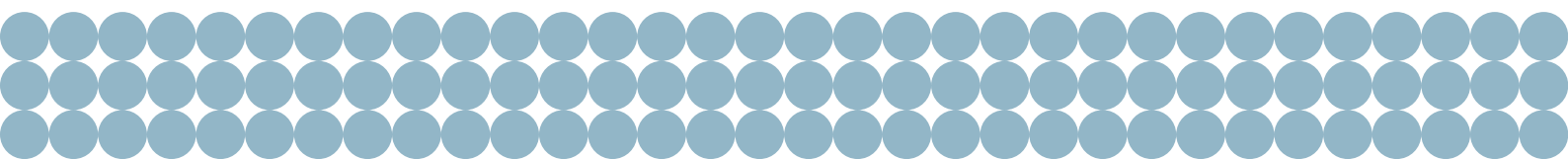


PUSHING THE WATER MANAGEMENT ENVELOPE:

INSIGHTS FROM THE
SIWW WATER UTILITIES
LEADERS FORUM



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PUSHING THE WATER MANAGEMENT ENVELOPE: INSIGHTS FROM THE SIWW WATER UTILITIES LEADERS FORUM

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MESSAGE FROM THE CHAIRPERSON

Dear Friends,



I am pleased to present to you the outcome document of the Singapore International Water Week (SIWW) Water Utilities Leaders Forum (SWULF): “Mapping Challenges and Solutions”, which was held from 18 – 19 September 2013. This post-event report, titled “Pushing the Water Envelope: Insights from SWULF”, captures key issues and solutions that were shared and discussed at the Forum.

We organised SWULF as we recognised that water utilities, which are essential to every nation’s survival and prosperity, are increasingly confronted by unprecedented challenges in carrying out their work, such as rapid urbanisation, ageing infrastructure, climate change, and rising energy costs. Despite the different contexts in which utilities operate in their own countries, they have certain similarities and common concerns arising from these new challenges, such as: the supply and quality of water and wastewater services; the ever-growing global demand for water and sanitation; and the resources and infrastructures required to deliver water and sanitation services.

Hence, SWULF served as a platform where over 180 water leaders from 46 countries all over the world could gather to network, exchange experiences and share potential answers to the problems they face, including how they could enhance the

planning and running their operations; improve collaboration with the private sector and the community to ensure water sustainability; and be more future-ready. 4 major focus areas for water utilities emerged from the fruitful two-day discussions:

- a) Taking the Lead in Water Policies:** Utilities should take the initiative in water policies to encourage political commitment, aid water organisations in surmounting obstacles, and work with a wide spectrum of key stakeholders, so as to drive positive change and develop the water industry.
- b) Financial Sustainability:** Optimal water pricing and good asset-management approaches are needed to fuel greater investment in improving water and wastewater services; utilities should also capitalise on mutually beneficial Public-Private Partnerships (PPP).
- c) Stakeholder Engagement:** Utilities must ensure more effective public education and heightened transparency, which will motivate their stakeholders to value and conserve water; they should also provide adequate and varied training to retain and enhance their workforce.
- d) Driving Innovation:** Utilities should actively guide innovation not just in technology but also in planning, finance, operational management and communications; they should also challenge available solutions and assess what risks are involved.

This outcome document is thus structured along the lines of these 4 focus areas. Besides indicating the main issues and potential solutions for each area, this report features case studies, provided by participants of SWULF, which elaborate on possible means of tackling certain challenges.

SWULF participants and those who were unable to join us at the Forum will have the chance to continue these discussions at SIWW 2014, which will feature a stronger focus on utility-centric issues and municipal water solutions, and involve a wider range of stakeholders. While utilities are key players in the provision of water and wastewater services, many of the issues are cross-cutting and necessitate the active contribution of other sectors.

The Water Leaders Dialogue on utility issues at SIWW 2014 will see the 4 key SWULF outcomes (good governance and leadership, financial sustainability, stakeholder engagement and innovation) being further discussed not just by utilities, but also by other key water stakeholders such as governments, private companies, researchers, international organisations and non-governmental organisations, which will provide more lateral perspectives on how to ensure sustainable water and wastewater management.

