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# WORDS FROM THE EDITOR

The Anthropocene epoch or era is proposed as the current geological time during which human activity has had a significant influence on climate and ecosystems. Australian Climate Change Councillor Professor Steffen is part of an international committee of experts involved with the collection and analysis of geological data to scientifically prove a case for this epoch in the Earth's history.

But did this epoch start much earlier than the scientists previously thought? According to an international research project released in August, the climate warming we are witnessing today is not just a 20th-century phenomenon. The lead researcher on the project, Associate Professor Nerilie Abram from The Australian National University (ANU), said the study found warming began during the early stages of the Industrial Revolution. The research has pinpointed the early onset of warming to around 180 years ago, and found the early warming was attributed to rising greenhouse gas levels.

This latest research reinforces the need for emissions reductions to combat this warming. In Australia, the Climate Change Authority (CCA) recently released a report that pointed to energy efficiency as one of the quickest and cheapest ways to reduce emissions while improving productivity and creating jobs. However, most of you would have heard that a minority report was subsequently released arguing for the adoption of a carbon budget — a specification of the upper limit of Australia's total emissions between now and 2050 - as the basis of all of Australia's climate policies.

This issue features further discussion on climate change as well as details on water security, water-sensitive urban environments, energy efficiency, large-scale solar technology and more.

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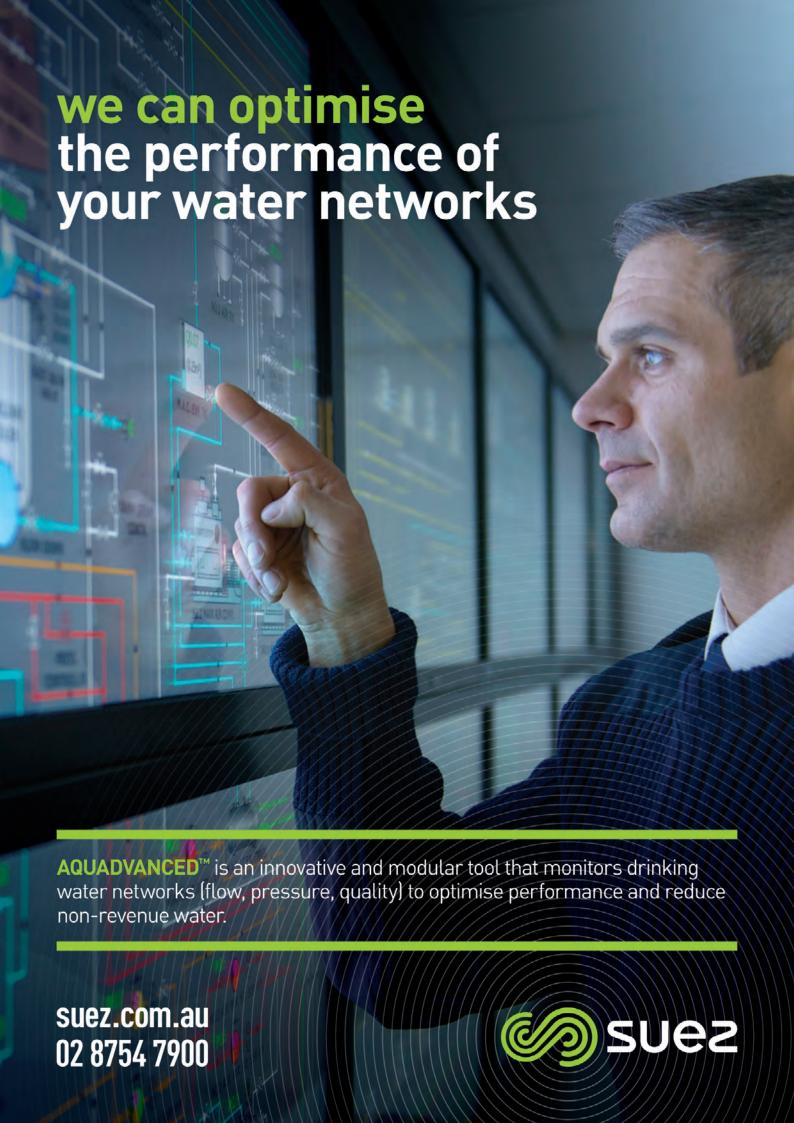
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t its most simple, designers use water-sensitive urban design (WSUD) to reduce environmental degradation and improve residents' quality of life by integrating the urban water cycle into design.

As city makers strive to improve urban space livability, WSUD has emerged as a best practice approach to environmental planning and design. For cities focused on residents' quality of life and water sustainability, the hunt is now on for the best way to adopt and roll out the technique.

#### Hong Kong's challenge

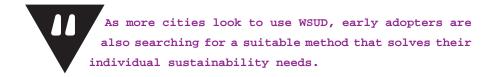
An examination of WSUD in Hong Kong's New Development Areas (NDAs) provides a great insight for early adopters in cities around the world. This city's experience shows the importance of early information collection, as well as clear context establishment. Focusing on these two elements at the outset mitigates project challenges, guides funding decisions and may in fact be essential for a WSUD project to realise its full potential.

For planners in Hong Kong the method has been used to construct the city's 'from scratch' developments. These developments

are generally built on vacant land (as opposed to already established urban environments) and aim to provide additional housing and livable spaces for Hong Kong's burgeoning population.

As they are new developments, there is a great opportunity to integrate much-prized open space with transport and sustainable waste management, as well as new development techniques.

AECOM's research into Hong Kong's NDA experience found that using WSUD is an effective solution for some of the city's livability challenges. Further, this project strategy ensures a range of passive and active open



spaces, pedestrian and cycling paths, sustainable water, energy and solid waste strategies feature in Hong Kong's NDAs.

#### Why is establishing context so important?

As more cities look to use WSUD, early adopters are also searching for a suitable method that solves their individual sustainability needs.

AECOM's research reveals that context integration at the project's inception is a key metric for success. By localising the project, there is greater stakeholder ownership and accountability, a better alignment of shortterm investment with long-term strategy and ultimately more efficient planning, design and project delivery.

AECOM's Hong Kong research shows that localising WSUD projects empowers the government or project owners to look for collaboration and engagement opportunities. It also helps stakeholders to identify potential challenges early, so they can be mitigated, increasing the likelihood of achieving the project's objectives.

#### Building an information framework

While context is important, so is getting in early. For early adopters of WSUD, finding out who the stakeholders and drivers are, and what the opportunities and values are right at the beginning is a must-do.

Constructing an information framework based on a set of 'foundation questions' is a technique that Hong Kong designers have been using for the successful construction of their NDAs.

The framework is built through rigorous information gathering, which includes rounds of internal workshops, feasibility studies and stakeholder negotiations.

Using 'foundation questions' steps users through the information-gathering process and allows designers to gain insight at the planning stage. This supports decision making as the project progresses.

#### A strategy for WSUD funding

One of the central decisions for project design is how to negotiate funding mechanisms. This is another area where using a context-based information framework is beneficial. Because infrastructure works are publicly financed in Hong Kong, sourcing funding has not been typically cited as a major concern. However, there is the challenge of ongoing operation and maintenance costs for WSUD assets.

AECOM's research found that answering foundation question two at the beginning (see table 1) can be a viable technique to resolve this challenge.

In other cities there is still pressure, unlike Hong Kong, to establish appropriate funding sources. AECOM found that an understanding of context and local stakeholders' requirements is a way of locating new and different funding sources. Some examples of different types of funding arrangements emerging out of context-driven WSUD include the privatepublic partnerships being promoted in China and 'value capture financing' in Australia. This strategy, which has been much discussed in the media, identifies and captures the additional increase in tax revenues (over and above the status quo) which have been realised as a result of the planned capital investment within an identified precinct. The additional revenue is captured and ring fenced to provide a source of funding for the delivery of the project, typically a mass transit station or network.

#### A paradigm shift for success

For cities traditionally accustomed to a more compartmentalised approach to urban water management, the idea of building context into WSUD presents an initial challenge. To support the transition, governments must be more proactive in making room for experimentation and innovation.

AECOM's research in Hong Kong showed that there is inevitably a period of learning and uncertainty with any new method.

If sufficient energies are given to establishing local context early in the design of any WSUD project and developing a strong information framework via 'foundation questions', delivery challenges can be mitigated with the result being a water-sensitive urban environment adaptive to the changing needs of residents.

Aecom www.aecom.com

Foundation Questions and Building Blocks to WSUD Policy Development (Lowe et al 2015)	
Foundation Question 1	What are the primary drivers?
Foundation Question 2	Who are the relevant policy stakeholders; What is the existing government structure?
Foundation Question 3	What is the existing extent of WSUD knowledge in industry?
Foundation Question 4	What is the existing level of community engagement with environmental protection?
Foundation Question 5	What is the financial capacity of public agencies and private sector to adopt new WSUD measures?
Foundation Question 6	What is the value of implementing WSUD?
Foundation Question 7	Are there other local priorities?

Table 1. Foundation Questions and Building Blocks to WSUD Policy Development (Lowe et al 2015) Reference: Lowe, K., Henderson, C. and Wu, A.Y.F. (2015) A Comparative Assessment of International WSUD Policy and Implementation Strategies in the Context of Different National Drivers. In Proc. of the 9th International Water Sensitive Urban Design Conference, Sydney, 19-23 October 2015.

Establishing corporate management practices with a focus on water stewardship is critical. Risk from having too much or too little water is now a boardroom issue.

he CDP's 2015 Global Water Report has found that almost two-thirds of over 1200 responding companies report exposure to water risk, with reported financial impacts in 2015 alone totalling more than US\$2.5 billion.

According to the Singapore International Water Week 2016 conference proceedings, 'Water Technology Futures: A Global Blueprint for Innovation', the global industrial water market is expected to grow by a CAGR of 8% from US\$19.9 billion in 2015 to US\$26.2 billion in 2019.

Clearly, for countries like Australia that have experienced severe drought as well as flooding over the past few decades, aligning water utility conservation goals with the business goals of industrial partners is a critical step in managing this resource.

Reducing consumption is one option, while the other is identifying alternative water solutions that help close the water loop and create a more sustainable supply for commercial purposes.

#### Leading the pack

For decades, Australia has been tackling the impact of climate change and rising commercial demands for water through some world-leading planning and development of advanced water facilities and conservation programs. The country's journey through the Millennium Drought (circa 2001 to 2009) was remarkable, made even more so as it coincided with a period of sustained economic growth in spite of the water crisis.

The water industry in Australia must continue to evolve and continue to lead sustainable thinking. Findings from 'Black & Veatch's 2016 Strategic Directions: Water Industry Report' include insights from a number of Australian water leaders. Common





across interviews was a belief that Australian water utilities need to rethink customer relationships and service provision: Have water utilities engaged domestic and industrial customers in the right way? Would a more customer-orientated mindset, enhanced by technology, improve water service provision?

Australia's water sector leaders believe it is important for the country to establish a direct relationship between the value of water and what customers are paying for it. This is an opportunity to prioritise big data and the Internet of Things, and many opportunities could be realised through closer collaboration with large enterprise-level customers looking to solve real-world sustainability challenges.

#### The nexus of data and water

Let's look at the engine behind big data and the Internet of Things: the data centre. The thirst for knowledge and greater access to information has seen approximately AU\$5 billion invested in data centres in Australia over the last five years alone. There is a lot more room to grow too and the next generation of data centres in Australia will be built in less urbanised areas as most data centre development today has been centralised around capital cities.

Security issues along with improving power consumption — the density of power used by the servers — and other energy efficiency concerns are typical concerns of data centre developers. However, like big business in general, water concerns are rising up the boardroom agenda.

Large data centres need to pump millions of cubic metres of water a year through the facilities to keep the servers from overheating. A news report by Bloomberg last month on data centres cited that "high demand for water has some investors concerned, especially in places where natural water resources are becoming ever more precious".

#### Integrated planning

Developments in California may hold valuable lessons for planning in Australia. One of the greenest complexes in the world is being planned for Monterey Bay. The Monterey Bay Regional Water Project will consist of a seawater reverse osmosis (SWRO) desalination facility and co-located 150-megawatt (MW) data centre campus. Cool water drawn up

deep from a submarine trench will be used to cool the data centres and the project features many other sustainable innovations. It represents a clear example of how public-private partnerships and advanced collaborative thinking between water utilities and commercial parties can produce new, more sustainable outcomes.

With the California region currently facing a drought, desalination alongside other alternative water solutions is at the fore. Silicon Valley has in recent years embraced water recycling through the Silicon Valley Advanced Water Purification Center [see breakout box], which treats wastewater to different standards suitable for several applications including industrial processes, cooling water, landscaping, irrigation and recreation.

