

2018 BLUEPAPER



What will drive the next era of water management?

Get insights from thought leaders on the
Circular Economy, Closed Water-Energy-Waste
Loops, Water Reuse, Digitalisation

*Celebrating 10 years
of water excellence 2008 - 2018*

[Front Cover] *A glass of NEWBrew. To commemorate the SIWW's 10 years of excellence this year, PUB, Singapore's National Water Agency collaborated with Brewerkz to create this uniquely Singaporean tipple made with NEWater.*

Acknowledgements:

The organisers of Singapore International Water Week 2018 would like to thank the chairpersons/moderators and speakers of the events featured in this document, as well as all the delegates for their participation and contributions in the sessions. We would also like to acknowledge the contributions from the following in the preparation of this Blue Paper: Eco-Business, Dr Cecilia Tortajada (Senior Research Fellow, Institute of Water Policy), as well as Cheryl Wong and Rachel Koh from the National University of Singapore.

Disclaimer:

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A Message from Professor Tommy Koh



Dear Friends,

2018 is a special year for the Singapore International Water Week (SIWW). It is our tenth birthday. For the past decade we have been bringing together water experts from across the globe to share best practices, create partnerships and advance the water industry. We continued to hold this year's SIWW alongside the World Cities Summit (WCS) and CleanEnviro Summit Singapore (CESS) because we recognise the nexus between human beings on the one side, the environment, cities and water on the other. If we continue to harm the environment, destroy our ecosystems, kill our biodiversity, we are threatening human civilisation on Earth. Cities are important because over half of humanity now live in cities, and cities drive our civilisation and our economies. Finally, water security is an existential challenge not just for Singapore, but for the whole world. Without water, there will be no human beings and no human civilisation.

For this reason, water security and adequate sanitation are enshrined in the United Nations' (UN) Sustainable Development Goal (SDG) 6. It is

significant that water and sanitation are put together in one goal. We have made some progress on water, but must advance much further and faster.

According to the World Health Organization (WHO), in the last 25 years, while 2.6 billion people have gained access to clean drinking water, over 2 billion people still have not. As for sanitation, the situation remains a disaster. 4.5 billion people - over half of the Earth's population, do not enjoy safe and proper sanitation. The UN has thus declared this decade, from 2018 to 2028, the International Decade for Action on Water for Sustainable Development, to galvanise efforts towards meeting water-related challenges and goals.

Having chaired the SIWW Water Leaders Summit (WLS) since 2008, I am always inspired by the insights and success stories shared. This year, we heard from His Excellency Ban Ki-moon, the 8th Secretary-General of the United Nations, about the critical importance of multilateral cooperation in resolving our increasingly complex climate and water problems, and the 2018 Lee Kuan Yew Water Prize

Laureate Professor Rita Colwell's pioneering research that has transformed water safety measures worldwide.

This edition further emphasised the need for political will and 4P - public-private-people partnership - in encouraging innovative solutions to our water issues. In addition, for the first time, our speakers at the Summit included a youth representative, Ms Maryam Farhanah. She reminded us that decision makers need to be brave, if true innovation is to be achieved in time to address current and future water challenges.

The Summit's key discussion outcomes are captured in this Blue Paper, and I hope they will strengthen our determination to surmount our water difficulties.

With best wishes,

Professor Tommy Koh

Chairperson, Singapore International Water Week 2018 - Water Leaders Summit Ambassador-at-Large, Ministry of Foreign Affairs, Singapore

[Opening Address] Mr Tharman Shanmugaratnam,
Deputy Prime Minister and Coordinating Minister for
Economic and Social Policies, Singapore



Key Conclusions of WLS 2018 Discussions

OPENING ADDRESS FOR SIWW-WCS-CES: HARNESSING INNOVATION FOR SUSTAINABLE AND INCLUSIVE CITIES

Countries will be confronted with an increasingly complex challenge over the next 15 years. Major risks such as poorly managed urbanisation, climate change, and unequal rather than inclusive growth in many societies, are converging and compounding one another. They may also spread and become global issues, for instance, through forced migration.

It is thus imperative for countries to resolve such problems by adapting innovations from multiple sources, including governments, companies, and civic society. Indeed, there is ample opportunity for countries to share solutions for a more sustainable environment, effective investments in human capital, and urban planning for more cohesive communities.