Last but not least, I would also like to once again thank all Session Chairpersons and delegates at SWULF for their participation, which generated the key points in this document, and all of who have contributed to the document in other ways, such as by providing information on the case studies. Thank you also to Professor Michael Rouse (Independent International Advisor, Distinguished Research Associate, University of Oxford), who worked closely with us to develop this report.

I hope that you will find this post-event report an enjoyable and enriching read, as well as food for thought on how we could take water utility performance to greater heights.

May we meet again at SIWW 2014 to continue this conversation topic!

With Best Wishes,

Chew Men Leong

Chief Executive, PUB Singapore
Executive Director, Environment & Water Industry Programme Office
Chairperson, SIWW Water Utilities Leaders Forum



A SNAPSHOT OF SIWW WATER UTILITIES LEADERS FORUM

More than 180 water leaders from 46 countries took part in the Singapore International Water Week (SIWW) Water Utilities Leaders Forum (SWULF), organised by PUB and held in Singapore on 18 and 19 September 2013. The Forum, opened by Singapore's Minister for the Environment and Water Resources Dr Vivian Balakrishnan and chaired by PUB Singapore's Chief Executive Chew Men Leong, aimed to identify key challenges and solutions for sustainable water and wastewater services. The two-day deliberations spanned 7 sessions, namely, those on Planning for Adequacy; Financing; Innovation; Customer Service and Community Engagement; Operational Optimisation, Asset Management and Utilities' Roles in Cities of the Future. The programme is given in Annex A; the list of participants is in Annex B. Each session was supported by position papers which can be accessed at <http://www.siww.com.sg/position-papers>.

The basic format for each session consisted of a short presentation by the Session Chairperson, who then posed questions for debate by tables of around 8–10 delegates each. A representative from each table shared the salient discussion points with the Forum, either verbally or electronically. This outcome document thus highlights some issues, potential solutions and in-depth case studies related to the 4 main outcomes of the Forum's conversations as follows:

- **Taking the Lead in Water Policies**
- **Financial Sustainability**
- **Stakeholder Engagement**
- **Driving Innovation**

3 KEYS TO SUCCESSFUL WATER SERVICE DELIVERY

In his opening speech, Dr Vivian Balakrishnan, Minister for the Environment and Water Resources, Singapore, welcomed the delegates and, based on Singapore's experience, referred to three points for success in water service delivery. The first one was government commitment to a long-term development plan. The second was collaboration between governments and the private sector. The third, which is associated with the second, was investment in technology and how to take it from the laboratory into practice. Dr Balakrishnan also referred to an agnostic approach to the debate over public or private water service provision – Private-Public Partnership (PPP) is just one option, with the criterion for choice being the most cost-effective way, based on full lifetime costs, of providing services to a specified standard.

(I) TAKING THE LEAD IN WATER POLICIES

Political Will and Commitment

Water is vital for all aspects of social and economic development, yet it is often not at or near the top of political agendas. Investment in water services requires long-term planning and commitment, and the timescales are generally beyond most political tenures. Furthermore, as lives of water infrastructure are long, the consequences of under-investment may not be seen during a politician's 'reign' and vital investment can be delayed. The Forum discussed some solutions as follows:

- (i) **Water utilities to take the lead:** The strong message from the Forum was that water utility leaders must take the lead to give water the necessary status in government thinking. There are many short-term objectives, such as political and financial objectives, which are not consistent with the development of sustainable water services. Taking the initiative requires diplomatic skills and sound information to set the national water agenda. Water utility leaders need to make a case for an integrated government strategic and planning approach, continuity of investment and cost-recovery for sustainability, and involve other stakeholders. This is the approach adopted by the Las Vegas Valley Water District in the formation of the South Nevada Water Authority (SNWA) and its cooperative agreements, as described in [Box 1](#).
- (ii) **Continuous reinforcement to encourage political commitment:** Planning for the water sector should entail establishing clear visions and long-term strategies, supported by all political factions. It may be too much to expect common political views on how to achieve the visions, but there has to be continuity in doing so, and political commitment to long-term strategies. This highly challenging task of ensuring continuity requires continuous attention by water utility leaders. As governments change and public opinion is not static, messages to both the government and the public have to be reinforced time and time again. Though extreme events create problems for utilities, they also provide opportunities to achieve political commitment – do not waste a crisis! For instance, major road collapses in the north of England in the 1980s resulted in severe disruption to cities and high re-construction costs. The collapses were caused by deteriorated sewers systems which caused the soil supporting the road structure to be washed away. These high-media attention events paved the way for a major research programme on underground water mains and sewers, and led to a structured approach to asset management. More recently, failure events – whether pipe failures or flooding – have helped the public to understand the need for investment in the infrastructure with associated increases in water service charges. Such events can be leveraged to keep water and sanitation services on the political agenda, and maintain the public's awareness of water management issues.

01

LEADERSHIP IN STATE AND INTERSTATE WATER RESOURCE SHARING AGREEMENTS

To partly address the water resource problems in an extremely dry region, a cooperative agency SNWA ([Reference 1](#)), comprising 7 South Nevada water utilities, was formed in 1991 to manage the sharing of available water resources. This body has a strong influence on the status of water and water policy in the region. SNWA entered into a water banking agreement managed by the Arizona Water Banking Authority (NWBA). NWBA ([Reference 2](#)) takes Arizona's unused water rights and stores the water in aquifers. That water is available at a later date for use by South Nevada water utilities and others. NWBA charges for the costs of acquiring, storing and recovery of the water.

The move to establish these cooperative agreements was taken by Las Vegas Valley Water District, whose General Manager, Patricia Mulroy, was a principal architect of the SNWA and also its General Manager. She describes the initiative as "a necessary evolution from the parochial approaches of the mid-20th century. Historically, there has been an inherent tendency on the part of water managers to think in terms of 'mine' and 'yours,' as opposed to 'ours.' While the need to protect one's interests is valid, this simplistic zero-sum approach to resource management simply does not align well with today's highly integrated, interdependent world. If we are to overcome the challenges ahead, we must move past our narrow self-interest and manage resources holistically. Collaboration, not confrontation, marks the path to meaningful long-term solutions."



Integration and Collaboration

There are many aspects of government which have to come together in water planning. Integration of water and wastewater is the essential logical next step to facilitate options like water re-use. Water resources are shared between cities, agriculture and industry – many government departments are involved and one department or a water agency should be given the responsibility for coordination. Rapid urbanisation and population growth demand that water planning go beyond simply hydraulics and river basin considerations, to become integrated with city planning. Some potential solutions include:

(i) **Greater collaboration within the water industry:**

Many water utilities cannot stand alone whether due to lack of scale or needing to share water resources with one another, as in the case of SNWA (see [Box 1](#)). Consultants, contractors and suppliers are part of the water industry team. PPP is just one option, with the criterion for choice being the most cost-effective way, based on full life-time costs, of providing services to a specified standard. National water associations, international professional associations and SIWW-type forums play an important role in bringing water industry leaders and experts together, and disseminating information. A national water-planning forum could provide an ongoing platform for government departments and all other stakeholders in a country to discuss water policy, and foster greater collaboration to iron out difficulties in policy implementation. One example of such a forum is the Land and Water Forum (LWF) in New Zealand, as elaborated in [Box 2](#).

02

NEW ZEALAND'S LAND AND WATER FORUM (LWF)

As it was increasingly difficult to establish a consensus on what constitutes sustainable land use and its implications for freshwater, the Government of New Zealand established the LWF in 2008 with the following scope and objectives:

- Conduct a stakeholder-led collaborative governance process to recommend reform of New Zealand's freshwater management;
- Using a consensus process, identify shared outcomes and goals for freshwater;
- In relation to the outcomes and goals, identify options to achieve them; and
- Produce a written report which recommends shared outcomes, goals and long-term strategies for freshwater in New Zealand.