Such advanced wastewater treatment facilities have been built in Australia, most notably as part of the Western Corridor Scheme in Queensland during the Millennium Drought and also at facilities like the Eastern Treatment Plant in Melbourne, where the recently completed tertiary upgrade was a winner of multiple global water awards. Australian water professionals certainly have the capabilities and expertise to further the development of facilities to increase alternative water supply for industrial uses.

#### Collaboration between utilities and industry

In Asia, an example of engaging industry comes from Singapore, where encouraging sustainable practices by industry forms part of its integrated water supply management program.

Singapore's challenge is to manage water costs while maintaining high service standards in water delivery and pushing for greater efficiency in water usage. In addition to tariff structures that encourage conservation, PUB designs specific outreach programs which aim to raise awareness and enhance the ability of water users to take their own steps to improve their water efficiencies on-site.

For example, PUB, together with the Singapore Economic Development Board, actively works with its large industrial water users to implement water management technologies and practices. Jurong Island, a self-contained industrial park in Singapore comprising many of the world's leading energy and chemical

#### water security

companies, accounts for around 10% of Singapore's water demand. PUB, together with Black & Veatch, also analysed Jurong Island companies' water management and future water needs for processing and cooling. The goal of the study and consultation was to identify cost-effective and sustainable solutions to optimise the use of local water resources as demand from users on Jurong Island is expected to increase.

The study highlighted alternative methods to improve water management practices on the island including identifying more opportunities for water recycling or re-use and using seawater rather than freshwater for cooling. Greater waste heat recovery was identified as a viable option for some companies to explore as the businesses examine their water management practices in more detail alongside other resource needs.

#### Reduce costs, increase revenues

CDP survey results reinforce the reality that prioritising water management strategic water stewardship efforts reduce operation risk, enhance strategic preparedness, improve investor appeal and make businesses more resilient.

Analysing information harvested through big data and the Internet of Things when planning for sustainable water solutions will keep enterprises ahead of the game. Enterprises that address the issue of resource security with an open mind will serve as early adopters for those who are preparing to minimise the effects of climate change through water and power resilience.

Black & Veatch www.hv.com

> \*James Currie is Associate Vice President and Managing Director at Black & Veatch Australia. Currie has over 30 years' experience in water and wastewater engineering in UK, Asia and Australia. He is currently leading Black & Veatch's water business in Australia. His recent project experience includes Melbourne Water's Capital Framework and Eastern Treatment Plant Tertiary Upgrade, and the Deep Tunnel Sewerage Project Phase 2 in Singapore.

For more on Black & Veatch's enterprise sustainability solutions, visit: bv.com/home/ capabilities/service/Sustainable-Enterprise-Solutions.



#### 10 opportunities identified to improve the sustainability of the Australian water industry

- 1. Leveraging digital assets and new materials, such as self-healing polymers, for maintenance.
- 2. Integrating between government departments to reduce cost and inconvenience; for example, by avoiding unnecessary digging up of roads for repairs.
- 3. Improving water quality diagnostics.
- 4. Engaging customers through using the collected data to create value for customers.
- 5. Re-using waste energy to make processes more efficient and cost-effective.
- 6. Trialling new treatment technologies at wastewater treatment plants.
- 7. Easing regulatory reforms to allow more private sector participation.
- 8. Encouraging private sector participation to facilitate innovation and new ways of doing things that could lead to a change in the business environment.
- 9. Increasing use of robotics to supplement the future workforce.
- 10.Including more technology systems and more young water professionals in industry changes.

Source: Black & Veatch's 2016 Strategic Directions: Water Industry Report

#### Case study: Keeping Silicon Valley businesses hydrated

Black & Veatch played a key role in increasing water supply throughout Silicon Valley, where big data needs are rising amid severe regional water shortages: a scenario not Valley Advanced Water Purification Center (SVAWPC) is a regional approach and cooperative effort between the Santa Clara Valley Water District and the city of San José.

The SVAWPC is treating wastewater that otherwise would be discharged into San Francisco Bay; further treating it through microfiltration, reverse osmosis and ultraviolet light; and producing around 30 million litres a day of highly purified water for multiple possibly expands, the area's precious drinking water supplies.

water supplies. Black & Veatch's services included preliminary and detailed design, construction and start-up.

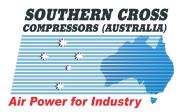


# SWITCH ON TO A SUSTAINABLE FUTURE through waste energy conversion

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As part of an accelerating trend in sustainable development, the world now adds more renewable energy capacity than fossil fuel generation annually. With solar photovoltaics (PV) solutions leading the charge, the primary drivers of this transformation have been positive policy conditions in key markets and dramatic reductions in the installed cost per unit energy of PV technologies.

n Australia, successful solar
PV project deployment,
supported by co-investment
from the Australian Renewable Energy Agency
(ARENA) and state governments, has contributed to radical declines in
the cost per MWh of large-scale solar. As a
result, we are approaching cost levels seen in
mature markets around the world — despite
the first large-scale solar PV project being
built in Australia just four years ago.

Although many factors influence the levelised cost of electricity (LCOE) for solar PV — including PV modules, balance-of-system (BOS), development, financing and operating costs — research and development (R&D) is the key fuel feeding a virtuous circle of innovations that continue to reduce the cost of large-scale solar and increase its impact on Australia's Renewable Energy Target (RET).

#### Increasing efficiencies

R&D provides opportunities for technological advancement that help maintain momentum for large-scale solar around the world. In recent years, higher module efficiencies and declining manufacturing costs have been at the forefront of these advancements, surpassing

expectations across the industry.

First Solar invests approximately US\$130 million annually in R&D, which has resulted in recent advancements of cadmium telluride (CdTe) module technology. Through constant development, mass production line efficiency has reached nearly 17%, and CdTe laboratory cells — which achieved a record efficiency of 22.1% in February this year — are rapidly surpassing silicon at significantly lower manufacturing costs, unlocking unrecognised potential for the solar industry.

Higher module efficiencies — provided they are achieved without impacting cost and reliability — are a powerful tool for increasing the cost-competitiveness of large-scale solar because they also reduce balance of system (BOS) costs by allowing more nominal power of PV to be installed in the same area. The recent commercialisation of PERC (Passivated Emitter Rear Contact) technology is also driving efficiency improvements in crystalline silicon cells, which will ensure healthy competition and lower overall costs for large-scale solar.

Similarly, continued investment into research that improves module energy yield, which determines how a module performs in the varying climates in which it is installed, will allow more energy to be generated from

the same amount of nominal power. Collectively, module efficiency and energy yield can be considered as energy density, essentially the energy generated per unit area, which is a crucial performance metric for comparing the cost-competitiveness of PV technologies. This is of particular importance to First Solar thin-film modules in Australia where higher temperatures across the country result in additional energy from the improved module temperature coefficient, and regions with higher humidity produce a relative energy gain due to changes in the solar spectrum.

#### Reducing risk

Looking beyond module efficiency and BOS costs, another cost component to consider is debt and equity financing, which can be as much as one-third of the total system costs. In determining the cost of financing, lenders and investors will take into account the various factors which pose a risk to their returns — again, R&D plays a key role in reducing costs by helping to reduce and quantify risk.

Demonstrations of PV module reliability both through long-term field performance as well as accelerated stress tests, combined with improvements in the accuracy of energy prediction analysis, will help a project to attract



#### solar technology

the degree of field validation. Several energy prediction software tools are now incorporating modelling of the shift in the solar spectrum that occurs due to changes in atmospheric conditions with factors such as humidity and air mass. First Solar has made contributions to the scientific body of knowledge through its R&D program via publishing its research and developing in-house software tools to assist the industry. As the solar industry is able to reduce the uncertainty of projected PV energy production, lenders can increase confidence levels that project revenues will be sufficient to pay down the loan and offer improved financing conditions.

Finally, a stable policy environment where there is confidence in existing frameworks supporting the deployment of renewables is crucial. Both actual policy change and the likelihood of change increase the risk lenders associate with a project because of the potential impact on the project's financial model. Policy stability at both a federal and state level is therefore essential to help ensure Australia has a competitive cost of finance for large-scale solar.

Sharing the knowledge

R&D across the entire large-scale solar supply chain generates key learnings that can be shared with the wider renewable energy community, allowing other organisations to boost the efficiencies of their own projects; thus driving the industry towards the RET at a faster rate. An example of this is the University of Queensland's PV research facility at Gatton, which is helping to understand the cost efficiencies of different thin-film PV solar technologies. The facility has been in operation for almost 18 months, and the results to date highlight the impressive performance of the thin-film PV single-axis tracking array. The industry is increasingly deploying singleaxis tracking technology in large-scale solar projects, where the incremental cost of the tracking components is more than offset by the improved energy output, delivering a better revenue profile over the lifetime of the project.

Furthermore, the knowledge-sharing program under ARENA-funded projects will help improve the process for integration of solar energy into the Australian electricity grid, reducing development costs and paving the way for future large-scale solar systems to be connected. These learnings are being dissemi-

nated to those in the industry — researchers, utilities, investors and governments — and are accelerating the improvement of the integration of solar energy into the electricity grid from both an engineering and economic perspective.

As a relatively young technology, it is also critical that the development of solar projects is informed by long-term operational data. As Australia's first operational large-scale solar plant, the 10 MW (AC) Greenough River Solar Farm is the best source of long-term solar energy performance data in the country and provides the entire industry with a better understanding of how modules can be expected to react in the harsh Australian climate.

#### Future of the Australian solar industry

While investment in R&D is critical to the future of the Australian solar industry, so too is the knowledge gained through the construction and operation of large-scale, grid-connected solar power stations. First Solar has delivered approximately 70% of large-scale solar projects in operation, including Australia's largest solar plants at Nyngan and Broken Hill. These projects are a clear demonstration of the greater role large-scale solar can play in meeting Australia's electricity needs by creating confidence in the solar industry and informing the direction of future R&D.

A promising example of recent progress is the New South Wales Government's planning approval for four new large-scale solar plants in the state which will potentially double the state's existing capacity to over 400 MW. ARENA has also recently announced The Clean Energy Innovation Fund, which will allocate up to \$100 million each year to commercialise innovative renewable energy projects.

Large-scale solar is rapidly approaching cost-parity with conventional fossil-fuel generators, and in selected markets this has already been achieved. As a developing solar industry, Australia's solar potential will only be realised if further investment in research and project deployment is made to increase the competitiveness of the technology. Ongoing targeted support and policy stability will continue to foster an attractive environment for investment, improving the integration of solar into the overall energy mix and enabling large-scale solar to reach its full contribution potential to the RET.

First Solar (Australia) Pty Ltd www.firstsolar.com

more competitive financing by reducing the perception of technology risk. The third-party testing industry has developed extended reliability programs such as the TUV Rheinland Long-term Sequential Test, Atlas 25+ Test, VDE and TUV SUD Thresher Tests, and the Fraunhofer PV Durability Initiative — these certifications offer manufacturers an opportunity to demonstrate to customers and lenders that their products provide the highest level of reliability and thereby minimise the risk that the plant's output will degrade at a fasterthan-expected rate. In this manner, research and collaboration with the testing industry can help improve reliability and lower the cost of solar through cheaper financing and increased energy production over the lifetime of the plant.

Accurately predicting the generation of a solar plant over its operational life is another key input to the project revenue stream that affects the cost of finance. Improvements in weather forecasting, and increasing the accuracy and resolution of global historical weather datasets, is helping to reduce the uncertainty in solar availability for new and existing sites. Software and algorithms for predicting the lifetime energy production of different PV power plants are also continuing to develop both in terms of sophistication and



A number of businesses are burdened with the rising cost of energy bills, with significant impacts to their bottom line.

his tremendous cost of power at a site is represented by the power used (active) and excess unused power (reactive). The combination of active (kW) and reactive power (kVAR) determines the actual power drawn from the network (apparent power kVA). The level of wasted reactive power causes poor power factor and attributes to rising energy costs.

A review of site energy bills will identify if power factor issues exist at your site. There are several benefits for a site when a high level of reactive power is eliminated through the integration of power factor correction equipment, some of which include lowering costs to achieve the same tasks, as well as gaining energy efficiency from your equipment and extending service life. You can also expect to gain additional capacity with increased system load capabilities from existing equipment such as transformers, switchgear and supply cables and the peace of mind knowing you are running your workplace as efficiently as possible.

Power factor correction system costs can vary depending on the size and complexity of the system. Typically, payback timelines can be within 1-3 years.

