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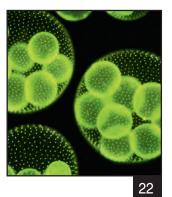




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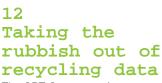


Network modernisation for utility companies

The changing face of the electricity system in Australia.

Renewable future for business and industry

Renewable energy technology innovations for business and industry.



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www.sustainabilitymatters.net.au/magazine

There is a growing realisation that Australia is home to some of the best renewable resources in the world, said ARENA CEO Ivor Frischknecht at the recent Australian Solar Council's Solar 2015 Exhibition and Conference held in May. While wind technology is currently more commercially advanced than large-scale solar in Australia, he says large-scale solar is likely to be competitive with wind by the end of this decade.

And in what has been described as a game changer for the renewable energy industry, CSIRO's 'supercritical steam' project could mean that one day the sun could be used to drive the most advanced power stations in the world, currently only driven by coal or gas. The breakthrough was achieved through a \$5.7 million research program supported by ARENA and part of a broader collaboration with Abengoa Solar.

Solar energy was used to generate hot and pressurised 'supercritical' steam, at the highest temperatures ever achieved in the world outside of fossil fuel sources. The world record was set in May last year at the CSIRO Energy Centre, Newcastle, where researchers achieved a pressure of 23.5 megapascals and temperatures up to 570°C. According to CSIRO Energy Director Dr Alex Wonhas, this breakthrough demonstrates that the power plants of the future could instead be using the free, zero-emission energy of the sun to achieve the same result.

In this, our renewable energy issue, we take a look at the increasingly compelling case for implementing renewables into business and industry - see page 8 for all the details.

Also held in May was AWA's Ozwater'15 conference and exhibition, and it was great to meet with many of our readers and contributors at the event. Australia has one of the highest hydroclimatic variabilities in the world, creating a risk that must be managed by both the water industry and many other industries that rely on water, such as agribusiness and food manufacturing. During

the conference, the AWA announced it will be working with the Bureau of Meteorology (BOM) to create greater industry awareness and uptake of BOM's valuable and comprehensive range of water tools which could assist these industries.

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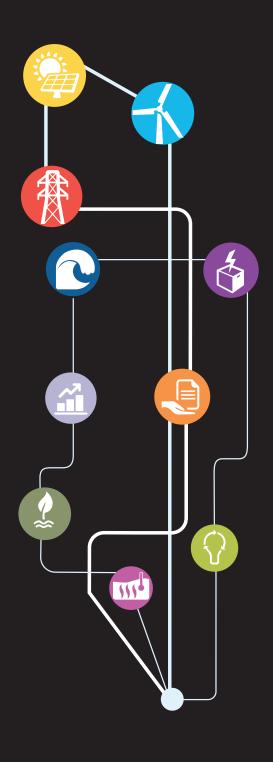


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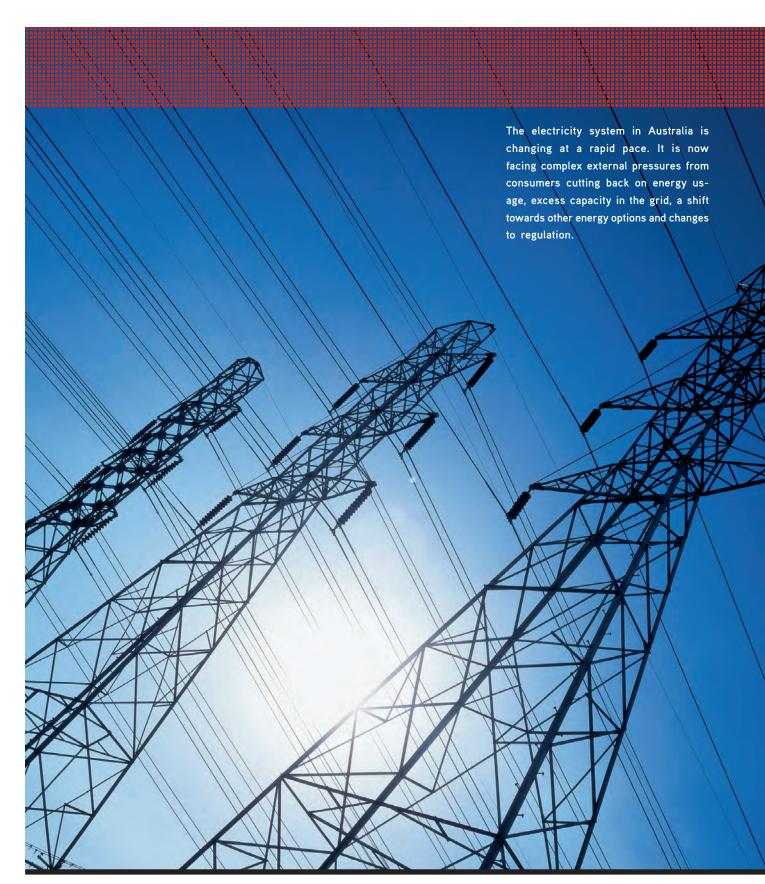
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Network modernisation for utility companies



verall, the demand for energy has changed. ABS Energy Account data shows the average annual household expenditure on electricity grew strongly

until 2009-10; however, since then it has barely increased. Consumers are responding to the increase in electricity prices and looking for more sensible ways to manage their energy consumption. In 2005, the manufacturing industry accounted for over 25% of Australia's energy usage but in recent years the country has experienced a significant decline, especially in energy-intensive manufacturing. With the decline in manufacturing made evident by the closure of aluminium smelters at Kurri Kurri in NSW and Point Henry in Victoria there has been an unprecedented fall in both maximum demand and the consumption of energy. The closure of Point Henry reduced energy consumption in Victoria by 7%.

This decline in energy consumption has adversely affected the turnover for both retailers and generators and has led to inefficiency in distribution networks. These changes, combined with an ageing network, are having massive impacts on the energy industry. It is driving the electricity industry to adapt and look to new technology that allows utilities to measure, monitor and analyse data in an effort to be more energy and capital efficient. Modern technology affords utilities the opportunity to improve productivity and reliability, enhance operational efficiency and utilise more effective, sustainable business models.

To remain competitive and ensure longevity, utilities must look for ways to improve its energy efficiency. This can be achieved

through network modernisation, by the availing of modern technologies and infrastructure improvements. The installation of more effective management systems and the commissioning of equipment provide greater visibility and remote monitoring, which allows utilities to readily respond to change in energy demands. This includes adopting the provision of management systems and digital metering that allow utilities to more effectively mine the data, understand and predict consumer behaviour, network impact and control energy usage.

This increased understanding and access to information will help utility companies deal with the challenges they are confronted with and implement modern technologies that will increase efficiency and minimise the total costs of network provision.

The implementation of sophisticated management systems allow for remote monitoring and control, and when deployed effectively will allow numerous benefits. This includes:

- With network modernisation, utilities can reduce the losses in transmission and distribution, which will allow them to minimise the risk of unexpected transformer failure.
- The option for more real-time knowledge about the electricity grid and its performance, which allows for less energy to be used and CO₂ emissions to be lowered.
- Network reliability can be improved as supplies can be restored to many customers automatically and prior to dispatching repair crews.
- There are more alternative, effective solutions for replacement of ageing assets. For

example, if a utility distribution company can deploy a fully automatic self-healing system, they may be able to substantially delay the replacement of an ageing cable network. Self-healing technology will give the utility and customers the comfort that should faults occur, energy supplies can be rapidly restored to affected customers. Extending the asset life cycle therefore will not unduly affect customer service or compromise reliability metrics.

- Energy generated from renewable sources is by its very nature intermittent and fluctuating, but it is attractive because of the societal and environmental benefits it would bring. Smarter management, storage and protection systems are a prerequisite if the percentage of renewable energy consumed is to be increased in a costeffective manner.
- The cost of connection to the electricity grid for new developments will also be reduced as a result of increased efficiency and through the use of microgrids with embedded renewable generation and energy storage technologies.

An efficient electricity grid is imperative for the success of Australia's economy. It is incumbent upon network operators to leverage available technologies, such as network management systems, remote controlled plant and demand response, to drive network efficiencies and increase usage of renewable energy sources, which will benefit not only their business but society as a whole. Many utilities have begun to embrace these technologies and commenced their modernisation journey, while others are yet to begin.



John Coffey is the segment marketing manager utilities for Schneider Electric. He obtained his electrical engineering degree at University College Cork in Ireland and began his career by spending 10 years working for the Midlands Electricity distribution utility in the UK. In 2002, he migrated to Australia and has spent 16 years with Schneider Electric. During his time working for Schneider Electric's overhead switchgear business, John travelled extensively, and throughout various global regions, gaining a broad understanding of the challenges currently facing electrical utilities.

A funny thing happened on the way to Australia's energy future: the humble householder became a literal powerhouse of change.

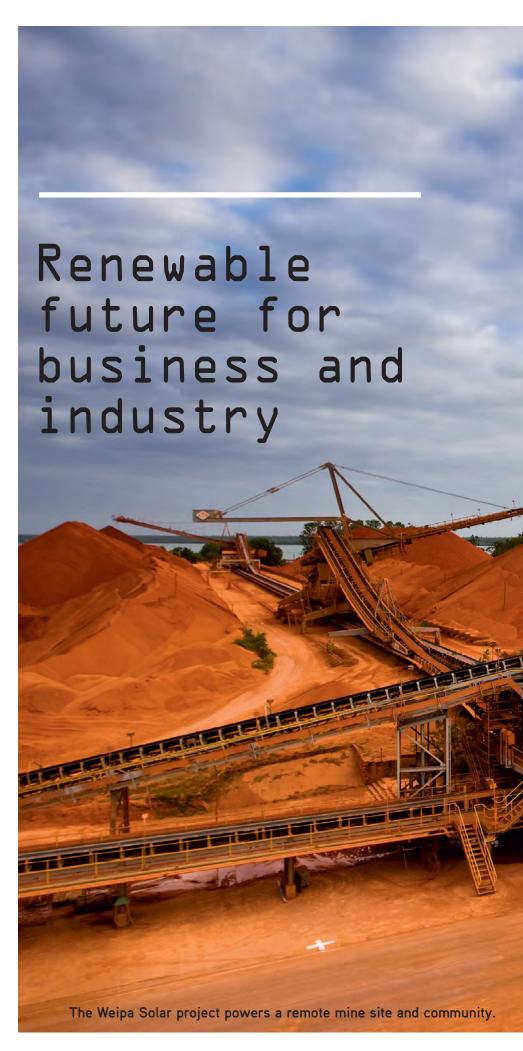
longside that domestic energy revolution, the Australian Renewable Energy Agency (ARENA) is working to bring the renewable energy benefits discovered by those householders to the rest of Australia's community, including businesses and industry.

In the past few years, Australian domestic energy consumers have installed rooftop solar systems in such unexpectedly large volumes that it has taken both the renewables industry and electricity sector by surprise. According to the Australian Bureau of Statistics, one in five Australian households have installed rooftop solar panels or solar hot water systems in an effort to take control of their electricity use, reduce costs and do their bit for the environment.

Just last year, Australians invested \$2.1 billion in distributed, small-scale solar, making it the fifth biggest market for that technology in the world and almost seven times the \$330 million spent on large-scale solar in 2014. International energy analyst Bloomberg expects half of the \$55 billion spent in Australia on new electricity generation over the next 15 years will be on rooftop solar PV.

Most of the business community has been slower off the mark to embrace renewables, which is perhaps understandable given the need to establish a business case before adding new technologies to industrial or commercial infrastructure. However, the ultimate cost saving to be made from making the move to renewables is making the proposition increasingly more compelling.

Renewable energy has been a feature of Australia's energy mix for several decades, growing from around 10% of electricity generated in 2005 to around 13% in 2013. Hydroelectricity has traditionally made up the bulk of that contribution. But with wind energy and rooftop solar PV maturing and







The mining industry, in particular, has demonstrated a growing interest in renewable energy solutions for their remote operations.

declining in cost, these newer technologies are now taking up a greater proportion.

The drive for household energy autonomy has upended the way we think about renewable energy, which in the past has focused mainly on the replacement of fossil fuel-based power generators. While large-scale renewable energy plants contribute to national energy supply, rooftop solar has highlighted the huge potential at the other end of the scale, not only for individuals but also for businesses, collectives and communities, to affordably generate their own electricity using renewable energy technologies.

In addition to mature solar PV technology, there are many other innovative renewable energy solutions emerging from the work of Australia's world-class researchers and developers that, with some targeted assistance, could also reach commercialisation and be made available to Australian consumers.

Providing such support is the role of ARENA, an Australian government agency that was specifically established to lower the cost and increase the use of renewables in Australia. By taking a strategic and business-focused approach, ARENA has identified and is pursuing a number of priorities that will accelerate Australia towards its energy future.

One of those priorities is to help large-scale solar farms approach the same cost as wind farms, which are already commercial. Another related priority is to identify and overcome the challenges that arise from increased volumes of renewable energy being sent into the nation's electricity grids. ARENA is also focused on helping communities and businesses in remote areas and on the fringe of grids to benefit from the same energy-autonomy being enjoyed by urban households with rooftop solar.

