for free

L'Oréal Australia and TerraCycle have partnered on a new recycling program, providing Australian consumers with the reassurance that all the beauty and personal care packaging they collect at home will not go into landfill.

The way TerraCycle works is that it takes waste and recycles it into something that can be beneficial for the community, such as a playground or outdoor furniture. As explained by the company's founder and CEO, Tom Szaky, "TerraCycle's core focus is taking traditionally unrecyclable products and making them recyclable, to divert as much waste as possible from landfill."

Through the Beauty Products Recycling Program, L'Oréal Paris and Maybelline are encouraging consumers to collect their empty beauty products at home and send them to TerraCycle to be recycled. L'Oréal Australia will cover the costs of the program, which



will accept the following waste products:

- Cosmetics packaging such as used lipstick and lip gloss, mascara, eye shadow, bronzer, foundation, eyeliner, eye shadow, lip liner and concealer packaging.
- Hair care packaging such as used shampoo and conditioner bottles and

caps, hair gel tubes and caps, hair spray and hair treatment packaging.

- Skincare packaging such as lip balm, face moisturiser, face and body wash soap dispensers and tubes, body and hand lotion dispensers and tubes and shaving foam packaging.

Consumers can recycle any brand, not just those within the L'Oréal Group. Furthermore, for each piece of waste sent to TerraCycle, consumers will be raising a \$0.02 donation for the school or not-for-profit of their choice.

"L'Oréal Australia is proud to be working with TerraCycle," said Christine Burke, corporate communications director, L'Oréal Australia. "We're looking forward to seeing what's possible from this new program."

TerraCycle

www.terracycle.com.au

Solar installation overcomes the challenge of clay

Deployed on the wide open plains of northern NSW, in a region with high irradiance, NX Horizon's expansive arc harvests the solar potential of Australia. The Moree Solar Farm combines sun availability and powerful tracking technology with a reduced total cost of ownership, making the farm a good example of a PV model project.

Solar array design and installation are some of the most costly components of tracker installation. The heavy, cracked clay found in the floodplains of Australia's Mehi River requires tailor-made foundations to address the clay's extremes of expansion and contraction. When developer FRV and EPC contractor Elecnor were faced with these challenges, they turned to NEXTracker.

NEXTracker's engineering team partnered with Elecnor and pier manufacturer Blade Pile to

deliver the Moree Solar Farm's solar pier foundation. Blade Pile's geodynamic design addresses the challenges posed by shifting clay, stabilising the tracker foundations as the clay sets around the piers. Furthermore, NEXTracker's NX Horizon solar tracker has a mechanically balanced design and optimised components that use less steel and require up to 33% fewer piers; thus, the number of these vital components was greatly reduced.

With no row linkages to further complicate the anchoring of the foundations, NX Horizon's independent row architecture and long

span between piers resulted in an agile mechanical system that withstands the challenges posed by shifting clay. The streamlined design empowered Elecnor to overcome the challenges of working with dynamic soil, helping the company to deploy Australia's largest solar tracking system in difficult terrain.

NEXTracker's system is said to have an $\pm 8^\circ$ advantage over the competition, allowing for a 120° tracking span that fully soaks in the 275 W/m^2 of solar irradiance beaming down on this desert region. These optimisations result in an efficient drive system that effortlessly powers an entire row. In projects of this size, the small details translate into large savings.

The Moree Solar Farm, outfitted with NEXTracker's robust technology, will supply clean electricity to the region, generating the equivalent electricity to power 15,000 homes and avoiding 95,000 tonnes of CO_2 emissions annually. The clean power plant will also help the region save approximately 165,000 ML of clean drinking water, compared to the operation of a coal-fired power station.

"NEXTracker's NX Horizon technology is an excellent tracker solution for this challenging project," said Elecnor Project Manager Pedro Fernandez. "The company has developed a unique foundation solution that addresses the challenging soil conditions found at this project site in Australia. This solution minimises site grading and grounding requirements and simplifies design, installation and maintenance."

NEXTracker Inc

www.nextracker.com

EYEFi SMART SENSORS GIVE COUNCILS THE INFORMATION THEY NEED TO IMPROVE WASTE MANAGEMENT, SAVE MONEY AND HELP KEEP RUBBISH OFF THE STREETS.

Australia's growing population poses a challenge for councils. Smart and sustainable solutions are needed to better manage waste, especially in busy urban environments. Thanks to new internet-connected devices, smart sensors are starting to transform the world of waste and asset management for the better.

Home-grown technology company EYEFi is leading this change with its Internet of Things (IoT) product suite. EYEFi's Smart Sensor system, for example, is improving the way City of Melbourne's waste services manage rubbish collections, by utilising EYEFi sensors located in street bins across the CBD that automatically monitor bin fill levels, using ultrasonic sensors and the cloud-based application.

The sensors can also be optioned with GPS and are ideal for public space bins and various sized rear-lift and front-lift commercial bins.

The system generates dynamic data on fill rates, fill profiles and other key metrics that helps ensure bins are positioned in the best locations to service demand. This in turn enables performance improvements and greater efficiency of the bin network and waste collections.

"The system provides entirely new data and intelligence for customers on their bin networks," EYEFi Managing Director Simon Langdon says.

Each sensor can also provide alerts to waste management teams when waste in a bin reaches a particular level, eg, 80%. The platform automatically calculates dynamic collection schedules and navigational information and delivers this to drivers on their smartphone, so collections can be executed in the most efficient way.

"The system's proactive alerting features enable waste services to prevent rubbish overflowing onto streets and into drains and waterways, before it becomes a problem," Langdon explains. "It also enables a more transparent and productive service while reducing operational costs."

Apart from sensors for waste management, EYEFi also has its next generation range of IoT smart sensors approaching release that will cover a variety of real-world sensing scenarios.



"The small, robust, networked sensors and smart cameras will be able to accurately monitor many different scenarios, such as the water levels in roadside pits to warn response crews, visual analysis of street foliage encroaching on power lines to keep maintenance teams informed, or the waste levels in bulk or skip bins to provide alerts to waste services," says Langdon.

The IoT sensors augment EYEFi's well-established Spatial Video product suite, which offers the seamless integration of video, spatial and mapping using fixed, mobile and airborne platforms, allowing for the rapid assessment and response to a wide range of emergency scenarios such as bushfire management, emergency and incident response.

"Solving problems for customers is what innovation is all about," Langdon says. "Our technologies deliver entirely new capabilities in the area of intelligence gathering and situational awareness, making people, assets and infrastructure safer and work flow processes smarter, faster and more cost-effective. This is particularly relevant for government organisations that need to carefully manage assets and infrastructure while balancing tighter budgets with increasing public expectations of their services."

Organisations can combine all of their remote monitoring needs within the one cloud platform, using EYEFi's GPS-enabled smart cameras on emergency management vehicles or mobile platforms, while EYEFi's spatially enabled cameras and sensors can be located on fixed towers or infrastructure to enable powerful, real-time intelligence gathering capabilities.

You can arrange a demo of EYEFi's products or find out more about the possibilities for your organisation by visiting www.eyefi.com.au or emailing smartsensor@eyefi.com.au.



EYEFi Pty Ltd
www.eyefi.com.au

A new phosphor for more efficient lighting

Researchers from KU Leuven have discovered a new phosphor that could make next-generation fluorescent and LED lighting even cheaper and more efficient. Writing in the journal *Nature Materials*, the team described their use of highly luminescent clusters of silver atoms and the porous framework of minerals known as zeolites.

Silver clusters consist of just a few silver atoms and have remarkable optical properties. However, current applications are limited as the clusters tend to aggregate into larger particles, thus losing the interesting optical properties.

Professor Johan Hofkens and his team from KU Leuven's Molecular Imaging and Photonics unit have now found a way to keep the silver clusters apart by inserting them into the porous framework of zeolites. "Zeolites contain sodium or potassium ions," explained Professor Maarten Roelfaers from the Centre for Surface Chemistry and Catalysis. "We used ion exchange to replace these ions with silver ions. To obtain the clusters we wanted, we heated up the zeolites with the silver ions so that the silver ions self-assembled into clusters."