Key examples of innovative solutions for urban sustainability include how the Indian city of Ambikapur reduced its solid waste and transformed it into an income-generating resource. This was done by mobilising women from low-income households to run Solid and Liquid Resource Management centres to sort out organic and inorganic waste, and resell compost and recyclable products. Singapore is also demonstrating how to unlock synergies and raise land productivity, through co-locating a wastewater treatment plant and waste-to-energy plant at the Tuas Nexus facility. Used water sludge from the treatment process will be co-digested with food waste from the waste-to-energy plant to increase biogas production, which cuts emissions and maximises resource recovery.

Moreover, governments must empower communities and ensure that everyone benefits from innovations. This is illustrated by the South Korean city of

Seoul, which introduced measures to better incorporate residents' input in urban planning, like citizen committees and digital platforms such as the mVoting system. Furthermore, Singapore is developing Virtual Singapore - a 3D digital model of the country, using real-time dynamic data. Potential applications include visualising how upgrading projects would impact local landscapes, and enhancing stakeholder involvement in designing industrial estates. Slated to be ready by the end of 2018, the full platform will first be employed by government agencies, and then progressively made available to companies and the public.

KEYNOTE ADDRESS BY HE RANIL WICKREMESINGHE, PRIME MINISTER, SRI LANKA: LIVEABLE AND SUSTAINABLE ASIAN CITIES OF THE FUTURE

Urbanisation has fuelled economic prosperity through advancements like improved productivity and job creation.



However, the unexpectedly rapid and unplanned expansion of Asian cities is overtaxing their infrastructure, basic services, land, housing and the environment. Asian leaders are thus challenged to make cities liveable for the present and future. To do so, they could consider several approaches to combine economic growth with sustainable development.

Firstly, leaders must ensure that their governmental structures can facilitate mega-city management. This is especially important for countries with many levels of government and local authorities, not initially organised for this purpose. In this light, Sri Lanka shows how to engage local authorities in large-scale urban redevelopment, such as that of Colombo. The Ministry of Western Megapolis Development was established to coordinate infrastructural development in the Metropolitan area, while the Minister for Development Strategy oversees investments entering the Megapolis area. To facilitate progress, the government is considering new laws to streamline decision-making processes and ensure that all stakeholders, including provincial systems and local authorities, are represented.

Secondly, leaders should be open to private-public partnerships, which can help deliver mega infrastructural projects for enhanced connectivity and urban sustainability. For example, Sri Lanka's Ministry of Megapolis worked with Surbana Jurong on plans to transform its western province, encompassing Colombo and its capital Sri Jayawardenepura, into a green megalopolis of interconnected metropolitan areas, involving sewerage projects, an Eco Zone, and Riverine Buffer Zone Development. These plans are in the nascent stages of implementation.

Thirdly, leaders should learn from other cities' successes. For instance, as Asia's best example of a well-managed city, Singapore has much to share in urban water management, having set benchmarks in desalination and potable quality recycling of wastewater. The Sino-Singapore Tianjin Eco-City further exemplifies how to achieve urban liveability and sustainability, with initiatives to remove barriers for the elderly and the disabled, and use integrated wastewater treatment and desalination.

Furthermore, leaders should look into how they can leverage developments in digital technologies (entailing sensors,

artificial intelligence and the Internet of Things), to build smart, safe and secure cities. For instance, this could include investments to make street lighting infrastructure "smarter" through sensors, communications, and analytics software.

OPENING PLENARY: URBAN SOLUTIONS FOR A LIVEABLE AND SUSTAINABLE FUTURE

According to the UN, the majority of the world's population would be urban by 2050, aggravating challenges like pollution, waste management, providing clean water and energy, and climate change. To address such issues, city leaders need to develop long-term vision and foresight, as well as prioritise public and private investments for more sustainable urban growth. They must also leapfrog in their advancement by tapping innovations in big data and artificial intelligence. In this light, several countries could point the way to successful urbanisation, by offering lessons in different aspects of sustainable development.