Since its inception almost three years ago, ARENA has committed more than \$1 billion in 230 projects that span the innovation chain - from laboratory research and pilot plants to demonstration and pre-commercial installations. Many have specific application for businesses, such as Granite Power's project to produce solar electricity and heat for a local swimming pool, CSIRO's solar-generated air conditioning and electricity for a community shopping centre and Weipa Solar's renewable-powered mine site and community in remote Australia. Around 76% of ARENA's projects are located in Australia's rural and remote locations.

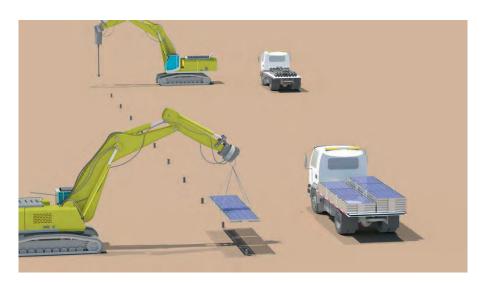
Other projects have broader applications, such as BlueScope's integration of solar cells into buildings, University of Melbourne's work on the printing of solar cells, Muradel's production of transport fuels from inedible plant matter and Carnegie Wave's harvesting of energy from the ocean to produce electricity and desalinated water.

In each case, these projects aim to speed up the advancement of the renewable energy technology or its application so that it will become more affordable and able to compete in the commercial market. ARENA's rigorous process for considering potential projects includes an assessment of the technology's technical and commercial readiness, which ensures that only those with the best chance of reaching commercialisation are provided with assistance.

ARENA takes a technology-neutral approach, and as a result its investment portfolio includes solar PV and thermal, ocean, biomass, geothermal and hybrid technologies as well as solutions that enable the use of renewables.

In remote Australia, solar PV and solar-hybrid installations are also proving to be more affordable - and reliable - than trucked-in diesel, which is expensive, needs transport and storage infrastructure, and is dependent on roads remaining open during the wetweather months.

The mining industry, in particular, has demonstrated a growing interest in renewable energy solutions for their remote operations.



Laing O'Rourke's redeployable solar hybrid power plant can be packed up and moved as needed.

Even though the sector has stopped rapidly expanding as it moves into operational phase, depressed commodity prices and increased energy costs have made renewable energy solutions more competitive and attractive. ARENA is supporting several projects that involve mining operations or have application to mining sites. One innovative example is a redeployable solar-hybrid farm that can be packed up and moved in containers when a mining operation moves to a new location.

One of the factors that make renewable energy expensive is that projects of this kind have not been done before in Australia, or only on a few occasions. Lack of relevant skills and local experience in building and operating renewable energy installations means higher interest rates, higher supply chain costs and big construction contingency margins. ARENA helps overcome this early mover disadvantage by providing support to technology developers over time frames that are longer than those



BlueScope Steel's project integrates solar PV modules into the roofs of homes.

usually accepted in the commercial market. And by ensuring these early projects get off the ground, ARENA reduces perceived risk, builds partnerships, attracts investors and increases local knowledge and expertise.

ARENA plays a unique role in funding the projects and sharing the knowledge that will hasten the arrival of Australia's energy future. The agency is constantly on the lookout to add new projects for its portfolio and is currently accepting applications for a number of programs. To find out more, visit arena.gov. au/initiatives-and-programmes/.

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

Latest project: Batteries trial to put storage on the front foot

A new Canberra-based storage trial will examine whether lithiumion batteries could enhance electricity grids and increase the use of renewable energy.

Australian Renewable Energy Agency (ARENA) CEO Ivor Frischknecht said IT Power (ITP) would carry out the trial, supported by \$450,000 of ARENA funding.

"ITP will analyse the performance of six major lithium-ion battery brands, comparing them to existing and advanced leadacid battery technologies to investigate how they could operate in large and small electricity grids," Frischknecht said.

"Storage is important for allowing more renewable energy to be used in Australia on-grid and off-grid by smoothing out energy supply.

"Power companies could, for example, consider renewable energy based on mini-grids with storage as an alternative to maintaining sections of the main grid that currently run at a loss."

Frischknecht said the testing in a controlled environment would result in a greater understanding of various storage technologies and how they can best be adopted as they begin to compete with lead-acid batteries on cost and reliability.

"Lithium-ion batteries are increasingly used in electric vehicles and consumer electronics, giving them great potential for future cost reductions compared to other storage technologies," Frischknecht said.

"ITP is building a test facility at the Canberra Institute of Technology to put each battery through its paces with repeated charge and discharge cycles simulating real-world applications and Australian environmental conditions.

"The findings will be shared broadly across the energy industry with investors, power companies and researchers in line with ARENA's commitment to knowledge sharing."

ITP Managing Director Simon Troman said conventional battery storage had been used to optimise the design of remote power systems for many years.

"Recent reductions in the cost of lithium-ion batteries coupled with potentially significant performance advantages warrant serious testing of this new storage option," Troman said.

The trial will proceed for three years and is scheduled for completion in June 2018.



Embracing a Green and Sustainable Future



Organised by the Hong Kong Trade Development Council and Messe Frankfurt (HK) Ltd, and co-hosted by the Environment Bureau of the Government of the Hong Kong Special Administrative Region, **Eco Expo Asia** is the leading trade fair for environmental protection technologies, services and products in Asia. Now in its 10th edition in 2015, the Expo is the perfect business platform for a broad spectrum of eco-friendly solutions, allowing governments, enterprises and individuals to pursue a sustainable and green future by exploring thousands of innovative products and services in one location. In 2014, the Expo gathered over 300 exhibitors from 22 countries and regions, and attracted more than 10,800 buyers from across the globe.

The 2015 edition will feature diverse product categories to help address government environmental protection initiatives in Asia, covering:

- Air & Water Quality
- Eco-friendly Product
- Energy Efficiency & Energy
- Green Building Solution & Service
- Green Transportation
- Waste Management & Recycling

"Theme Day" Concept

Each day of the show is highlighted by a corresponding theme with a lineup of special events and conferences. This year's topics include:

- Global Green Insight
- Cleaner Production and Waste Management
- Green Building and Energy Efficiency
- Green Living

Eco Asia Conference

Held alongside the Expo, Eco Asia Conference is an annual event that strives to connect attendees, government officials, scholars and other industry experts from around the world. The Conference provides participants an opportunity to share market insight and learn about the latest developments and trends.

This Expo also offers wonderful opportunities for in-depth, face-to-face discussions with business partners. In its social activities, such as a number of guided tours, informative seminars and networking events, participants can make direct contact with industry players in an engaging environment.

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PT has set strong objectives to achieve a genuinely sustainable outcome in waste and resource management. Its objectives centre around achieving a 98% diversion of waste from landfill, as well as closed-loop recovery - ie, the same resources can be used over and over again in the same production cycles.

Many other companies and government agencies have also set such sustainability objectives; however, there is much that needs to be done to ensure that the good intentions of these objectives result in real progress towards a closed-loop outcome. For progress to be made, managers need to make decisions with a better understanding of the end-of-life outcomes of their waste management processes. This requires more meaningful data than what is currently provided.

GPT therefore advocates, and is undertaking, a shift from inputs-based to outcomes-based reporting. An inputs-based report primarily looks at waste at the point of disposal. Whereas, an outcomes-based report follows the waste all the way to its end destination - in essence shifting the boundaries of where waste data is being reported. With accurate data and reviewing results at the end destination, the outcomes-based reporting approach will provide managers with the most appropriate information for waste management reporting and decision-making.

What is outcomes-based reporting?

Outcomes-based reporting in waste and resource management accurately tracks and categorises information about the end destination of disposed items. Using the common phrases of 'cradle-to-cradle' or 'cradle-to-grave', an outcomes-based report will provide both qualitative and quantitative information about the 'cradles' and 'graves'.

At GPT, an outcomes-based reporting method has been designed to provide better measures for assessing performance against its sustainability objectives for waste and resource management. The principal performance measures will be:

 Waste intensity - a measure of waste generation rates per m² at assets.

- Percentage diversion from landfill a measure of recovery rates.
- Percentage A-grade recovery a measure of quality where processes meet the closed-loop objective.

This reporting method indicates both the quantity and quality of the results of our waste and resource management processes.

There are three main elements of an outcomes-based report that drive improvement:

- Accurate weights the first preference is actual weights. If these are not available, verified site densities are to be applied to volume measures to derive weights. Industry average densities are undesirable.
- Deducting contamination processes should be implemented to net off any contamination or non-recoverables within recycling streams so that only the recoverable items are reported in recovery figures.
- 3. Grading the outcome GPT has named recovery outcomes A-, B- and C-grade. By adding this grading information to reports, the information improves from simply reporting the input weights to a recycling bin to assessing what happens to the contents of the receptacle at their final destination.

How do the recovery grades work?

GPT is implementing the recovery grading system so that the quality of the recovered material can be considered alongside its quantity. Each grade is explained below:

A-grade recovery:

A-grade recovered products:

- meet a closed loop objectives;
- may be used over and over again, constantly being returned to the same production cycle; and
- can be recovered without any consequent hazardous material build-up in the environment.

At GPT, the recovered A-grade product consists mostly of cardboard and paper, some organics and robust recoverable materials such a glass and metals.

B-grade recovery

B-grade recovered products are:

• down-cycled to a lower-value product;

- have a limited number of recovery cycles; and
- produce valueless by-products after several recycling cycles.

Generally, plastic products are down-cycled in Australia and this waste stream makes up the bulk of the B-grade recovered products in GPT's waste management processes.

C-grade recovery

C-grade recovered products are those which are produced in a waste diversion process but are only available for a single additional application.

At GPT, this generally refers to mixed source waste products made up of a composted mix of organics and other residual waste. Energy recovery from non-renewable sources would also fall into this category.

Landfill

This is the non-recovered waste. Sources include:

- general waste processes;
- contamination within a recycling stream;
 or
- losses from recovery processes.

Put simply, if it starts in a bin and ends up in a hole in the ground, this should reasonably be considered landfill and GPT will report it that way where it is identified.

A case study of input-based vs outcomes-based reporting

The following example demonstrates the differences between an inputs-based reporting system and an outcomes-based reporting system for waste and resource management. The inputs data is taken from a waste services provider's bills and monthly reports. The data in the case study is for a mixed commingled container recovery service at a shopping centre in Sydney.

To avoid singling out any waste operators, the asset and service provider information has been excluded. Similar results have been found at multiple assets, so the finger cannot be pointed at a supposed rogue operator. This simply illustrates the need to reform the waste reporting processes.

Other information in Table 1 is actual data from the service provider and billing costs.

The inputs-based report for this commingled stream presents a picture that suggests

resource recovery

	Input-based reporting	Outcome-based reporting
Monthly bill	\$673	\$673
Receptacle	660 L	660 L
Number of collections	31	31
Weight/bin	53.5 kg (derived from data)	18 kg (average measured weights)
Cost/tonne for service	\$405 (calculated)	\$1206 (calculated)
Reported results	1.66 tonnes of 'Primary recycling - commingled containers'	380 kg of PET plastics were recovered to be pelletised and sold to manufacturers to produce lower grade plastic products (Grade B recovery)
		40 kg of aluminium was recovered and sold as a commodity (Grade A recovery)
		80 kg of glass was recovered, crushed and used as an input to glass manufacturing (Grade A recovery)
		58 kg of mixed residual waste (contamination) was sent in landfill

Table 1: Case study example demonstrates the difference between input-based and outcome-based reporting

there is three times more 'recycling' than actually occurs and nearly 15 times what would be reported as meeting the GPT closed-loop objective (A-grade only).

Density data

The first point of interest is the difference between the current reported weight and the measured weight per bin. The reported weight per bin, based on incorrect density assumptions, is around three times higher than the actual weight per bin. So the simple bottom line for the above commingle container service is that it costs nearly three times as much per tonne than is reported. To improve current processes, a simple regime of verifying densities or weights must be implemented at the site level.

Contamination

The second point to consider is that contamination is not taken into account with the 'recycling' result - reported as 1.66 tonnes in Table 1. Effectively, everything that goes into those yellow-lidded bins is reported as 'Primary recycling - commingled containers'. Yet even the quickest of visual inspections highlights that a certain percentage of the contents is not recoverable.

Contamination, such as food waste and bags of 'rubbish', is incorporated in the recovery figures, whereas they should be deducted as it ends up in landfill. When these contamination levels are taken into account, the actual recovery rates drop further and the cost per tonne rises further. In effect, the reported 1.66 tonnes for resource recovery is actually closer to 500 kg when taking into account realistic densities and contamination.

Grading the outcomes

Once we have reasonable integrity for the recovery weights, the final point to consider for an outcomes-based reporting system is what actually gets recovered and how this compares to the objective. A cradle-to-cradle analysis is required here.

To achieve this, the report should include information on material flows through to their end destination. The outcomes are a range of commodities for re-use in the production processes or the return of value to the earth. Depending on the retained value or closed-loop nature, these can be graded.

