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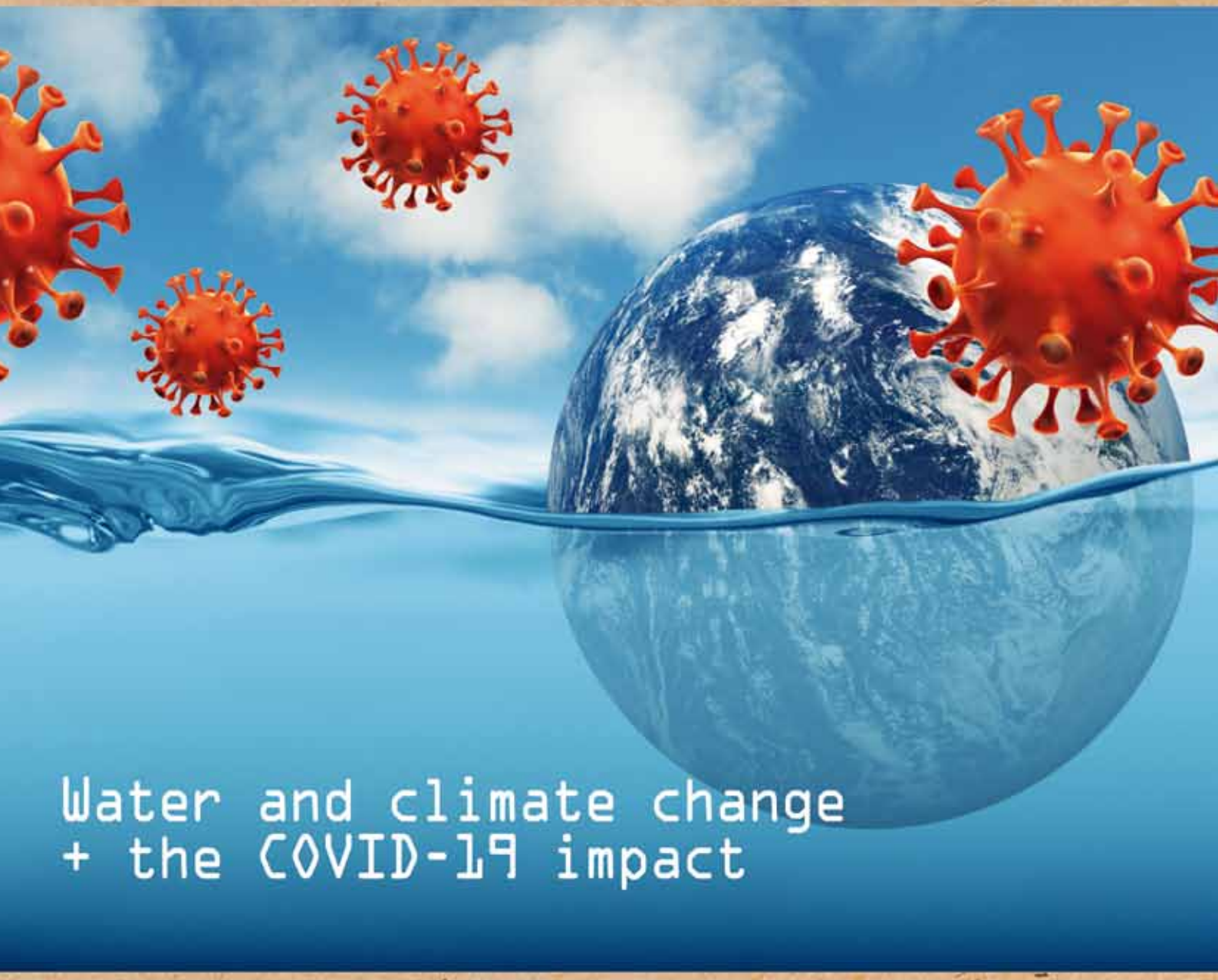

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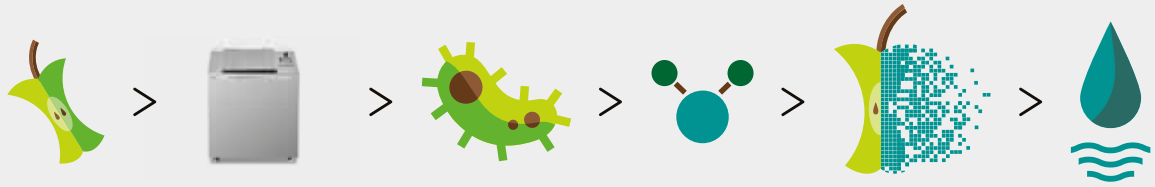

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APR/MAY 2020

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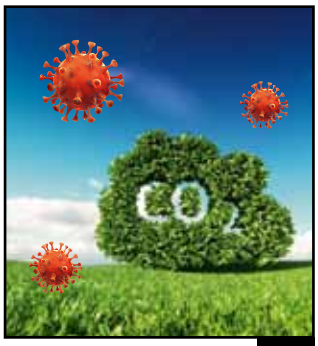

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WORDS FROM THE EDITOR

With droughts, bushfires and now the COVID-19 pandemic, 2020 is not the year we all imagined. In the world of sustainability, we were all looking forward to hearing from the experts at many upcoming events, including Ozwater and Smart Energy, which have all now been postponed. On a personal note, we were looking forward to weddings, holidays and get-togethers with friends, which have also now all been postponed or cancelled.

However, one of the positive outcomes from the pandemic is the environmental benefit. Emissions across the globe could be reduced by 50% or more as aviation is grounded and people are staying at home to stop the spread. Water quality could also be improved, which has already been evidenced in the pictures emerging of crystal clear water in the canals of Venice. In our feature article this issue, we explore these environmental benefits more fully in the hope that this will inspire further climate change action in the future when we all return to some sort of normality.

On another note, the pandemic has also highlighted the importance of maintaining good old home-grown manufacturing in Australia. Of course, many manufacturing plants have already closed down due to economic factors or are simply moving to offshore processing but the ones that are still here are proving their worth tenfold. Not only are they keeping their previous supply chains rolling, they are diversifying to meet the demands for critical supply chain shortages such as surgical masks.

Stay healthy everyone!

Carolyn Jackson

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connecting industry

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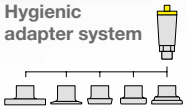

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Looking Forward VEGA

A brewing force

Australia's luxury tea brand T2 announced this year that it has achieved B Corp accreditation, making it one of the biggest retailers with B Corp status in Australia. The stamp of approval reflects the company's high standards of social and environmental performance to be a business to leverage not just for growth but as a force for good. The Global CEO of T2, Nicole Sparshott, explains how she has used leadership to leverage profit, not just for growth but as a brewing force for good.

Short for Beneficial Corporation, B Corps are redefining success in business by challenging companies to build a more inclusive and sustainable economy. In order to achieve the accreditation, B Corp requires companies to complete the B Impact Assessment; you'll need to score at least 80 out of a maximum 200 and it reviews your corporate governance, workers, community, environment and customers of the brand.

For us at T2, it's kind of a big deal to have joined the global B Corp community of over 3000 leading companies that are prioritising their social and environmental responsibilities through public transparency and legal accountability.

We began the journey to become a certified B Corp in 2018 and it has certainly been an eye-opening two-year process with every area of the business being assessed and giving us insight into ways to reduce our impact on the planet, and be leaders of change. We hit other major milestones along the way, like achieving a carbon-neutral status for our entire operation in 2019.

Prioritising the planet

While sustainability is an important practice to implement, it rings true for our specific industry.

In the past few years we have begun to see the impact of the climate on tea in a significant way — from droughts in South Africa that threatened rooibos crops to the ever-changing and unpredictable conditions in Darjeeling each year. Tea is a sensitive crop and cannot grow everywhere — the more harm we do to our environment, the less likely it is that future generations will be able to enjoy a drink that plays a significant role in cultures globally. Our work continues in the areas of sustainable sourcing of ingredients, supporting and improving the lives of the communities we source from.

Achieving B Corp has also provided incredible insights into how to improve our sustainable manufacturing practices. At T2,

over 90% of packaging is now recyclable, re-usable or compostable, and we are on track to reach 100% in 2021. As an example, T2 retail bags are now made from uncoated paper without any plastic lamentation, making them 100% recyclable.

People

What I really love about B Corp is that it focuses on people as much as it does on planet. For us at T2, the core of our brand is that diversity in all forms makes the world more beautiful and what we exist to do is unite the world for good by promoting social inclusion and belonging for some of the most vulnerable and marginalised groups in our society. We celebrate, support and welcome people of all faiths, cultures, beliefs, gender identities, orientations and experiences. I'm proud to say that over half of our leadership positions and three-quarters of the global workforce are women.

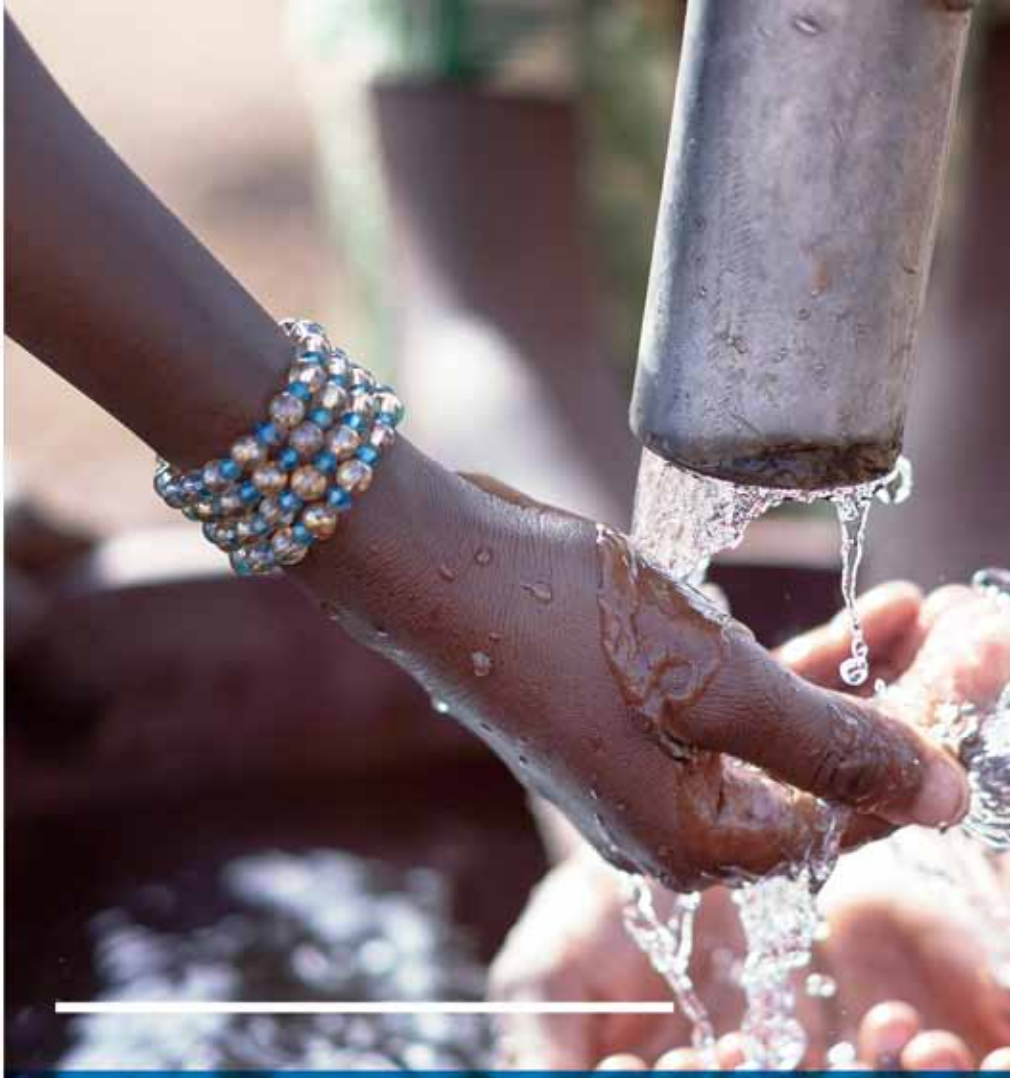
Some of our B Corp milestones have been the introduction of a diversity inclusion action plan, the introduction of volunteer leave for all our team members globally, refreshed recruitment strategy including the introduction of blind recruiting and linking our individual goal plans to drive purpose.

And purpose

Australian retailers and businesses have a unique opportunity — to make a difference and show customers and employees that they are balancing profit with purpose through responsible and value-driven practices. As many businesses set to achieve higher standards, the B Corp has created the ultimate benchmark for balancing profit and purpose.

Fortunately, the future holds unparalleled opportunities for businesses that want to do good, rather than harm. Achieving B Corp isn't an end goal for T2, rather the beginning. We have many more milestones and will continue to drive positive people and planet impacts, so that not only can we have the best tea in the world, but we can be the best for the world.

Nicole Sparshott (Nicky) has around 24 years of leadership experience in global corporations, spanning from food and beverage to health and personal care sectors. In 2011, she was promoted to VP Refreshment at Unilever where she led a portfolio of ice cream and beverage brands across Asia Pacific. In 2016, she was appointed CEO of T2 Tea, a company which took its first sip 20 years ago in Melbourne and now has over two hundred tea flavours like Fruitalicious and Jade Mountain and favourites such as French Earl Grey and Melbourne Breakfast. Nicky is also a board director of the World Wildlife Fund Australia.



Good water management could save our planet

Water use has increased sixfold over the past century and is rising by about 1% a year. However, it is estimated that climate change, along with the increasing frequency and intensity of extreme events — storms, floods and droughts — will aggravate the situation in countries already currently experiencing 'water stress' and generate similar problems in areas that have not been severely affected. The 2020 UN World Water Development Report, *Water and Climate Change*, highlights the fact that poor water management tends to exacerbate the impacts of climate change, not only on water resources but on society as a whole.