In collaboration with Professor Peter Lievens' Laboratory of Solid-State Physics and Magnetism, the researchers examined the properties of these heat-treated 'silver zeolites' and found that the structural, electronic and optical properties of the zeolites were strongly influenced by the silver clusters. That's how they discovered that the shape of the silver clusters is essential to obtain the right fluorescence properties.

"Clusters of silver atoms can assemble into different shapes, including a line or a pyramid," said Professor Hofkens. "This pyramid shape is what we need to obtain the best fluorescence properties. Heating up the silver ions in the zeolite framework makes them adopt this shape. Because they are 'trapped', as it were, in the cages of the zeolites, they can only form a pyramid with up to four silver atoms. That is exactly the shape and size in which the silver cluster emits the largest amount of fluorescent light, with an efficiency close to 100%."

The new phosphors not only emit a large amount of light, they are also cheap to produce. The findings therefore have great potential for the development of next-generation fluorescent and LED lighting and for biological imaging.



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How sustainable are the world's urban water cities?

Sydney and Melbourne have been declared the eighth and 11th most sustainable urban water cities in the world, according to the Sustainable Cities Water Index.

But it's not all good news, with the report finding that most cities need greater investment and prioritisation to improve their resiliency to extreme weather events and unforeseen water shortages.

The index, conducted by design and consultancy firm Arcadis in partnership with the Centre for Economics and Business Research (CEBR), examined 50 cities from 31 countries, ranking them across a range of indicators to estimate the sustainability of each city with regards to water environment. Those included within the report were selected to provide an overview of the planet's cities.

According to Arcadis City Executive Sydney Stephen Taylor, the NSW capital's high ranking was attributed to a good amount of water reserves and green space.

"The city has invested in securing long-term water supply due to the earlier investment in a desalination plant using renewable energy," noted Taylor. "Importantly, the City of Sydney is now part of the Rockefeller 100 Resilient Cities program and has appointed a chief resiliency officer giving resiliency the attention it deserves."

However, most cities need greater investment when it comes to their ability to withstand natural disasters and drinking

water shortages, with climate adaptation and resiliency being the most pressing issue for future city leaders. A lack of urban green space was found to impact the resiliency of many cities in the Middle East and Asia, while US cities were amongst the most susceptible to higher flood risks due to natural disasters. The cities of New York, London and Hong Kong, meanwhile, have greater water vulnerability.

"Water demand is rising, aquifers are being depleted and the threat of extreme weather is increasingly real, meaning that cities can be overburdened with too much water or stressed without enough," Arcadis Global Director of Cities and Water John Batten said. "This report highlights the areas of opportunity for cities to inform decision-making around how they use and manage water, hopefully making them more sustainable economically, environmentally and for the benefit of their people."

The top and bottom 10 cities in the Arcadis Sustainable Cities Water Index are:

The full list of rankings can be viewed at www.arcadis.com/waterindex.

Top 10	City	Bottom 10	City
#1	Rotterdam	#41	Doha
#2	Copenhagen	#42	Jeddah
#3	Amsterdam	#43	Mexico City
#4	Berlin	#44	Rio de Janeiro
#5	Brussels	#45	Johannesburg
#6	Toronto	#46	Nairobi
#7	Frankfurt	#47	Jakarta
#8	Sydney	#48	Manila
#9	Birmingham	#49	Mumbai
#10	Manchester	#50	New Delhi

Arcadis Australia Pacific
www.arcadis.com

Retrofitting for net zero energy

Retrofitting New Zealand's commercial buildings to use less fossil fuel-generated energy could save enough energy to power many homes on the South Island, a Victoria University of Wellington study shows.

Shaan Cory, a building scientist with a PhD in Architecture, investigated whether New Zealand's current commercial building stock could be converted to net zero energy. He explained, "A net zero energy building is one that is energy efficient and offsets any energy that was generated from greenhouse gas-emitting fuels with renewable energy generation such as hydro, solar and wind."

Cory reached his findings by constructing energy models for a sample of existing buildings, matching their attributes and energy performance. The models were then retrofitted with a set of energy conservation measures.

He found the current commercial building stock could be converted to eliminate the use of greenhouse gas-emitting energy without New Zealand needing to generate more renewable energy. The energy saved by retrofitting all commercial buildings could power 330,000 homes, with the reduction in greenhouse gas emissions equivalent to the methane emissions produced by 200,000 dairy cows.

According to Cory, half of the net zero energy target could be achieved by retrofitting just 1200 of the largest of



New Zealand's 27,000 commercial buildings. The savings from these large buildings would be equal to the annual electricity generated by all wind turbines in New Zealand.

Cory said the most effective energy-saving techniques are more efficient plug-in equipment, lighting, heating, ventilation and air conditioning, and the installation of electric light dimming. The benefits of a net zero energy building stock, he said, would include lower carbon emissions, improved energy security for New Zealand and better thermal comfort for buildings' occupants.

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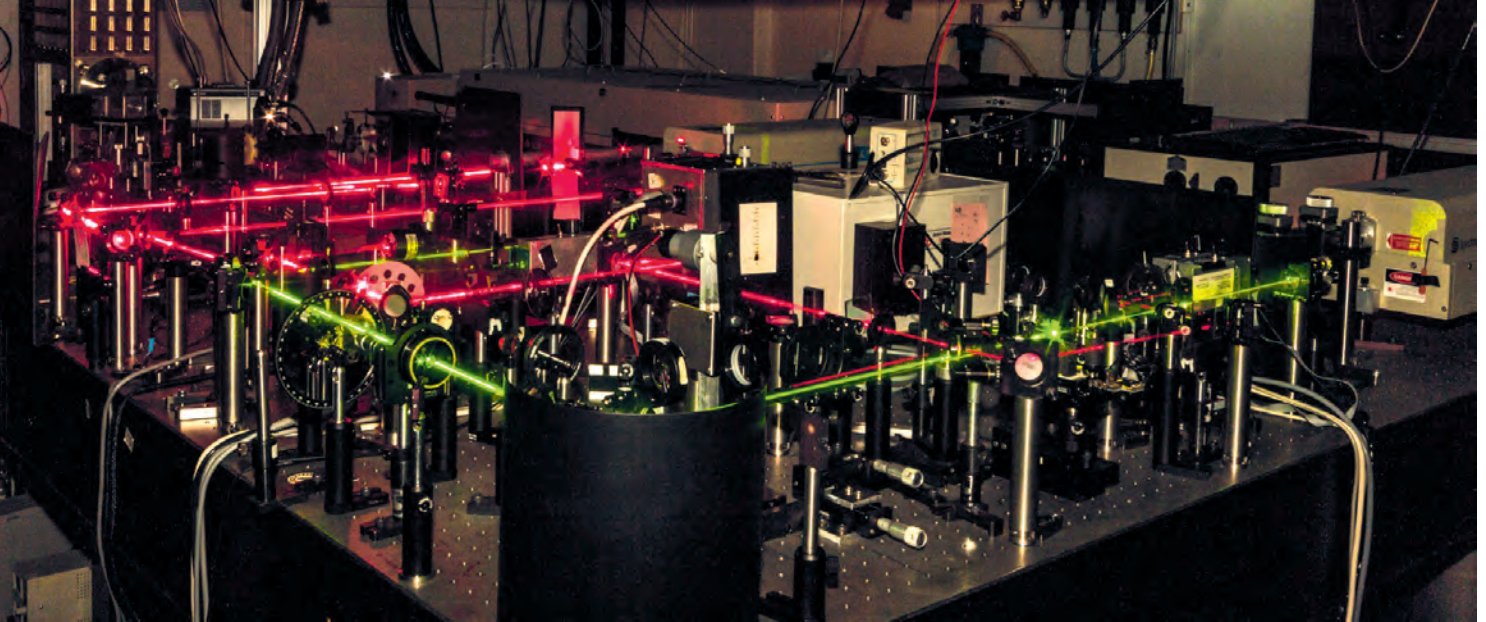
**WATSON
MARLOW**

Fluid Technology Group

Solar cells based on iron molecules

Lund University researchers have explained how iron-based dyes work on a molecular level in solar cells. The ultimate goal of their study, published in the journal *ChemSusChem Energy & Materials*, is to be able to use iron-based dyes in solar cells.

that achieving the right electronic properties in dyes based on iron is much more difficult compared to other metals. As noted by Persson, "Iron dyes have traditionally had a problem in that they are short-lived; they can't keep the energy from the sun long enough to make this energy useful."