Consider the input-based data in the example in Table 1 which is reported as 'commingled'. This is not an outcome that can be assessed against a closed-loop objective. In this case, a range of glasses, plastics and metals are recovered and traded as inputs to another process. There is no such thing as recycling a commingle. The term commingled is simply a description of the receptacle used to achieve the outcomes.

With an outcomes-based reporting approach, the notion of primary versus secondary recycling targets becomes irrelevant. Primary and secondary only refer to the location of the separation processes, not the actual outcome of these processes.

The separation processes are unimportant compared to attributes such as retained value, waste miles, ethical stewardship, processing energy, etc. These attributes should be considered more important than whether the waste is recovered through a facility that deals with yellow- or redlidded bins.

Summary

Outcomes-based data reporting is a significant shift for the waste industry. Waste services providers will be required to provide a greater level of transparency and a willingness to explain the disadvantages as well as the advantages of their services.

However, outcomes-based reporting is going to require an equally large shift for the waste service recipient. Firstly, in nearly every case there will need to be an acknowledgement that publicly reported recycling results have been exaggerated and possibly misinterpreted in the past. Data verification may only be achievable in some cases through on-site management processes. Therefore, managers can no longer completely pass on responsibility for reporting integrity to waste industry vendors.

However, most of all, industry will need to take up the challenge of achieving the best quality outcomes from recycling, not only the highest rates of recycling.

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ABB supplies EV charger for renewable energy research

Power and automation company ABB has been awarded a contract for the supply and installation of an electric vehicle (EV) charging solution for the Australian Energy Research Institute (AERI), located at the University of New South Wales (UNSW).

The recipient of a \$19 million grant from the Education Infrastructure Fund (EIF), AERI has been tasked with investigating the challenges faced with the integration of renewable energy sources into the grid. A key facet of this work involves simulating future scenarios to model how future loads and usage will impact overall system stability; the uptake of EVs in large numbers is one such scenario.

The ABB Terra53 CJG EV charger will be used to power a small fleet of BMW i3s, as well as Tesla's new model S. Modelling the performance and impact of the charger - multiplied many times throughout a simulated grid - will allow AERI researchers to develop management and mitigation strategies at the system level to ensure solutions to future problems are available before they eventuate.

"ABB's Terra53 was selected due to its ability to charge some of the latest EV batteries from 30 to 80% in 15 minutes," said AERI Manager Tim Dixon. "The ease of access to detailed charging data for the Terra53 also makes it an excellent fit for our research activities.

"The Terra53 offers AERI the flexibility of being able to fulfil the various charging standards across their fleet of vehicles,"



added Anthony Froelich, the sales manager for ABB EV chargers. "It is compatible with all CHAdeMO, Combined Charging Systems (CCS) and Type 2 AC vehicles currently on the road."

Installation and commissioning of the fast-charging unit will be completed by June.

ABB Australia Pty Ltd
www.abbaustralia.com.au

Concrete plant provides in environmental education

Building materials supplier Hanson recently hosted a site tour at its Lytton concrete plant for students from Queensland University of Technology (QUT). There, the students witnessed a combination of complex production processes and sound environmental management in practice.

The visit was coordinated by Paul Timmins, sustainability manager for Hanson, and Belinda Davies, course coordinator for Environmental Studies at QUT, who sought an opportunity for the students to experience how sustainability can translate from theory to reality. The plant also hosted a tour for the course's international students from Saudi Arabia, Zambia, China, Japan, Philippines, Malaysia, Nigeria and Pakistan.

Surrounded by bushland and close to protected wetland areas, the Lytton site is described as a good example of industry best practice in South-East Queensland. Developed at a cost of \$8 million, the facility demonstrates high standards in environmental protection protocols and throughput processing productivity.

Hanson managers provided the tour groups with information about the concrete-making process: from international logistics to how the national network of Hanson plants connect, create and deliver thousands of cubic metres of concrete for some of the biggest projects across Australia every year. The site tour also reviewed the company's on-site processes



and raw materials, potential environmental and safety risks, and community outreach.

International student Martha, from Kitwe in Zambia, works for a local council in her home country and was sponsored to study Australian environmental issues management to enable her to apply new thinking in her workplace. She said the practical elements of the QUT course, such as the Hanson site visit, were critical to learning to develop training and procedures for practical use at home.

Davies said the tour was invaluable for enabling students to gain insights into industry practices and the chance to ask questions and engage with plant managers, staff and Hanson's national manager of sustainability. She said, "During the tour we discuss a range of course linkages and we had several spirited discussions about potential pollutants, their implications and mitigations, including dust, noise, water, land contamination, waste management and recycling."

Hanson Construction Materials www.hanson.com.au

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Community-funded solar project at Sydney convention centre

An innovative sustainability initiative will see the International Convention Centre Sydney (ICC Sydney) become home to the first community-funded solar energy project of its kind in Australia.

Due to open in December 2016, ICC Sydney is being developed through a public-private partnership (PPP) with the NSW Government and Darling Harbour Live (comprising Lend Lease, HOSTPLUS, Capella Capital, AEG Ogden and Spotless). The roof of the venue will be home to one of Australia's largest solar arrays within a central business district.



Canadian Solar was selected to provide the 520 kW PV system after offering a turnkey solution which included Quartech-Next Generation PV panels, micro-inverters and innovative rooftop mounting structure. The company's deployment expertise and experience were also crucial to its appointment.

"The solar array will produce enough for approximately 5% of the energy required for the facilities, which is equivalent to powering more than 100 homes every year," said Darling Harbour Live General Manager David Lovell.

Members of the public can buy shares in the social venture that will own the solar array, Sydney Renewable Power Company. Lovell stated, "The social venture allows people to participate in funding renewable energy and is another way we can engage with the local community."

According to Lovell, the solar energy project is "only one of the ways we are creating a socially responsible and environmentally sensitive convention, exhibition and entertainment hub". The venue is expected to operate with optimal resource efficiency because of smart design strategies integrated with cost-efficient and renewable technologies.

"During construction we have a target of 90% material diversion of waste to landfill, and we have already exceeded that target in the demolition phase," said Lovell. Other goals include a 75% operational waste recycling target; over 15% reduction in annual greenhouse gas emissions to 2012 NCC minimum requirements; and a 14% reduction in potable water use.

Additionally, the precinct will feature more public space and improved pedestrian connections. Lovell said, "A renewed and upgraded public domain will see a reconfiguration of Tumbalong Park, providing an additional 3000 m² of green space as well as a new adaptable event space capable of hosting up to 27,000

"A new pedestrian boulevard will connect the harbourfront to the south and Central Station," he continued. "In addition, new and improved access links will better connect the student precinct of the University of Technology, Sydney in Ultimo and the media and arts hub of neighbouring Pyrmont, as well as the city centre."

The project is the first Australian convention and exhibition facility registered with the US Green Building Council for LEED (Leadership in Energy and Environmental Design) certification. The project is targeting Gold certification.

Canadian Solar (Australia) Pty Ltd www.canadiansolar.com



Andzac enables efficient

water aeration

he Andzac Aerator, from Andzac Water Treatment, is a pontoon-mounted aeration machine that is designed to be more energy efficient than traditional rotary or paddle aerators. When used in conjunction with wind and solar power, it can also provide a clean energy alternative that is ideal for remote sites and off-grid applications.

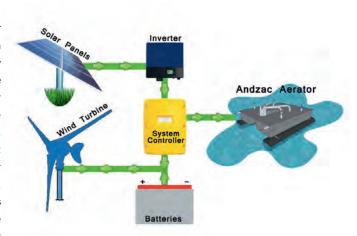
The Andzac Aerator recently underwent independent testing at Goulburn Valley Water's wastewater management facility (WMF) in Tatura, country Victoria. The product's venturi air-injection design provides a system for the efficient and economical surface aeration of wastewater in treatment ponds and other bodies of water.



The aerator is assembled around a 2.2 kW submersible pump - the only moving parts of the system. Water is pumped through a specially designed manifold that directs it to each of four venturi injectors. Once the water and air have mixed, aerated water is ejected out of the nozzles positioned at each corner of the unit.

Nathan Epp, senior engineer - energy & commercial projects at Goulburn Valley Water, explained that the company "specified two floating jet-venturi aerators to replace a single 30 kW traditional low-speed mechanical (LSM) surface aerator". The Andzac Aerator was tested over a five-day period in comparison with traditional 30 kW LSMs.

"Due to the fact that the original aerator had failed and we needed something straight away, we used



Andzac's test unit on an 8 m cable only about 4 m from the bank - in a 1.5 ha lagoon!" said Epp. "We noticed the difference within just a few days.

"After running the single 2.2 kW Andzac test unit for a few weeks (correctly positioned), we ran a trial that showed we were getting similar COD results to the parallel lagoons (each with 30 kW aerators running 24/7) with significantly higher DO - average >2 mg/L compared with $\langle 1 \text{ mg/L} \text{ in the parallel lagoons.}"$

As the second Andzac unit was no longer needed at Tatura, Goulburn Valley Water decided to install it at its Kyabram WMF, where an old 11 kW LSM aerator had failed.

"Given the size of the lagoon (57 ML, 3 ha), we were planning to operate the 2.2 kW Andzac unit in parallel with the other (operational) LSM for enhancing mixing," said Epp. "After a week or so, we ended up switching off the LSM aerator as our DO was well over 2 mg/L."

Epp is grateful to Andzac Water Treatment for allowing Goulburn Valley Water to test the technology risk free, saying the company was very accommodating throughout the whole process. According to Epp, Goulburn Valley Water is now looking at saving over 600,000 kWh per year in aeration at both sites - around \$80,000.

The aerator is also designed to be suitable for government, council, sewerage plant, nursery, golf course, sportsground, farm and aquaculture, winery and brewery applications.

Andzac Group Pty Ltd
www.andzac.com

Centrifugal compressors at sewage treatment plant

The sewage treatment plant in the city of Gütersloh, Germany, treats an average of between 6.5 and 7 million m³ of sewage water. Up until recently, three Atlas Copco ZB 130 VSD centrifugal compressors and two older single-stage screw compressors supplied the compressed air for the biological process that occurs in the plant's exceptionally deep sedimentation tanks.



"The biological process takes place in eight tanks that are subdivided into four lines," explained sewage water technician Reinhard Schweinforth. The tanks are 10 m high with a water depth of 8.5 m - unusual dimensions for sewage treatment plants, noted Schweinforth, which are normally 4 to 5 m deep. The air required for the biological cleaning process is blown

into the eight tanks from below via diaphragm tube aerators - an energy-intensive process that accounts for 40% of the plant's entire power consumption.

The five single-stage screw compressors which provided the compressed air needed to be completely overhauled at great cost, so the search for a new energy-efficient solution began. Centrifugal compressors with magnetic bearings were deemed to be the best option because a comparatively high pressure is required for the exceptional depth of the tanks.

"We have purchased the new compressors with the aim that the machines will now be more energy efficient and easy to maintain," said plant manager Karl-Heinz Schröder. "Now that we are using the centrifugal compressors from Atlas Copco, we are saving around €15,000 each year on maintenance, energy and resources compared with screw compressors."

The three speed-regulated centrifugal compressors generate between 2500 and 7500 Nm³ of oil-free compressed air per hour, depending on the amount of sewage water and the polluting load. The interaction is engineered by the ES 130 master control system from Atlas Copco. The process control system determines the air requirement on the basis of the oxygen content in the tanks.

"Our next goal is to optimise this regulatory process and integrate a variable pressure regulator," said Schröder. "Up to now, we have wasted a lot of energy as we have been operating against closed gate valves at a constant pressure of 1020 mbar. With the variable pressure regulator in place, all eight gate valves are linked and the pressure can be adjusted in line with demand, thereby enabling us to reduce the pressure used."

Atlas Copco Compressors Australia www.atlascopco.com.au

Tip-top efficiency upgrade at meat wholesaler

Tip Top Butchers installed a 202 kW solar PV array and 108 high-bay LED lights in 2013 with grant funding support from the Clean Technology Innovation Program (CTIP). Energy consultant Enhar, which provided an energy audit and assisted with the original grant application, has now assessed the solar and energy-efficiency outcomes after the first 12 months.

The 5500 m² Tip Top facility, based in Laverton North, Melbourne, includes a shop outlet and wholesale service to customers throughout the city and beyond. Designed by Tip Top's

Kent Goodwin to maximise productivity and optimise energy efficiency, the facility is carefully temperature controlled via state-of-the-art computer systems and high-tech refrigeration equipment and freezer rooms.



Already a highly efficient site, the addition of the 202 kW solar array has taken Tip Top's energy efficiency to a new level. The array was installed by Euan Angus Solar using LG panels and Fronius inverters, while Clean Technology Partners provided solar engineering services. LED lighting was also

installed for all high-bay lighting in the working areas of the factory.

company's manufacturing process now uses 31% less energy from the grid per tonne of production, and the solar array produced 5% more energy than expected in its first year of operation. The business is now said to be one of the lowest carbon meat producers in Australia.

Enhar has assisted Tip Top and many other manufacturing businesses to obtain grants for efficiency and solar. According to the company's

director, Demian Natakhan, Tip Top's results show how "solar and LED lighting can reduce energy consumption in food industries by 30% or more".