LWF brings together all stakeholders, including indigenous peoples, the water industry, agricultural sector, industrial sector, and urban and environmental organisations. Its first report ([Reference 3](#)) in 2010 made recommendations on requirements of national and local governments, including consultation with communities; targets, standards and limits; and need for monitoring and reporting. The second and third reports ([References 4 and 5](#), both in 2012) were focused on the 'how', like setting limits to improve freshwater management and in freshwater policy; planning through collaboration; managing water quality; and allocating water.

(ii) **Working with other industries:** It is not just the water utility but the water industry which will not be able to meet future challenges alone. Increasingly, collaboration must go further and involve other industries such as energy, agriculture, manufacturing and health care. The water industry has to reach out beyond its own boundaries. Water and energy are interdependent, and growing populations require more of each. Will there be enough reliable energy for water supply purposes? Will there be enough water for energy production? The design and construction of a water-and-power plant in the United Arab Emirates illustrates how we can integrate water and energy production to develop sustainable solutions (see [Box 3](#) and [Reference 6](#)). An example of integrated water, energy and sludge innovation in Suzhou Industrial Park, China, in handling domestic and industrial (sewage) sludge, was provided by Alan Thompson, Executive Vice-President, Suez Environnement in [Box 4](#). SWULF also stressed the importance of water managers reaching out to understand and work with other sectors. In South Africa, the Water, Energy and Food Forum (SAWEF) (see [Box 5](#) and [Reference 7](#)) brings together stakeholders to explore challenges in the water-energy-food nexus. Water, urban and environment leaders from around the world can also gather to discuss vital collaboration issues in the water-environment-urban planning nexus at Singapore International Water Week, which is held in conjunction with the World Cities Summit and the CleanEnviro Summit Singapore.

03

THE FUJAIRAH INDEPENDENT WATER AND POWER PLANT (IWPP) IN THE UNITED ARAB EMIRATES – AN INTEGRATED WATER AND ENERGY FACILITY

Construction of a 136,000 CMD reverse osmosis (RO) plant will be completed in 2015. This expansion of the Fujairah plant involves a 20-year purchase agreement between Abu Dhabi Water & Electricity Company and the plant constructor and operator, Emirates Sembcorp Water & Power Company (ESC).

The expansion project enables the use of un-contracted surplus power from the existing plant, to produce the additional water through RO at a competitive cost.

Nick Carter, Director General of the Regulations and Supervision Bureau (RSB) in Abu Dhabi, said, "This additional expansion is part of an integrated approach to provide high quality drinking water to the northern Emirates and to satisfy the increasing demand in Abu Dhabi. RSB has licensed this facility at Fujairah, having been satisfied of the need for a further 30 MIGD of drinking water production and the operational skills and financial standing of the project company, ESC."



