

SOLUTIONS No 3

WEDNESDAY • 11 July 2018



INTERVIEW

Perspectives with Renee Mison

Renee Mison, CEO of Eco-Wiz, shares her ideas for actionable ways through which the public and private sectors can help reduce food waste

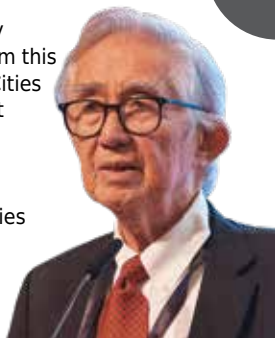


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LIVE @ WCS

Collaboration is the Way Ahead

One of the key takeaways from this year's World Cities Summit is that partnerships will likely help pave the path forward for cities



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LIVE @ SIWW

Ban Ki-moon on Climate Change

Global partnerships between the public and private sectors will help meet the UN SDGs



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OPINION

The Smart Way to Save

Ng Joo Hee, CE of PUB, shares his thoughts on how and why Singaporeans need to save water



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

COLLABORATION KEY TO OVERCOMING CHALLENGES: SINGAPORE MINISTERS

This week's many discussions highlight the importance of interactive dialogue in shaping solutions to pressing issues. They must continue for the foreseeable future, said Mr Masagos Zulkifli, Minister for the Environment and Water Resources, and Mr Lawrence Wong, Minister for National Development and Second Minister for Finance

By **Howard James**



The 2018 editions of WCS, SIWW and CESS have seen an array of topics discussed. All three featured a wide variety of dialogue, ranging from discussions about highly sophisticated technologies to beer made from recycled water (and anything in between).

Mr Masagos Zulkifli, Minister for the Environment and Water Resources remarked, "This week's events have brought together

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LIVE @ WCS/SIWW/CESS



TIME TO CELEBRATE

A quick look at yesterday's Industry Night@City Solutions Singapore

By **Will Chin**

Over the years, World Cities Summit, Singapore International Water Week and CleanEnviro Summit Singapore have proven to be premier global platforms for cutting-edge technologies and sustainability solutions – and this year's edition was no different.

More than 20,000 delegates from some 100 countries and regions descended upon Marina Bay Sands Expo and Convention Centre this year, with various exhibitions, panels, seminars, workshops and events spread across five floors. Even though the delegates came from different countries and backgrounds, everyone came together for the same purpose: to make the world a better place to live in.

In between the debates and discussions, however, attendees found time to have some fun. Here is a look at last night's celebrations and festivities.

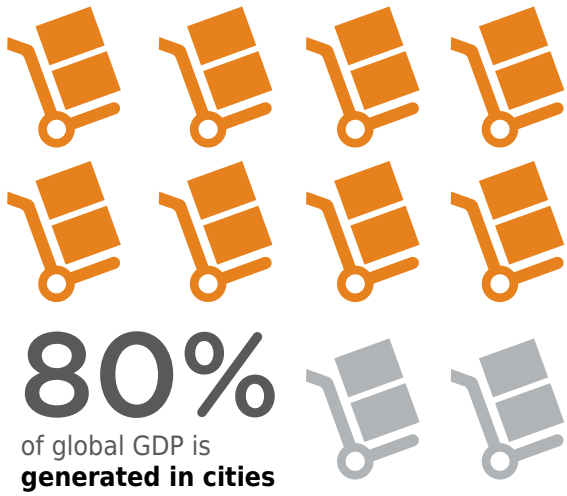
▶ Continued on P2

DAILY HIGHLIGHTS

<p>Peony 4506, Level 4</p> <p>GREEN JOBS SYMPOSIUM</p> <p>13.30–15.30</p>	<p>Peony 4502–4504, Level 4</p> <p>E-WASTE BUSINESS FORUM</p> <p>14.00–18.00</p>	<p>Ballroom M, Level 5</p> <p>CHINA INNOVATION FORUM: CHINA IN THE NEW ERA</p> <p>09.00–12.15</p>	<p>Heliconia 3401A–3403, Level 3</p> <p>SMART WATER FORUM</p> <p>09.30–13.00</p>	<p>Begonia 3002, Level 3</p> <p>WATER CONVENTION CLOSING PLENARY</p> <p>16.00–17.30</p>
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WCS



Source: World Bank

SIWW

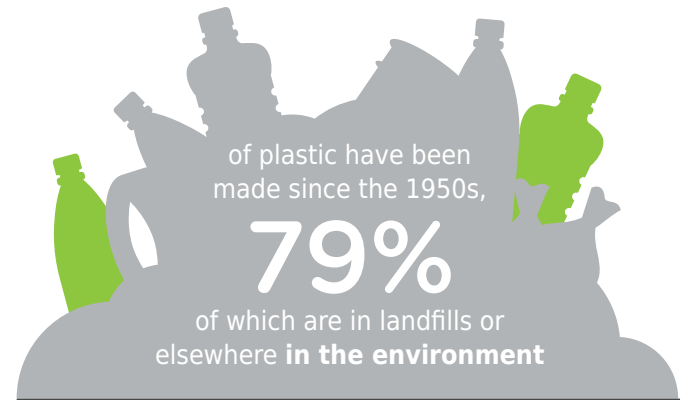


Smart Water market will be worth **US\$20.1 billion** by 2021

Source: Markets and Markets

CESS

9 billion tonnes



Source: University of California, Santa Barbara, the University of Georgia, and the Sea Education Association

COLLABORATION KEY TO OVERCOMING CHALLENGES: SINGAPORE MINISTERS

► Continued from P1



From left, Mr Lawrence Wong, Minister for National Development and Second Minister for Finance, and Mr Masagos Zulkifli, Minister for the Environment and Water Resources

governments, civil society and businesses from around the world to share and co-create innovative solutions, to overcome the challenges we currently face and foresee in climate change, water issues and sustainable development."

He added, "I am heartened to see the strong sense of urgency to act together to preserve our environment and avoid more adverse consequences of climate change. While the increasingly visible and negative impact of climate change gives rise to unprecedented

urban challenges, it has also helped to build momentum for technological adaptation and a green economy. With continued investments in research and technology, international partnerships and implementation of policies enabled by strong political will, I am confident we can move a step closer to leaving behind a more sustainable environment for our future generations when we work together."

Mr Lawrence Wong, Minister for National Development and Second Minister for Finance, said, "There have been many good ideas thrown up during our conversations with city leaders – about disruptive innovation, and infrastructure. But many also related it back to an important point, which is underpinning everything we do – and that is the ultimate objective of wanting to make life better and happier for our citizens. So many highlighted the need for our urban development to be human-centred, and to be people-centred. I think that is extremely important, particularly in a time when we see growing inequality, rising divisions and polarisations all over the world."

He continued, "It means city leaders need to work even harder to promote mutual trust and understanding across our different communities. We need to work even harder at inclusive developments so that no one gets left behind. We need to continue to harness the power of diversity, so that we embrace our differences, and can all contribute to a larger cause."

LIVE @ WCS/SIWW/CESS

WHAT'S TRENDING AT SIWW, WCS AND CESS?

Writers Sabina-Leah Fernandez, Will Chin, Rachael Goh and Howard James, share their observations from the past three days

Sabina-Leah Fernandez: I noticed gender diversity popping up a lot at SIWW. It's great to hear this conversation taking place, and not just because it is good for women, but because diversity benefits men, women, children and – as studies show – it improves the bottom line.

Will Chin: The utopian vision of Industry 4.0 continues to be the talk of the town. However, I noticed whispers of Industry 5.0 growing louder this year. Industry 5.0 is all about collaboration between humans and smart systems, thus combining high-speed accuracy with intuitive, critical thinking.

Rachael Goh: The future of our cities rests on partnerships. At this year's WCS, I discovered that building modern, efficient and inclusive cities is the responsibility of every individual and that public-private-people partnerships can lead to effective, innovative solutions that solve system-wide challenges.

Howard James: Some delegates expressed concern about the dearth of water talent in the global marketplace. But with the proliferation of niche tech curricular in universities around the world, this shortfall is already abating.