Enhar

www.enhar.com.au

Clean combustion project



ARC Professorial Fellow Assaad Masri, from the University of Sydney, is collaborating with Qatar University's Dr Samer Ahmed on a project that will help engineers develop cleaner combustion of sustainable fuel alternatives.

Professor Masri believes that the process of burning of fuels for energy is an inefficient procedure that produces too much waste and pollutants. He and his team from the Clean Combustion Research Group in Sydney's School of Aerospace, Mechanical and Mechatronic Engineering are therefore working towards 'clean' combustion - both of fossil fuels and of renewable fuels such as biofuels - thus improving energy-conversion efficiency and reducing the emission of pollutants from combustion devices.

"When we introduce new fuel alternatives into the market, we need to ensure that these fuels can be burnt efficiently, safely and cleanly, in that they do not produce harmful emissions such as nano-sized particles that will have negative long-term health effects," Professor Masri explained. He and his colleagues have recently been designing burners that allow them to better understand turbulent combustion and assist engineers in optimising the design of their engines.

For this latest project, Professor Masri will study how to optimise the combustion

of new fuels such as biodiesels obtained from renewable sources or synthetics such as gas-to-liquid (GTL) fuels that may be blended with conventional diesel. GTL fuels can be used directly in conventional diesel engines and turbines, with lower emissions than traditional fossil fuels.

The project is being conducted in collaboration with Dr Ahmed, whose experience lies in the areas of energy conversion technologies and combustion. Dr Ahmed was last year the supervisor on two projects - 'Development of new induction manifold designs for high efficiency and low emissions internal combustion engines' and 'Improving the design of the fuel injection system for lower fuel consumption diesel engines' - which came first and third respectively in Qatar University's Best Poster Awards category at its Mechanical and Industry Design days.

The project has also received more than \$1 million in funding from the Qatar Foundation, a non-profit organisation that serves the people of Qatar by supporting and operating programs in three core mission areas: education, science and research, and community development. The project is of particular relevance to the Middle-Eastern nation, which has become the world's biggest GTL fuel producer after investing heavily in technology to convert some of its vast natural gas resources to liquid fuels.

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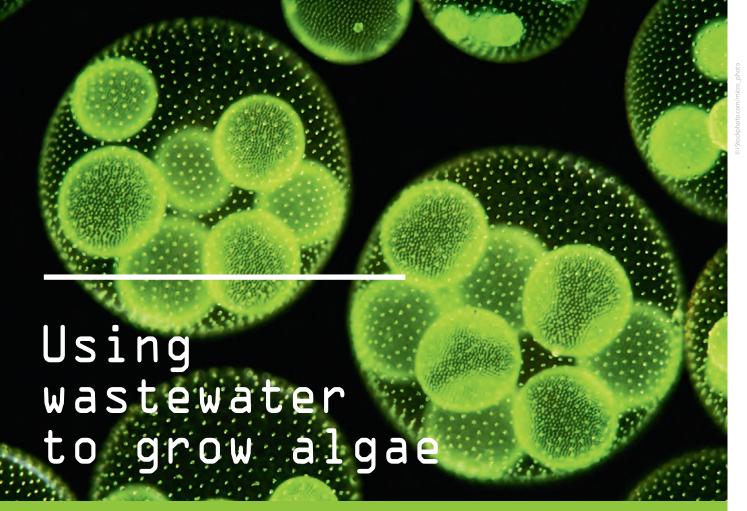
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Researchers from Rice University have found they can easily grow high-value strains of oil-rich algae while simultaneously removing more than 90% of nitrates and more than 50% of phosphorous from wastewater. Their study, which was one of the first to examine the potential for using municipal wastewater as a feedstock for algae-based biofuels, has been published in the journal *Algae*.

ead author Meenakshi
Bhattacharjee said algae
producers currently remain heavily dependent
on chemical fertilisers,
which both "reduces
profit margins and puts them in competition with food producers for fertilisers".
She said algae producers "must address
sustainability if they are to progress toward
producing higher-volume products, 'green'
petrochemical substitutes and fuels".

A 2012 National Research Council report found that with current technologies, scaling up production of algal biofuels to meet 5% of US transportation fuel needs could create unsustainable demands for energy, water and nutrient resources. However, the report suggests wastewater-based cultivation as a potential way to make algae production sustainable and, at the same time, address nutrient pollution from excess nitrogen and phosphorous in US waterways.

"The idea has been on the books for quite a while, but there are questions, including whether it can be done in open tanks and whether it will be adaptable for monoculture - a preferred process where producers grow one algal strain that's optimised to yield particular products," said study co-author Evan Siemann. "We were surprised at how little had been done to test these questions. There are a number of laboratory studies, but we found only one previous large-scale study, which was conducted at a wastewater facility in Kansas."

Rice's research team set up a test involving 12 open-topped 2270 L tanks at one of the city's satellite wastewater treatment plants. The tanks were fed with filtered wastewater from the plant's clarifiers, which remove suspended solids from sewage. Various formulations of algae were tested in each tank; some were monocultures of oil-rich algal strains and others contained mixed cultures, including some with local algal strains from Houston bayous. Some tanks contained fish that preyed on algae-eating zooplankton.

"We recorded prolific algal growth in all 12 tanks," Siemann said. "Our results are likely to be very encouraging to algae producers, because the case they would prefer - monocultures with no fish and no cross-contamination - was the case where we saw optimal performance."

Bhattacharjee said more research is needed to determine whether wastewater-based algaculture will be cost-effective and under what circumstances. For instance, the algae in the Rice study was four times more effective at removing phosphorous than were the algae in the Kansas study. Bhattacharjee said that could be because the Houston test was performed in summer and autumn, so the tanks were warmer than those in Kansas.

"Using wastewater would be one of the best solutions to make algaculture sustainable," she said. "If temperature is key, then cultivation may be more economical in the southeast and southwest."

Bhattacharjee added that other factors, like starting levels of nitrogen and phosphorous, might have caused a rate-limiting effect. "These are the kinds of questions future studies would need to address to optimise this process and make it more attractive for investors," she said.

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Flour power: industrial site development

International design practice HASSELL is overseeing architecture, interior design, urban design and landscape architecture for a \$120 million development at a disused flour mill.

The 2.5 ha Summer Hill Flour Mill site, located in Sydney's inner west, will be transformed into 380 modern apartments and terraces, a small retail precinct, commercial studio spaces and public parks and gardens. Bike paths, pedestrian walkways and streets will connect people to the Flour Mill, the neighbouring villages of Summer Hill and Lewisham and a new light rail stop.

According to HASSELL Principal Matthew Pullinger, the development will "open up the almost 100-year-old former industrial site, while retaining and re-using the concrete silos and other significant heritage buildings, along with an existing avenue of brush box trees". He added that the site will be a highly connected, vibrant residential community.

"We have incorporated a range of housing types, from threelevel terrace houses along Edward Street complete with courtyard gardens, to mid- and higher-rise apartments overlooking the new public park and views towards Sydney's CBD," Pullinger said. "The silo apartments have been particularly sought after and stand as the focal point of the site."

The Flour Mill of Summer Hill will also promote environmental sustainability. Photovoltaic panels, shading screens and natural ventilation will reduce energy consumption throughout the precinct, while the collection and re-use of rainwater will minimise water use. Pullinger noted, "Communal gardens also add to the green aspect of the development while encouraging and fostering a sense of community."

Pullinger said the heritage significance of the flour mill site and the need to retain a sense of its industrial past was key to the HASSELL master plan and design of the apartments. He claimed residents will feel "the benefit of living in an existing





community with a strong local identity and a contemporary design that incorporates and pays homage to its history".

"We are proud to have had a role in an important project that will extend the legacy of the historic Summer Hill Flour Mill, while paving the way for a bustling new heart that will serve the area for years to come."

HASSELL

www.hassellstudio.com



The winners of the first Emissions Reduction Fund (ERF) auction have been announced. Congratulations to those who succeeded in securing a Carbon Abatement Contract with the federal government and commiserations to those who missed out. But don't despair: there are many more auctions to come.

nder the ERF, the federal government is purchasing lowest cost abatement through what it refers to as a 'reverse auction process'.

The first auction closed on 16 April. A total of 47 million tonnes of CO₂e was purchased at an average price of \$13.95/t CO₂e. Of this, the waste industry accounts for nearly 17 million t CO₂e or 35% of total volume purchased, proving that the waste industry continues to play a major role in emissions reduction efforts.

A total of 107 contracts were awarded to 43 participants covering 144 projects. Most successful participants were those who were operating Carbon Farming Initiative (CFI) projects (which transitioned to the ERF late last year).

A total of \$660 million out of the \$2.55 billion ERF was spent in this first auction. At an average price of \$13.95, some argue the government will need \$3.3 billion to meet the 236 million t CO₂e target by 2020.

While the price is likely to fluctuate in coming auctions, as more methods are added, 26% of funding has now been spent.

Given the political commitment to not spend more than already allocated, all eyes

are now turned towards the government's other emission reduction tools such as the Safeguard Mechanism, the Renewable Energy Target and Vehicle Emission Standards regulation. Watch this space.

New projects

Current approved methods for the waste and recycling sectors include:

- Landfill gas capture and destruction;
- Alternative waste treatment: and
- Wastewater treatment.

New methods which will hopefully be ready for the next auction include:

- Source-separated organics;
- Biofilters;
- Phytocaps;
- Energy from waste; and
- Waste-avoidance projects.

To create carbon credits and generate revenue, project proponents will need to:

- 1. Register a project with the Clean Energy Regulator as soon as possible.
- 2. Forecast emissions over the next seven vears.
- 3. Register for the next auction.
- 4. Bid at auction.
- 5. If successful, carry out the project and report progress.
- 6. Deliver abatement in accordance with the delivery schedule.

7. Receive funds from the government for the abatement.

A key requirement of the ERF is that a project must be NEW at the time of project registration. So if you are planning to carry out any of the projects listed above within the next five years, register your project with the Clean Energy Regulator now to avoid the risk of breaching this 'newness' test.

The next auction date will be announced as soon as there are enough new participants and projects registered.

Down to business

The most significant challenge faced by successful proponents now is to ensure that their projects continue to operate in accordance with their chosen method and that they are able to meet their abatement delivery schedule. While there are flexible contract terms to account for deviations from the forecasted volumes, participants must still make good the total volume bid at auction. So don't overcommit. If you undercommit, then you can always sell the excess at a later auction or to an organisation covered by the Safeguard Mechanism.

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A solar thermal field for Cyprus

CSIRO scientists have designed and installed a solar thermal field - a half-acre plot of land consisting of 50 special mirrors called heliostats - for a research institute on the island nation of Cyprus, Europe.

The field will be used to generate solar thermal technology, with the heliostats set to reflect sunlight towards a receiver on top of a tower and heat a fluid (the energy generated by the field could bring a kettle to the boil in less than five seconds). The hot fluid will be subsequently used to drive a turbine for generating electricity and power a seawater desalination plant.

The technology will initially be utilised for research purposes by The Cyprus Institute, with a view to longer-term commercial use of the technology in Mediterranean islands and the Middle East. Cyprus Institute President Professor Costas Papanicolas explained that the country has "lots of sunshine, not enough water and is cut off from the continental power grid of Europe,

so we need electricity and water. So solar energy, we think, is the answer to part of this problem."

CSIRO solar research leader Wes Stein revealed that the project was "the first time we've deployed this cutting-edge technology outside of our own backyard".

"It's given CSIRO a lot of confidence in understanding how we're going to deploy these things outside of our own safety zone and into other environments. So that's where we want to go; we want these things to be commercialised and build on the good research that we're doing now," he said.

Stein noted that CSIRO recently signed a memorandum of understanding to undertake joint solar research with The Cyprus Institute. He stated, "By working collaboratively through exchange of ideas and researchers, and now with common solar concentrating research infrastructure, we can accelerate the deployment of this technology and make big inroads in reducing global emissions of carbon dioxide."



One of the largest rooftop solar systems in Australia

Property group Stockland has selected Todae Solar and Canadian Solar to install a 1.22 MW rooftop solar system on Stockland Shellharbour Shopping Centre in the Illawarra region of NSW. Once completed, the system will be Australia's largest single-building rooftop solar system and one of the top 10 largest installed across the country.

Stockland's regional retail manager for NSW South, Daniel Buchanan, said: "Since completing our \$330 million redevelopment of Stockland Shellharbour in 2013 and receiving our 4 Star Green Star rating by the Green Building Council of Australia, we have continued to add initiatives to benefit our customers, the community and the environment.

"We have been considering largescale solar for the portfolio for some time. While we have installed a number of smaller solar PV systems, and learned from the experience, it is only now that the economics and time are right for us to set a renewable energy target and commit to a range of projects across our portfolio."

Canadian Solar will supply 3991 PV panels with a total surface area of 7658 m², which is expected to generate an average 4789 kWh per day - 28% of the centre's daily base building power requirements. Canadian Solar Australia's country manager, Daniel Ruoss, said the company was chosen due



to its "extensive experience and expertise with commercial rooftop installations here in Australia, our excellent bankability and providing the industry's highest power outputs per panel".

