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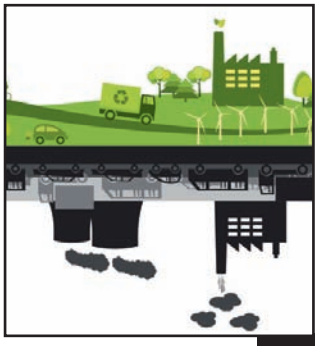

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WORDS FROM THE EDITOR

It has been a busy couple of months with many conferences on the go and more to come.

At my seventh Ozwater, it was good to catch up with some old friends and find out what's happening in the water industry. During the Melbourne event in May, the AWA announced its plans for a Sustainable Water Alliance. The alliance aims to give the water industry a stronger voice with government and the community at large in order to influence policy and achieve a sustainable water future for Australia. AWA is seeking interest from like-minded organisations to help with the alliance's approach to unite the water industry and engage the community and government nationally with its key priorities.

Also in Melbourne, the Solar Energy event was surrounded by a lot of vibe about the latest in battery storage technology. I recently caught up with Sunwiz's MD to talk about the progress of solar for commercial premises — read the full details on page 8.

The Sydney Markets was another one of my destinations in May. Here I saw first-hand how the market's food waste is being diverted from landfill in what is claimed as the first food waste to energy plant in Australia — see page 20 for further details. Although in operation for over 10 years, the EarthPower site can now provide a competitively priced solution to convert organic waste to energy due to recent rises in landfill gate fees in NSW. The site will also be receiving all non-edible food waste from the Opera House restaurants during Vivid LIVE in Sydney.

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ECO Expo Asia
國際環保博覽
International Trade Fair on Environmental Protection

Green Solutions for a Changing Climate

Spearheaded by local and international governments, the green movement is strongly supported by Eco Expo Asia, the region's premier fair for sustainable initiatives.

This year the 11th edition of **Eco Expo Asia** takes place at AsiaWorld-Expo in Hong Kong from 26 – 29 October, with the theme being "Green Solutions for a Changing Climate". The expo is organised by the Hong Kong Trade Development Council and Messe Frankfurt (HK) Ltd. The Environment Bureau of the Government of the Hong Kong Special Administrative Region is the co-host, underscoring the HKSAR government's commitment to environmental protection.

Exhibitors are grouped into the following product categories:

- Air and Water Quality
- Energy Efficiency and Energy
- Green Building Solutions and Services
- Green Transportation
- Waste Management and Recycling

The emphasis is very much on ground-breaking technologies, smart and innovative products. In 2015, the exhibits covered the full spectrum of environmental initiatives with 320 exhibitors presenting a global overview. More than 12,000 buyers from 97 countries and regions attended the fair. They represented both the private sector and government representatives who were in search of new technologies to apply for the benefits of the community and different industries.

Eco Asia Conference is an important highlight of the fair. It has become a prestigious event, attracting top-flight speakers to share insights into environmental protection. There is a programme of seminars and forums during the expo designed to foster knowledge exchange and to promote relationships within the green sector. Each day revolves around a theme to generate deeper interest for its events and activities.

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Eco Expo Asia

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Carbon management in a climate of uncertainty

For many Australian businesses, climate policy and corresponding reporting requirements have been surrounded by much uncertainty, with the major political parties having different ideas about climate policy.

> **A carbon footprint provides the means to identify emission-intensive processes and products, as well as identify improvement opportunities through an assessment of abatement options and costs.**

Consequently, in recent times we have seen the proposal for the Carbon Pollution Reduction Scheme being rejected twice by Senate, the introduction and repeal of the carbon price mechanism and the scaling back of the Renewable Energy Target from 41,000 to 33,000 GWh by 2020. In September this year, the government introduced its Safeguard Mechanism Rules, which is the compliance instrument to the Emissions Reduction Fund (ERF).

The ERF itself is a voluntary scheme that aims to provide incentives for businesses and individuals to reduce their greenhouse gas (GHG) emissions. Setting aside a discussion around the effectiveness of Direct Action, the ERF, its Safeguard Mechanism and the adequacy of Australia's announced emission target for 2030, it becomes clear that it can be a trying task keeping up to date with policy, reporting requirements and managing one's own carbon strategy. To complicate matters more, potential liabilities from climate-related exposure arise from rising energy costs, fluctuating input resource costs, environmental regulations, changing consumer preferences and scrutiny from investors and shareholders, as well as reputational risks from other stakeholders such as clients and NGOs.

Under these circumstances, it can be difficult for business to determine the amount of change possible at the lowest cost possible. It is understandable that there is a robust debate on who should do what or who will bear the economic burden. After all, for business it is critical to understand how climate policy will affect both their companies and the business environment in which they operate. But business has also acknowledged that climate change is a central issue for domestic economic and environmental policy. Despite all the uncertainty, proactive firms leave potentially lagging policy behind, incorporate carbon management into their business decisions, create financial value and differentiate their business.

The incentive for doing so is often financially driven, for example in form of a possible (re)introduction of a price on carbon, be it a carbon tax or emissions trading. And in the case of larger organisations, many are already captured under the National Greenhouse and Energy Reporting scheme (NGERs) or report under the Carbon Disclosure Project, which require businesses (in the case of NGERs that trigger the liability threshold) to report on their GHG emissions and energy consumption.

But more frequently, we also see emission reduction targets by firms of all sizes and branding benefits from being transparent about business operations and/or the carbon footprint of a product or service. And while NGERs focuses on reporting requirements, rather than provide a clear policy for achieving emission reduction goals, businesses can take advantage of the opportunities inherent in assessing the energy and emission intensity of their products and services.

What's your carbon footprint?

Starting with a verifiable inventory of sources and types of GHG emissions (more commonly known as a carbon footprint) is an essential and effective first step in identifying the overall carbon intensity of business operations, products or services. A carbon footprint does not only improve a business's understanding of the key drivers affecting emissions through assessing the relationship between emissions, energy consumption and relevant business metrics. It also allows them to assess their exposure to climate change and climate policy-related risks, in particular those from policy measures aimed at reducing emissions and energy consumption by putting a price on them. A carbon footprint provides the means to identify emission-intensive processes and products, as well as identify improvement opportunities through an assessment of abatement options and costs. Based on this assessment, businesses may then re-evaluate, for example, operating procedures, procurement policies, service delivery or manufacturing processes.

Identifying the sources and types of emissions, setting calculation approaches, collecting data and choosing the appropriate emission factors, applying the relevant calculation tools and methods and rolling the data up to the corporate level is inherently a technical undertaking.

Despite the current situation around climate policy in Australia, businesses should not dismiss the necessity to monitor policy developments. The prospect of future changes should remain on the radar to avoid 'surprises'. Through a sophisticated approach to energy and emissions reporting and management, businesses may be able to reduce their liability in a low(er)-carbon economy and respond to changes early and effectively.

Alexander Stathakis of Conversio started his career in sustainability and climate change with The Sustainable Business Unit at The University of Queensland Business School, which provides research and consultancy services for business organisations in the area of corporate sustainability and climate change adaptation strategies. In the past, he has administered the National Carbon Offset Standard Carbon Neutral Program at Low Carbon Australia. More recently, while working at EY, Alex has been the CitySwitch Green Office Program Manager in Queensland. He worked with SMEs to determine their carbon footprint and energy intensity, as well as identify opportunities to save energy and reduce unnecessary costs.

More and more businesses are taking up solar photovoltaic (PV) systems on commercial premises in Australia and, according to SunWiz Managing Director Warwick Johnston*, it's happening more frequently. Warwick talks to *Sustainability Matters* about some of the latest trends in commercial PV and the push and pull factors at play in Australia.

The push and pull of commercial solar in Australia

While the solar industry has been 'distracted' by the residential solar market for some time, Warwick believes there are now greater opportunities and less market saturation in the commercial market. "This is giving commercial PV a push," he said, "while the pull factor, and one of the main drivers for the growth of commercial PV, is that solar is now recognised as making good financial sense.

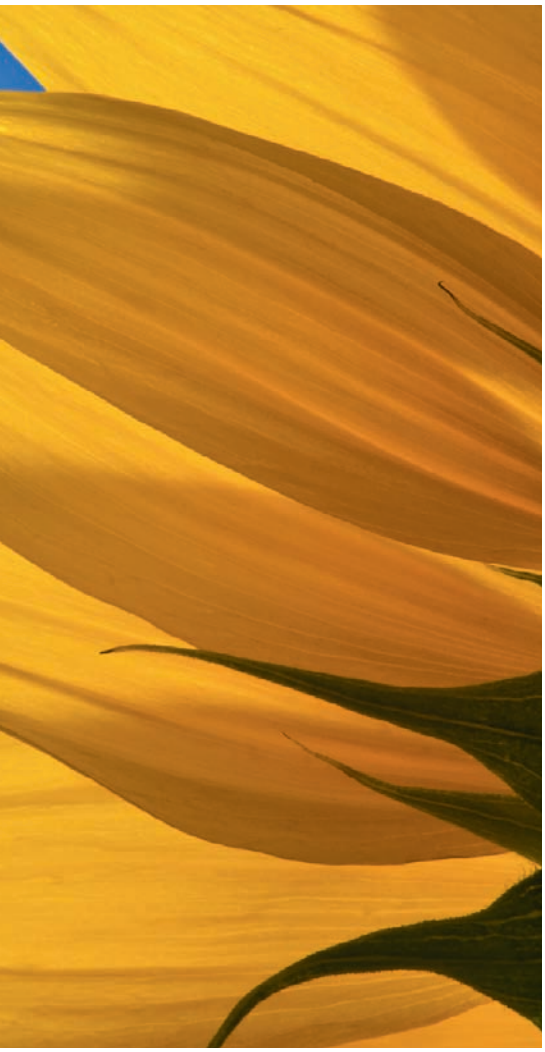
"We've seen a considerable decrease in pricing over the past two years, which has made solar affordable for business," said Warwick. "Now, with only relatively incremental improvements in solar PV efficiency and price, businesses are no longer holding off investing in solar.

"Financing is also more readily available for commercial PVs than it once was."

However, businesses should take care when it comes to investing in solar. "Make sure you get a financial evaluation that takes into account your hour-by-hour energy consumption and your tariff structure," Warwick advised. "All too often, we see businesses investing in an oversized system that doesn't match their energy consumption profile. So what might have been an impressive return, if it was appropriately sized or positioned on a better business, might end up being a woeful financial return.

"Businesses need to get an analysis that takes into account an hour-by-hour energy balance across an entire year."

Small businesses have an energy tariff structure that is pretty similar to residential structures — mainly a fixed charge and then a per-kilowatt charge over that that can be quite high, explained Warwick. "But when it comes to large industry energy users, they generally have a low kilowatt-hour charge and then have a separate charge for their peak demand."



Warwick has completed a white paper on how solar can reduce the demand charges that many of these businesses face. "Interestingly, our analysis showed solar can reduce peak demand charges quite considerably, but it varies depending on where the business is located, the tariff structure and the energy consumption profile. In summary, peak demand reduction is possible from solar; never guaranteed, but always worth evaluating if that's going to change the financials from reasonable to outstanding."

How will the upcoming election influence the solar market?

Warwick forecasts that STC (small-scale technology certificate) pricing under the government's Small-scale Renewable Energy Scheme will be pretty much unaffected by the election. He also expects renewable energy regulations will remain untouched but believes the price of LGCs — large-scale generation certificates which are sold through the open large-scale generation certificate market — could be affected.

"We have just been through a fairly brutal cut to the RET (Renewable Energy Target), so it's unlikely that anyone is going to try to cut it further."

Although the election could add a bit of caution to the market, Warwick believes there are other significant factors that are influencing the price of renewable energy certificates more than the election, such as electricity retailers avoiding financing projects. "That said, the space in which the retailers are holding back is being filled by the state government and other industries. We are seeing the likes of the Queensland and Victorian governments announcing that they will support renewable energy generation. There is also movement by a coalition of Melbourne councils and business to go out to tender for a fairly large amount of renewable energy. So there's a bit of activity there."

Trends in commercial PV solar

The development of battery technology is one of the main trends in the commercial PV solar market at the moment. "From a commercial perspective, batteries can be more cost-effective or more financially viable to the extent that they are used in combating peak demand charges. From a residential perspective, when Tesla first announced its battery, PV residential solar took a bit of backward step." Warwick explained that this was a result of people holding off investing in PV as they were waiting for the battery solution to develop, even though most PV systems are future-compatible with battery storage systems.

As far as technology goes, it looks likely that a variation of silicon will remain the dominant technology for around the next 10 years. This technology is now efficiently mass-produced in China, which is keeping prices falling each year. "I'd be quite confident in buying Chinese panels from the right manufacturer, but it would have to be a reputable manufacturer so you make sure you're getting quality," said Warwick.

Warwick said that the growth of Internet of Things (IoT) technology could also have an impact on the growth of solar. "For example, with household appliances, IoT technology can give you the ability to control when you consume energy. Therefore, when you have excess electricity generation, say on a sunny day in the middle of the day, your system may be capable of telling you this and you may be able to use this energy to run your dishwasher then, rather than at night."

Although we don't see many bakeries or hotels buying PV at present, as most of their energy is consumed during the night, this could change as technology develops. "Beyond that, we see that there is a huge number of industries across the economy that could benefit by buying PV.

"If you're in business, you should be considering solar," concluded Warwick.

**Warwick Johnston is the Managing Director of SunWiz. He has been working in solar energy since 2005 and holds a master's degree in renewable energy. He is also the Australian representative to the International Energy Agency PV Task and a longstanding member of the PV Leadership Committee.*
Warwick will be one of the opening presenters at the All-Energy Australia conference, which is taking place from 4–5 October in Melbourne and is free to attend. His session is centred on solar market trends from 2016–2017 and will be focused on the outlook and direction for successful development of commercial-scale photovoltaic (PV) solar.

SunWiz
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Urban living: a high-density roadblock to sustainable lifestyles

Big city living is an aspiration for many Australians, but with rising costs to the owners and the environment, it is a dream that is at risk of becoming unachievable for future generations. The 2016 Urban Living report by the Urban Taskforce has indicated that a staggering 24% of Australia's population, with much more in cities like Sydney and Melbourne, dwell in medium- to high-density housing such as shared flats and apartments.

Many of these urbanites are highly aware of climate change and sustainability issues. While 87% of Australians believe it is a present issue that we do bear responsibility for, the choice for many of these Australians in medium- and high-density living spaces to live sustainability is simply not available. This is because of the myriad of issues that prevent them, or their landlords, from integrating sustainable technologies such as solar into their dwellings.

Meeting the demand for 'futureproofed' living

More and more property buyers across Australia are beginning to expect futureproofed dwellings which are sustainably designed and equipped with renewable energy. These properties can produce cost savings as well as increase future resale value through energy-efficient building materials, appliances and technologies that can act as a buffer to the dangers of future energy or resource cost increases.

Apartment developers have had difficulty meeting this demand due to limits of existing solar technology. With several apartments each needing their own 'system', the transparent distribution of harvested solar energy to owners is a daunting task.

Taking on the challenge with Flo Apartments, Psaros succeeded in style with 86 residential apartments that confer all the benefits of ecologically sustainable design, with full owner control of said benefits. Leveraging Enphase's distributed Microinverter architecture, Flo allows apartment owners to actively participate in a form of sustainable living that benefits their carbon footprint as well as their bill.

A whole new level of energy independence for apartments

Not satisfied with solar being used to only passively reduce costs, Psaros assigned 2 kW of its 172 kW rooftop system to each apartment to give Flo apartment dwellers an active role in reducing their own carbon emissions. Made possible by the flexibility of the Enphase Microinverter System, the individual allocation of 2 kW systems means that each apartment can view its own solar energy generation and benefit from net cost savings.