The Chair of UN-Water, and President of the International Fund for Agricultural Development (IFAD), Gilbert F Houngbo, said: "If we are serious about limiting global temperature increases to below 2°C and achieving the Sustainable Development Goals by 2030, we must act immediately. There are solutions for managing water and climate in a more coordinated manner and every sector of society has a role to play. We simply cannot afford to wait."

The Director-General of UNESCO, Audrey Azoulay, stresses "that water does not need to be a problem — it can be part of the solution. Water can support efforts to both mitigate and adapt to climate change."

Indeed, water quality will be affected by increased water temperatures and a decrease in dissolved oxygen, leading to a reduction in the self-purification capacity of freshwater basins. We will see increased risks of water pollution and pathogen contamination caused by floods or higher concentrations of pollutants during periods of drought. In addition to the impact on food production, the effects on physical and mental health — linked to disease, injury, financial loss and the displacement of people — are therefore likely to be considerable.

Many ecosystems, particularly forests and wetlands, are also under threat, reducing biodiversity. Water supplies will be affected, not only for agriculture — which accounts for 69% of freshwater withdrawals — but also for industry, energy production and even fisheries.

Much of the impact of climate change on water resources will be manifested in the tropics, where most developing countries are located, with potentially apocalyptic consequences for small island states, some of which could be wiped off the map. Mountainous areas are also exceptionally vulnerable through impacts on mountain glaciers and snowcaps, which show a decreasing trend almost everywhere in the world. The authors recognise, however, that a number of uncertainties remain, particularly at the local level and due to the seasonal variability of rainfall patterns.

Suggested solutions: adaptation and mitigation

In the face of these threats, the report highlights the two complementary strategies to be implemented — adaptation and mitigation:

- Adaptation encompasses a combination of natural, technical and technological options, as well as social and institutional measures to mitigate damage and exploit the few positive consequences of climate change. It is likely to have very rapid benefits, mainly at the local level.
- Mitigation consists of the human actions needed to reduce greenhouse gases (GHGs) emissions while exploiting carbon sinks to reduce the amount of CO_2 and other GHGs in the atmosphere. It can involve large geographical areas, but with gains that may spread over decades. However,

> **Water can support efforts to both mitigate and adapt to climate change.**

the possibilities for mitigation in water management remain largely unrecognised.

Improved wastewater m anagement

Wastewater treatment also contributes to climate change as it generates GHGs, accounting for an estimated 3 to 7% of all emissions. These emissions arise from both the energy required for wastewater treatment and the biochemical processes used. But because of the decomposition of the organic matter it contains, untreated wastewater is also a major source of methane, a powerful greenhouse gas. The report points out that wastewater harbours more energy than is needed for its treatment, provided, of course, that it is harnessed. It is estimated that worldwide, between 80 and 90% of wastewater is discharged to the environment without any form of treatment.

In concrete terms, the optimal management of water resources means investing in modern treatment techniques that allow for the extraction of methane from organic matter and then use this biogas to generate the energy needed to run the process, as is already done in water-scarce countries such as Jordan, Mexico, Peru and Thailand. These techniques have enabled the public utilities concerned to reduce emissions by thousands of tonnes of CO_2, while making financial savings and improving the quality of the service.

The report also mentions innovative water management interventions such as fog capture, or more traditional ones such as wetland protection, as well as proven 'conservation agriculture' techniques. These make it possible to preserve soil structure, organic matter and moisture, despite lower rainfall. Similarly, the 're-use' of partially treated wastewater for agriculture and industry, without necessarily making it safe to drink, is another interesting approach.

Prioritising water

Unfortunately, note the authors, while the need to combat climate change through better management of the water cycle is well recognised, it is not being translated into reality. "The word 'water' rarely appears in international climate agreements," observed Azoulay. The 'nationally determined contributions' submitted by States under the Paris Agreement remain general in nature, without proposing specific plans for water. While a majority of countries recognise water in their 'portfolio of actions', few of them have actually calculated the costs of these actions and even fewer have put forward specific projects. Meanwhile, the possibilities for synergies between adaptation and mitigation measures are often neglected.

Accessing climate funds

The question of finance is obviously crucial. The authors point out that water resources management and water supply and sanitation services are underfunded and require greater attention from States. They argue that there are increasing opportunities to systematically integrate adaptation and mitigation planning into water-related investments, in order to make them more attractive to donors.

A good example of this is a Green Climate Fund project in Sri Lanka. This aims to improve irrigation systems in vulnerable village communities and promote climate-smart agricultural practices in three river basins, offering both climate adaptation and mitigation benefits, while conserving water and protecting drinking water sources.

Various water and climate change initiatives can also bring co-benefits such as job creation, improved public health, poverty reduction, promotion of gender equality and improved livelihoods, further enhancing their attractiveness to donors.

The adoption of integrated adaptation and mitigation measures is a win-win proposition, concluded the authors of the report. They are clearly beneficial for the sustainable management of water resources and for the human right to safe drinking water and sanitation. They also directly address the causes and consequences of climate change, including in terms of the response to extreme weather events. Finally, they contribute to the achievement of several of the Sustainable Development Goals.

The United Nations World Water Development Report is UN-Water's flagship report on water and sanitation issues, focusing on a different theme each year. The report is published by UNESCO, on behalf of UN-Water, and its production is coordinated by the UNESCO World Water Assessment Programme. Launched in conjunction with World Water Day, the report provides decision-makers with knowledge and tools to formulate and implement sustainable water policies.

$198m solar farm opens in Victoria

Neoen has commenced full-scale commercial operation at its Numurkah Solar Farm in Northern Victoria, officially launched by the state's Minister for Energy, Environment and Climate Change, Lily D'Ambrosio.

The $198 million, 128 MWp solar farm, featuring 373,839 solar panels, will produce 255 GWh of emission-free, renewable energy each year — the annual equivalent of taking 77,000 cars off the road and enough to power 48,000 Victorian households. With construction completed by Downer in April 2019, the facility will power Melbourne's tram network and the Laverton steel works.

"The Numurkah Solar Farm will play an important role in supporting the transformation of our energy network towards clean, renewable energy and reaching our renewable energy target of 50% by 2030," D'Ambrosio said.

In addition to the supply of sustainable energy to the Australian market, Neoen is committed to local development and community growth. The renewable energy producer has established a Numurkah Solar Farm Community Fund to provide financial support to community groups to grow the region.

Neoen Australia Managing Director Louis de Sambucy said, "Numurkah is an important project for Neoen, and the commencement of commercial operations here is a significant milestone for our operations. We sincerely thank our stakeholders — the Victorian Government, the Numurkah community, Moira Shire Council, Powercor Australia, the Australian Energy Market Operator (AEMO) and SIMEC Zen Energy — for helping us make this project a success.

"Neoen will continue to work with its partners, the local communities, councils and state governments to ensure that the people of Australia enjoy clean, reliable and affordable electricity for decades to come."

Neoen's Chairman and CEO, Xavier Barbaro, said, "We are very proud to be bringing into service the Numurkah Solar Farm. With this project, Neoen confirms its commitment as a long-term owner and operator contributing to Australia's renewable energy transition.

"We are determined to continue growing our asset base in Australia, and we will pursue all future developments with the same integrity and respect for local areas."

Neoen Australia

www.neoen.com

Fine screen technology simplifies wastewater treatment

Wastewater fine screen technology is designed to curtail blockages, spills and their associated maintenance and safety issues in municipal and industrial wastewater treatment plant (WWTP) applications.

To simplify fine screening processes, CST Wastewater Solutions has engineered horizontal in-channel rotary drum screening technology. The in-channel, low-maintenance, stainless steel design — with low fluid head loss at peak flows for increased solids removal efficiency — is used on wastewater flows and is custom-engineered for conditions in Australia and New Zealand.

"Advantages of this technology when dealing with fine screening of larger flows (5 mm or finer screening on flows up to 2000 L/s flow) include mechanical simplicity, self-cleaning and high-efficiency screening for reduced maintenance and cheaper whole-of-life costs compared with other types of screens, such as band and inclined drum screen designs," said CST Wastewater Solutions Managing Director Michael Bambridge.

CST's inline rotary fine screening avoids blockages, short-circuiting, maintenance and safety issues.

Key to functionality is the configuration of the design — the screening drum is installed horizontally semi-submerged in line with the incoming wastewater. The plate at the back of the drum directs flow radially through the mesh to optimise solids separation and self-cleaning.

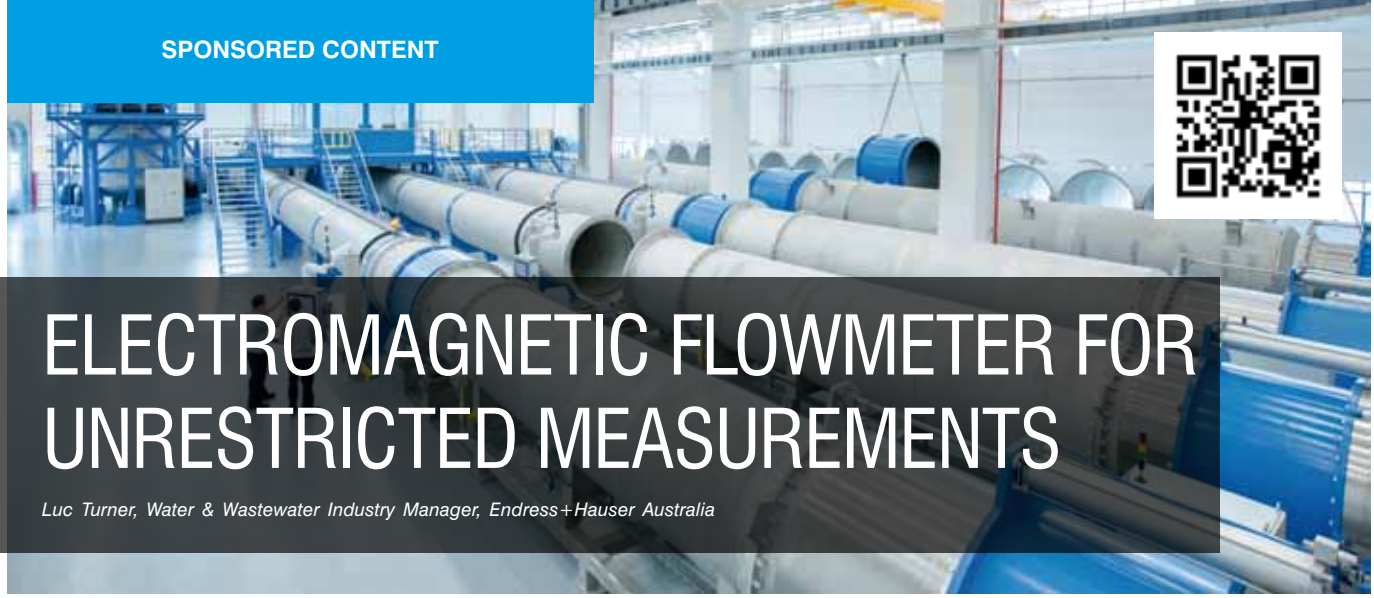
An internal hopper collects the screenings, which are flumed out to the integral lifting and dewatering screw, to efficiently dewater and reduce screenings volume. The lifting screw is shaftless to avoid any blockages, even in the presence of long rags and fibrous products, and includes screen and screening washing. Lifting and screenings handling can also be conducted outside the channel, which increases options for additional washing and dewatering, according to individual applications.

"Screening and the solids lifting and dewatering are separate operations, using high-efficiency screening technology to convert the high-flow, low-solids wastewater to low-flow, high-solids dewatering," Bambridge said.

"Separate screening and lifting equipment makes access simpler for more cost-effective housekeeping and maintenance for lower whole-of-life costs."

CST Wastewater Solutions

www.cstwastewater.com



ELECTROMAGNETIC FLOWMETER FOR UNRESTRICTED MEASUREMENTS

Luc Turner, Water & Wastewater Industry Manager, Endress+Hauser Australia

In the water and wastewater industry, high measurement accuracy from electromagnetic flow metering is indispensable for optimal process control.

It has long been an industry standard that any electromagnetic flowmeter installations require at least five straight run pipe diameters upstream and two pipe diameters downstream from the electrode plane in order to comply with the specified accuracy. Why? Electromagnetic flowmeters like stable flow profiles.

Pipeline bends, valves, insertion devices and tee-fittings disturb the flow profile of measured liquids, resulting in increased measurement errors. In many cases, the upstream and downstream pipe lengths are simply not available. Plant operators had a choice — either comply with the recommended installation guidelines or install a flowmeter which can sufficiently handle the changing flow profile. Flowmeters with constricted measuring tubes were developed in order to condition the disturbed flow profile. This worked, but a sensor tube restriction results in a pressure drop and thus increased pumping/energy costs.

The Proline Promag W 0 x DN is the world's first electromagnetic flowmeter without measurement tube restriction to allow reliable flow measurement independent of the flow profile and mounting location. With the full bore design — there is no pressure loss across the flowmeter. Reliable measurement values and flexible installation are now a combination and no longer a contradiction. Without the need for any inlet or outlet runs, they are particularly suitable for installation in tight spaces, such as compact systems or skid packages. The Promag W 0 x DN can easily handle swirling flow profile that occur downstream of obstacles such as pipe bends and insertion devices, tee-junctions and even downstream of unknown obstacles such as build-up on pipe walls, protruding seals or different inside diameters.

Innovative measurement signal analysis

The new and innovative measuring concept of Promag W 0 x DN features multiple measuring electrodes that detect the flow. For DN25 to DN80, two pairs of measurement electrodes are installed. For DN100 and above, three pairs of measurement electrodes are installed. This generates a substantially higher density of measured data than for standard devices. Together with the refined signal analysis, reliable measurement results for swirl conditions are also possible.