LIVE @ WCS/SIWW/CESS

TIME TO CELEBRATE

► Continued from P1



Musical entertainment for guests at the dinner event



(Left) Discussions continued over food and drinks for delegates at the event (Above) Guests at last night's Industry Night having fun at the photo booth, complete with digital backdrops and props

FEATURE

FINANCING TOMORROW'S PROJECTS AND TODAY'S SMART CITIES

The monetary issues that lie behind the development of smart, sustainable and liveable cities go beyond funding

By **Howard James**



The money required to develop a city's infrastructure has to come from somewhere – and today, it is essentially impossible for the bill to be footed solely by the government. The private sector must step in, but how?

The financing of cities, water and environmental projects generally fall into two categories: funding of critical infrastructure, such as water treatment facilities, waste management solutions and transportation systems, which are sponsored over an extended period of time; and the financing of public services, such as the provision of water, waste disposal and public transportation, where transactions usually occur daily, monthly or quarterly.

Project Financing

Recent years have seen infrastructure investments become heavily reliant upon private-sector participation, and supported by disruptive technologies. Mr Abhas Jha, East Asia and Pacific Manager for the Social, Urban, Rural and Resilience Global Practice at the World Bank, asserted that the investment needs required to fund these types of projects are usually too large for governments and multilateral development banks to finance alone. Nations globally must raise US\$93.7 trillion to meet their infrastructure investment needs between 2016 and 2040, according to the World Bank – a feat universally deemed unrealistic without private-sector participation.

The World Bank Group and its partners are tackling this challenge creatively and collaboratively, said Mr Jha. They have found new ways to leverage private-sector finance, through efficient use of shareholder capital, innovative financing solutions, knowledge and convening power. The World Bank calls this Maximising Finance for Development (MFD).

"In the urban space, we are carrying out MFD through many mechanisms, including through partnerships with commercial banks, land value capture, PPP financing, risk finance and insurance, and guarantees," said Mr Jha. "These initiatives are being successfully implemented to leverage the private sector and optimise scarce public resource for urban projects."

Technology Transfer

Disruptive technologies – be they big-data and analytics or distributed ledger technologies

(blockchain) – are increasingly being used by project developers to tackle development challenges. Blockchain is being used to improve land registries in Georgia; mobile apps with geospatial data are being used to enforce zoning governance in Vietnam; and biometric IDs are being used to help eliminate fraud, waste and corruption in Nigeria.

"While many business cases of disruptive technologies are in the pilot or early implementation phases, in the urban space, open- and big-data and business intelligence tools have allowed cities to make data-informed, evidence-based decisions on investments and re-evaluate how to efficiently and effectively deliver urban services to its citizens," said Mr Jha.

Non-Bank Participation

While the above approach is gaining traction, it is not without challenges. Creativity, collaboration and innovation are essential to the formation of financial partnerships and the deployment of disruptive technologies – traits that are more prevalent in some organisations than others. All relevant institutions, asserted Mr Jha, must be able to adapt their processes to this new paradigm in order to keep up and provide added value.

Moreover, there is further value to be found in leveraging non-bank participation.

In China, for instance, the Gansu Silk Road Economic Development Project leverages

China, India and Japan will account for

39%

of global infrastructure investment, from 2016 to 2040

Source: World Bank

funds from the International Finance Corporation, financial sectors and local governments to achieve a mix of lending, microcredit through financial institutions, and public-private partnership solutions to boost the tourism economy along the Silk Road. Meanwhile, the Shanghai New Urbanisation Financing and Innovation Project provides guarantees to support the issuance of long-term bonds with higher credit ratings for green infrastructure projects in small towns.

Smarter Payments

The payments industry has seen more change in the last five years than the past 50, asserted Mr Hany Fam, Executive Vice President, Enterprise Partnerships, Mastercard, and this has brought on a broad range of technologies today that enable a more intuitive, inclusive and secure way of living and doing business for governments and citizens than ever before.

"One such innovation has been our work with over 100 cities to enable contactless and mobile payments for the cities' transit systems. By creating open-loop transit systems, residents and visitors are able to get around their city using the same card when purchasing items in-store and online," explained Mr Fam.

Contactless and mobile payments in transit systems have enabled authorities to better manage transportation challenges and service demand by providing a more holistic view of a city's travel data. Any public expenditure savings made can then be redirected to improving infrastructure.

Beyond Payments

An innovation that goes a step further is the multi-use citizen card that Mastercard has

piloted and implemented in Tatarstan, the Czech Republic and Bratislava, Slovakia, in partnership with local government bodies.

These cards combine traditional payment functions with non-payment functions such as social disbursements, national identification, medical history and school campus access, among other things. This streamlines access to services for both governments and citizens, and thereby allows the reaping of significant efficiencies, improving the overall experience for every party involved.

"With multi-use citizen cards, governments and citizens have a secure solution that overcomes challenges and inefficiencies related to financial and social exclusion, paper-based systems, legacy infrastructure and lack of data insights into payment and non-payment flows. It also gives the unbanked a digital identity that enables them to participate and contribute to the formal economy," explained Mr Fam.

In-Depth Insights

Payment technologies will also play a greater role in helping governments and urban planners better manage a city's infrastructure and ecosystem. It not only increases convenience, security and speed, but it also provides insights into how, where and why consumers are spending money.

"With active data management becoming a key aspect of payment technologies, cities will be able to better understand how their policies affect their citizens by identifying the drawbacks, challenges and opportunities of their existing ecosystems. This then helps them make better and faster planning and resource management decisions that maximise their limited resources and budgets," said Mr Fam.

Infrastructure Investment Needs, 2016-2040, by Region

Oceania (2%)
US\$1.9 trillion

Africa (6%)
US\$6 trillion

Americas (22%)
US\$20.2 trillion

Europe (16%)
US\$14.8 trillion

Asia (54%)
US\$50.8 trillion

Source: World Bank

Top 10 Countries by Quality of Infrastructure

Switzerland	6.6
Hong Kong SAR	6.4
Singapore	6.4
Japan	6.2
Netherlands	6.2
United Arab Emirates	6.2
Finland	6.1
France	6.1
Austria	5.9
United States	5.9
Denmark	5.8

Source: Statista



INTERVIEW

PERSPECTIVES WITH RENEE MISON, CEO OF ECO-WIZ

By Howard James



Can you summarise the enormity of today's food waste challenge, and some of the recent emerging trends that are shaping this issue?

The UN Food and Agriculture organisation has estimated that 30% to 40% of food production is lost before it reaches the market. While a lot of this is lost in agriculture, there is a significant amount of food waste in the supply chain. Hence, infrastructure needs to improve to ensure better transport to each point in the supply chain.

Significant investment from both government and the private sector would be needed to address such gaps and reduce crop wastage through risks of spoilage, as well as cut down on transport emissions and costs. Technology to monitor temperature and gas emissions,

as well as biosensors can also be deployed to lower food waste across the supply chain.

Government, non-governmental organisations and private firms should do more to creatively and collaboratively increase efficiencies at both supply chains and waste management.

What incentives are there for businesses and the general public to practise responsible food waste recycling, and what can be done to limit waste volumes?

Governments must encourage both businesses and end-consumers to practise responsible recycling of food waste. This can be done through education to create greater awareness, such as guidelines for food manufacturers, retail food outlets and supermarkets to prevent food wastage at source and redistribute unsold or excess food.

Schools can do their part by emphasising the need to reduce food wastage in the canteen and demonstrating how to segregate food waste from non-organic material for easier collection and subsequent recycling. Educational tours can also help students better understand the waste-handling process and create awareness from an early age.

For businesses, actions might include better staff training and incentives to start the ball rolling. The latter could include funding for waste minimisation initiatives. For instance, the National Environment Agency

in Singapore offers 3R funding to help in the initial outlay for equipment and installation costs (by up to 40% over a three-year period).

Hotels can donate their excess food. Supermarkets can sell food close to expiry at lower prices so these do not go to waste. Some food businesses have also been using mobile apps or web platforms to sell surplus food at discounted prices.

What new food waste recycling technologies could emerge soon?

We are working on a system called ecoGen that can take in both food waste and general waste without any segregation. This will greatly enhance the operational feasibility of applying our system.

Another target that Eco-Wiz set was to treat food waste from residential estates. Our latest technology ecoResidential makes it possible for every residential unit in an estate to recycle food waste by simply throwing their food waste into the in-sink grinder. With the aid of an automated food waste transport system, ecoResidential has been able to achieve closed-loop recycling.

Furthermore, at present, we are partners with numerous government organisations and universities, and are working to develop new breakthroughs in food waste management technologies.