Stockland has meanwhile appointed Todae Solar as the system's project manager and system designer. Todae Solar CEO Danin Kahn said: "Being selected by Stockland for this project showcases our experience and capability in delivering large-scale projects of the highest quality. This project will hopefully make many other organisations out there sit up and take notice to start thinking about solar."

Stockland expects the new system to generate sufficient renewable energy to offset approximately 1700 tonnes of ${\rm CO}_2$ annually. The company has a target of 1.35 MW of installed renewable energy capacity in its shopping centre portfolio by FY17; this installation alone will have a capacity of 1.22 MW.

Students take on construction waste

Murdoch University has partnered with Master Builders WA, the building and construction industry association, to tackle real-life construction waste issues on building sites.

Six of Murdoch's environmental engineering students recently visited three Right Homes sites in the Perth metropolitan area, where they reviewed construction waste processes and were tasked with designing new ones to ensure that less waste goes to landfill. If successful, their waste management designs could be utilised by the construction industry.

The industry has been encouraged to increase the recycling of its waste by the recent doubling of the landfill levy rate from \$28 per tonne to \$55 per tonne for putrescible waste and from \$12 up to \$60 per m³ for construction and demolition waste. Waste reduction consultant Michael Norriss explained, "In the wake of the levy increase, we want to be able to go out to our members and educate them about the best waste practices available - and this is where the students come in."

Master Builders WA has provided the students with the appropriate training and protection gear so they can work onsite. Norriss said, "The students will be required to undertake research into how waste is currently disposed of on construction sites, identify what materials can be recycled and investigate the best practices in construction site recycling.

"We want them to recommend recycling practices that are the least time consuming, the cheapest and the most energy efficient. We want them to work with recycling companies to identify recycling opportunities for materials that might not be widely known about or utilised."

Professor Bogdan Dlugogorski, the dean of Murdoch's School of Engineering and Information Technology, said the project aligned well with the school's aim of providing students with industry-focused learning experiences to prepare them for the workplace.



"Moreover, such industry partnerships can also be harnessed for higher level research objectives," said Professor Dlugogorski. "For example, the present investigation could, in future, be progressed to a PhD study of the entire building construction resources supply chain in WA, which is currently of great interest to the Waste Authority of WA as well as to the Master Builders Association."

The project will last for three months and the students will present their ideas to Right Homes and Master Builders WA in June. Norriss said, "We hope any changes made to [Right Homes'] practices because of the students' work will filter down to the rest of the industry."



The essentials of building automation



here are few markets as fast paced or lucrative as the technology market, particularly in the context of building automation solutions.

Enabling coordination between systems is now a key focus in the wake of multiple new vendor products - something that can prove to be complex and intricate. Which is where integration design holds the key.

As part of the Building Automation & Controls 2015 conference, Jon Clarke*, Senior Associate Controls Group Manager, Norman Disney & Young (NDY), shares his insights into the complexity of integration design and how consultants can support the interaction of different vendor products in automation systems.

"We're finding unprecedented demand for integrated automation systems, where interoperability is a priority from a functionality perspective," he said. NDY was recently involved in a major project to design a national monitoring platform.

"In this instance, there were a number of sites that had to be designed against a certain technology - once each site came online it could be literally plugged into the system. This was a different approach for us; we traditionally don't specify products as a consultant, rather the technical outcomes," Jon explained.

As a result, the entire implementation was based on a software framework infrastructure that allows disparate systems to share data across an integrated communications network.

"Each site was based upon a modular design with packaged plant for ventilation, cooling, controls and electrical infrastructure," added Jon. "We took this modular principle into the design of the automation systems by specifying the control systems to comply with a set of integration rules, which enabled a 'plug and play' approach."

This architecture resulted in real-time data flows and communication between the remote sites and national monitoring platform. But one of the key learnings, according to Jon, was making sure that each system provider adhered to the integration rules.

"You have to ensure that where the modules bolt into site infrastructure, all of the componentry is designed to a specific standard. From wiring practices, through to

Australian licensing, Jon believes they will eventually find greater prevalence.

Enabling connectivity between disparate systems requires careful consideration, according to Jon. And one particular variable relates to the reality of open systems.

"There is quite a bit of glossiness and hype around terms like integration and interoperability, but these obscure the real meaning and value of the systems," said Jon.

The latest industry buzzwords are Analytics and Big Data.



We're finding unprecedented demand for integrated automation systems, where interoperability is a priority from a functionality perspective.

language for communications and off-site testing, everything has to be aligned in the set-up. This keeps site work to a minimum and commissioning time is significantly reduced," he said.

Online and wireless technology has emerged as a flexible solution for clients across Europe and the US, and while these products currently do not comply with

"The objective is to review all performance regimes, not just for buildings but for contractors, tenants, everyone. When we offer solutions, it's all about return on investment. Feasibility is not just about the costs or logistics of introducing the system in, but how much revenue (savings) it can generate for the client, and the subsequent payback term," Jon said.



*Jon Clarke has worked within the field of control systems for his entire professional career - initially in the petrochemical industry working with PLC- and SCADA-based systems with mission-critical and life safety applications. He has since clocked up over 20 years working with building services. Using his systems experience, he has consulted to major international air-conditioning and refrigeration manufacturers, and has designed a diverse range of applications including conventional office space, home automation with AV and mission-critical data centres.



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Infratech Industries has launched a floating solar system that will generate an estimated 57% more power than fixed land-based systems. he technology uses water to counteract the gradual loss of output caused by overheating solar panels to create a more efficient system.

Based in South Australia's Jamestown, the Northern Areas Council Waste Water Treatment Plant is the first to implement the new system, which is expected to exceed the plant's high energy needs and will feed through to the surrounding local communities and council buildings.

Infratech Industries Director Felicia Whiting said the benefits extend beyond energy efficiencies to improve the treatment plant's water quality. She said a number of water treatment systems, such as aerators, can also be bolted onto the floating solar system. "This technology incorporates a tracking system, cooling system and concentrating system, all which help to increase the efficiency," she said.

"Blue-green algae is a major concern for wastewater treatment plants and the shade produced by the floating solar panels combats this problem by limiting the photosynthesis process. The energy goes into the panels, not the water, so the surface stays cool, which helps to lift the quality of treated wastewater," she said.

"On a broader scale, the technology is suitable for any body of water including drinking water and moving water bodies such as lakes. Since it reduces evaporation by up to 90%, it can have a powerful saving for areas affected by drought and dry climate such as Australia and Califor-



renewable for wastewater

The development of Australian-owned, researched and developed floating solar is to be applauded as it shows that Australian companies can be leaders in the transition to economies that are powered by increasing amounts of renewable energy.



Jon Dee, co-founder of the Planet Ark and DoSomething organisations, has applauded the innovation and leadership of Infratech Industries.

"Solar PV panels currently generate renewable electricity on more than 1.36 million Australian rooftops, so we've more than shown our acceptance of solar technology," said Dee. "However, many people want to see more solar innovation being undertaken in Australia by local companies, in a way that helps the environment and generates local jobs at the same time.

"The development of Australian-owned, researched and developed floating solar is to be applauded as it shows that Australian companies can be leaders in the transition to economies that are powered by increasing amounts of renewable energy. In addition to reducing greenhouse emissions, there is also strong potential to export this technology to other countries, which can only lead to even more jobs."

As such a major milestone in the renewable energy movement, Whiting expects a national and international spotlight will be focused on Jamestown with visiting ambassadors from South East Asia, France and the Hon. Minister Ian Hunter MLC for Climate Change attending the launch with key members of the SA Cabinet having already visited the site.

"Just how strong Australia's post-2020 emissions reduction targets remain unknown; however, we do know solar innovation is a milestone towards Australian councils, communities and businesses making a difference. As Australians evangelise this type of technology, it is our hope that renewable energy becomes the mainstream rather than niche solution. Change is not beyond us and this is definitely a strong step forward," Whiting said.

Due to the close proximity with water, standard panels with special coatings on the solar PVs are suitable for the device. Applications of the technology extend to the mining and agricultural sectors. Whiting says the technology is intended to help make businesses, especially the farming community and irrigators, more competitive on a global scale.

Infratech Industries Pty Ltd www.infratechindustriesinc.com

nia, Indonesia, Singapore and Philippines," she said.

The Northern Areas Council will reap additional economic benefits with a cost saving of approximately 15% on their current energy expenditure plus an additional 1% margin on the excess energy provided to the local community.

No small undertaking and privately funded, more than 15 Australian engineers and research scientists in the Nano Science and Technology Department in Adelaide's Flinders University were involved in the project's technological and engineering development. The development team will remain involved as research and development continues into integrated water treatment, phosphorous treatment systems and energy storage.

Making wheat drought-proof

A University of Queensland (UQ) PhD candidate has developed a cheap and simple technique allowing scientists to better adapt grain crops such as wheat to drought conditions, which are predicted to become more frequent and severe due to climate change.

Cecile Richard, from UQ's Queensland Alliance for Agriculture and Food Innovation (QAAFI), said drought tolerance is "a priority for feeding the growing human population". She explained that



roots allow plants to access water deep in the soil, even when rain is scarce - therefore, the solution lies in increasing the length and number of these roots.

The method uses a system of clear plastic pots, which allows scientists to see through the pot wall and view the roots. Scientists can then attempt to combine favourable root characteristics in new wheat varieties that could improve the plant's access to water.

"The roots are growing around the wall of the clear pot and it's possible to measure different characteristics such as the angle and number of roots, based on images captured at 10 days after sowing," Richard said.

"These characteristics reflect the root growth pattern displayed by wheat in the field, which is important for the plant to access water.

"We hope to use the clear-pot technique to rapidly discover the genes responsible for these important root characteristics."

Richard said the method is "easy, cheap and rapid", unlike previous techniques for measuring roots which had been timeconsuming and expensive. It therefore has the potential to speed up selective breeding for drought-tolerant wheat strains and boost global wheat production.

The method has been published in the journal Plant Methods.

Roads made of recycled printer toner

The City of Sydney is trialling an environmentally friendly asphalt blend which uses recycled materials including toner from discarded printer cartridges - to resurface sections of road across the city.

The TonerPave asphalt was developed by the City's road contractor, Downer

EDI, in partnership with cartridge recycling company Close the Loop. Sergio Cinerari, Downer's CEO infrastructure services, explained that the company utilises toner powder, which contains comparable particles to that of asphalt.

"The use of printer toner in the asphalt mix reduces the amount of bitumen, which

is derived from crude oil," Cinerari said.

"We work closely with Close the Loop, who collect and recycle huge quantities of toner cartridges for large printer and copier companies. The cartridges are then shredded for recycling and the toner powder comes to us to be made into TonerPave at our Rosehill plant."

Andrew Christie, the City's construction services manager, said the asphalt blend can reduce emissions by 40% compared to conventional asphalt. This is because the mix is "heated at temperatures 20 to 50°C lower than regular asphalt", he said, meaning it takes less energy to produce.

Not only does the asphalt mix reduce the amount of energy which goes into resurfacing 50,000 m² of City road every year, but it also keeps the printer toner out of landfill. Christie noted, "Landfill sites produce huge amounts of methane, a greenhouse gas with 25 times the global warming potential of carbon dioxide."

Lord Mayor Clover Moore added, "Around 20,000 tonnes of cartridge waste has been recycled in asphalt across Australia since the initiative began in 2012."



Saving energy with smart facades

In Germany, buildings account for almost 40% of all energy usage. Heating, cooling and ventilating homes, offices and public spaces is expensive - and offices with huge glass facades are one of the worst offenders in terms of energy wastage. In the summer, these buildings begin to resemble giant greenhouses that take an enormous amount of effort to cool, while in winter, heating requirements shoot up because of insufficient heat insulation for the glass surfaces. In a bid to cut energy consumption, researchers from the Fraunhofer Institute for Machine Tools and Forming Technology IWU in Dresden have teamed up with the Department of Textile and Surface Design at Weissensee School of Art in Berlin to develop facade components that respond autonomously to sunlight and its thermal energy.

A thermally reactive fabric blind for glass facades

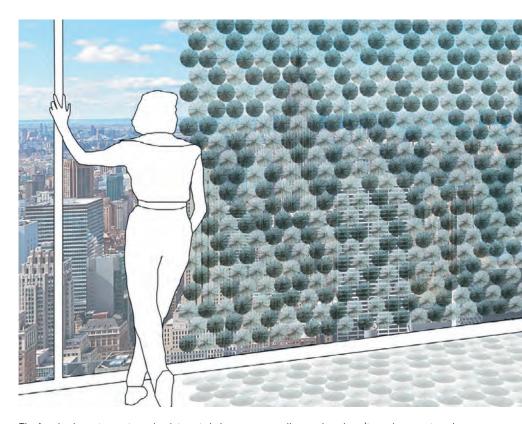
"We don't need any power since we can rely solely on thermal energy to control the facade element," said André Bucht, researcher and department head at Fraunhofer IWU. "The challenge in this project was how to bring together innovative technology and design," added Prof. Christiane Sauer from the Weissensee School of Art. "Having designers and scientists work together is the key to pioneering concepts for smart building envelopes." The demonstrator is based on a concept by design student Bára Finnsdottir and consists of a matrix of 72 individual fabric components shaped like flowers. Each textile module has shape-memory actuators integrated into it; thin 80-millimetre-long wires of nickeltitanium alloy that remember their original shape when exposed to heat. Should the facade heat up due to the sunlight falling on it, the wires are activated and noiselessly contract to open the textile components. The exposed surface of the facade is covered and sunlight can no longer penetrate into the room. As soon as the sun disappears behind a cloud, the components close again so that the facade is transparent once more. The effect is thanks to a special lattice arrangement in the material. "When you bend the wire, it keeps that shape. Then

when you expose it to heat, it remembers the shape it had originally and returns to that position. Picture the facade element as a sort of membrane that adapts to weather conditions throughout each day and during the various seasons of the year, providing the ideal amount of shade however strong the sun," said Bucht.