Transmitters for seamless system integration

The Promag W 0 x DN can be combined with different transmitters: as a compact version (Proline 300 and 400) or as a remote version (Proline 400 and 500) with up four outputs. Proline transmitters make no compromises in terms of performance and accuracy. The digital signal processing begins in the intelligent sensor and is the basis for a reliable, highly accurate measurement. Full access to all measurement data, including diagnostic data acquired by Heartbeat Technology, is possible at any time thanks to digital data transmission or the freely combinable inputs and outputs.

Application examples

Applications for the Promag W 0 x DN full bore flowmeter are numerous and can enable large cost savings both during the design and construction phase of projects.

A great application for the Promag 0 x DN would be use on dewatering skids in the mining industry. Mine dewatering has a number of critical objectives such as the controlling inflows to create workable conditions, reduced blasting costs and reduction of haulage costs. Additionally, the water itself is important for its role in mineral processing, dust suppression and slurry transport. On some sites, there may be hundreds of dewatering skids which each require the use of flowmeters. It's very common for connecting pipes to have mis-matching internal diameters. This can result in a large disturbance to the flow profile and inaccurate measurement results for a standard flowmeter. When considering the number of dewatering skids on site, this combined inaccuracy could be enormous. With the Promag W 0 x DN, an accuracy of at least 0.5% is guaranteed in these applications.

There are many Promag W 0 x DN applications in the Water/Wastewater industry too. Let's consider a de-salination plant, where inlet flowmeters can often be 1000 mm or more in diameter. In a standard electromagnetic flowmeter installation, you would require a significant length of straight pipe on both the inlet and outlet to ensure the flowmeter measures within its nominated accuracy. With the Promag W 0 x DN, this is no longer an issue, and the flowmeter can be installed directly before or after bends. This can result in significant cost savings during the construction phase. We can apply these benefits not only to the inlet section, but throughout general plant operations. There are numerous opportunities to reduce the footprint of an installation with the Promag W 0 x DN.

Flow metering across industry has trended towards an increasing reliance on accuracy and reliability. With the Promag W 0 x DN, both of these have been addressed for applications that were previously impossible with standard flowmeters.

For further information, visit cx.endress.com/au-promag-w-0dn

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Modifying nanocarbons to purify water

Heavy metals in drinking water represent a serious threat to human health in many parts of the world — particularly developing countries — with the possibility of some heavy metals accumulating in the body over time and leading to cancers and organ damage. In addition to the health threats of contaminated water linked to poor sanitation, metals such as mercury, lead, cadmium and arsenic can be present in untreated and unprotected sources of water.

Nanocarbons are currently under investigation for their ability to purify water and wastewater by adsorbing dyes, gases, organic compounds and toxic metal ions. Nanocarbons can adsorb heavy metal ions such as lead and mercury onto their surfaces via molecular attraction forces — but this attraction is weak, meaning that they aren't efficient adsorbents on their own.

To improve adsorption, researchers are adding molecules such as amino groups to nanocarbons, which form stronger chemical bonds with heavy metals. They are also investigating ways to use all available surfaces on nanocarbons for metal ion adsorption, including the surfaces of their inner pores. This would enhance their capacity to adsorb more metal ions at a time.

Research from a team of scientists at Nagoya University, Japan may help in the effort to improve universal access to clean water via a one-step process that improves the ability of nanocarbons to remove toxic heavy metal ions from water.

Materials scientist Nagahiro Saito from Nagoya University's Institute of Innovation for Future Society, together with colleagues, has developed a new method for synthesising an 'amino-modified nanocarbon' that more efficiently adsorbs several heavy metal ions compared with conventional methods. The findings are published in *ACS Applied Nano Materials*.

The team mixed phenol as a source of carbon, with a compound called APTES as a source of amino groups. This mixture was placed in a glass chamber and exposed to a high voltage, creating a plasma in liquid. This 'solution plasma process' was maintained for 20 minutes, following which black precipitates of amino-modified carbons formed and were collected, washed and dried.

A series of tests showed that the amino groups had evenly distributed over the nanocarbon surface, including into its slit-like pores.

"Our single-step process facilitates the bonding of amino groups on both outer and inner surfaces of the porous nanocarbon," Saito said.

"This drastically increased their adsorption capacity compared to a nanocarbon on its own."

The researchers put the amino-modified nanocarbons through 10 cycles of adsorbing copper, zinc and cadmium metal ions, washing them between each cycle. Although the capacity to adsorb metal ions decreased with repetitive cycles, the reduction was small, making them relatively stable for repetitive use.

Finally, the team compared their amino-modified nanocarbons with five others synthesised by conventional methods. Their nanocarbon had the highest adsorption capacity for the metal ions tested, indicating there are more amino groups on their nanocarbon than the others.

"Our process could help reduce the costs of water purification and bring us closer to achieving universal and equitable access to safe and affordable drinking water for all by 2030," Saito said.

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Is water the solution for renewable energy storage?

A new study has suggested that seasonally pumped hydropower storage (SPHS) could be the answer for storing renewable energy over the long term.

Seasonal pumped hydropower storage means pumping water into a deep storage reservoir, built parallel to a major river, during times of high water flow or low energy demand. When water is scarce or energy demand increases, stored water is then released from the reservoir to generate electricity.

IIASA research published in the journal *Nature Communications* showed that compared with other mature storage solutions, such as natural gas, there is considerable potential for SPHS to provide highly competitive energy storage costs.

"The energy sectors of most countries are undergoing a transition to renewable energy sources, particularly wind and solar generation," said IIASA postdoc Julian Hunt, the study's lead author.

"These sources are intermittent and have seasonal variations, so they need storage alternatives to guarantee that the demand can be met at any time. Short-term energy storage solutions with batteries are underway to resolve intermittency issues; however, the alternative for long-term energy storage that is usually considered to resolve seasonal variations in electricity generation is hydrogen, which is not yet economically competitive."

The new study provides a global, high-resolution analysis of the potential and costs for SPHS technology. In their analysis, researchers assessed the theoretical global potential for storing energy and water seasonally with SPHS, focusing on the locations with the highest potential and lowest cost. They also analysed different scenarios where the storage of energy and water with SPHS could be a viable alternative. The study included topographical, river network and hydrology data, infrastructure cost estimation and project design optimisation, to identify technically feasible candidate sites.

The study shows that water storage costs with SPHS plants vary from US$0.007–0.2 m^3, long-term energy storage costs vary from US$1.8–50/MWh and short-term energy storage costs vary from US$370–600/kW of installed power generation capacity, considering dam, tunnel, turbine, generator, excavation and land costs. The estimated world energy storage potential below a cost of $50/MWh is 17.3 PWh, which is approximately 79% of the world electricity consumption in 2017.

The researchers found that significant potential exists for SPHS around the world, in particular in the lower part of the Himalayas, Andes, Alps, Rocky Mountains, northern part of the Middle East, Ethiopian Highlands, Brazilian Highlands, Central America, East Asia, Papua New Guinea, the Sayan, Yablonoi and Stanovoy mountain ranges in Russia, and a number of other locations with smaller potential.

"Concerns about the intermittency and seasonality of wind and solar can be valid, but are also sometimes exaggerated," said IIASA researcher Edward Byers, a study co-author.

"This study demonstrates that there is an extremely high potential for SPHS to be used across much of the world, providing a readily available, affordable and sustainable solution to support the transition to sustainable energy systems and overcome real and perceived barriers to high shares of renewable generation."

The study also addresses some of the potential environmental concerns related to hydropower. Because SPHS reservoirs are deep and constructed parallel to, rather than within, the course of a river, the environmental and land use impacts can also be up to 10–50 times smaller than traditional hydropower plants.

"With the need for a transition to a more sustainable world with lower CO_2 emissions, renewable energies and energy storage will play a major role in the near future. Given the vast untapped and cheap potential of SPHS, it will soon play an important role in storing energy and water on a yearly basis," said Hunt.

Smart Water Solutions

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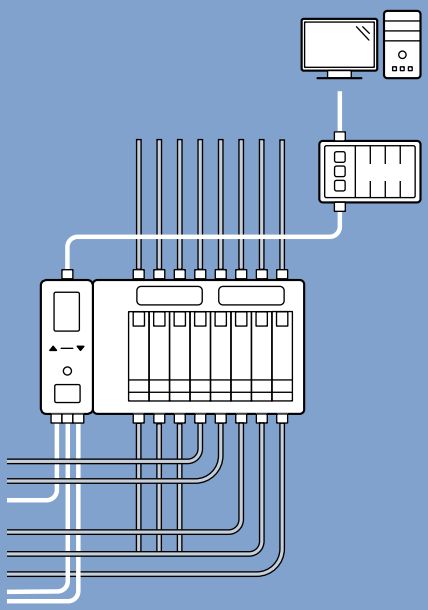

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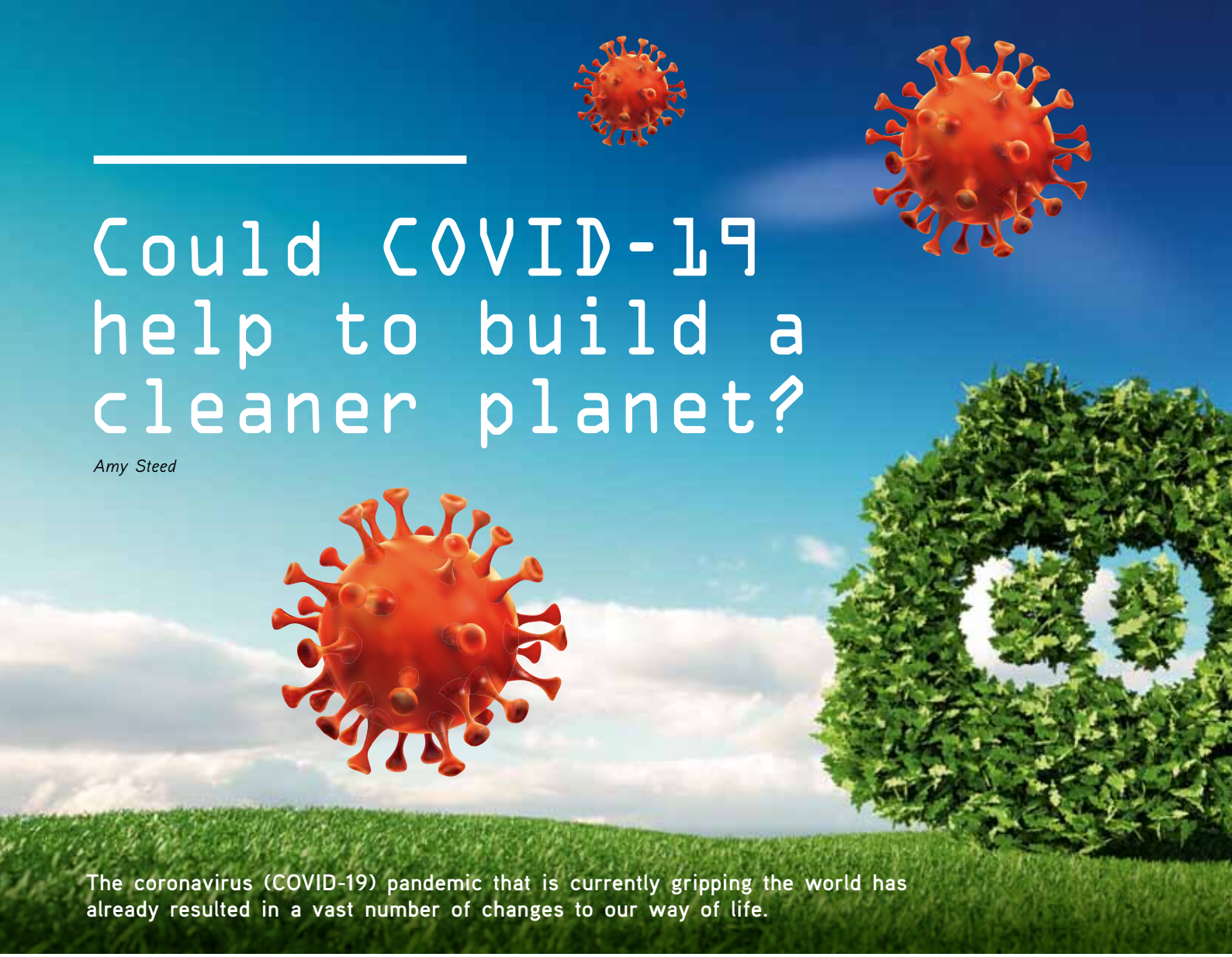
FLUID CONTROL SYSTEMS

Could COVID-19 help to build a cleaner planet?

Amy Steed



The coronavirus (COVID-19) pandemic that is currently gripping the world has already resulted in a vast number of changes to our way of life.

International and domestic movements have been curtailed by travel bans and the grounding of entire airline fleets, social distancing regulations are in full swing and many workplaces are moving to online and virtual spaces in the interests of preventing illness.

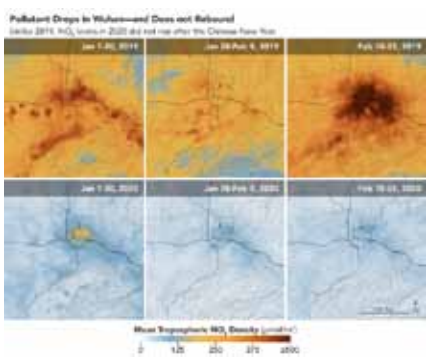
In the midst of all these limitations and changes, however, one positive aspect appears to be emerging — a drop in the amount of pollution around the globe.