These microinverters are not only effective, achieving high solar yields for each panel, but invisible as well, without any high-voltage DC wiring across the rooftop that could risk marring the design aesthetic of the beautiful apartments. In fact, the sleek installation looks like a single system of panels from the outside to any rooftop observer.

By actively building ecofriendly habits, residents have the opportunity to cut their power bills by up to 50% — and if this isn't incentive enough, the ability to compare solar power generation with surrounding neighbours provides that extra little bit of competition. The best part? While owners get to save and indulge their inner ecochampion, Psaros wins as well with a shrinking carbon footprint on its property development.

The success of Flo Apartments proves that there is overwhelming buyer support for projects incorporating renewable technologies. By continuing to pioneer projects that overcome traditional roadblocks to sustainable living, daring developers and installers are lighting the way forward for the rest. Not only are they cost cutting, but people are recognising that this is the way of the future. Enphase is proud to be helping build that future where energy is evolved.

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Can improved agricultural practices help combat climate change?

Agricultural emissions arise principally from enteric fermentation in livestock, manure management, rice cultivation, agricultural soils, savanna burning and field burning of agricultural residues, all of which emit nitrous oxide (N_2O) and methane (CH_4).

Over half of global non-carbon dioxide (non-CO_2) greenhouse gas (GHG) emissions are reportedly accountable to agriculture. According to a new research study recently published in the *Journal of Integrative Environmental Sciences*, this figure is set to rise substantially in the next two decades, especially in developing countries. However, by analysing US Environmental Protection Agency (USEPA) data and models, the authors have projected that there is significant potential for the agricultural sector to provide relatively low-cost opportunities for reducing GHG emissions by 2030.

Even though farms and businesses across the agricultural sector are interested in effective global GHG abatement, there is limited data on global agricultural sector emissions relative to the data development on fossil fuel emissions. One of the reasons for this is that there are unique challenges to developing agricultural data over large geographical areas, particularly with different regions and countries employing diverse farming methods and activities that emit multiple types of GHGs, with potentially complex interactions. The authors of this new research paper analysed data and models from the USEPA's updated global non-CO_2 GHG mitigation assessment to investigate the potential for GHG reductions from agricultural emissions from seven regions globally, offsetting costs against social benefit of GHG mitigation (eg, human health, flood risk and energy costs). Various mitigation scenarios have been analysed for crop production, rice systems, livestock management and manure management. For each scenario the authors calculated the break-even price, taking into account yield levels, commodity prices, labour requirements and water resources. The authors have also compared baseline emissions versus mitigation emissions levels to formulate mitigation potential at break-even prices for 2010, 2020 and 2030. The results revealed significant potential for GHG mitigation in the agriculture sector, with a projected 13–16% reduction of GHG (or over 520 Mt CO_2) per year. Asia in particular offers a lot of opportunity for significant GHG mitigation, with improved or reformed livestock management and rice cultivation practices found to offer the greatest reduction. The authors do, however, urge caution due to the potential impact on yield production, which could have implications for regional and global food security.

Are sensors, drones and satellite apps the future for agribusiness?

Three major issues face agriculture — declining productivity, cost of production and retention of the next generation. An answer to these and a strong focus for the immediate future should come from advances in technology.

The importance of agriculture in the 21st century is tremendous, and the agricultural industry has the potential to underpin the Australian economy. Digital agriculture in the form of precision farming, big data, sensor technology and drones presents potential for productivity gains. On-farm innovation is thriving and Australian researchers and farmers are experimenting with data-driven applications to reduce costs and optimise land and water use. Making its debut alongside the Irrigation Australia International Exhibition, AgriTech Australia 2016 showcased the latest in high-end agricultural technology, and the free-to-attend seminars showcased the tools to unlock the next wave of productivity needed to keep Australian agriculture competitive.

What was on show at AgriTech?

Precision mapping and imagery

Aerial Image Works specialises in aerial surveys, mapping and asset/pipeline inspections using unmanned aerial vehicles (UAVs), also known as drones. Coverage includes all land types including mining, exploration, agricultural, construction and environmental areas.

Aerial Image Works' team can export data captured in a variety of formats ready for use in the user's preferred GIS software. Staff can also provide additional data processing services such as point cloud classification, vegetation identification, NDVI, slope analysis and watershed analysis, to name a few. The company was one of the first in Australia to operate the Bramor rTK UAV — a high-precision, long-endurance UAV suitable for surveying and remote sensing applications.

Moving weather-based scheduling into the future

IrriSAT is a weather-based irrigation scheduling and crop benchmarking tool that uses remote sensing to provide site-specific crop management information across large scales at relatively low cost. It combines two sources of information: on-ground weather station networks and satellite imagery. It calculates the crop coefficient (Kc) from a linear relationship

Feeding the world protein in 2050

Insects are considered a delicacy in Asia and are offered in the market in a similarly wide range as meat varieties and cuts are at a butcher's store in western countries.

Europeans, North Americans and Australians, admittedly, still often find insects repulsive. However, if their distaste can be overcome by suitable processing — into protein powder, for example — and if open issues regarding food safety, the legal situation and processing can be settled, insects may in the future become an extremely promising source of protein for human nutrition.

Providing enough food for the world's population stands to become a huge challenge for humanity. Proteins are the building blocks of life and every adult needs about 60 grams of high-grade protein per day. An evaluation shows that by the year 2050, we will need an additional 265 million tonnes of protein to feed the growing population. In order to prevent a shortfall in supply, current production levels must be raised by 50%.

Even today, protein supplies are difficult to sustain because a growing number of people are eating meat and fish. To close the looming protein gap, Bühler and ETH Zurich (Swiss Federal Institute of Technology Zurich) have entered into a close cooperation: "Together, we plan to create the basis for the industrial utilisation of alternative sources of protein such as pulses, algae and insects to ensure a sustainable supply of food and feed for humans and animals and to make them attractive for consumers," explained Ian Roberts, chief technology officer of Bühler. As part of this joint venture, Bühler is supporting the new chair of the Sustainable Food Processing Group at the Institute of Food, Nutrition and Health of the ETH Zurich, affiliated with the World Food System Center, Prof. Alexander Mathys.

Even today, our protein supplies are not sustainable because we consume too much animal protein in the form of meat or fish. Two-thirds of all vegetable proteins produced end up in the stomachs of livestock such as cattle, pigs, poultry or fish.

"Intensive farming, mass animal breeding and fishing do not cover our protein needs in a sustainable and environmentally compatible way," said Bühler CTO Roberts. "What we need are new, innovative approaches to protein production and processing. Otherwise, our agricultural systems face the threat of collapse," added Prof. Alexander Mathys of ETH Zurich.

Although an increasing number of people enjoy eating meat and fish, there is no alternative in the long term to increasing the utilisation of plant proteins. High hopes are currently being pinned on pulses such as peas, lentils or beans. These gluten-free sources of protein are currently experiencing a revival, especially in Europe and North America, although they have always been part of the staple diet in Asian and African. Bühler offers systems that not only hull, split and sort pulses but also process them in their pure form or blended with other raw materials to make pasta, baked products, snacks or meat substitutes. Such novel products make pulses more attractive for a wider circle of consumers because they do not have to change their dietary habits.

New sources of protein

In the medium to long term, however, the use of new raw materials is inevitable. Algae and insects especially stand out as high-grade sources of protein. Microalgae such as *Chlorella* or Spirulina (*Arthrospira*) do not compete with existing farming land, grow quickly and take up little space. Their high-quality protein may be processed, for instance, into food and animal feeds. Whole algae and algae extracts are already available in the marketplace today. They are consumed mainly in Asian countries, but are also highly appreciated in the West by a small community of particularly health-conscious consumers. If algae-based products are to appeal

with a satellite-derived normalised difference vegetation index (NDVI). Daily crop water use is determined by simply multiplying Kc and daily reference evapotranspiration (ETo) observations from a nearby weather station. A seven-day forecast of ETo is then available to assist with accurate advanced irrigation scheduling.

Big data analytics for intelligent farming

The Intelligent Environmental Knowledgebase (i-EKbase) is a Farm Health Monitoring System that provides automated analysis and predictions to support farm management by integrating public and commercial data sources, applying big data analytics, predictive modelling and a visual overlay of analysis on Google Maps. The innovation in this idea is the incorporation of scalable analytics and customisable predictive modelling into the system as new applications or as partners arise. The purpose of the analytics is to present high-resolution visual information to farmers in a manner that can be interpreted and acted on.

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to a broad mass of western consumers, they will need to be integrated in traditional foods without significantly changing their taste and texture. In addition to proteins, algae also contain valuable polyunsaturated fatty acids and colour pigments.

Insects such as mealworms or the larvae of the black soldier fly also hold major potential. They can be fed with industrial co-products or even certain types of waste and are astonishingly efficient: from 2 kilograms of feed, they build 1 kilogram of insect mass. Another benefit is their low space requirement. As a protein source, insect meal has similarities with fish meal. It could, therefore, revolutionise aquaculture as a sustainable source of feed and help reduce the pressure on natural fish populations.

Bühler is currently setting up a pilot facility with a partner in China for processing fly larvae and mealworms on an industrial scale. Its aim is to produce insect flour as a replacement of fishmeal plus a high-grade fat with properties similar to those of palm kernel oil.

"The benefits of algae and insects are obvious. In designing integrated biorefineries for their cultivation and processing, it is important that we collaborate at an early stage with technology companies such as Bühler," said Prof. Mathys, summarising the motivation for the collaboration of ETH Zurich with the Uzwil-based technology group.

A lot of questions regarding industrial-scale cultivation, extraction and processing of algae or insect proteins still remain to be answered. Bühler possesses vast process engineering expertise, which could be put to use in such future processing and production systems. For instance, the Group has already demonstrated that the most cost-efficient mechanical method for rupturing algae cells today is by agitator bead mills. This wet grinding technology is also used for manufacturing printing inks or paints. It allows particularly gentle rupturing of the tough cell walls of algae for extracting and separating all the valuable constituents.

Extracting value from waste wool

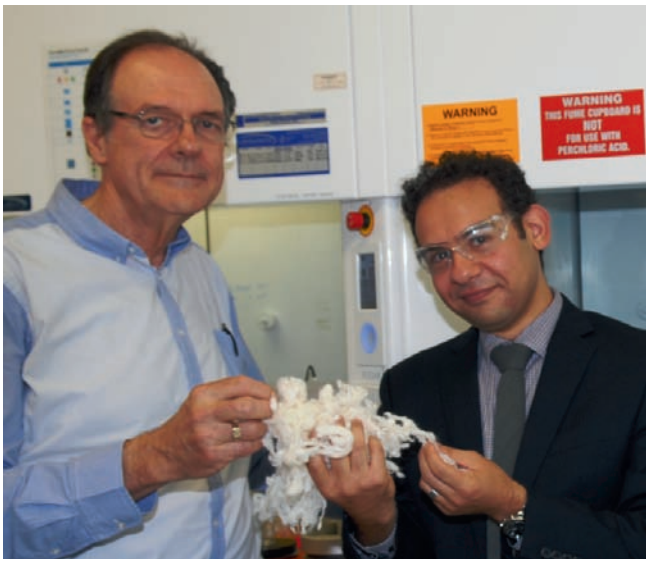
Flinders University researchers have used a non-toxic, biodegradable chemical process to 'dissolve' waste wool and unwanted woollen products. The technique produces a high-value protein called keratin and other by-products with potential applications in the cosmetic, pharmaceutical and even animal feed markets.

"Sheep wool is clearly an abundant biomaterial, with the wool-weaving industry worldwide discarding tonnes of low-grade, non-spin wool fibres every year and much more landfill from wool garments from human waste," said Dr Ramiz Boulos, who worked on the technology with Professor Colin Raston, Dr Katherine Moore, Daniel Mangos and Dr Ashley Slattery.

"Our system makes use of a waste stream, deemed unsuitable for the clothing industry, to produce an additional revenue source."

The researchers explained that a benign eutectic melt is used to break down the wool, creating the opportunity for the valuable keratin to be extracted with simple dialysis techniques. Once refined and freeze-dried to form a protein powder, the nanomaterials can be used for a range of products — from wound healing in bandages to animal feedstock.

"The final product would be highly useful for electrospinning to form keratin bandages or for implantation into a hydrogel, both of which have demonstrated clear wound-healing advantages," said Professor Raston.



Professor Raston and Dr Boulos with dirty wool cleansed by the new green chemistry technique.

Writing in the journal *RSC Advances*, the researchers describe their method as simple, efficient and environmentally friendly.

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- Chillers or other cooling devices: Maintain optimal temperature and humidity levels
- Proactive monitoring and maintenance services: Reduce total costs and operating expenses throughout the equipment life cycle

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State of waste 2016

– current and future Australian trends

*Mike Ritchie**

Australians now produce about 50 million tonnes of waste each year, averaging over two tonnes per person. There are more of us and we generate more waste per person, each year.

From 1996 to 2015, our population rose by 28% but waste generation increased by 170%. Waste is growing at a compound growth rate of 7.8%/year.

On the positive side, recycling is growing at a faster rate, and since 2005 we have actually seen (for the first time) a decline in tonnages of waste sent to landfill (in the most progressive states). We now recycle approximately 58% of all the waste we generate and send the rest to landfill.

Targets

Most governments have established recycling targets to divert waste from landfill and to capture and recover materials for the productive economy. Most readers know that almost all recycling comes at a cost to society compared to landfill. Generally, metals, paper and cardboard and plastic (in sufficient quantities) are commercially viable recyclables. Almost all other recycling in Australia is subsidised by someone via gate fees, grants or the like. That includes most household, construction and commercial waste. Unfortunately, there is no free lunch in recycling.

It is important to point out that it is the proper role of state government to set waste policy and direction. Most governments have set targets of between 60–90% diversion by 2020. Having done so, governments should have the courage of their convictions and put in place the mechanisms to permit the private sector and local governments to achieve those targets.

It is way too easy to put out a strategy with targets but then not bother to create

the economic or policy conditions to achieve them. For recycling to work it must be commercially viable — whether for a private business, council or other generator.

To put it another way, waste is like a river — it flows downhill to the cheapest price. For most materials, the cheapest price is almost always landfill. Continuing the river analogy, diverting it to recycling requires a 'weir' (a price barrier on landfill), so that the river banks up and then flows into a different, in this case a lower, price channel (relatively cheaper recycling).

Levies

Most states have recognised this reality and introduced landfill levies to drive recycling (except Queensland and NT; NT has only 1% of Australia's waste). NSW charges a levy of $133.10/t of waste (metro), Victoria $60.52, South Australia $57 and Western Australia $55.

Queensland, on the other hand, has no levy and total landfill costs in SE Queensland are as low as $30/t, due to the removal of the levy (Figure 2), strong competition and an overabundance of landfill void space.

The effect of SE Queensland's unsustainably low landfill price has been 477,000 tonnes of waste (2014) and 398,000 (2015) travelling (by road and rail) from NSW and Victoria to Queensland. The NSW Government needed to introduce the 'proximity rule' to try to slow the flow of waste to cheap Queensland landfills.

Not only did the Queensland policy settings attract 15,000 heavy truck movements onto the Pacific Highway, but NSW recyclers lost the opportunity to recover materials from that stream. It was and remains a significant unintended consequence of the removal of the $35/t levy by the (previous) Queensland Government.

It is important for all waste generators to understand that the levy is avoidable. It is only paid on waste actually landfilled. In other words, if you don't want to pay the levy, then recycle.

Fix the economics of recycling

All states with compulsory levies hypothecate some proportion of the raised funds to support recycling (to lower the cost of that channel). Levies drive recycling by increasing the opportunity cost of landfill and providing funds for grants for recycling.

Taking NSW as an example, in 2013 the government introduced the $465.7 million 'Waste Less, Recycle More' four-year infrastructure and recycling services grants program. This provides real financial support for new resource recovery businesses and investment.