As explained by study co-author Petter Persson, the researchers are looking for new opportunities to utilise solar energy in an inexpensive way. For some years now, scientists have been developing technology that uses a ruthenium dye molecule to harvest sunlight. "Unfortunately," said Persson, "ruthenium is a very rare element."

The Swedish researchers planned to use an iron-based dye molecule instead, with Persson stating, "Iron is very abundant on Earth; ruthenium, on the other hand, is something like 100 million times less common in nature." By replacing ruthenium with iron, this would open the way for large-scale, inexpensive solar energy.

For decades, scientists have tried to develop iron-based dyes without success. A crucial reason for this difficulty is

However, the Lund researchers succeeded in creating molecules that are able to keep this energy for up to 100 times longer than previous iron dye molecules. "We can use this energy to shuttle electrons into an electrode," said Persson. "This is the first step of generating an electric current."

Persson said it will probably take a few years before iron dyes are used commercially in the production of solar cells and light catchers, stating, "To make a full solar cell requires some more development of these dye molecules." He is, however, surprised at the rapid speed of development so far.

"It is difficult to develop new materials for solar energy conversion," Persson said. "For once, the process has been unusually quick, and we have made several important breakthroughs in just a few years."

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3D printing to recycle waste

A researcher from Victoria University of Wellington is revealing new ways to recycle waste in the Pacific using 3D printing.

The project began when Lionel Taito-Matamua, a Master of Design Innovation, saw firsthand the lack of education in the Pacific around recycling. "There is so much plastic and other recyclable waste in the Pacific," he said, "and local companies, industries and people don't know how to dispose of it properly."

"For example, landfills in Samoa are not divided into separate areas — paper, different types of plastic and organic waste are all mixed together."

Taito-Matamua has now found an alternative option to repurpose and re-use the waste to produce useful items. He explained, "Once you separate the different types of plastic items from a landfill, you can shred them into small particles and extrude that through a specialist machine that makes the filament rolls used in 3D printing."

"The filament rolls can either be sold for use on 3D printers across the world, or people in the Pacific can start 3D printing their own objects, like souvenirs, household items and spare parts."

"This approach ... creates jobs and incomes for local families. It's the whole idea of creating a cottage industry through 3D printing and digital creation."

Taito-Matamua has created 3D scans and models of various items, including shells and turtle skulls. "These also educate people about disposing of waste," he said. "We can transform materials that are potentially harmful to local wildlife."

As part of his research, Taito-Matamua identified the importance of upskilling the general public about new technology and digital literacy and believes that outreach into local Pacific communities is needed. He noted, "There is no point in us taking 3D



printers over to the Pacific and establishing a system if locals aren't the users."

Together with his collaborative partners — Victoria's School of Design, ^{MZ}Product Accelerator, Viclink and Te Ropu Awhina — Taito-Matamua has now created an outreach program called Creative Pathways. He goes into classrooms to give children the opportunity to interact with these different types of technology and teachers to teach through new learning tools.

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Audit helps energy management

Reid Industrial Graphic Products strives to provide innovative solutions to human-machine interface (HMI) problems. But as the company faces steep rises in electricity prices, managing energy use has come to play an increasingly important role in business operations.



Aware of the rising costs and impact on the environment, Reid Industrial decided to engage Assurance Consulting to undertake an energy audit of its Brisbane-based site. The company's goal was not only to identify energy savings, but more importantly to reduce its carbon footprint.

The on-site survey analysis indicated electrical usage data of 129,104 kWh per annum. The total electricity costs for this period came to a total of \$46,019 with an average monthly spend of \$3835. The site's greenhouse gas emissions represented 102 tonnes of carbon dioxide released per year. Something had to be done.

The outcome of the audit was suggestions to make cost-effective recommendations. This involved replacing the majority of Reid Industrial's existing lighting with high-quality LED technology, as well as the implementation of an on-site renewable power source – solar panels.

By taking action and implementing the integrated recommendation, Assurance Consulting estimated Reid Industrial's new annual electricity bill to be approximately \$12,537 – with the predicted savings increasing as future price rises occur. In addition, Reid Industrial has pledged to do its best to minimise the impact operations have on the environment.

Reid Industrial Graphic Products
www.reidindustrial.com.au

TANK-MOUNTED SCROLL AIR COMPRESSOR

Southern Cross Compressors has added the 4.5 kW tank-mounted version to its Ganey Scroll series of orbital technology air compressor.

Designed to be ultraquiet and energy efficient, the lightweight, high-output compressor offers a capacity of 0.663/min at 8 bar — a higher output than a conventional 5.5 kW, reciprocating, piston type. With capacities from 4.5 to 7.5 kW, the Ganey range of advanced, lubricated, 'Scroll technology' compressors provides good energy efficiency with minimal moving parts.

The compact air compressors are vibration-free, quiet and reliable. Suitable for applications where low noise is a consideration, the dynamically balanced, non-contact orbital scroll results in ultraquiet operation.

Maintenance requirements are minimised as the unit is direct drive, meaning there are no drive belts to wear or need replacement.

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Southern Cross Compressor Technology Pty Ltd
www.sccompressors.com.au



BUILDING ASSET MANAGEMENT SYSTEM



3G SIM LOGGERS FOR MONITORING SYSTEMS

Telstra has announced that it will be decommissioning its 2G signal on 1 December 2016. As a result, all smart meters across Australia running on the 2G signal will stop functioning. Now is the time for users to think about upgrading their smart meters to the latest 3G technology models, which will provide futureproofing for their monitoring systems.

WaterGroup offers 3G SIM Loggers that can be used to monitor water, gas, electricity, solar and tank level. The logger comes with a vandal-proof box and has a battery life of 3–5 years. It has been in production for over 10 years and has been through several significant hardware revisions, creating a robust solution suitable for monitoring applications.

The data collected by the hardware in the field is displayed on the WaterGroup smart metering portal. This is a highly customisable user interface where data can be viewed and managed in multiple layouts and formats. Data can be manually exported as a CSV file to be opened in Excel. Automatic delivery of data can be arranged via multiple methods. A hierarchical user access allows certain users to have different levels of permissions.

WaterGroup Pty Ltd
www.watergroup.com.au

SenseAgent is a cloud-based, building asset management system that uses wireless autonomous sensor agents embedded in and interacting within commercial spaces to provide a wealth of data. The product's sensors extract actionable data for refining autonomous behaviour in the areas of lighting control, safety compliance, climate control and security tracking to optimise a building's use, reducing energy consumption and operational expenses across geographically distributed assets.

By installing the system, the user can reduce the energy consumption of lighting through presence detection (automated light control to ensure lights are off or dimmed when not required), daylight harvesting (controlling the lighting intensity when natural light is available) and programmable schedules (user-defined algorithms, running 24/7, triggered by events to autonomously control lights). To control building HVAC systems, the sensors acquire temperature and location density data to regulate the climate.

The system's emergency lights and signs conduct autonomous testing, reporting to the cloud to ensure that they are continually compliant. The system also allows location tracking of people and assets, providing the user with increased control.

SenseAgent has a full product offering with applications in the areas of lighting, safety, climate and security.

Levaux
www.levaux.com

VACUUM PUMP

The GHSVSD+ vacuum pump is a dry pump that does not require any sealing water. It features Atlas Copco's latest variable speed technology, providing the ability to match the vacuum pump's speed to the demand of the sewerage system.

The VSD+ drive eliminates the start-up peak that is common with traditional vacuum pumps.

The product has a plug-and-play design, making installation quick and simple.