INTERVIEW



60-SECOND INTERVIEW WITH HE DR THANI BIN AHMED AL ZEYUUDI

UAE's Minister for Climate Change and the Environment shares his nation's past achievements and bold plans

By Howard James

What measures is UAE taking to tackle climate change, and what targets has the federal government set?

Since the nation's formation in 1971, environmental stewardship continues to play a critical role in our nation's development. To counter climate change, we made the bold decision in the early-2000s to move away from conventional hydrocarbons and move towards cleaner forms of energy. We have an ambitious clean energy target of 27% by 2021, and 50% by 2050. This is a considerable leap, given that clean energy accounted for less than 1% of the total energy mix in 2016.

To achieve this, we have a number of industry-specific initiatives designed to lower their carbon footprint. These include tourism, infrastructure, transportation, housing and more. In the automotive sector, for instance, owners of electric cars enjoy free parking and free vehicle registration, among other incentives.

Support for environmental causes is widely embraced by UAE's citizenry. How is this achieved?

Since day one, our country's leaders have actively participated in environmental projects. The nation's founding president, HE Sheikh Zayed bin Sultan Al Nahyan, planted trees and invested significantly in environmental projects. Because of this, older generations respect the environment.

To engage with today's younger generation, we are fortunate to have our views represented by HE Shamma bint Suhail Faris Al Mazrui, who was appointed UAE's Minister of State for Youth Affairs two year ago, aged just 22. Being able to relate to citizens and businesses is key to achieving public buy-in.

What else can countries learn from UAE's experiences?

We believe that when it comes to solving environmental issues, nothing is impossible. We encourage other countries to think the same.

LIVE @ CESS

THE CIRCULAR ECONOMY: POLICIES, REGULATION AND MARKETS MUST ALIGN

For the circular economy to function, stakeholders across the entire value chain must collaborate to set workable rules and trading conditions

By Howard James

A panel featuring prominent government and market leaders convened during the first session of this year's Clean Environment Leaders Summit at the CleanEnviro Summit Singapore 2018 to discuss the role of policies and regulation in spurring the circular economy.

Dr Amy Khor, Senior Minister of State, Ministry of Health and Ministry of the Environment and Water Resources, Singapore, highlighted the importance of establishing a clear vision of what the circular economy is and how it will function, as well as the importance of achieving buy-in from the private sector. Once this has been achieved, she said, rules, goals and targets can be appropriately set.



From left to right: Professor Seeram Ramakrishna, Chair, Circular Economy Taskforce, National University of Singapore; Dr Amy Khor, Senior Minister of State, Ministry of Health and Ministry of the Environment and Water Resources, Singapore; Dr Kristalina Georgieva, CEO, World Bank; Dr Marcus Gover, CEO, WRAP UK; the Honourable James Shaw, Minister for Climate Change, New Zealand; and Dr Walter R Stahel, Founder-Director, Product-Life Institute, Geneva

The Honourable James Shaw, Minister for Climate Change, New Zealand, shared his country's challenges in adopting the circular economy: as a nation that imports almost all of its manufactured goods, China's decision to prohibit recycling materials from abroad meant New Zealand could not export a significant proportion of its waste. Instead, the country is now having to innovate to better manage waste. To highlight his point, he described a brewery that, instead of offshoring bottle waste, has developed a process to break down glass into sand, somewhat like a reversal of the glass-making process. "Necessity is the mother of innovation," the minister paraphrased.

Dr Marcus Gover, CEO of the UK's WRAP, stressed the importance of having a balance between regulation and market forces to drive and incentivise the circular economy. He cited the introduction of the UK's landfill tax, which prompts the market to further embrace recycling; and explained how the nation's plans to make all plastics recyclable by 2021 is moving industry away from non-recyclable polymers.

Panelists agreed that to fully realise the circular economy, alignment from all actors – including the public and private sectors – regulators, non-governmental organisations and the man on the street – is essential, a feat they were committed to achieving.



LIVE @ CESS

IS IT TIME TO RETHINK AND REFRESH?

Of "cobots", public bathrooms and cherry trees. Here are some highlights from the Clean Environment Leaders Summit

By **Will Chin**

Yesterday's Clean Environment Leaders Summit saw a slew of interesting case studies and lively debates, as speakers congregated to discuss global trends in environmental technology, as well as innovative business concepts in pursuit of sustainability.

Mr Markus Asch, Deputy CEO and Vice Chairman of the Management Board of Kärcher Group, predicted the rise of "cobots" – a robot designed to physically interact with humans in a shared workspace. Instead of robots



completely replacing humans, Mr Asch believes that Industry 5.0 will see tighter integration between humans and their machine counterparts. He also spoke of how processes need to switch from fixed procedures to dynamic procedures. He used the example of public bathrooms at Changi Airport, and how cleaning schedules can be adjusted based on human traffic, with quieter hours dedicated to more cleaning. "Dynamic knowledge-based [processes] will drive not just productivity, but customer satisfaction as well!" he added.

In a separate session on sustainable business ideas, Professor Dr Michael Braungart of Leuphana University of Lüneburg, CEO of the Environmental Protection and Encouragement Agency of Hamburg, noted that effectiveness – not efficiency – should be the core concept for companies operating in the sustainability space. "When you are minimising the bad via efficiency, you are optimising the wrong thing," he said. "Instead, it's about the quality and effectiveness of the product. A cherry tree may not be efficient at growing cherries, but it is incredibly effective at doing so. No one thinks of a cherry tree as being 'wasteful.'" He said that companies should rethink what the product is and the kind of impact it has on the environment.

NEWS

SPA AWARDS 2018

Signatories of the Singapore Packaging Agreement (SPA) were recognised for their efforts in reducing packaging waste at the SPA Awards 2018

By **Howard James**

Top Achievement Award Winners

Nestlé Singapore (Pte) Ltd
Resorts World at Sentosa Pte Ltd
Australian Fruit Juice (S) Pte Ltd

Excellence Award Winners

Asia Pacific Breweries (Singapore) Pte Ltd
CROWN Beverage Cans Singapore Pte Ltd
Wildlife Reserves Singapore Pte Ltd
LHT Holdings Ltd

Merit Award Winners

Abbott Manufacturing Singapore Private Limited
Fagerdala Singapore Pte Ltd
Hewlett Packard Enterprise
Greenpac (S) Pte Ltd
Ha Li Fa Pte Ltd
Sunfresh Singapore Pte Ltd

LIVE @ CESS

BRIDGING THE GAP

Leaders and experts convened to turn innovations into reality

By **Will Chin**

The best innovations sometimes fail to come to fruition due to a disconnect between leaders and technologies – and that is where the Leaders-Experts Forum (LEF) comes in.

The LEF is designed to allow environmental leaders and technical experts to discuss

best practices, strategies and technological solutions. During the event, several speakers highlighted the symbiotic relationship between good leaders and great ideas.

Ms Low Yen Ling, Senior Parliamentary Secretary for Singapore's Ministry of Education and Ministry of Manpower, opened the session by driving home the threat of climate change, as well as the role the government plays in championing change. On waste management, Mr Philip Heylen, Honorary Vice Mayor of Antwerp, Belgium, advised leaders: "Don't look at waste as waste. Look at it as material." That mentality, Mr Heylen believes, will trickle down to the general population as well. "Yesterday is not ours to recover," he said. "But tomorrow is ours to win or lose, and we have the chance to do that."

LIVE @ CESS

CIRCULAR ECONOMY DOES NOT END AT OUR BORDERS: MINISTER MASAGOS

Singapore's Minister for the Environment and Water Resources called on governments and the industry to shape a global circular economy

By **Howard James**



Mr Masagos Zulkifli, Minister for the Environment and Water Resources, Singapore

At the Opening Ceremony of this year's Clean Environment Leaders Summit, Mr Masagos Zulkifli, Singapore's Minister for the Environment and Water Resources, called on both governments and private businesses to openly embrace the circular economy.

The minister shared Singapore's efforts in curbing waste generation and realising the circular economy: "The Sustainable Singapore Blueprint outlines part of our strategy to become a zero-waste nation and achieve a 70% recycling rate by 2030."

Minister Masagos emphasised the importance of international relations and trade in spurring industry growth, explaining that the circular economy does not end at national borders due to the global nature of manufacturing supply chains.