In addition to poor power factor, many businesses may be unknowingly subjected to non-optimal network tariff and in some cases demand charges (depending on the tariff the distributor chooses to apply to the account for that NMI). The current energy agreement may not necessarily be the optimal tariff for that site's account if the usage profile for that site is not as per the local network service provider's (LNSP) initial information when the site is connected. On initial connection of a site, the network tariff is typically based on the site's usage at full capacity. The maximum capacity usage profile does not always come to fruition and in some cases the intended use for a site is not always as specified in the electrical connection application.

If your business has recently relocated, a network tariff review should be undertaken to ensure that you do not take on a non-optimal network tariff based on the usage profile of the previous user. On the other hand, for existing sites either a data spike or an unusual usage spike can cause the site demand to be set at a far higher level than what is consistently used. In instances where the LNSP does not apply a rolling peak demand type tariff structure, this too can result in excessively higher network charges through the demand charges applied for the energy account.

The impact of having a non-optimal network tariff or excessive demand charges on an electricity account can be costly. Network charges can be as much as 40% of the overall cost on an electricity bill. Having charges applied that are excessive due to them being non-optimal can lead to network tariff charges costing your business far more on an annual basis than you would otherwise have to pay. This can unnecessarily remain as an ongoing issue if it remains undiagnosed and not remedied.

A network tariff review will expose any potential unnecessary overspend. A solution can be applied to reduce costs on your account. The benefits from having a network tariff review are two-fold. Your business will have peace of mind that it is not paying more

than it should. In other cases, where action is required either due to a non-optimal tariff or where the business contract demand does not match the demand profile, your costs will become rationalised if a tariff change or demand reset is successful.

Power factor specialist companies such as Control Logic can simplify the process of site energy consumption analysis through their complimentary power factor, network tariff and demand review service. If funding is a concern, then there are options to tailor a solution that requires no capital outlay. A complete turnkey solution is offered by Control Logic, which is structured to generate immediate savings, including warranties, service and maintenance. The solution is insured for errors or omissions.

A managed service agreement is suitable for energy-efficiency initiatives to deliver a turnkey service-based package and includes network tariff and energy bills review, site audit, system recommendation, financing, system design, commissioning, scheduled service and maintenance alongside ongoing support.

This means you'll be able to maximise the appropriate rebates and grants at the state and federal level, which can be then applied to the solution to benefit your business. This process is simplified through Control Logic's services by completing the relevant documentation for you. A turnkey solution can assist your business to preserve capital and traditional funding for other important service delivery requirements, reduce risk and ongoing maintenance costs, and improve site operation costs.

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





European research project led by Chalmers University of Technology has launched a set of tools that will make computer systems more energy efficient.

The EU-funded Excess project set out three years ago to take on what the researchers perceived as a lack of holistic, integrated approaches to all system layers from hardware to user-level software, and the limitations this caused to the exploitation of the existing solutions and their energy efficiency. They initially analysed where energy performance is wasted, and based on that knowledge they have developed a framework that should allow for rapid development of energy-efficient software production.

"When we started this research program there was a clear lack of tools and mathematical models to help the software engineers to program in an energy-efficient way, and also to reason abstractly about the power and energy behaviour of the software," said Philippas Tsigas, professor in Computer Engineering at Chalmers University of Technology, and project leader of Excess. "The holistic approach of the project involves both hardware and software components together, enabling the programmer to make power-aware architectural decisions early. This allows for larger energy savings than previous approaches, where software power optimisation was often applied as a secondary step, after the initial application was written."

The Excess project has taken major steps towards providing a set of tools and models to software developers and system designers to allow them to program in an energy-efficient way. The tool box spans from fundamentally new energy-saving hardware components, such as the Movidius Myriad platform, to sophisticated efficient libraries and algorithms.

Tests run on large data streaming aggregations, a common operation used in real-time data analytics, have shown impressive results. When using the Excess framework, the programmer can provide a 54 times more energy-efficient solution compared to a standard implementation on a high-end PC processor. The holistic Excess approach first presents the hardware benefits, using an embedded processor, and then continues to show the best way to split the computations inside

the processor, to even further enhance the performance. Movidius, a partner in the Excess project and developer of the Myriad platform of vision processors, has integrated both technology and methodology developed in the project into its standard development kit hardware and software offering. In the embedded processor business, there has been a gradual migration of HPC class features getting deployed on embedded platforms. The rapid development in autonomous vehicles such as cars and drones, and driving assist systems, and also the general development of home assist robotics (eg, vacuum cleaners and lawnmowers), has led to the porting of various computer vision algorithms to embedded platforms. Traditionally, these algorithms were developed on high-performance desktop computers and HPC systems, making them difficult to re-deploy to embedded systems. Another problem was that the algorithms were not developed with energy efficiency in mind. But the Excess project has enabled and directed the development of tools and software development methods to aid the porting of HPC applications to the embedded environment in an energyefficient way.

# the complete billing package



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#### Blower system assists WWTP

Three Kaeser EBC series blower systems were recently installed at Water Corporation's Collie Wastewater Treatment Plant (WWTP) to efficiently and reliably meet the compressed air requirements of an upgraded process aeration system.

Water Corporation supplies water, wastewater and drainage services to thousands of homes and businesses in Western

Australia. Wastewater management is an essential part of the water cycle and, at present, the Water Corporation is responsible for the collection, treatment and either reuse or disposal of almost 450 million litres of wastewater a day.

When the wastewater reaches one of the many treatment plants (WWTP) that Water Corporation operates, it must go through a number of processes before it can be returned to the environment. From aeration to digestion, a reliable and high-quality supply of compressed air is required.

Recently, an inadequate process aeration system at the Collie WWTP was upgraded by the Water Corporation. With a Kaeser blower

system already reliably powering the digestion process at the Collie WWTP, the local authorised Kaeser Partner, Pneumatic Engineering, was requested to propose a suitable blower system upgrade solution for the aeration process.

To efficiently meet the demand for compressed air, Pneumatic Engineering recommended and subsequently supplied three Kaeser Compact EBC series blower systems. Part of the Compact series from Kaeser, the EBC models have been designed to incur minimal operating and maintenance costs and to ensure maximum reliability. Every Kaeser blower is equipped with a high-efficiency blower block

featuring Omega Profile rotors and an IE3 electric motor

(which complies with and exceeds prevailing

Australian GEMS regulations for three-phase electric motors) to ensure maximum energy savings and outstanding system performance. These highly reliable and robust Omega Blower blocks

feature long-life roller bearings and come prelubricated, ready for use.

In addition, a clever design not only delivers efficiency and dependability but also ensures a small footprint and ease of maintenance. An access-friendly configuration enables side-by-side installation of multiple units, while a spacesaving component layout results in a compact footprint.

The Kaeser Compact series blower units are further delivered complete with an acoustic enclosure that has been designed to minimise noise emissions.

The Water Corporation commented: "The blower systems have been up and running for over

12 months. In that time they have proven to be exceptionally quiet in operation and very reliable in efficiently delivering compressed air as and when required."

Together with their minimal maintenance and service requirements, the versatile blowers ensure low life cycle costs. Mechanically tested in Germany, the Kaeser BB-FB series rotary blower packages are available with free air deliveries from 1.5 to 74 m<sup>3</sup>/min, pressure up to 1000 mbar and vacuum to 500 mbar.

Kaeser Compressors Australia

www.kaeser.com



#### Evoqua electrochlorination systems for Australia's navy

Evoqua Water Technologies has been selected by defence contractor BAE Systems Australia to design and deliver technology that prevents marine growth in seawater cooling systems on eight Royal Australian Navy ANZAC Class frigates.

Evoqua's expertise and existing relationships with the Australian, US and UK navies assisted in positioning its Chloropac system as a suitable technology for the remaining life of each ship. The seawater electrochlorination system is said to be a proven method of preventing marine and biological fouling for energy-efficient, longterm plant operation. Chloropac systems produce a dilute, safe solution of sodium



hypochlorite from natural seawater for direct injection into the seawater cooling circuits and sea chests. Evoqua has more than 2500 Chloropac systems installed worldwide through its Electrocatalytic family of products.

Evoqua will deliver the Chloropac systems for installation onto eight ANZAC Class frigates over the next six years.

Evoqua Water Technologies Pty Ltd www.evoqua.com

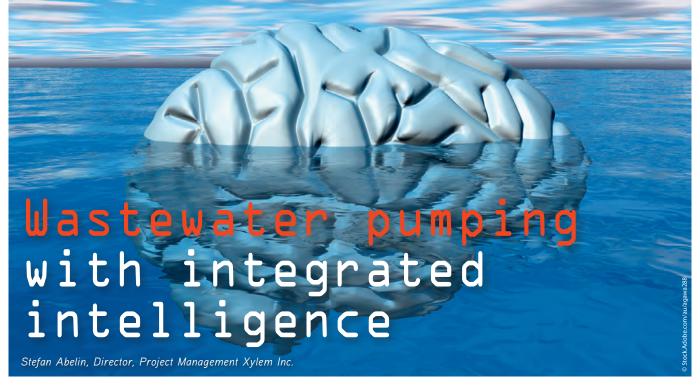
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Improved system reliability, reduced energy consumption, operational flexibility, reduced footprint, connectivity and a lower pump system lifecycle cost can all be achieved with integrated intelligence in wastewater pumping.

he word "intelligent" in wastewater pumping is a result of factors that together contribute to a new level of operational autonomy and efficiency, a pumping system designed to automatically deliver the desired performance at minimum energy consumption while reducing the total cost of ownership.

The word "pumping" is used to indicate that the affected operational area has been expanded from the pump itself to include the hardware, functionality that resides both in a wastewater pump, pump controls and external communication technology.

A typical submersible wastewater pump station consists of two pumps and a control panel that operates a sewage lift station based on varying liquid levels and an on/off controller — whereas the new integrated intelligent wastewater pump system consists of a submersible wastewater pump with integrated control, power electronics and a pump station controller unit that operates the sewage pump station.

The in-pump processor controls the power electronics to achieve variable pump performance to meet demands. A single impeller size per volute size minimises the need for multiple spare impellers and yields maximum hydraulic efficiency as the impeller is optimised for the volute. Instead of having to remove the pump to trim or change an impeller, a different duty point can simply be met by the touch of a button. A new, simpler and more com-

pact high-performance synchronous motor further improves pump system efficiency allowing operation at reduced pump capacity with maintained high motor efficiency. The concentrated winding synchronous motor does this and meets the proposed future super-premium motor efficiency standards (IE4).

The new system features soft-start, pump clog detection, pump cleaning, advanced motor protection and 'always correct' impeller rotation.

The pump station controller can handle up to four pumps and provides pump system management functions such as pump energy minimiser, sump cleaning and pipe cleaning function, pump sequencing and alternation.

The pump's drive unit is an assembly consisting of monitoring and control circuitry, software, power electronics and a synchronous motor in a single package. By using a new motor design, the concentrated winding design, benefits such as increased motor efficiency, controllability, improved low-speed efficiency and reduced size are derived.

The pump station controller allows for data communication and analysis, providing communication to the outside via standard communication protocols. The pump station can be easily connected to remote station monitoring systems including Supervisory Control and Data Acquisition (SCADA) systems. Integrated intelligence creates opportunities for reduced control panel

footprint, both physically, environmentally and in your wallet. Reduction of CO<sub>2</sub> emissions will result from installations with intelligent pumps and a pump station controller. The reduced physical footprint is due to relocation of major components from the control panel to within the submersible pump as well as the compactness of new components, a result of innovation, adaptation and integration of technology.

The powerful and patented energyminimising software algorithm assures the lift station is always operated at the minimum specific energy level (kWh/m³), given the prevailing head and flow requirements. The pumps are soft started and soft stopped; the integrated pump clog detection function will protect the pumps from clogging by triggering a pump cleaning cycle, preventing unnecessary service calls. The sump and pipe cleaning functions will assure that the pump sump is kept free of sediment, floatables and fat. Power and motor protection functions will protect the motor from supply grid issues and thermal overloads.

Additionally, the system will assure complete knowledge of what's going on with the pumps and the system. Local and remote operational data such as pump and station status information, warnings and alarms are readily available and user-configurable to suit different system requirements.

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The IS rating scheme articulates the themes, categories, credits and benchmarks that the infrastructure industry has embraced as the vernacular of sustainability over the last four years. The IS rating scheme is now used widely in sustainability assurance processes across Australia. Presently the scheme boasts 54 projects/assets valued at over \$79 billion (capital value).

he Infrastructure Sustainability Council of Australia (ISCA) facilitated the development of a sustainability community of practice in the infrastructure industry when it developed and launched the Infrastructure Sustainability (IS) rating scheme in 2012.

