

# SOLUTIONS No 1

MONDAY • 9 July 2018



**LIVE @ WCS**  
**WCS Young Leaders Symposium**

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What does innovation mean to the leaders of tomorrow? And, how can disruption and innovation be harnessed to benefit cities around the globe?



**LIVE @ SIWW**  
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"We need to adopt a whole-of-government approach to solve water shortage, which is a wicked problem."



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"The tech industry needs to be more involved in DfE and recycling"



**SPECIAL REPORT**  
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"Developing countries don't need to replicate the mistakes developed countries have made"



**LIVE COVERAGE @ Sands Expo & Convention Centre, Marina Bay Sands, Singapore**

**FEATURE**

## TOWARDS A SUSTAINABLE AND ENVIRONMENTALLY RESILIENT WORLD

Innovative solutions for pressing urban, water and environmental challenges will be showcased at this year's WCS, SIWW and CESS

By **Howard James**



**Around 20,000 attendees** from almost 100 countries will convene at Singapore's Marina Bay Sands Expo and Convention Centre over the ensuing days to attend this year's Singapore International Water Week (SIWW), World Cities Summit (WCS) and CleanEnviro Summit Singapore (CESS), as well as other co-located events.

In the past decade, all three have grown to become key international platforms for discussions on urban sustainability. This is an especially significant year for these events, as Singapore has designated 2018 as the Year of Climate Action, and the nation is the current Chair of ASEAN, focusing on resilience and innovation.

Of particular note, this year marks the eighth edition of SIWW, as well as the sixth edition of WCS and fourth edition of CESS. Combined, the events expect to welcome some 160 city leaders and a range of influential decision-makers from all corners of the world – including public-sector leaders, business executives, technology providers, experts and academics – who will gather to discuss how they will address today's most pressing urban challenges facing cities and nations.

► **Continued on P2**

**SPECIAL REPORT**



## 3 AWARDS, 1 GOAL

Recipients to be commended for their contribution to solving sustainability issues

By **Will Chin**

**Prestigious and unique** in their own way, the Lee Kuan Yew Water Prize (LKYWP), Lee Kuan Yew World City Prize (LKYWCP) and Singapore Packaging Agreement (SPA) Awards exemplify the remarkable efforts of companies and individuals to embrace social welfare, environmental stewardship and economic prosperity – the three core pillars of sustainability.

LKYWCP winner Seoul transformed itself from a place dogged by urban sprawl to a highly liveable city characterised by aesthetic design and green cityscapes; LKYWP winner Professor Rita Colwell's groundbreaking work enables governments and health authorities to prevent and control outbreaks of cholera – a disease that infects up to four million people each year, according to the World Health Organisation; and recipients of the SPA Awards have made significant strides in reducing the amount of packaging waste produced in Singapore.

► **More information on P2 and P3**

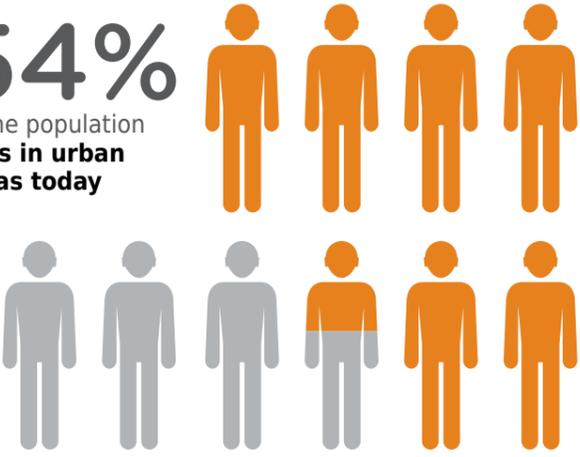
### DAILY HIGHLIGHTS

<p><b>Ballroom L-M, Level 5</b></p> <p><b>OPENING ADDRESS AND OPENING PLENARY</b></p> <p>09.30–12.00</p>	<p><b>Ballroom I-J</b></p> <p><b>LEE KUAN YEW PRIZE LECTURES</b></p> <p>13.30–15.00</p>	<p><b>Ballroom ABGH, Level 5</b></p> <p><b>ENVIRONMENT AND WATER LEADERS FORUM</b></p> <p>15.15–17.15</p>	<p><b>The Ritz-Carlton, Millenia Singapore</b></p> <p><b>LEE KUAN YEW PRIZE AWARD CEREMONY AND BANQUET</b></p> <p>18.30–21.30</p>	<p><b>Hall B, Level 1</b></p> <p><b>WHOLE-OF-GOVERNMENT PAVILION</b></p> <p>09.00–17.30</p>
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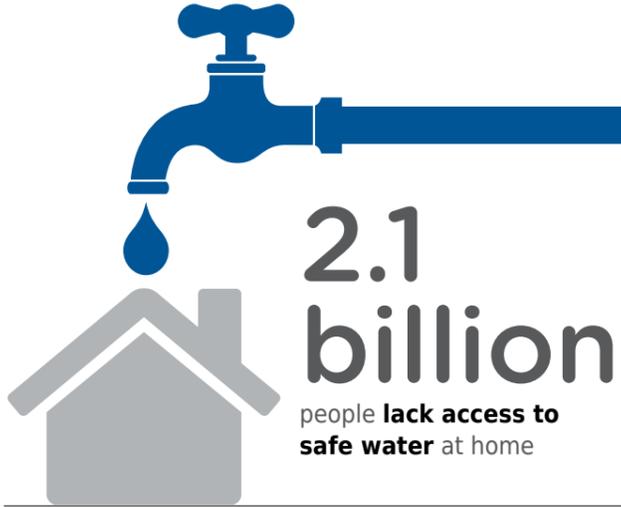
WCS

**54%**  
of the population  
lives in urban  
areas today



Source: World Bank

SIWW



Source: World Health Organization

CESS

Cities account for more than

**70%**  
of global greenhouse  
gas emissions



Source: World Bank

## TOWARDS A SUSTAINABLE AND ENVIRONMENTALLY RESILIENT WORLD

► Continued from P1

Highlights this week will include the Lee Kuan Yew Water Prize and Lee Kuan Yew World City Prize, which recognise significant contributions towards urban and water sustainability. This year's winners, Professor Rita Colwell for her pioneering insights into microbial water quality surveillance and pivotal contributions to the management of waterborne diseases and public health, and Seoul for its admirable transformation into an inclusive, socially stable and highly innovative city, exemplify the commitment and efforts industry leaders and city leaders must undertake to enact significant change.

While cities have made great strides to become more liveable and sustainable, many challenges remain. To create environmentally, socially and economically resilient cities, for example, issues relating to inclusivity and diversity, and the securing of financing for urban infrastructure, amongst others, must be carefully managed.

As an island city-state, climate change poses an existential challenge to Singapore. Studies show that by the end of the 21st century, Singapore could see daily temperatures rise by up to 4.6 degrees Celsius. This would pose unprecedented challenges to the nation's natural and built environments, and the quality of life for its citizens. Mean sea levels could also rise by up to one metre, drastically altering the nation's coastline. Under the Paris Agreement, Singapore is committed to reducing its emissions intensity by 36%, from 2005 to 2030, and stabilising the nation's greenhouse gas emissions with the aim of peaking by this date.

To address the challenges of climate change and environmental sustainability, Singapore is looking to strategic long-term planning and dynamic governance structures that are able to respond to and anticipate disruptions. Harnessing smart and digital capabilities to improve the functioning of cities and the daily life of its residents is another key element. Governments, non-governmental organisations and the private and people sectors need to innovate and collaborate.

In Singapore's experience, international cooperation and learning from the experiences of different cities across the globe is an integral part of formulating solutions to urban issues. All three events aspire to provide valuable platforms to facilitate discussions on the challenges,

experiences and best practices associated with attaining urban sustainability.

This year is of particular significance for SIWW, as it marks a decade since the event was first established. A series of activities and events highlighting the event's contributions and achievements in the water industry have been planned to celebrate this milestone. Activities will include a look at past and future water trends through an interactive word cloud that invites delegates to "co-create the future" of the water industry, and a timeline of the best water technologies displayed on close to 200 posters as part of the Water Convention programme attended by close to 1,300 water practitioners, leaders and delegates. In addition, this year's Water Expo will feature the Smart Water Pavilion, Tuas Water Reclamation Plant – Integrated Waste Management Facility Pavilion and country pavilions for Cities, Environment and Water, among many other highlights.