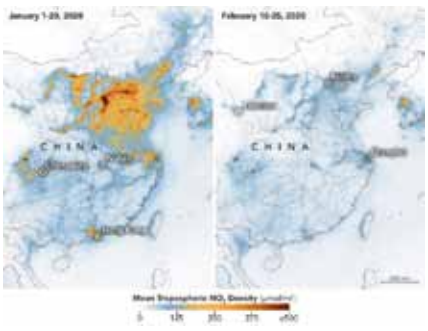
From pictures of crystal clear water in the canals of Venice flooding the media, to reports of blue skies and improved air quality in some of the most pollution-choked parts of the world, the economic slowdown associated with COVID-19 has resulted in an improved earth — which clearly demonstrates how much human activity was affecting it in the first place. Hopefully, when things return to normal, this evidence will provide a powerful voice to encourage more sustainability initiatives in the future.

Significant drop in nitrogen dioxide levels over China

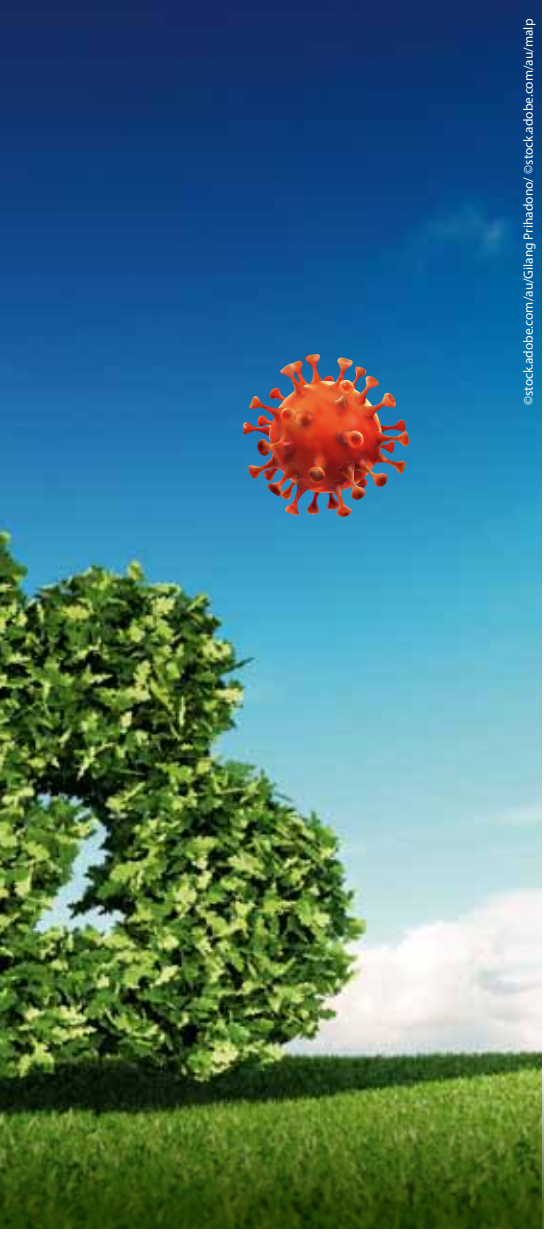
Pollution monitoring satellites from both NASA and the European Space Agency (ESA) have detected significant decreases in nitrogen dioxide (NO_2) over China. The Copernicus Sentinel-5P satellite observed a decrease of fine particulate matter air pollutants during February 2020, when comparing data to the previous three years. By combining satellite observations with detailed computer models of the atmosphere, studies indicated a reduction of around 20–30% in surface particulate matter over large parts of China. The evidence would seem to indicate that this change is partly linked with the limitations placed on human activities following the outbreak of COVID-19.

According to ESA, nitrogen dioxide concentrations released by power plants, industrial facilities and vehicles in all major Chinese cities saw a steep drop between late-January and February 2020. The decrease in concentrations also coincided with Lunar





NASA Earth Observatory images by Joshua Stevens, using modified Copernicus Sentinel 5P data processed by the European Space Agency.



Grounded

- Commercial aviation emissions in Australia could drop by over 50% in 2020 as a result of the COVID-19 pandemic.
- COVID-19-related cuts to commercial air traffic have already resulted in approximately a 10.3 Mt reduction in global CO_2 emissions over February and March 2020.
- International Air Transport Association (IATA) now projects a 38% cut to air travel in 2020 which equates to a 352.7 Mt fall in global civil aviation emissions compared to 2019, and a 8.8 Mt CO_2 fall in Australian aviation emissions compared to 2019 (37% decrease).
- Emissions from Australian commercial aviation could decrease by up to 13.2 Mt CO_2 in 2020 (56% decrease from 2019) under an extreme scenario of continual grounding of most Qantas and Virgin planes for 9 months.
- Business travel may not rebound to 2019 levels, given the systemic shift to online conferencing and communication and weakened corporate budgets post COVID-19.
- Under the UN deal on international aviation emissions, major airlines have committed to carbon neutrality using 2020 as the baseline year, which could end up as a record low year for emissions.

Source: Grounded, Australia Institute Climate & Energy Program, April 2020

New Year celebrations, which usually sees a similar drop in NO_2 each year.

NASA said that although the Lunar New Year may have been a contributor, it is believed that the decrease is "more than simply a holiday effect or weather-related variation". In a preliminary analysis, NASA researchers compared NO_2 values detected by OMI (the Ozone Monitoring Instrument on NASA's Aura satellite) in 2020 with the average amounts detected at this time of year from 2005–2019. In 2020, NO_2 values in eastern and central China were 10–30% lower than what is normally observed for this time period.

"We can certainly attribute a part of the nitrogen dioxide concentration reduction to the impact of the coronavirus. We currently see around a 40% reduction over Chinese cities; however, these are just rough estimates, as weather also has an impact on emissions," said Claus Zehner, ESA's Copernicus Sentinel-5P mission manager, in a statement.

"We are conducting a detailed scientific analysis which will soon provide more insights and quantified results in the following weeks and months."

Italy's air quality has also improved

In Italy — now considered the 'epicentre' of the COVID-19 outbreak — a similar drop in NO_2 levels has been noted in data from the Copernicus Sentinel-5P satellite. According to ESA, the reduction is "particularly visible in northern Italy, which coincides with its nationwide lockdown to prevent the spread of the coronavirus".

A video has been released by ESA which maps out the fluctuation of nitrogen dioxide concentrations across Europe between the dates 1 January 2020 and 11 March 2020. The animation uses a 10-day moving average, and demonstrates the remarkable reduction of pollution above the country during this time frame.

"The decline in nitrogen dioxide concentrations over the Po Valley in northern Italy is particularly evident," Zehner said.

"Although there could be slight variations in the data due to cloud cover and changing weather, we are very confident that the reduction in concentrations that we can see coincides with the lockdown in Italy causing less traffic and industrial activities."

Creating a cleaner future

With fewer cars on the roads, fewer planes in the air and fewer emissions from factories and other big polluters, it seems logical that the health of the planet is going to improve. The COVID-19 situation lends weight to the notion that humans can in fact change their behaviour to tackle issues such as climate change and reducing pollution, the destruction of the planet is not inevitable and it is possible for our actions to make a difference.

"Science tells us that [pandemics] like COVID-19 will occur with increasing frequency. So cleaning up the streets is a basic investment for a healthier future," said European Public Health Alliance Acting Secretary General Sascha Marschang.

Going hard on soft plastics recycling

Nestlé and Australian recycler iQ Renew have announced a trial to find a way to collect, sort and process soft plastics. The trial will see soft plastics collected from over 100,000 homes through kerbside recycling and diverted from landfill.

The announcement comes alongside the federal government's National Plastics Summit, which aims to identify new solutions to the plastic waste challenge and mobilise further action from governments, industry and non-government organisations.

Soft plastics make up about 20% of the volume of Australian household landfill bins and are often found incorrectly placed in recycling bins. In order to meet Australia's National Packaging Targets — including the goal of recycling 70% of plastic packaging by 2025 — significant expansion of plastics recycling is needed. Soft plastic can be recycled via physical recycling, which turns soft plastic into other items such as heavy-duty outdoor plastic goods and roads; and chemical recycling, which turns soft plastic back into oil that can be used for making new plastic resins for fuel and other purposes.

iQ Renew CEO Danial Gallagher said there is an opportunity to turn soft plastic from a waste to a resource. "Most material recovery facilities can't separate soft plastic from other items in household recycling, so while soft plastic can be recycled, what we lack is a robust, scalable system to collect and process it using existing kerbside collection," Gallagher said.

"We've designed the trial so that at the front end, it will support householders to pre-sort their soft plastic and get it into a recycling stream, while behind the scenes, we'll test using the sorted soft plastic as a resource in a range of different manufacturing processes," he said.

Nestlé Australia CEO Sandra Martinez said Nestlé wanted to find sustainable paths to recycle packaging.

"While we are working to make all our packaging recyclable, we know that soft plastics is an area that needs greater focus and collaboration. We need to find ways to drive more recycling here," Martinez said.

"As Nestlé plans to reduce our virgin plastic use and increase the amount of food-grade recycled plastic packaging we use, we need plastic to be collected.

"Given the low amount of soft plastic collected from consumers today, we hope this trial can unlock the significant potential for soft plastic packaging to become a resource."

Martinez said Nestlé also wanted to help people to recycle effectively.

"Australians are enthusiastic recyclers and want better recycling systems that take plastic packaging out of landfill. This trial will uncover how households understand soft plastics collection and answer critical questions about how it affects their in-home recycling behaviour.

"We have a vision for Australia to have a waste-free future," she said.

The project will initially pilot 2000 households, then plans to expand to over 100,000 households later in the year, processing around 750 tonnes of soft plastic that would otherwise be sent to landfill.

ULTRASONIC WATER METER

The Axioma Qalcosonic W1 water meter from AMS Water Metering is now LoRaWAN Certified, confirming that the device fully conforms to the LoRaWAN specification. This specification is a standard declaring how a device must operate correctly according to LoRa technology to meet the LoRa Alliance conformity tests. The positive test results with the Qalcosonic W1 water meter confirmed that the device operates on LoRa networks with other manufacturers' equipment.

LoRaWAN is the widely used technology of the Internet of Things (IoT) — a low-power wide-area network (LPWAN) protocol designed to allow wireless communication of things operated on a battery in regional, national or global networks. The main advantage of LoRa technology is long distance data transfer, without requiring complex solutions. A LoRa module allows different sensors to connect and readings can be monitored via the network or wireless connection.

Using a static method to measure hot and cold water consumption, the unit has no moving parts and is sensitive to low flows, down to 1 L/h. The unit eliminates measuring deviations caused by sand, suspended particles or air pockets and features 9 digits, multi-line LCD, and total volume and instantaneous flow rate indication.

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CLOUD SOLUTION

The KOLIBRI Cloud from KELLER is designed to fill the needs of users that want to access their data anytime and from anywhere. The product allows pressure measurements such as fill levels or monitor limit values to be tracked remotely. The cloud solution is available to all KELLER AG customers without recurring costs.

With a personal login and SSL encryption, the KOLIBRI Cloud enables secure and convenient access to measured data. Measurements can be graphically displayed in real time and the export function allows users to export data into Excel and CSV formats. The integrated alarm system ensures the effortless monitoring of all measuring points, eg, if the water level is high or the battery level is low, a warning message will be sent by email.

Authentication and encryption are based on best practices and standards. The KOLIBRI Cloud API allows custom software to retrieve metrics via HTTPS in a standardised JSON format. In this way, the measurement data can be forwarded to users' own systems, visualised or processed further on users' display software. Open-source software and documentation help users build cloud solutions — based on the mechanisms of the KOLIBRI Cloud.

The cloud is compatible with all KELLER IoT devices: GSM and ARC series as well new remote data transmission units based on IoT protocols such as LoRa.

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Sustainable energy from waste

for a better future

Unlike all of Europe and most of Asia, Australia is rich in space. Our cities can sprawl — and they do. As such, our waste also sprawls into ever-expanding landfills, where it is, for want of a better word, wasted.

Australia is one of the biggest producers of municipal waste per capita in the world. Every year, Australia saves 25 million tonnes of waste from going to landfill. But it takes very little to make a truckload of separated waste unusable, which is the general waste problem.

Even some of the most environmentally savvy people don't fully understand where everything goes in our complicated waste and recycling system. For example, many of us think pizza boxes are an excellent candidate for recycling. After all, they're made of cardboard. But if there is any contamination with leftover food, pizza boxes cannot be recycled into new paper products. On top of this, there is still a considerable stream of unrecyclable waste — Municipal Solid Waste (MSW) — produced every day.

Landfills can be used in the rehabilitation of degraded mine sites. However, organic waste is a significant component of waste in landfills, and this produces methane. The upside is that the methane, and other landfill gases, can be captured and used as fuel to produce energy. That may sound like a less than sustainable process, but it turns out to be the right thing to do.

Methane is 25 times more potent than CO_2 as a greenhouse gas. Burn the methane to create energy and you get an equivalent amount of CO_2 and water. That's a 25-times reduction in the landfill's production of greenhouse gases.

Methane is produced from the breakdown of organic matter in the MSW stored in landfill. That organic matter was going to break down anyway, and its carbon was going to return to the environment and be re-absorbed by growing plants sometime in the future. It was already part of the natural carbon cycle. So, it's different to CO_2 from fossil fuels, which comes from digging up carbon-based materials that were removed from the natural carbon cycle tens or even hundreds of millions of years ago.

This participation in the natural carbon cycle means that the decay of waste, slowly and naturally by microbes, or rapidly by combustion, makes it a renewable energy source.

Instead of burning landfill gas as it is produced, we can move directly to extracting value and energy from organic waste. This energy production from waste which is the transformative power of Energy from Waste (EfW) technology. The biogenic content of wastes — the renewable organic waste from the kitchen and other residues from food processing and restaurants — can all be used to produce energy in a renewable and sustainable way.

In Australia, Veolia's EarthPower facility in Camellia, NSW, turns food waste into energy using what is, basically, a scientifically optimised version of the process that occurs in landfills. It is called anaerobic digestion, and it relies on microbes to turn organic waste into biogas. This biogas is a fuel input for EarthPower's cogeneration system, which produces heat and green electricity that is sold into the grid.