Projects and assets that have been awarded IS ratings have achieved amazing outcomes:

- The Enlarged Cotter Dam project replaced 100% of potable water with non-potable water and reduced embodied carbon emissions by 23%.
- The Gateway WA design reduce the life cycle environmental impact of materials by 58% and introduced the use of LED lighting on highway roads.
- Gold Coast Light Rail saved \$15 million through the implementation of sustainability initiatives, reduced embodied carbon emissions by 55%, had an 89.7% recycling rate for inert and non-hazardous wastes and more than 96% of project employees were local.
- The Googong Water Treatment Plant Chemical Facility Upgrade achieved a significant reduction in materials life

cycle environmental impact and kept the footprint entirely within the original facility.

- The Great Eastern Highway Upgrade used warm mix asphalt in WA for the first time reducing energy use and greenhouse gas emissions as well as achieving 43% recycling rate for imported materials.
- The Sydney Metro Northwest Early Works project discovered and preserved a colonial era heritage site by modifying the skyrail section of the project.
- The Sydney Metro Northwest Surface and Viaduct Civils project modelled a 44% emissions reduction, had a potential 9% water saving over the life of the project and demonstrated Australia-based market transformation through development of sustainability data collection and reporting software.
- The Sydney Metro Northwest Tunnel and Station Civil Works reduced emissions by 24%, reduced water use by 37% and had a 45% reduction in environmental impact of materials, achieving the highest IS score to date of 83.
- The Whitsundays STP Upgrades saved more than \$1 million through the implementation of sustainability initiatives,

- saved 305 MWh of electricity over operational life, reduced water use by 15%, reduced their materials footprint by 25% and, in a world first, trial of parallel nitrification and denitrification technology.
- Wynyard Walk achieved a number of initiatives, including minimising waste, reducing community impacts during construction and optimising energy efficiencies.
- The Yarra Park Recycled Water Treatment Facility gained water efficiencies of 7% during summer and 8% during winter operations and has been able to supply 99.99% of potable water replacement demand (directly offsetting 291,818,800 litres of potable water to date).

The IS rating scheme has also been of interest outside Australia. There are now five ISCA New Zealand Founding Members (Auckland Airport, AECOM, BECA, Panuku Auckland and Tonkin + Taylor) showing significant leadership and commitment to the New Zealand infrastructure industry. New Zealand is also home to two IS ratings. Auckland Airport has used IS to benchmark its operations and Madden and Packenham reduced construction carbon emissions by 27% and its materials environmental





#### infrastructure

footprint by 18%. ISCA has also signed a collaboration agreement with a newly created Chinese alliance with China City Development Foundation and Green World City to create the Green Infrastructure Finance Accreditation (GIFA) scheme for the Chinese infrastructure industry based on the IS rating scheme.

ISCA released version 1.2 of the IS rating scheme in May 2016.

"This milestone signifies the step change improvement the infrastructure industry has achieved since the launch of the IS rating scheme in 2012," said ISCA CEO Antony Sprigg. "Industry has been instrumental in significantly advancing sustainability outcomes in Australian infrastructure over the past three years. The IS rating scheme has provided an important platform for being able to measure this progress and the opportunity to provide ongoing feedback on efficiencies and enhancements as a result of the growing importance of sustainable infrastructure in Australia. This industrydriven feedback has informed v1.2, which will deliver a more directed approach to managing asset sustainability."

IS rating scheme v1.2 considers the unique aspects of any asset by applying weightings to each credit, so effort is directed on the most appropriate areas and incremental progress is rewarded. The use

of preset credit weightings and by exception scope-outs processes has been replaced with a compulsory materiality assessment that focuses sustainability activity towards initiatives that are most relevant for each project or asset.

Other changes will increase efficiency and sustainability value by reducing the effort and evidence burden on assessors driving improved outcomes. Key changes include:

- Some credits have been consolidated, resulting in a reduction from 52 credits to 44 credits.
- Customised credit requirements and guidance has been incorporated into 16 of the 44 credits specifically for minor works projects.
- The benchmarking of some credits has been changed from a step scale to a linear scale, enabling the reward of all improvements, not just those that result in a project/asset surpassing the next hurdle.
- The amount of innovation bonus points has increased from five points to 10 points.
- Rulings from the current version of the scheme have been incorporated into the credits of the new scheme.
- Greater flexibility has been incorporated into 10 credits' manage, review and audit requirements while maintaining the same level of rigour.

• The ISCA Materials Working Group identified a number of improvements to the IS Materials Calculator that have been incorporated into v1.2. They include more than doubling the number of materials available, addition of multiple transport modes for relevant materials, addition of simple tools that allow default and custom ready mixed and precast concrete mixes to be formulated and analysed, the addition of unit conversions for relevant materials, the incorporation of a revised methodology for environmental impact to be calculated (from EcoPoints to IS EnviroPoints) and a revision of the source of materials environmental impact data.

Infrastructure Sustainability Council of Australia www.isca.org.au

\*Antony Sprigg is CEO of the Infrastructure Sustainability Council of Australia (ISCA). Prior to joining ISCA in 2012, Antony had held a number of senior management roles in professional service firms and on major capital works projects. Antony's experience spans across South-East Asia, southern Africa, North America and Australia. Antony is also a husband, father, cyclist and mountaineer.



#### Soil moisture monitoring for better irrigation and crop nutrition

While soil moisture monitoring is often thought of as a water-saving technology, it also provides other significant benefits - for example, better crop irrigation and nutrition.

Crop nutrition is intrinsically linked to crop irrigation. Many nutrients move quickly with water or only move through plants when water is available. Nitrogen is released in water and too much irrigation can result in nitrogen leaching, causing low soil nitrogen and poor plant growth.

Testing only the nutrient content of a plant or soil in isolation may give you the answer as to why a plant is expressing a symptom, but not necessarily the contributing factors that led to the issue developing in the first place. Looking at concentrations of nutrient in isolation does not showing how the water availability is potentially affecting availability of the plant to access those nutrients. Monitoring soil moisture continuously, and comparing the water availability to the nutrient testing, adds significant value to any testing.

wildeye soil moisture monitoring is a simple soil moisture solution that continuously monitors the moisture in soil. Measurements taken every 15 min are reported daily to the web, so growers can make sure that the irrigation they applied kept up with the crops' demands. Fine-tuning irrigation depth



and timing, based on the measurements from wildeye, can ensure that water (and therefore nutrients) is always available for good growth.

Using wildeye highlighted the need to monitor irrigation and proved useful for growers Bao Duy and Bao La Nguyen of Sun City Produce. The brothers have two wildeye units installed, monitoring irrigation of cucumbers in two different soil types at their farm near Geraldton.

The product showed that a sandy loam soil holds soil moisture as high as 21% before draining and only requires once-a-day irrigation. This information suggests that slightly less water would



reduce drainage in the lower profile. The lighter sandy soil required more frequent, shallow irrigation, because of lack of water-holding capacity. Moisture greater than 12% drains through the profile taking nutrient away from the crop's root zone.

Consequently, the plants recovered from looking yellow and became greener. This was a result of less drainage, allowing nutrients to be retained where the plants can access them.

**Outpost Central** www.outpostcentral.com



#### Egg producer invests in biogas plant

Since the Colombian government started supporting the generation of renewable energies, the agricultural industry has discovered the potential for biomass; however, only little of this potential has been converted into green energy. Now, egg producer Incubadora Santander has decided to generate energy from biomass.

Incubadora Santander is said to be Colombia's biggest egg producer, producing about 3.5 million eggs per day. The enterprise — which operates several poultry farms close to the western Colombian province of Cauca - markets its eggs under the 'Kikes' brand in 14 cities. The company has recruited German plant manufacturer WELTEC BIOPOWER to build an anaerobic digestion plant which will utilise dry chicken manure and process water for co-digestion, enabling the 800 kW biogas plant to operate without the purchase of any additional substrate.

The feedstock will be pretreated in a sedimentation tank. There, the manure will be separated from sand and lime and will be pumped into the 4903 m<sup>3</sup> digester by way of an upstream storage unit with a capacity of 1076 m<sup>3</sup>. Through the codigestion, the digestate will reach a high fertiliser value, enabling it to be returned into the plant's agricultural substance cycle for efficient use as liquid manure on its own fields. The high-quality requirements of South America's agricultural and food industry

were a key reason why Incubadora Santander Manager Juan Felipe Montoya Muñoz opted for the WELTEC technology. The plant manufacturer had already demonstrated its experience through the establishment of large biomethane parks and biogas plants for various customers from the waste and food industries, as well as

from the agricultural and sewage treatment industries.

Before making his decision, the Colombian operator toured various plant locations in Germany in

order to see this for himself.

For the sake of hygiene and other reasons, the company prefers stainless steel for the construction of the pre-storage tanks and digesters. Apart from the high quality and the flexible substrate input, compact delivery and quick assembly are additional advantages of this material. Plant modules such as the ready-for-operation CHP plant, the preinstalled

pump and control technology, and the stainless steel panels for the tanks will be transported to the plant location in maritime containers from Germany that will pass the Panama Canal.

Montoya Muñoz revealed that Incubadora Santander plans to establish the Kikes brand around the globe, eventually stepping up production to 10 million eggs a day. With the WELTEC biogas plant set to supply power and process heat from early 2017, the company will be well prepared for these expansion plans.



#### Trees grown from wastewater to fuel our cars

Almost 4000 pongamia trees have been planted at two sewage treatment plants in the towns of Boonah and Toogoolawah, Queensland, where they will be irrigated by treated wastewater as part of an Australian-first trial to produce biodiesel.

The trial is being run by Queensland Urban Utilities, which planted the trees on four hectares of unused land around the sewage treatment plants. The plan is to extract oil from the seeds of the trees and convert it into biodiesel.

"We hope to harvest enough seeds to yield at least 12,000 litres of biodiesel every year — that's enough to run approximately 24 cars for a year," said Queensland Urban Utilities spokesperson Michelle Cull.

The trial has been commended by the University of Queensland's Professor Peter Gresshoff, who described it as "an exciting advance from university-focused research to practical application".

"The advantage of growing this particular type of tree is that their seeds





Queensland Urban Utilities' Michelle Cull and the University of Queensland's Professor

produce a higher quality and quantity of oil than other biodiesel crops," Professor Gresshoff said. He noted that biodiesel is better for the environment than fossil fuels because it's a sustainable source of energy that emits fewer greenhouse gases into the atmosphere.

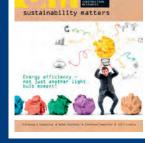
According to Cull, the sewage plant component is "just the first step" of the trial.

"In the next stage of the trial, we'll be establishing a research facility where we'll test using wastewater to irrigate other crops," she said.

"It's all part of our renewable energy plan, which aims to reduce our carbon footprint and keep costs down."

Queensland Urban Utilities www.urbanutilities.com.au





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#### Victoria's 6 Star Energy-rated NABERS building

Cbus Property and Charter Hall's 171 Collins Street has become the first building in Victoria to achieve a 6 Star NABERS Energy rating, featuring best practice sustainability features in an architectural landmark that fuses a heritage facade with modern design.

The foundations for the building's success were laid early on, with a NABERS strategy established well before practical completion and adoption of a sustainability team to ensure energy-efficient policies and procedures were developed prior to the building's operation.

"Part of this included ensuring project teams were on the journey from the outset, ensuring the construction team and subcontractors bought in to the goal," revealed Cbus Property CEO Adrian Pozzo.

After opening its doors to tenants in June 2013, 171 Collins Street became the first premium building to achieve a 6 Star Green Star As Built Office V2 rating by the Green Building Council of Australia (GBCA). Now it is the second commercial office building in Australia to be awarded a 6 Star NABERS Energy rating, emitting 50% less greenhouse gases than a 5 Star-rated building. The building achieves its energy savings through a combination of features, including a ceiling tile system that absorbs office pollutants and creates a healthier office environment for workers. The building's exterior is also a big driver of cost efficiency, with its high-performance facade folding light from the sky into the building to reduce heat gain and glare.

A radiant cooling and heating system and an underfloor air distribution network provides energy-efficient thermal comfort for occupants, while the air-conditioning system allows large quantities of outside air to be brought into the office space at a low velocity and distributed using natural stratification. A greywater treatment program collects used water from the cyclist shower facilities and recycles it through the building's cooling towers and toilets, offsetting more than 90% of the cooling towers' water consumption.

Other sustainability credentials include:

- a 9-storey glass atrium that maximises natural light;
- floor-to-ceiling double glazing with thermal insulation to help maintain occupant comfort;
- a dedicated waste storage area for separation, collection and recycling;
- optimised lighting design with extensive controls for occupancy and daylight harvesting;







- energy-efficient fixtures and fittings;
- low VOC and formaldehyde emissions;
- 280 bicycle spaces, showers, change rooms and lockers;
- destination-controlled lift systems.