04

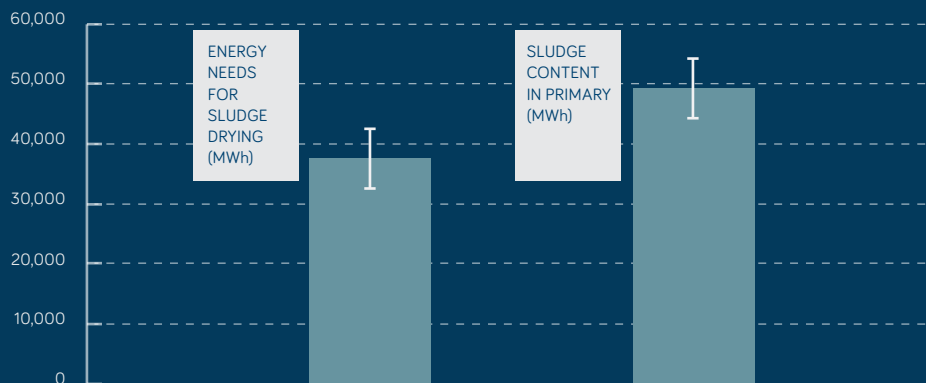
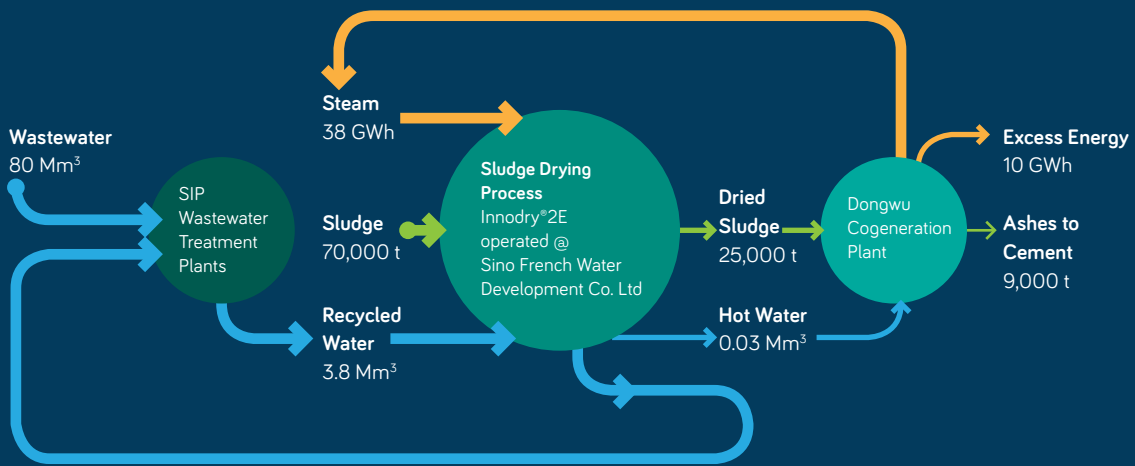
SLUDGE, WATER AND ENERGY SYMBIOSIS AT SUZHOU INDUSTRIAL PARK, CHINA (SIP)

The figure below displays the central role played by the sludge dryer operated by SinoFrench Water Development Co. Ltd in the urban symbiosis existing at the Suzhou Industrial Park. This symbiosis concerns energy, water and material flows in a cradle-to-cradle approach.

Concerning energy, sludge is dried and incinerated with lignite at Dongwu cogeneration plant. Since the primary energy content of dry sludge amounts to 46 to 54 GWh per year, sludge incineration provides enough thermal energy to make the drying process energy-efficient.

Excess energy is provided to the rest of the SIP as steam or electricity. Sludge incineration reduces 12,000 Tonnes of lignite per year.

Concerning water, the sludge-drying process reuses 3.8 Mm³ of treated wastewater per year for cooling and provides 30,000 m³/year of water extracted from sludge to the Dongwu cogeneration plant. Finally, 9,000 Tonnes ashes produced by sludge incineration are valorised by the cement industry.



05

THE WATER, ENERGY AND FOOD FORUM, SOUTH AFRICA

Driven by many factors, including the controversies surrounding acid mining discharges (AMDs) with concerns for water and food, SAWEF was founded in 2011 to debate issues surrounding the water-energy-food nexus. The Forum now funds research programmes, has an annual award programme, and recently inaugurated a scholarship for water-energy-food nexus research. The South African Deputy Minister of Water and Environmental Affairs, Ms Rejoice Thizwilondi Mabudafhasi, presented the awards in July 2013, endorsing SAWEF as an important forum in bringing together the various stakeholders to address problems rather than argue at a distance. SAWEF describes itself

as “a forum designed to raise issues of national strategic significance, to be debated and engaged with by credible individuals, each with the deep desire to find permanent and sincere solutions.”

Hamanth Kasan, General Manager, Scientific Services Division, Rand Water, says that “water is inextricably linked to energy, food and life. Therefore the need for collaboration and partnership to seek sustainable solutions to overcome both current and future challenges for the benefit of people and the planet cannot be over-emphasised.”