Designed for large expanses of glass, the sun shield can be attached either on the outer layer of glass or in the space in between in the case of multilayer facades. The innovative structure is easy to retrofit and comes with a range of design options, allowing users to choose the pattern, shape and colour of the individual components.

In the next phase of the project, the researchers want to collaborate with industry partners to develop a range of prototypes for private and office buildings, with the intention of testing them long term on a detached house and on buildings at the institute. "One priority will be to design fabric elements that are stable enough to withstand any weather," said Bucht of the work ahead. The plan is to have versions for new builds as well as variants suitable for retrofitting onto existing buildings. The goal is for the systems to be ready for market launch by mid-2017.

But the researchers' ideas for the facade of the future don't end there: future



The facade element operates using integrated shape-memory alloys and so doesn't require an external power source. © Bára Finnsdóttir | Weißensee School of Art Berlin

"For instance, you might want to replace the circular design with triangles or a honeycomb arrangement. You can also control the level of sun exposure for individual sections of the facade - just the top left area, for instance. What's more, the membrane even fits on curved areas of glass. We've reached the point where the design has become independent of the shape of the building," said the researcher.

plans include climate functions for the facade element, for instance variable heat insulation. "It might be possible to store solar thermal energy and then release it when needed to heat the interior, for instance at night. Another idea is to coat the flower fabric components with malleable, organic solar cells in order to generate electricity that can be used within the building."

Bacteria break down toxic chemicals in groundwater

University of New South Wales (UNSW) researchers have improved a standard remediation practice in order to speed up the degradation of toxic industrial chemicals in contaminated groundwater. Their research has been published in the journal Environmental Science and Technology.

Groundwater remediation is currently a long and costly process, explained study co-author Associate Professor Mike Manefield. At the Botany Industrial Park, for example, chloroform and dichloroethane were released into the groundwater during



the mid-twentieth century. The current custodians of the site have since installed a \$167 million groundwater treatment plant that is not only energy-intensive to run and costly to maintain, but it will need to be in operation for "around 200-300 years", according to Manefield.

Manefield and his team have now isolated three types of naturally occurring bacteria, including Dehalobacter, which can break down chlorinated solvents such as chloroform. He explained, "We take samples from the contaminated environment, which contain billions of different bacteria, and we bring them back to the lab, and we incubate them under specific conditions that favour the organisms that can actually break down these compounds."

Once the bacteria have been grown, they are brought back to the site and injected under nitrogen pressure into contaminated aquifers. "It colonises the aquifer in large numbers and starts consuming the compound, the pollutant," Manefield said. "Once it's finished consuming the compound, then it dies off."

The researchers have now combined their technique with another approach to remediation - the installation of a reactive iron barrier, which breaks down chemicals as the contaminated groundwater flows through it. In a laboratory study, Manefield and his colleagues showed that chloroform was broken down eight times faster when a culture of Dehalobacter bacteria was added to reactive iron, compared with just iron alone.

"Some people favour the iron barrier, some favour the bugs," said study co-author Dr Matthew Lee. "But our research shows that combining them could be the best solution."

Graphene light bulb to brighten up the future

Just over a decade since graphene was first isolated by researchers at The University of Manchester, spin-out company Graphene Lighting PLC plans to produce a light bulb made of the revolutionary material.

Graphene Lighting PLC is based on a strategic partnership with the National Graphene Institute (NGI) at The University of Manchester to create graphene applications. Officially opened in March, the £61m NGI will see academic and commercial partners working side by side on graphene applications of the future - with the light bulb to be the first of these.

The graphene light bulb is expected to have lower energy emissions, a longer lifetime and lower manufacturing costs than LED bulbs. Furthermore, the light bulb could be on the shelves in a matter of months.

"This is just the start," said University of Manchester Deputy President and



Deputy Vice-Chancellor Professor Colin Bailey. "Our partners are looking at a range of exciting applications, all of which started right here in Manchester. It is very exciting that the NGI has launched its first product despite barely opening its doors yet."

There are currently more than 35 companies collaborating with the NGI. In 2017 the university will open its Graphene Engineering Innovation Centre (GEIC), which will accelerate the process of bringing products to market.

"The graphene light bulb is proof of how partnering with the NGI can deliver real-life products which could be used by millions of people," said Graphene Business Director James Baker.

"This shows how The University of Manchester is leading the way not only in world-class graphene research but in commercialisation as well."

www.manchester.ac.uk



ON-SITE FOOD WASTE TO ENERGY

The Flexibuster is a self-contained anaerobic digester designed to process food and organic waste on-site, saving on waste disposal costs and producing energy. Manufactured by SEab Energy, the system's modular design means it can

be configured to suit food producers, the retail supply chain and hospitality installations with process waste of between 200 and 1000 tpa.

The system converts waste into biogas, which is used to generate electricity and heat. It is designed as a turnkey solution to food industry waste, with the anaerobic digester providing the user with automated operation and remote management capabilities.

The product is designed to continuously produce between 8 and 55 kW of electricity, via a combined heat and power unit (CHP) or a gas turbine, which can be used on-site or sold back to the grid. This provides enough energy to power up to the equivalent of 40 average homes and reduces CO₂e emissions by up to 1000 tonnes.

In2itive Sustainability www.in2itive.net.au

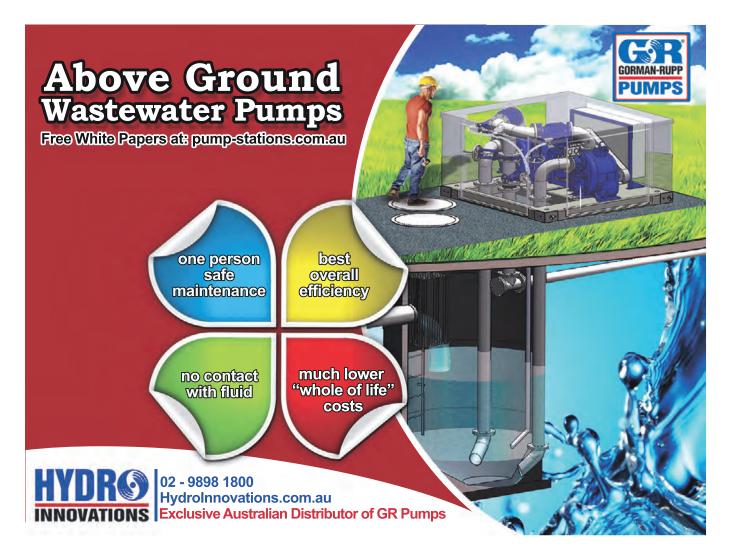
WIRELESS COMMUNICATION SYSTEM FOR GAS DETECTION

Combustible and toxic gases can leak virtually anywhere, and leaks may not occur near a facility's gas detection instrument installation area. MSA's Wireless Communication System is suitable for gas detection at locations where no infrastructure exists.

A 900 MHz radio communicates to a gateway, providing real-time detection at distances of up to 1.6 km with clear line of sight. The product accepts both analog and Modbus inputs.

Power options include solar panel, battery and charger to help ensure up to two weeks of autonomous operation. A wireless HART adapter can be added to any MSA HART-enabled field device to communicate with any existing wireless HART network.

MSA Australia Pty Ltd www.msa.net.au



SPRAY COATING FOR SEWERS

Calix's ACTI-Mag SP60 is a concentrated, controlled-viscosity, concentrated, stabilised suspension of magnesium hydroxide (MgO). The product is hydrated from Calix reactive MgO, imparting a good neutralisation capability due to the high surface area.

The MgO spray coating maintains a high pH on the sewer walls, neutralising sulfuric acid and preventing it from reacting with the pipe concrete. The high pH inhibits the growth of specific acid-forming bacteria (eg, Thiobacillus concretus).

The thixotropic properties of the coating allow the suspension to be easily pumped for spraying. The material sets to a gel that adheres to concrete surfaces. The user-friendly application can be carried out without diverting the sewage flows and does not require man entry.

The spray allows for thick coatings to be applied (typically 2 mm in a single pass), with the potential to control the coating strength and thickness through specific additives that derive strength from the high MgO reactivity. Sacrificial MgO coating is said to protect the integrity of concrete sewer walls for 2-3 years.

Calix Limited www.calix.com.au



EFFICIENT ICP-MS

With the introduction of the PlasmaQuant MS, Analytik Jena has extended its portfolio with an ICP-MS. The

mass spectrometer, with a free-running 27 MHz solid-state RF generator for plasma generation, handles organic matrices without changing the torch configuration.

The highly efficient RF generator produces a robust,

balanced plasma with an argon consumption rate of less than 10 L/ min plasma coolant gas, effectively reducing argon consumption by half compared to a conventional ICP-MS. The Eco Plasma is said to conserve resources and reduce running costs without sacrificing the performance of the ICP-MS.

The system's powerful plasma is suitable for the analysis of liquid samples, although its strength is shown in the analysis of single particles or dry aerosol - eg, in combination with laser ablation sample introduction. Other features include: neutral plasma for low kinetic energy spread of the analyte ions; efficient decomposition and ionisation of high solid matrices; variable plasma power between 0.3 and 1.6 kW; and an aerosol dilution option for high matrix samples.

MEP Instruments Pty Limited www.mep.net.au



PORTABLE FLOW METER

The FLUXUS F401 is a single-channel portable flow meter for applications in the municipal water and wastewater sector, offering long-term stable and precise bidirectional flow measurements in remote areas.

The product is equipped with watertight IP68 transducers, with the flow transmitter residing inside an IP67 suitcase. Combining its internal battery capacity with an additional external battery case (IP67 protected), the unit offers continuous remote measurements outdoors for up to a week in duration.

As the measurement is carried out from the pipe wall, outside and without contact with the water column, there is no need to enter the piping system or to interrupt supply. The product is therefore suitable for service and maintenance activities, long- or short-term monitoring, data logging and existing meter verification.

Due to its matched transducer pairs and internal signal processing, the product is zero-point stable and recognises even small flow rates. This makes it a suitable measurement tool for leak detection.

The meter can be used with pipe diameters from 25 mm to 3 m. Solid contents of up to 6% by volume, old and rusty steel, badly manufactured GRP and armoured concrete pipes (with lining and build-up inside the pipe) are not a challenge.

Flexim Instruments Asia Pte Ltd www.flexim.com

DATA LOGGERS FOR HYDROSTATIC LEVEL **MEASUREMENTS**

Keller offers probes to monitor groundwater levels and filling levels in tanks that can be used under a wide range of conditions. The probes provide fully autonomous operation or they can be used with an integrated data logger, wireless transmission (GSM), ambient pressure-compensating capillary or a separate absolute pressure sensor. Probe diameters of 16, 18 and 22 mm are available.

The DCX-16 can be used in locations where every millimetre counts. The product, which is screwed into position and fully watertight, operates as an autonomous battery-powered data collector with an absolute pressure sensor. In shallow water, a barometer can be used for separate recording of the barometric pressure on the surface. The differential pressure and/or the filling level are then calculated in the PC by subtraction of the time-stamped measurement data from the individual loggers.



The fully welded DCX-18 is designed as an autonomous level logger for long-term measurements of level and temperature, with rechargeable accumulator-type batteries. The microprocessor electronics compensate for linearity and temperature deviations by the pressure sensor. Different operating modes, with an absolute pressure sensor or an overpressure sensor with a pressure-compensating capillary, can also be supplied. The measurement data are stored in a nonvolatile memory. The batteries are fast-charged every time data are extracted via the charging/read-out plug.

DCX-22 AA level loggers register and compensate for fluctuations in the local barometric pressure with a watertight air pressure sensor that is fitted on the top end of the sounding tube. The devices are resistant to conditions of use in a damp environment and will not be damaged by brief flooding. The electronic equipment registers the signals from the high-precision pressure and temperature sensors, corrects linearity or temperature deviations according to a mathematical model and records the values to the internal memory. The built-in battery has a lifetime of 10 years.