In a vacuum sewer installation, the pump will deliver the suction needed at the time with its variable speed drive. The GHSVSD+ Humid Version is also suitable for this application as a drying cycle will eliminate any moisture build-up in the oil, therefore extending service intervals and pump life. It can deliver energy savings and payback periods as short as 18–24 months in many scenarios.

Atlas Copco Compressors Australia
www.atlascopco.com.au



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Golden building with the 'smarts'

Completed in June this year, 200 George Street is one of Australia's first so-called 'smart buildings'.

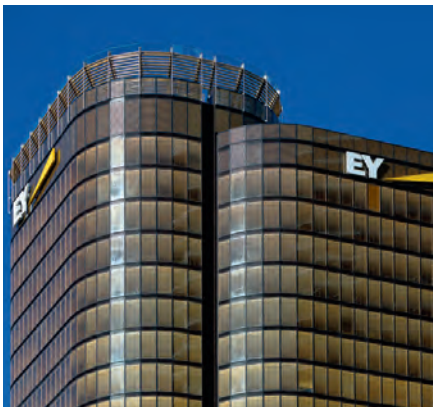
With its distinctive golden curves, 200 George Street is one of Australia's first so-called 'smart buildings'. Completed in June 2016, it features a range of smart technologies that are designed to enhance the sustainable performance of the building.

Beacons and sensors are incorporated throughout the building to monitor air quality, sunlight, and power and water usage, and can automatically adjust the internal environment according to the needs of the building and its occupants.

The building also features technology that responds to the external environment, with a closed cavity facade (CCF) used in conjunction with an automatically adjusting timber blind system designed to control the light and heat radiating from outside. Claimed to be the first time a CCF system has been used in Australia and the first time timber blinds have been incorporated, this technology is designed to not only reduce glare but also result in cost and energy savings on heating and cooling the building.

Mirvac has worked with the International WELL Building Institute to design a headquarters that actively promotes the health and wellbeing of its workers. The floor plates have been designed to accommodate workspaces that are highly responsive to the workforce, allowing teams to connect horizontally and vertically to promote collaboration and integration.

Other innovative features include: SAMBA sensors on the floor to monitor air quality;



LED lighting that can be programmed for varying brightness and darkness at appropriate points throughout the day to maintain optimal circadian rhythms; a Biophilia plan that incorporates nature's patterns throughout the tenancy design, water recycling, the latest building energy- and water-efficient designs, and intelligent monitoring and control systems.

Connected to bus, rail, bicycle lanes and ferry transport and soon to be light rail, the building also incorporates end-of-trip facilities that include 257 secure bicycle

spaces for tenants, 54 visitor bicycle parking spaces, 257 lockers and 65 showers.

The building is jointly owned by Mirvac Property Trust (50%) and AMP Capital Wholesale Office fund (50%), the architect is Francis-Jones Morehen and Arup was responsible for the ESD strategy for the base building. The developers are targeting a: 5 star NABERS Energy rating, a 4 star NABERS Water rating and Gold WELL Certification.

Mirvac Ltd
www.mirvac.com

Highlight on the water recycling features

David Chan, Senior Development Manager at Mirvac has provided some detailed information on the water recycling features at 200 George Street.

Condensate recycling

- A bespoke drainage system has been designed for the collection of condensation from the Air Handling Unit (AHU) coils within the major plantrooms (area of a building that houses the mechanical services).
- Collected water is sent to the Non Potable Cold Water (NPCW) storage tank for reuse within the building.
- It is estimated that approximately 500 to 1000 kL per annum is available for reuse.

Rainwater recycling

- Rainwater recycling has been provided through a series of gutters, syfonic gutter outlets and syfonic roof drains.
- All rainwater is collected in the rainwater collection tank for use within the building.

Emergency Shut Down (ESD) hydraulics

- All hydrant and sprinkler pump test water is re-circulated and reused for future tests.
- Each floor with sprinkler coverage is provided with an isolation valve to

drain for on floor works. The water drained down is diverted to fill the sprinkler tank.

Water meters

- Water meters are provided for all major water uses within the building.
- Meters allow for effective collecting, recording and monitoring of water consumption data.
- Alarms are triggered to notify building management in the event of any major water trends.

Blackwater provisions

- A space has been made available within the plantroom for a future black water reuse system.
- The provision allows for future building management to install the system as desired.

Water efficient fixtures

- All fixtures within the building are targeted to achieve the WELL Building Standard and energy efficient standards to achieve maximum end use water efficiency.
- Urinals and toilets are provided with recycled and non-potable water.

Landscape irrigation

- All landscape irrigation is provided from the NPCW storage tank to reduce irrigation water usage.

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Aquafides UV water disinfection systems are validated to meet the stringent global performance benchmarks as part of DVGW, ÖVGW and SVGW certification. The DVGW (German Technical and Scientific Association for Gas and Water), ÖVGW (Austrian Association for Gas and Water) and SVGW (Swiss Gas and Water Industry Association) decree technical rules which set the standard within Europe and globally for optimum system performance and quality.

The UV disinfection systems have been through rigorous testing, which under the DVGW standard validates the system to ensure it achieves a minimum UV dose. Under the DVGW standard, UV systems are validated by independent bioassays where achieved reduction equivalent doses (REDs) are established based on inactivation of indicator microorganisms. The DVGW code stipulates that a UV system must achieve a RED of 40 mJ/cm², which is sufficient for comprehensive disinfection of virtually all human pathogens in drinking water.

The series has a compact design and the ability to be installed either vertically or horizontally. It consists of 12 models, so there is a system to treat every level of water quality and flow rate. Systems are easily maintained and can be installed into new or existing water infrastructures. The systems are said to be up to 75% more efficient than comparable systems in the market.

User-friendly electronic controls provide operation of the system. Several pre-alarm and alarm options inform the operator if the system is not operating as required. The software for these systems can be modified at any time and uploaded with the use of a USB stick or a computer.

UV-Guard Australia Pty Ltd
www.uvguard.com



RADAR LEVEL SENSOR FOR LIQUIDS

VEGAPULS 64 is a radar level sensor for liquids, operating at a frequency of 80 GHz. The product features high dynamics and good-quality focusing, enabling media with poor reflective properties, ie, low dielectric constant, to be measured.

Due to the improved focusing, the beam simply passes by internal tank installations or build-up. Interfering signals, which previously had to be filtered out with false signal suppression, now play hardly any role in the measurement process. Moreover, VEGA offers process fittings with an antenna diameter of only 3/4".

The technology also allows precise measurement of the level very close to the tank bottom. This opens up perspectives in determining the level in small containers used in the pharmaceutical and biotech industries, as well as determining the amount of fuel left at the bottom of large fuel tanks. Measurement accuracy is ±2 mm, even with a working range up to 30 m.

VEGA Australia Pty Ltd
www.vega.com/au



POWDER FLOW MEASUREMENT WITH A RHEOMETER

The Anton Paar Powder Cell, for the MCR rheometer series, brings an array of traditional rheological methods to the field of powder. The product makes it possible to simulate and determine powder flow under different conditions. An MCR rheometer plus a Powder Cell is a suitable combination for true rheological investigations of powders in quality control as well as research and development.

The product combination can simulate and determine powder flow under different conditions; it therefore ensures efficient quality control and smooth powder processing. It can furthermore determine a powder's cohesion strength — the internal resistance of the powder to flow — making it possible to predict whether a powder will flow through a process smoothly and whether the quality of a powder has changed.

The device delivers reproducible results by clearing the 'powder memory' with fluidisation. An automatic measurement program ensures results within 2 min and therefore high throughput. The product is easy to use, providing automatically performed calibration and live visualisation of the measurements. Operating costs are said to be low and the dust protection hood safeguards the operator and the instrument from fine and potentially hazardous powder.

More than just an instrument for quality control, the product also enables the study of dry granular flows, especially in the fluidised or near-fluidised state. It brings the precision achieved with MCR rheometers to the field of granular media. It not only includes a high-precision pressure-drop device, but also enables rotational and oscillatory tests in any state of consolidation, fluidisation or any state in between. The included precision mass flow controller gathers new data between zero-load and the fluidised state.