The leftovers from this process form valuable fertiliser, which goes to farmers. Some farmers are using this same EfW process on their waste, but on a smaller scale, to generate energy or to provide heat to the sheds.

MSW also contains many other non-organic components, such as plastics or materials manufactured from plastics. These can be used as an alternative fuel source. However, they aren't considered renewable because plastic is generally sourced from fossil fuels.

There are already many facilities in operation around the world producing alternative fuels from plastic and from waste biomass (ie, manufactured wood products). There are many more EfW plants in operation burning MSW (both organic and inorganic wastes) to create energy, using a mixture of technologies. The primary process used is incineration to generate electricity and heat, with advanced technology filtering the exhaust air to minimise emissions to the atmosphere.

What can we do to bring more EfW facilities to Australia? It's time we devoted resources to working together to create the EfW solutions Australia needs. As individuals, we can support legislation that will help make EfW viable. EfW facilities are big projects, and they require collaboration on many levels to be successful. Now is the time to start laying the groundwork and building the connections and know-how we're going to need to support a sustainable future for Australia.

Veolia Australia and New Zealand
www.veolia.com.au

The photovoltaic modules in the "SOLAR.shell" facade element deliver up to 50% more solar energy than conventional, planar-mounted solar modules. © Fraunhofer IMWS

Generating solar power on building facades

Using photovoltaic elements on facades could be a useful way to supplement solar energy supply, new research suggests.

Researchers at the Fraunhofer Center for Silicon Photovoltaics CSP have discovered that if they are appropriately designed, these elements can be attractively integrated and deliver 50% more energy than existing types of wall-mounted PV elements. Even concrete walls are suitable.

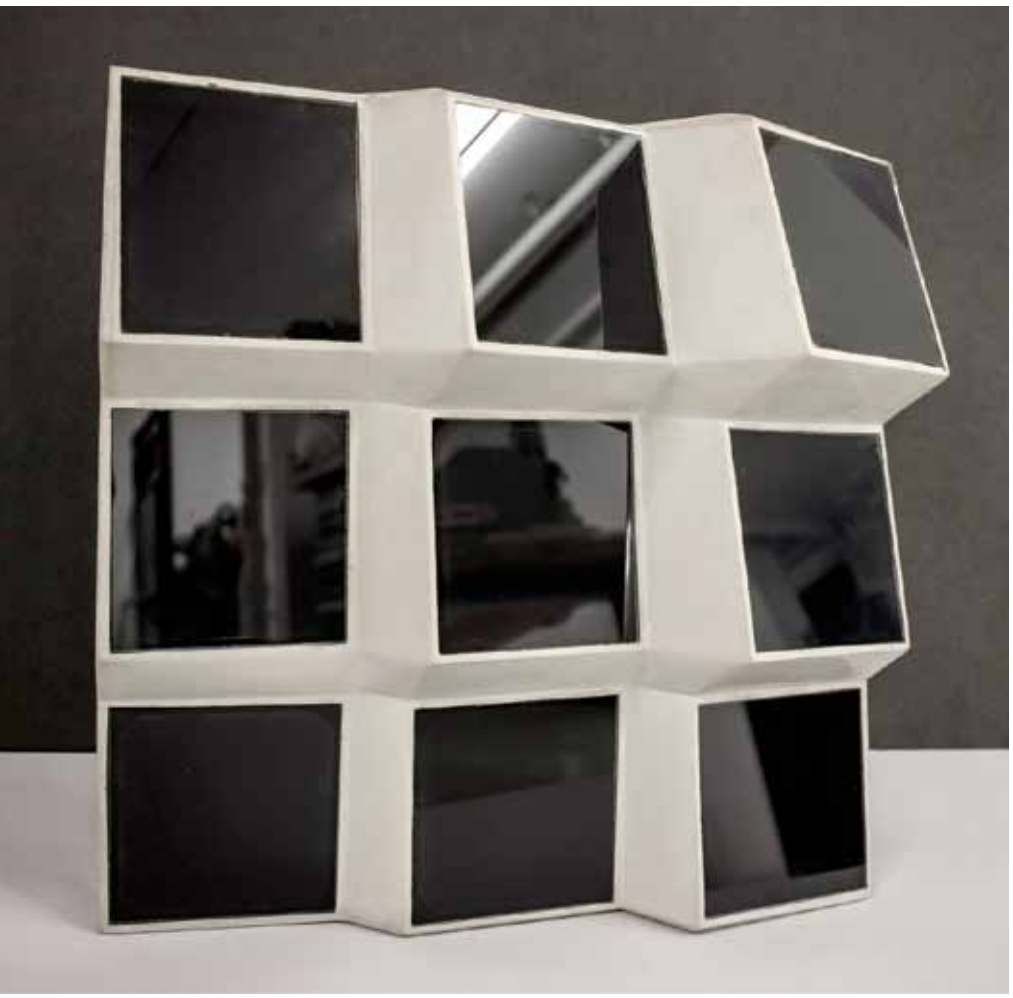
While PV elements on roofs receive the most sunlight, it makes sense to have them on building facades. Firstly, they make use of otherwise unused space, and secondly, the energy they collect can usefully supplement the power supply. However, given that the sun usually shines on facades at an unfavourable angle, and the elements themselves tend not to be aesthetically appealing, little use has been made of this opportunity.

In their SOLAR.shell project, researchers suggested — alongside architects at the Leipzig University of Applied Sciences (HTWK Leipzig) — that there is a way to remedy these problems.

"The photovoltaic elements integrated in this facade deliver up to 50% more solar energy than modules mounted perpendicularly on building walls. Plus the facade offers visual appeal," said Sebastian Schindler, Project Manager at Fraunhofer CSP.

The HTWK architects developed the idea and designs. How do the individual photovoltaic elements have to be tilted in order to capture as much solar irradiation as possible? How large should the modules be, and how many solar cells should they ideally include? The team's findings were presented in a 2 x 3 m demonstrator made of aluminium composite panels featuring a total of nine embedded solar modules. The Fraunhofer experts offered their experience, advice and assistance, and the photovoltaic elements used in the demonstrator likewise came from Fraunhofer CSP.

> **Researchers devised three different concepts and methods for integrating the PV elements in façade sections.**



A faceted design significantly increases the electricity yield, but it requires small, flexible solar modules. © A. Heller, Architektur-Institut Leipzig (ai:L)

Solar modules on concrete facades

In collaboration with HTWK Leipzig and TU Dresden, the Fraunhofer CSP researchers also developed suitable options for integrating photovoltaic elements in concrete facades — more specifically in facades made of carbon concrete, a material developed by a consortium of more than 150 partners in the 'C3 — Carbon Concrete Composite' project. The required stability of the concrete comes from carbon fibres rather than steel wires.

"At Fraunhofer CSP, we analysed how photovoltaic elements can best be mounted on these kinds of carbon concrete facades — that is, how to obtain the optimum result when combining this novel concrete with the production of solar energy," Schindler said.

To this end, the researchers devised three different concepts and methods for integrating the PV elements in facade sections. The solar modules can either be included directly when casting the concrete sections or be laminated on or bonded to the concrete slabs. The modules can also be attached to the concrete slabs using stud fasteners, screw connections or other means, facilitating easy removal for maintenance or repairs.

"We were able to demonstrate that all three mounting options are technically feasible," Schindler said.

One of the main challenges is ensuring that the method used to produce the concrete sections is compatible with the required dimensional accuracy of the PV modules. This is done, for instance, by casting the concrete parts with a depression that is perfectly sized to accommodate a module. In this way, the desired orientation with respect to solar irradiation and the overall design are preserved.

"The dimensional accuracy should be implemented directly in the concrete section," Schindler said.

It must also be ensured that the PV modules aren't fastened where the concrete is particularly thin or where the carbon fibres are located, as this would impair the strength of the facade elements. The project has since been successfully completed.

SOLARcon: concrete facades 2.0

In the SOLARcon follow-up project — likewise in collaboration with HTWK Leipzig and TU Dresden, as well as two corporate partners, and launched in November 2019 — the Fraunhofer experts are now establishing marketable solutions for integrating PV modules into precast concrete slabs.

Will the solar cell mounting hold permanently? To answer this question, the Fraunhofer researchers are conducting appropriate endurance tests on both the PV components and the interface with the concrete. How does the interface behave under various weather conditions? What do accelerated ageing tests show? In addition to the experiment-based approach, simulations are also on the agenda — more specifically, finite element methods. These allow the experts to calculate, for example, how the concrete and the attachment point of the PV element heat up at high temperatures, or what wind and pressure loads the solar module must withstand.

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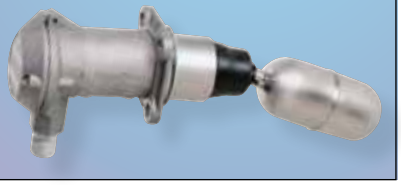

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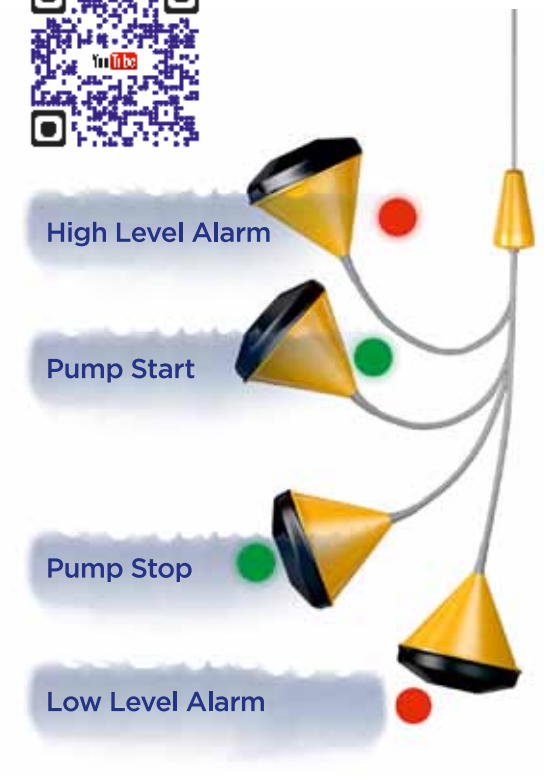

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Bubble tech blows contaminants out of the water

Australian water treatment company Evocra has developed a technology that uses bubbles to remove contaminants such as microplastics from water. The process — known as ozofractionative catalysed reagent addition (OCRA) — floats microplastic out of the water, where it is collected and sent for recycling.

Evocra Managing Director Mark Sykes said OCRA is a solution for many water-based environmental challenges.

"Microplastics are plastic items smaller than 5 mm that are found in everyday products such as sunscreen, shampoo and detergent. Too small to be filtered out in the treatment plants, they wash into waterways where they harm our aquatic wildlife," he said.

"OCRA offers a positive solution to this complex environmental issue. The technology can be applied as a pre-treatment — that is, before the plastic enters the sewerage system — or at the treatment plant to remove the particles before discharge."

In the OCRA process, chemicals or metals attach to tiny, charged microbubbles, each the size of a width of hair, which balloon out of the water.

Microplastics researcher Dr Thava Palanisami is working with Evocra and is supportive of its work in this area.

"Evocra was an early entrant into finding a solution for microplastics, which is a potential planetary boundary threat. OCRA has demonstrated it has a part to play in the solution of remediating the 12.7 million metric tonnes of plastic litter than enter the ocean each year," he said.

Plastics can enter the human food chain and, when ingested by marine life, can potentially cause death from starvation.

Sykes said the applications for OCRA are vast, with capability to treat minerals and contaminants in mining, oil and gas extraction, agriculture and aquaculture, high-intensity industrial manufacturing, municipal water and wastewater treatment, and contaminated land remediation.

Environmental consulting firm Arcadis recently signed an exclusive licensing agreement to use OCRA to treat toxic PFAS (per- and poly-fluorinated alkyl substances), a component of products such as aqueous film-forming foams (AFFS), household chemicals, carpets and some clothes.

The technology was successfully used to help remediate a PFAS-impacted industrial sewer resulting from a firefighting foam spill at Brisbane Airport in 2017, removing greater than 99.9% of contaminants.

Sykes said OCRA is addressing old, new and future water contamination issues.

"Our first commercial application was in acid mining drainage, which has been an ongoing problem for the mining sector. PFAS is an international challenge we are facing right now and microplastics are certainly an emerging issue. Evocra are passionate about delivering technologies that have high social impact and that offer solutions across the spectrum in Australia and globally," he concluded.

Evocra
www.evocra.com.au

A soil-less solution for coffee waste

An Australian producer of modular and custom-designed greenwalls — The Greenwall Company — is putting ground coffee waste to good use in its soil-less medium for greenwalls and greenroofs.

An estimated 75,000 tonnes of ground coffee waste is produced by Australians each year, most of which ends up in landfill — contributing to climate change via the production of the greenhouse gas methane.

In a bid to reduce the company's carbon footprint, founder Mark Paul created a soil-less inorganic medium — of which ground coffee is just one component — to mimic the natural growing conditions of plants. Going soil-less reduces the overall weight of the wall or gabion and eliminates the need to replace the soil on a regular basis.

"Over the past six months we have sourced coffee ground waste from Harvest Store & Kitchen in Newport, our local coffee shop, and included it in our patented media formula," Paul explained.

"Our trials on various walls and in our gabions used for greenroofs are proving to be a more sustainable and cost-effective solution, with the plant species continuing to flourish."

The Greenwall Company tested greenwalls and greenroofs made up of 94% Australian recyclable materials that would otherwise end up in landfill.

"Our aim has always been to reduce our carbon footprint by using everyday recyclable items," Paul said.

"By diverting coffee waste from landfill, we are helping to reduce greenhouse gases going into our atmosphere while creating a sustainable habitat for small animals and insects and also protecting the lifespan of our plants."