Testimony to the power of price, when the Queensland Government introduced its $35/t waste levy (on commercial waste only) in 2013, there was an immediate spike in recycling rates. But 18 months later, after the removal of the levy, recycling rates crashed by 15% overnight and have not moved since. In the same period NSW has achieved a 16% growth in recycling (Figure 3).

We are still a long way from achieving each state government's recycling targets. Further intervention via levies or other instruments, such as bans, grants and regulation, is required.

One of the main frustrations of the waste sector is that plenty of new recycling/recovery technology is available, and the sector has the appetite for capital investment, but the main barrier remains government willingness to shift market economics. Only where recycling is commercially viable will companies invest.

Household waste

In the household sector, consumption continues to grow with the economy. The major trends in domestic waste treatment are:

- The average garbage bin contains 60% organic material waste. The bulk is food (40%) and garden waste (20%). The introduction of food/garden organic bins in many council areas will go a long way to achieving the targets for the household sector.
- New technologies in composting and anaerobic digestion will accelerate organics diversion.
- Almost one-third of all recyclable items are placed in the garbage bin and end up in landfill. Education and enforcement are the best solutions.
- Approximately 17% of households fill their recycling bin to capacity each fortnight. These households need more recycling volume usually via a 360 L recycling bin.
- Many councils are also contracting alternative waste technologies (AWT) to sort through the garbage bin, to recover recyclables and convert the organic com-

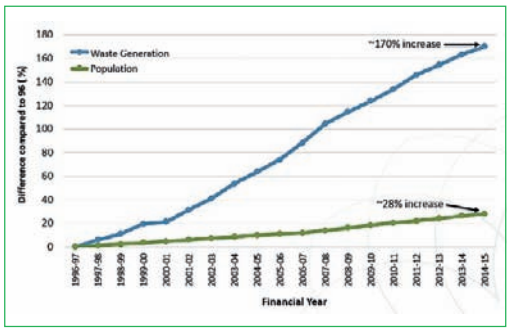


Figure 1: Comparison of waste generation and population growth. MRA Consulting Group, October 2015.

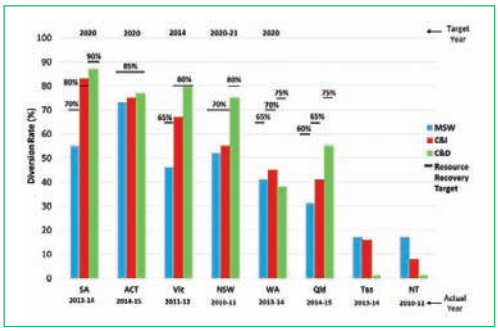


Figure 2: National resource recovery targets. MRA Consulting Group, October 2015.

Figure 3: National landfill levies (excluding ACT, Tasmania and NT). MRA Consulting Group, October 2015.

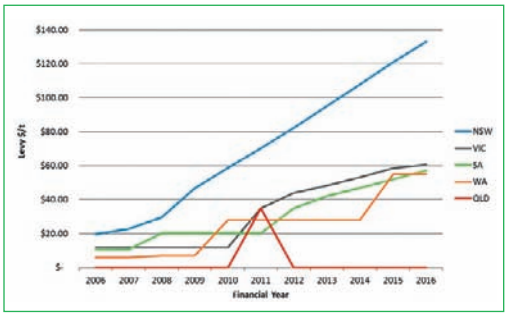
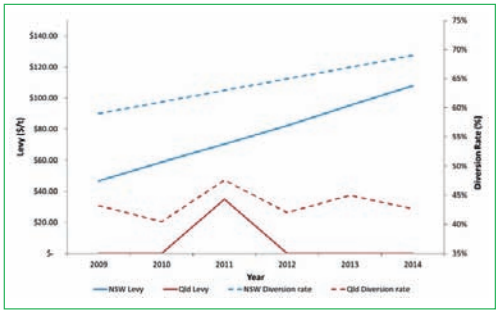


Figure 4: The effect of levies on recycling rates — Queensland vs NSW. MRA Consulting Group, October 2015.



ponent into low-grade compost. These will continue to grow.

- Some minor streams including mattresses, polystyrene and batteries can now also be recycled, as a result of support by government and the participation of charitable organisations.

There are a plethora of minor innovations but the diversion of significant tonnages of household waste will be achieved by three initiatives:

- Three-bin organics (or AWT processing of two-bin systems) combined with energy from waste for residuals.
- 360 L recycling bins.
- Education to reduce leakage of recyclables and reduce contamination.

Commercial waste

In 2013–2014, the commercial and industrial (C&I) sector generated 17.13 million tonnes of waste, representing just under a third of all generated waste in Australia. Around seven million tonnes still ends up in landfill.

By 2020, the sector will generate 29 million tonnes of waste. The effect of the levies has been to drive waste costs for most companies from 1% of operating costs towards 2–3%. While these are small numbers, they are a hit on EBITDA and profit.

Most businesses want to do the right thing, but they are also economically rational. They will recycle to the extent limited by cost and return.

Improved technology and service offerings are contributing to improving the rate of commercial recycling outcomes. Organic materials represent over 60% of commercial waste (pallets, timber, food, etc).

The major trends in commercial waste treatment are:

- Source-separated food/organics collections will increase with levies and grants. Only with an increased opportunity cost of landfill can a business owner justify the increased labour and collection costs associated with separated food and organics.
- Product stewardship will see the producer or importer liable for the end-of-life disposal of 'problem wastes'. Over the past few years, schemes for televisions, computers, oil and tyres have been introduced. Similar schemes are under review for paint, batteries, smoke alarms and gas bottles.
- Weight-based billing for front lift skips and 240 L bins, etc, offers the potential for price signals to be directed at waste generators, encouraging recycling behaviour change.
- 'Commercial dirty materials recovery facilities' (MRFs) are now becoming commercially viable due to the rise in landfill levies, combined with new government infrastructure grants.
- Alternative waste treatment of commercial waste streams will increase with levies.

Construction waste

Construction and demolition (C&D) waste (typically timber, concrete, plastics, wood, metals, cardboard, asphalt and mixed-site debris such as soil and rocks) comprises approximately 40% of Australia's total waste generation. The good news is that most is recycled. Recycling this material is generally cheaper than landfill and, being made up of heavy materials, C&D waste is particularly sensitive to landfill levy costs. As such, the sector has achieved 75% recovery rates, and rising, in many states.

A study released in 2013 found that, on average, 21–30% of cost overruns in construction projects were due to material wastage. As landfill costs rise, the commercial incentive to better manage materials flow will rise, further improving recovery rates. And with over 500 active businesses in the C&D sorting and recovery system, it is a strong supplier of jobs and resources to the productive economy.

Part 2 of this article addresses the key reforms required in the areas of infrastructure, landfills, energy from waste and jobs, as well as the role of government, in order to move closer to our recycling targets. It is online at: www.sustainabilitymatters.net.au/content/waste/article/state-of-waste-2016-part2-1020719069

**Mike Ritchie is the Director of MRA Consulting. MRA specialises in waste, resource recovery and carbon and provides advice to companies and all levels of government.*

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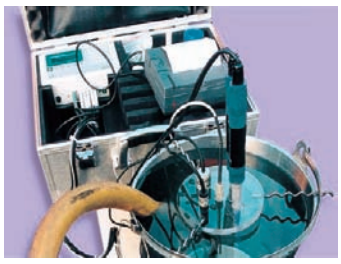

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Organics recycling at the markets

Bradley Latham, chief executive officer, Sydney Markets

Sydney Markets receives an impressive amount of produce from approximately 20,000 growers Australia-wide, and the wholesale operation supplies fresh fruit and vegetables to over two-thirds of the Australian population.

Over the last 10 years, Sydney Markets has been more effectively and efficiently managing its waste streams, increasing the amount of waste saved from landfill from 17% to 65%. This has contributed to a recovery of 100,000 tonnes of waste, with an estimated saving of $18 million.*

The markets have been working with Veolia since 2005 to collect and transport waste streams with the aim of diverting the majority of the organic waste produced.

Organics ready for processing at the EarthPower site.

Veolia has achieved these results with Sydney Markets through the markets' Green Point Facility, where waste is delivered to be sorted, separated and diverted into eight waste streams including organic, cardboard/paper, timber, steel, plastic, polystyrene, steel and concrete.

Bradley Latham, chief executive officer, Sydney Markets, says over six bins of organics are now recovered each day. This amount is seasonal — for example, during the wine season he says around two tonnes of wine grape waste are produced.

In total, around 5000 tonnes of organic waste are now diverted from landfill every year and processed by EarthPower Technologies using anaerobic digestion technology. "We are allowed to have one layer of plastics, but it must be 95% pure organics for the EarthPower facility," said Latham.

David Clark, EarthPower general manager, says the site was about 10 years ahead of its time when it was built back in 2003. In 2007, Veolia and Cleanaway (formerly Transpacific) acquired EarthPower Technologies in a joint venture. Since this joint venture, and now with increased landfill tariffs in NSW, Clark says the facility has improved its operation and is now a success.

Claimed to be Australia's first regional food waste-to-energy facility located in Sydney's west, the EarthPower site process uses bacteria to convert solid and liquid organic wastes into a biogas and a sludge that is dried to produce a high-nutrient organic fertiliser. Sydney Markets' organic and general residual waste generates 1800 MWh of electricity.

In addition to organics, Sydney Markets also recycles cardboard and paper materials and recovers polystyrene. Con Kapellos, Sydney Markets environment manager, says around 50 polystyrene boxes can be processed into 15 kg of ingot, which is then re-used for high-value building products. Timber pallets are also a growing waste stream, with 70% re-used and 30% recycled into garden mulch and poultry bedding.

Sydney Markets has set the lofty goal of becoming the greenest market in Australia. It has already achieved many awards that validate its efforts to create more sustainable operations with cooperation from its tenants, employees and partners.

**These figures take into consideration the partnership between Veolia and other Sydney Markets waste stream contributors.*

Veolia Australia and New Zealand

www.veolia.com.au

Greenhouse gas mitigation in the livestock sector

Scientists have found that the global livestock sector, which supports about 1.3 billion producers and retailers around the world, can significantly reduce carbon emissions without impacting the economic and social benefits it delivers.

The recent study, published in the journal *Nature Climate Change*, estimates that livestock could account for up to half of the mitigation potential of the global agricultural, forestry and land-use sectors, which are the second-largest source of emissions globally. It is described by lead author Dr Mario Herrero, from CSIRO, as the most comprehensive analysis to date as it considers both the supply and demand sides of the industry.

The study finds that we can get the best mitigation potential from the livestock sector if we take an integrated view of land use and practise change that considers the whole of agriculture and forestry, as well as looking at dietary patterns and how we address the needs of global nutrition. As explained by Dr Herrero, "Livestock has a role in a healthy and sustainable diet, and the sector has an important economic and social role, particularly in developing countries.

A model silvopastoral farm established in Matiguas, Nicaragua.

Fulani boy in Niger herds his family's animals.

"We need to balance these health outcomes and the economic and social benefits, while also capturing the mitigation potential the livestock sector can offer."

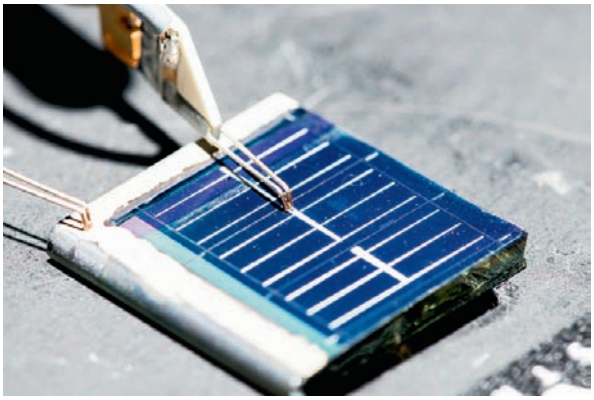
Sustainably intensifying livestock production is one way this could be done, with management practices such as rotational grazing and dietary supplements working to increase livestock production, promote carbon sequestration in rangelands and reduce greenhouse gas emissions at the same time.

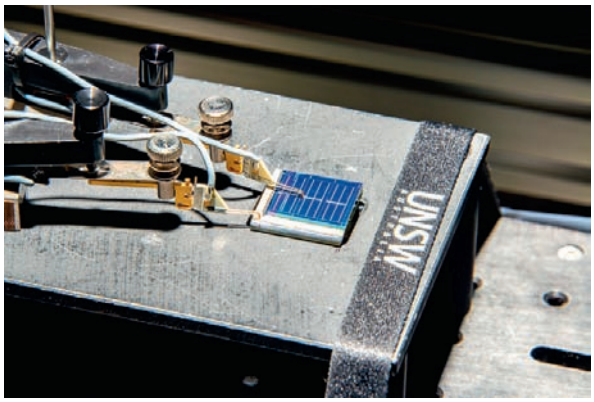
"We need to increase the adoption of these different strategies by making sure that we have the right incentives," Dr Herrero said.

"If appropriately managed with the right regulatory framework, these practices can also achieve improved environmental health over and above the greenhouse gas benefits delivered, for example, through improved ground cover and soil carbon."

UNSW develops world-leading thin-film solar cells

UNSW researchers have achieved the world's highest efficiency for a full-sized thin-film solar cell using a competing thin-film technology known as CZTS. Led by Dr Xiaojing Hao of the Australian Centre for Advanced Photovoltaics, the team achieved 7.6% efficiency in a 1 cm^2 area CZTS cell — a world-leading result which has been confirmed by the US National Renewable Energy Laboratory.





It is believed that the milestone will make it easier to achieve the dream of 'zero energy' buildings, which have until now been held back by two hurdles: the cost of the thin-film solar cells (used in facades, roofs and windows) and the fact that these solar cells are made from scarce, and highly toxic, materials.

Thin-film technologies such as CdTe (cadmium-telluride) and CIGS (copper-indium-gallium-selenide) are attractive options for the solar industry because they are physically flexible, which increases the number of potential applications. But cadmium and selenium are toxic at even tiny doses, while tellurium and indium are extremely rare. CZTS cells, on the other hand, are made from abundant materials — copper, zinc, tin and sulfur — and are non-toxic.

"In addition to its elements being more commonplace and environmentally benign, we're interested in these higher bandgap CZTS cells for two reasons," said Professor Martin Green, a mentor of Dr Hao. "They can be deposited directly onto materials as thin layers that are 50 times thinner than a human hair, so there's no need to manufacture silicon 'wafer' cells and interconnect them separately. They also respond better than silicon to blue wavelengths of light and can be stacked as a thin-film on top of silicon cells to ultimately improve the overall performance."

By being able to deposit CZTS solar cells on various surfaces, Dr Hao's team believe this puts them on the road to making thin-film photovoltaic cells that can be rigid or flexible, and durable and cheap enough to be widely integrated into buildings to generate electricity from the sunlight that strikes structures such as glazing, facades, roof tiles and windows. And because CZTS is cheaper — and easier to bring from lab to commercialisation — than other thin-film solar cells, applications are likely even sooner.

"This is the first step on CZTS's road to beyond 20% efficiency and marks a milestone in its journey from the lab to commercial product," said Dr Hao. In fact, UNSW is currently collaborating with a number of large companies keen to develop applications well before it reaches 20% efficiency — probably within the next few years.

"I'm quietly confident we can overcome the technical challenges to further boosting the efficiency of CZTS cells, because there are a lot of tricks we've learned over the past 30 years in boosting CdTe and CIGS and even silicon cells but which haven't been applied to CZTS," Dr Hao concluded.