(II) FINANCIAL SUSTAINABILITY

Affordability and Willingness to Pay

The future investment requirements in water and wastewater worldwide have been estimated to be greater than those for energy and transport combined. The World Health Organisation estimates that there is a 2-dollar benefit for every dollar invested in water and a 5.5-dollar benefit for every dollar invested in sanitation. So it is not a question of affordability, as the costs to society due to lack of water and sanitation services are greater than the costs of providing the services. It is a matter of marketing these financial benefits to politicians and promoting the need for improved services to the public. Some possible solutions discussed include:

- (i) **Linking of investment to financial sustainability and the government's resolve:** Quite independent of whether the water service operations are wholly public or privately operated, there has to be cost recovery through subsidies, water charge revenue or a combination of both, to pay for investment. The consequence of a lack of cost recovery is a spiral of decline resulting in an asset condition crisis (see Figure 1).

Willingness to invest by donors and the private sector is dependent upon

- (1) financial sustainability of a utility's operations through water pricing that reflects production and operations costs, and
- (2) willingness of governments to specify service standards and associated water pricing, whether in contracts or in public-sector delivery requirements.

The key to attracting investments into the sector is to get both aspects right. The Phnom Penh Water Supply Authority (PPWSA) moved to financial sustainability with strong support from the government to prioritise water services and eradicate corruption, as well as a block tariff system that covers cost (see Box 6 and Reference 8). Manila Water in the Philippines, where management is delegated to a private company through a PPP contract, also achieved financial sustainability with strong commitment from the government, a clear and objective tariff-setting process and prudent and efficient spending (see Box 7).

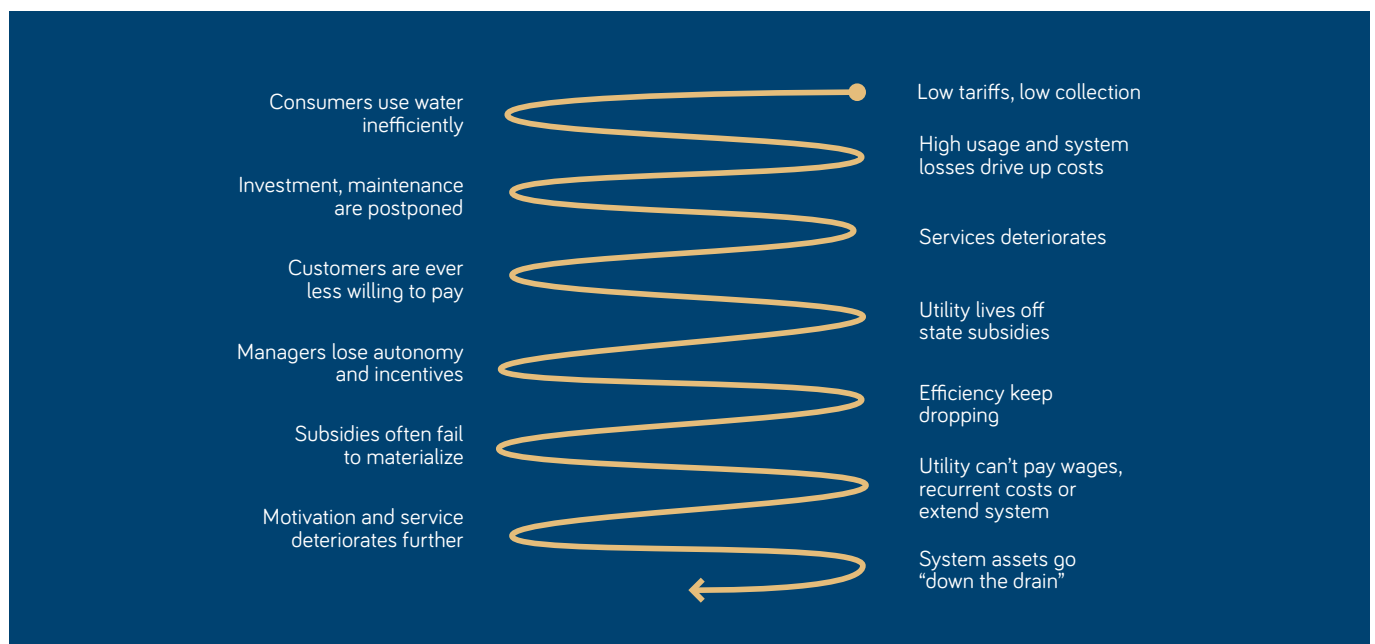


Figure 1: Spiral of Decline. (Source: Water and Sanitation Program (WSP) , World Bank)