Firstly, leaders must commit to raising stakeholders' climate-consciousness through policies, laws and regulations



[Opening Plenary, L-R] Professor Chan Heng Chee, Ambassador-at-Large, Ministry of Foreign Affairs, Singapore; Dr Kristalina Georgieva, Chief Executive Officer, World Bank; Mr Zhuang Guotai, Vice-Minister, Ministry of Ecology and Environment, China; HE Shri N. Chandrababu Naidu, Chief Minister of Andhra Pradesh, India; Mr Steve Demetriou, Chairman and Chief Executive Officer, Jacobs; Mr Bernard Charlès, Vice-Chairman and Chief Executive Officer, Dassault Systèmes; HE Dr Thani Al Zeyoudi, Minister of Climate Change and Environment, United Arab Emirates

that deliver long-term solutions. For instance, China's strategies to nurture an ecological civilisation include introducing environmental protection and soil pollution prevention laws, as well as promoting green transportation by citizens through a bike-sharing programme. In the United Arab Emirates, initiatives like the 2030 Green Agenda and National Climate Change Plan 2050 set out ambitious sustainability goals, such as reducing solid waste by 75% by 2021, and expanding clean energy to constitute half of the power supply by 2050. Measures to meet these targets include enhancing desalination technologies through renewable energy, and storing over 41 million tonnes of carbon dioxide in mangrove plantations which simultaneously nourish marine life. Such steps are also bolstered by efforts to educate all the country's stakeholders, including industries and youth, about the importance of sustainable production and consumption.

Secondly, countries can leverage smart technologies and transformative structural solutions to enhance resource management and increase climate-change resilience. For example, the Indian state of Andhra Pradesh uses real-time data and devices like sensors

to improve monitoring of rainfall and water quality, as well as cyclone forecasts. In the United States (US), global company Jacobs is working on an innovative and massive sediment diversion programme to restore and reinforce the Louisiana coastline, featuring oyster beds to address critical environmental, economic and cultural resilience challenges. Moreover, countries could explore installing hybrid infrastructure, combining grey built infrastructure with natural features like dune-scaping and native vegetation, to enhance flood protection while contributing to economic and property values.

Indeed, to ensure that urban solutions have maximum impact, they must be implemented as part of a master plan to construct infrastructural systems which integrate multiple considerations like energy, water, transportation, recreation and commercial uses. Advances in data collection and digitisation could also be game-changing in helping leaders manage such complex frameworks. For instance, as virtual replicas of cities become more accurate, including in representing how different services interact, governments will be able to see exactly how their cities work, more precisely predict decisions' impact, and better residents' lives.

ENVIRONMENT AND WATER LEADERS FORUM: CLOSING THE LOOP – CATALYSING A RESILIENT AND SUSTAINABLE FUTURE

As burgeoning populations and urbanisation continue depleting finite resources like water and energy, the need for circular economies is increasingly urgent. Besides improving efficient use and increasing supplies of resources, circular economies can also channel investments towards innovation to resolve constraints, and thus unlock business opportunities. Indeed, building such economies involves more than merely recycling, and demands collective support by governments, companies, and communities.

Firstly, countries could adopt multi-pronged approaches to create circular economies. For instance, Singapore tackled several fronts to develop a closed water loop that continually recycles the resource. This involved pursuing novel R&D and technologies to produce NEWater, which is ultra-clean, high-grade reclaimed water used mainly for non-potable purposes by industries. The government also ran campaigns to assure the community that NEWater was safe to drink. Backed by political and community leaders who publicly drank NEWater, such efforts



[Environment and Water Leaders Forum, L-R]

Mr David Newman, President, World Biogas Association; Mr Ahmed Aboutaleb, Mayor, Rotterdam, the Netherlands; Mr Masagos Zulkifli, Minister for the Environment and Water Resources, Singapore; Professor Tommy Koh, Ambassador-at-Large, Ministry of Foreign Affairs, Singapore; HE Patricia Espinosa, Executive Secretary, United Nations Framework Convention on Climate Change; Mr Masatoshi Akimoto, Parliamentary Vice-Minister of Land, Infrastructure, Transport and Tourism, Japan; Mr Neil McGregor, Group President and Chief Executive Officer, Sembcorp Industries

underscored the need for water reuse as a weather-resilient alternative, given the threat of climate change. Hence, despite being amongst the world's most water-stressed countries, Singapore's quest to overcome its water challenges has yielded opportunities, and even generated 14,000 jobs to date.