MEP Instruments Pty Ltd
www.mep.net.au



PORTABLE COLORIMETRIC CHLORINE TEST KIT

The Electro-Chemical Devices HCA1 Portable Colorimetric Chlorine Test Kit is suitable for testing free and total chlorine in drinking water, wastewater, environmental waters, cooling towers and rinse waters in the food and beverage industry. The test kit is designed to use the Micro Strip reagent delivery system.

The kit is supplied with 100 test strips for free chlorine and 100 test strips for total chlorine. Test strips for combined chlorine, chlorine dioxide, high-range chlorine and peracetic acid are also available for the HCA1 Chlorine Plus meter.

The DPD test system used in the test kit is accepted by most health departments because the test is USEPA (DIN Standard 38 408 G4, ISO 7393/2) accepted for testing requirements for free and total chlorine. All tests have been calibrated using certified reference standards and standard analytical spectrophotometric methods. The algorithm in the kit's software mirrors the AWWA, US EPA, DIN and ISO reference test methods for chlorine.

The HCA1 Chlorine Plus System, with the Micro Strip CL (DPD-1), is said to repeatedly agree with an EPA Compliant reference method greater than 99%. The HCA1 Chlorine Plus Advanced Photometric System has been factory calibrated; the fixed calibrations in the meter will be valid for the life of the meter due to the long-life LED, the photo cell and the software.

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

A photograph of the Burkert Type 8905 Online Analysis System. The device is a stainless steel unit with a digital display screen showing a graphical interface. It is connected to various pipes and hoses. The Burkert logo is visible in the top right corner of the image.

Type 8905
Online Analysis System
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www.burkert.com.au

Untapped opportunity with solar PV recycling

The potential of materials recovered from end-of-life solar PV panels could exceed US\$15 billion (78 million tonnes) globally by 2050, according to a report released by the International Renewable Energy Agency (IRENA) and the International Energy Agency's Photovoltaic Power Systems Programme (IEA-PVPS).

The global solar photovoltaic (PV) boom currently underway will represent a significant untapped business opportunity as decommissioned solar panels enter the waste stream in the years ahead, according to the 'End-of-Life Management: Solar Photovoltaic Panels' report released by IRENA and the IEA-PVPS.

The report includes a projection of PV panel waste volumes to 2050 and highlights that recycling or repurposing solar PV panels at the end of their roughly 30-year lifetime can unlock a large stock of raw materials and other valuable components. It estimates that PV panel waste, comprising mostly glass, could total 78 million tonnes globally by 2050. If fully injected back into the economy, the value of the recovered material could exceed US\$15 billion by 2050. This potential material influx could produce 2 billion new panels or be sold into global commodity markets, thus

increasing the security of future PV supply or other raw-material-dependent products.

"Global installed PV capacity reached 222 GW at the end of 2015 and is expected to further rise to 4500 GW by 2050. With this tremendous-capacity growth will come an increase in waste associated with the sector," said IRENA Director-General Adnan Z Amin.

"This brings about new business opportunities to 'close the loop' for solar PV panels at the end of their lifetime. To seize these opportunities, however, preparations for the surge in end-of-life material should begin now.

"With the right policies and enabling frameworks in place, new industries that recycle and repurpose old solar PV panels will drive considerable economic value creation and will be an important element in the world's transition to a sustainable energy future," added Amin.

The report suggests that addressing growing solar PV waste, and spurring the establishment of an industry to handle it,

would require: the adoption of effective, PV-specific waste regulation; the expansion of existing waste management infrastructure to include end-of-life treatment of PV panels; and the promotion of ongoing innovation in panel waste management.

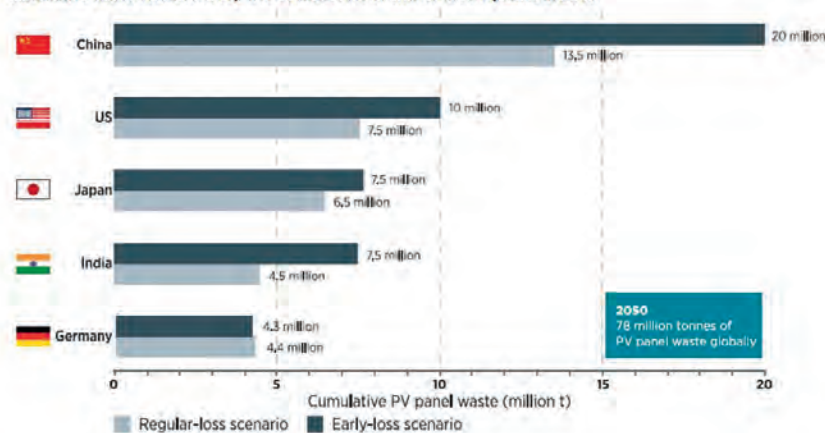
"Experience with electronic waste tells us that developing technological and regulatory systems for efficient, effective and affordable end-of-life management requires long lead times," said Stefan Nowak, chairman of IEA-PVPS. "This timely report can be used by public and private sector institutions to anchor the necessary investments in technology and policy research and development and supporting analysis to unlock the significant recoverable value in end-of-life panels.

"Responsible life-cycle management is an imperative for all PV technologies — the socio-economic and environmental benefits which can potentially be unlocked through end-of-life processes and policies for this waste stream in the future should be seen as an opportunity today to start extending the photovoltaic value chain," added Nowak.

In most countries PV panels fall under the classification of 'general waste', but the European Union (EU) was the first to adopt PV-specific waste regulations, which include PV-specific collection, recovery and recycling targets. The EU's directive requires all panel producers that supply PV panels to the EU market (wherever they may be based) to finance the costs of collecting and recycling end-of-life PV panels put on the market in Europe.

The report is available for download at from IRENA.

Cumulative waste volumes of top five countries for end-of-life PV panels in 2050





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PV PANEL SHUTDOWN

The Solarcheck RSD photovoltaic panel shutdown from Phoenix Contact independently puts photovoltaic rooftop systems into a safe state, protecting personnel from electric shock during installation and maintenance or in dangerous situations.

Photovoltaic rooftop systems generate DC voltages of up to 1000 V and cannot be disconnected easily on the DC side. This becomes very dangerous if the system is damaged and personnel are working inside.

The panel shutdown analyses the current and voltage conditions on the DC side of the system. Deviations from the normal state or shutdown of the inverter result in automatic shutdown of the photovoltaic panels.

The system is restarted automatically when a technically safe environment is present. The Auto Rapid Shutdown technology is claimed to be more reliable and faster than any human assessment or manual intervention.

The product consists of a central start unit per string and shutdown units that are installed directly on the respective photovoltaic panels. The system can be easily integrated into the existing panel cabling and does not have to be programmed or configured manually.

Phoenix Contact Pty Ltd
www.phoenixcontact.com.au



PARTICULATE TRANSMITTER

The Series PMT2 Particulate Transmitter, from Dwyer Instruments, is designed to measure particulate emission levels from dust collector discharge. Using DC-coupled, electrostatic, induction-sensing technology, the transmitter monitors a pA current that is generated as particulate passes near the probe and transmits a 4–20 mA signal that will vary based on the particulate level.

The product offers six sensitivity ranges, allowing the user to choose the range that will best fit the application. The range and test selector switch can also be set to output a 4 or 20 mA signal to assist with set-up or troubleshooting. Averaging time setting can be used to dampen the signal if desired.

Applications include emissions monitoring; broken bag detection in dust collectors; filter leak or wear detection; and bin vent monitoring.

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

REMOTE MONITORING PROGRAM FOR COMPRESSORS

Sullair Australia announces the release of a cloud-based remote monitoring program, AirLinx, which allows users to monitor the company's Champion compressors 24 hours a day. The program addresses the problems faced by facilities due to compressor failure or delayed compressor service, resulting in production downtime that can hurt a business's bottom line and reputation.

The program alerts users to breakdowns and unscheduled interruptions in their compressors, improving system reliability. It is also suitable for monitoring compressor performance.

An AirLinx controller mounted in the compressor records system parameters in real time and sends information to the cloud. The compressor's performance data can be viewed and analysed by the user on a simple dashboard accessible on a mobile or computer. Receiving this information in real time helps the user limit machine downtime through timely action.