All in all, 171 Collins Street saves more than 1.3 million kg of carbon dioxide each year - equal to 568,000 L of petrol or 139 homes' energy use for one year when compared to a building with a 5 Star NABERS Energy Rating. According to Charter Hall's head of office, Adrian Taylor, the 6 Star rating proves that sustainability measures can be delivered at a competitive cost and with no adverse impact on the forecast investment returns.

"We are very pleased with the performance of 171 Collins Street," he said. "It is a building that continues to be recognised for its innovation in sustainability and we hope sets the benchmark for the industry into the future."



#### Underground water tank to prevent flooding in Melbourne

The City of Melbourne is working with the Victorian Government to install Australia's first combined stormwater harvesting and flood mitigation tank to protect against flooding in Melbourne's CBD.

Lord Mayor Robert Doyle said the \$3 million underground tank, to be based in Lincoln Square, Carlton, is part of an overall program of works that will help to reduce the flood risk in Elizabeth Street from Extreme to High.

"Elizabeth Street was once a creek that flowed into the Yarra River, so it has been the site of major flooding throughout Melbourne's history," the Lord Mayor said. These floods have over the years left thousands of people homeless (1891, 1934), caused dozens of deaths and injuries (1934), submerged cars (1972) and disrupted public transport (2011).

"By installing a two million-litre tank at the top of the catchment, we can reduce rainwater collecting around Flinders Street Station, which is one of



the busiest areas in the central city," the Lord Mayor said.

"The system relies on new technology which allows the water to be either purged or recycled based on the weather conditions."

The tank will collect stormwater from surrounding areas of Parkville and Carlton via the Bouverie Street drain next to Lincoln

Square, one of three heritage squares that were set out in the 1850s. It will be Australia's first combined flood mitigation and stormwater harvesting project.

"The water tank is larger than an Olympic swimming pool and will save thousands of litres of drinking-quality water a year," the Lord Mayor said. "We will harvest this water to keep Carlton's heritage squares lush and green during Melbourne's long hot summers."

"We manage 480 hectares of parkland across the city, so it's important that we use water wisely to protect our iconic gardens from drought and extreme weather conditions," added the chair of council's Environment Portfolio, Councillor Arron Wood.

"Exciting projects like this will help us to reach our target of sourcing 50% of our water from non-drinking sources in the coming years." Excavation works to install the tanks are currently underway and are expected to be completed by September.

#### 'Green corridor' showcases sustainability in tourism

Hotelier Dr Jerry Schwartz has launched a 'green corridor' between his hotels in NSW and the ACT to highlight the potential of environmental initiatives in the tourism industry. According to Dr Schwartz, the new sustainability measures will have "long-term benefits for the environment and our energy management".

Electrical vehicle charging stations have been installed for free usage by guests in Schwartz Family Company properties in the Hunter Valley (Crowne Plaza Hunter Valley), Blue Mountains (Fairmont Resort and Leura Gold Club) and Sydney (Mercure Sydney, Rydges Sydney Central). Mercure Canberra will be shortly added to the network.

"Use of electric vehicles is still in its infancy, but if people are aware they can drive from Sydney to the Hunter Valley, Blue Mountains and Canberra and recharge their vehicles for free, it provides added incentive to make the switch," said Dr Schwartz.

In addition, a 100 kW system comprising 376 solar panels has been installed on the rooftop of the Fairmont Resort, where it is set to produce CO<sub>2</sub> savings of 155,658 kg per annum. The Fairmont installation, and an accompanying 30 kW system on the adjacent Leura Golf Club, follows the inauguration of a major solar plant at the Crowne Plaza Hunter Valley earlier this year.

The use of solar is part of an integrated environmental energy management strategy at the Fairmont, which also includes a 'smart' system allowing lights and air conditioning to be turned off in rooms when the guest is away and for ambient room temperature to be



Image caption: New solar panels will significantly reduce the carbon footprint of the Schwartz-owned Leura Golf Club.

varied according to the outside temperature. The resort's infinity pool will stop flowing over the edge after dark to save considerable heat loss, and a variable speed drive system on all air-conditioning pumps will allow better management of flows according to demand from guest rooms and common areas.

Dr Schwartz said, "When you have properties in pristine areas such as the Blue Mountains and Hunter Valley, it is really important for operators to respect the environment and do their utmost to reduce their footprint.

"This is a small step but an important one, because Australian tourism should be at the vanguard of promoting environmental sustainability."

#### Detecting changes of water quality at an early stage





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#### Carbon-neutral plasterboards

Carbon-neutral plasterboards are now available for projects in NSW and Queensland, thanks to a joint venture between partners on the Barangaroo South project.

Barangaroo South developer Lendlease was committed to implementing a range of sustainability initiatives, including a 20% reduction in embodied carbon (EC) - the sum of all the greenhouse gas emissions created during the manufacture, transport and installation of building materials for the project. Working on the Alexander and Andara residential buildings, comprising 159 apartments and ground-level retail space amounting to 18,225 m<sup>2</sup> of combined floor

space, the company partnered with manufacturer Knauf Australia which has been reducing the environmental impact of its plasterboards through measures such as the recycling of waste heat in the plastermill, heat exchangers installed on dryers, reduction of water usage, optimised mixing processes, a move to natural light and LEDs, and ongoing staff training.

"Plasterboard wall linings make up a significant proportion of the building materials for this project," said Kathryn Walker, sustainability manager, Knauf Australia. "Lendlease approached us to see if we could work with them to provide a means of meeting their sustainability

requirements." In order to meet the stringent standards required for carbonneutral certification under the government's National Carbon Offset Standards (NCOS) scheme, the entire manufacturing

process was documented, bringing the companies within close reach of the overall target. Where the environmental reduction measures weren't able to completely eliminate carbon emissions, Knauf used qualified providers of carbon offsets that not only met the NCOS standard requirements, but that also met its own social responsibility criteria of providing social and environmental benefits to communities - in this case in Kenya through the LifeStraw Project.

"With a long-term commitment to producing our boards in an ethical and environmentally considerate manufacturing process, we were excited to be invited to be part of this challenge on such an auspicious project," said Walker.

Knauf Australia's MastaShield, WaterShield and FireShield plasterboards are now available from the company's Matraville plant for major projects along the Eastern seaboard from Sydney to Brisbane, supplied with carbon-neutral certification.

"The leadership shown by Lendlease in this area provides opportunities for manufacturers like us to develop commercially viable sustainability solutions," concluded Walker.

Knauf Australia

www.knaufplasterboard.com.au

#### Energy-efficient and safe wastewater pump for chicken plant

A NSW chicken process plant went for safety and energy efficiency in selecting the wastewater pumps for its latest expansion. The plant had a lot of wastewater to shift - 10 ML per day — so getting the pump selection right was important.

Firstly, the plant wanted self-priming wastewater pumps. This would mean the pumps are easy to access for monitoring and/or maintenance and, importantly, operators would not be exposed to open wet wells and confined spaces issues when performing maintenance duties, as would be the case with submersible pumps. When the efficiency numbers were crunched, the Gorman-Rupp V6A60-B Ultra V Series pump came out the clear winner when compared with other 6" pumps on the market.

At the particular duty point, the V6 could deliver a hydraulic efficiency of 68%, compared to the 55% offered by other manufacturers. Based on an energy price of \$0.21 per kWh, the savings worked out to be \$3875 per annum. That's \$38,750 for a 10-year period (excluding an allowance for inflation) and \$96,875 over the expected 25-year life cycle of the pump. Safety, efficiency and ease of maintenance were said to be the drivers in the development of the Ultra V Series pump range. A pressure relief valve vents excessive pressure if



a valve is inadvertently closed, and as a second failsafe, the non-return suction flap valve has a built-in burst disk. As well as this, the fill port of the pump has a shield to divert flow to the ground, instead of outwards, if an operator inadvertently opens it while the pump is still pressurised.

Operators will also appreciate the ease with which the pump can be maintained due to the following features:

- A pusher-bolt system on the inspection cover-plate to make it easy to remove.
- A pusher-bolt capability on the rotating assembly.
- Shim-less external adjustment of internal pump clearances, done in 4 min without exposure to the pumped media.

- Inspection and/or replacement of the suction flap valve without opening the pump cover plate.
- Instant visual of seal and bearing oil through external sight glasses.

The series offers asset owners an efficient, safe and easy way to maintain wastewater pumps. The V6 can deliver flows to 120 L/s and pressures to 95 m. Smaller pumps in the range can cater for lower flows. The pump range is also available with a choice of materials for the wearing parts, including hardened iron, 316SS and duplex stainless steel.

Hydro Innovations www.hydroinnovations.com.au



#### Bacteria-powered 'wind farms' and micromachines

A team of scientists from Oxford University has shown how the natural movement of bacteria could be harnessed to assemble and power microscopic 'wind farms' - or other man-made micromachines such as smartphone components.

The study, published in the journal Science Advances, uses computer simulations to demonstrate that the chaotic swarming effect of dense active matter such as bacteria can be organised to turn cylindrical rotors and provide a steady power source.

Researchers say these biologically driven power plants could someday be the microscopic engines for tiny, man-made devices that are self-assembled and self-powered everything from optical switches to smartphone microphones.

Co-author Dr Tyler Shendruk, from Oxford University's Department of Physics, said: "Many society's energy challenges are on the gigawatt scale, but some are downright microscopic. One potential way to generate tiny amounts of

power for micromachines might be to harvest it directly from biological systems such as bacteria suspensions."

Dense bacterial suspensions are the quintessential example of active fluids that flow spontaneously. While swimming bacteria are capable of swarming and driving disorganised living flows, they are normally too disordered to extract any useful power from. But when the Oxford team immersed a lattice of 64 symmetric microrotors into this active fluid, the scientists found that the bacteria spontaneously organised itself in such

a way that neighbouring rotors began to spin in opposite directions — a simple structural organisation reminiscent of a wind farm. Dr Shendruk added: "The amazing thing is that we didn't have to predesign microscopic gear-shaped turbines. The rotors just self-assembled into a sort of bacterial wind farm. "When we did the simulation with a single rotor in the bacterial turbulence, it just got kicked around randomly. But when we put an array of rotors in the living fluid, they

> suddenly formed a regular pattern, with neighbouring rotors spinning in opposite directions."

Co-author Dr Amin Doostmohammadi, from Oxford University's Department of Physics, said: "The ability to get even a tiny amount of mechanical work from these biological systems is valuable because they do not need an input power and use internal biochemical processes to move around.

"At micro scales, our simulations show that the flow generated by biological assemblies is

capable of reorganising itself in such a way as to generate a persistent mechanical power for rotating an array of microrotors."

Senior author Professor Julia Yeomans, from Oxford University's Department of Physics, added: "Nature is brilliant at creating tiny engines, and there is enormous potential if we can understand how to exploit similar designs." The paper, 'Active micromachines: Microfluidics powered by mesoscale turbulence', is published in Science Advances. DOI: 10.1126/ sciadv.1501854





#### Carbon nitrites for CO<sub>2</sub> capture and conversion

Professor Ajayan Vinu will lead the Future Industries Institute, based at the University of South Australia, in a project that aims to remove carbon dioxide gases from the atmosphere and converting them into green energy.

Professor Vinu is globally recognised for his work in the emerging field of nanoporous materials. Of particular interest to the institute is his research into carbon nitrides, which have just the right properties to support the capture and conversion of CO<sub>2</sub> molecules.

"Their interesting properties — a semiconducting framework structure and ordered pores - make them exciting candidates for the capture and conversion of CO2 molecules into methanol, which can then be used as a source of green energy with the help of sunlight and water," Professor Vinu said.

"My goal is to develop this unique approach which has the potential to make a huge contribution to cleaning the environment and addressing one of our most significant environmental problems - the mitigation of atmospheric CO<sub>2</sub>.

"This fascinating material is not only helping in reducing CO. levels by developing an efficient, low-cost photoelectrochemical semiconductor device, but also offers a clean fuel source from the conversion of absorbed CO2 molecules."