The biennial WCS is an exclusive platform for government leaders and industry experts to address challenges to building a liveable and sustainable city, share integrated urban solutions and forge new partnerships. Themed "Liveable and Sustainable Cities: Embracing the Future through Innovation and Collaboration", this edition of WCS will offer a wide range of discussions for city leaders, industry partners, academics, urban practitioners and the public to provide strategic insights on the interplay of leadership and governance and the latest debates on liveability and sustainability. This year's special focus is on financing, urban regeneration, planning for inclusive communities, resilience, collaborations and governance for disruptive innovations. Also of note are the South Asia Business Forum and the China Innovation Forum, which place a spotlight on new opportunities and innovations in response to new demands on high-growth cities. It is hoped that the discussions at the Mayors Forum, Young Leaders Symposium, plenary discussions, thematic tracks, forums and co-located events will leave participants with innovative new ideas and solutions.

The rapid proliferation of technological innovation in the environmental industry forms the backdrop of CESS 2018. Themed "Transforming Tomorrow's Cities with Clean Environment Solutions", the fourth edition of the event places an emphasis on the presentation of novel ideas to overcome



old and emerging issues. Reflecting this, the highlight of CESS 2018 is The Innovation Pitch, where inventors get the chance to present cutting-edge concepts to an audience of investors and collaborators. In addition, detailed discussions and the sharing of global best practices will be facilitated through numerous forums and high-level plenaries, such as the

Clean Environment Leaders' Summit, Clean Environment Convention, and Clean Environment Regulators Roundtable.

The events' organisers are confident that all attendees will have a fulfilling time engaging with international counterparts, sharing ideas and solutions to address the many challenges the world faces today.

FEATURE

## RECOGNISING ACHIEVEMENTS AND EFFORTS IN PACKAGING WASTE REDUCTION

The Singapore Packaging Agreement (SPA) Awards 2018

By **Howard James**

**T**he Singapore Packaging Agreement (SPA) was introduced in 2007 as a voluntary joint initiative by the government, industry and NGOs to reduce packaging waste.

Since then, signatories to the Agreement have optimised their packaging designs and manufacturing processes to reduce the amount of packaging waste. Signatories also raise consumer awareness on the importance of packaging waste minimisation through their outreach activities. As of 2017, the SPA signatories have collectively reduced

packaging waste by 39,000 tonnes and, in the process, saved about S\$93 million in packaging material costs.

The annual SPA Awards (formerly known as the 3R Packaging Awards) recognise signatories for their efforts in reducing, reusing and recycling packaging waste. This year's winners will be receiving the Awards from Mr Masagos Zulkifli, Minister for the Environment and Water Resources, at the SPA Awards 2018 Presentation Ceremony on Tuesday, 10 July 2018, 08.45–09.15, at Level 5, Sands A Room 5001–5103.

## FEATURE

# DESIGNING A PEOPLE-CENTRIC CITY

Lee Kuan Yew World City Prize 2018 winner Seoul exemplifies an inclusive, creative, and economically and environmentally sustainable city

By **Howard James**



As the epicentre of South Korea's burgeoning industrial economy during the 1980s and 1990s, Seoul experienced a multitude of urban challenges. The nation's capital bore many of the traits associated with emerging economies, including urban sprawl, social inequality and environmental degradation.

Following the nation's democratisation during this period, Seoul faced increasing resistance from citizens who felt they had been overlooked in the urban development process. Adding to the city's woes, vehicle ownership soared, which created widespread congestion and high levels of air pollution.

## Visionary Leadership

The election of successive visionary leaders in the 2000s brought about significant change. Mayors Lee Myung-bak, Oh Se-hoon and current Mayor Park Won-soon demonstrated strong political will to take on these challenges, and implemented a series of catalytic projects that would bring about benefits for the city.

The city's leaders realised that clear and frequent communication was needed to achieve buy-in from all stakeholders. Through rigorous engagement, the city formulated a set of conflict management strategies. This

led to the establishment of a dedicated team of negotiators within the Seoul Metropolitan Government, who are present in all urban development projects.

Residents were also given a say over local issues that affect their communities, and were given control of up to 5% of the city budget under the Public Participatory Budget System.

## People Spaces

Seoul's move from car-oriented transportation to people-centric spaces is noteworthy. Today, the city manages this process through a comprehensive set of measures and the use of big data, making public transport as seamless and convenient as possible.

Notable projects include the restoration of the former stream at Cheonggyecheon, once the site of an overhead expressway; the pedestrianisation of popular high street Yonsei-ro; and the conversion of the Seoul Station Overpass into Seoulo 7017, a kilometre-long landscaped elevated walkway. Seoul is also highly innovative in its rejuvenation of older structures. One such project is Mapo Culture Depot, a conversion of disused oil tanks into a cultural venue and public space.

By turning the people into active participants in the city's development, Seoul has demonstrated that a truly bottom-up city is possible, where the citizens own their shared city.

## THE LEE KUAN YEW WORLD CITY PRIZE 2018 SPECIAL MENTION CITIES ARE:



### HAMBURG, GERMANY

Transformed the city's underused drab industrial area into a dynamic mixed-use district, and created a welcoming city of opportunities for a growing population.



### KAZAN, RUSSIA

Transformed a city with crime and poor health systems into a city known for sports, and social and religious harmony.



### SURABAYA, INDONESIA

Transformed kampung neighbourhoods into clean, conducive and productive environments, and alleviated poverty.



### TOKYO, JAPAN

Transformed an economically depressed city into a highly efficient, liveable and vibrant city.

Source: Urban Redevelopment Authority

## FEATURE

# PROFESSOR, INNOVATOR, LIFE-SAVER

Meet Professor Rita Colwell, 2018 Lee Kuan Yew Water Prize Laureate, whose work transformed the management of waterborne diseases

By **Sabina-Leah Fernandez**

To say that Dr Rita Colwell, the first woman to receive the Lee Kuan Yew Water Prize, has made waves with her work is an understatement. Her research on fighting cholera and other waterborne diseases has shaken up the scientific community and touched countless lives.

Dr Colwell began blazing a trail in the 1970s. When most experts believed *Vibrio cholerae* – the cause of the disease cholera – needed a human host to survive, and that it would die within hours of leaving the human body, Dr Colwell discovered that the bacterium can not only survive without a human host, but that it occurs naturally in the aquatic environment associated with plankton.

This key information helped scientists and doctors better understand the relationship between the disease and the environment. Leveraging this knowledge, Dr Colwell was

able to predict cholera outbreaks using satellite imagery and modelling, opening up opportunities for better surveillance and management of the disease.

But the American molecular microbiologist is not restricted to high-tech developments. Understanding the unique challenges of the developing world, she championed the use of *sari* cloth water filters in Bangladesh. Her innovative idea led to a 45% decrease in cholera incidence in 65 rural villages in Bangladesh, and has since been applied to cholera-endemic locations in South America and India.

The prediction model she developed has been refined over the years, to the point where experts can now predict cholera outbreaks a few months in advance – providing lead time to intervene and save countless lives.



Professor Rita Colwell's work was groundbreaking – both in terms of scientific knowledge and in terms of saving human lives

In the 1980s, Dr Colwell's laboratory once again made a crucial breakthrough. Culture-based methods were the primary mode of determining if disease-causing bacteria like cholera were alive and harmful. Dr Colwell's laboratory found that, in fact, bacteria experience a phenomenon called "viable but not culturable" (VNBC) – meaning it can cause harm even when it cannot be cultured. Prominent scientists received the VNBC phenomenon with scepticism at the time, but it was not only proven correct, it has since been established that over 50 species

of bacteria – including the bacteria that cause salmonella poisoning and tuberculosis – can exist in a VNBC state too.

Following her unearthing of the VNBC phenomenon, Dr Colwell became an early adopter of novel molecular methods for diagnostics of water pathogens, advocating more precise and comprehensive methods. Ever the innovator, Dr Colwell also invented an approach to identify bacteria strains, and determine their virulence and antibiotic resistance. This approach makes use of whole genome sequencing and specialised databases.

In recent years she has focused on applying this diagnostic technology (called the GENIUS system) through COSMOS ID, the company which she founded in 2008. She has written 17 books and amongst her numerous advisory and leadership positions, was Director of the United States' National Science Foundation from 1998 to 2004, leading and shaping policy and practice to tackle and manage cholera and other waterborne diseases.