The remote monitoring program is offered with a choice of two plans. While the basic plan AirLinx monitors all fundamental parameters, including pressure, service and machine running hours, AirLinx Plus provides these features in addition to benefits such as ambient temperature monitoring and motor speed/utilisation on VSD machines.

Sullair
www.sullair.com.au

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Clog-free pumping for aircraft wastewater

London's Heathrow Airport is one of Europe's busiest airports, catering for more than 200,000 passengers each day with an average of 1200 flights arriving and departing from the airport daily. Heathrow Airport Water Services Department has an extensive network of 120 pumping stations to manage.

It recently installed and trialled Xylem's latest Flygt wastewater pumping system in an effort to solve chronic clogging issues at one of the airport's wastewater pumping stations. As well as delivering consistently clog-free pumping, Xylem's Flygt Concertor reduced energy consumption by 53% at the pumping station.

The Central Area Sanitation Unit adjacent to Terminal 1 is a receiving station for aircraft toilet waste, which contains a high level of non-biological solids including various plastic material, wipes, nappies and clothing. This stringy material can be difficult to pump, since it can easily get caught on the

Flygt's new wastewater pumping system combines built-in sump and pipe-cleaning functionalities in a single integrated solution, capable of tackling sump floating debris as well as pipe sedimentation. Furthermore, the pump-cleaning function, together with Adaptive N-hydraulics, effectively detects and solves clogging from large debris.

Since its installation at the Heathrow Central Area Sanitation Unit in November 2015, the system has provided clog-free operation, along with an improvement in the wet well environment. "Since installing Concertor, we have had absolutely no clogging and the sump remains clean with no fat build-up," said Jolly. "As well as peace of mind — which really is priceless — the cost savings are significant at approximately 87.5% of the annual costs in cleaning and servicing."

Clog-free operations and a clean wastewater pumping station are, however, not the only ways that the system improves wastewater operations. It also aims to deliver reliability at the lowest total cost of ownership and to achieve this it also, among other benefits, drastically reduces energy consumption.

In the case of the once-troublesome Central Area Sanitation Unit pumping station, energy savings are up to 53%, which again is a result of both sophisticated software and cutting-edge components.

The Energy Minimizer function, together with the Adaptive-N hydraulics and the IE4 efficiency motor, automatically ensures that all the pumps run at their most efficient duty point. Additionally, since there is no need for ventilation, cooling or heating of cabinets, customers benefit from substantial energy savings over the system's total life cycle.

The new system uses sophisticated technology but is still compact, user-friendly and simple to install, commission and operate.

"Concertor's compact design allowed it to fit into the existing position within the pump station, without any extra investment required to enlarge the cabinet. From an aesthetic and practical consideration, the reduced panel requirement size will be of great benefit," said Jolly. "It was simple to install and very user-friendly. Actually, the trial pump was installed by one of the airport's water services mechanical technicians, who was not experienced in the commissioning of wastewater pumping systems and quickly gained confidence in the ease of installation and operation."

impeller and partially block the pump — leading to increased energy consumption and, in the worst case, a full blockage of the pump.

This challenging wastewater application led to regular clogging and to the sump requiring significant operational activity to try to keep it clean.

"We would usually have to deal with two or three clogging issues during a three-month period," said Ian Jolly, systems specialist for water, Heathrow Airport Water Services Department. "We also used to see a shelf of fat and material deposits build up on the walls of the sump, as well as floating debris. This presented a very tough challenge to our existing wastewater pumps, which we frequently had to de-clog."

Heathrow Airport required a solution that would solve the operational costs and environmental problems caused by:

- high levels of floating debris on the surface of the wet well;
- higher than normal percentages of rag/non-biological solids in the wastewater.



Xylem

flygt.com/one-ultimate-system



ONLINE SOLAR POWER CALCULATOR

Solar resource website Solar Calculator has developed an online solar power calculator for users that want to evaluate the cost, savings and solar output from any new solar panel or battery installation. Users need only provide their postcode, average electricity bill amount and energy retailer in order to use the calculator.

Based on selections made by the user, the calculator displays results for the generation of solar power, electricity powered directly from solar panels and batteries, excess power exported to the grid, system cost, annual savings, payback period, ROI, lifetime savings

and the reduction in greenhouse gas emissions as a result of the system's clean energy output. Users are able to add a battery to their desired solar panel system, opt to finance their system and factor in panel performance elements like shading.

Available to use free of charge, the web-based solar power calculator is user friendly. However, more knowledgeable solar users can adjust advanced settings like the rate of bill inflation and system degradation and see the effect it has on their results.

Solar Calculator is not affiliated with any energy companies or solar providers. It is a private, independent corporation that strives towards a clean, renewable energy future by providing tools to educate users on the benefits of solar power.

Solar Calculator
www.solarcalculator.com.au

MAINS POWER ELECTROMAGNET

STEINERT Australia has been supplying tramp removal magnets for harsh working environments for many years. However, the challenge recently has been to provide a standalone power supply to run the magnet that can survive in extreme climates.


The STEINERT MP mains power electromagnet is suitable for industry applications in the mining and resource recovery sectors. It does not need a separate power supply and has been specifically designed to run directly off the user's mains power supply, requiring only a suitable three-phase power source.

The simplicity of plugging the magnet into the site's mains power source makes it easy to use. Once it is attracted, it stays firmly stuck until the time of release. It results in a reduced overall footprint as there is no area required for a control cabinet, as well as reduced installation and commissioning time.

The Australian-made electromagnet is available in several sizes and models, including a self-cleaning model. It is also underground compatible (zone 21).

Steinert Australia Pty Ltd
www.steinert.com.au





disclaimer notice

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Resource recovery

— an important step towards
a sustainable future

Richard Pittard, Head of Health, Safety and Environment, Cleanaway

There is an ever-increasing focus on sustainability across all industry and community sectors. More companies are beginning to report on sustainability targets, and the community is increasingly focused on the sustainability of not just the businesses they purchase from — but their entire supply chain as well.



Of the 17 Sustainable Development Goals (SDGs) adopted by the UN in 2015, one is dedicated to ensuring sustainable consumption and production patterns by 2030. And a critical component of this complete supply chain is the management of 'waste'. It will be through businesses revisiting the concept of 'waste' and increasingly switching focus to resource recovery that they will be able to make more progress towards a more sustainable future.

Since the introduction of kerbside recycling collections in the 1980s, the industry, and the technology we use, has consistently evolved. Today's resource recovery and recycling efforts are exploring new ways to recycle more items than ever before, reducing the amount of residual 'waste' going to landfill — and even then, not leaving any resource untapped.

The April launch of Paintback, in partnership with Cleanaway, a waste paint and packaging collection scheme developed and implemented by the Australian paint manufacturing industry, is one such example. Using new processing technologies, the scheme aims to collect more than 45,000 tonnes of waste paint over the next five years — significantly reducing the amount going to landfill and maximising the inherent value of the recyclable materials.

In the Albury Wodonga region, on the border of New South Wales and Victoria, in partnership with six local councils and shires, we supported the introduction of a kerbside organics collection service in July 2015 and we are now seeing recovery rates in excess of 80% from local households' kerbside collection service. Which means only 20% of the 'waste' put out for kerbside collection by local residents' bins ends up in landfill.

Cleanaway also works with a number of large Australian-based manufacturers to tailor bespoke solutions to recover as much as possible from their waste. And with more companies aiming towards zero waste to landfill as a key sustainability measure, it is a growing area of focus for our business.

In 2014, Cleanaway's Thomastown Grease Trap processing plant received the Innovation in Sustainability Award for our patented

filtration system, which not only allows us to discharge cleaner water after processing, but importantly has led to an 80% reduction in the amount of residual waste going to landfill, and allows us to generate millions of litres of recoverable, saleable tallow — something which would have previously been lost.

This process was developed from those in other parts of our business to refine used ship oil — processing it for beneficial re-use. We are the nation's largest collector of used mineral oil from workshops all over the country — seeing us process more than 150 million litres of oil each year. Refining this, and closing the loop to put it back into production, saves Australia 900,000 new barrels of oil each year.