The Greenwall Company
www.greenwall.com.au

LIQUIPHANT FTL51B AND FTL41 POINT LEVEL INSTRUMENTS

The Endress+Hauser Liquiphant FTL51B and FTL41 vibrating fork (vibronic) level instruments are designed to detect the point level of liquids in storage tanks, containers and pipes, while providing proof test, verification and IIoT functionality. The FTL51B features Industry 4.0 and IIoT capabilities, including access via wireless Bluetooth technology, automatic proof tests and verification, and commissioning via a mobile device. The FTL51B also features a high-visibility LED.

The FTL51B can be used in storage tanks, containers and pipes for point level detection of different types of liquids. Its vibronic sensor is not affected by changing media properties, flow, turbulence, gas bubbles, foam, vibration or build-up. The instrument works in temperatures of -50 to 150°C and pressures up to 1450 psi (100 bar). It can be used in SIL2 and SIL3 hazardous locations and has built-in automatic maintenance and verification functions.

The FTL41 is similar to the FTL51B, but works at lower pressures, up to 580 psi (40 bar), with a narrower temperature range of -40 to 150°C. Both perform proof tests, with the FTL51B meeting SIL and WHG (Water Resources Act) requirements. The proof test can be activated remotely at a control system or locally via a magnet or push-button test. The products can diagnose the sensor for corrosion and build-up, with verification activated either manually or automatically with Endress+Hauser's Heartbeat Technology. Access via Bluetooth and a mobile device allows users to identify each device, commission it, check the status, start a proof test and download verification documentation.

Endress+Hauser Australia Pty Ltd
www.au.endress.com

TRITON TR80 TURBIDITY SENSOR WITH AUTOMATED CLEANING WIPER

The Triton TR80 from Electro-Chemical Devices is a nephelometric turbidity sensor designed for use in water and wastewater.

Turbidity, the cloudiness or haziness of a water sample, is caused by particles suspended in the water, typically clay and silt. Since bacteria and viruses can be attached to these particles, turbidity has become a critical indicator of the overall water quality.

The Triton TR80 uses an optical method for determining the turbidity — a light beam is directed into the sample where it is scattered by suspended particles in the water. The amount of scattering depends on the amount of material in the water, the wavelength of light, and the size and composition of the suspended particles. The Triton TR80 uses a near infrared LED light source and the 90° scattered light method in accordance with ISO 7027/ EN 27027 to assure accurate turbidity values under standardized and comparable conditions.

The TR80 response depends on the size, shape and composition of the suspended particles. For this reason, mg/L, ppm and % Solids measurements must be calibrated with suspended solids from the waters to be monitored. Turbidity measurements (NTU, FNU) can be calibrated with calibration standards such as Formazine, StablCal or SDVB beads.

The Triton TR80 sensors are available in four (4) different ranges.

Designed for use in environmental, water treatment, or drinking water, the Triton TR80 is suitable for most aqueous applications. It is not suitable for use in organic solvents or in solutions with an extreme pH value, only use when the pH is between 2–12 pH. The temperature range for the sensor is 0° to 50°C.

TR80 Installation is accomplished with a 1″ stand pipe for immersion service, PVC flow cell for an in line flow through application, Valve Retractable, or De-Bubbler for Micro air bubble applications. Typically, applications of < 30 NTU range use a flow cell or de-bubbler assembly and must be calibrated as an assembly with the sensor for best accuracy.

The optical surface must remain clean for accurate measurements. The sensor sensing face of the TR80 should be oriented so that the flow of the water can clean and remove particles that could adhere to the sensor face. The TR80 incorporates an automated mechanical wiper design which can be programmed for frequency and duration. This can be utilized in any installation configurations such as: open tank using standpipes, immersion, pipe insertion and flow cells. In all installations the sensor should be able to be simply removed for standard maintenance.

Air bubbles in the water reflect light and will interfere with the measurement. Micro air bubbles can form when a water sample is depressurized. Care must be taken to ensure the water sample at the measurement point has a higher head pressure than the incoming sample. Water siphoning out from the measurement point can release dissolved gases in the flow cell and create noisy erratic readings. If air bubbles cannot be removed from the sample, an optional De-Bubbler flow cell can be used which removes air bubbles that are entrained in the sample flow.

The Triton TR80 sensors are factory calibrated in formazine, NTU (Nephelometric Turbidity units) and are ready to use in most clean water applications. The factory calibration is permanently stored in the sensor's memory and these values are also used for diagnostic purposes throughout the sensor's life. Additional nonvolatile memory is used to log user initiated calibration data.

AMS

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

The future role of instrumentation in the Australian irrigation sector

Chris Krincevski, ABB Measurement and Analytics

When it comes to managing the challenges of water scarcity, Australia has it tougher than most. Of the 2,789,400 GL of rain estimated to fall on Australia per year, just 292,000 GL finds its way into surface water or groundwater supplies,[1] with the rest either being lost through evaporation or absorbed by plants. As the world's driest inhabited continent, Australia has learned to make the most of its available supplies of water to sustain the needs of its population of 26 million.

The agricultural sector is a major consumer of the nation's water supplies, meaning it must work especially hard to ensure that the available supply of water is utilised effectively. Around 50–70% of the nation's water is used for agricultural activities, of which 90% is used for irrigation.[1] Figures from the Australian Bureau of Statistics for agricultural water use for 2017–2018 show that a total of 22,470 businesses used irrigated water supplies, consuming 9,734,182 ML of water.[2]

Irrigation is the lifeblood of Australia's agricultural economy. Dating back to 1886, the use of irrigation for agriculture in Australia has grown from a disused sheep ranch in Mildura to a network spanning several thousands of square kilometres. Today, water delivered by irrigation is key to growing a variety of crops including cotton, rice, grapes, cereals, fruit and nuts as well as hay and grain for dairy herds. It also makes a significant contribution to the wider economy, generating additional revenues directly through the processing and sale of crops, and indirectly through connected employment, including the engineering and technical support of the irrigation systems themselves.

While just 5% of Australia's land is irrigated, this proportion accounts for around 30% of all agricultural production, making it important to ensure that supplies are managed and maintained as efficiently and as carefully as possible.

Making the most of every drop

The importance of conserving supplies is highlighted by the significant impact that a dry or wet season can have on agricultural activities. During the Millennium Drought in 2000–2011, water use for agriculture decreased by 37% in the period between 2000 and 2005,[3] causing widespread disruption, including crop failures and unemployment in communities directly reliant on the cotton industry.

Projections from the Australian Bureau of Meteorology indicate that there has been a steady increase in the incidence of extreme heat events and the frequency of prolonged droughts since the 1970s, most likely caused by climate change.[4] This has led to variations in expected weather patterns, making it difficult to predict the quantity and pattern of rainfall from one year to the other.

Added to this is the fact that every user is subject to a strict allocation controlled by the state. Users must ensure they do not exceed their allocated quantities, which are either based on their metered usage from previous periods or, where this does not apply, to theoretical requirements based on the type of crop being irrigated and the size and nature of the area in which it is being grown. Those users that exceed their allocation are charged a penalty according to the excess volume extracted and may also face additional compliance actions under the *Natural Resources Management Act 2004*.

There is a need to ensure that the demand for irrigated water does not exceed available supply. A good example is the Murray–Darling Basin, where close management of irrigated water supplies is becoming increasingly important in limiting environmental damage caused by a combination of growing demand and potentially unsustainable farming practices.

In each case, it is in the interest of the user to ensure that any wastage through over-consumption is minimised and that they can accurately measure and control the quantities of water they use for irrigation.

> **"Flow meters are forming part of increasingly sophisticated automation systems aimed at further reducing avoidable water losses through enhanced measurement and control.**

How technology is helping to manage irrigated water supplies more sustainably

Like in any water distribution network, it is inevitable that some water will be lost in irrigation networks between the initial source and the final point of use. Traditionally, water loss in irrigation networks has tended to centre around four main causes: leakage, seepage and spills, evaporation and theft (the unauthorised and invariably unmeasured extraction of water by the user or third parties).

With no new sources of water to supplement irrigation supplies, the onus is on those providing the water and those using it to find innovative ways to make the most of what there is. With the development of technologies to measure and control the flow and extraction of irrigated water more effectively, many problems are being addressed. Coupled with the ability to collect and use near-real-time or real-time data for reporting more easily, the result has been a significant improvement in the way that irrigated water supplies are managed.

The adage 'you cannot manage what you do not measure' is especially pertinent to irrigation, both in terms of assessing consumption and finding ways to stem avoidable wastage. For this reason, flow meters are now a standard item of equipment used throughout irrigation networks. ABB's high-accuracy AquaMaster and WaterMaster electromagnetic flow meters are amongst a range of approved flow technologies for irrigation applications that provide a yardstick for ensuring users adhere to their allocations and for quantifying losses through leakage, evaporation and seepage.

In many cases, flow meters are forming part of increasingly sophisticated automation systems aimed at further reducing avoidable water losses through enhanced measurement and control. Using measurements from flow and level instruments, these systems handle the opening and closing of regulating gates in irrigation networks to ensure the right amount of water is supplied at the right times to meet user demands.

Options range from basic automated channel control, where users can remotely access data on flow rates and water levels and use it to manually adjust their gate controls, through to fully autonomous systems featuring networked channel gates that automatically regulate channel flow and level and ensure users receive consistent supplies. At the high end, these fully autonomous systems can be further augmented by the inclusion of additional business-level functions that manage, schedule and record deliveries of irrigated water and ensure that users adhere to their allocated limits.

Compared to manually operated systems, automated systems can help to substantially improve water management, delivering a variety of benefits including:

- Improved water use efficiency and reduced losses through seepage. The automatic management of channel flow and level helps ensure that users receive the exact amount of water needed, eliminating the problem of water lost through spillage.

- On-time delivery of water. Ensuring that users receive the right amount at the right time allows optimisation of crop irrigation routines. By using water more efficiently, users can make their allocations stretch further and maximise yields through effective watering.
- Improved budgeting and accounting. Using measurement data from flow and level instruments installed in irrigation networks can provide the basis for improved prediction and management of irrigation supplies. When used in conjunction with additional information such as crop growing characteristics and water demand and weather forecasts, instrument data can be used to help better match the demand for irrigated water against the available supply. The ability to accurately measure and quantify water consumption can also be useful for ensuring that users are billed according to their actual usage.

There is an increasing requirement for the irrigation industry to know that their flow meter assets are performing accurately and reliably. Accuracy directly impacts on irrigators billing and revenue. This has been a challenge for irrigators as the technology, up until now, has not existed to perform in situ checks on flow meter health. ABB has addressed this in AquaMaster 4 with the latest digital technology supported by the ABB Ability Verification Tool that allows the customer to perform a simple, non-intrusive test via near-field communications (NFC) and generate a certificate to satisfy local authorities.

Looking to a sustainable future

The events of the opening months of 2020 are already providing a salutary lesson that the Australian continent needs to be prepared to handle the potential issues surrounding climate change. With water a precious yet unpredictable resource that is vital to the country's agricultural and economic prosperity, the need to make every drop count through efficient and effective irrigation management is of paramount importance. Instrumentation plays a key role in ensuring a sustainable future for water irrigation.

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ABB Australia Pty Ltd

www.abbaustralia.com.au

Plant gasifies to slash biosolid waste

The Australian Renewable Energy Agency (ARENA) has pledged $6.2 million in funding for the development of the Loganholme Wastewater Treatment Plant Gasification Facility at Loganholme, Queensland. The $17.28 million project — claimed to be the first time that gasification has been incorporated into a wastewater treatment plant in Australia — will lead to a 90% reduction in the volume of sewage sludge (biosolids) waste disposal at the plant.

The facility — Logan City Council's (LCC's) largest wastewater treatment plant — serves 300,000 people and produces approximately 34,000 tonnes of biosolids each year. Biosolids are currently dewatered via an energy-intensive mechanical drying and treatment process before being transferred for land application.

The plant upgrade will include installation of a gasifier, which will create gaseous fuel from the biosolids that have been dewatered, dried and treated at high temperatures. The material produced is a biochar containing carbon, phosphorus and potassium that could be used as an environmentally friendly soil conditioner. LCC intends to market this biochar once the facility becomes operational.

The gasifier will reduce greenhouse gas emissions from the plant and the gas produced during the process will be utilised within the system as part of the biosolid drying process. An onsite solar power system will also help the facility move close to energy neutrality.

ARENA CEO Darren Miller said the project will offer significant opportunities to be replicated by other councils.

"Logan City Council's demonstration project is expected to deliver a commercial business case for the gasification of biosolids for similarly sized wastewater treatment plants across Australia. The key knowledge learned from this installation will be significant given the first-of-kind deployment.

"This innovative process will reduce energy costs, emissions and significantly reduce the volume of waste from the sewage treatment process," he said.

Acting Road and Water Infrastructure Director Daryl Ross said LCC was committed to finding a more viable and sustainable management solution that also lessened the environmental impact.

"At present, six truckloads of biosolids are taken 300 km to Darling Downs for land application each day. That costs $1.8 million annually and accounts for 30% of the operating costs of the plant," he said. "Costs are increasing due to rising electricity prices, increasing population and tightening of government regulations on carbon reduction and managing persistent organic pollutants in soils."

The construction is set to begin in July 2020, with the facility fully operational by July 2021.

Australian Renewable Energy Agency
arena.gov.au

CHILLED MIRROR HYGROMETER

Michell's Optidew 501 is a fast-responding chilled mirror hygrometer that utilises the latest developments in chilled mirror technology.

Designed for use in industrial humidity control and precision laboratory applications, the product is available in benchtop and wall-mount configurations as well as a transmitter version (without a display).

Featuring a hybrid chilled mirror sensor, the product is capable of a response speed comparable to a polymer sensor, coupled with the stability and accuracy of a chilled mirror instrument. Its mirror is resistant to corrosion and contamination and allows accurate measurements to ±0.15°C dewpoint across its -40 to +120°C dewpoint measurement range.