Dr Colwell says she is "truly honoured" to be the 2018 Lee Kuan Yew Water Laureate. But her work is by no means done. Professor Colwell received a S\$300,000 cash award from the prize, and intends to use it to fund her research on fighting cholera in Africa.



LIVE @ WCS

# INNOVATE AND COLLABORATE FOR BETTER, SMARTER CITIES

Mayors can look at embracing disruptive innovations and public-private collaborations to advance the development of their cities

By **Genevieve Chan**

This year, 122 city leaders from 117 cities attended the World Cities Summit (WCS) Mayors Forum. Touching on this year's theme "Embracing the Future through Innovation and Collaboration", Mr Lawrence Wong, Singapore's Minister for National Development, recognised the importance of harnessing disruptive technology to build smarter cities. "Rapid advances in technology like digitalisation, big data and artificial intelligence are all potential game changers that will enable us to reimagine and rebuild our cities," he said.

This disruption can even come from city planning itself; for the first time in Sydney's history, Greater Sydney has unveiled a regional map that was a result of collaboration between all its government agencies and some 750,000 social media points of contact. "This coordination, supported by infrastructure, is a critical and fundamental need for a growing city," explained Mrs Lucy Turnbull, Chief Commissioner, Greater Sydney Commission.

Other speakers who discussed the importance of long-term city planning coupled with the efficient use of technology included: Dr Vallop Suwadee, Chairman of Advisers to Governor of Bangkok; Mr Shan Zefeng, Director-General, Eco-city



122 city leaders from 117 cities attended the 2018 World Cities Summit Mayors Forum

Administrative Committee, Tianjin; and Mr Nguyen Van Suu, Permanent Vice-Chairman of Hanoi.

According to the United Nations, the world's urban population is expected to rise exponentially from 55% in 2018 to 68% by 2050. In Asia alone, the need for urban infrastructure is estimated at around US\$100 billion a year. Another major focus of the forum was thus the need for financing for infrastructure projects.

"We must have a holistic, integrated and sustainable development plan as a tool to attract investments," said HE Maimunah Mohd Sharif, Executive Director of UN-Habitat. She added, mayors could look into the "4 Ps" – public, private, people and partnerships.

Ms Stephanie von Friedeburg, Chief Operating Officer, International Finance Corporation, agreed on the need to collaborate with the private sector. However, with the increasing involvement of the private sector, governance will be key. Regulations should foster innovation while establishing rules around public safety, privacy, distribution and benefits.

Other speakers who spoke about how cities can help themselves be investment-ready included Mr Ahmed Aboutaleb, Mayor, Rotterdam, Mr Yousef Shawarbeh, Mayor, Amman, and Mr Chow Kon Yeow, Chief Minister of Penang, Malaysia, while Mr Louis Lim, Chief Operating Officer, Keppel Land and Managing Director, Keppel Technology and Innovation, gave insights into the private sector's perspective on financing cities' infrastructures.

WCS Mayors Forum 2019 will be held at Medellin in Columbia, Lee Kuan Yew World City Prize 2016 Laureate.

technologies to tackle and overcome common environmental challenges specific to the region, including water-related disasters and climate change.

At the ASEAN Mayors Forum on 7 July, mayors, governors and government leaders from different ASEAN member countries offered insights into urban challenges faced by their cities, and discussed solutions and initiatives that have been adopted for smart and sustainable growth. The forum explored the importance of collaboration between local governments and associations in addressing local urban issues, the need for more people-centric and community-focused development, and the value of ASEAN in enhancing more collaborative efforts to create smart and inclusive cities and regions.

Speaking at the inaugural ASEAN Smart Cities Network (ASCN) meeting on 8 July, Singapore's Minister for Foreign Affairs Dr Vivian Balakrishnan stressed that private-sector solution providers and city and state planners must focus on developing urban innovations characterised by interoperability and integrated services – especially in a region as diverse and connected as Southeast Asia – in their quest to build smart cities of the future. The first ASCN meeting saw national representatives from member cities formally endorsing the draft ASEAN Smart Cities Framework, which articulates the bloc's definition of a smart city, outlines key principles and identifies core goals in areas such as transportation planning, water and air quality, and citizen security and safety.



ASEAN Mayors Forum 2018 – "Building Sustainable and Smart Development in ASEAN Cities and Regions"

LIVE @ WCS

# SOUTHEAST ASIA GETS "SMART" ABOUT URBANISATION

Connectivity and collaboration will form the backbone of smart and sustainable cities in the region, as ASEAN leaders and industry experts demonstrate

By **Rachael Goh**

Smart technology and collaborative action were two main themes that marked a series of events on sustainable urban development, held alongside World Cities Summit in Singapore, from 5 July to 8 July.

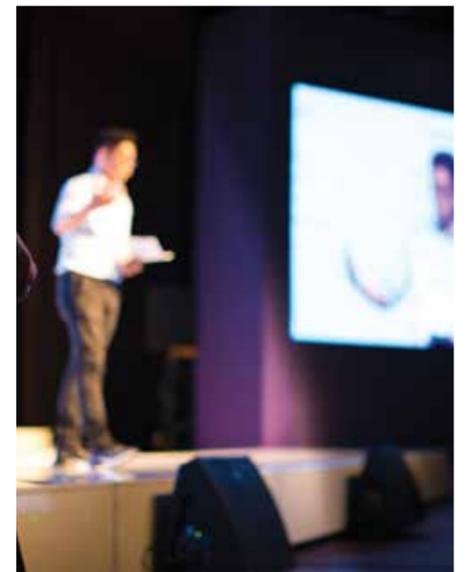
Mayors and governors from ASEAN (Association of Southeast Asian Nations) capitals pledged their commitment to building a sustainable environment at the 6th Meeting of Governors/Mayors of ASEAN Capitals from 5 July to 7 July. During the three-day meeting, over 40 delegates exchanged ideas and shared best practices on how to leverage smart

PREVIEW

# CALLING CITY INNOVATORS

Introducing the next game-changers in urban development

By **Pang Hui Zhen**



A key part of World Cities Summit (WCS) is its role in bringing new and disruptive urban solutions to the global marketplace.

Recognised worldwide for its innovative efforts, a joint study by Cornell University, INSEAD and the World Intellectual Property Organisation ranked Singapore as the leading Asian nation for innovation, and the world's sixth-most innovative country behind Switzerland, Sweden, the United Kingdom, the United States and Finland. Indeed, for more than 50 years, Singapore has had to overcome an array of city problems, including long-term potable water supply; food security; affordable housing; infrastructure; and much more.

Combined, the above creates the perfect arena for innovators to present new solutions to today's and tomorrow's pressing urban challenges.

City Innovators is a new pop-up platform to present to WCS attendees some of the most creative and innovative solutions in urban development. It will begin with a panel titled "Innovative City: The Singapore Story", where key leaders will share Singapore's experience in shaping innovation in a city context. In addition, they will discuss Singapore's current innovation landscape, covering topics that may range from deep tech to business to social innovation.

This will be followed by "Pitch Perfect: Bringing your Innovation to the World Arena", where local start-ups will present their latest innovative technologies and ideas to an audience comprising more than 3,000 government and industry leaders, urban solution experts and potential investors who are participating in WCS 2018. It will culminate with a networking opportunity at the Industry Night at City Solutions Singapore expo, on Tuesday evening at 18.00.

**"WCS City Innovators – Pitch Perfect Panel Discussion – Innovative City: The Singapore Story" will take place on Tuesday, 10 July 2018, 15.30–18.00, at City Innovators, Level 5, Sands Expo and Convention Centre.**



LIVE @ WCS



Ratti, Director, MIT SENSEable City Lab; Mr Ted Chen, Co-founder, EverComm; Mr Devin de Vries, Co-founder, WhereIsMyTransport; Mr Justin Lester, Mayor of Wellington; Ms Lucinda Hartley, Co-founder, Neighbourlytics; Mr Shaishav Dharia, Regional CEO, Lodha Group; and Mr Chintan Raveshia, Cities Lead, Arup – was their vision of a future city.

Green spaces and no traffic congestion – Essen for example has become a green capital, the third-greenest city in Germany, and has the world's longest bicycle highway, removing 52,000 cars from their roads in the process. Wellington city in New Zealand is successfully reintroducing the country's native flora and fauna to its urban landscape.