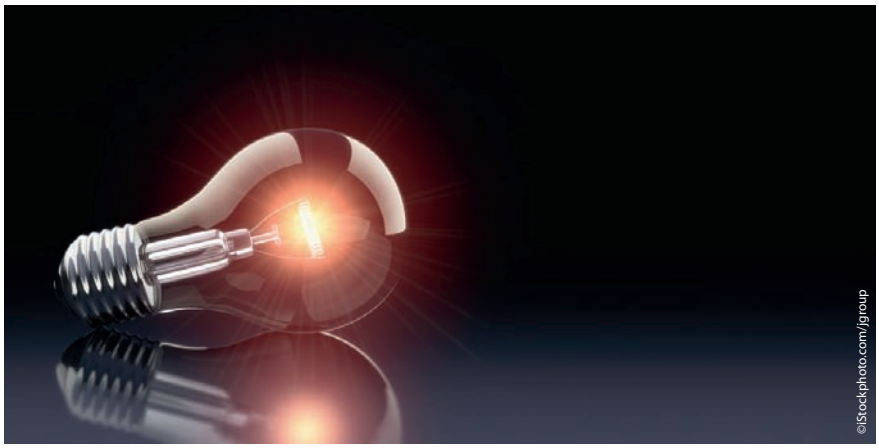
Utility slashes fuel usage with combined cycle optimisation

Emerson Process Management has completed a combined cycle optimisation project that generated operational improvements and slashed average fuel usage at a large power-generating unit operated by one of the largest utilities in the US.

To help the utility reduce fuel costs during unit start-up, Emerson combined its expertise in combined cycle plant control and operations with several of its Ovation Advanced Power Applications. The result was a 67% reduction in average 2x1 hot start fuel usage. Additionally, average transition fuel usage — the fuel used to bring another combustion turbine/heat recovery steam generator (HRSG) train online and blend it with the running units — was reduced by 31%.

These fuel reductions and corresponding improvement in start-up time are particularly significant, as the unit averages 50 hot starts and 300 hot transitions a year. Emissions are also expected to decline accordingly. Emerson now plans to implement its combined cycle optimisation program at several additional units owned by the utility.

"Our extensive balance-of-plant experience has shown that for power blocks experiencing heavy cycling, it is critical to look at the complete operational cycle,



from shutdown back through the start-up, in order to drive maximum performance," said Bob Yeager, president of Emerson Process Management's Power & Water Solutions. "We can help our customers adapt to this changing operating environment and achieve quantifiable and sustainable combined cycle performance improvements."

Emerson's combined cycle optimisation program is based on a highly structured process involving close collaboration with the customer. The initial stages of the project entail collecting historical process data to generate models of the plant's current operating performance in order to identify opportunities for improvement. Emerson then develops and deploys dynamic performance metrics, which are created in standard Ovation logic, that serve as the basis for tracking and validating improvements throughout the project.

Once the optimised start-up process is validated through analysis and testing, Emerson's power experts focus on reducing variability through increased task automation and reduced dependency on manual operator intervention. Advanced control strategies — which actively control HRSG energy distribution to coordinate combustion turbine firing, steam turbine generator loading, and steam bypass and attemperation — result in steam flows and conditions that minimise energy losses within engineering constraints.

Emerson Process Management Aust P/L
www.emersonprocess.com.au

How to recycle a three-and-a-half-tonne tyre

Green Distillation Technologies (GDT), the developer of a process to recycle end-of-life car and truck tyres, was recently faced with the challenge of handling extra-large 'off the road' (OTR) tyres used by heavy-duty mining dump trucks, large agricultural tractors and road-making equipment.

It was estimated in 2013–14 that there are 155,000 tonnes of OTR end-of-life tyres of various sizes generated in Australia each year. 79.4% of these are left on-site, with no means of recycling them. The usual means of disposal is burial on a mine site or in an EPA-nominated dump.

GDT technology has the ability to recycle end-of-life car and truck tyres into oil, carbon and steel using a destructive distillation process. A tyre weighing 3.5 tonnes could yield 1500 L of oil and 1.5 tonnes of carbon, as well as the steel reinforcing to go back to the tyre manufacturer for re-use. The CEO of GDT, Craig Dunn, said the company recently signed an agreement with Perth-based Tytec Logistics, which provides logistics, storage and remanufacturing for OTR tyres. He revealed that the company faced some difficulty with the handling of oversized tyres, defined as having rim sizes ranging from 25 to 63".

"Our first concepts have entailed placing our processing chamber horizontal to the ground, rather than the vertical position used for recycling car and truck tyres, and using a forklift and tractor to feed the OTR tyres into the chamber," he said. "That approach appears to work quite well, but we need to make it more mechanised."

Dunn said the test plant for the world's first processing plant for OTR tyres is currently being built at the GDT complex in Warren, western NSW. The first OTR operating plant, to be based in Perth, will follow in 2017.

"We believe that after the first operating plant has been built in Perth, there will be a need for other OTR plants in Australia, as well as the United States and South America," Dunn said.

Mine strikes gold with a reliable alternative to diesel

Traditionally, remote industries such as mining have relied on diesel generator facilities to power their infrastructure. However, environmental and economic concerns over this reliance on fossil fuels led to a search for an alternative to transported diesel.

The DeGrussa Gold and Copper Mine, which operates in an isolated area roughly 900 km north-east of Perth, was previously powered by a diesel generator facility. The introduction of NEXTracker's solar solution has paved the way for one of the largest integrated solar installations in the country, providing peak power load to an essential local business.

The solar energy generated by NEXTracker's self-powered rows is able to provide a clean, renewable and reliable alternative, helping supply the mine's daytime electricity needs. Due to the energy production from NX Horizon solar trackers, the DeGrussa Mine now offsets 5 million litres of diesel fuel per year, contributing to a steady stream of clean energy and cost savings.

Along with the energy boost provided by NX Horizon's 120° rotational tracking range, NEXTracker's solution includes a self-powered drive system with integrated backup power. This allows for greater autonomy and cost savings compared to other trackers that require AC wiring. The company therefore offers a simplified, easy-to-construct solution for the secluded Australian mine. Joining the growing number of mines powered by renewable energy, the Degrussa Copper and Gold Mine project is a prime example of how an established, industrial powerhouse such as the mining industry can benefit from renewable energy.

NEXTracker Inc

www.nextracker.com

Screen technology improves sewage treatment efficiency

As part of its goal of providing high-quality, safe drinking water to households while at the same time finding ways to improve the management of wastewater, MidCoast Water is using band screen technology to improve efficiencies at its Dawson Sewage Treatment Plant (STP).

While MidCoast Water currently delivers sewerage services to 40,000 households in the Manning, Great Lakes and Gloucester communities, the number of homes requiring such services is predicted to increase to 58,000 by 2037. The utility aims to meet the needs of this growing population by constantly improving its systems and by adopting new technologies. One of these new technologies is the HUBER EscaMax Band Screen, designed specifically to process wastewater with high levels of solids and gross material.

The HUBER EscaMax Band Screen is used in the plant to screen and remove solids, fine material and plastics that would otherwise block equipment downstream. MidCoast Water chose the technology to replace and upgrade its existing screen system at the Dawson STP for three reasons: it is said to be the most efficient in the market; it removes the highest level of solids; and it is easy to retrofit. The through-flow band screen uses a linked band comprising perforated stainless steel panels. The through-flow profile allows for flexible hydraulic conditions when compared to centre-flow types and allows easy integration within inlet works designs, particularly those incorporating downstream grit removal systems. It is a compact system that can be easily retrofitted into existing channels. The product is particularly suitable for situations where good separation efficiency is required in deep channels with high water levels. Perforated screening elements are said to provide superior separation efficiency in comparison with slit screening elements. Since Hydroflux installed the new technology, replacing the first of two screens, MidCoast Water has achieved a screen rate which is double that of previous screens. This is helping achieve major savings in the cost of maintenance. John Koumoukelis, a director of the Hydroflux Group, said the HUBER EscaMax Band Screen technology will continue to replace other fine screen types because of its efficiency and because of the kinds of results being achieved at plants such as the Dawson STP.

"Once this technology has been installed to replace and upgrade previous systems, it is quite common to achieve screening captures of more than 80%," he said.

Hydroflux Pty Ltd

www.hydrofluxhuber.com.au

Do you have the most efficient wastewater pump?

In selecting the most efficient wastewater pump, do managers of assets just look for the pump with the best hydraulic efficiency? If so, they may not be winning the pump efficiency game, according to Hydro Innovations.

If selecting a clean water pump, energy costs amount to up to 80–90% of a pump's overall life cycle cost. For a wastewater pump, energy costs may only equate to 25–35% of a pump's whole of life cost, with blockages, downtime, ease (or otherwise) of maintenance, reliability and cost of repairs being the biggest cost.

A pump can be very hydraulically efficient, but if it is not an efficient solids handler, all the costs will be in maintenance and upkeep of the pump. Factors such as blocking frequency, unblocking efficiency and ease of access should be taken into account. Also, if the internal clearances of a pump are easily adjusted, that pump will maintain its hydraulic efficiency and also block less frequently than a pump whose clearances have 'opened up' because of the abrasive action of wastewater.

Downtime is another hidden cost of a poorly selected wastewater pump. Some unreliable pumps can cause frequent overflows and production line stoppages and, if they are difficult or time-consuming to repair, make the problem worse. A pump that is a good at passing solids — including stringy materials such as rags and gloves — will be more reliable. And if it can

be put back into service quickly after a breakdown, it will be an asset worth having.

A white paper on selecting the right wastewater pump has been written by Hydro Innovations. For a copy of the white paper, visit the company's website.

Hydro Innovations

www.hydroinnovations.com.au

Auckland Airport halves cabin waste sent to landfill

Facilities management company OCS, Auckland Airport and the Ministry of Primary Industries (MPI), in collaboration with Air New Zealand, have developed an innovative way of re-using processed aircraft cabin waste, with an average of 695 kg of waste recycled every day.

Auckland Airport Sustainability Manager Martin Fryer said the airport previously saw 40 tonnes of cabin waste compacted, steam sterilised and buried in landfill each month to meet MPI's biosecurity risk requirements. Frustrated with the waste management process and lack of innovation, Fryer went to OCS — which also specialises in sustainable waste solutions — to help come up with an innovative idea.

"The innovative solution was to build a waste management facility," said OCS Wasteline Solutions Manager Tony Phillips. "Auckland Airport repurposed a rundown building and OCS staffed the facility with seven shift workers who were trained to sort the waste to MPI specifications."

Since the facility's opening in June 2015, said Fryer, the waste facility has exceeded expectations in terms of the amount of waste re-used and recycled. "Our goal is to reach 80% diversion of the airport's waste from landfill by 2030," he said.

MPI Senior Quarantine Officer Doug Farr said he was happy to work with OCS and Auckland Airport to identify non-risk items that could be streamed off individually for re-use and recycling. He said, "The new process of sorting waste has actually made the real biosecurity risks easier to manage, as genuine risk items are easier to steam sterilise once separated from a pile of other waste."

Air New Zealand also welcomes the new facility, with head of sustainability James Gibson saying "... this facility has allowed us to substantially improve our approach to international in-flight waste management, which is subject to far greater restrictions due to biosecurity controls." OCS is meanwhile continuing to push innovation boundaries at the airport, coming up with a concept

to divert back-of-house food waste from airside landfill as well.

"We have implemented procedures for capturing and separating all food waste to MPI biosecurity standards, preventing this food waste from going to the transitional waste facility," said Phillips.

"At this stage, around 35% is being diverted from landfill and we expect this to increase to 50% once we commence the sorting process."

Intelligent lighting for logistics supplier

GMK Logistics, a logistics supplier to the flooring industry, recently opened a new distribution centre at Gregory Hills, NSW. The company was specific that the facility's lighting needed to meet the required lighting levels in the most energy-efficient manner. After vetting many brands, the Digital Lumens Intelligent Lighting System from Maser stood out as the only choice. Using integrated occupancy and daylight sensors, the Digital Lumens Intelligent LED fixtures have been customised by Maser to deliver light only where and when needed, reducing proposed kWh consumption estimates of standard LED fixtures.

The GMK Digital Lumens Intelligent Lighting System consists of 192 intelligent LED fixtures and LightRules, a wireless lighting management system that communicates individually with each fixture to send user-defined operating profiles and also to collect usage data. Through LightRules, GMK can review lighting expenditure by time range, date range or specific areas, which allows the company to tailor lighting conditions to suit different shifts and tasks.

An example of the system flexibility is evident above the first aid room, where GMK has zoned specific fixtures and manipulated their active and inactive operation to keep the area safely illuminated at all times. This enables the company to meet both work health and safety practices and energy-efficiency goals.

Maser Communications
www.maser.com.au

St George awarded 6 Star Green Star rating for Barangaroo branch

St George's Barangaroo branch has become the first bank branch and the first retail fit-out in Australia to achieve a 6 Star Green Star rating — the highest rating possible.

The Barangaroo branch fit-out received the 6 Star Green Star — Interiors rating by Green Building Council of Australia (GBCA) after being assessed across nine categories. The branch was particularly praised for the following sustainable elements:

- The use of building materials with a reduced environmental impact over their entire life cycle.
- Reduced internal air pollutants.
- Reduced water and energy consumption.
- The inclusion of innovative options for community usage of the space.

St George Retail General Manager Ross Miller said that the certification demonstrates the bank's focus on innovation to provide employees and customers with a great place to work and bank, underscoring its "commitment to ensuring we operate sustainably to support a healthy, happy and productive workplace for our people and our visiting customers, as well as contributing to better outcomes for our environment".

GBCA CEO Romilly Madew added that the achievement is "not is not just about minimising the bank's environmental footprint — although this is important".

"International research has found bank branches designed with sustainability in mind are also better places for customers and staff — and can cut costs, boost productivity, attract and retain employees, and provide a positive brand contact for customers," she said. "We applaud St George's achievement, which sends a signal to the financial services sector that sustainability is a strategic business decision." The news follows the GBCA's award of a 6 Star Green Star — Communities rating to the entire Barangaroo South precinct. Billed as Sydney's largest urban renewal project since the 2000 Olympics and targeted to become Australia's first large-scale carbon-neutral community, the precinct achieved an unprecedented sustainability performance score of 104.98 out of a possible 110 points.

Green Building Council Australia
www.gbca.org.au

What is holding back waste-to-energy developments in Australia?

*Chani Lokuge**

Just what are the obstacles preventing Australia from joining the global waste-to-energy market, and how can they be overcome?

In 2009, I co-authored an article on the potential benefits of introducing commercial-scale, best practice waste-to-energy (WtE) facilities into Australia. At the time, following an increase of the federal government's Renewable Energy Target (RET) and the growing adoption of energy-from-waste initiatives overseas, I had high hopes that two or more commercial-scale WtE plants would shortly be developed in Australia. Seven years later, however, there remain no commercial-scale WtE plants processing municipal solid waste (MSW) in Australia, despite the demonstrated benefits of such facilities.

While some innovative private firms working closely with progressive state and local government authorities and communities — particularly in Western Australia — have progressed through the planning process for commercial-scale gasification and combustion facilities, none are yet to commence construction. When a brief look at the global WtE market suggests continued growth, it begs the question: what is holding back WtE in Australia?

The global WtE market

The global WtE market, valued at US$24 billion in 2012, is expected to reach US$37.6 billion by 2020 (Grand View Research 2015), growth being driven by decreasing landfill area and the continued movement away from fossil fuels. In Europe, WtE adoption continues to grow on the back of EU Waste Legislation, which promotes diversion from landfill, and the adoption by Germany, Austria and Netherlands of WtE technologies that sustainably generate energy from industrial waste.

In the Asia–Pacific region, meanwhile, Japan is currently the key market, with around 60% of generated solid waste sent to WtE facilities. Continued industrialisation in China and India means these countries are expected to account for major future WtE

Modern WtE in Italy

growth as they strive for more sustainable approaches to their rapid development. The Indian government, for example, has recently increased its energy-from-waste target and is working on provisions to make it mandatory for state electricity firms to purchase all power generated from MSW.