"There is an opportunity for us – government and industry leaders – to actively shape a

global circular economy. One where clean and valuable recycled fractions can move freely across borders to support economic activity," the minister said. "This will unlock economies of scale to transform waste into feedstock for new products. This is good for the environment as we reduce both the extraction of virgin material and the amount of waste going to landfill."

Minister Masagos expressed his enthusiasm for the development of NEWSand – made from incineration ash and mirroring Singapore's NEWater, which is created by treating used water – and how environmental stewardship and economic prosperity are mutually beneficial.

"The Singapore story demonstrates that environmental sustainability and economic growth are not a zero-sum game. As we write the next chapter, the circular economy will allow both to coexist and reinforce each other," the minister concluded.

TODAY'S HIGHLIGHTS

Orchid
4201-4203,
4301-4303
Level 4

CEC SESSION 1 - FINDING THE GLOBAL MAXIMA: OPTIMISATION IN ENVIRONMENTAL SYSTEMS

10.00-12.00

Orchid
4201-4203,
4301-4303
Level 4

CEC SESSION 2 - NUDGING FORWARD WITH BEHAVIOURAL SCIENCES: CREATIVE WAYS TO SOLVE ENVIRONMENTAL CHALLENGES

10.00-12.00

Orchid
4204-4205,
4304-4305
Level 4

CEC SESSION 3 - SMART GRIDS AND SMART SENSORS IN ENVIRONMENT MANAGEMENT

14.00-16.00

Orchid
4204-4205,
4304-4305
Level 4

CEC SESSION 4 - FAST FORWARD: ACCELERATING AUTOMATION IN THE ENVIRONMENTAL SECTOR

14.00-16.00



LIVE @ WCS

BUILDING LIVEABLE CITIES THROUGH COLLABORATION

Better people-public-private collaboration is key to unlocking liveable and sustainable cities of the future

By **Rachael Goh**

A panel of distinguished speakers from government boards, international organisations and research institutes gathered at the World Cities Summit Plenary Session on Tuesday, 10 July, to round off two days of discussions on strategies, insights and solutions on creating sustainable and liveable cities.

Solving Complex Problems Through Partnerships

Said moderator Mr Peter Ho, Chairman of the Urban Redevelopment Authority of Singapore, "What we are seeing today is that many urban issues are complex, wicked problems that require collaboration across all sectors of the community."

Echoing his point, Mrs Lucy Turnbull, Chief Commissioner of the Greater Sydney

Commission, said that the agency was already exploring working with private sectors, business organisations and cultural linguistic groups to make the region more productive, sustainable and liveable, especially as it is projected to see a growth of about 1.6 million people over the next 20 years.

Migration, digitisation, climate change and growth are four global urban trends that we cannot solve in silos, added Mr Peter Bakker, President of the World Business Council for Sustainable Development.

"Achieving a sustainable future is impossible unless we work together in cities," he said.

Integration Among Sectors is Crucial

Aside from establishing partnerships across various sectors, there is also a need to integrate



From left to right: Mr Bambang Susantono, Vice-President, Knowledge Management and Sustainable Development, Asian Development Bank; Mr Peter Bakker, President, World Business Council for Sustainable Development; Mrs Lucy Turnbull, Chief Commissioner, Greater Sydney Commission; Dr Liu Thai Ker, Chairman, Centre for Liveable Cities, Singapore; Mr Peter Ho, Chairman of Urban Redevelopment Authority and former Head of Civil Service, Singapore; and Professor Geoffrey West, Distinguished Professor and past President, Science Board, Science Steering Committee, Santa Fe Institute

urban planning among different agencies to achieve economic competitiveness, social inclusion and environmental sustainability.

"Urbanisation in Asia is unprecedented. We need to integrate urban planning projects across various agencies to ensure that every dimension of city life progresses collectively," said Mr Bambang Susantono, Vice-President of Knowledge Management and Sustainable Development at the Asian Development Bank.

Describing the benefits of urban development through integration, Professor Geoffrey West, Distinguished Professor and past President, Science Board, Science Steering Committee at the Santa Fe Institute, highlighted how social interaction and sharing of ideas among different sectors can lead to improved standards of living.

"The most successful cities are the most diverse. Studies show that GDP increases exponentially with diversity, pointing at the need for input from different sectors of a city," he said.

Tackling Future Urban Challenges Head-On

Closing the plenary, Dr Liu Thai Ker, Chairman at the Centre for Liveable Cities, said that he was optimistic about cities tackling future challenges brought on by urbanisation.

"The challenges will be tremendous, but based on the past few World Cities Summits, we have seen how participants are becoming more sophisticated in understanding urban issues," he said. "If we are able to handle the challenges ahead well, we may even be able to solve the global warming issue."

LIVE @ WCS

THE IMPORTANCE OF PARTNERSHIPS IN CITIES

Cities of the future must harness the power of private-public-people collaboration to tackle urban challenges ahead

By **Rachael Goh**

On 10 July, an international panel moderated by Executive Director of the Singapore Institute of International Affairs Mr Nicholas Fang discussed the importance of partnerships between local governments, businesses, research institutions and citizens in creating a healthy city ecosystem.

Cleaner Cities Through Collaboration

Melbourne's Deputy Lord Mayor Arron Wood highlighted that Australia's fastest-growing city was able to accelerate its transition to renewables by pooling the resources of 14 organisations, including businesses, local councils and universities, to form a first-of-its-kind purchasing group.

Dr Goh Eng Lim, Vice President and SGI Chief Technology Officer at Hewlett Packard Enterprise, expanded on how the software company has implemented smart technologies that ramp up sustainability and cost savings for global cities through close collaboration with governors.

Cities would be more equipped to tackle urban issues such as air pollution if governments worked with private companies

and residents to democratise the supply of renewable energy, added Dr Frank Rijsberman, Director General of the Global Green Growth Institute.

Cities for the People, by the People

Solutions to urban challenges must be developed with people in mind, said Ms Nasima Razmyar, Helsinki's Deputy Mayor for Culture and Leisure, stressing that transparency between all sectors would lead to higher standards of living as individuals leverage open data to improve efficiency.

Mr Hany Fam, Executive Vice President of Enterprise Partnerships at Mastercard, explained how the company's new model of public-private partnerships – known as City Possible – is already co-developing and piloting urban solutions that improve living standards in cities.

"Right now, entrepreneurs are from Mars and policymakers are from Venus. If we bridge this gap, we may be able to create solutions to complex urban challenges in areas like agriculture and environment for the benefit of citizens," said Mr David Wallerstein, Chief Exploration Officer at Tencent.



From left to right: Mr Nicholas Fang, Executive Director, Singapore Institute of International Affairs; Arron Wood, Deputy Lord Mayor of Melbourne; Ms Nasima Razmyar, Deputy Mayor for Culture and Leisure, Helsinki; Mr David Wallerstein, Chief Exploration Officer, Tencent; Dr Goh Eng Lim, Vice President and SGI Chief Technology Officer, Hewlett Packard Enterprise; Mr Hany Fam, Executive Vice President, Enterprise Partnerships, Mastercard; and Dr Frank Rijsberman, Director General, Global Green Growth Institute



LIVE @ WCS

FINANCING CITY DEVELOPMENT IN THE AGE OF TECHNOLOGY

Technology has redefined the way we live and work, and could bring with it alternative financial resources for cities

By **Genevieve Chan**

In the past, cities have often financed development through public funding and tax revenues. In recent years, however, alternative financial resources for cities such as the master developer approach and public-private partnerships have emerged.

As technology continues to evolve, it could even bring with it new financial revenues. Mr Michael PM Spies, Senior Managing Director Innovation, India and New Market, and Chair of Investment Committee, Tishman Speyer, highlighted the example of mixed-use development, as technology redefines where and how we work. Parks, traditionally public spaces, can be planned and accommodated in a way to generate revenue, like Amazon's headquarters in Seattle, Washington.

Mr Sean Tompkins, Chief Executive Officer of the Royal Institution of Chartered Surveyors

(RICS) agreed: "City leaders who have strategies that put people first and [who] put the future of work first, will be the most investable places in the long term."

One main challenge that emerged was mitigating the risk involved. "Governments need to step up and take full responsibility of political risk," said Mr Tompkins. Mr Stewart Upson, Managing Partner, Infrastructure, Asia Pacific, Brookfield Asset Management, shared an investor's perspective: "A big issue in funding city development is about getting the right risk-reward."