Speakers such as Mr de Vries, Professor Ratti and Mr Raveshia spoke about future cities promoting accessibility and mobility – for example through the use of autonomous cars, ride-sharing and active mobility technology such as Uber, Grab and Ofo. Mr Dharia emphasised the walkability factor – where citizens can easily move around on foot, even in the tropics.

**Embrace Different Ideas to Push Innovation Forward**

Ms Hartley, Mr Chen and moderator Mr Pang Yee Ean, Director-General, Asian Infrastructure Investment Bank spoke of the different challenges that need to be addressed. These included not just creating but sustaining technology development as well as using social data to help urban planners better plan and improve cities. This in turn helps create cities that citizens can connect to – organic communities that retain culture and a human element rather than urban sprawl. To achieve this successfully, sandboxing and listening to feedback from citizens is important.

Summing up the event, Mr Lim Hock Chuan, Chief Executive, Temasek Foundation Connects noted that city leaders have the daunting task of leading the process of reimagining our communities, creating cities for the people that encompass thriving economies and a healthy, happy environment.

## BACK TO THE FUTURE

How innovation and disruption are changing the world to create more liveable and sustainable cities

By **Shanti Anne Morais**

Innovation is changing the world, but how is it impacting cities? To create new opportunities and ensure vibrancy and relevance, cities must actively respond to the disruption that occurs due to technological advancements. "A crucial way to do this effectively is by engaging its citizens," said Mr Desmond Lee, Minister for Social and Family Development, and Second Minister for National Development, Singapore at the World Cities Summit (WCS) Young Leaders Symposium 2018.

The symposium highlighted how city mayors and governments worldwide are in different stages of enforced radical changes that harness technology for the good of citizens, while young leaders shared what innovation means to them, and the associated challenges and solutions they have in mind.

**Sharing a Vision**

A key takeaway of the speakers – Mr Thomas Kufen, Lord Mayor of Essen; Professor Carlo

PREVIEW

## REALISING SMART MOBILITY

Introducing the LTA-UITP Singapore International Transport Congress and Exhibition – an event held in conjunction with World Cities Summit

By **Andrea Lee**

As cities grow, authorities increasingly rely on robust public transport systems to enable citizens and goods to travel with ease, and deter car ownership.

The rail industry is playing an increasingly critical role in urban mobility. Between 2007 and 2017, construction of rapid transit systems soared, according to the Institute for Transportation & Development Policy. A significant benefit of rapid transit systems is their relatively low emission rates. In Singapore, for instance, the National Climate Change Secretariat notes that its Mass Rapid Transit system contributes 4% of all transport emissions, versus private cars that emit 35%.

Technological innovation drives the efficiencies and effectiveness of the industry. In the Asia-Pacific, 43% of metro lines are fully automated. Digitalisation is key to improving capacity and asset performance capabilities.

In light of these developments, the Land Transport Authority of Singapore (LTA), the International Association of Public Transport (UITP) and LTA's subsidiary, MSI Global, have combined to present the third edition of the LTA-UITP Singapore International Transport Congress and Exhibition (SITCE).

Themed "People at the Heart of Digital Railways", SITCE 2018 will focus on how digital technologies can transform the rail transport landscape, and the need to bring innovative solutions to a people-centric transportation system, in order to improve commuters' experience. The event will host a congress, exhibition, technical visits and various networking sessions to allow the global transportation community to share knowledge, learn more about the latest digital technologies for rail and establish new contacts.

For more information visit [SITCE.org](http://SITCE.org).

PREVIEW

## CELEBRATING INNOVATION AND COLLABORATION IN URBAN PLANNING THE SINGAPORE GOVERNMENT PAVILION

A must-see exhibition where attendees can immerse themselves in the successes and challenges of past, present and future urban projects

By **Chan Jia Yi**

For more than half a century, collaboration and innovation have played a critical role in driving Singapore forward. This is particularly the case regarding the country's approach to urban planning.

The Singapore Government Pavilion shares Singapore's progress in developing integrated urban solutions; building economic, environmental, physical and social resilience; and engaging with communities, which consequentially strengthens businesses and helps government agencies to serve citizens better and sustain a high quality of life.

The Singapore Government Pavilion 2018 will showcase how the Singapore government, research institutions, agencies, industries and citizens work together in creating innovative solutions for tomorrow. The pavilion will also exhibit the collaborative efforts of various government agencies – in areas including research and development, urban development, information and communications technology (ICT) infrastructure, policymaking, capabilities building and ecosystems development – to transform Singapore into a progressive, adaptive and sustainable city in the near future.

The Singapore Government Pavilion 2018 will focus on four themes:

**THEME 1:**  
ENSURING A RESILIENT SUPPLY OF FOOD AND ENERGY

Featuring projects by



**THEME 2:**  
USING SPACE INNOVATIVELY

Featuring projects by



**THEME 3:**  
BUILDING RESILIENCE

Featuring projects by



**THEME 4:**  
DEVELOPING STRONG DIGITAL CAPABILITIES

Featuring projects by



Visitors are encouraged to share their experiences on common challenges faced, and communicate possible collaboration opportunities.

The Singapore Government Pavilion 2018 is located at Level 5 of Sands Expo and Convention Centre, and is open at all hours of World Cities Summit.

### TODAY'S HIGHLIGHTS

**Ballroom I-J, Level 5**

**LEE KUAN YEW WORLD CITY PRIZE FORUM**

15.15–17.15

**Roselle 4611–4713 and Peony 4411–4512, Level 4**

**SINGAPORE INTERNATIONAL TRANSPORT CONGRESS AND EXHIBITION**

09.00–16.30



LIVE @ SIWW

# FOUR TAKEAWAYS FROM TECHXCHANGE

A forum designed to foster interactive debate and present innovative technologies, TechXchange 2018 didn't disappoint

By **Howard James** and **Chin Wei Lien**



From right to left: Mr Kevin Price, Senior Science and Technology Advisor, Middle East Desalination Research Center; Mr Harry Seah, Assistant Chief Executive (Future Systems & Technology), PUB, Singapore's National Water Agency; Mr Glen Daigger, Professor of Engineering Practice, University of Michigan; Mr Christopher Gasson, Managing Director, Global Water Intelligence; and Professor Tom Stephenson, Pro-Vice Chancellor (Research and Innovation), Cranfield University

## 1. A Disconnect Between Utilities and Technology Providers Exists

"There is an enormous amount of clever technology, but what we need is clever implementation and integrated solutions," remarked Ms Sue Murphy, CEO of Water Corporation, Western Australia, during a debate between utilities and manufacturers questioning whether today's low uptake rate of technology is due to a lack of innovative ideas. The resolution, said Mr

Booky Oren, CEO and Chairman of Booky Oren Global Water Technologies, is to bring all parties together to co-create solutions.

## 2. Know the Right People

Finding the right technology is one thing, but penetrating a foreign market presents a different set of challenges. Panellists at the Markets Insights session agreed that having the right connections can make or break your venture overseas. "In the US, without finding

a corporate customer, it is very difficult to break into the new market," said Mr Per Lilleboe, CEO of Cambi. Mr Akhil Barar, COO of Organica Water, added, "Always go with a local representative. They cut across the bureaucracy and put you in front of the decision makers. Otherwise, you can be lost in the Valley of Death."

## 3. The Next Big Thing is China (or a Hand-held Desalination Device)

Mr Christopher Gasson, Managing Director of Global Water Intelligence, thinks that China's river pollution problem presents huge opportunities for innovators. "China is the world's biggest industrial market, and it will continue to be the biggest game in town." Mr Kevin Price, Senior Science and Technology Advisor at the Middle East Desalination Research Centre, thinks otherwise: "The future is the creation of a handheld desalination device, which allows individuals to inexpensively purify water during short-term catastrophic events."

## 4. Rising Stars Abound

Two companies, AeroLion and Aquafortus, received the coveted TechXchange 2018 Rising Star Award, while the Most Valuable Technology went to ROTEC for presenting the best business case and technical merits. Although only three companies were selected for the prizes, considering the range and depth of ideas shared during TechXchange, everyone is a winner.

NEWS



## COPING WITH EXTREME WEATHER - WHY WE NEED TO GET REAL

Floods, droughts, forest fires and heatwaves are becoming more common globally. We look at some of the key issues as extreme weather affects and changes our world

By **Shanti Anne Morais**

The weather took centre stage at the Water Convention 2018 Hot Issues Workshop on Coping with Extreme Events. Unanimously, panellists agreed on the need to have adequate adaptation measures in place, especially as these weather incidents are expected to increase in frequency.