KELLER AG für Druckmesstechnik www.keller-druck.com



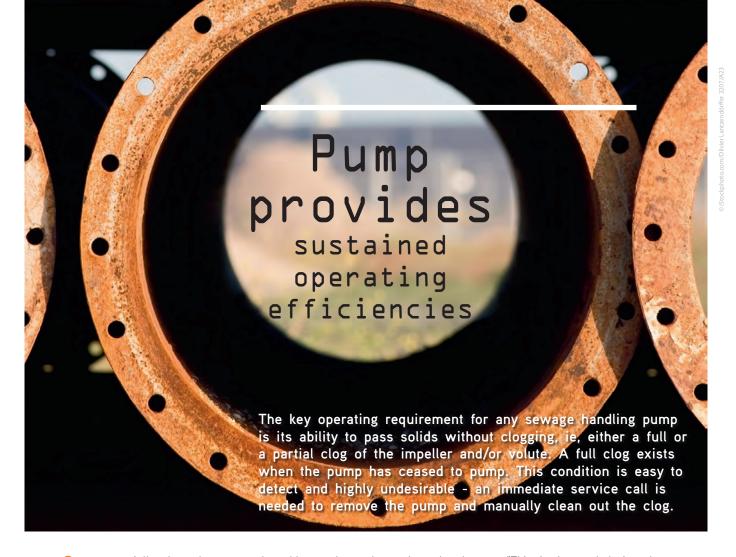
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partially clogged pump, however, is harder to detect because the pump delivers flow at a varying reduced rate. This can go unnoticed for long periods of time, resulting in a number of adverse operating conditions. These include increased energy usage, reduced Q/H performance, longer run times and vibration. If the pump is operated continuously, the pump efficiency will gradually decline to levels as low as half of the clean water efficiency or lower. A pump operating for extended periods of time at substantially reduced overall efficiencies results in much higher consumed power and running costs.

Impeller design is fundamental to how well sewage pumps can operate without clogging. Traditionally, it was assumed impellers with large throughlets would eliminate clogging. Throughlet size is determined by the largest diameter of a hard, solid, spherical object that can pass through the pump. The concept is old, dating back to 1915, and was developed at a time when energy costs were not of significant importance.

Pump manufacturers and operators intuitively believed that pump clogging could be avoided simply by having an internal pump throughlet equal to or larger than what the toilet of the day could pass. The last few decades of research and development, coupled with experience from hundreds of thousands of pump installations, have proven that this simplistic logic of throughlet size is incorrect and misleading. It has been found that the vast majority of full and partial pump clogging occurs from long fibrous material such as rags accumulating on the leading edge of the pump's impeller and/or between the rotating and stationary wear rings. Yet the practice of specifying a minimum throughlet size for wastewater pumps within requests for tender specifications is still prevalent today.

The Flygt N-pump, from Xylem, utilises a completely different hydraulic design to that of traditional sewage handling pumps, such as the closed channel and vortex impeller designs. The pump has been designed with a semi-open impeller with backswept leading edges working together with a relief groove located in the lower section of the pump volute. The design allows the impeller and hydraulic areas to clear itself of any build-up of rag or fibrous materials. This self-cleaning function ensures the hydraulic profile of the impeller is maintained, resulting in the pump being able to operate with sustained high operating efficiencies.

"This fundamental design change to a self-cleansing impeller was adopted quickly by our customers," said Terry Gralton, Xylem Oceania's wastewater manager. "Operators found they experienced fewer pump chokes and reduced electrical power costs when using the N-pump."

In recent years, options have been further developed to provide operators the ability to customise the Flygt N-pump to suit their on-site conditions. Impeller material options include hard iron and duplex stainless steel materials, providing increased service life when high corrosion and erosion conditions are present.

In addition to material options, the pump can also be equipped with new impeller designs to better handle sewage with abnormally high concentrations of rag and solid materials. The Adaptive N-impeller provides the ability for the impeller to move axially when needed, allowing bulky rags and debris to pass through the pump. Also available is the option of a chopper impeller to reduce clogging in heavily ragged sewage pumping stations. High-efficiency IE3 drive motors are available when required to minimise the drive motor's consumed electrical power.

Xylem Water Solutions Australia Ltd www.xvlemwatersolutions.com/au



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Smarter analytics — predictive asset optimisation and your industry **Joanna Batstone**, VP and Lab Director, IBM Research-Australia + CTO, **IBM ANZ**

IoT and Industry — perfect match or perfect storm?

Michael Freyny, Executive General Manager - Digital Factory/Process Industries and Drives, Siemens

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TSS SENSOR

The Cerlic ITX sensor uses near-infrared (NIR) technology to measure total suspended solids (up to 2%) in activated sludge processes. Unlike turbidity sensors designed for clean water processes, the sensor utilises transmission of light for concentration measurement, which means it is immune to changes in water colour.

The submersible sensor has a self-cleaning system completely integrated into the body of the unit. It has no moving parts and uses pressurised water (eg, re-use water) or compressed air (eg, from blowers). The handrail mounting assembly and 4 m fibreglass telescopic mounting rod are designed to shake with the user's aeration to help reduce ragging. The sensor is calibrated against regular tap water (zero) and a single lab sample.

As part of the Cerlic family of online suspended solids, dissolved oxygen, pH and biosolids sensors, the product communicates in real time to the user's SCADA with a choice of 4-20 mA or Profibus DP. Up to four sensors can be controlled (including cleaning cycles) from the one BB2 transmitter.

When compared with typical sample lab testing, the product is said to provide ±0.5% full-scale accuracy to dry-weight results. With low maintenance and a long life expectancy, the sensor can help bring real-time control of MLSS to the user's plant.

Control Components Pty Ltd www.controlcomponents.com.au

ANAEROBIC WASTEWATER **TREATMENT**

The Hydrothane ultrahigh-rate anaerobic process takes organic content within wastewater and generates green energy. The ECSB (External Circulation Sludge Bed) process can typically take 1 kg of chemical oxygen demand and generate up to 0.35 m3 of methane, which can be used as an alternative fuel for boilers or, with sufficient quantities, be converted into electricity.

A common misconception of anaerobic processes is that they require a long hydraulic retention time and a large amount of space is required. With Hydrothane's vertical design, the tall vertical reactors can treat flows of up to 1 ML/day within a diameter of a few metres.

All odours are controlled, removing the need for odour control systems. No maintenance is required inside the reactor as there are no complex internals or rotating equipment. There is also no corrosion as the over-pressurised design prevents air from getting in.

Hydroflux Pty Ltd www.hydrofluxindustrial.com.au

IMAGING PARTICLE ANALYSIS SYSTEM

The FlowCAM imaging particle analysis system is a tool for detecting, identifying and quantifying algae or problem particulate matter in water treatment processes. Four models are available - from the imaging-only VS-I to the VS-IV with two channels of fluorescence measurement and scatter trigger capabilities.

The product captures particle images at up to 22 fps, allowing for high sampling efficiency and fast analysis times. It measures particle size and shape, with over 30 morphological measurements on each particle

imaged. It delivers results on all particles from 1 µm to 2 mm (count) and 4 µm to 2 mm (shape).

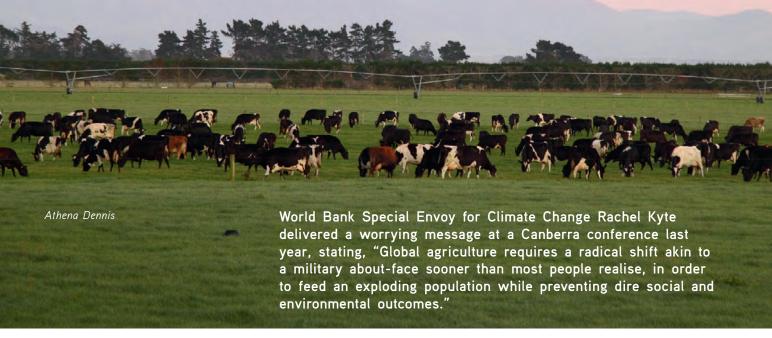
The unit provides statistically relevant results quickly, allowing the user to look at tens of thousands of particles per minute. It allows automated, trainable, statistically based pattern recognition, saving time by isolating different types of particles into categories and subpopulations. An auto focus feature provides convenient, repeatable focus.

Water treatment applications include: filter fouling algae detection; taste and odour algae detection; visual and numeric floc feedback tracking; coagulant feed optimisation and control; flocculator mixing speed optimisation and control; and filtration optimisation.

The flexible and customisable system meets user-specific requirements. Four magnification sizes (2x, 4x, 10x and 20x) and various flow cell sizes are available to accommodate a broad range of sample particle sizes (2 µm to 2 mm). It is easy to alternate between multiple analytical ranges.

Kenelec Scientific Pty Ltd www.kenelec.com.au

The path towards climate-smart farming and agriculture



ccording to Kyte, cereal yields will decline by 15-20% if current agricultural practices continue in the next three decades. In order to feed the global population of 9 billion people by 2050 with nutritious food, there needs to be fundamental shift in how we grow food and limit carbon emissions.

Recent research cited by World Bank shows that agriculture and land use changes are directly responsible for 30% of the world's greenhouse gas emissions.

Fast facts about food consumption and carbon emissions

- Meat consumption in emerging economies of the world is expected to grow 75% between 2005 and 2050. This will increase to 30 kg per person, per year; this intensifies pressure on crop lands and generates higher carbon emissions.
- For every 1 kg of meat consumed, an additional 10 kg of feed is required.

 A recent CGIAR-funded study found that beef and dairy cattle account for up to 77% of global greenhouse gas emissions from livestock.

Climate-smart farming and agriculture: a paradigm shift

Unless we figure out new methods of food production, legislation and resource management, the world will face disruption to food sources - not 30 years from now, but possibly within the next decade.

Treading water to stay in the same position isn't really an option. New and intelligent solutions are required to galvanise industry, government and consumers to work as one in order to better manage agricultural resources. Innovative solutions are required to feed the growing population of the world and also to protect the planet.

Climate-smart agriculture means providing an integrated and broad approach to food that factors in areas like sustainability, carbon emissions, climate change and nutrition. The answer to this issue doesn't need to be a trade-off; instead, it can be a three-fold win for the natural environment, consumers and business: biogas cogeneration for agribusiness.

Biogas cogeneration: how it works

Biogas cogeneration is suitable for use in food processing facilities, livestock and dairy farms, agribusinesses and also food waste and treatment facilities. This technology is capable of up to 90% energy efficiency, resulting in far lower carbon emissions per tonne of food produced.

This sort of technology offers a win-win for agriculture and the sustainable energy sector. It provides the same food production levels while also mitigating against carbon emissions and therefore climate change.

According to a study by the Australian Meat Processor Corporation, biogas cogeneration is the most economical renewable energy source - especially for labour-intensive tasks like on-site meat rendering, which take up to 70% of the heat energy

climate-smart farming

at the facility. Typical payback scenarios range between 3.8 and 10.1 years.

What this means for farms and agricultural businesses is that they can have an efficient and decentralised source of energy and produce food for a lower cost. At the same time, these businesses manage their energy consumption efficiently with a decentralised power source that uses waste products to generate energy to run the farm.

This method of power generation is at least 40% more efficient compared to ultrahigh-efficient micro-turbines. Biogas cogeneration is a prime example of how food production can still operate within a sustainable environmental framework.

The way forward

Evo Energy Technologies has combined its solid industry reputation in Australia for energy-efficient products with 2G's track record of thousands of biogas CHP plants successfully installed in facilities all over the world.

Biogas cogeneration is suitable for use in food processing facilities, livestock and dairy farms, agribusinesses and also food waste and treatment facilities.

First the company conducts a rigorous feasibility study to evaluate project risk, operational output, budget and all other variables. This means that all of the hard work is already done for feasibility by skilled project managers.

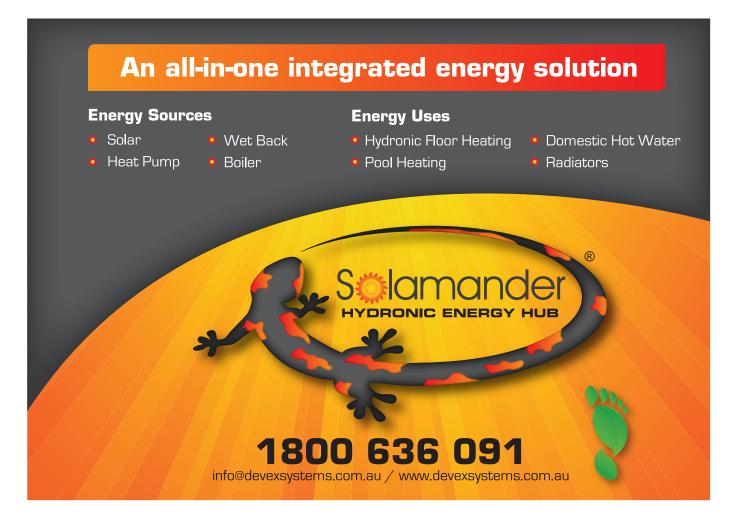
Right from the beginning, EvoET provides end-to-end energy solutions that are clear about service deliverables, the ROI scenario and pricing structure.

References

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Evo Energy Technologies www.evoet.com.au



DIGITAL COMBINATION TRANSMITTER

Keller has launched a fully functional digital combination transmitter for pressure and temperature. In the LD series, all the electronic components are accommodated in a laser-welded stainless steel housing filled with silicone oil.