Furthermore, governmental policies and legislation could help stakeholders make resource circularity a way of life. For example, the Dutch city of Rotterdam lobbied the national authorities to change building regulations, so that it could partner firms to establish eco-friendly infrastructure like houses

that use less water and filter it, and produce energy to contribute to the grid. In Japan, the government enacted the Basic Act on Water Cycle to raise awareness of the importance of protecting the natural water cycle, and spur cooperation on water issues. In this light, citizens in Japan's Hadano City, which experienced decreasing groundwater levels, were given easy-to-understand information on visualising groundwater storage and levels. They were thus able to facilitate efforts to recover groundwater levels and quality.

Countries could also consider tougher measures to build circular economies,

such as taxation of pollutive and climate-change aggravating substances like carbon. For instance, as Singapore aspires to achieve a low-carbon economy, it will implement a carbon tax from 2019. The tax revenues will then be spent on projects to incentivise local industries to become low-emission and energy-efficient.

However, circular-economy efforts must be accompanied by methods to minimise the use and waste of resources at the outset. In Singapore, for instance, Sembcorp's facility on Jurong Island reclaims water from industrial wastewater effluent. Countries could



[Water Leaders Insights 1, L-R] Mr Bruce Gordon, Coordinator of Water, Sanitation, Hygiene and Health, World Health Organization; Ms Jane Nishida, Principal Deputy Assistant Administrator for International and Tribal Affairs, United States Environmental Protection Agency; Mr Miguel Angel Sanz, President, International Desalination Association; and Director of Strategic Development for Treatment Infrastructure Division, SUEZ; Mr Ng Joo Hee, Chief Executive, PUB, Singapore; Mr Subramanyan Kanakasabapathy, Regional Managing Director, South East Asia, Jacobs; Dr Sanjay Mukherjee, Additional Municipal Commissioner (Projects), Municipal Corporation of Greater Mumbai, India; Ms Diane D'Arras, President, International Water Association; Mr Allard Nooy, Chief Executive Officer, InfraCo Asia Development

[SIWW Water Dialogue]

HE Ban Ki-moon, 8th Secretary-General,
United Nations

also consider outlawing planned obsolescence of goods, as France has done. This would deter companies from deliberately designing products with short lifespans, so that consumers would replace them.

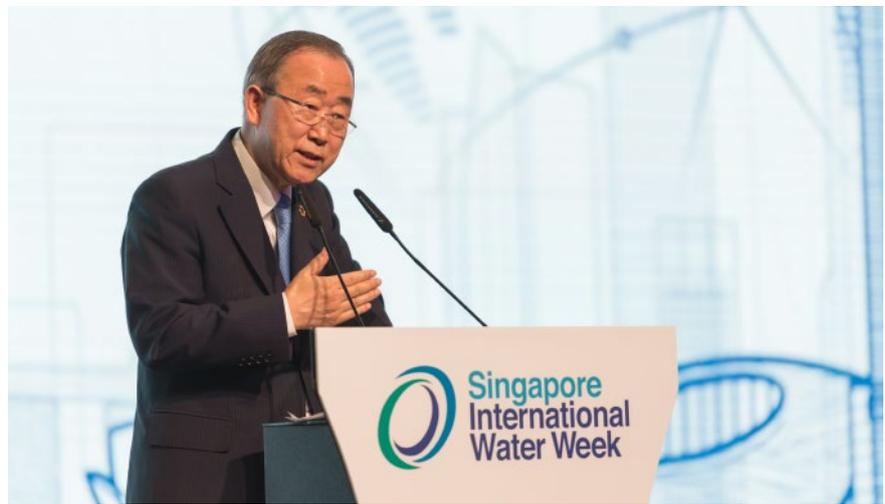
Ultimately, circular economies will underpin more resilient and sustainable cities for future generations. Countries must thus make bolder strides to develop such economies.

SIWW WATER DIALOGUE: TACKLING OUR CLIMATE AND WATER ISSUES – THE MULTILATERAL WAY

Climate change is unleashing serious risks and instability through unprecedented extreme weather events such as droughts and hurricanes, as well as rising sea levels that may force massive population resettlement. This is affecting global water supplies, already severely stressed by unsustainable consumption patterns, poor management practices, pollution, and insufficient infrastructural investment. With some countries now experiencing water scarcity, water demand will continue to rise with worldwide population growth.

Climate change and water sustainability are thus global issues, which call for global responses. These include the Paris Agreement, designed to help countries combat and adapt to climate change. The UN has also adopted the 2030 Agenda for Sustainable Development including 17 SDGs, such as universal access to safe drinking water and adequate sanitation, which affects the other SDGs. This initiative represents the UN's most ambitious and far-reaching vision to enable countries to achieve sustainable development, responsible economic growth and social inclusion.