Key risks and obstacles to WtE adoption in Australia

There are a number of factors in play which explain, to some extent, the lack of investment in WtE in Australia. Recent work by AECOM associated with identifying the key risks associated with implementation of advanced waste treatment (AWT) plants provides insight to the key obstacles and risks common to WtE development in Australia:

Waste supply

Upfront capital costs of WtE developments are high when compared with the traditional landfilling approach. Typically, commercial-scale WtE facilities are cost-effective at scales greater than 100,000 tonnes per annum. In Australia, very few local government authorities would generate such an amount of residual waste post-recycling, thus requiring a collaborative approach to waste management between councils that would achieve the required economies of scale. The potential amalgamation of councils, or formation of voluntary regional organisations of councils, could achieve this, but in the case of the latter, success has been varied given extensive agreements still required between individual councils and WtE developers.

WtE regulatory framework

A numbers of states have developed policies, yet there remains no national, consistent approach that includes deferring landfill levies, resource recovery and thermal efficiency criteria. The reality is that consistent WtE policy provides some certainty for investment decisions at a national level. In NSW, the metropolitan waste levy is currently at $133.10 per tonne, resulting in a gate fee at certain landfills of over $300 per tonne, a key driver for investment in advanced waste treatment. The situation in NSW is in stark contrast to that in Queensland, where there is no levy on waste disposed to landfill.

Technology risk

The development of AWT plants in Australia has had somewhat of a chequered history; some facilities have not performed to their initial expectations, in some cases requiring decommissioning. Limited due diligence on the track record of certain overseas developed technologies and their suitability for Australian conditions has also increased the perceived risks for financiers considering an investment in these types of developments.

Price of energy and other products

WtE developments typically rely on three primary sources of revenue:

1. The gate fee price per tonne of waste delivered to the facility.
2. The price for energy exported from the facility in the form of heat and/or power.
3. The price for other products (eg, char) which may be produced by the facility.

For commercial-scale facilities, revenue sources (1) and (2) are the key drivers of commercial success. While long-term (20-year) contracts for the price per tonne of waste delivered can be negotiated with suppliers of waste (typically a local government authority), the price of energy and other products is highly variable and WtE developers have found it difficult to both identify suitable purchasers of energy and agree to long-term supply agreements.

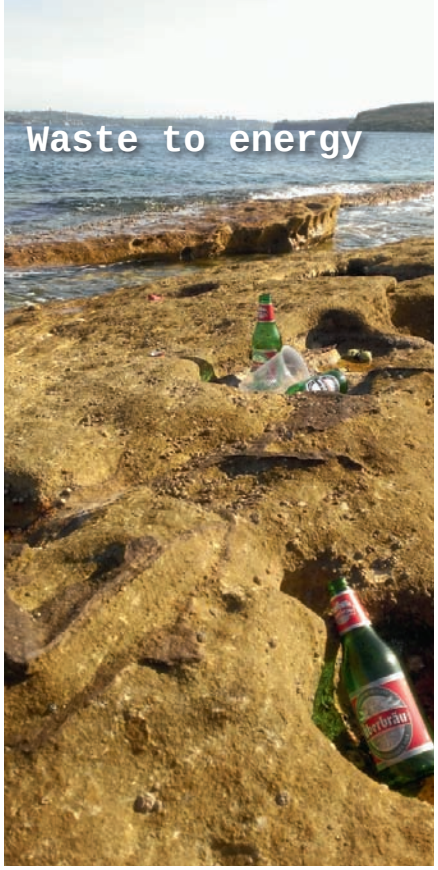
Facility siting

The identification of suitable sites for WtE development is challenging. Sites need to be in relative close proximity to key sources of residual waste, as well as near suitable electricity distribution network connections and/or industrial facilities with a need for energy in the form of power and/or heat. Suitable land use zoning at both a local government and state planning policy level also creates challenges. Even if all those boxes are 'ticked', the local community must ultimately accept such a facility being on its doorstep.

"The bigger the risks, the bigger the returns": that's the common line trotted out when weighing up investment and, in the case of WtE developments in Australia, it's clear the risks — either real or perceived — have been holding back investment and growth like that seen in Europe and Asia.

The good news is that, with consideration given to solutions like those below, sufficient confidence required by financiers to invest in WtE developments can be achieved:

- **Waste supply:** Better cooperation is needed between councils, with the objective of setting up one legal entity able to enter into a long-term waste supply contract with the WtE developer and provide the required economies of scale.
- **Regulatory framework:** A consistent waste management policy across Australia would drive diversion of waste from landfill and contribute to the implementa-



tion of a consistent national landfill levy, resource recovery and thermal efficiency criteria.

- **Technology:** A consistent national requirement to ensure only technologies with a proven track record in treating similar feedstock, at a similar scale, are approved would provide increased confidence.
- **Price of energy and other products:** An increase in the federal government's RET, and provision of specific incentives for project participants who invest in, and generate, renewable energy from WtE facilities, while diverting waste from landfill, would reduce the energy pricing uncertainty to some extent.
- **Facility siting:** State and local government authorities should take a lead in identifying suitable land for WtE facilities and preserve these areas specifically for waste management infrastructure, including allowing for appropriate buffer areas.

Recent developments, including the Turnbull government's commitment to retain the Clean Energy Finance Corporation, which recently supported the set-up of a $200m fund specifically established to invest in bioenergy projects, is a step in the right direction. However, further work is required to support the WtE industry as continuing to dispose of around 20 million tonnes per year of waste to landfill is not a sustainable solution for Australia.

Despite the lack of progress since my optimistic 2009 article, I nevertheless remain positive that commercial-scale, best practice WtE facilities will be established in Australia over the next 10 years. As key obstacles such as waste supply and regulatory risks are overcome by industry working closely with all levels of government, we stand to divert at least a quarter of the waste currently going to landfill into these developments, kickstarting a market that, as is evidenced elsewhere worldwide, can and does work.

Aecom
www.aecom.com

**Chani Lokuge is an Associate Director – Waste Management in AECOM's Sydney office.*

A solar solution for the manufacturing industry

Origin Energy's Solar as a Service allows companies to enjoy the benefits of low-cost solar energy without having to make a capital investment in a solar system. The service is suitable for businesses within the manufacturing industry that have been prevented from installing a large enough system to meet their energy needs due to high costs. As explained by Phil Mackey, general manager, Solar and Emerging Business at Origin, "Solar as a Service provides business with a simple way to save money on their energy bills by providing them with access to low-cost solar energy at a lower price than they are presently paying for their grid energy.

"Plus, the business does not have to pay for the system or worry about ongoing maintenance, as Origin owns the system and looks after all this," continued Mackey. "This option is ideal for companies with unshaded roof space who plan to be in their premises for the long term and operate during the day."

Under Solar as a Service, businesses can keep the same solar electricity rate for up to 15 years, protecting them against any possible future electricity price hikes, or they can choose a CPI-indexed rate. The amount that each business can save will depend on its daytime energy needs, roof space, the size of the system installed, the length of the agreement and what happens more generally with retail electricity rates.

The service has already been taken up by Richard Parker, general manager of Townsville Engineering, whose premises covers over 5000 m^2 and services local government operations, mining companies and bulk-handling facilities, operating for almost 10 hours a day. Parker had been considering going solar since 2014, but never pursued it until Origin launched Solar as a Service. The initiative has now enabled Parker to install an 80 kW solar system on his roof without any capital investment in the system. Furthermore, the system is generating a third of the business's energy needs at a rate much lower than what the business is paying for electricity from the grid.

"The whole process has been really easy since Origin came back to us with this new option," said Parker. "We're excited to see the new electricity savings but are also glad that we can find a way to be environmentally conscious."

"The service is something that adds great benefit to not only a company's cash flow but also to their green credentials too," said Mackey. "And, at the end of the day, it gives companies a solution for some of their biggest and ongoing considerations."

Origin Energy
www.originenergy.com.au

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Cleaning oil spills with paper waste

Researchers from the National University of Singapore (NUS) have converted paper waste into green cellulose aerogels that are non-toxic, ultralight, flexible, strong and water repellent. The material is suitable for oil spill cleaning, heat insulation, packaging, drug delivery and more.

The leader of the team, Assistant Professor Duong Hai Minh, described aerogels as "one of the finest insulation materials available". Traditional aerogels are made from silica, which is not environmentally friendly, so the NUS team set out to create the material from low-cost cellulose, which is made up of 75–85% of recycled paper.

"Our team developed a simple, cost-effective and fast method of converting paper waste into aerogels," said Assistant Professor Duong.

"Our fabrication process uses 70% less energy, produces fewer polluting emissions into the air and water, as well as uses fewer dioxins in the chlorine bleaching process. It is also faster — the entire process only takes three days."

The aerogels also have a super-high oil absorption capacity. Coated with Trimethoxy-methylsilane (MTMS), they are water repellent and are capable of absorbing oil (excluding water) up to 90

times their dry weight, making them up to four times more effective than commercial oil sorbents. Furthermore, they can be squeezed to recover over 99% of the crude oil absorbed.

"Sorption has been considered one of the most effective ways to clean oil spills," said Assistant Professor Duong. "Polypropylene (PP)-based absorbents are widely used for oil absorption, but they are non-biodegradable, and their absorption capabilities are both low and slow. Our novel cellulose aerogels therefore serve as an attractive alternative to current methods of oil spill cleaning, which has a potential market size of US$143.5 billion."

The aerogels could also serve as insulation materials for buildings, with their absorbency and water-repellent properties making them a suitable alternative to energy-guzzling air conditioners. According to Assistant Professor Duong, the aerogels are adaptable to both dry and rainy weather and their structure remains stable for about six months in a tropical climate.

"Being extremely strong, they increase building strength," he continued. "In addition, these aerogels are lightweight and slim, resulting in slimmer walls, thus increasing building space."

Other potential applications include:

- the packing industry, with plastic-based packing materials such as the bubble wrap to be replaced with biodegradable aerogel-based foam or nanosheets;
- hygiene, with the absorption capabilities of MTMS-uncoated aerogels suitable for products such as nappies and sanitary napkins; and
- the biomedical industry, with compressed cellulose aerogels able to plug life-threatening wounds such as gunshots.

Detecting nitrogen dioxide

Australian and Chinese researchers have developed a low-cost and reliable method of detecting nitrogen dioxide (NO_2) — an air pollutant that contributes to more than seven million deaths worldwide each year.

Nitrogen dioxide increases the risk of respiratory disorders in children and can severely affect the elderly. The main contributors of the gas are the burning of fossil fuels — particularly in coal-fired power stations and diesel engines, which can impact on the health of people in urban areas. Furthermore, there are still significant challenges for NO_2 sensing at low detection limits — especially in the presence of other interfering gases.

"A lack of public access to effective monitoring tools is a major roadblock to mitigating the harmful effects of this gas — but current sensing systems are either very expensive or have serious difficulty distinguishing it from other gases," said Professor Kourosh Kalantar-zadeh, from RMIT University's Centre for Advanced Electronics and Sensors. Professor Kalantar-zadeh said the negative impact of NO_2 could be prevented by access to personalised, selective, sensitive and reliable monitoring systems that could detect harmful levels of the gas early. With the help of fellow RMIT researchers and colleagues from the Chinese Academy of Sciences, that is exactly what he has created. "The method we have developed is not only more cost effective, it also works better than the sensors currently used to detect this dangerous gas."

The team created their sensors by transforming tin disulfide (SnS_2) — a yellowish-brown pigment generally used in varnish for gilding — into flakes just a few atoms thick. The large surface area of these flakes has a high affinity to nitrogen dioxide molecules. The sensors operate by physically absorbing nitrogen dioxide gas molecules. Not only do they increase the level of sensitivity to accepted EPA standards, but they are said to outperform any other nitrogen dioxide sensing solutions on the market. "The device shows high sensitivity and superior selectivity to NO_2 at operating temperatures of less than 160°C, which are well below those of chemisorptive and ion conductive NO_2 sensors with much poorer selectivity," the researchers said in the journal *ACS Nano*. "At the same time, excellent reversibility of the sensor is demonstrated, which has rarely been observed in other 2D material counterparts."

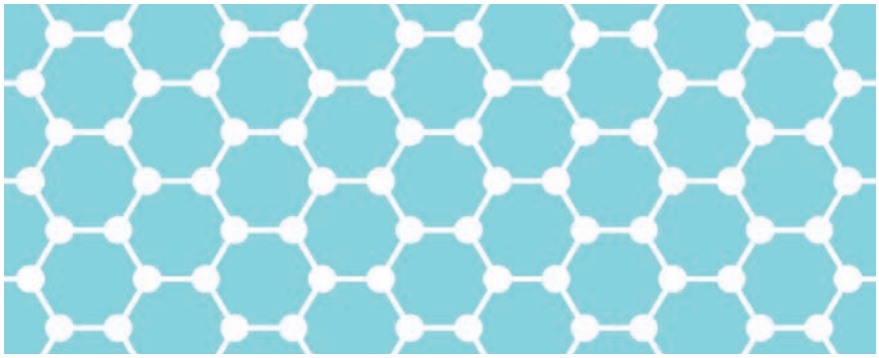
"The revolutionary method we've developed is a great start to creating a handheld, low-cost and personalised NO_2 sensor that can even be incorporated into smartphones," Kalantar-zadeh concluded.

Nanomaterial to help turn heat into electricity

Physicists have demonstrated a new artificial material, or metamaterial, that glows in an unusual way when heated. The findings could drive a revolution in the development of cells that convert radiated heat into electricity, known as thermophotovoltaic cells.

Thermophotovoltaic cells have been predicted to be more than twice as efficient as conventional solar cells. They do not need direct sunlight to generate electricity; instead, they can harvest heat from their surroundings in the form of infrared radiation. They can also be combined with a burner to produce on-demand power or can recycle heat radiated by hot engines.

The metamaterial, made of tiny nanoscopic structures of gold and magnesium fluoride, radiates heat in specific directions. The geometry of the material can be tweaked to give off radiation in specific spectral range, in contrast to standard materials that emit their heat in all directions as a broad range of infrared wavelengths. This makes it suitable for use as an emitter paired with a thermophotovoltaic cell. The key to the metamaterial's remarkable behaviour is its novel physical property, known as magnetic hyperbolic dispersion. Dispersion describes the interactions of light with materials and can be visualised as a 3D surface representing how electromagnetic radiation propagates in different directions.



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For natural materials, such as glass or crystals, the dispersion surfaces have simple forms: spherical or ellipsoidal. The dispersion of the new metamaterial is hyperbolic in form. This arises from the material's remarkably strong interactions with the magnetic component of light.

The efficiency of thermophotovoltaic cells based on the metamaterial can be further improved if the emitter and the receiver have just a nanoscopic gap between them. In this configuration, radiative heat transfer between them can be more than 10 times more efficient than between conventional materials. The metamaterial was created by researchers from the Australian National University, the ARC Centre for Ultrahigh bandwidth Devices for Optical Systems and the University of California, Berkeley. Their work has been published in the journal *Nature Communications*.

A drone to assess energy efficiency

A drone fitted with a thermal camera, designed to monitor buildings' energy efficiency, is being developed by students at the University of Strathclyde.

The concept, designed by Americo Pino, Ken Brooksbank and Kai Pham, is intended to provide a comprehensive assessment of energy use. The students are currently exploring the diversity and viability of innovative drone technology to create environmental value across industries such as energy, agriculture and construction.

"Energy efficiency is important in buildings for environmental and economic reasons, but some equipment used to measure it is expensive and doesn't always give a full reading," said Pino. "Drones can make these types of inspections more comprehensive, and thermal imaging technology takes this a step further.

"Our drone lifts off automatically and can link to around 17 satellites at a time, so it's very precise in the images it takes and very safe to fly."