Of course, the innovations and investment haven't stalled in the tried and true collection and processing of paper, cardboard and plastics. The nation's recycling rates continue to improve, and technological advances mean increasingly sophisticated processing and sorting plants across the country.

Even the residual waste, which isn't able to be recovered and subsequently ends up in landfill, doesn't go to waste. Cleanaway aims to still recover as much from this as possible — in the form of energy which is generated as a by-product of natural decomposition. Demonstrating the value of this, in 2015, Cleanaway captured 113 million kilowatt-hours of energy from landfill gas, enough to power 16,000 homes for a year. And as we increase our capacity to tap this new resource, we anticipate these rates will increase.

So while we all have a way to go to ensure we are protecting our scarce natural resources for future generations, ongoing investment into new technology and innovative ways to recover more from waste will help pave the way forward. It will be through an ongoing partnership between companies like Cleanaway and our customers, as well as Australian households and communities, which will see us together make continued progress towards a more sustainable future.

Cleanaway
www.cleanaway.com.au

RESIDENTIAL STORAGE UNIT

In the rapidly evolving residential storage market, there are three key elements that end users and installers look for when selecting a residential storage unit: compactness and weight, expandability and aesthetic appeal. LG Chem's RESU 6.4 EX with 144 Wh/L is a light and compact storage solution providing value to both end users and installers.

With a superslim size (406 x 664 x 165 mm), the product is easy to handle and small enough to be placed inside a home. The increase in energy density to 144 kWh enables an ultracompact, ultralightweight battery to be designed.

The unit allows for expansion with up to two 3.2 kWh expansion packs, so the user can have a 6.4, 9.6 or even a 12.8 kWh system. With such flexibility, it is suitable for households of many sizes.

The residential storage unit comes in a slimline design to harmonise with its surroundings, making it feel as ordinary as a home appliance. Due to its compactness, it can be installed where other systems are too large or bulky to fit, such as low-ceiling attics and narrow utility rooms.

Solar Juice Pty Ltd
www.solarjuice.com.au



FILTER ELEMENT RANGE

HYDAC has launched the Optimicron filter element range, enabling considerable energy savings for fluid oil systems. The design emphasis on the filter media pack is on minimal energy consumption combined with a high level of fluid cleanliness and extended service life.

The filter series has a wealth of features, such as pleat geometry, innovative drainage layers, efficient filter materials and optimised filter element wrap. Tests have shown that the elements have up to 30% lower differential pressure in comparison to similarly sized filter elements on the market, according to the company.

Test results indicate a definite energy-saving potential if using the filter element technology. This means energy can be saved in the form of either fuel or electrical power when operating fluid oil systems. This reduces operating costs, conserves resources and reduces emissions.

HYDAC International
www.hydac.com.au



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ACTI-Mag is a concentrated, stabilised suspension of magnesium oxide. It is particularly effective for neutralisation and heavy metal capture in industrial wastewater treatment plants, municipal wastewater treatment plants, flue gas treatment (sulfur dioxide, chloride removal), sugar and chemical processing.

The product is a low-viscosity slurry that flows easily in most dosing systems. It is hydrated from Calix's highly reactive magnesium hydroxide, imparting good neutralisation speed due to the high surface area. The product is safer to handle than traditional neutralisation chemicals, with reduced sludge generation making for easier disposal.

The product is useful for treating industrial metal-laden acidic wastewater, where, compared with caustic soda or lime, metals are removed at lower pH and less sludge is produced. It is also used by municipal wastewater treatment facilities and is a suitable product for odour control (prevention of hydrogen sulfide formation), neutralisation and corrosion protection in sewerage systems.

Calix Limited
www.calix.com.au



PARTNER PORTAL FOR ENERGY STORAGE PRODUCTS

LG Chem has launched the LG ESS Partner Portal, a website dedicated to providing installers and distributors with helpful information about the company's products.

The partner portal will provide partners with detailed information about energy storage solutions, including product information, warranties, manuals, product images, specifications, brochures, flyers and other materials to help support all activities across residential, commercial and industrial grid and UPS applications.

The launch of the portal comes in conjunction with the introduction of a membership points program, the LG ESS Partner Care Program. By registering with the portal, distributors and installers can accumulate points in exchange for additional benefits such as price reductions and presentation materials.

The company's products are equipped with a serial code that can be entered into the portal to register the points. Installers will receive points for selling the products and distributors will receive points when an installer buys the products from them.

LG Chem Energy Solution Company
www.lgesspartner.com

NITROGEN DIOXIDE ANALYSER

Ecotech's Serinus 60 is a direct nitrogen dioxide (NO₂) analyser.

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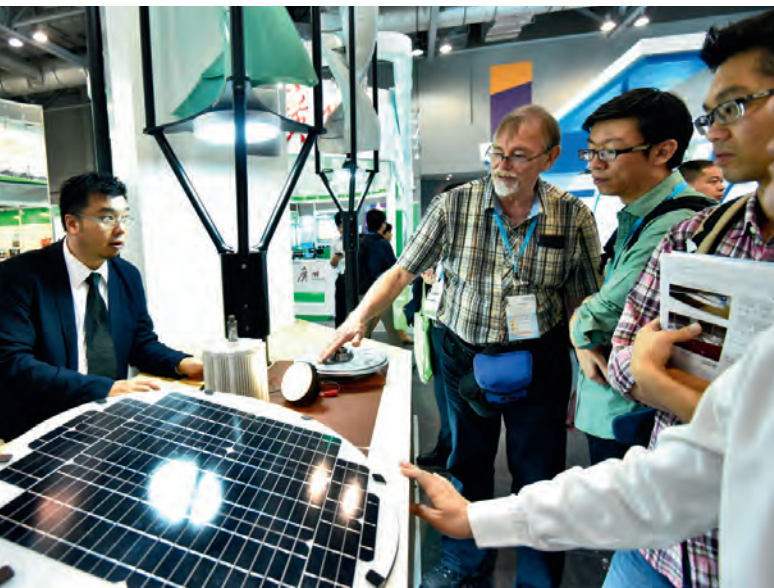
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Eco Expo Asia 2016



The 11th edition of Eco Expo Asia – International Trade Fair on Environmental Protection will run from 26–29 October 2016 at Hong Kong’s AsiaWorld-Expo. This year’s expo will open with the new theme ‘Green solutions for a changing climate’ and includes an exhibition of green solutions to help governments and industry achieve their sustainability goals.

With commitment to the Paris Agreement, world governments have set ambitious emission reduction targets that give impetus to environmental protection. The Chinese mainland and other countries in Asia are not only rolling out measures to cope with climate change, but are also taking aggressive actions to manage waste problems and to reduce the reliance on non-fossil fuels.

The Chinese mainland pledged to drastically reduce carbon emissions and increase its clean energy ratio in its 13th Five-Year Plan. The country’s cumulative investment in non-fossil fuels and low-carbon technologies is forecast to exceed US\$6.26 trillion by 2030. The Belt and Road Initiative will also bring about new green

solutions that will help the Chinese mainland meet its environmental goals as it deepens trade ties with 64 countries.

Meanwhile, Hong Kong also aims to tackle its long-standing waste problems and surging energy consumption. Apart from dedicating a US\$129 million recycling fund to cut waste, Hong Kong is also determined to reduce energy intensity by 40% by 2025 in the city’s first Energy Saving Plan. Some of the measures include implementing higher green building standards, using sustainable building technologies and launching energy-saving measures.

Mr Wong Kam-sing, Secretary for the Environment of the HKSAR Government, said: “We see Eco Expo Asia as an effective platform for Hong Kong, the Chinese mainland and other regions to cooperate and work towards achieving the common goal of promoting environmental protection.”