To deliver on these international commitments, we need global partnerships, including industry leaders' active participation. For instance, the Organisation for



Economic Co-operation and Development estimates that implementing the Paris Agreement and SDGs would require several trillion dollars. As government money alone would not suffice, financing from public-private partnerships should be explored. Moreover, no country, however resourceful and powerful, can single-handedly solve our shared climate and water problems. Consequently, countries must foster and reinforce smart and engaged multilateralism, currently being menaced by rising protectionism and populist nationalism. The US, in particular, should return to the Paris Agreement and multilateralism.

Still, there are causes for optimism about the future. For instance, there is heightened recognition by government, business and civil society leaders of the importance of collaboration to address climate and water challenges. There is also no shortage of innovative solutions to do so, with accelerated scientific and technological progress. Singapore, for instance, has shown how the full use of innovation (including reclaimed water reuse, rainwater catchment systems and desalination), is key to enhanced, integrated and sustainable water management. In addition, this must be supported by effective governance systems to educate people about the need to treasure and conserve water.

WATER LEADERS INSIGHTS 1: RECYCLING AND REUSING WATER ENDLESSLY

Water reuse has been gaining traction as a means to attain water sustainability.

Still, it is not universally embraced, with public distaste amongst the chief reasons. Consequently, countries could explore several pathways towards popularising water reuse.

Firstly, the advantages of water reuse should be promoted more actively. Essentially, countries can boost their water supply by five times if they recover 80% of their used water and reintroduce it into the system. Furthermore, water reuse is climate-resistant, far less energy-intensive than desalination, without requiring land-intensive storage. Moreover, water reuse technologies are now increasingly commonplace, affordable, and improving.

Countries could also adapt water reuse to specific exigencies. For instance, in India, Mumbai plans to raise its sewage collection from 80% to 100%, and use the additional treated water for irrigation, to avoid straining freshwater sources. In this light, companies could also facilitate water reuse by tailoring solutions to its various applications, such as by transforming secondary-treated sewage for tertiary usage by industries.

Ultimately, countries must earn community acceptance to successfully implement water reuse. This entails guaranteeing safe practices through regulatory frameworks, treatment guidelines, and robust compliance systems. For instance, in the US, the Clean Water Act and Safe Drinking Water Act establish public health standards which help state govern-



[Water Leaders Insights 2, L-R] Mrs Cindy Wallis-Lage, President, Water Business, Black & Veatch; Mr Patrick Decker, President and Chief Executive Officer, Xylem; Ms Joke Cuperus, Chief Executive Officer, PWN Water Supply Company, the Netherlands; Ms Sue Murphy, Chief Executive Officer, Water Corporation of Western Australia, Australia; Mr Peter Herweck, Executive Vice President Industry Business, Member of the Executive Committee, Schneider Electric; Mr Seong Han Kim, Vice President and Chief Research Officer, K-water, South Korea

ments adapt regulations for potable water use. The WHO has also collaborated with experts in Singapore to produce potable reuse guidelines. Moreover, in Singapore, where NEWater (ultra-clean reclaimed water) is generated mainly for industrial processes, schoolchildren learn at NEWater factories that NEWater is also safe for drinking. In fact, where potable use is concerned, NEWater is not sent straight to taps, but directed to reservoirs, blended with rainwater and re-treated for drinking purposes. While unnecessary, this increases public acceptance.

Nonetheless, water reuse must go hand-in-hand with curtailing water demand. The US exemplifies this through water-efficiency certification programmes including products and plumbing systems. Countries should also employ measures like meters and tariffs, to raise awareness of the costs of excessive water consumption.

In summary, with water reuse, countries need never go thirsty. Hence, greater efforts are needed to encourage its adoption, along with water conservation.

WATER LEADERS INSIGHTS 2: GETTING READY FOR A DIGITAL (R)EVOLUTION

Faced with challenges like increasing urban water demand, utilities are under mounting pressure to optimise service delivery. Their task is further compounded by issues like ageing infrastructure, which would be costly and time-consuming to replace. It is

thus timely that utilities capitalise on digitalisation, which offers new ways to enhance planning and operations.