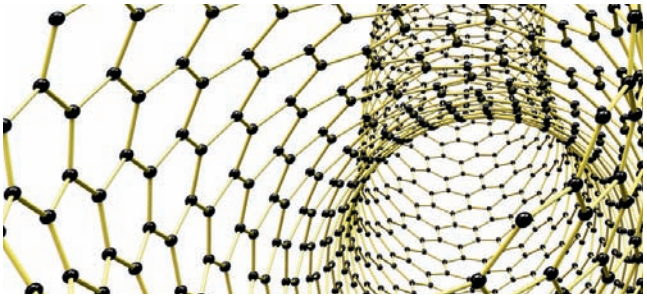
On a recent test flight, the drone surveyed four buildings on Strathclyde's campus and a fifth building at the university's playing fields. Each assessment took around 30 minutes to conduct and, as a safety precaution, the flight took place at 3 am, offering the team ideal light conditions. The students are currently analysing the data.

The students are using their project as a proof-of-concept exercise and currently working with Strathclyde's Enterprise Hub in setting up a company called Drone Wrangler in order to commercialise the concept.

Semiconducting nanostructures for mopping up oil spills

Australian researchers have developed a multipurpose fabric covered with semiconducting nanostructures, which they say could one day be used to mop up oil spills.

The research team consisted of Dr Faegheh Hoshyargar and Associate Professor Anthony O'Mullane (QUT), Dr Louis Kyratzis and Dr Anand Bhatt (CSIRO) and Manika Mahajan, Anuradha and Dr Sheshanath Bhosale (RMIT). Their work was published in the journal *ChemPlusChem*.



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As explained by Associate Professor O'Mullane, the team created the fabric from commercially available nylon that already had a seed layer of silver woven into it. They then dipped the fabric into a vat, where a copper layer was electrochemically deposited onto it.

With the copper coating now added, the researchers converted the fabric into a semiconducting material with the addition of a solution that causes nanostructures to grow on the fabric's surface. These nanostructures are the key to the fabric's enhanced properties, Associate Professor O'Mullane said — the means by which it is able to repel water and attract oil. "The nanostructures are like tiny rods that cover the surface of the fabric," Associate Professor O'Mullane said. "Water just runs straight off it, but the rods attract and hold oil.

"Also, when the fabric is saturated it allows the oil to permeate, where it then acts like a sieve to separate oil and water."

The team has already tested the fabric and found it effective at cleaning up crude oil and separating organic solvents, ordinary olive and peanut oil from water. They were also able to mop up crude oil from the surface of fresh and salt water.

Associate Professor O'Mullane said the chemistry behind the creation of the new material was not complex, with all the steps in its production being easy to carry out. In principle, he said, production of the fabric could be scaled up to be used on massive oil spills.

"On a large scale, the material could mop up crude oil to saturation point and then be washed with a common organic solvent and re-used," Associate Professor O'Mullane said.

Associate Professor O'Mullane described the fabric as "multifunctional", saying its unique properties open up further applications beyond cleaning up oil spills.

"Its antibacterial properties arising from the presence of copper could be used to kill bugs while also separating water from industrial waste in waterways or decontaminate water in remote and poor communities where water contamination is an issue," he said.

"Because it is also a semiconductor, it can interact with visible light to degrade organic pollutants such as those found in wastewater streams." The next step is to test the scalability of the approach and whether or not the material is mechanically robust, Associate Professor O'Mullane said.

Soap, light and clean water

Adam Florance

Contaminated water sources are a rapidly escalating global problem, but the latest research from Monash University may have found a unique and cost-effective solution using light, soap and graphene.

Graphene is a two-dimensional honeycomb lattice of carbon that is just one atom thick. First recognised in the 19th century, it is only in recent decades that large-scale graphene production has become practicable. It has now found its place in a wide variety of industrial applications, such as composites, batteries and semiconductors.

Dr Rico Tabor of Monash University has been exploring the unique structure and properties of graphene, which is believed to have a potentially huge range of diverse technological opportunities. He said: "Among its many potential uses, the prospect of using graphenes for the purpose of water purification is extremely promising. Because the structure is essentially two-dimensional and only an atom thick, graphene 'sheets' have the highest surface area possible, meaning their capacity to mop up contaminants in water surpass that of any currently used materials or membranes."

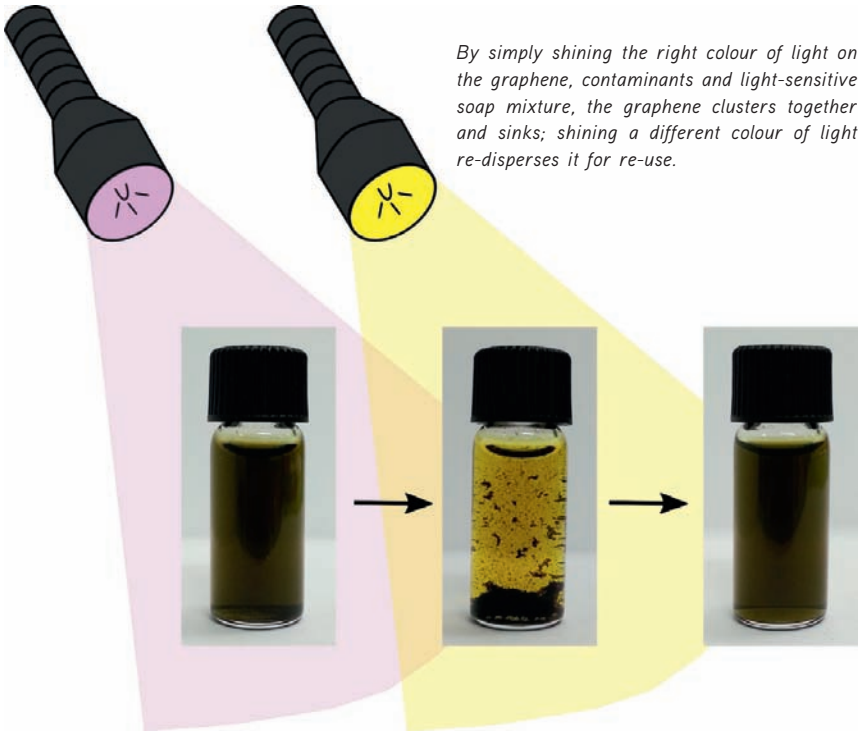
The theoretical specific surface area of graphene is 2630 m^2/g — substantially larger than carbon black at around 900 m^2/g — and its unique 2D structure means it is the only form of carbon where every atom is exposed on two surfaces. It is also self-repairing when exposed to external sources of carbon atoms.

While it has been known that graphene can be used to extract contaminants from water, traditional approaches have been costly due to the use of expensive polymers or the large amounts of energy required for centrifugation.

The Monash team found that the addition of a small amount of light-sensitive soap to contaminated water may be the answer. The soap reacts to different coloured lights, changing its molecular structure and the way it interacts with carbon materials. By shining a particular colour light on the contaminated water the graphene separates out, taking the contaminants with it. Once the contaminants are removed, a different coloured light causes the graphene to redisperse for future use.

As co-researcher Thomas McCoy said: "Light is appealing as it is abundantly available, simple and low cost when compared to most separation methods." McCoy believes that this research could have "significant implications for cost-effective, large-scale water treatment".

The Monash University research was published in *Nanoscale*, the journal of the Royal Society of Chemistry.



By simply shining the right colour of light on the graphene, contaminants and light-sensitive soap mixture, the graphene clusters together and sinks; shining a different colour of light re-disperses it for re-use.

Light-emitting cement

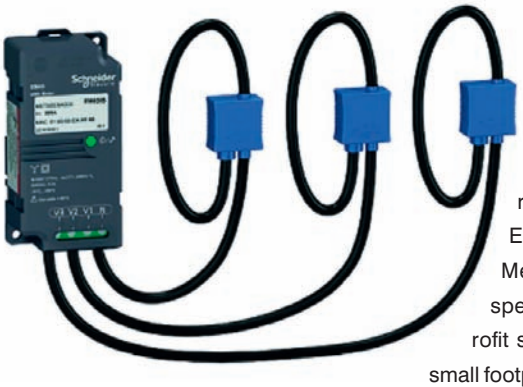
Dr José Carlos Rubio, from Mexico's University of San Nicolas Hidalgo, has created a light-emitting cement that has a life span of 100 years. By absorbing solar energy and returning it to the environment, Dr Rubio says the material will be able to light roads, highways and bicycle lanes without the need for electricity.

"Nine years ago, when I started the project, I realised there was nothing similar worldwide, and so I started to work on it," said Dr Rubio. "The main issue was that cement is an opaque body that doesn't allow the [passing] of light to its interior."

Dr Rubio explained that common cement is a dust that, when added to water, dissolves as an effervescent pill. "In that moment," he said, "it starts to become a gel" — similar to the kind used for hair styling, but stronger and more resistant. At the same time, some crystal flakes are formed — these are unwanted subproducts in hardened cement. Because of this, Dr Rubio focused on modifying the microstructure of the cement in order to eliminate crystals and make it completely gel, helping it to absorb solar energy and then return it to the environment as light. The idea is that the building, road, highway or structure that's made out of the cement will begin to absorb solar light in the morning and emit it for around 12 hours during the night.

Dr Rubio noted that most fluorescent materials are made out of plastic and have an average life span of three years because they decay with UV rays. The new cement, on the other hand, is made out of sand, dust or clay, which becomes the gel, and the only residue is water. It is also sun-resistant and has an estimated life span of 100 years.

The material currently exists in the colours blue and green, while the light intensity can be regulated to avoid dazzling drivers or cyclists. Its inclusion in plaster and other construction products is also being developed.



WIRELESS ENERGY METER

Schneider Electric has released the PowerLogic EM4300 Wireless Energy Meter. The meter has been specifically designed for retrofit situations and takes up a small footprint within a switchboard.

Collecting a broad scope of electrical data, the meter can be used to monitor energy consumption, detect potential savings and optimise the service for the building occupants. It is flexible and has a high level of scalability. The product can be quickly fitted to the switchboard, so there is minimum downtime for the customer. There is no need to introduce additional cabling conduit as it fits easily into the switchboard. In scenarios where several meters are fitted into the one switchboard, they can be connected with a single gateway.

The wireless monitoring provides measurement performance of 1% accuracy. The transmission is actioned using Zigbee Pro HA protocol with 2.4 GHz radio frequency and is compatible with Com'X and MPM gateways, data loggers and energy servers. Collected data is then transmitted through to a building management system so that analysis can be made. The meter allows building and facility managers to keep track of energy usage and make savings where possible. The wireless feature saves cabling and reduces installation time.

Schneider Electric Industry Business
www.schneider-electric.com

SOLAR CARPORT

Radiant Australia's Solar Carport transforms a carport into a multifunctional power source and can also charge an electric car.

Suitable for modern residential or small- to large-scale commercial settings, the carport comes in two- or three-bay car parking options with single- or double-row parking space configurations. With full protection for vehicles whatever the weather, its barrier-free design allows for the free movement of vehicles, which is important when parking space is at a premium. Its simple but solid structure also makes it a good mount for commercial advertising boards.

Installation is quick and simple, needing only the simple connection of a rail to the carport frame using the company's spring-loaded rail clips. The frame itself is constructed by connecting three high-grade aluminium posts together, creating an 'N' shape. It is highly adaptable due to options for framed or unframed PV modules, as well as generous vertical and horizontal adjustment tolerances.

Each two-bay section generates 5 kW of power from 250 W panels, enough to provide power for a decent-sized residential or commercial space and charge up battery storage. The system is easy to install and recyclable, according to the company.

Radiant Australia Pty Ltd
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Football club with sustainable design

Completed in 2015, Port Melbourne Football Club Sporting and Community Facility, in Victoria, was awarded Sustainability category winner at the 2015 National Australian Timber Design Awards. k20 Architecture delivered the project, including materials and labour, to promote locally sourced and manufactured materials.

Sustainably sourced timber, with a high carbon sink, was used in the design to provide a cost-effective outcome. Standard, off-the-shelf and locally sourced timber materials and timber components were procured and k20 also ensured that local labour was commissioned to skilfully assemble and construct the building.

The location of the building was identified, based on k20 Architecture's requirement, to retain all healthy trees. Council's arborists assessed the site to ensure no healthy trees were removed during the construction process and assisted to identify which trees could be removed while work progressed within the tree protection zone.

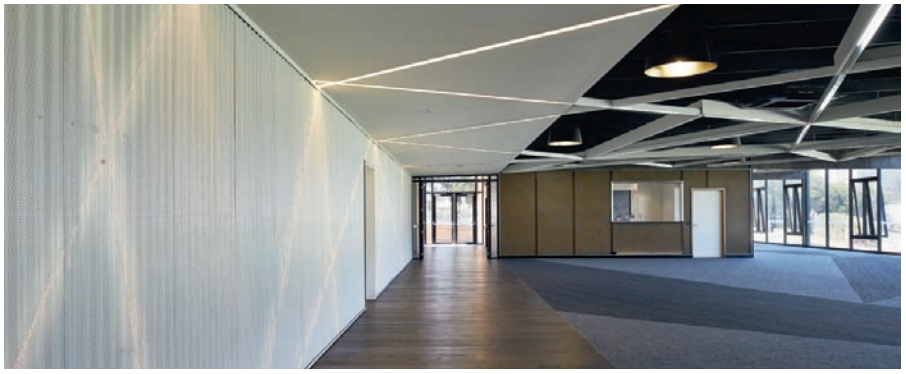
Low-grade contaminated soil on the site was re-used and re-blended to meet clean-fill status. The soil was relocated to other parts of the site, thereby diverting landfill impacts concurrently reducing the associated costs of relocating the soil.

The building included low-energy light fittings, sustainable plywood linings and extensive use of plywood in place of plasterboard, with the use of plasterboard limited to the administration offices. Further ESD initiatives included incorporating underground rainwater tanks for toilet cisterns and landscape irrigation, solar hot water units, exhaust systems with makeup air, low energy and high-performing mechanical supply air conditioning systems.

The building is also highly insulated, exceeding minimum standards, and includes double-glazed thermally broken glazing systems.

The design solution around this high efficiency rate included the use of an open

ESD initiatives



trussed ceiling, open ceiling grid system incorporating customised lighting using off-the-shelf items, perforated metal feature panels that double as acoustic treatments and material selection preferences locally made from readily available building materials. Sustainably sourced material selections included modular carpet tiles with 90% post-consumer content backing, certified by CRI Green Label Plus. Engineered timber flooring with low maintenance and low VOC coating suited to chemical-free cleaners were also adopted.

Situated on the northern corner of the North Port Oval, the pavilion was designed to provide new headquarters for the 129-year-old Port Melbourne Football Club. The project was jointly funded by the Australian Football League (AFL), AFL Victoria and Sports & Recreation Victoria and was delivered within a tightly controlled fixed budget. The construction efficiency rate was achieved via a value managed design process, which in turn required a high level of design innovation.

The design concept was to create a building reflective of its surroundings. The form of the building echoes the raw industrial context of the vernacular seen in the local context of Port Melbourne. This is also reflected in the materiality as the exterior is made up of a minimal palette of timber and glass. The 'V' form that appears on the East and South elevations was adopted as a subtle reference to the building's purpose as home to VFL and its form was used to enable the building to lift and rise to secure view lines through the building to connect people with the game.

The building provides universal access and a new street presence to the sporting precinct via an accessible timber-clad pathway that connects with the pavilion entry. The building itself is made up of two parts connected by a pathway that delivers and connects visitors through the building to the sporting precinct beyond. The rear part of the pavilion reflects the industrious nature of its interior program — amenities, kitchen, stores and cool rooms. Since the completion of the Port Melbourne Football Club Sporting and Community Facility there have been many positive social, economic and environmental benefits for PMFC and its community. The future is bright with the hope that this important piece of architecture will support the longevity of the club and inspire future generations to incorporate the highest in sustainable design initiatives.

k20 Architecture
www.k20architecture.com

VSD BLOWER

The ZB 100-250 VSD blower is designed, manufactured and tested to comply with ISO 9001 quality systems. The totally enclosed motor and magnetic bearings are built to ensure continuous operation and reliability in these environments.