UniSA Deputy Vice Chancellor Research and Innovation Professor Tanya Monro has welcomed Professor Vinu to the

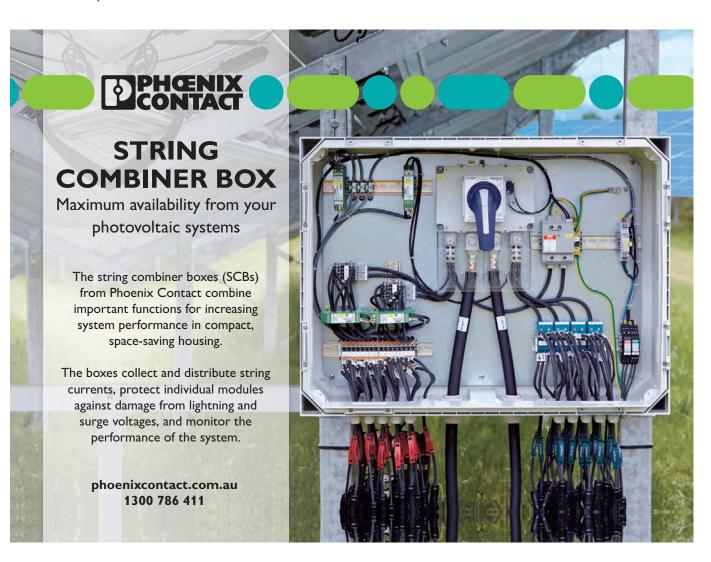


Future Industries Institute, saying his appointment will set the stage for some exciting developments.

"Professor Vinu is a fantastic complement to the institute, which is focused on research that will seed future industries and also provide solutions to emerging challenges," she said.

"This appointment adds capacity to our strength in materials and energy engineering, with a clear pathway to partner engagement and impact."

www.unisa.edu.au



#### Solar cell captures CO, and sunlight

Researchers at the University of Illinois at Chicago (UIC) have engineered a potentially game-changing solar cell that cheaply and efficiently converts atmospheric carbon dioxide directly into usable hydrocarbon fuel, using only sunlight for energy.

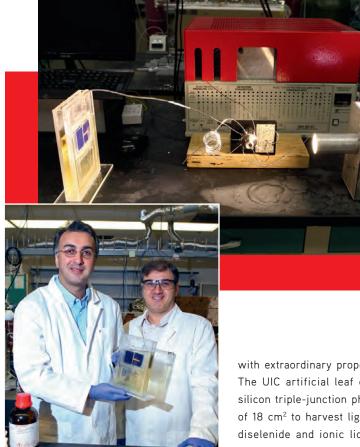
Unlike conventional solar cells, which convert sunlight into electricity that must be stored in heavy batteries, the new device essentially does the work of plants, converting atmospheric carbon dioxide into fuel and thus solving two problems at once. A solar farm of such 'artificial leaves' could remove significant amounts of carbon from the atmosphere and produce energy-dense fuel efficiently.

"The new solar cell is not photovoltaic — it's photosynthetic," said Amin Salehi-Khojin, assistant professor of mechanical and industrial engineering at UIC and senior author on the study.

"Instead of producing energy in an unsustainable, one-way route from fossil fuels to greenhouse gas, we can now reverse the process and recycle atmospheric carbon into fuel using sunlight," he said.

While plants produce fuel in the form of sugar, the artificial leaf delivers syngas, or synthesis gas — a mixture of hydrogen gas and carbon monoxide. Syngas can be burned directly or converted into diesel or other hydrocarbon fuels.

The ability to turn CO2 into fuel at a cost comparable to petrol could render fossil fuels obsolete.



Chemical reactions that convert CO<sub>2</sub> into burnable forms of carbon are called reduction reactions, the opposite of oxidation or combustion. Engineers have been exploring different catalysts to drive CO<sub>2</sub> reduction, but so far such reactions have been inefficient and rely on expensive precious metals such as silver, Salehi-Khojin said. "What we needed was a new family of chemicals

with extraordinary properties," he said. The UIC artificial leaf consists of two silicon triple-junction photovoltaic cells of 18 cm<sup>2</sup> to harvest light: the tungsten diselenide and ionic liquid co-catalyst system on the cathode side and cobalt oxide in potassium phosphate electrolyte on the anode side.

The technology should be adaptable not only to large-scale use, like solar farms, but also to small-scale applications, Salehi-Khojin said. The finding is reported in the journal Science and was funded by the National Science Foundation and the US Department of Energy. A provisional patent application has been filed.



#### Verifying power plant CO<sub>2</sub> emissions

New Zealand scientists have developed a way to use radiocarbon measurements to verify greenhouse gas emissions from power plants. The new method uses a novel sampling technique of collecting grass growing downwind of power plants, which faithfully records

a measure of the carbon dioxide emitted from the power plant.

Developed by researchers at GNS Science, the method allows for the first time independent verification of greenhouse gas emission rates that have previously only been self-reported by power companies that use fossil fuels.

The research was published in the Proceedings of the National Academy of Sciences with the paper titled 'Independent evaluation of point source fossil fuel CO, emissions to better than 10%'.

Under the Paris Climate Agreement agreed on in December 2015, 195 countries including New Zealand agreed to reduce their carbon dioxide emissions.

Lead author Dr Jocelyn Turnbull said, "Our new technique provides an inexpensive and simple way to verify that companies and nations are actually doing what they have promised to do."

The researchers use a novel method which involves collecting grass samples downwind of a power plant. The grass faithfully records the

radiocarbon content of carbon dioxide from the atmosphere that the grass uses to grow. Due to the extreme age of fossil fuels, carbon dioxide derived from combustion contains zero radiocarbon, whereas natural carbon dioxide sources contain high levels of radiocarbon.

> By measuring the amount of radiocarbon present, the researchers are able to determine how much of the carbon dioxide at the location of each grass sample was emitted from the power plant. They use wind data to translate the measured fossil fuel carbon dioxide concentrations at each location to the rate of emissions from the power plant.

It reduces uncertainties in the emission rate to less than 10%, an improvement over the current 20% using other more conventional methods and sufficient to allow governments to verify the reported emissions.

This new research is the latest application of radiocarbon measurements that GNS Science, and its predecessor, the DSIR,

has been making since 1951 at its Lower Hutt facility, the Rafter Radiocarbon Laboratory. This laboratory is the oldest continuously operating radiocarbon facility in the world.

**GNS** Science www.gns.cri.nz



Radiocarbon researcher Dr Jocelyn Turnbull, of GNS Science, collecting data at Kapuni in Taranaki. The Kapuni gas-fuelled power station is in the background. Image credit:





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#### Solar-powered water treatment



A project to install solar panels at the Korong Vale Water Treatment Plant has significantly reduced the plant's consumption of grid energy.

Korong Vale is located in north-western Victoria and is serviced by the Wimmera Supply System. The water treatment plant delivers treated water to residents, commercial and industry users through 121 connections.

The plant can treat up to 3.6 ML of raw water per day before it pumps the treated water from its clear water tanks to the reticulation system. When the pumps are not in operation, the water from the tanks is supplied to the town through a gravity-fed system. The pump and filtration systems consume high levels of energy.

Jon Anstey, general manager Insight & Innovation at Coliban Water, said the treatment plant project is part of Coliban's commitment to deliver innovation and achieve renewable energy targets set by the Victorian Government, with 25% of the state's electricity set to come from renewable energy by 2020.

"Whilst the targets were officially announced in June, we had been anticipating them for some time," he said. "Our Sustainability Strategy outlines our longstanding commitment to supporting innovation and operational improvement by investing in sustainable technology."

With this in mind, said Anstey, the organisation made the \$55,000 decision to install a 30 kW solar energy system, consisting of 112 panels, at the Korong Vale Water Treatment Plant. He explained, "This improves the plant's energy efficiency by using solar power, before drawing from the grid network.

"The Korong Vale plant was chosen for the project because of its location, size and the compatibility of its electricity system with the solar network," he added.

This project will enable 50% of the plant's operations to be powered by solar energy, making it an encouraging early step towards achieving the 2020 goals. It will also deliver a \$7000 annual saving in energy costs and reduce the plant's carbon emissions by 50 tonnes each year. "With the successful completion of this project, we are keen to explore opportunities for renewable energy at other treatment plants and will continue to work with the state government on emission reduction targets," Anstey said.

## Could a filter made of graphene solve the water crisis?

Researchers from Monash University and the University of Kentucky have developed a graphene-based filter that they believe could be the key to managing the global water crisis. The device can filter out anything bigger than one nanometre and could be used to filter chemicals, viruses or bacteria, with

potential applications purifying water, dairy products or wine, or in the production of pharmaceuticals.

Graphene is a lattice of carbon atoms so thin it's considered to be two-dimensional. It has been hailed as a 'wonder material' because of its incredible performance characteristics and range of potential applications. However, this is the first time that a graphene filter has been able to be produced on an industrial scale, as they have previously been difficult and expensive to produce.

"Graphene-based membranes demonstrating ultrafast water transport, precise molecular sieving of gas and solvated molecules

shows great promise as novel separation platforms; however, scale-up of these membranes to large areas remains an unresolved problem," the study authors wrote in the journal Nature Communications.

The leader of the research team, Associate Professor Mainak Majumder from Monash University, said the key to making the filter was developing a viscous form of graphene oxide that could be spread very thinly with a blade. He explained, "This

technique creates a uniform arrangement in the graphene, and that evenness gives our filter special properties."

The device is said to filter liquids nine times faster than the current leading commercial product. It is also so strong and stable that it can be used for extended periods in the

> harshest corrosive environments. and with less maintenance than other filters on the market. Most importantly, the new technique allows the filters to be produced much faster and in larger sizes. which is critical for developing commercial applications. The team's research was supported by industry partner Ionic Industries, as well as a number of Australian Research Council grants. Ionic Industries CEO Mark Muzzi said the next step is to get the filter on the market, noting, "We are currently developing ways to test how the filter fares against particular contaminants that are of interest to our customers." The research has so far gathered

interest from a number of companies in the United States and the Asia-Pacific region. It has been hailed as a commercial breakthrough by co-author Professor Dibakar Bhattacharyya from the University of Kentucky, who praised its ability to control the thickness of the filter and attain a sharper cut-off in separation, as well as the use of water as the casting solvent.

Monash University www.monash.edu





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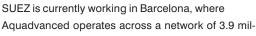
MEP Instruments, a company of Metrohm and Anton Paa

#### **SMART WATER SOLUTION**

Aquadvanced is an innovative solution developed by SUEZ to support water distribution operations. It helps monitor and control the water supply networks by providing a dashboard and optimisation tools to support efficient decision-making. Bringing together multiple IT systems, the device allows water operators to evolve from traditional to smart network management.

The product addresses each component of the urban water cycle, including the resource, the treatment system, transportation and distribution.

It includes a suite of dedicated modules based on a framework of functions known as the Aquadvanced Foundation which is fully integrated with the operation information system. Modules include hydraulic monitoring, energy management, water quality data collection and resource management. They can be specified for an explicit role within the drinking water cycle or they can be used across the whole network.



lion people delivering 200 GL/year of water through a network of

4600 km of pipes. Through this partnership, the city has demonstrably reduced water losses and optimised its network operations. Similar partnerships are in place in Versailles, France (20 GL/year), in Macao, China (90 GL/year) and in Casablanca, Morocco (190 GL/year).

SUEZ is seeking opportunities to work with water providers to introduce this technology in Australia.

SUF7

www.suez-environnement.com

#### **SOLAR INVERTERS**

Redback Technologies is launching a second generation version of its smart hybrid inverter and a family of grid-tie inverters.

The Single and 3-Phase Grid Tie Family and the Generation II Hybrid solar inverters will help households and commercial users increase the percentage of solar power they consume, improving the payback from solar panels and helping to reduce reliance on fossil fuels. The products make use of the Internet of Things and cloud technology to give users more options.

The grid-tie family is said to revolutionise the traditional inverter, which converts DC power generated by solar panels into AC power for general use. The range incorporates Redback's cloud-enabled intelligent system for analytics and remote control, the Ouija Board. The Ouija Board is also found in the Generation II Hybrid for household use; a second-generation inverter that is battery- and solar panel-agnostic.

Redback's system will use machine learning to gather intelligence over time, learning from user preferences as well as drawing data from external factors like the weather. So when the sun is shining, the system will ensure the batteries are full and household appliances, like the pool pump and hot water system, are turned on. The idea is to maximise the energy users are producing by using their appliances before they store it in batteries.

The company's products are hosted in Microsoft's Azure IoT Suite cloud platform, ensuring easy updates and upgrades as technology develops. The hardware and software are integrated from the very beginning.

Redback Technologies Australia www.redbacktech.com

# Climate change

## rural and urban gap

Climate change is likely to worsen the systemic disadvantages suffered by rural and regional communities and further widen the gap between rural and urban areas, according to a report by the Climate Council.



n the Frontline: Climate Change & Rural Communities' finds the increase in extreme weather events is disproportionately affecting those in rural areas, with many agricultural businesses taking on increased debt in response to these events. And while many businesses have made changes to adapt to the changing climate, such as changing sowing and harvesting dates or switching to new breeds of livestock, there is a limit to how much farmers can adapt.