Firstly, digitalisation can remove the guesswork from infrastructural maintenance, repair, replacement and expansion. For instance, sensors and data analytics allow real-time monitoring of asset health, to identify failing infrastructure, pinpoint leaks and prevent sewer overflows. This enables more granular understanding and speedier assessment, which can guide utilities' infrastructural investments.

Companies can also significantly boost utility adoption of digitalisation, by developing solutions which are user-friendly, cost-effective, easy-to-upgrade, inter-operable, and durable, to match water infrastructure lifespans. They could also help utilities make more proactive decisions and lower the cost of new capital investment. For instance, in Colorado in the US, Xylem used smart diver technology to assess a 44-square-mile pipeline in less than a day, instead of the usual few weeks. The inspection tool located leaks and captured data that can be used to predict them. The company also worked with another US city to use distributed sensing technology and real-time modelling during storms, which determined how to optimise, instead of replace, the city's storm water network to reduce floods. This slashed expected capital expenditure from US\$800 million to about US\$300 million.

Furthermore, digitalisation can help utilities to better educate customers on water issues, and build confidence. For instance, in South Korea, to tackle public distrust of tap water, K-water introduced a smartphone app for residents to ascertain the good quality of tap water supplied. Subsequently, the tap water drinking rate dramatically increased.

However, utility leaders must have courage to drive digital innovation in their organisations. While the water sector is understandably conservative as mistakes could harm customers, change is vital for progress. To minimise innovation-related risks, utilities could first target incremental improvements. For example, they could select assets, such as a network, where they could experiment with affordable digital technology which promises quicker results.

Nonetheless, no smart technology is invulnerable to cyber-attacks. To prevent and detect such incidents, utilities must safeguard digitalised water systems through cyber-security protocols and workforce training. For instance, software deployed must follow cyber-security standards, with process controls to protect networks and customer data. This includes forbidding employees from plugging unknown thumb-drives into computers. Utilities could also conduct regular cyber-security audits and mock exercises for employees on dealing with cyber-attacks.



[WLS Closing Session, L-R] HE Eng Ali Al-Hazmi, Governor, Saline Water Conversion Corporation, Saudi Arabia; HE Henk Ovink, Special Envoy for International Water Affairs, the Netherlands; Dr Bambang Susantono, Vice-President (Knowledge Management and Sustainable Development), Asian Development Bank; Mr Ramoncito S. Fernandez, President and Chief Executive Officer, Maynilad Water Services, Inc., the Philippines; Mr Jean-Louis Chaussade, Chief Executive Officer, SUEZ; Ms Maryam Farhanah, Process Engineer, Mott MacDonald and Representative from the Young WLS; Professor Tommy Koh, Ambassador-at-Large, Ministry of Foreign Affairs, Singapore

WLS CLOSING SESSION: TOWARDS A SUSTAINABLE AND RESILIENT WATER FUTURE

The future of water is increasingly characterised by alarming projections, such as global water demand outstripping supply by 50% by 2025. However, the future is also the biggest opportunity to overcome such challenges. Indeed, the world is entering a new era of water management, with more countries pursuing innovative and collaborative approaches to tackle their water woes.

Firstly, utilities are more cognizant of the need to transform water from a one-time commodity to a renewable resource. Water reuse is thus becoming a cornerstone of the circular-economy model, critical for sustaining countries' future development. With the evolution of water reuse technologies and regulatory frameworks for environmental and health protection, reclaimed water can now be produced for multiple uses. Continued innovation would further enhance water-reuse practices, develop more energy-efficient technologies, increase public acceptance, and facilitate the growth of a competitive global water reuse market.

Digitalisation is also revolutionising planning and operations within the water industry. For instance, real-time data collection and

big data analysis can help utilities minimise water losses and maximise operational efficiencies. This includes facilitating climate-change resilience, for example, through monitoring potential flooding in high-flood-risk urban areas.

Furthermore, there is heightened recognition in the water industry that political will and collaboration are critical to develop, implement and promote innovative water solutions. To conventional public-private partnerships between governments and businesses, a fourth 'p' – people, must be added. These include young water professionals who are leading efforts to ensure water is treated as a precious resource.

Overall, the water industry has made significant headway in finding cost-effective and sustainable solutions. To continue paving the road towards a brighter and resilient future, leaders must aspire to instil greater social responsibility for water conservation, by highlighting the value of water in all aspects of life.