## Expect to be Surprised

Mr Paul Brown, President of Paul Redvers Brown, cited the example of Montecito, California, where earlier this year, the wealthy coastal enclave was hit first by a massive fire and before it could recover, was caught off guard by a river of mud and debris. This incident emphasises that most people are not prepared when two extreme events occur together. A key learning is that authorities and the public can never entirely plan for everything. "We need to move towards being less dependent on probabilistic forecasting tools alone as we have to be conscious of random events that we have never seen before," Mr Brown said.

## The Irrationalities of Extreme Events

Dr Olivia Jensen, Senior Research Fellow, Institute of Water Policy, Lee Kuan Yew School of Public Policy, Singapore, noted that making decisions in the face of uncertainty – especially when it involves thinking in extreme conditions – is a major challenge faced by communities and policymakers. "There's a danger that we over- or underestimate the power of these events. We need to look at the whole spectrum while finding ways to match the risks and what we know about them, then match these to the policies being made to make better decisions," she added.

## The Need to be Prepared

Speakers Mr Craig Woolhouse, Deputy Director of the Environment Agency in the UK, Dr Rinus Vis, Director of Singapore Operation, Deltaes, Singapore, and Professor Francisco Arellano, Senior Technical Consultant, Maynilad Water Services highlighted the severity of stress that extreme weather events exert on water resources. Workshop moderator Dr Mark Fletcher, Director, Arup, UK asserted the importance of learning lessons from past events so that communities and their policymakers can be prepared for all eventualities.

LIVE @ SIWW

# RAISE YOUR GLASS TO NEWBREW - THE BEER MADE USING RECYCLED WATER

PUB has launched a special beer made using NEWater – and it's delicious

By **Sabina Leah Fernandez**

Launched yesterday at Singapore International Water Week (SIWW), NEWBrew is made using NEWater, Singapore's ultra-clean, high-grade recycled water. And yes, it tastes great.

**Here are seven interesting facts about NEWBrew, NEWater and beer made from recycled water.**

1. The beer is to commemorate 10 years since the first edition of SIWW.
2. It was created by Singapore's National Water Agency PUB in partnership with Brewerkz microbrewery. NEWBrew was launched at SIWW on Sunday, 8 July

2018, and will be served at events such as Industry Night. Event participants can also try it as part of the NEW Taste Challenge.

3. Brewerkz Managing Director and Head Brewer Mr Sean McLin used 1,920 litres of NEWater to create NEWBrew.
4. NEWBrew is a pale ale, a light-coloured beer that is one of the most popular bitter beers. Its flavour profile is floral and aromatic, with tropical notes, particularly citrus, and tinges of pine.
5. NEWater has been a part of Singapore's water supply since 2003 and is a key pillar of Singapore's water supply.



Can you guess which is which? Take part in the NEW Taste Challenge, and see if you can tell the difference

6. Beer has four ingredients: yeast, malt, hops and water, but it is between 90% and 95% water. Hence water quality is, in Mr McLin's words, "paramount" as it affects the taste of the beer.
7. NEWater has passed more than 150,000 scientific tests, and is ultra-clean and entirely wholesome. Mr McLin called it "the best water [he's] ever brewed with".

*Event participants are invited to take part in the New Taste Challenge at the Water Expo. The New Taste Challenge is a blind taste test during which beer-drinkers will be asked if they can tell the difference between craft brew and beer brewed using recycled water.*



LIVE @ SIWW

# YOUTHS NEED TO DRAW ON INNOVATION TO SOLVE WORLD'S WATER PROBLEMS

Opportunities abound in the developing world, but they require the support of employers to innovate

By **Sabina-Leah Fernandez**

Young water leaders have tremendous prospects to tackle the world's water problems, and need the support of their employers to bring innovation to the water sector, said Ms Sim Ann, Senior Minister of State, Ministry of Communications and Information and Ministry of Culture, Community and Youth at the first session of the Young Water Leaders Summit (YWLS) today.



Senior Minister of State, Ministry of Communications and Information and Ministry of Culture, Community and Youth, Ms Sim Ann (left) at YWLS

"The role of young professionals is limitless but it is really up to firms and industries to accommodate and allow innovation," Ms Sim said during a fireside chat hosted by Mr Nicholas Nelson, Head of Competence for Water Treatment, Omya. "I have faith that young people will come up with ideas and approaches that are unique in your own way. What is important is that workplaces support them," she reiterated.

Every day, 160,000 new people are added to the planet; 90% of them are in developing countries. Their standard of living is improving and the rate at which they utilise resources increasing. How do we manage that supply-demand deficit going forward? That is the question that current and future water leaders need to answer."

During his keynote address, Executive Director of the International Water Association Professor Kala Vairavamoorthy said, "We require a level of leadership and innovation unprecedented in our history.

YWLS was attended by 70 water professionals in the early stages of their careers who hailed from over 30 countries.

LIVE @ SIWW

# WATER SECURITY THE "BLACK ELEPHANT" ISSUE

Water security is a critical issue facing our planet, but hope springs eternal if the public, private and people sectors come together to address it

By **Rachael Goh**



Mr Peter Ho, Senior Advisor to the Centre For Strategic Futures and Chairman, Urban Redevelopment Authority of Singapore

At the Aqua Conversations dialogue in Singapore on 8 July, Mr Peter Ho, Chairman of the Urban Redevelopment Authority of Singapore (URA), highlighted steps that countries can take to strengthen water security, and underscored the importance of collaboration in solving this.

To solve a complex problem like water security, we have to spot warning signs early, understand how different parts and agents

of the problem interact with each other, and prepare for potential outcomes. "When the problem blows up, we feign surprise and shock, behaving as if it were a black swan," said Mr Ho. "[In reality,] the problem is already visible, but no one wants to deal with it and so we pretend it is not there."

Likening the water security issue to a "black elephant" – a cross between a black swan and the proverbial elephant in the room – Mr Ho warned that a lack of foresight and planning could eventually lead to dire consequences.

### Could Striking Up a Private-Public-People Partnership be the Solution?

"We need to adopt a whole-of-government approach, where government agencies work closely with people and private sectors to solve water shortage, which is a wicked problem," said Mr Ho.

Citing Singapore as an example, he explained how government ministries are working with private sectors on innovations that will increase the country's water supply while using the same amount of resources. Currently, Singapore is leveraging technological innovations to increase its water supply. At the same time, local consumers are accepting of higher water prices in the name of innovation.

"Consumers [tend to be] more understanding of price hikes in the short term, driven by new innovation, if it means that it will go some ways in securing our water supply in the future," said Mr Ho.

NEWS

# WELCOMING THE WATER WORKPLACE OF THE FUTURE



Dr Amy Khor, Senior Minister of State for the Environment and Water Resources (middle), was the guest of honour at the launch of the Singapore Water Exchange

The Singapore Water Exchange will house an ecosystem that drives water innovation and industry growth

By **Howard James**

Launched yesterday by Dr Amy Khor, Senior Minister of State for the Environment and Water Resources, the Singapore Water Exchange is the nation's first specialised development that is designed to house water companies spanning the entire water value-chain.



Singapore Water Exchange

Aimed at spurring the growth of Singapore's vibrant and dynamic water industry, Singapore Water Exchange will facilitate a collaborative ecosystem of water start-ups, technology companies, system integrators, investors, accelerators, market advisors and associations. It will provide opportunities to leverage mutual strengths and potential synergies to push the frontier of water innovation and business growth.

As an incubator of water technology innovation, the six-storey building offers 24 private office units with different configurations, some of which come with reinforced flooring for conversion into laboratory or workshop areas.

With virtual offices and co-working facilities with flexible lease terms, tenants will have access to a wide range of spaces and services that suit businesses of all sizes, from start-ups to global multinational corporations.

"Having the water companies located within a single development allows them to foster more collaboration and innovation, enhance their productivity across the value chain and increase their competitiveness," said Dr Pang Chee Meng, Director of Industry Development, PUB. "The Singapore Water Exchange is sited close to PUB facilities, and this allows technology developers to test-bed their innovations under real-life conditions to improve their product's viability and market-readiness. This provides a great opportunity for companies to carry out their product's proof of concept and build track records, and is a stepping stone for the product's future global implementation."