Meanwhile, Mr Jerzy Kwiecieński, Minister, Investment and Economic Development, Poland, stressed the importance of having a clear vision and concrete plan that comprises grants, loans and credits.

Dr Sreedhar Cherukuri, Commissioner, Capital Region Development Authority, Government of Andhra Pradesh, and Mr Simon Treacy, President of Hawaii at The Howard Hughes Cooperation, shared their elaborate development plans: Andhra Pradesh is in the midst of building its capital city Amravati, while Mr Treacy's team is developing Ward Village, a 60-acre (24-hectare) Hawaiian community that aims to tackle issues such as housing and walkability.

At the heart of it, city leaders must keep their people in mind. Datuk Ismail Ibrahim, Chief Executive Officer, Iskandar Regional Development Authority concluded, "While growth continues to happen, we must make sure that the cost of living shall not exceed the growth that we are experiencing."

LIVE @ WCS



CREATING MORE INCLUSIVE COMMUNITIES IN OUR CITIES

Urban planning and design that is sensitive to environmental and social realities are crucial to the future of cities

By **Shanti Anne Morais**

As cities globalise, their communities become more diverse. Urban planners worldwide are increasingly realising the importance of listening to these communities' voices.

A panel of experts led by moderator Dr Orna Rosenfeld, Independent Senior Housing Expert and Adviser, the European Commission, explored how cities can be planned so they are more inclusive and accepting of diversity, in order for their communities to thrive. Key takeaways include:

Economic Growth – A Double-Edged Sword

Dr Aisa Kirabo Kacyira, Assistant Secretary-General, United Nations (UN) and Deputy Executive Director, UN-Habitat noted that while economic growth can drive a city to greatness, governments and urban planners must ensure that there are plans in place to ensure that there is balance and harmony.

Moving Beyond Inclusive Housing

Dr Cheong Koon Hean, CEO of Singapore's Housing and Development Board, observed that in Singapore, the concept of master planning and design has shifted somewhat. The focus now lies on nurturing communities, she said, so that the people themselves take ownership of building their own community and living spaces, forging closer bonds and more creative spaces.

Resilience can Begin from the Ground Up

In 2012, Hurricane Sandy brought the neighbourhood of Red Hook to its knees. In response, the community rallied together to help themselves, shared Mr Alex Washburn, former Chief Urban Designer, NYC Department of City Planning and Principal, DRAW, Brooklyn LLC. This has helped build the community's social and physical resilience.

Improving Resources is Crucial For Success

Bringing the perspective of the private sector, Mr Abhishek Lodha, Managing Director of Lodha Group, stressed the importance of having an economic master plan in place: "This reduces the 'cost burden' of the community yet ensures a high-quality place to live in."

Agreeing with this, HE Soichiro Takashima, Mayor of Fukuoka, said that bringing people and businesses together through cutting-edge technology and innovative ideas was key to his city's growth and success. His observations: cities change all the time so there is a need to look long-term even when starting out; cities also go through life cycles and have different needs at various stages.

Wrapping up the discussion, Dr Rosenfeld reminded attendees of the importance of taking the examples of countries who have done this successfully, such as Singapore, and localising it for the community.

PREVIEW

DRIVING URBAN SUSTAINABILITY THROUGH SCIENCE AND INNOVATION

Introducing Springer Nature's inaugural Science and the Sustainable City Summit

By **Howard James**

An emerging research discipline, urban science fuses science, urban design, computation and data with the goal of creating liveable and sustainable cities. It is therefore fitting that Springer Nature's inaugural Science and the Sustainable City Summit joins World Cities Summit 2018 as a co-located event.

The summit is part of Springer Nature's Grand Challenges initiative, which aims to help develop solutions to complex global problems by connecting scientific research with individuals and organisations that can apply it practically. It will explore how science is addressing present-day urban issues, and how innovation from an array of scientific disciplines might be deployed in tomorrow's cities.

Topics that will be discussed include the application of research to create cutting-edge solutions; how science is helping create spaces for social interaction and bringing nature into daily life; and how scientific innovation can help authorities overcome pressing societal challenges.

The summit will also showcase how Singapore is deploying science-based solutions to meet air pollution and water supply challenges, among other issues. An international event, it will feature speakers from academia, government and the private sector. Entry is by invitation only.

Science and the Sustainable City Summit will take place on Wednesday, 11 July 2018, 08.30–17.00, at Sands Grand Ballroom B, level 5

TODAY'S HIGHLIGHTS

**SITE VISIT:
KAMPUNG ADMIRALTY
AND KHOO TECK PUAT
HOSPITAL**
08.30–13.00

**Ballroom L + K,
Level 5**
**THE LIVEABILITY
CHALLENGE**
09.00–12.30

**Sands A
5001–5003, 5101–
5103, Level 5**
**LE MONDE SMART CITIES
INNOVATION AWARDS:
CITIES PROGRAMS
EVALUATION, BEYOND
MARKETING**
10.00–12.00

**SITEC - Ballroom
Roselle Jr &
Peony Jr, Level 4**
**PUBLICATON LAUNCH:
URBAN SYSTEM STUDIES
- INTEGRATED LAND USE
& MOBILITY**
16.00–17.30



LIVE @ SIWW

NEW SYSTEMS AND MORE DATA KEY TO FUTURE OF WASTE WATER REUSE

Panellists at the Water Convention Keynote Plenary agree that rethinking existing systems, innovation and a wide range of data are what will bring waste water processing forward

By **Sabina-Leah Fernandez**



From left to right: Mr Darryl Day, Co-chair of Water Convention 2018 Programme Committee and Managing Director, International Centre of Excellence in Water Resources Management; Dr Kalanithy Vairavamoorthy, Executive Director of the International Water Association; Professor Perry McCarty, Emeritus Professor of Civil and Environmental Engineering, Stanford University; and Dr Joan Rose, Homer Nowlin Chair in Water Research, Michigan State University

Yesterday's Water Convention Keynote Plenary brought four experts in various water-related fields together for a thought-provoking session. After an opening address by Mr Darryl Day, Co-chair of Water Convention 2018 Programme Committee and Managing Director, International Centre of Excellence in Water Resources Management, there were keynote presentations by Dr Kalanithy Vairavamoorthy, Executive Director of the International Water Association, Professor Perry McCarty, Emeritus Professor of Civil and Environmental Engineering, Stanford University, and Dr Joan Rose, Homer Nowlin Chair in Water Research, Michigan State University.

Dr Vairavamoorthy kicked off by drawing a parallel between airplane travel and a small village. Pointing out that on average 750,000 people are airborne at any one time, he said that all these people in airplanes travelling around the world have access to clean water, sanitation and all their wastes are handled well.

"We are capable of doing this for the population of a small town," he said. "But what is astonishing and disgraceful is that we have not yet managed to provide safe water and sanitation to a number of people on the ground – though not for a lack of trying."

Dr Vairavamoorthy pointed out that 85% of all waste water on the planet is not treated, and it has created huge environmental and health challenges. However, the developing world is leapfrogging current water systems and producing exciting, more effective innovations. "The last 50 years were a pilot study on water management, and these countries have the opportunity to leapfrog the current systems and learn

from the West," he said. He highlighted the need for more data on human resources in the water industry, and noted that it must develop specific programmes and investments to attract more women to the sector, as they are heavily under-represented.

Focusing on waste water for agriculture, Prof McCarty emphasised the importance of tailoring waste water treatment plants to the location. Citing California, his home state, as an example, he described how the agricultural town of Monterey suffered from the problem of sea intrusion – sea water encroaching on the town's freshwater supply. To make the best of this, a seawater processing plant was built in the middle of the agricultural plant. The professor explained that after filtration, the water was found to be suited for treating fruit and vegetables. "If you get strawberries in the US it has probably been treated with reclaimed water," he said.

Dr Rose agreed with Dr Vairavamoorthy that much more data is required and called for the water industry to understand the viruses in water streams.

"While we talk about extracting nutrients and other things, public health is the main reason we treat waste. It's the pathogens we need to take away," she said.

Dr Rose ended by underscoring the importance of "one water", as well as waste water analysis and treatment, in meeting the 2030 Sustainable Development Goals (SDGs).