LEE KUAN YEW WATER PRIZE LECTURE: PIONEERING BREAKTHROUGHS IN MICROBIAL WATER QUALITY SURVEILLANCE

At least two billion people currently use a contaminated drinking water source,



which can contain numerous infectious disease agents. With the global population projected to rise significantly, it is vital to control such agents to provide safe drinking water.

Professor Rita Colwell, an American microbiologist, received this year's Lee Kuan Yew Water Prize for her pioneering insights into microbial water quality surveillance, and her pivotal contributions in translating these insights into concrete practices. These practices have improved the management of water-borne diseases and the protection of public health globally. During the Lee Kuan Yew Water Prize Lecture which she conducted, Professor Colwell shed more light on her groundbreaking work.

Firstly, the key to controlling waterborne diseases is understanding how different pathogens interact with one another and the environment. This could help detect, isolate, characterise and thus prevent other emerging infectious diseases. For instance, Professor Colwell showed that bacteria can be alive and cause harm even when they cannot be cultured, contrary to popular belief at that time. She thus championed novel molecular methods for more accurate and comprehensive diagnostics of water pathogens.

Professor Colwell also discovered that

Vibrio cholerae, the cholera-causing bacterium, can occur naturally in aquatic environments and is associated with plankton behaviour, unlike the prevailing view then that it could not survive more than several hours outside a human host. This discovery enabled her to demonstrate that satellite imagery can be used to anticipate the occurrence and intensity of cholera outbreaks, because microscopic animals in water that carry *Vibrio cholerae* feed on plankton, which contain observable chlorophyll. For example, in Bangladesh, her methods predicted that with an increase in chlorophyll, there would be about a one-third increase in cholera cases. Moreover, a test in Yemen foresaw a cholera outbreak four weeks before it happened.

Another major breakthrough being launched, and what Professor Colwell deems the most exciting work of all, is the extraction of DNA directly from water samples. The DNA is then, in purified form, sequenced, and compared against a highly comprehensive database. This allows swift identification of bacteria, viruses, parasites and fungi (in the samples) all at once, and how they interact. Potential applications of this process include diagnosing diarrheal diseases more accurately, and assessing the safety of recycled water for potable use.

[Lee Kuan Yew Water Prize Lecture]
Professor Rita Colwell, Distinguished University Professor, Johns Hopkins Bloomberg School of Public Health

A Global Gathering of Water Leaders

The WLS is an exclusive high-level gathering which aims to shape the global water agenda by providing the latest policy, business and technological insights into tackling our shared water challenges. WLS 2018, held from 8 to 10 July, was attended by some 500 leaders from governments, utilities, international organisations, academia and industry, including ministers and chief executive officers of the world's biggest utilities and water companies. The chairpersons, moderators and speakers of the event are listed below. The WLS delegate list is available at <http://bit.ly/wls2018delegates>.

WATER LEADERS SUMMIT

Chairpersons/Moderators:

- **Dr Janil Puthuchery**, Senior Minister of State, Ministry of Communications and Information and Ministry of Transport, Singapore
- **Professor Chan Heng Chee**, Ambassador-at-Large, Ministry of Foreign Affairs, Singapore
- **Professor Tommy Koh**, Ambassador-at-Large, Ministry of Foreign Affairs, Singapore, and Chairperson, SIWW Water Leaders Summit
- **Professor Greg Clark**, Chief Advisor and Chairman, OECD-LEED Forum on Development Agencies and Investment Strategies, United Kingdom
- **Mr Subramanyan Kanakasabapathy**, Regional Managing Director, South East Asia, Jacobs
- **Mr Peter Nicol**, Global Director of Water, Jacobs
- **Mrs Cindy Wallis-Lage**, President, Water Business, Black & Veatch

Speakers:

- **HE Ranil Wickremesinghe**, Prime Minister, Sri Lanka
- **Mr Tharman Shanmugaratnam**, Deputy Prime Minister and Coordinating Minister for Economic and Social Policies, Singapore
- **HE Dr Thani Al Zeyoudi**, Minister of Climate Change and Environment, United Arab Emirates
- **HE Ban Ki-moon**, 8th Secretary-General, United Nations
- **HE Shri Nara Chandrababu Naidu**, Chief Minister of Andhra Pradesh, India
- **HE Patricia Espinosa**, Executive Secretary, United Nations Framework Convention on Climate Change
- **Mr Masagos Zulkifli**, Minister for the Environment and Water Resources, Singapore
- **Mr Ahmed Aboutaleb**, Mayor, Rotterdam, the Netherlands
- **Mr Masatoshi Akimoto**, Parliamentary Vice-Minister of Land, Infrastructure, Transport and Tourism, Japan
- **HE Eng Ali Al-Hazmi**, Governor, Saline Water Conversion Corporation, Saudi Arabia
- **Dr Kristalina Georgieva**, Chief Executive Officer, World Bank
- **HE Henk Ovink**, Special Envoy for International Water Affairs, the Netherlands