Report co-author Dr Lauren Rickards said the risks posed by climate change threaten to exacerbate many of the social, health and economic challenges already being experienced by those in regional areas.

"In addition to affecting agricultural production, climate change affects rural communities in many far-reaching ways, increasing the cost of essential goods and

services, devaluing community assets and degrading places we love," she said. "Rural and regional communities are often poorly equipped to deal with the health impacts of higher temperatures.

"While all Australians will be affected by these challenges, those living in rural communities will be worst affected."

The silver lining, according to the Climate Council's Professor Lesley Hughes, is that tackling climate change "provides an unrivalled opportunity to attract jobs and investment back to these communities", with rural areas currently receiving about 30-40% of investment in renewables in Australia - or 1-2 billion dollars per year.

Many farmers are adding additional revenue streams to their properties from renewable energy, with about \$20.6 million paid annually in lease payments to farmers and landholders hosting wind turbines.

Renewable energy can also attract jobs back into rural and regional areas, as large-scale renewables projects tend to be located outside urban areas. Finally, renewable energy can reduce electricity costs for rural and remote communities, who traditionally pay much higher prices than their urban counterparts.

Climate Council Chief Councillor Tim Flannery concludes that strong climate action is required to protect those living in rural and regional areas from worsening impacts.

"People in the bush look after themselves and each other and they're already getting on with the job in adapting farming practices and implementing solutions for climate change." he said.

"Now it's time for our political leaders to match their effort and take the action we need to tackle climate change."

The report can be found at: www.climatecouncil.org.au/ruralreport.



#### **ENERGY STORAGE SYSTEM**

LG Chem's Next Gen RESU Series is a flexible energy storage system that features the JH3 Li-ion battery cell, which has double the capacity compared to the previous battery. This was made possible due to the 'lamination and stacking' production method, which enables a stable structure that hinders distortion and deformation after hundreds of uses and results in almost no dead spaces.

The compact size and weight of the battery storage system are also made possible due to the lamination and stacking process. For example, the RESU 6.5 model is 4 cm flatter and 8 kg lighter than the comparable RESU 6.5 EX model.

The system's flexible storage options make it a suitable energy solution for any home. The series now offers five products, with the option for indoor and outdoor, stand and wall-mount systems, a diverse range of capacity expansions and low- and high-voltage options.

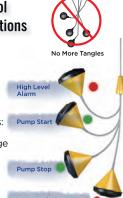
The series is sleek in design, allowing for easy assimilation into any home or small business, and is available in silver. It is compatible with nearly every inverter on the market.

LG Chem Energy Solution Company www.lgesspartner.com



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#### REMOTE POWER **CONTROL UNITS**

The ENVIROMUX IPDU series remote power con-



trol units allow the user to remotely reboot and control up to eight servers or other powered devices from any location via secure web interface, RS232, SSH or Telnet. The series includes models with two, four and eight outlets. All models allow two external environmental sensors to be attached.

Power control and management features include: on/off/ reboot/default switching; outlet sequencing and power-up delays; manual/scheduled/associated reboot modes; current/ line voltage/line frequency/power factor monitoring; normally open (NO) or optional normally closed (NC) relay contacts; and overload protection via a circuit breaker.

Environmental and IP monitoring features include: temperature/ humidity/water detection via external sensors; ping monitoring of up to eight IP network devices; and alert notifications via email/syslog/LEDs/webpage/SNMP. SMS messages sent via an external USB 3G modem are available on the four- and eight-outlet models.

The two- and four-outlet models can be cascaded to increase the number of power outlets and sensor ports. A maximum of 17 systems can be combined via RS485, with one acting as the master controlling 16 slave units.

Interworld Electronics and Computer Industries www.ieci.com.au

#### E-WASTE RECYCLING SERVICE

Advanced Resource Recycling (ARR) is offering an e-waste service for organisations seeking best practice recycling in Melbourne. The company's recycling facilities utilise technology which is designed to minimise energy consumption and maximise recovery.



AAR's machinery is designed to separate e-waste components into their base materials, which minimises cross-contamination. The fully automated equipment is able to recover up to 98% of the resources available in e-waste. According to the company, data and product destruction is ensured.

The company is now actively seeking partnerships with local or regional governments, private companies or transport companies willing to invest to have their e-waste fully recycled rather than buried or exported. While AAR is able to accept small e-waste volumes, it currently has the capacity to process up to 50,000 tonnes of e-waste per year.

Advanced Resource Recycling Pty Ltd advancedresourcerecycling.com.au

#### **UV SPECTROSCOPIC ANALYSERS**

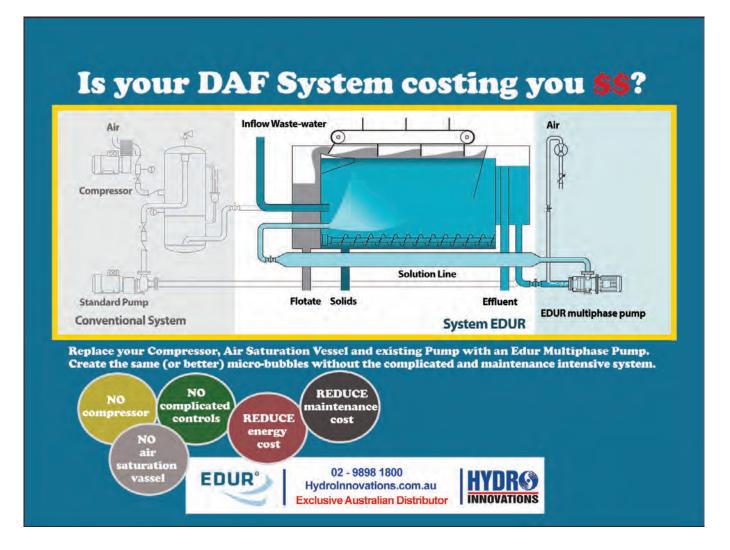
Water engineers responsible for municipal or industrial water and wastewater will find the single- or dual-parameter CA-6 UV family of spectroscopic analysers from Electro-Chemical Devices (ECD) can monitor any two selected parameters in separate measurement ranges for ammonia, nitrate or chemical oxygen demand (COD 254 nm).

The UV analyser family is an online sampling system that's designed with UV absorption sensor technology to monitor harmful pollutant parameter levels. The analyser's sensors are available in multiple parameter measurement ranges: ammonia from 0-10 mg/L or 0-1000 mg/L; nitrate from 0-30 mg/L, 0-100 mg/L or 0-250 mg/L; and COD 254 nm from 0-200 mg/L or 0-20,000 mg/L. Accuracy is 5% for the measurement of ammonia, nitrate and COD with the analyser based on a sample temperature range of 0 to 80°C, so long as the sample is liquid and not frozen.

Each model is easy to order with either a single parameter or dual parameters in the factory-precalibrated measurement ranges. Everything needed comes in one box ready to install and start up. A single technician can complete the installation process in 15 min by connecting the sample, waste and cleaning solution (reagent) lines and powering up the analyser. Accessing the chosen precalibrated parameter data or customising an analysis routine is easily done with user-friendly intuitive menus and a touch screen display.

The versatile analyser is designed with four alarm relays. A single 4-20 mA analog output is included with 12-bit resolution. RS232 communications are provided for data download to a CSV file, with an optional RS485 MODBUS communication module available.

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





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#### REMOTE MONITORING SYSTEM

SmartLink is Atlas Copco's flexible solution for data monitoring. Easy to install and customise, as well as being user-friendly, the system enables central compressed air and vacuum systems and individual machines to be connected to the user's engineering team. The product brings system-relevant data to the user's mobile phone, smartphone and PC.

Whenever the user has access to the internet, it is possible to display the information required: from machine alarms and faults, to visualised representations of demand and load for complete site vacuum installations. This allows the user to respond quickly to changing circumstances. Service calls can be efficiently planned and production losses minimised. The flexible system delivers as much or as little information as the user chooses.

The web portal features an event overview of the last 30 days, access to service data and monthly status reports by email. Requirements of machine-related services (service, spare parts) are displayed directly via the web portal.

Logging and download service data for the last 30 days is available via Excel, Word or PDF. SMS/email notifications indicate service, failures and warnings. A status display is available via an online trend graph.

Atlas Copco Compressors Australia www.atlascopco.com.au

#### **POWER QUALITY ENERGY METER**

Electrex has released the Kilo Net D6 power quality energy analyser and data manager. Providing power quality analysis and a 0.5S class accuracy, the product seamlessly bridges networks be-



tween the ethernet and RS485 ports, including other Electrex devices for Modbus communication.

The unit features an intuitive web interface for monitoring real-time variables, along with log data capabilities and simple system configuration options. The power quality analysis includes single harmonics up to 51st order, peaks, dips and interruptions among other variables and has the ability to send alarm notifications on monitored threshold values via email or SMS.

With a wide range of power supply versions, an operating temperature range of up to 60°C and compact size, the product provides the user with installation flexibility.

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



#### HYDRAULIC TRAINING SYSTEM

Fluid Power Training Institute's MF102-H-TSE is said to come with everything required to help students understand the principles and theories of hydraulics. Students will be able to learn about fixed displacement pump circuits, pressurecompensated pump circuits and load-sensing circuits all on one training system.

The product teaches 95% of the components in a hydraulic system, with various plug-and-play modules offering unlimited training flexibility. It is load cycle-capable and features electronic auto-fault insertion. It also contains six directional control valves: three parallel industrial type, one series industrial type, one cylindrical spool-centred mobile type and one motor spoolcentred mobile type.

The system has an efficient and convenient use of space and energy. It measures 76 x 122 x 196 cm and was designed to fit through a standard doorway. Its Safe-T-Bleed safety system, which de-energises and air-bleeds hydraulic systems and components, is the same lockout system used in industry.

Bestech Australia Pty Ltd www.bestech.com.au



ONLINE SPECTRAL NITRATE/ NITRITE SENSOR

TriOS develops and produces optical sensors (and associated equipment) for water quality analysis. The reagent-free sensors are used in environmental monitoring and process control in a broad range of applications, such as surface/drinking water, marine research, industrial and wastewater treatment (inlet and outlet).

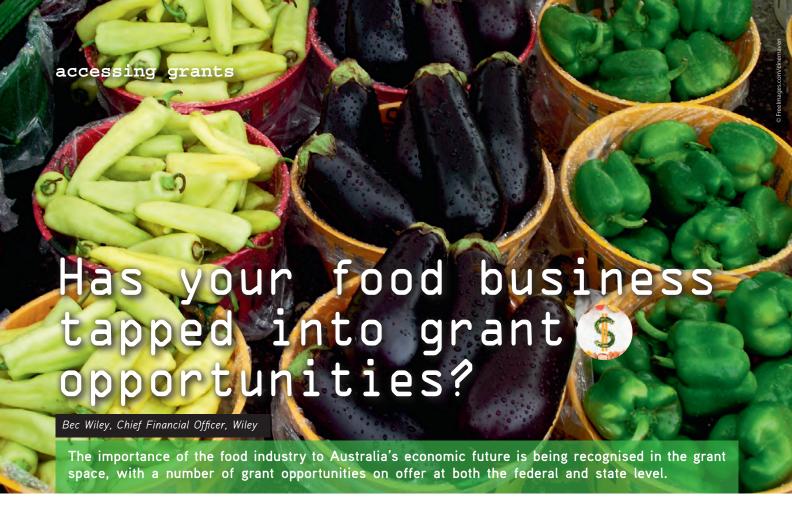
The TriOS family covers a range of parameters with online photometers, fluorometers, radiometers and other sensors. Typical applications include the measurement of nitrogen (nitrate and nitrite), BOD equivalent (BODeq), CODeq, SAC254, radiance/irradiance, colour, concentration of oil in water and algae such as cyanobacteria (blue-green algae).

Replacing time-consuming lab tests, the OPUS is an optical sensor for online analysis of nitrogen (nitrate/nitrite) and carbon compounds (CODeg and BODeg). Manual maintenance is reduced by the use of revolutionary nanocoated (hydrophobic) lenses and built-in air cleaning. The sensor's reagent-free spectral measurement allows for field mounting of the OPUS to deliver real-time, continuous information for automated control.

All products are supported with a full range of mounting alternatives such as process mount (floats and flowcells), inline and remote operating solar-powered buoys. The innovative TriOS G2 interface allows sensor configuration either through one of the TriOS centralised controllers or remotely over any web browser. Communication outputs include analog (4-20 mA) and digital Modbus (ethernet or Wi-Fi).

Control Components Pty Ltd www.controlcomponents.com.au





rants and programs supporting sustainability and renewable energy initiatives as well as export development continue to be available, for which businesses in the food and agriculture sectors are well placed to benefit.