The fair will again feature a Theme Day concept in which each day will be complemented by corresponding business events, conferences and workshops on a specific topic. The concept aims to highlight related products and solutions to facilitate effective sourcing. The themes to be covered this year include:

26 Oct: Global Innovations for Climate Change

27 Oct: Waste Management

28 Oct: Sustainable Energies and Buildings

29 Oct: Green Living

Companies showcasing their latest climate management solutions at this year’s expo include: DELABIE and Environnement S.A from France, FSE Environmental Technologies Group Limited, REC Green Technologies, Robin Energy and The China Engineers from Hong Kong as well as SK Kaken from Japan. ALBA Integrated Waste Solutions from Germany, Baguio from Hong Kong, Donasonic from the UK and Envac from Sweden will demonstrate their expertise in waste management. The fair also marks the debut of the Finland Pavilion and the return of the Switzerland Pavilion. The Canada Pavilion, led by Government of Ontario and Consulate General of Canada in Hong Kong, will again gather a group of green-tech companies to unveil their innovations at the 2016 edition. A regular exhibitor, China Energy Conservation and Environmental Protection (Hong Kong) Investment Co Ltd, will return to the fair again. This year, it aims to give a more comprehensive demonstration of its environmental technologies as well as its achievements in solid waste management.

The event is organised by Messe Frankfurt (HK) Ltd and the Hong Kong Trade Development Council, and co-organised by the Environment Bureau of the Government of Hong Kong Special Administrative Region.

What: Eco Expo Asia

Where: AsiaWorld-Expo, Hong Kong

When: 26–29 October 2016

Web: www.ecoexpoasia.com

An insider's guide to All-Energy

Thousands of clean and renewable industry experts are expected to attend this year's All-Energy Australia Exhibition and Conference, taking place from 4–5 October. Delegates can expect a number of new elements at the 2016 event, according to All-Energy Australia Exhibition Director Robby Clark.

"High demand from the industry has seen our programming team introduce a stronger focus on energy storage, energy efficiency and the potential of smart grids to improve the economy, lifestyle and environment for Australians," said Clark. Specialised conference sessions have been developed for these three areas, offering the latest in industry developments and best practice case studies for visitors.

The conference schedule is structured around 12 session categories: bioenergy, community energy, energy efficiency, energy storage, government initiatives, low-carbon transport, market developments, new tech-

nology and innovation, project development, smart grid, solar and wind. This will be presented by more than 150 industry speakers from organisations such as CSIRO, Solar Analytics, World Wind Association, AECOM and Jemena.

The opening plenary will feature state and federal ministerial welcomes and a panel discussion on the peer-to-peer renewable energy marketplace with the Clean Energy Regulator's executive general manager for the Renewables and Carbon Farming Division, Mark Williamson, PowerShop's chief executive, Ed McManus, and the Clean Energy Council's Kane Thornton.

Highlights on display will be SMA Australia's recently developed Sunny Boy Storage battery inverter designed for high-voltage batteries like the Tesla Powerwall, Enphase Energy's Enphase Home Energy Solution and ABB's REACT (Renewable Energy Accumulator and Conversion Technology).



What: All-Energy Australia Exhibition and Conference
When: 4–5 October 2016
Where: Melbourne Convention and Exhibition Centre
Web: www.all-energy.com.au

Waste Summit @ Waste Expo



Waste Summit 2016, held as part of Waste Expo from 4–5 October, is a free-to-attend conference on waste management and resource recovery. It is supported by EPA Victoria, the Clean Energy Regulator, ACT Government, City of Wodonga, Albury City, Corowa Shire, Indigo Shire Council, East Gippsland Shire Council and a number of key suppliers, industry consultants and industry groups.

The conference provides attendees with the opportunity to stay informed, learn from case studies and engage with peers. With over 16 seminar sessions to choose from, it covers case studies, regulations, trends, policy and opportunities and will stimulate thinking and discussion.

Sustainability Victoria's Stan Krpan will deliver the opening address, providing an industry update on the waste and resource recovery agency's programs, plans and learnings. This will be followed by an in-depth seminar detailing research results from Sustainability Victoria and CSIRO's research partnership, exploring community attitudes and perceptions to waste and resource recovery.

In a panel featuring Cleanaway's Nina McHardy, participants will discuss the Halve Waste three-bin organics system, how it was implemented and its first year of success, which saw over 18,000 tonnes of waste diverted from landfill and significant community behaviour change achieved. These results were achieved through a researched and targeted education and engagement campaign focusing on the barriers householders have to utilising the new system.

Another panel session providing insight will look at issues, drivers and solutions to apply the three Rs — reduce, re-use, recycle — to a circular economic model presented from four differing viewpoints: supplier, consultant, regulator and industry.

What: Waste Summit @ Waste Expo
When: 4–5 October 2016
Where: Melbourne Convention and Exhibition Centre
Web: www.wasteexpo.com.au

Councils can benefit through clean energy transformation

Ageing assets and inefficient energy practices are adding to the cost burden of councils. On the other hand, clean energy investments can transform local government operations and provide ongoing benefits for their communities. CEFC sector lead for Local Government Melanie Madders provides her opinions.

The Clean Energy Finance Corporation (CEFC) supports the local government sector to invest in a cleaner future through energy-efficient, low-emissions and renewable technologies.

These technologies have a range of ongoing benefits. Councils can achieve lower operating costs, reduced carbon footprints and more efficient asset management while developing facilities that enhance their communities. Through these sustainability projects, councils are leading their communities by example. However, there is still plenty of opportunity for further improvement.

At the recent National General Assembly of Local Government in Canberra, I spoke with elected representatives and council staff from across Australia about many great projects they've undertaken to reduce their energy costs. It was refreshing to meet council representatives who were already planning their next sustainability projects after realising the ongoing benefits of such initiatives, such as upgrading lighting equipment or installing solar.

But what struck me was how much broader the scope of clean energy change could be. With some strategic forward planning, councils can borrow now while interest rates are at historic lows and lock in committed finance to fund the capital cost for, say, a three-year clean energy program.

The CEFC's view of the local government sector has two key elements: councils typically have the financial capacity to readily service borrowings, as they generally have

stable cash flows and strong credit profiles; and clean energy projects deliver cost savings, which means that debt can be used to finance the upfront capital investment requirements and the debt repayments can be offset by the project savings.

At the CEFC, we have lent to councils and are happy to do more, noting that borrowing legislation varies across the states. In most cases we can provide financing solutions that will help councils to invest to achieve long-term sustainability outcomes and energy cost savings, with minimal net cost for debt service.



Making councils' operations more efficient, through energy efficiency and renewable energy technology investment, frees up council funding for other important projects in need of council support and which may not generate cost savings.

By offering a three-year availability period over which councils can draw down approved finance, we're enabling councils to prepare and roll out a forward program of works to meet the council's sustainability goals. This also delivers funding certainty for councils that are looking to harness clean energy and reduce operational costs without using their normal funding sources for the upfront capital investment.

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So how does a council push clean energy projects forward? First, identify where most of your energy is used — sustainability teams have a good understanding of what areas can be addressed to yield the best results. Next, look at how this aligns with your council's policy objectives and targets for carbon reduction and map out a forward plan for the transition.

We want to help councils target projects that make a significant reduction to their energy consumption and carbon footprint. We've previously helped councils finance better lighting and building management

systems, more energy-efficient air conditioning and heating, and LED street lighting. We've also financed projects that harness energy from landfill and we can finance electric vehicle fleets and community charging stations.

We know that councils are constantly reviewing the way they provide services to ensure the best possible outcomes at the lowest cost for ratepayers. The CEFC recommends that councils make sustainable energy use an integral part of that focus and consider using debt appropriately to invest in initiatives that will deliver ongoing benefits for your local community and the lead the way by investing in better, cleaner cities.



Melanie Madders is the CEFC's sector lead for Local Government, taking projects from initial discussions through to signed loan documentation. She also leads the CEFC's university sector transactions. Recent projects include the \$30m loan to the City of Melbourne and \$9.1m loan to the University of Melbourne. Melanie has a project finance background, having worked at The Royal Bank of Scotland in London on infrastructure projects as diverse as roads and smart meters and in a financial advisor, debt lender or equity investor capacity. She also led major infrastructure projects at Queensland Treasury, from business case development through to project procurement.



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- Technologies
- Environmental Solutions
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