She said, "We need to understand the one water concept, and understand viral flow through various pathways and treatment processes as we face the future and invest in the SDGs and sanitation for all in the future."

PREVIEW

SMART WATER UTILITY OF THE FUTURE

Advancements in digital and infocomm technology are rapidly transforming the global landscape, offering water utilities new ways of enhancing productivity and efficiency in planning and operations

By **Hana Schoon**

Driven by increasing water demand, rising operational costs, manpower constraints and new challenges like climate change, Singapore's national water agency PUB is leveraging digital solutions and smart technologies to strengthen its operational resilience, productivity, safety and security.

The integration of smart water technology will be a key pillar in Singapore's water resource management to achieve greater efficiencies and faster response time in planning, operations and service delivery.

To this end, PUB is exploring a range of smart water technologies such as:

Remote Micro-Invertebrate Detector

The Remote Micro-Invertebrate Detector is an in-house prototype, designed and

developed by PUB's Water Quality Department. The portable low-cost device is easily deployed on-site to provide real-time detection and identification of images using artificial intelligence, with split-second imaging to determine the presence of micro-invertebrates in the water samples. The unit is linked to a mobile app and chat-bot, which allows the system to perform 24/7 real-time testing of water samples on-site, respond to commands, send live image reports, and trigger alerts when anomalies are detected. PUB targets to use this on a larger scale by end-2020.

Autonomous Boat

With desalination being one of Singapore's four National Taps, it is important for PUB to monitor the quality of seawater intake to the city's desalination plants. PUB is also test-bedding the Autonomous Boat, which

has the capability to brave choppy waters to perform real-time water quality monitoring via onboard sensors, collect awater samples, and take photos and videos of actual water conditions. Programmed to avoid obstacles in the water, the boat is also able to self-navigate to the designated sampling points.

Automated Lab Analysis

Through robotics and automated processes, PUB's Automated Laboratory System (ALS) will be able to test two to three times more water samples in the same amount of time, while operating around the clock. The ALS automatically scans and records sample data based on their QR codes, thereby reducing the need for manpower.

Virtual Reality Training for PUB Operators

PUB uses Virtual Reality (VR) to provide Water Reclamation Plant operators with a realistic and immersive training experience of operating a dewatering centrifuge. With the use of a VR headset and a pair of handheld sensors, operators can start up and shut down the dewatering centrifuge, and perform checks as well as respond to abnormalities in a simulated environment.

Visit the *Smart Water Pavilion* located on Level 1 (Booth M14) in the Water Expo to learn more about these technologies.

The *Smart Water Forum* will take place on Wednesday, 11 July 2018, 09.30–13.00, at Heliconia 3401A–3401B and 3402–3403, Level 3.





LIVE @ SIWW

BAN KI-MOON: PUBLIC-PRIVATE PARTNERSHIP WILL HELP ATTAIN SUSTAINABLE DEVELOPMENT GOALS

Cooperation – among nations, sectors and industries – is the key to tackling climate change, said Mr Ban Ki-Moon at the SIWW Water Dialogue yesterday

By **Sabina-Leah Fernandez**



Mr Ban was unequivocal about climate change, saying it is no longer a future threat, but that it is happening now. From record-breaking heatwaves and drought to wild fires and typhoons of historic intensity and frequency, climate change is unleashing risk and instability all over the world, he said. A warming planet and rising sea levels could dramatically alter our lives. And, even rich countries with well-established infrastructure are no exceptions to this phenomenon, he warned. Globally, 250 million people live in coastal areas that could be flooded to the point of inhabitability. Another 5.6 million people live on low-lying islands. Some countries are already experiencing water shortage. India is seeing what has been called the worst water crisis in its history, with some 600 million people affected by insufficient water, while the relatively affluent city of Cape Town is fast approaching “Day Zero” – the day the entire city is completely out of water.

But there is hope for change, he said. “We are living in an age of unprecedented innovation along with striking global connectivity. Despite the many diverse challenges we currently face, we must also remind ourselves that we are all global citizens and that if we work together we will not only persevere, we will thrive.”

In closing Mr Ban reiterated that the problems and the solutions are global in nature, calling on water leaders to continue to play their parts in helping the UN achieve the SDGs.

Dr Puthuchery agreed with Mr Ban that the world continues to struggle with the issue of achieving water sustainability, and even though it may not be solved in the short-term, it is hearteningly on the agenda. The Senior Minister also related an anecdote about Mr Ban’s last visit to Singapore, while the latter was still Secretary-General of the UN. While at a state dinner held by Singapore Prime Minister Lee Hsien Loong, Mr Ban proposed a toast with a bottle of NEWater, which he had obtained during a visit to the NEWater plant in Changi. Mr Ban also made mention of Professor Tommy Koh, formerly Singapore’s Permanent Representative to the UN, referring to the professor as his mentor of diplomacy.

In his keynote speech at the SIWW Water Dialogue yesterday morning, former Secretary-General of the United Nations (UN) HE Ban Ki-moon asserted global partnerships that include the private sector and water leaders are necessary to fight climate change and meet the 2030 Sustainable Development Goals (SDGs).

Set by the UN, the SDGs are 17 targets “to transform our world” that are to be met by both developed and developing countries, by 2030. Of these, Mr Ban noted Clean Water and Sanitation is one of the most important and cross-cutting issues, as it is integral to achieving several other SDGs.

“It is as though water is a global currency that makes everything work,” Mr Ban said during the session, which was chaired by Dr Janil Puthuchery, Senior Minister of State, Ministry of Communications and Information, and Ministry of Transport, Singapore.

He explained that every day, sadly, 1,000 young children under the age of five are killed because of contaminated water and at least 2.1 billion people on the planet do not have access to safe water today.

“I have seen this for myself,” he shared. “When I went to developing countries, I saw a lot of women and girls who walk miles to just fill a bucket of water and bring it back home. This is heartbreaking. Heartbreaking.”

NEWS

PUB, GRUNDFOS TO JOINTLY DEVELOP WATER SOLUTIONS

Singapore’s National Water Agency PUB and Grundfos have signed a Memorandum of Understanding (MoU) to collaborate on the research and development of sustainable water treatment solutions. PUB and Grundfos plan to continue their work in the areas of water treatment technologies, water quality monitoring technologies and digital water solutions, as well

as applications of high-efficient pump solutions in water treatment. The MoU was signed by Mr Harry Seah, PUB’s Assistant Chief Executive (Future Systems and Technology), and Mr Kim Jensen, Grundfos Regional Managing Director Asia Pacific, and witnessed by Mr Ng Joo Hee, CE of PUB, Ms Dorte Bech Vizard, Ambassador, Danish Embassy in Singapore, and Grundfos Head of Innovation Hub Gao Xin

LIVE @ SIWW

4 WAYS THE WORLD BANK IS INCREASING WATER RESILIENCE

Today, 2.1 billion people do not have clean water services while 4.5 billion lack access to safely managed sanitation

By **Genevieve Chan**

These are four ways the World Bank plans to help cities increase water resilience and boost water security.

Fixing utility problems: Without strong regulatory policies and pricing structures for their utilities, countries may not be credit-worthy enough for commercial funding, and this lack of funding may lead to the deterioration of systems. The World Bank provides knowledge to help cities solve their utility problems.

Bringing in private partners: Financing for water and sanitation in developing countries is currently estimated to be US\$16 billion. More than six times that amount is needed to bridge the funding gap. To do this, countries cannot depend on national funding alone – commercial funding is needed.

A holistic approach to water: Instead of looking at water in silo, the World Bank is now looking at the full water cycle



Jennifer Sara, Director, Water Global Practice, World Bank Group, spoke at the World Bank Business Forum at Singapore International Water Week 2018

to help cities secure water and manage extremities, considering not just the water needs of the city but also that of the upstream and downstream.

Embracing disruptive technology: Disruptive technology such as blockchain, crowdsourcing apps and water treatment solutions are expected to make a splash, enabling new services such as blockchain-enabled subsidies, improved utilities billing and data analytics.

LIVE @ SIWW

SOUTH ASIA'S FUTURE CITIES: 5 FACTS TO NOTE

As cities in South Asia grow, sustainable development is leading the charge. Both opportunities and challenges abound

By **Shanti Anne Morais**

Speakers at SIWW’s South Asia Business Forum outlined key drivers and trends that will help shape the region’s smart and sustainable cities. Here are some takeaways:

Planning, partnership and engagement: With 34% of South Asia’s population living in unplanned settlements without access to basic needs, technology coupled with good governance and planning is needed by the region’s

government. More collaboration is also needed with the private sector.