In South Australia, the Advanced Food Manufacturing (AFM) Grant Program is considering EOIs for grants of up to \$100,000 for co-funded projects from South Australian food and beverage manufacturers (excluding wine) and public or private research technology providers that strengthen the food industry's innovation capabilities and improve productivity, profitability and competitiveness.

With automation and data analytics key to the future success of the food industry, South Australia's Manufacturing Technologies Program and Big Data Connect Program can provide the catalyst for businesses to leapfrog in this area with grants on offer to businesses looking to evaluate, assess, trial and adopt new technologies. In Victoria, the state's Regional Jobs and Infrastructure Fund has a number of programs where food and agri-food can benefit. Under the Innovation and Productivity stream, food and fibre is a designated emerging sector which draws preference for assistance with new technology and infrastructure projects that improve the efficiency and competitiveness of regional businesses.

New technologies and processes are also supported under Victoria's Future Industries Manufacturing Program with grants of up to \$500,000 available.

On a national level, the Rural Industries Research & Development Corporation's (RIRDC) research funding program, which can support research programs in a number of industries including chicken meat and honey bee and pollination, opened in August.

A myriad of grant opportunities are on offer or upcoming (open but not yet accepting applications) for businesses. If your food business is considering or exploring opportunities, new processes or technologies or moving premises, would possible financial assistance be an enabler?





## disclaimer notice

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#### Case study example

AJ Bush & Sons, a major Australian meat by-products rendering company, engaged Wiley to establish the best project for them to reduce carbon emissions and improve energy efficiencies. Wiley sought to find a suitable grant to implement the project and obtained a \$6.2m grant from the Ministry of Industry and Innovation. The Clean Technology Food and Foundries Investment Program Grant provided AJ Bush & Sons with the funding to implement a bioenergy project that converts its wastewater into energy

The project which was also delivered by Wiley, reduced ongoing fossil fuel energy consumption by more than 34%.

to help power its operations.

This was achieved through the capture of biogas from anaerobic ponds for use in a new boiler along with the replacement of inefficient coal-fired boilers. The added benefit was

> a reduction in site carbon emission intensity of 64%.

The Queensland meat byproducts manufacturer won the Business Eco-efficiency Award at the Queensland Premier's Sustainability Awards for the project. The award was granted for outstanding performance in improving its operational efficiency by applying environmentally beneficial processes, systems or practices.

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## Melbourne

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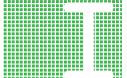
#### 8 PRE-CONFERENCE TRAINING WORKSHOPS

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# Growth is a habit but not the answer



n 1968, when Apollo 8 broadcast the first images of Earth from space, millions of Earth's citizens observed their planet in all its glory

and beauty - blue, white and breathtaking. Even trained astronauts were stunned!

That beautiful and breathtaking sight is rapidly changing and nearly gone today. Its rich blue oceans are darkening and turning brown as global warming impacts the planet, and everyone and everything will suffer from it.

Observations that began in the 19th century, advanced examinations that started in the mid-20th century and 'paleoclimate reconstructions' that provide insights spanning many millennia confirm unambiguously that the Earth's climate is getting warmer.

Higher temperatures have affected weather patterns. Globally, scientists assess that it is highly likely that more days and nights will be warmer than cold. Emissions from burning fossil fuel have caused temperatures to rise by more than 1°C so far.

This has increased storms over the oceans, creating larger systems carrying more rain and making more lightning. Rainfall now goes up 1.5% each decade and, since the rain doesn't fall where it is needed, the extra lightning ends up causing more forest fires.

Climate change also affects the tropics, which have expanded more than two degrees of latitude north and south since 1980. Such shifts disrupt weather patterns, bringing permanent drought conditions to large parts of Australia and the US.

Economic growth has long been mankind's cultural norm; however, that is coming to an end. This 'reflex' is an adaptation that fits the old world, not the new one. It just isn't possible to keep growing forever.

The new economy needs to go slower than the one society now takes for granted, and this change will require a serious mental shift. As society slows down, it also needs to downsize, and, as the world has gotten faster, major elements of the Western economy have gotten bigger.

Houses have become larger, retail spaces have expanded and organisations — particularly banks — have become not just bigger, but too big to fail. Organisations that get too large can't react well to changed conditions.

Despite the urgency of global warming, governments are not moving quickly to redesign their energy framework. A city's infrastructure may take decades to change, but this is not quick enough to mitigate damages from climate change.

Climate change adaptation, such as to changes to rainfall and sea levels, is becoming increasingly important, especially in vulnerable and poorer countries. Individual countries must devise their own adaptation strategies, but delaying will make the inevitable disruptions all the more devastating.

negotiations are difficult since nations have a strong incentive to cheat, but robust enforcement, perhaps with trade sanctions, is crucial. A 'carrot only' strategy, without strong 'sticks', will not curb emissions.

According to various media sources, large corporations such as Apple, Google, Microsoft, Berkshire Hathaway and Goldman Sachs are looking to invest at least US\$140 billion (AU\$182 billion) to shrink their carbon footprints.

The committed funds will be utilised to cut emissions, provide financing to environmentally focused companies, reduce water consumption and produce 1600 MW of new, renewable energy, which is enough to power nearly 1.3 million homes. Governments need to also take stronger action



Numerous climate change conferences over the years have stimulated discussion on climate change risks to our planet. Most recently, climate change was highlighted as the biggest global risk facing humanity; however, all these conferences and talks border around climate diplomacy - a pattern of setting bold and ambitious emission-reduction goals - without factoring in whether they are even realistic or not.

When countries face uncertainties in forecasting CO<sub>2</sub> emissions, non-binding agreements let governments move forward, gain experience with market participants and determine what works best. Some countries are committing to reach certain benchmark reductions if other nations promise to do so as well. Climate change

to combat climate change. Introducing a set of tougher and updated versions of proposed environmental regulations, designed to drastically curb greenhouse gas emissions from a country's power plants, could ultimately transform their energy/electricity industry. If the regulations can get past certain legal obstacles, it could create a snowball effect through incredible policy changes leading to the closures of hundreds of coal-fired power plants, prevent new coal plants being built and drive innovation and production of renewable sources of energy such as wind and solar. Understanding the behavioural psychology to climate change policy is an art — something governments and the private sector are slowly but surely realising. We know a lot needs to be, and can be, done.

## Energy rating tool for apartments announced



NABERS Energy for apartment buildings will assess the energy performance of central services. Potential retrofits include upgrades to lighting, HVAC systems, pool pumps, hot water systems, sensors and building management systems.

"The built environment contributes almost a quarter of Australia's emissions, and residential apartments represent the fastest growing market in the built environment," said NABERS National Program Manager Carlos Flores. "We know bringing large-scale sustainability change to the apartment sector will be a major challenge, but one that government and industry can tackle if we work together."

NABERS tools have proven effective in the commercial building sector, where they have allowed building owners to better understand their assets' performance and provided a metric on which numerous policy and incentive schemes have been built. The office sector is now saving more than \$100 million a year in power bills compared to 2010 levels, resulting in annual CO<sub>2</sub> emissions savings of more

than 635,000 tonnes.

"In the office sector, NABERS provided a 'common language' that made energy efficiency tangible for building owners and tenants," noted Luke Menzel, CEO of the Energy Efficiency Council. "As a result, energy efficiency is now understood as more than just a cost-saving strategy; it's a way to improve amenity, occupant health and leaseability, which has had a huge impact.

"NABERS Energy for apartment buildings has the potential to deliver those same benefits to the growing number of Australians that rent and own apartments, if it is supported by sensible, well-targeted policies and programs. We're looking forward to working with all levels of government including local governments — to make this new NABERS tool a success."

The Property Council of Australia has added its support for the tool, with CEO Ken Morrison saying it "reflects the property industry's willingness to work with government on sensible and cost-effective measures which reduce emissions".

"Rating tools like this one provide better information for everyone," said Morrison. "This is a practical measure that will reduce emissions and costs for landlords and tenants.

"We support the development of coherent national initiatives such as this and encourage governments to bring this level of coordination to other residential sustainability policies, where initiatives are often fragmented and inconsistent among jurisdictions."

NABERS Energy for apartment buildings will embark on its development phase over the coming months, with a pilot phase expected to be run in 2017. The tool is also expected to include a NABERS Water tool, to help occupants of apartment buildings to assess and improve their water performance.

## Australian Utility Week 2016

Australian Utility Week 2016 is a large-scale expo dedicated to the theme 'Building digital futures'. Set to take place from 29-30 November 2016 at Australian Technology Park, it is said to be the only event that focuses exclusively on digital and customer-facing innovations.

Now in its 14th year, the event will feature a range of speakers, including Australian and international utility leaders, smart grid technology innovators and R&D professionals. Attendees can visit over 150+ exhibitors plus other free sessions on the expo floor, including the Innovation Zone, Technical Zone, Start Zone, Focus Groups and Track 1 of the conference.





The event provides a one-stop shop for participants to gain new knowledge, discuss the current issues facing in the industry and network with 1500+ utility professionals from the electricity, gas and water sectors. Book your free visitor pass now by visiting http://www.australian-utility-week.com/.

What: Australian Utility Week 2016

When: 29-30 November 2016

Where: Australian Technology Park, Sydney Web: www.australian-utility-week.com

# Reduce maintenance and operating costs

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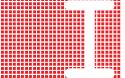


Bredel
Hose Pumps

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# Put politics aside it's time to take the power back



t's little wonder that our trust in political leaders to do the right thing and make the right decisions about our future has been

shaken to the core.

We are confronting a trifecta of uncertainty - Brexit, a cliffhanger Australian election and Donald Trump in real contention for the White House.

In Australia, a poll by independent think tank The Australia Institute found that in the wake of the federal election, 90% of people want tougher laws on truth in political advertising.

Meantime, a Gallop poll in the US revealed that 81% of Americans think politicians put their own interests first.

If it is indeed the case that our political leaders are inherently self-interested, can we count on them to make the right call on matters impacting our future? Important issues such as renewable energy, emissions targets and energy efficiency?

Taking our energy future into our own hands It's Ecocentric's view that the expectation we place upon our political leaders to shape our energy future is misguided. We can and need to take the power back.

We need to take steps outside of politics in order to effect meaningful change.

The wasteful and inefficient policies of government, coupled with inaction by their supporting bureaucracies, is choking energy efficiency initiatives in a quagmire of red tape.

When it comes to inefficiencies, the French President's hairdressing bill is a deplorable example. He spends more on haircuts each month than 10 Australian households spend on their annual electricity bill.

It doesn't need to be this way. We don't need to wait for governments to legislate on emission reduction schemes or renewable energy targets; we have the power right now to make the switch to more innovative technologies.

The free market and competition between energy providers is already driving this shift.

A recent report by investment bank Morgan Stanley predicts that 10% of Australian households will be using battery storage by 2020. That's the equivalent of one million households.

This transition to clean energy is happening in spite of government policy, not because of it.

Solar power and battery storage are already challenging conventional electricity generation and distribution models.

The next game changer for the industry will be access to real-time monitoring of electricity consumption for each and every connected device.

the way. Demand side management is an example of a policy setting which at face value is a mechanism for managing peak loads, but may actually prevent wide-scale investment in energy efficiency initiatives.

The way electricity tariffs are structured also has the potential to distort price and consumption if a flat rate is charged regardless of time of use.

Electricity tariffs should be linked to real-time monitoring data so that prices more accurately reflect the changing cost of supply during the day, allowing customers to choose when they operate appliances.

Ecocentric believes that transparency is the key to taking the power back. Taking the power back from government and from the

The wasteful and inefficient policies of government, coupled with inaction by their supporting bureaucracies, is choking energy efficiency initiatives in a quagmire of red tape.

The absence of meaningful device-level energy data is the biggest single barrier to energy efficiency and access to it will be the biggest driver of success.

Real-time energy use data will truly return the power to the people.

#### Energy efficiency in spite of government policy

The best way for governments to support our clean energy future is to ensure they don't create impediments or schemes that manipulate outcomes to produce perverse results. Put simply, they should get out of

slick marketing campaigns of those utilities that are fighting to defend a business model that is broken while breaking our planet. Once businesses and households have access to real-time data, they will be empowered to take affirmative action for a clean energy future.

The corridors of power are powerless to stop the rapid uptake of renewables and energy efficiency initiatives.

If our political leaders are looking to implement good energy policies, perhaps the best policy is to get out of the way.



Tim Bray is the Chief Executive of energy efficiency company Ecocentric Energy. Ecocentric Energy is helping businesses around the world understand their electricity use and reduce energy consumption.



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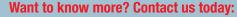
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