The device can be used in procedures that include careful control of temperature and humidity during emissions testing.

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

Sugar ant pee preference may reduce greenhouse gases

Research from the University of South Australia has revealed that the sugar ant's preference for urine over sugar may play a role in reducing greenhouse gas emissions.

Led by wildlife ecologist Associate Professor Topa Petit, the team observed that sugar ants nocturnally forage on urine to extract nitrogen molecules, some of which could end up in the greenhouse gas nitrous oxide.

The study compared the behaviours of sugar ants (*Camponotus terebrans*) as they were exposed to different concentrations of urine (human and kangaroo ~2.5% urea), sugar water (20% and 40%) and urea in water (at 2.5%, 3.5%, 7% and 10%), finding that the ants were most attracted to higher concentrations of urea, mining them for long periods within a dry sand substrate.

Assoc Prof Petit said the discovery could play a role in nitrogen cycling.

"We found that the ants determinedly mined urea patches night after night, with greater numbers of ants drawn to higher urea concentrations," she said.

"*Camponotus terebrans* are undoubtedly looking for urea in urine because, similar to certain other ant species, a bacterium in their digestive tract allows them to process urea to get nitrogen for protein.

"This remarkable ability to extract urea from dry sand not only shows how sugar ants can survive in arid conditions, but also how they might reduce the release of ammonia from urine, which leads to the production of nitrous oxide — a highly active greenhouse gas."

Nitrous oxide is 300 times more potent than carbon dioxide. Its presence in the atmosphere has increased substantially over the past decade, accelerated mostly by the widespread use of fertilisers.

"Researchers working on ants as bioindicators on grazed and ungrazed lands should take ants' ability to process urea into account, because large amounts of urine will probably affect the assortment of ant species in the area. It would also be interesting to investigate how much ants may modify the urine ammonia volatilises from paddocks," Assoc Prof Petit said.

Image courtesy of University of South Australia

Taking cars out of the urban planning equation

Does car ownership really give us freedom? According to University of South Australia urban planning researcher Hulya Gilbert, maybe not.

More than half of Australian households own two or more motor vehicles, with only 7% of the population reported to own none.

Despite cars being marketed as providers of freedom and idyllic lifestyles, Gilbert argues that there are growing reasons to question the cost of that freedom, and even challenge whether it is freedom at all.

"There's obviously the environmental impacts, and the health and fitness consequences of using cars, but there's also a huge social impact," she said.

"Despite the common view across the world that cars provide freedom and flexibility, increasingly we're seeing the priority given to cars is infringing people's ability — and right — to get around without one.

"That's especially true of children, and the more we build our cities around cars, the more we rob kids and teenagers of opportunities to enjoy some independence and develop self-reliance."

Gilbert's research indicates that current transport discussions are based on the assumption that most people travel by car, which has dictated the design and location of key places in children's lives such as schools and sporting clubs.

She explained that once our cities are built that way, it's hard to move outside the plan.

"It's not enough just to say, 'kids need to walk to school more'," Gilbert said.

"In many situations we have planned that possibility out of cities, and now it's just not safe or practical for children to ride or walk to the places they need to go — so much so that there are now perceptions that parents who do let their kids ride or walk are being negligent."

Gilbert said that — to reverse this trend — urban planners need to change the priorities. Despite a growing interest in alternatives to the private car across the world, Gilbert's research suggests we're unlikely to see large-scale shifts in travel behaviour unless we make the required changes to infrastructure first.

"That involves building and maintaining safe walking and cycling paths and associated infrastructure including green spaces, trees and pedestrian crossings, and reducing speed limits and traffic flow around those areas to ensure they're safe.

"It also means ensuring public transport is connected to those active transport networks and that key locations such as schools and sports clubs are located so they're accessible by those modes."

Gilbert explained that developing these networks will not only benefit children and teenagers, but also help other social groups currently disadvantaged by being unable to drive, including the elderly as well as vision-impaired and lower-income earners.

URBAN HUB — an interactive platform for people working on the future of cities and mobility — has outlined that although it's a long road to a world with fewer cars, steps can be taken to begin the process.

URBAN HUB described some ways that cities can begin on the road to less traffic:

- Increase bike friendliness.
- Provide access to multiple modes of public transport.
- Introduce rush-hour and congestion charges.
- Institute temporary and permanent car-free zones.
- Widen pathways by reducing on-street parking.
- Provide incentives for those that go car free.
- Introduce park and ride schemes.
- Promote car sharing.

"At the moment, our cities and societies are set up based on the idea that having a licence and owning a car is the norm, and we often consider the lack of car ownership as a disadvantage," Gilbert said.

"Our right to move around our cities without a car is not commonly considered.

"Now, even though it's the case that most people have access to a car and travel by car in cities such as Adelaide, planning and thinking as if they don't would open up many possibilities and opportunities which would accelerate progress towards less private car usage and the associated, wide-ranging benefits."

A choice pump for wastewater polymer dosing

UK-based electrical and mechanical engineering company Chemical Support Systems (CSS) designs, manufactures, installs and commissions chemical dosing systems across a variety of industries, including water treatment.

Phosphorus in wastewater remains the most common cause of Water Framework Directive (WFD) quality failure in the UK. More than half of the UK's river water bodies and three-quarters of its lakes exceed the phosphorus discharge consent level of 0.1 mg P/L for good environmental status.

To help combat phosphorus levels, a chemical coagulant or polymer is typically dosed into wastewater. The amount of dosing depends on the amount of phosphorus present, with potential fines for those found guilty of discharges outside of limits.

For polymer dosing in wastewater treatment applications, CSS opts for Qdos pumps from Watson-Marlow Fluid Technology Group (WMFTG).

CSS co-owner Ian Bishop said, "Companies with wastewater streams are trying to achieve increasingly stringent discharge consent limits, but also want to reduce operational wastewater treatment costs. Our chemical dosing systems, many of which rely on Qdos pumps, help companies achieve both these things.

"When supplying a chemical dosing system to a customer, there are certain qualities we look for in a dosing pump," Bishop said.

"We use Qdos pumps predominantly for their reliability, intuitive operation, accurate dosing and ease of maintenance. If

chemicals are particularly viscous, such as polymers, we find Qdos pumps even more useful.

"In our experience, using conventional diaphragm pumps for dosing high-viscosity polymers can be problematic due to blockages within the suction and discharge valves. The benefit for customers of specifying Qdos pumps is a reduction in the level of maintenance required by not having to clean and flush the associated pump head and valves on a periodic basis."

Watson-Marlow Fluid Technology Group
www.wmftg.com.au

Recycling polyester could keep textiles out of landfill

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Researchers from the Queensland University of Technology (QUT) have discovered a treatment to extract and re-use polyester from polyester/wool mix fabrics, which should help prevent some of the 92 million tonnes of textiles dumped every year from going to landfill.

Associate Professor Alice Payne, from the QUT School of Design – Fashion, said Australians send 500,000 tonnes, or $140 million worth, of textiles to landfill every year, with an average lifetime of three months for each item.

"Polyester is incorporated in much of the 80–150 billion items of clothing made each year," Assoc Prof Payne said.

"It is favoured on its own or incorporated with natural fibres like cotton or wool because it is durable, lightweight [and] easy-care with anti-wrinkle properties."

Now, Assoc Prof Payne and her colleagues have found that a commercial enzyme dissolves wool fibres from polyester and wool mix fabrics, without damaging the polyester strands.

"Complete degradation of wool fibres was achieved by application of a keratinase in a two-step process with addition of reducing agent and undigested polyester fibres were recovered," the researchers wrote in the journal *Waste Management*.

"Electron microscopy showed complete breakdown of the natural fibres in the fabric blends, while spectroscopic and mechanical analysis of the recovered synthetic fibres confirmed that the enzymatic treatment had no significant impact on the properties of the polyester compared to virgin samples. The polyester fibres are therefore suitable to be recycled to polyester yarn and re-used in the manufacture of new garments or other products.

According to corresponding author Professor Robert Speight, from QUT's Institute for Future Environments, recycled polyester is a valuable tradable commodity.

"The polyester extracted from fabric can be made into polyester chips and turned into anything from yarn for new textiles to playground equipment," he said.

"The value of recycled polyester has gone up significantly and gives clothing manufacturers a massive marketing advantage to be able to claim recycled material.

"Adidas, for example, has committed to using only recycled plastic by 2024, which includes polyester, contributing to the demand for recycled polyester."

Prof Speight said the researchers' next phase is to partner with recycling companies to take the process to kilogram scale and understand more about the process design for commercial use and the economics. Assoc Prof Payne meanwhile added that separating and re-using polyester is part of the drive to prevent waste in the fashion industry — other ways to prevent waste include using clothing longer, buying second hand rather than new and circulating, lending, borrowing, repairing, upcycling or reselling unwanted clothing.

QUT
www.qut.edu.au

INSERTION FLOW METERS

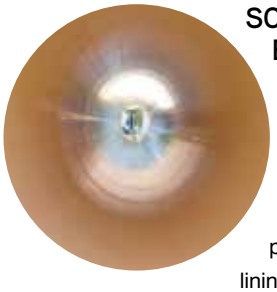
Trimec Flow Products' Dualpulse insertion paddle wheel flow transducers are designed to cost-effectively and accurately measure the flow of water, water-like liquids or low-viscosity liquids in completely full, large-diameter pipes (40–2500 mm).

A sensor is inserted into the process piping via a suitable fitting. Liquid flow through the pipe results in rotation of the affixed paddle wheel. The rotational speed of the paddle is proportional to the flow velocity and, therefore, proportional to the flow rate in the pipe.

The insertion mode of design is claimed to provide a measuring technique that is less expensive than full bore flow meters, especially in larger pipe sizes.

Insertion paddle wheel sensors are designed as a robust measuring technology with tolerance to dirt and solids.

Trimec Flow Products Pty Ltd
www.trimec-fp.com.au



SOLVENT-FREE ELASTOMERIC POLYURETHANE

AkzoNobel has introduced the Polibrid 705E elastomeric polyurethane and Polibrid 670S concrete primer as part of its coatings and linings portfolio.

Suitable for water and wastewater applications, the flexible system has crack and bridging properties and the ability to withstand concrete movements.

Key features include: solvent free and zero VOC; high film thickness in a single coat (5 mm+ if required); fast curing/low temperature curing; low moisture transmission rate; flexible, elastic, crack resistant, and abrasion and chemical resistant; suitable for steel and concrete substrates, and applied by plural component spray (2:1 mix ratio).

Applications include: wastewater treatment plants; clarifier tanks, lift stations, penstocks and channels; concrete and steel potable water tanks; steel bolted tanks; mining and mineral processing; and power generation.

AkzoNobel Pty Limited
www.akzonobel.com

GIGABIT ETHERNET SWITCH

The NT328G Layer 3 Ethernet switch from Red Lion offers 28 high-speed ports (24–1 Gb, 4–10 Gb) and a wire-speed switching performance to suit bandwidth-intensive industrial applications from the network edge to the core.

Available from Control Logic, the models feature a flexible mix of copper and fibre ports allowing for a variety of connection options, with Layer 3 routing that provides the ability to route across VLANs or subnets.

The industrial-grade NT328G's feature set includes network redundancy, advanced, integrated security, policy-based traffic control and easy-to-use configuration and management, which is claimed to reduce operating costs while providing continuous monitoring of network activity.

The product's rugged IP30 rackmount metal housing is constructed for long-life use in harsh industrial environments, including wide operating temperatures and hazardous locations for durability.

The NT328G is designed to meet the current and future needs of the oil and gas, water and wastewater, energy, transportation, and video and security sectors, as well as other bandwidth-intensive industrial applications.

Control Logic Pty Ltd
www.controllogic.com.au

SOLAR STREET LIGHT

Green Frog Systems' ASPIRE Solar Street Light uses monocrystalline panels to generate power, combined with CREE XP-G LED chips that are said to provide more light with less power.

Each solar cell on the ASPIRE panel is tested to eliminate poor-performance cells, such as those with micro-cracks undetectable to the naked eye, ensuring the panel performs at its best.

The ASPIRE was developed with contemporary architectural design in mind, ensuring that the solar panel and pole unit would be elegant, low profile and fit in seamlessly with its surroundings. The large pole base holds up to four stackable batteries for dependable energy storage.

The product is IoT- and smart city-ready, with the ability to connect to the SAM (Solar Activity Monitoring) system, which allows lighting assets to be centrally managed — using software that provides users with a dashboard where they can command, control and monitor assets at an individual or collective level.

The unit is suitable for applications including roadways, streets, car parks, pathways, industrial sites, recreational areas and marine infrastructure.

Green Frog Systems
www.greenfrogsystems.com.au

60-CELL SOLAR PANEL

The REC Alpha Series 60-cell solar panel is designed to reach 380 W-peak power and deliver over 20% more power from the same area and the same number of panels.

Now available in Australia, the panels are built around 120 half-cut heterojunction cells (HJT) and advanced connection technology, designed by engineering experts from Germany and Singapore. With HJT, REC combines the benefits of crystalline silicon solar cells with those of thin film technologies for higher efficiency and energy yield, even at higher temperatures.

With a strong frame, the panels can provide protection against extreme weather events, reducing the chance of cell damage and ensuring continued high-power performance. The panel is suitable for both cold and hot climates, thanks to a temperature coefficient of -0.26%/°C.

The Alpha Black version provides design aesthetics and a premium look to the solar panels thanks to its sleek black colouring, and is fitted with near-invisible cell connections.

Other features include: two versions available: with white backsheet (up to 380 Wp) and as a full-black panel for good aesthetics (up to 375 Wp); twin panel design provides performance in shaded conditions; half-cut cell technology; high-efficiency n-type mono wafers between thin layers of amorphous silicon; 30 mm thin frame construction allows more panels per pallet and an easy installation.