Creating a sustainable city: The planned city of Amaravati will incorporate many new ideas that are crucial for sustainability including a transit-oriented development, modern waste collection and disposal mechanisms and green spaces to maintain ecological balance.

Changing cities, changing needs: Cities are never static – policymakers should not plan just for today but for what has to be changed as people’s needs change.

A change of paradigm is needed: Different cities have different needs but above all, it should be about improving the life of people across social strata.

Culture’s role: South Asian culture – not Western – reigns here and this is something that foreign companies looking to collaborate with South Asian provinces should bear in mind.

TODAY'S HIGHLIGHTS

Water Expo, Basement 2

NEW TASTE CHALLENGE

12.00–17.30

Hibiscus 3601A–3702, Level 3

ABC WATERS SEMINAR

09.00–14.00

Heliconia 3501A–3503, Level 3

INDUSTRIAL WATER SOLUTIONS FORUM

10.00–17.30

Heliconia 3401A–3403, Level 3

SMART WATER FORUM

09.30–13.00



SPECIAL FEATURE

BUILDING A RESILIENT SINGAPORE PART 3 — CLIMATE RESILIENCE

Unlocking a sustainable future for Singapore through green growth and environmental resilience

By **Rachael Goh**

This article is the last of a three-part series on Building a Resilient Singapore and explores how Singapore interacts with its citizenry to ensure that the society is engaged and invested in creating a resilient city.

Confronted with limited land and resources, Singapore has placed great emphasis on sustainable development since its formative years, balancing economic growth with environmental resilience, in a bid to attract foreign talent and investment as well as create jobs and business opportunities. Increasingly, policymakers and businesses around the world are reorienting their “grow now, clean up later”

approach to one that takes into account the environment and its importance to sustainable economic growth.

Beyond dollars and cents, maintaining a clean and green city also ensures the physical and mental well-being of the population. This translates to a nimble and cohesive workforce that is not only able to contribute to the economy, but is also driven to become a cleaner, less wasteful society, amid growing global environmental challenges.

These are some examples of how Singapore has built its resilience through green growth and environmental resilience.

Greening the City

Since the nation's independence, the government has recognised the value of providing people with access to greenery, as well as creating a pleasant and liveable environment for all.

In 1963, Singapore's founding Prime Minister, Mr Lee Kuan Yew, launched the country's first tree-planting campaign and set a target of planting 10,000 new trees every year, with half of them along new roads, housing estates, school grounds and car parks. Aesthetics aside, the campaign was also aimed at promoting awareness and appreciation of the need for trees in the environment.

Under the Park and Trees Act, guidelines were set to ensure the maintenance of greenery in Singapore. These included tree conservation and mandatory landscaping in any proposed land development. Stretches of roads were lined with flowering trees and shrubs, and concrete structures such as flyovers screened with a variety of creepers, palms and shrubs



became a common sight. Parks were also carved out in commercial districts to function as “green lungs” for office workers.

Inclusivity is Key

In a bid to bring communities closer to greenery, Singapore is introducing more recreational facilities and amenities in existing green spaces.

The Urban Redevelopment Authority, Singapore's national urban planning authority, plans to connect recreation and sports facilities to blue and green corridors. For example, the Park Connector Network, which stretches across the island, integrates tree-lined walking and biking paths with pockets of parks and picturesque waterways. There are also plans to convert a former car park at Holland Village into a park, integrating trees and planters along walkways and around shops.

Cleaning Up the City

The local government has also made significant efforts to encourage cleanliness in public spaces.

As part of the first nationwide public education programme – “Keep Singapore Clean” – launched in 1968, fines were imposed on litterbugs while competitions were held to rate schools, markets, community centres and government offices on their cleanliness. To lead by example, members of Parliament and community leaders also worked with residents to clean up common areas.

In 2011, the National Environment Agency launched the “Clean and Green Singapore” campaign, which encourages citizens to care for and protect the environment by adopting eco-conscious lifestyles. Under this campaign, Singaporeans can sign up for programmes that champion environmental ownership and participate in activities that challenge households to cut down on consumption.

Along with robust environmental policy and innovative infrastructure, community outreach programmes will help citizens to cement Singapore's resilience as a city and allow it to thrive, even when faced with economic and environmental challenges.

2018: YEAR OF CLIMATE ACTION

Singapore has designated 2018 as the Year of Climate Action to complement the country's current efforts in building resilience against climate change, whether through environmental conservation or waste reduction. The year-long initiative aims to raise awareness and inspire collective action to fight unsustainable practices and cut the nation's carbon footprint.

FEATURE

CELEBRATING EXCELLENCE IN ENVIRONMENTAL ENGINEERING

Semakau Landfill, 20 years on

By **Howard James**

When Singapore's then-Minister for the Environment and Water Resources, Dr Vivian Balakrishnan, opened a new section of the offshore Semakau Landfill in 2015, he quipped, “This is probably one of the few landfill sites in the world that can also become a tourist attraction.”

A World-First

Each year, enthusiasts travel the eight-kilometre sea journey from Singapore's mainland to Semakau Landfill to admire its diverse ecosystem of plants and animals, and to experience the landfill's meticulous waste disposal operations. The facility is the world's first of its kind, a man-made offshore landfill.

In its 20th year, environmental protection has been the project's highest priority since day one. When it was announced, the landfill instantly caught the attention of environmentalists and engineers globally. Why develop sea space between offshore islands to serve as a landfill, given the risks to the

surrounding marine environment, and how could such a facility help preserve nature at the same time, questioned experts.

With the world's third-highest population density of about 8,000 people per square kilometre and a small island of 721.5 square kilometres to call home, Singapore faced increasing pressure for space. An alternative site had to be sourced; an offshore landfill was the choice.

To implement this decision, Singapore's National Environment Agency (NEA) and other state authorities, private-sector businesses and numerous higher education institutions worked closely together to ensure that the environment surrounding the selected site would be protected and the wildlife would also thrive alongside the facility.

Engineering Feats

The landfill was developed in two phases. Phase I operations commenced in April 1999,

but before that, 350 hectares of sea space between Pulau Sakeng and Pulau Semakau had to be carved out by a seven-kilometre perimeter bund. Internal bunds were constructed to convert 55% of the enclosed sea space into 11 landfill cells, providing 13.6 million cubic metres of landfill space and other amenities.

Phase II operations began in August 2015. Instead of multiple cells as in Phase I, a single-cell design was adopted to prepare an additional 14.5 million cubic metres of landfill space – the equivalent of almost 5,800 Olympic-size swimming pools – to meet the waste disposal needs of Singapore up to 2035 and beyond.

Phase II features two new facilities: a 200-metre-long floating platform that allows trucks to discharge incineration ash directly into the landfill cell, supported by a long-arm excavator on the floating platform that spreads the incineration ash and levels the seabed to a depth of about two metres before conventional landfill operations using bulldozers and compactors can commence;

and a floating waste-water treatment plant to treat water within the Phase II cell that builds up due to rainfall. To prevent flooding, the excess water that collects within the Phase II cell is treated at the waste-water treatment plant to meet Trade Effluent Discharge Standards before being discharged into the sea.

Environmental Preservation

To preserve the rich biodiversity in the vicinity of the landfill, NEA embarked on two projects: first, about 13 hectares of mangrove were planted to replace mangroves affected by the Phase I development of the landfill; and second, more than 700 colonies of corals in the Phase II lagoon were carefully harvested and transplanted to the nearby Sisters' Island Marine Park.

Aside from achieving the seemingly unachievable – that is, to fuse an offshore landfill with natural ecosystems – the facility also successfully demonstrates that innovative solid waste management can greatly enhance the environment, as well as improve the liveability of cities for citizens.



Semakau Landfill

OPINION

DIGITALISING WATER: THE SMART WAY TO SAVE

By **Ng Joo Hee**

It's Existential

Water – specifically, the lack of the stuff – occupies a special place in the Singaporean consciousness. We simply do not have enough space to collect and to store all of the rainwater that we will need for later consumption. More than half of Singapore's daily demand has to be imported from Malaysia, by way of a 99-year water agreement.