For more information on the Singapore Water Exchange, visit the WaterHub Pavilion on Level 1 or email [pub\\_waterhub@pub.gov.sg](mailto:pub_waterhub@pub.gov.sg) for more details.

## TODAY'S HIGHLIGHTS

<p><b>Water Expo</b> Level B2</p> <p><b>NEW TASTE CHALLENGE</b></p> <p>12.00-17.30</p>	<p><b>Pre-function Area,</b> Level 3</p> <p><b>WATER CONVENTION POSTER PRESENTATION</b></p> <p>15.30-17.30</p>	<p><b>Heliconia 3505-3506,</b> Level 3</p> <p><b>YOUNG WATER LEADERS SUMMIT</b></p> <p>11.30-12.30</p>
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## FEATURE

# CATALYST FOR CHANGE

The digitisation of industrial technologies is revolutionising how cities manage environmental challenges

By **Howard James**

The past few decades have seen significant advancements in the field of environmental technology. Combined with robust policymaking at the national and municipal level, many cities are today reaping the rewards of investments in cutting-edge technologies.

Yet despite these advancements, significant challenges remain.

Rising volumes of waste coupled with growing energy consumption are compromising the well-being of citizens and the natural environment. These issues are further exacerbated by the rapid pace of industrialisation and population growth. Governments recognise the significance of these environmental issues, and the challenge lies in balancing economic growth and ensuring sustainable development – a feat that is difficult to achieve.

## The Circular Economy

A solution to ensuring both economic growth and sustainable development is the circular economy. Within this model, resources are kept for as long as possible, where maximum value is extracted, before products and materials are remanufactured, refurbished or recycled.

In a circular economy, industries and businesses also prioritise energy from

renewable sources, as these are typically less pollutive. This is supported by greater resource-efficiency and reduced energy demand. Key enablers of the circular economy include smart technologies, where machines, data and humans work together in an entirely new way.

## Innovation Calling

Use of such technologies to reduce waste and spur greater resource efficiency were core focus areas of the inaugural CleanEnviro Summit Singapore (CESS) Catalyst held in October 2017 over two days.

Attended by more than 150 participants including environment leaders and technology and service providers of the environmental services industry from 17 countries, the forum explored the potential benefits of smart technology across the entire value chain.

## Market Deployment

Today, Singapore has already begun leveraging smart technology to help solve some of the nation's pressing environmental challenges.

In the field of vector control, the National Environmental Agency worked



JFE Engineering was one of many technology and service providers from the environmental services industry that participated in the inaugural CleanEnviro Summit Singapore Catalyst in 2017

with the Saw Swee Hock School of Public Health at the National University of Singapore to develop a dengue forecasting model for the incidence of dengue fever up to four months ahead of time. The model, powered by data science, provides advanced warning of impending outbreaks, enabling the city to be more responsive in implementing mitigation measures.

In the area of solid waste management, sensor technology is also playing an increasing role. In Singapore, all public waste collection trucks are equipped with GPS sensors, which allow real-time tracking of their movements; all recycling bins provided under the public waste collection scheme are RFID-tagged; and public waste collectors scan the tags upon collecting recyclable waste from these bins. As a result, the interoperability of the waste collection network in Singapore has improved its productivity and work processes.

Furthermore, in the field of public cleanliness, Singapore's Changi Airport has deployed automated cleaning bots to Terminal 4 to clean the common areas. The use of these automated cleaning bots makes the job easier for the (human) cleaners, as the bots can help take on work that requires intensive manual labour, thereby freeing up staff to focus on other higher-value-add work.

The above examples highlight how national governments, cities, the private sector and academia can capitalise on the opportunities that span from the circular economy and smart technologies.

*Following the success of the inaugural CESS Catalyst, the event will subsequently be held in the year leading up to the biennial CESS event. The next edition of CESS Catalyst will be held in 2019.*

## INTERVIEW

## 60-SECOND INTERVIEW WITH ZHANG CHAO EXECUTIVE DIRECTOR AND CEO OF CHINA JINJIANG ENVIRONMENT HOLDING COMPANY LIMITED

By **Alison Marshall**



**W**hat macro trends are causing rapidly increasing demand for waste disposal in China?

Over the past 40 years, a large number of people have migrated to Chinese cities, resulting in a sharp increase in waste generation. While this has created challenges, it has also brought about opportunities for the waste management industry.

**By the end of the 13<sup>th</sup> Five-Year Plan in 2020, about 600 WTE plants are expected to be operating in China**



The Chinese government has introduced policies over the past decade that focus on the treatment of both municipal and rural household waste. Collection of waste from villages is also a core contributor to China's rapid increase in waste. Further, changing lifestyles among China's emerging middle class is also leading to growing waste generation nationwide.

**What opportunities does China's Belt and Road Initiative (BRI) present to environmental companies?**

Since the late 1970s, China has experienced many environmental problems. We can share our experiences from the past 20 years with countries and peers along BRI. We are particularly optimistic about the

waste markets in Southeast Asia, South Asia and Central Asia.

**Your company established China's first waste-to-energy (WtE) plant using circulating fluidised bed (CFB) incineration technology in 1998. How has the WtE market in China progressed since then?**

Since 1998, when China started using CFB technology to dispose of waste, the WtE industry had been gradually developing until 2012. Then, China realised that incineration was more in line with national conditions, and related policies were issued, which stipulated that the on-grid tariff for WtE can share the same pricing as renewable energies.

Since 2012, China's WtE industry has grown exponentially. By the end of the 13<sup>th</sup> Five-Year Plan in 2020, about 600 WtE plants are expected to be operating in China.

**How important are events like CleanEnviro Summit Singapore to the market?**

The summit attracts different industries, technologies and companies. Participants will discover the latest industry trends, and share their views and opinions. New ideas will emerge from such dialogue.



PREVIEW

# ATTENTION INVESTORS

Are you looking for the next big idea in enviro-tech? Look no further

By **Howard James**

**A**cross the globe, environmental challenges are rapidly exacerbating. Issues ranging from solid waste generation to increased pollution are calling for innovative solutions to counter these and ensure environmental preservation.

As an environmental research and development hub, Singapore is working towards the development of cutting-edge solutions that meet today's challenges, whether at home or abroad. These include ideas and new concepts in the fields of waste management, cleaning, pest management, sustainable energy, as well as pollution control.

Technology is playing a vital role in this story, whether through use of robotics and other advanced technologies like artificial intelligence and blockchain, or through innovative reworkings of conventional tools. The CleanEnviro Summit Singapore Innovation Pitch grants inventors the chance to present cutting-edge solutions to an audience of investors and partners. Participants include research institutions, government entities, the private sector and non-governmental organisations.

**Challenge #1: Rising solid waste volume leads to more incineration ash. There are limitations on how much space can be used for landfill.**

The potential to use incineration ash in an environmentally safe manner as alternative material for manufacturing not only greatly reduces waste, it prolongs the lifespan of Semakau Landfill.

A team from the Republic Polytechnic's School of Applied Science has developed a cost-effective solution to transform solid waste incineration fly ash into fillers for fabrication of high-quality composites. The project could save up to 30% of the production costs associated with polymer fillers by using raw materials found in incineration ash.

Innovators from the Nanyang Technological University's School of Civil and Environmental Engineering plan to produce aerated concrete from incineration ash. The project is a collaboration involving Pan-United Concrete Pte Ltd, as well as Singapore's Housing and Development Board and the nation's Building and Construction Authority. (The use of IBA as a supplementary, cementitious material could replace raw materials and reduce material costs by 20%.)

Similarly, a collaboration between Sembcorp Industries, EnGro Corporation and the Singapore Polytechnic's Department of Technology, Innovation and Enterprise aims to convert incineration ash into aerogel and foam glass – the developed technology has the potential to achieve a recycling rate of 90% for incineration ash.



**Challenge #2: Waste-to-Energy plants face net electrical efficiency limits.**

The global waste-to-energy (WtE) market is expected to almost double from US\$25 billion in 2015 to US\$44 billion in 2024. Although seen as a highly effective solution in meeting two needs – managing waste and creating energy – further efficiencies can be achieved.

Innovators at the Nanyang Technological University's Energy Research Institute aim to replace conventional water-wall technology with technology based on phase change materials that will assist WtE plants to achieve net electrical efficiencies of more than 30%.