Measuring 11 mm in diameter, the housing contains the sensor technology, the (mathematical) compensation coefficients, the digital signal processing and the I2C interface for simple, loss-free integration into higher level systems. Made of stainless steel or Hastelloy, the housing not only acts as a Faraday cage but also offers ap-



propriate protection against electromagnetic radiation and potential environmental influences. With Keller's Chip-in-Oil technology, short signal paths with high impact and vibration resistance are realised.

Six standard measurement ranges extend from 1 to 200 bar with a compensated temperature range of -10 to +80°C. Accuracy is rated as better than ±0.15%FS and a total error band of less than $\pm 0.5\%FS$ is attained between 0 and 50°C. The temperature measurement accuracy is ±2 K.

Transmitters in the series are optimised for battery-powered applications, eg, during A-to-D conversion, current consumption is ~ 1.5 mA, dropping to $\sim 0.1 \mu A$ in 'idle' mode. The supply voltage range of 1.8 to 3.6 VDC corresponds to a normal microprocessor environment.

The Series 4 LD is the smallest of four versions. Larger models measuring 15, 17 and 19 mm in diameter are also available for relative pressure measurements, offering an additional temperature range (-40 to +110 °C) without changes to the electrical characteristics.

KELLER AG für Druckmesstechnik www.keller-druck.com



24 VDC, 15 A BUFFER UNITS

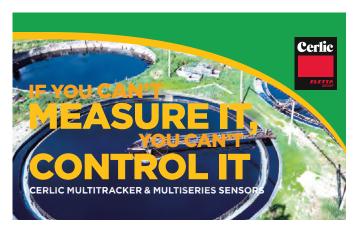
DIN rail-mount power supplier PULS has released the UC10.241 and UC10.242 DC buffer modules. They extend the buffer times currently offered by the UF20.241 and UF20.481 by utilising electrochemical double layer capacitors (EDLC), which can provide a backup time of up to 33 s for a 10 A load.

Unlike with DC UPS systems which utilise batteries, no cabinet ventilation is required. With a short charging time compared to that of

batteries, the units are rapidly back in ready mode following a discharge. They also maintain a regulated output voltage in buffer mode of 22.5 V and are capable of providing full output power between -40 and +60°C. With quick-release spring clamp terminals, wiring is quick and easy.

Other features include an inhibit digital input which, when activated, turns off the output and buffering; and ready relay outputs to provide unit status back to a control system. The modules have an operational lifetime expectancy of 10+ years.

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



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LIGHTNING AND SURGE PROTECTION FOR PV SYSTEMS

DEHN + SOHNE has lightning protection components and surge protection devices for photovoltaic systems.

Systems are available for one-family houses up to PV power plants. The modular systems allow for lightning and surge protection measures for all kinds of PV systems - starting with external lightning protection with an air-termination system, down-conductor system and earth-termination system, along with equipotential bonding and up to lightning and surge protection.

Even when devices overload, the arrester control of the DEHNguard PV SCP ensures a safe state of operation without a risk of fire in the system. The combined disconnection and short-circuiting device is able to carry the short-circuit current until corrective maintenance of the PV system.

The Type 1 combined lightning current and surge arrester DEHNlimit PV 1000 protects the generator and inverter against surges in case of direct lightning strikes. Potential shortcircuit currents up to 100 A at a photovoltaic voltage up to 1000 VDC will be interrupted within a few split seconds.

The DEHNcon-Ha module, in the field of an isolated air-termination system, is usable wherever proximities have to be avoided. The HVI conductor light is used not only controls proximities, but it is also individually adjustable to the architectural design by selecting the corresponding colour of the paint coating.

DEHN + SOHNE GmbH + Co KG www.dehn.com.au

STRUVITE REMOVAL AND **BIOSOLIDS ENHANCEMENT PROCESS**

AirPrex technology, by German group CNP, provides a struvite removal and biosolids enhancement process. It removes struvite (magnesium ammonium phosphate) from anaerobically digested sludge streams, thus eliminating potential pipe blockages and mechanical issues without increasing chemical use.

The technology creates phosphate fertiliser as a by-product of the process, providing a sustainable source of this diminishing commodity. It also reduces the phosphorus load returned to the plant by 90%. It is said to improve sludge dewatering performance, reduce polymer consumption, create higher cake solids and reduce a plant's overall operational expenditure.

Hydroflux Pty Ltd www.hydrofluxindustrial.com.au

ROTARY SCREW VACUUM PUMPS

The GHS VSD+ Series is a range of efficient, intelligent vacuum pumps with variable speed drive (VSD) from Atlas Copco. Based on the plug-and-play design principles of Atlas Copco compressors, the pumps have been designed to deliver peak performance at operating pressures commonly found in industrial applications.

The GHS 350-900 VSD+ vacuum pump range is said to provide users with energy savings of around 50% compared to traditional rotary vane pumps, with its VSD and an innovative inlet control valve combining to reduce lifecycle costs. The product has a lower environmental impact due to ultrahigh oil retention at all operating pressures - from ultimate pressure to atmospheric pressure. It conforms to energy management and environmental commitments according to ISO 50001/14001.

The series offers a low noise level compared to other vacuum pumps. Energy recovery leads to minimal hot air in the workplace, while its oil retention means that the quality of the exhausted air is optimal. It also avoids oil spills on the factory floor, which commonly occur with conventional oil-lubricated pumps. This leads to a cleaner working environment and faster cycle times.



Due to its plug-and-play design, the series assures an easy and fast installation that saves time and space. The footprint is no larger than that of a standard pallet and everything required is delivered as a complete package.

The vacuum-specific element is said to offer a longer lifetime than a screw compressor and vane pumps, as well as high efficiency. The inlet control valve provides modulating vacuum control in conjunction with the VSD drive to minimise energy consumption.

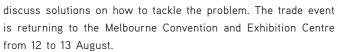
Atlas Copco Compressors Australia www.atlascopco.com.au

Waste matters at AWRE 2015

Electronic waste is currently a hot topic in the waste management and recycling industry, with numerous reports shining a spotlight on Australia's increasing 'e-waste' problem.

According to recent figures, e-waste is the fastest growing type of waste in the country, which has prompted government, at both a state and federal level, to review and update recycling schemes.

The annual Australasian Waste and Recycling Expo (AWRE) presents an important opportunity at an industry level for members and thought leaders to come together to



Alexandra Haughton, AWRE event manager, said that AWRE hoped to connect government and other businesses with Australasian companies that are leading the way for e-waste services, such as MobileMuster and ECOACTIV, as part of the event's dedicated E-Waste Zone.

Haughton said that the AWRE seminar program, which is held over the event's two days and hosts some of the industry's most influential thought leaders from Australia and abroad, will include dedicated e-waste sessions: 'e-waste futures' and 'businesses go e-waste free'.



Kate Gavens, director of sustainability policy at the Victorian Department of Environment, Land, Water and Planning, will be leading the 'e-waste futures' session, which will cover the role of regulation and landfill bans.

Solutions to organic waste will also feature prominently on the seminar program. This includes an afternoon session on 'market development and research in organics' featuring representatives from the Environment Protection Authority Victoria and Sustainability Victoria.

A session on 'food recycling in commer-

cial premises' will be led by Closed Loop - an Australian company working with the aviation, hospitality and health industries on waste control programs to maximise recycling rates, minimise waste to landfill and reduce overall waste disposal costs and environmental impact.

"AWRE's seminar program is not only applicable to waste management and recycling experts, but also a unique professional development opportunity for operations managers from government and business concerned with sustainable practices," Haughton said.

Visitors to AWRE can see more than 100 brands in the waste and recycling industry showcasing the latest technologies and innovations.

Individuals can register to attend this free event online at www.awre.com.au.

All-Energy Australia 2015

The All-Energy Australia Exhibition and Conference is set to return to Melbourne in 2015. Thanks to an important strategic partnership with the Clean Energy Council, the show will provide the Australian Renewable Energy sector with the scale and quality it needs amongst uncertain times. AEA Director Anthony Reed said: "As the industry faces uncertainty with the RET review, a partnership seemed the obvious way forward to ensure the same business opportunities are available without the pressure on the industry."

After a strong 2014 with attendees from over 1850 companies across 22 countries. the expo has taken on industry feedback to

provide a specialised conference that will cater to what the people want and need to see. This will include free Solar CPD sessions provided by the Clean Energy Council that allow attendees to earn up to 100 points towards their CPD at All-Energy 2015.

Headlining the conference will be the RT Hon. John Gummer, Lord Deben, the longest serving Secretary of State for the Environment the UK has ever had. His experience as an international



negotiator has earned him worldwide respect both in the business community and among environmentalists.

With such a big-name speaker on the cards and more to be announced soon, All-Energy sets a high standard in speakers and continues to impress with sessions headed by such names as Greg Steele, Enphase Senior Vice President for Engineering; Raghu Belur, Enphase Co-founder; Westinghouse Plasma Corporation; Krannich Solar; and DNV GL.

Running alongside the conference will be an exhibition showcasing renewable energy, clean energy, sustainable transport and energy efficiency. With over 100 exhibitors to be on display, this provides

an opportunity for members of the industry to meet suppliers and facilitate business that will help the renewable energy sector of Australia move towards a bigger, brighter future.

All-Energy Australia 2015 will be running from 7-8 October 2015 at the Melbourne Convention & Exhibition Centre, alongside Waste Expo as a part of Australian Sustainability Week. Registration opens in June. For more information, visit www.all-energy.com.au.

Let's talk trash

ustralia generates 48 million tonnes of trash a year. That is 2.2 tonnes per person and the amount we throw away each year is growing 40%

faster than population growth, according to the Department of Sustainability (DoS). Fortunately, 60% of what we throw out is recycled, putting our recovery rate around the middle amongst developed nations.

The DoS highlights that Germany achieves a recovery rate of 91% despite generating more than double the trash per capita (4.6 tonnes) as Australia. In fact, they identify seven European countries that have recovery rates in excess of 97%. They attribute this performance to:

"... directives prohibiting unsorted waste going to landfill and greater use of advanced waste processing and EfW facilities."

EfW stands for energy-from-waste or incineration. In Germany, 14% of its municipal solid waste (MSW) is burned to make renewable electricity. In Australia, only 3% of our waste is recycled for its embodied energy. EfW, as it is practised overseas, is non-existent in Australia. Energy recovery here is primarily achieved via the harvesting of landfill gas to produce electricity, as well as a small amount from anaerobic digestion and a few cement kilns using old tyres as supplementary fuel.

A few years ago we had the opportunity to visit a modern EfW facility owned by Covanta Holding Corporation. Their Essex facility converts 2800 tonnes of MSW per day into baseload electricity for 45,000 homes. A remarkable aspect of the facility was that despite the amount of garbage being collected daily, there was no foul smell. The use of negative air pressure pulls odours into the facility while simultaneously keeping the fires burning. In terms of emissions, a modern EfW facility, like the one at Essex, produces fewer emissions than from a natural gas-fired power station, minimising local air pollutants.

In fact, the German Ministry of the Environment reports that residential fireplaces emit 20 times more dioxins than an EfW plant.

EfW technology is widely available, and there is nothing preventing its use in Australia. For example, New South Wales (NSW) generates 4.8 million tonnes of MSW per year with 43% of it landfilled. This landfilled MSW is sufficient feedstock to support a 2800-tonne facility that would already bring our national MSW recovery ratio up to about half of what Germany is currently achieving.

According to the NSW Office of Environment and Heritage, in August 2011 the average gate fee over landfill sites surveyed in the Sydney region was \$195 per tonne for mixed waste. Because landfill gate fees are so high, this suggests EfW could be economic in NSW based on Covanta's overseas experience.

Besides potentially being cheaper, a modern EfW facility in Australia could also displace coal-fired power generation as it is capable of providing continuous supply.



In Germany, 14% of its municipal solid waste (MSW) is burned to make renewable electricity. In Australia, only 3% of our waste is recycled for its embodied energy.

We know that Covanta's Essex contract allows it to collect US\$150 per tonne of MSW. The facility also earns revenue from the sale of electricity. The current contract was sufficient for the company to commit US\$100 million in upgrades and increase its dividend. We believe this points to a strong economic contract for the company. Assuming this facility was operating in NSW and it received a credit for its electricity at \$34 per megawatt hour (the average wholesale price in NSW last year), the equivalent contract price would be around \$160 per metric tonne.

Waste management is a perpetual problem that only gets bigger over time. The NSW Government's policy to divert 66% of waste from landfill is a good example of a progressive policy that has supported more sustainable solutions, but to continue this drive we need new solutions. The success of some European countries to nearly eliminate MSW from landfills is a remarkable and achievable goal Australia should look to mirror. Too much valuable material is simply being buried and wasted that could otherwise go towards making ours a more sustainable society.



Nathan Lim, International Equities Portfolio Manager, Australian Ethical, has 20 years' experience within the financial/investment sector and has been Australian Ethical's International Equities Portfolio Manager for nearly three years. Prior to that he was the portfolio manager at van Eyk. Nathan is an expert in international equities/ investment and the energy sector including renewables.



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