Our water situation compels us to turn to expensive manufactured NEWater and even dearer desalinated seawater in order to quench new thirst. Indeed, the enduring sustainability and security of Singapore's water supply present, no less, an existential challenge for our country. This challenge can be made lighter through conscientious conservation.

National water agency PUB is Singapore's champion for water conservation. We are the ones constantly badgering the consumer, to save water, to use less, and to only buy water-efficient appliances.

Good, Can Be Better

Most recently, we reported that the daily domestic per capita water consumption in Singapore reduced sharply by five litres, from 148 litres in 2016 to the current 143 litres/person/day. This reduction, of course, coincided with the first round of water price increases last year. In the popular imagination, this decrease has to be entirely due to the price increase! I would not go so far, but will concede that pricing was of focal importance.

The truth is that we do not yet know for sure. Because other than higher prices, there are two other moving parts: (a) a 2017 that was wetter than normal (water consumption correlates inversely with rainfall) and (b) the average efficiency of water appliances in Singaporean homes continues to improve. More research and analysis are required before we can definitively parcel out the independent effects of each.

Anyhow, mechanical efficiency, wetter weather and more expensive water conspired

to bring down per capita water consumption by more than 3% last year. This is very encouraging, but still nowhere compared to the 100 litres/person/day being reported in Europe.

Conscientious Conservation

Just look at Denmark, which perhaps offers the most instructive exemplar for us in Singapore. Almost exactly the same number of people call Denmark and Singapore home. Both are developed high-income jurisdictions with large sophisticated water systems that produce wholly potable tap water. However, per capita household water use in Denmark was already 106 litres/day in 2015. By itself, this is a pretty good number, one which we are envious of. But what really impresses is that quotidian consumption in Denmark declined 31 litres – from 137 in 1994 to 106 litres in 2015 – in just two decades. A whopping 23% drop!

The reader should be assured that the Danish method for bringing this about was not outrageous in the least or extreme in any way. Much like what we do, the reductions in Denmark were achieved through water-saving equipment and public campaigns, accompanied by economically efficient pricing. The average Dane happily pays about \$14 (€8.50) per cubic metre of tap water, compared to the \$2.70 that Singaporeans have to fork out for the same volume.

To be clear, our aim is not to match the high Danish price for water, but to equal their attitude towards conservation. Doubtlessly, the average Danish consumer is far more environmentally responsible than his Singaporean cousin, and absolutely gets that water wasted is water lost.

Every one of us can, should and must use less water. Doing so is entirely feasible, and does not require giving up modern-day comforts, compromising personal or public hygiene, or sacrificing commercial profitability. But it does require enlightened thinking, imagination, determination and conscious effort.

Personally, I believe 100 litres a day is achievable in Singapore, and should not be bothersome or inconvenient. But it will require a real behavioural change in the way every one of us uses water in the home. What would be required is that we all have to become smarter users of water. And we can only become smarter if we have more information and can do better sense-making every time we decide to flip that water tap.

Smart Water

Imagine that you are driving a car which has neither a speedometer nor a fuel gauge. This is essentially analogous to what domestic water users find themselves in today. The water meter outside every Singaporean home is the dumbest, albeit highly accurate, of sensors. It does not even require electrical power to work. Inside every plain-vanilla water meter is an impeller that rotates as water flows through it, the revolutions of which are subsequently converted into volumetric readings in a numerical counter.

In order to keep track of water consumption, the consumer needs to physically sight the meter dial, make a record of the counter reading, and then return and repeat the same at a later chosen time. The difference between consecutive readings would be what was consumed in the intervening period. As physical verifications of meter readings are cumbersome and costly, they are done infrequently. For billing purposes, water meters in Singapore are read every other month. Any more often would make it uneconomical.

Our challenge in PUB is to give our customers the water equivalent of the speedometer and fuel gauge, and so empower them to become smarter users of water. The digital water meter is just such a thing. Battery and wireless technology, together with cloud computing, have improved to such an extent that a computer-enabled water meter now costs no more than the brass block of old. Yet, such a smart sensor that can measure, register and wirelessly transmit usage data to remote servers, which in turn calculate and analyse before proceeding to inform the consumer almost instantaneously, promises to change the game entirely.

A recently concluded smart metering trial in Punggol proved this. People living in 500 HDB households, because they received timely usage information, were able to meaningfully adjust behaviour and become more efficient consumers, saving water and money in the process. Enabled by information on tap – something previously unavailable to end-consumers – we saw participants save as much as 5% by the end of the short trial. Another recent tryout, this time with smart showers in homes that instantly count down the amount of water used up as one washes, produced much the same benefits.

These experiments have convinced PUB that the digitalisation and constant availability of water use information will help to change consumer behaviour, leading to significantly reduced consumption. They also confirm that our ambitious plan to digitalise Singapore's entire water system is a worthy and worthwhile one.

Use Less, Enjoy More

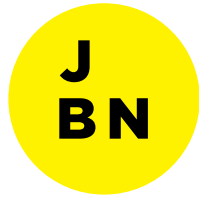
Ultimately, a litre of water that is not required, and therefore not used, is a litre not produced. The consequent savings in energy, chemicals, man and material, plant and equipment are not just expenditure avoided, but also go towards reducing our collective carbon footprint. Producer or consumer, we both do the earth a favour by not having to make or to use up that marginal litre of water.

When it comes to water, we should all strive to become minimalists. Less is more.

Ng Joo Hee is the Chief Executive of PUB, Singapore's National Water Agency.

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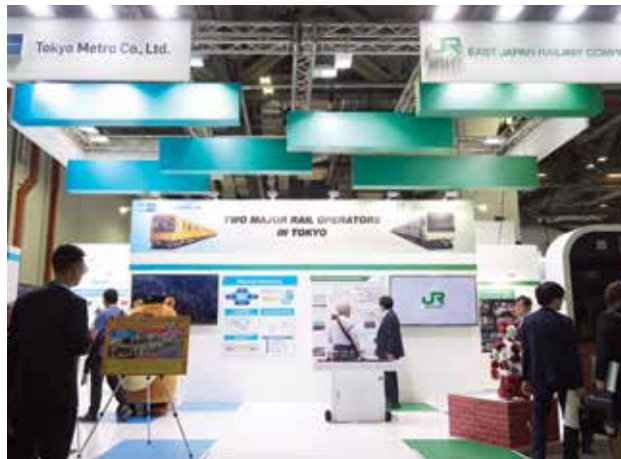
SEEN@ WCS



Unfortunately, our cities back home are poorly planned. It is a key challenge that we want to address. One thing I learnt from this conference is that cities need to be more humane. You need to have the human element taken care of first

Hon. Mboha Joseph Oloo
Member of the County Assembly, Siaya, Republic of Kenya

Right: AI, smart grid and maintenance robots are just some of the reasons why JR East is world-renowned for its efficiency on the rails. Its booth is a train enthusiast's dream



SEEN@ SIWW



One key takeaway from the conference is that it's all about data. That's where the industry is going. Data is providing valuable insights and visibility to the world's water problems, which we are all trying to solve together

Colin Sabol
SVP, President, Measurements and Control Solutions, Xylem



Left: Riding on the coat-tails of this year's World Cup fever, the 2017-2018 English Premier League champion Manchester City brought a trophy to their sponsor Xylem's booth

SEEN@ CESS



I especially loved the Environment and Water Leaders Forum panel with HE Patricia Espinosa from the United Nations and Ahmed Aboutaleb, the Mayor of Rotterdam. It was very insightful and even a little controversial. Very exciting to watch

Stefanie Beiten
Director, Partnerships, Eco-Business



Above: DOWA's TEC Incineration Plant has a special stoker-type kiln that reduces fuel use and bottom ash generation. The team even has a scaled model at its booth to show visitors exactly how everything works

TOMORROW'S HIGHLIGHTS

SITE VISIT: CLOSING THE WATER LOOP - A SUSTAINABLE SOLUTION
08.00-14.00

SITE VISIT: ADVANCING WITH MEMBRANE TECHNOLOGY IN DESALINATION AND WATER REUSE
08.00-14.00

SITE VISIT: TUAS SOUTH INCINERATION PLANT (TSIP) AND NTU WASTE-TO-ENERGY RESEARCH FACILITY
08.30-13.00

SITE VISIT: SEMAKAU LANDFILL
08.30-13.00