06

PHNOM PENH WATER SUPPLY AUTHORITY'S (PPWSA) ACHIEVEMENT OF FINANCIAL SUSTAINABILITY

At the time of the Paris Accord in 1993, piped water operations in Phnom Penh were limited to supplying the city centre; there was corruption, increasing illegal connections, high non-revenue water and low revenue collection. The new Government of Cambodia gave water services high priority and supported the management of the PPWSA in the reform programme. With initial external financial and technical support, largely from France and Japan, the fundamentals of water supply and financial management were addressed. Corruption was eradicated; the infrastructure was refurbished and extended. Emphasis was given to treating customers as 'king', staff training and constant attention to revenue

collection and managing leakage. There was a gradual move away from subsidies to full cost recovery, with provisions for the poor both in payment of service connections and by including a lifeline tariff within a block tariff system. By 2012, almost all the people of Phnom Penh had a water service connection. The comparison with 1993 is given in the table below.

The current Director General of PPWSA, Mr Sim Sitha, "Attributes the success to government support without interference in operational management, a clear vision, initial external support and management leadership with a focus on a culture of continuous improvement."

Performance Indicator	1993	2012
Coverage Area (%)	20	90
Number of Connections ('000s)	27	235
Supply duration (hours/day)	10	24
Revenue Collection (%)	48	99.9
Non-revenue water (%)	72	6
Staff per 1,000 connections	20	2.66
Financial Situation	Subsidy	Full Cost Recovery

07

MANILA WATER: ACHIEVING FINANCIAL SUSTAINABILITY

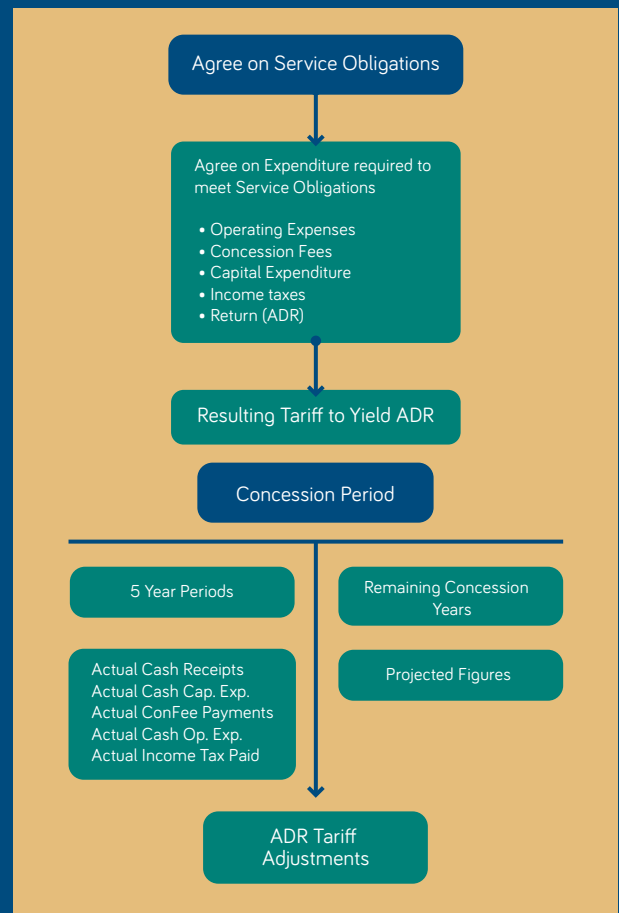
In the Philippines, a long period of under-financing had led to poor water and wastewater services, low coverage and a spiral of decline. The problems were compounded by droughts resulting from El Niño events from 1991–1994. The government in 1995 passed the Water Crisis Act provisions, which included involving the private sector to provide financial resources and operational know-how to address the problems.