The ZB range helps to reduce costs: the centrifugal gearless and frictionless direct drive provides high air volume at the lowest energy consumption. The integrated variable speed drive (VSD) technology automatically tunes blower output to the precise air demand, claimed to enable energy savings of up to 30% compared to traditional blowers.

As with other Atlas Copco equipment, the ZB blower is delivered ready for use with Atlas Copco's plug-and-play package. The ZB blower packages are supplied as all-in-one packages including a powerful controller, frequency convertor, modulating blow-off valve, blow-off silencer and check valve. The complete scope of supply eliminates the need for extra field assembly of components, reducing installation to an absolute minimum. Built for easy integration in a user's existing compressed air network, the ZB blower is quickly up and running.

The patented magnetic direct drive ZB blower comes fully loaded with technologies that provide a host of operational benefits.

Atlas Copco Compressors Australia
www.atlascopco.com.au

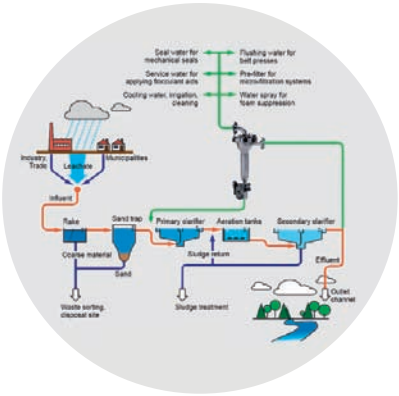
VACUUM PUMPS

The SX Series Vacuum Pumps are operated by compressed air, offering an innovative solution for transferring solids and abrasive materials. The range's ability to handle solids of up to 80% of the pump's inlet/outlet diameter, with transfer distances of up to 1000 m on larger units, makes it a smart solution for difficult material transfer.

The pumps can be easily operated by one worker or set up for automatic operation. They are available with capacities up to 60 m^3/h and are fully enclosed for zero discharge of waste into the atmosphere to comply with environmental requirements. The pumps' construction means there is no contact between the product and moving parts.

The pumps have been deployed in a wide range of applications, including tailing dam dewatering, sump cleaning, transfer of high-density slurries, hazardous waste, effluent and bentonite. They are built to be robust, with minimal wearing parts, and are easy to service.

Pentair Australia
www.southerncross.pentair.com



SOLID SEPARATION FROM PROCESS WATER

Treated process water has a variety of uses in operational areas, such as prefiltration for membrane systems, cooling water, flushing and cleaning water, water spray for dust suppression and seal water. But even with a low concentration of solids and suspended sediments within secondary sedimentation tanks, pretreated water is often not sufficient quality for direct use as service water.

Undissolved organic substances can lead to blockages, deposits and damage to the systems. To achieve appropriate water quality, suitable filters must be connected, enabling impurities within a grain size range of 50 and 250 μm to be filtered out. HYDAC provides a solution with the AutoFilt TwistFlow Strainer ATF, which ensures the production of service water from a secondary sedimentation tank's runoff.

The product is a self-cleaning filter apparatus for solid-liquid separation, suitable for separating suspended solids up to several grams per litre from treated wastewater. Combining a centrifugal separator and inline filter in one system, it enables fully automatic operation, separation performance, particle retention security, trouble-free operation and low maintenance.

For high flow rates, any number of units can be combined into one system and thus flexibly adapted to the required flow rates. Due to the use of conical slotted tube and sintered wire meshes (with filtration ratings of between 200 and 3000 μm), a precise selectivity and a constant filtrate quality are ensured. Due to the special flow conditions resulting from the element geometry and their arrangement, the pressure drop on the overall unit is low.

The prefiltration of solid particles of a higher density means that the filter surface area can take a correspondingly higher load and the filter size can be comparatively small. The filter elements are cleaned solely by flushing with untreated fluid. The unit is said to save more space than conventional separators.

HYDAC International
www.hydac.com.au

FLOAT SWITCHES

A small Finnish company, Kari, services Australian organisations ranging from municipal water authorities to farming equipment OEMs. The company specialises in the design and manufacture of level sensing equipment.

The range includes three float families, each designed for a different set of conditions. The mini M Type float is suitable for narrow spaces and clean liquids. The standard S Type is a large and buoyant float for dirty, demanding or blackwater applications, even when build-up is possible. The general C Type suits applications that fall somewhere between these extremes, with a float designed to fit through tank nozzles as small as 100 mm. The floats can offer multiple switch points, stand-alone pump control (emptying or filling) and even a combination of both - all from a single float. In doing so, they reduce the risk of tangles and may even lower the purchase and installation costs. Each float switch is functionally tested before leaving the factory. Distributor Control Components holds units from each family, including models with gold-plated contacts for low-voltage, low-current applications (eg, PLC circuits). The range offers a choice of cable type and length, along with the capability to factory-customise floats to suit the user's specific needs.

Control Components Pty Ltd
www.controlcomponents.com.au

SYSTEM FOR THE SEPARATION OF BLACK PLASTICS

The STEINERT Group has launched the UniSort BlackEye — an optical sorting system that enables recycling companies to produce high-purity granules from black plastics.

At the heart of the sorting system is the detection unit, which is located above the conveyor belt and equipped with hyperspectral imaging (HSI) technology. A source of light illuminates the plastic flakes on the conveyor belt while a camera system analyses the reflected light. Using stored reference spectra, the company's analysis software recognises whether an item is made of plastic, wood, glass or paper and whether it is a dark object. The camera simultaneously scans 320 pixels across the entire belt width, enabling even tiny variations in the NIR spectrum to be detected.

In cases where the operator wants to separate polyolefins such as polyethylene (PE) and polypropylene (PP) from one another, or sort other types of plastic out of a mixture of materials, the software transmits the corresponding position data to the compressed air system installed at the end of the conveyor belt. Within a fraction of a second, it opens the appropriate high-speed valve so that a well-aimed blast of compressed air causes the targeted material to be ejected.

The unit operates quickly enough to scan belts moving at up to 4 m/s. During this time, it can scan about 35 million detection points or up to 5000 objects. This makes it suitable for efficient industrial applications for crushed plastic parts measuring between 10 and 30 mm. On average, the product has a throughput rate of 1 tonne of plastic flakes per hour.

Steinert Australia Pty Ltd
www.steinert.com.au

ENERGY STORAGE SYSTEM

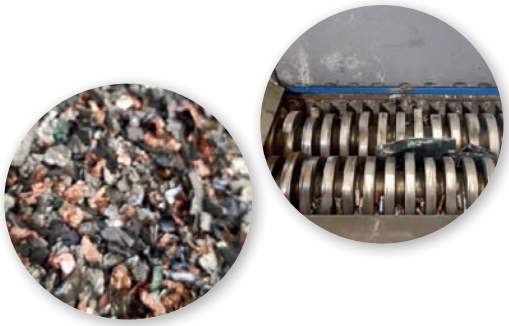
The Fronius Symo Hybrid is the heart of the storage system for 24 h of sun: the Fronius Energy Package.

Boasting power categories ranging from 3 to 5 kW, the three-phase inverter allows excess energy from a photovoltaic system to be stored in the Fronius Solar Battery. The result is maximum self-consumption of the available power and maximum energy independence. Excess solar power can thus be used at times when generating conditions are poor or impossible.

With the emergency power function, the household can enjoy an optimum electricity supply even during power outages. Good system configuration and visualisation are provided by the built-in web server with graphical interface, WLAN and ethernet. In addition, the DC coupling on the battery ensures maximum efficiency of the overall system.

The product offers a comprehensive and efficient complete package for maximum independence, which can also be adapted to the owner's individual needs.

Fronius Australia Pty Ltd
www.fronius.com.au



LITHIUM-ION BATTERY RECYCLING

PF Metals recently launched a facility that recycles all types of lithium-ion rechargeable batteries. Through this innovation, the company can recover 97% of the battery waste stream, including copper, aluminium, cobalt, nickel, lithium and plastics, which all go back into streams to create new products. Cobalt, nickel and lithium, which are in dust form and mixed, go for further processing and can be separated and purified to be used again in battery manufacture, closing the loop on around 27% of the battery's weight.

The process requires batteries to have all their energy discharged prior to any handling by the company's staff. After this first step, all batteries are granulated in an environment of negative pressure to ensure that all airborne dust particles are captured. Once the granulated material reaches the desired size, it flows from the machine along conveyors, removing any steel and plastics to produce a clean copper and aluminium granule.

PF Metals can offer a full recycling program for all industrial sectors which have the issue of these batteries at end of life. The company can supply a turnkey solution for national collectors to ensure battery transport, resource recovery and return is conducted responsibly and sustainably.

PF Metals Pty Ltd
www.pfmetals.com.au

HYBRID LASER ANALYSER FOR CONTINUOUS GAS ANALYSIS

The Rosemount CT5100 continuous gas analyser is claimed to be the world's only hybrid analyser to combine tunable diode laser (TDL) and quantum cascade laser (QCL) measurement technologies for process gas analysis and emissions monitoring.

The product can detect down to sub-ppm level for a range of components while simplifying operation and reducing costs. It can measure up to 12 critical component gases and potential pollutants simultaneously within a single system, meeting local, state, national and international regulatory requirements.

The device operates with no consumables, no in-field enclosure and a simplified sampling system that does not require any gas conditioning to remove moisture. Suitable for process gas analysis, continuous emissions monitoring and ammonia slip applications, it provides subsecond response time for precise measurement of complex gases and emissions to ensure regulatory compliance and prevent costly fines or unexpected shutdowns.

The analyser's 'laser chirp' technique expands gas analysis in both the near- and mid-infrared range, enhancing process insight, improving overall gas analysis sensitivity and selectivity, removing cross interference and reducing response time. The technique produces sharp, well-defined peaks from high-resolution spectroscopy that enable specificity of identified components with minimum interference and without filtration, reference cells or chemometric manipulations.

Solid-state components and a modular design, with up to six lasers inside a single enclosure, simplify start-up and commissioning and reduce field maintenance costs during the analyser's life cycle.

Emerson Process Management Aust P/L
www.emersonprocess.com.au

WATER MANAGEMENT SERVICE

WaterGroup's Water Management Service is suitable for site and facility managers who want to save water but don't have the time.

The service comprises submetering and smart metering, water management and active follow-up on leaks and abnormal consumption. After the supply, installation and commissioning of a smart metering system, WaterGroup's smart metering team will personally analyse the user's data, follow up on any abnormal usage alarms and ensure needed actions are taken to secure savings.

A water management plan is also developed and implemented as part of the service. This includes setting key performance indicators (KPIs) and identifying and reducing any unaccounted for water. The plan can be disseminated to site staff to ensure they are aware and understand the objectives of the plan.

Regular review of the water meters and submeters will provide data to help prioritise water conservation actions and allows identification of unusual water consumption. The service reduces total consumption and allows users to react to changes quickly, such as organising the repair of leaks.

WaterGroup Pty Ltd
www.watergroup.com.au

PORTABLE SENSOR

The portable Cerlic MultiTracker has helped busy plant operators greatly reduce their daily lab work by providing fast and repeatable measurements for MLSS/RAS/WAS/sludge blanket profile and dissolved oxygen, without having to step into the lab.

Unlike other portable units, the product has a choice of three plug-and-play sensors in its carrycase — Solido (TSS), Blanko (sludge blanket) and OxyDuo (DO) — one for whichever parameter needs testing. Rather than wait for time-consuming lab test results, operators can quickly and simply sample each part of their process before storing the results to a customised folder in the MultiTracker's built-in memory — all without having to remove dirty gloves or use a pen.

With the latest free firmware upgrade, Cerlic has given the Solido suspended solids sensor the ability to store three separate TSS calibrations. Operators can now switch between primary, secondary and even effluent sampling (%, ppm, mg/L) with a single sensor, without recalibration. Using the supplied USB sync cable and free Cerlic software, operators can download their sampling history to PC for archive or reporting purposes.

For more information, click here.

Control Components Pty Ltd
www.controlcomponents.com.au

MULTIGAS ANALYSER

AquaGas introduces the MAMOS multigas analyser. The MAMOS concept has been developed to minimise the installation and ongoing operation cost until now required to fulfil monitoring needs.

The analyser has a modular construction and offers a large panel of add-ons to match site-specific application requirements. Programmed operating modes include continuous measurements, scheduler, measurements triggered with digital input, redundancy, multiplexing and multipoint monitoring.

The product's standard configuration includes six sensors to measure O_2, CO, CO_2, CxHy, NO, NO_2, SO_2, H_2S, H_2, N_2O, Cl_2 and VOC. It features a large display with a backlight and a built-in gas chiller with continuous condensate removal. A data logger with an SD card is used for the collection of results. User-configurable functions are available via digital and analog inputs, with the analog outputs (both current and voltage) used to control external devices. The powerful PC interface provides operators and system integrators with a range of settings to adjust many aspects of the measurement tasks, such as automated sampling, calibration, purge sequences, analog outputs' behaviour and data presentations.

Small in size yet skilful, the product is a suitable alternative for large, intricate continuous emissions monitoring systems.

AquaGas Pty Ltd
www.aquagas.com.au

BIOGAS PLANTS

WELTEC BIOPOWER has a range of products for the efficient utilisation of waste and wastewater for the generation of energy. The company's technology can be used for the installation and upgrade of anaerobic energy plants. The modular structure of the company's plants, with its stainless steel bioreactors, facilitates the planning and construction of custom-tailored digestion concepts. With comprehensive service and its own lab, the company ensures uninterrupted, optimum energetic use of leftovers.

WELTEC BIOPOWER
www.weltec-biopower.com

TEMPERATURE/LEVEL/CONDUCTIVITY SENSOR

The OTT PLS-C unit provides basic water quality indicators by measuring water level, temperature and conductivity. The probe is suitable for measuring both surface water and groundwater, with its high-quality and robust equipment ensuring easy operation and long-term precise readings. Low power consumption makes the product suitable for long-term deployment, particularly at solar-powered measuring stations.

The precise ceramic capacitive pressure cell withstands mechanical impacts and aggressive media. It is also stable over the long term, virtually drift-free and protected against overloads of up to at least four times its measuring range. Influencing factors such as temperature or changes in atmospheric pressure are compensated so that the probe provides precise water-level data.

For conductivity measurement, a four-graphite electrode measuring cell is incorporated. It is unaffected by polarisation effects and immune to any contamination. With its sealed-in waterproof electronics, saltwater-resistant stainless steel housing and Kevlar-reinforced longitudinally stable probe cable, the unit can also be deployed in harsh operating conditions. The Windows-based operation software makes it easy to calibrate the conductivity cell and step-by-step instructions guide the inexperienced user safely through the process. Flexible connection options, available for communication by PC, make it easier to handle. The SDI-12 interface enables the probe to be connected to any SDI-12 compatible data logger. When longer distance communication is required, the RS485 interface allows cable lengths of up to 1000 m when used with an OTT data logger.

Aqualab Scientific Pty Ltd
www.aqualab.com.au

VERTICAL MULTISTAGE PUMP RANGE

PENTAIR SOUTHERN CROSS has partnered its SBI vertical multistage pump range with electric motor and drive manufacturer WEG. All SBI units are built with WEG W21 motors, while the variable speed units harness drives also produced by WEG.

The SBI range is available in a wide range of sizes producing volumes from 1–150 m^3/h and heads in excess of 300 m. The vertical multistage offering is available in a number of configurations, including single-pump and multipump pressure systems.