**Challenge #3: E-waste produces toxins and other environmentally harmful materials. Volumes are growing exponentially.**

A team from Si Pro and the Singapore Polytechnic's Department for Technology, Innovation and Enterprise aims to develop the necessary processes for the recycling and recovery of valuable materials in solar photovoltaic (PV) modules. Using green chemicals, the proposed solution, with a reclaim rate of over 90%, includes the recycling of crystalline silicon PV from entire modules, as well as individual components, including silicon wafers, silver, copper, aluminium and more.

Similarly, a collaboration between the Singapore Polytechnic's Department of Technology, Innovation and Enterprise, the Waste Management and Recycling Association of Singapore, and Cimelia Resource Recovery seeks to develop a new green technology to recover precious metals from base metals in e-waste recycling. The technology will potentially help the industry save time, energy and cost, as well as mitigate the unintended negative environmental effects of e-waste recycling.

**Challenge #4: Pollution detection has advanced leaps and bounds in the past decade, but there is still room for improvement.**

Having the ability to detect anomalies is critical for environmental management.

The rapid rise of e-waste and metals waste volumes in the past decade – as well as growing air pollution – means that authorities and the private sector need to have enhanced tools to assess environmental risks.

Innovators from the Nanyang Technological University's Residues & Resource Reclamation Centre, in collaboration with A\*STAR, Vtara Energy Group, IDSG Engineering & Trading, Metrohm Singapore and M&D Prize Foods, want to develop an ultrasonic-assisted tumbler to accelerate the testing process of heavy metals leaching from waste materials, and develop portable detection systems that can perform metals sensitive and rapid tests for heavy metals.

A team from the Hendricks Corporation aspires to create real-time automated detection of flaring and smoke from smoke stacks at industrial estates. Using video analytics, the program detects pollution automatically by monitoring for fire and smoke emissions from the smoke stacks around the clock, and alerting enforcement officers via mobile communication devices.

**Challenge #5: Manual cleaning is manpower intensive and laborious.**

While machines are rapidly being deployed in the public cleaning space, many still require workers to manually operate them. Innovators from the Singapore University of Technology and Design (SUTD) are building a new class of high-performance self-reconfigurable robots, which will significantly improve the performance of existing solutions, and specifically target closed drain inspection, hawkker centre floor cleaning and pavement cleaning.

SUTD is not alone. Inventors at the National University of Singapore have also developed an untethered robot that inspects closed drains for cleanliness and favourable mosquito breeding conditions.

**How much impact will they have?**

To learn more about the above-mentioned solutions, and to hear first-hand how these solutions work in practice, visit the Innovation Pitch on:

**9 July 2018, 14.30**  
Robotics and Automation

**10 July 2018, 14.30**

- Technologies for Using Incineration Ash
- Improving Energy Efficiency in Waste-to-Energy Plants
- Novel Methods for Mosquito Control

**11 July 2018, 10.00**  
Technologies for Using Incineration Ash and E-waste Recycling

**11 July 2018, 14.30**  
Robotics and Automation

INTERVIEW

## PERSPECTIVES WITH MINORU TOBITA

President and Representative Director, DOWA Eco-System



By **Will Chin**

**T**he e-waste problem has been described as one of the biggest issues facing the tech industry. What can tech companies do, particularly in emerging economies, to ensure that devices are responsibly disposed of once they reach the end of their life cycle?

In emerging markets, unlike Japan in which various systems and technologies are already installed, it is possible to achieve the decoupling of economic growth and environmental conservation by introducing best available technologies from the beginning. As a Japanese company, we want to help them. The tech industry needs to be more involved in DfE (designed for the environment) and recycling.

**What can be done by governments, people and businesses to curb the amount of plastic waste?**

International discussions on plastic waste are on the rise, and now it seems that each player will have to dig deeper. In Japan, we separate plastic secondary materials from end-of-life products, and generate more than 80 gigawatt-hours per year through plastics waste incineration. Waste-to-energy will become increasingly important to plastic waste treatment in the near future.

**What are some of the challenges in embracing the circular economy, and how might governments and the private sector work together to overcome these?**

As a final safety net in the circular economy, we believe that environmentally safe landfills and recycling are indispensable. Governments are responsible for creating a mechanism to ensure that the proper processes run economically, but private businesses like us are needed for their trusted technology and to operate projects.

**In your opinion, how important are events like CleanEnviro Summit Singapore to the environmental industry?**

CleanEnviro Summit Singapore is a valuable communication opportunity for many stakeholders. We look forward to learning about each country's needs and to showcase DOWA's capabilities as well.

## TODAY'S HIGHLIGHTS

NEA  
Innovation Pavilion,  
Level 1, Hall A

**CESS INNOVATION  
SHOWCASE**

09.00–17.30

NEA  
Innovation Pavilion,  
Level 1, Hall A

**CESS INNOVATION  
PITCH**

14.30–15.30



SPECIAL FEATURE

# BUILDING A RESILIENT SINGAPORE PART 1 – EMBRACING INNOVATION

Innovation can overcome tough challenges

By **Sabina-Leah Fernandez**

**T**his article is part one of a three-part series on Building a Resilient Singapore and takes a closer look at how embracing innovation helped Singapore become resilient. Part two will focus on how the island-state utilised collaboration to do the same.

Robust infrastructure is key to building resilience, but it is not enough to just stop there. Cities and nations must constantly reflect and learn from one another, and be open to embracing innovative solutions to old and new problems in a systematic manner.



The Marina Barrage creates a freshwater reservoir in the heart of the city

Singapore's water story is a perfect exemplar of how a small island nation has overcome all odds to turn its vulnerability into a strategic asset. The nation has embraced innovative urban water solutions on various fronts, including turning the Marina Bay into a freshwater reservoir, building a sewerage super highway to collect the nation's waste water, recycling used water, and turning seawater into drinking water, amongst others.

This is no mean feat for a city with no natural resources to boast of. Through tenacity,

perseverance and a whole lot of gumption, PUB, the city-state's national water agency, delivered what it was tasked to do: provide a continuous supply of clean drinking water to the population.

With the innovative spirit built into its DNA, Singapore continues to evolve with the wave of digitalisation that is sweeping the world. In line with Singapore's Smart Nation drive, PUB is exploring the use of smart technologies to enhance productivity and efficiency in planning and operations.

Two excellent examples of how Singapore is applying smart technologies in its water management are smart shower devices and an automated meter-reading (AMR) system. Smart shower devices track water consumption, either through colour codes displayed at the showerhead, or through numerical figures displayed in real time. A 2015 trial on some 500 households showed that real-time information and goal-setting can cut water use in showers by 3% a month, and about five litres a day. Smart showers have been fitted in some 300 homes so far, the first of 10,000 that PUB plans to install in brand-new Housing Board Development residential units in Singapore by the end of 2019.

With the game-changing AMR system, residents are able to track their detailed water consumption on a daily basis, and this empowers them to take steps to reduce their water usage. They are also able to receive leak and high-usage alerts. In 2016, PUB piloted the AMR project to provide some 500 households in Punggol with timely information on water consumption, coupled with gamification to encourage them to conserve water. These households were observed to achieve water savings of approximately 5% from early leak detection and good water-saving habits. PUB will be exploring how this system can be progressively implemented nationwide.

FEATURE

# PUSHING THE FRONTIER OF WATER TECHNOLOGY

With a belief in nurturing continuous innovation for the long run, PUB aims to further harness R&D to meet tomorrow's water demand at today's energy and sludge footprint

By **Sally Toh and Nawwar Syahirah**



EDI technology can help reduce the energy consumption of desalination

**W**ithin half a century, Singapore has transformed itself from a nation challenged by a host of water issues, including supply shortages, pollution and flooding, to one of the most water-progressive nations globally.

Its success in water management was driven by a clear and bold vision: to deliver a robust, sustainable and affordable water supply against the backdrop of increasing water demand, extreme weather patterns and rising energy needs.

Investments in research and development (R&D) and innovation have been key to realising this vision, giving rise to NEWater

and desalinated water – two sources that ensure Singapore's water security.

This, however, does not mean the end of its journey towards water sustainability.

Meeting future water demand with today's technologies will see national water agency PUB's energy footprint quadruple from the current 1,000 gigawatt-hours per year (GWh/year) to 4,000GWh/year, and the amount of sludge generated double from the current 300,000 tonnes per year to over 600,000 tonnes per year by 2060. This is unsustainable and can only be overcome by leveraging technological innovations.