- **Dr Bambang Susantono**, Vice-President (Knowledge Management and Sustainable Development), Asian Development Bank
- **Mr Zhuang Guotai**, Vice-Minister, Ministry of Ecology and Environment, China
- **Mr Bernard Charlès**, Vice-Chairman and Chief Executive Officer, Dassault Systèmes
- **Mr Jean-Louis Chaussade**, Chief Executive Officer, SUEZ
- **Ms Joke Cuperus**, Chief Executive Officer, PWN Water Supply Company, the Netherlands
- **Ms Diane D'Arras**, President, International Water Association
- **Mr Patrick Decker**, President and Chief Executive Officer, Xylem
- **Mr Steve Demetriou**, Chairman and Chief Executive Officer, Jacobs
- **Mr Ramoncito S. Fernandez**, President and Chief Executive Officer, Maynilad Water Services, Inc., the Philippines
- **Mr Bruce Gordon**, Coordinator of Water, Sanitation, Hygiene and Health, World Health Organization
- **Mr David Henderson**, Managing Partner and Founder, XPV Water Partners Inc.
- **Mr Peter Herweck**, Executive Vice President Industry Business, Member of the Executive Committee, Schneider Electric
- **Mr Seong Han Kim**, Vice President and Chief Research Officer, K-water, South Korea
- **Mr Neil McGregor**, Group President and Chief Executive Officer, Sembcorp Industries
- **Dr Sanjay Mukherjee**, Additional Municipal Commissioner (Projects), Municipal Corporation of Greater Mumbai, India
- **Ms Sue Murphy**, Chief Executive Officer, Water Corporation of Western Australia, Australia
- **Mr David Newman**, President, World Biogas Association
- **Mr Ng Joo Hee**, Chief Executive, PUB, Singapore's National Water Agency
- **Ms Jane Nishida**, Principal Deputy Assistant Administrator for International and Tribal Affairs, United States Environmental Protection Agency
- **Mr Allard Nooy**, Chief Executive Officer, InfraCo Asia Development
- **Mr Miguel Angel Sanz**, President, International Desalination Association; and Director of Strategic Development for Treatment Infrastructure Division, SUEZ
- **Ms Maryam Farhanah**, Process Engineer, Mott MacDonald; and Representative from the Young Water Leaders Summit

LEE KUAN YEW WATER PRIZE LECTURE

Moderator:

- **Mr Ng Joo Hee**, Chief Executive, PUB, Singapore's National Water Agency

Speaker:

- **Professor Rita Colwell**, Distinguished University Professor, Johns Hopkins Bloomberg School of Public Health - Lee Kuan Yew Water Prize Laureate

SPOTLIGHT 2019

Held in between the main SIWW editions, the *SIWW Spotlight* series are exclusive by-invitation events to continue the dialogue from SIWW and foster ongoing exchanges on pressing challenges faced by the water industry worldwide. This meeting of minds focuses on critical issues and discussions in greater depth, where the outcomes will shape the programme and content for SIWW.

The next edition of Spotlight will be held from 6 to 7 June 2019.

SINGAPORE INTERNATIONAL WATER WEEK 2020

The Singapore International Water Week (SIWW) is the world's premier platform to connect the water industry for innovative solutions and sustainable urban water management. The biennial event gathers stakeholders from the global water industry to share best practices, showcase the latest technologies and tap business opportunities.

The next edition of the SIWW will be held from 5 to 9 July 2020.

For more information, visit www.siww.com.sg.



Stay connected with us:



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PUB WaterHub serves as a strategic platform for PUB and the Singapore water industry to converge and tackle global water challenges.

The WaterHub comprises three main buildings

– Singapore Water Exchange, Singapore Water Academy and PUB Offices.

SINGAPORE WATER EXCHANGE

- A specialised space meeting all the business needs of water companies
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