The panels are also backed by REC's 25-year product warranty (on installations by REC Solar professional, otherwise 20 years) and a 25-year power output warranty, guaranteeing 92% of nameplate power after 25 years.

REC Group
www.recgroup.com

UQ develops quantum dot solar cells

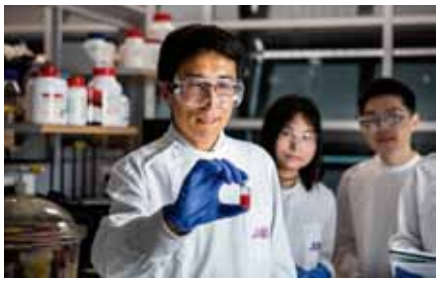
A University of Queensland (UQ) team has developed quantum dot solar cells that can be made into thin, flexible films and used to generate electricity.

The technology converts solar energy to electricity via the use of tiny nanoparticles called 'quantum dots', which pass electrons between one another and generate electrical current when exposed to solar energy in a solar cell device. The team's findings are published in *Nature Energy*.

Study leader Professor Lianzhou Wang said conventional solar technologies used rigid, expensive materials, whereas the quantum dots are flexible and printable.

"This opens up a huge range of potential applications, including the possibility to use it as a transparent skin to power cars, planes, homes and wearable technology.

"Eventually it could play a major part in meeting the United Nations' goal to increase the share of renewable energy in the global energy mix," he said.



Professor Wang's team set the world record for quantum dot solar cell efficiency by developing a unique surface engineering strategy.

"This new generation of quantum dots is compatible with more affordable and large-scale printable technologies," Professor Wang said.

"The near 25% improvement in efficiency we have achieved over the previous world record is important.

"It is effectively the difference between quantum dot solar cell technology being an exciting 'prospect' and being commercially viable."

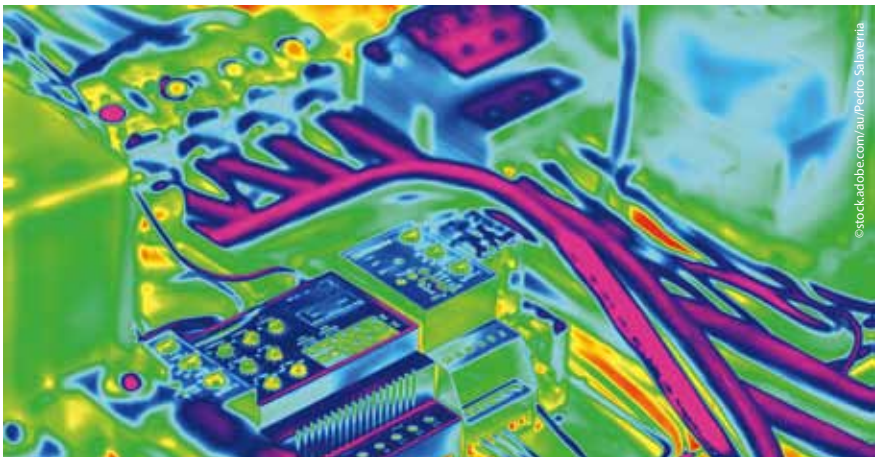
UQ Vice-Chancellor and President Professor Peter Høj AC extended his congratulations to the UQ team.

"The world needs to rapidly reduce carbon emissions and this requires us to invest much more in research to improve existing energy-generation technologies and develop entirely new ones," Professor Høj said.

"Harnessing the power of fundamental technological and scientific research is a big part of this process — and that's what we're focused on at UQ."

University of Queensland
www.uq.edu.au

Powering electronics with waste heat



Thermocells are devices that convert environmental heat, such as that lost from the human body, into electricity via a thermal charging effect. Although inexpensive and efficient, thermocells have historically produced temperature-dependent low output voltages — just tens of millivolts (mV).

Researchers from the University of Tsukuba in Japan have now improved the energy-harvesting performance of thermocells, publishing findings in *Scientific Reports*.

The team developed a thermocell containing a material that exhibited a temperature-induced phase transition of its crystal structure. The team's design, combining thermocell technology with an appropriately matched phase transition material, will increase the ability to harvest waste heat to power electronics.

The researchers finely tuned the phase transition temperature of their material to just above room temperature. When a thermocell containing this material was heated above this temperature, the phase transition of the material was induced, leading to a substantial rise in the output voltage from zero at low temperature to around 120 mV at 50°C — a considerable performance improvement compared with existing thermocells.

"The temperature-induced phase transition of our material caused its volume to increase," senior author Professor Yutaka Moritomo explained. "This in turn raised the output voltage of the thermocell."

The improved thermocell also overcame the issue of temperature-dependent output voltage. Because the increase in voltage was much larger than the temperature-dependent fluctuations of output voltage, these fluctuations could be ignored.

"Our results suggest that thermocell performance can be strongly boosted by including a material that exhibits a phase transition at a suitable temperature," Prof Moritomo said.

"This concept is an attractive way to realise more efficient energy-harvesting devices."

Acciona to build wind farm complex in Qld

The construction of a 1026 MW wind farm complex in Queensland has been announced by Acciona following an agreement with CleanCo Queensland, the Queensland Government's renewable energy generator.

Reported to be the largest ever wind farm in Australia, the MacIntyre complex will boost the Queensland Government's decarbonisation strategy, mobilising total investments of $1.96 billion.

As part of the announced agreement, CleanCo will become the independent owner and operator of a 100 MW wind farm within the complex in addition to acquiring the annual production of 400 MW from Acciona's facilities for 10 years through a power purchase agreement.

MacIntyre's 1026 MW capacity will generate clean electricity to power about 700,000 homes and avoid the emission of nearly three million tons of CO_2 per year. By greening Queensland's electricity mix, the MacIntyre wind complex will help the state meet its decarbonisation commitments and climate change mitigation strategies.

Set to be Acciona's biggest renewable energy facility and one of the largest onshore wind farms in the world, the complex will consist of 180 Nordex Group Delta4000 turbines, each with a capacity of up to 5.7 MW. Transmission lines spanning 64 km will be laid to connect the wind complex to the grid.

The project is scheduled to begin construction in mid-2021, with a gradual start-up in phases to ensure connection to the grid for the state's electricity system while optimising the return on investment. The entire MacIntyre complex is scheduled to be fully operational in 2024.

Acciona is negotiating additional supply agreements with private clients as well as the possible involvement of other investment partners for its 926 MW in the MacIntyre complex.

ACCIONA Australia

www.acciona.com.au

New dates for Smart Energy 2020

The Smart Energy Council has announced new dates for the 58th Smart Energy Conference and Exhibition in Sydney, moving the event from 7–8 April 2020 to 29–30 September due to the potential impact of COVID-19.

"The safety of our visitors, exhibitors and sponsors is our primary concern," the Smart Energy Council said.

"We have always run fantastic events that are extremely well attended, and drive business to business sales and opportunities.

We want to make sure our 2020 Conference & Exhibition is a success for all participants too."

The rescheduling of the event follows the World Health Organization's declaration of a global pandemic, and heeds federal and state government advice regarding restrictions to large public events in NSW.

The council stated that — despite September looking to be a busy time for large events in the smart energy calendar — the industry will be keen to get back to work and showcase their businesses and success stories as soon as possible.

What: Smart Energy Conference and Exhibition 2020

When: 29–30 September 2020

Where: International Convention Centre (ICC) Sydney

Web: https://www.smartenergyexpo.org.au/

Ozwater'20 postponed

Ozwater is the Australian Water Association's annual international water conference and trade exhibition.

Ozwater'20 had planned to put the thirst for sustainability into action but it will not proceed in Adelaide in May due to COVID-19 concerns.

The AWA is currently assessing options, which will be updated as soon as information becomes available.

For further information, visit www.ozwater.org.

Energising Australia

At the centre of our lives, no matter what we're doing, is energy. The ongoing challenge to source new and renewable options is a blessing in disguise for standards development as it provides a strong demand for standards.

Australia is a unique space for a vast array of energy sources; coal, uranium, oil and gas have powered us for years, but as the demand for sustainable options increases, we must adapt and support industry innovation to fulfil these needs.

Part of this is smart energy, which, among other improvements, will help in supporting our local electricity networks to integrate and maximise the use of solar and energy storage. While this is exciting, there are challenges to overcome and support systems that need to be implemented to help smart energy reach its full potential. Standards are essential to this.

The demand for more energy can't be ignored. Standards Australia continues to help these growing industries by providing a foundation to produce sustainable, safe and effective solutions. The way we source energy is changing, new technologies assure us of that and Australia now has opportunities to engage with and adopt many of these to support the global effort towards reducing carbon emissions and creating a healthier planet.

Ocean energy

Renewable energy is a top priority in the sector as the world works together to decarbonise and create a more sustainable future. In an exciting step forward, this year Standards Australia has seized the opportunity to enter the international conversation on renewable ocean energy by setting up a committee to discuss the implications and standardisation of this energy source.

The global appeal to address climate change is driving major growth in renewable sources of power generation and it is undeniable that water is one the world's most valuable and attainable resources.

The facts about ocean energy include:

- Energy is harnessed from waves, tides, currents and temperature differentials.
- Australia's industry is centred around wave and tidal energy.
- Waves are created by wind passing over the surface of the ocean.
- The natural movement of water within oceans can be transformed into electricity.
- The ocean has more available energy per unit areas than on land.

Water covers 70% of earth's surface but currently remains underutilised. Australia could present major benefits to the Australian

economy, communities and energy sectors by investing in ocean energy initiatives such as harnessing available wave and tidal resources.

By engaging in the international discussions on this energy, Australia has a voice in yet another innovative and evolutionary development in the energy sector, and standards will play an important role in moving forward with this initiative. While we are just beginning the journey in this sector, we continue to provide important updates in other areas.

Network of standards

Standards exist across the energy sector, helping to guide industry and professionals from the traditional centralised grid system through to new energies such as hydrogen and ocean energy. These innovations imply today is no longer about simply delivering energy, and the broader opportunities, developments like hydrogen create, are infinite. In the electricity sector, grids are undergoing rapid change driven by the unprecedented demand for new use cases and flexibility. While energy remains central, now it is about information, communication and data, all of which are shifting the focus to a customer-oriented supply chain.

So how are standards supporting this?

Standards Australia is a participant on many international committees that look at smart energy standards to help determine terminology, public network electricity characteristics, grid integration and design and management of decentralised electricity supply systems. The network of standards already available to support the energy industries is large; however, as smart energy expands, standards and similar documents will become even more necessary. Standards Australia strives to be on the forefront of innovation and supporting our industries in their evolutions is one way to get the right standards to the right people.

What else is happening at Standards Australia?

New guidance has arrived for the battery storage sector with the publication of a standard late last year. The guidance sets out requirements around the safe installations of home batteries, including the use of non-combustible material when mounting the batteries onto a wall.

AS/NZS 5139:2019 *Electrical installations –Safety of battery systems for use with power conversion equipment* was a complex project, made possible by the support of industry representatives, government and regulators, consumer representatives and technical experts.

The standard has been developed for use by manufacturers, system integrators, designers and installers of battery energy storage systems. It intends to set out the requirements for the safety and installation of battery systems connected to power conversion equipment for the supply of AC and DC power.

Having these types of guidelines in place aims to reduce the risk of fire spreading should one start from within the battery. Setting out requirements that keep fire away from habitable rooms to protect consumers is an important aspect of this standard. Standards Australia is committed to working with stakeholders and industry to provide guidelines to help ensure the safety of communities across the country. The work on battery storage standards will continue. With this being a new standard, it is expected there will be further refinement as the industry evolves.

Feedback is always welcome and encouraged, email sem@standards.org.au.

Standards Australia
www.standards.org.au

Using smelly fruit to charge your phone

A new method that involves converting durian and jackfruit waste into supercapacitors that can charge mobile phones has been developed at the University of Sydney.

This system could substantially reduce the cost of energy storage and charge devices such as mobile phones, tablet, laptops and electric cars very quickly.

"Using durian and jackfruit purchased from a market, we converted the fruits' waste portions (biomass) into supercapacitors that can be used to store electricity efficiently," said School of Chemical and Biomolecular Engineering academic Associate Professor Vincent Gomes.

"Using a non-toxic and non-hazardous green engineering method that used heating in water and freeze drying of the fruits' biomass, the durian and jackfruit were transformed into stable carbon aerogels — an extremely light and porous synthetic material used for a range of applications.

"Carbon aerogels make great supercapacitors because they are highly porous. We then used the fruit-derived aerogels to make electrodes which we tested for their energy storage properties, which we found to be exceptional."

What are supercapacitors?

"Supercapacitors are like energy reservoirs that dole out energy smoothly. They can quickly store large amounts of energy within a small battery-sized device and then supply energy to charge electronic devices, such as mobile phones, tablets and laptops, within a few seconds," Gomes said.

"Compared to batteries, supercapacitors are not only able to charge devices very quickly but also [offer] greater charging cycles than conventional devices.

"The current supercapacitors are made from activated carbon [and] are nowhere near as efficient as the ones prepared during this project."

Why were durian and jackfruit chosen?

"Durian waste was selected based on the excellent template nature provides for making porous aerogels," Gomes said.

"The durian and jackfruit supercapacitors perform much better than the materials currently in use and are comparable, if not better, than the expensive and exotic graphene-based materials.

"Durian waste, as a zero-cost substance that the community wants to get rid of urgently due to its repulsive, nauseous smell, is a sustainable source that can transform the waste into a product to substantially reduce the cost of energy storage through our chemical-free, green synthesis protocol.

"We have reached a point where we must urgently discover and produce ways to create and store energy using sustainably sourced materials that do not contribute to global warming.

"Confronted with this and the world's rapidly depleting supplies of fossil fuels, naturally derived supercapacitors are leading the way for developing high-efficiency energy storage devices."

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to industry and business professionals

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