"PUB is pushing the frontier of water technology to tackle the pressing challenges in energy and sludge management efficiency and is on track to meet its long-term targets. The key to this is collaboration with the local and global research community to develop real, applicable solutions to keep water supply secure and affordable," said Mr Harry Seah, PUB's Assistant Chief Executive (Future Systems and Technology).

To drive the next phase of innovation, PUB has set long-term targets for the following areas:

## a) Low-Energy Desalination

Desalinated water is Singapore's fourth national tap and is its most energy-intensive source. It currently meets up to 30% of water demand and will meet 30% of future demand in 2060. PUB's target is to reduce the energy consumption of the desalination process by more than half from the current 3.5 kilowatt-hours per cubic metre (kWh/m<sup>3</sup>) to 1.5kWh/m<sup>3</sup> in the short term, and eventually to 1kWh/m<sup>3</sup>, as a system, in the long-term.

PUB, together with United States-based Evoqua Water technologies, has reached a milestone in improving the energy efficiency of seawater desalination. Using electro-deionisation (EDI) technology, PUB and Evoqua have demonstrated the technology at an achievable energy

consumption of 1.65kWh/m<sup>3</sup> at a 50-cubic-metres-per-day (m<sup>3</sup>/day) pilot plant. This method uses an electric field to pull dissolved salts, with either a positive or negative charge, from the seawater. This technology is now being further validated in PUB's R&D facility at Tuas, at a 3,800m<sup>3</sup>/day EDI demonstration plant, the largest of its kind in the world. There are plans to further validate this technology at 10,000m<sup>3</sup>/day at the Tuas Desalination Plant once the technology is proven to work.

## b) Increasing NEWater Recovery at Low Energy

Singapore produces high-grade reclaimed water on a scale unprecedented anywhere in the world. NEWater currently makes up to 40% of water demand and will meet up to 55% of future demand in 2060. PUB's short-term target is to increase the NEWater recovery rate from the current 75% to 90% at the same energy consumption of 0.4kWh/m<sup>3</sup> for its energy-intensive RO treatment stage. The long-term target is a 90% NEWater recovery at less than half the energy consumption rate for RO treatment.

## c) Energy Self-Sufficiency and Sludge Reduction in Used Water Treatment

PUB is actively testing technologies which have the potential to make the used water treatment process energy self-sufficient, producing as much energy as it uses. PUB has set the target for its water reclamation plants to move from the current 25% energy self-sufficiency to 75% in the short term, and ultimately to 100% energy self-sufficiency in the long term.

Energy self-sufficiency and sludge management are inextricably linked. Thus, PUB also aims to reduce the amount of sludge generated by the used water treatment process by more than 50% in the long term, through harnessing the biogas generation potential of sludge. This will allow double the amount of used water to be treated in the long term at today's sludge footprint.

SPECIAL REPORT

# THE BIG INTERVIEW

*Solutions* newspaper speaks to Mr Pierre-Yves Cousteau, environmentalist, explorer, author and film-maker. Mr Cousteau is at CleanEnviro Summit Singapore 2018 to mark the inauguration of the International Solid Waste Association's Initiative for Mayors and Municipalities

By **Howard James**



Photo: Mr Dean Gocevski

**W**hen discussing pollution, you once remarked, "As soon as money is part of the equation, destruction is permitted." Yet others argue that there are not enough financial incentives to prompt economies to embrace environmental preservation. How can governments and the private sector strike a balance between environmental responsibility and monetary reward?

Due to the very nature of the economic system, businesses with the lowest costs, which externalise most of their true social and environmental costs, gain significant competitive advantage. One of the government's major roles is to counterbalance the negative impact of economic activities.

Unfortunately, today we are seeing quite the opposite happen: wealthy companies can afford to lobby governments to subsidise, rather than offset, their destructive practices. This creates a spiral of negative externalities that is largely responsible for the global environmental crisis we are witnessing today. Short of modifying the economic system to integrate all externalities – for which science and technology are advancing enough to envision this as a realistic possibility – governments must play their intended role of safeguarding people and nature from the blind devastations of the economy.

In many instances, this is undermined by poor professional mobility: ageing and unsustainable industries sometimes generate a lot of employment. Professional mobility (opportunity and training) is central in ensuring a sustainable industrial transition.

**How can businesses and state authorities overcome the negative perceptions associated with waste, and spur greater adherence to the 3Rs of reduce, reuse and recycle?**

The two most powerful ways to achieve this are positive and negative incentives.

In some countries, you are charged for how much waste you produce. This incentivises you to give more thought to your consumption habits. In other countries, some waste can be sold – for instance, deposits for plastic bottles or selling compost. These two methods encourage mindfulness about waste.

**You famously reported on the excessive volume of plastic waste in the world's oceans. Is the problem more a matter of educating individuals, businesses and industry about responsible waste management, or rather that the world must find an alternative to plastics in the global economy?**

Plastic has brought many benefits to humankind. The problem is how we use it, and once again this is largely due to the subsidies that go into the oil industry and hence make plastic prices too low for alternatives to compete with.

The plastic problem is tentacular and calls upon every actor of society to help solve it. Its core causes, nefarious subsidies and negligence of externalities are the same as for all other environmental challenges including climate change, overfishing and deforestation.

**Developing countries do not need to replicate the mistakes developed countries have made, and they can 'leapfrog' their development, jumping into best practices directly**



**In some countries, particularly in the developing world, environmental preservation is not a high priority, whereas other issues like social welfare, political stability and economic advancement are. What is your advice to such places, and how challenging might switching their priorities towards environmental stewardship be?**

Developing countries have the significant advantage of having less inertia to sustainable practices, so I would encourage a smarter and more sustainable development than the developed ones. Developing countries do not need to replicate the mistakes developed countries have made, and they can "leapfrog" their development, jumping into best practices directly.

**Where do you see the biggest opportunities for the environmental industry in the forthcoming decade, and why?**

The global environmental challenges we face can be addressed as opportunities. Renewable energy, alternatives to meat, alternatives to plastics, solutions for over-exploitation of resources, all require innovation and readiness of society, which we are very close to today. Those who prepare for this transition today are in the starting blocks for new demand. Professional mobility is central to transitioning to sustainable economies.

**What is the importance of events like CleanEnviro Summit Singapore in addressing present-day challenges and unearthing partnerships and other collaborative opportunities?**

CleanEnviro Summit Singapore is a wonderful opportunity for established industries and newcomers to showcase technical solutions to pressing environmental challenges. These events are very useful in helping to build a community of innovators and problem-solvers dedicated to reducing our negative externalities.

*For more information, visit [www.iswa.org/programmes/imm/](http://www.iswa.org/programmes/imm/)*



**SOLUTIONS**

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**SEEN@ SIWW**



**Celebrating 10 years of water excellence**

First row, from left: Mr Chiang Chie Foo, Chairman, PUB; Dr Amy Khor, Senior Minister of State for the Environment and Water Resources; Mr Masagos Zulkifli, Minister for the Environment and Water Resources; Mr Albert Chua, Permanent Secretary, Ministry of the Environment and Water Resources; and Mr Ng Joo Hee, Chief Executive, PUB

**SEEN@ WCS**



**We want to differentiate ourselves on the national landscape; to give us a unique point of difference from other Australian cities. I believe this can be achieved through technology and sustainability**

**The Right Honourable Martin Haese**  
Lord Mayor of Adelaide, Australia



**Above:** The Singapore government's impressive pavilion, which showcases smart city solutions from the likes of the Housing Development Board and the Urban Redevelopment Authority of Singapore

**TOMORROW'S HIGHLIGHTS**

Level 5,  
Level 1,  
Basement 2

**INDUSTRY NIGHT  
@ CITY SOLUTION  
SINGAPORE**

18.00–20.00

Peony 4403-4606  
and 4502-4506,  
Level 4

**SPECIAL ASEAN  
MINISTERIAL MEETING  
ON CLIMATE CHANGE**

12.00–18.00

Ballroom ABGH,  
Level 5

**WATER LEADERS  
SUMMIT KEYNOTE**

09.00–09.45

Sands A Room  
5001-5103, Level 5

**CLEAN ENVIRONMENT  
LEADERS SUMMIT**  
08.30–13.00

Sands A 5001-5103, Level 5  
**LEADERS-EXPERTS  
FORUM**  
15.30–17.30

Ballroom B-G,  
Level 5

**WORLD CITIES  
SUMMIT PLENARY**

14.00–15.00