The pumps and pressure systems are suitable for applications including pressure boosting; process water in industrial and commercial situations; seawater pumping; and irrigation. The pressure systems are available in fixed-speed and variable-speed operation.

The pump range provides an efficient, high-performance way to provide large volumes of water at high heads while maintaining a compact, space-saving design. All wetted components are constructed from 304 grade stainless steel (316 grade available). The pressure systems are built on galvanised steel bases and are supplied assembled with the necessary manifolds, valves, pressure vessels and pressure switches/transducers, allowing for fast and easy installation.

The variable speed pump sets are fitted with WEG's CFW08 or CFW11 (dependent on motor size) variable speed drive (VSD). The WEG PLC300 controls the multipump sets and can manage up to eight pumps in unison. Each pump has its own VSD, allowing for individual operation should the controller unexpectedly fail. Other failsafe measures of the drives include resorting to a fixed-speed operation should the transducer fail and a 'pipe fill mode' function that prevents the system going out on a failure when commissioning.

Pentair Australia
www.southerncross.pentair.com

FILTRATION BIN

The Smart Sinks filtration system removes particulate waste from cleaning water so that the solids can be disposed of in a bin or skip, leaving clean, potable water that can be released to the drainage system. The multistage filtration and collection system eliminates fine matter from entering normal liquid waste disposal areas.

The latest version of the product is the Smart Sinks Filtration Bin, a fully mobile system suitable for both indoor and outdoor applications. The unit is suitable for tradespeople needing to clean equipment when working in high-rise construction sites or remote locations.

Based on a standard 'wheelie bin', the product comes with its own water supply that is recirculated back through the unit, making it environmentally friendly. It can also be used in conjunction with a 'wet vac' when cutting concrete or using a hole saw; the wet vac is emptied into the filtration bin and solid waste is separated from the wastewater.

The design incorporates three disposable bags, a valve and visual indicators that simplify the use of the system. The filtration bags concentrate the solid material so that the bags from each of the three stages of filtration can be simply lifted out and disposed of as standard rubbish. The primary filter collects up to 92% of waste material, with subsequent filters ensuring that all waste is removed.

Smart Sinks can be used to dispose of trade waste from professions such as plastering, tiling, concreting and rendering, and other industries that potentially release pipe-blocking solid waste into the environment through waterways, sewerage and drainage systems.

Smart Sinks
www.smartsinks.com.au

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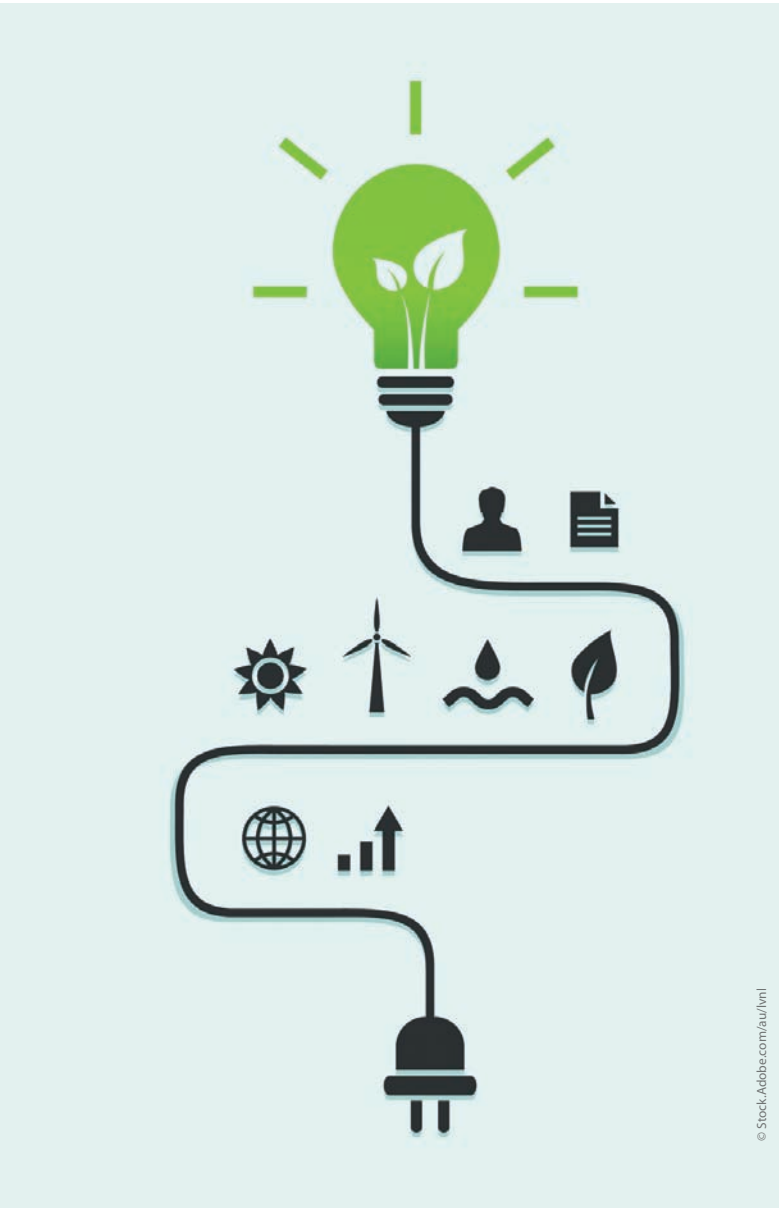

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Clean and renewable energy event All-Energy Australia will this year look at the three key areas of future grid, energy storage and energy efficiency, for a focused approach that will provide delegates with the latest technology and expert advice in the sector.

More than 150 industry speakers are lined up to cover the event's seven conference streams, including smart grid, off-grid solutions, community energy, investment opportunities, electric cars, bioenergy and wave energy technology.

Energy storage, smart grid and energy efficiency have been earmarked as the standout streams for the All-Energy Australia conference, with each set to attract internationally acclaimed speakers.

Leading companies have meanwhile signed on for All-Energy Australia's exhibition floor, which this year will include a two-day solar installer demonstration run by Clenergy, Solar Juice, Trina Solar and SMA. Through the MeetMe networking opportunity, delegates will have the chance to schedule one-on-one sessions with exhibitors.

The event will also see the continuation of the strategic partnership between Reed Exhibitions Australia and Clean Energy Council. As part of the Clean Energy Council's Professional Development Day, solar installers will have access to expert advice on the big design and installation issues facing the industry, while designers and installers will get the latest updates on standards and compliance issues.

Clean Energy Council Chief Executive Kane Thornton said the organisation was proud to continue the partnership, which would "ensure the renewable energy industry could access the best innovations, experts and solutions in the one place".

"All-Energy Australia 2015 was a resounding success, and we look forward to building on that success in 2016 through the Clean Energy Council's solar technical program and professional development components, which are free to attend."

The program also features the ATRAA conference, which will delve into more detail on technical and business issues and opportunities across two streams. The technical stream will focus on new technologies, battery storage issues and case studies from the Clean Energy Council Industry Award winners. The business stream will examine issues facing the industry, including panel integrity, warranty concerns and challenges facing commercial installs.

Clean Energy Council Accreditation Manager Sandy Atkins said: "All-Energy is the perfect opportunity for solar installers to complete some valuable professional development, all at no cost.

"The Clean Energy Council accredits more than 4000 solar installers right across Australia, and the partnership with All-Energy Australia has allowed us to vastly improve the conference and professional development opportunities we deliver to them.

"The technical solar conference (ATRAA) and Professional Development Day at All-Energy are both first rate in terms of the content and expert presenters. In 2016, we will once again incorporate all the hot topics the solar industry wants to hear, including battery storage, important changes to standards and regulations, installation how-tos and the latest exciting technologies," said Atkins.

The event is free to attend, with delegate registrations set to open on 20 June.

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

Sustainable Brands 2016 Sydney

Sustainable Brands 2016 Sydney is all about knowledge sharing, which is said to be crucial in building a greater sustainable business community and implementing successful sustainable business practices. Event attendees will connect with leading brands, impactful organisations and social entrepreneurs, immersing themselves in the fresh new ideas, case studies, tools and partners required in order to successfully align brand and purpose.

The conference will deliver a world-class line-up of thought leaders and practitioners who are shaping the future of commerce worldwide through leading-edge technology, innovative brand strategies and sustainability initiatives. Its 80+ speakers will include Sally Uren from Forum for the Future, Bert van Son from MUD Jeans, Simon Mainwaring from We First and Tom Szaky from TerraCycle, plus representatives from Republic of Everyone, RACV, Climate Friendly, WWF, H&R Block, IAG, Oz Harvest, Vivid Sydney, NAB and more.

By joining the conversation in Sydney, attendees will learn how best-in-class business case methodologies can benefit from cost savings and increased speed to market; how reimaging models can create increased value for your brand; how triple bottom line growth can deliver faster and stronger growth; and how to maximise boom demands for sustainable products and services.

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What: Sustainable Brands 2016 Sydney
When: 27–29 June 2016
Where: Sofitel Sydney Wentworth
Web: http://events.sustainablebrands.com/sb16syd/

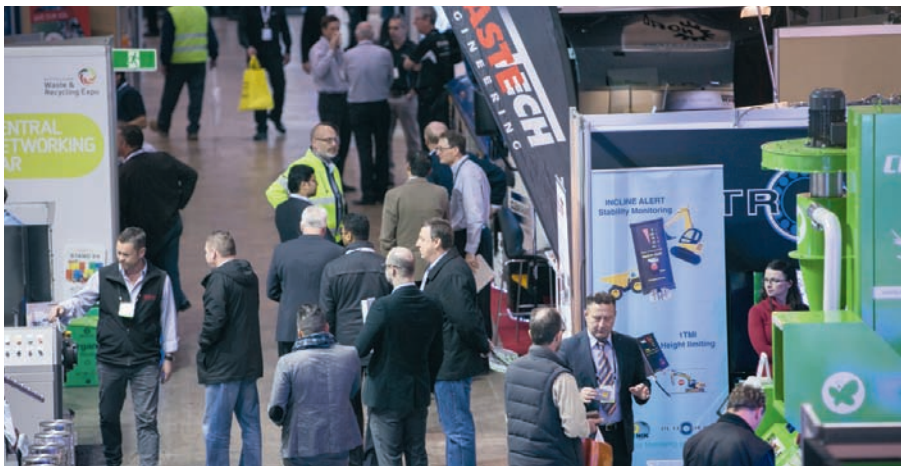
Australasian Waste & Recycling Expo 2016

Registrations are now open for the 2016 Australasian Waste & Recycling Expo (AWRE) — one of the key industry gatherings on the Australasian waste and recycling calendar.

Celebrating its seventh year, AWRE 2016 will encourage specialist companies from around the globe to exhibit their products. The AWRE Seminar Series will meanwhile feature over 70 experts from both government and leading companies providing input on how industry, government and waste generators should continue to work together to improve efficiency and drive innovation.

The 2016 AWRE Exhibition will include areas catering to the specialist nature of the waste and recycling sector, including an Organics Zone in association with AORA, e-Waste Zone, 'Safety Alley', Innovation Zone, 'Consultants Corner' and a lively Demonstration Zone. Registration to the exhibition is free.

Following on from the successful Melbourne event in 2015, the AWRE Seminar Series will return to Sydney in 2016, coinciding with the exhibition over two days. This year's comprehensive program will feature both international and local specialists in the areas of commercial waste best practice, food waste and the circular economy.



New in 2016, and as a lead-up to ENVIRO'17, WMAA and AWRE are collaborating to present the 'ENVIRO Keynote Session' at AWRE this year. This 2–3 hour innovative session will feature two renowned keynote speakers, both international and Australian, and will offer a premier networking opportunity. This session will also feature a line-up of speakers already confirmed for ENVIRO'17.

What: Australasian Waste & Recycling Expo (AWRE)
When: 10–11 August 2016
Where: Sydney Showground
Web: www.awre.com.au

Trends and challenges for emissions monitoring

Although CO_2 is said to be the primary greenhouse gas that can lead to climate change, Australia's turbulent political environment has resulted in changes and backflips when it comes to emissions policies. According to Frank Silberberg, director at Group Instrumentation, "Compared to Europe and even America, Australia is a third-world country when it comes to taking environmental emissions and monitoring seriously."

One of the founders of Group Instrumentation, Frank is a specialist in continuous emissions monitoring systems (CEMS) with over 27 years' experience in the business. During this time, he has seen some significant trends and challenges. Frank blames the fragmentation of state and federal government legislation as the main source of our inaction on monitoring emissions policies. He says greenhouse gas monitoring seems to have fallen by the wayside with the collapse of the Labor government's carbon trading policy.

"We used to include stack flow monitoring within our CEMS, for the greenhouse gas legislation (NGER), as industry had to report a mass emission in a tonnes-per-year type of measurement. These reports still need to be done under the legislation, but with no carbon trading, industry no longer specify these flow monitors," he said.

In comparison, he said, Europe has to abide by a set of strong environmental directives so there is a level playing ground for industry. "However, in Australia, each state has different environmental rules to follow, so this makes it difficult for industries that operate across different states.

"In this country, we tend to be just concerned about visual and odorous emissions. So if we can't see it or smell it, it can't be too bad!" he said.

"Most companies have licences to operate and emit at certain levels, but it is pretty much self-regulating."

Luckily for us, Frank says the majority of the more mature manufacturers that are left in Australia do the right thing. "Many industries have a desire to be good corporate citizens or they have ties to Europe or America and just follow that legislation, and use the same equipment that their parent company has in Switzerland, Belgium or somewhere else."

When it comes to dust emissions, the state-based EPAs do know the typical emissions produced by each industry and want them to reduce, reduce, reduce under their environmental improvement plans, but even this is mainly self-regulating according to Frank.

"As dust emissions come down, the technology to measure dust emissions needs to be better and more sensitive. To give you an idea, coal-fired power stations used to have licence limits of around 400 mg/m^3, whereas today, if you're building a new coal-fired plant (which you probably wouldn't), it would be 100 at the most or even 50 mg/m^3. Dust measurement technology has become more sensitive and includes more self-checks to prove that the equipment works."

> **"As dust emissions come down, the technology to measure dust emissions needs to be better and more sensitive.**

While mobile phone technology changes every 15 minutes, Frank says analyser technology changes every 15 years. "It is a very slow, conservative industry, but the current trend is away from extractive gas analysers to in-stack gas analysers. Using this technology, you measure directly in the stack, so you're getting a true measurement of actually what's happening in the stack. It's more accurate, more repeatable and requires less maintenance."

Food manufacturing and processing is one industry that is doing very well in Australia. According to Frank, there have been massive new export opportunities in milk powder and baby formula processing plants springing up for China. "Emissions from these plants, being dust, are not so much about making a mess of the environment but about product loss. Monitoring equipment is an easier sell for these jobs as there is a payback.

"Also, lately there has been some focus on the brick industry that heats clay in kilns. This process gives off hydrogen chloride (HCl) and hydrogen fluoride (HF). In recent years, we've supplied a number of analysers for those gases. There are only small amounts, but HF is quite dangerous in small amounts and HCl gas becomes hydrochloric acid if there is condensation forming."

Although Australia has its faults with legislation, Frank says it is a great country to live in. "We can breathe!" he said.

"Manufacturing industries are gradually reducing and I do have some concerns about what my three grandchildren may do for a job in the future.

"It's gloomy if you don't have a job. So we can't frighten away industry altogether, but at the same time, they need a clean footprint so our great-grandchildren can keep breathing clean fresh air," concluded Frank.

Frank Silberberg is one of the founders and directors of Group Instrumentation. The company was formed to satisfy industry requirements for minimal maintenance, in situ continuous emission monitoring products and systems. Requirements for CEMS are increasing each year; for industry, the challenge is to select a system that is cost-effective and reliable while conforming fully to environmental legislation requirements.

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