Manila Water was awarded a 25-year concession contract in 1997 for Metro Manila East Zone. This area covers 23 cities/municipalities with a total population of around 6 million. Manila Water achieved organisational cultural transformation through restructuring and staff development. The impact of the improved management is shown in the table.

There is a clear and objective tariff-setting process which is illustrated in the figure. Through this process, the Metropolitan Waterworks and Sewerage System (MWSS) Regulatory Office reviews the concessionaires' business plans, and makes recommendations to the MWSS Board of Trustees who are responsible for approval of tariffs. The Regulatory Office monitors and assesses concessionaire performance based on objective pre-determined key performance indicators (Reference 9).

Gerardo Ablaza, CEO and President of Manila Water, highlights that "Over the years, Manila Water has achieved financial sustainability in the East Zone through continued capital investments and proper project execution. Amidst a regulatory environment that requires prudent and efficient spending, our concession has grown significantly with the increase of our service connections, the expansion of our network and the development of an empowered workforce. These have transformed a once languishing water system into now world-class water operations which help enhance the Filipino's quality of life."

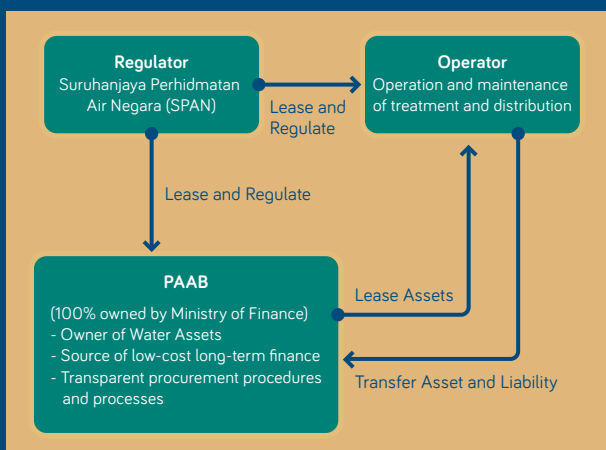
Performance Indicator	1997	2012
24/7 Coverage by Population	26	99
Additional low-income connections	Serving an additional 1.7 million	
Delivery of potable water (MLD)	440	1181
Supply duration (hours/day)	16	24
Non-revenue water (%)	63	12
Staff per 1,000 connections	9.8	1.02
Net income (US\$ million)	-1	+113



08

MALAYSIA'S WATER ASSET MANAGEMENT COMPANY

As part of reform of Malaysia's water sector, which introduced a national regulatory system, particular attention was given to the impact of capital expenditure on charges. To manage capital charges effectively, an asset-light approach was adopted. With this model, all assets and liabilities related to water will be transferred to Pengurusan Aset Air Berhad (PAAB), which will lease assets to the operators. The water services industry is a very capital-intensive one which requires long-term and cheap funding. PAAB, as the water asset management company backed by the Government, will facilitate fundraising from the capital market with an AAA credit rating, and thus be able to raise financing at much cheaper cost. PAAB will optimise its financial resources through borrowing on a longer tenure to match the water asset life (40 to 50 years) and thus be able to impose a lower lease rental rate on the operators and for a longer lease period. This is illustrated by the figure below.



The Chief Executive Officer of SPAN, Teo Yen Hua, points out that "The Malaysian financing model is able to provide a low-interest and payment requirement more reflective of the long lifespan of water infrastructure through PAAB. This innovative funding model forms an integral and essential part of the Malaysian reform programme, leading to full-cost recovery and sustainable water services for present and future generations."

(ii) **Water pricing that ensures fairness and equity:** Issues associated with water pricing include fairness of pricing over time and provision for the poor. Fairness of pricing requires having long-term loans to spread the costs across generations of customers.

The approach taken by the Government of Malaysia through establishing an infrastructure funding agency, Pengurusan Aset Air Berhad (PAAB), called in English 'Water Asset Management Company', provides for obtaining long-term low-interest loans on the international money market.

This means that the leasing costs for the companies are spread over 40 years (instead of the usual 20 years or so), and reflected in the water tariffs, thus reducing the burden on the current generation of consumers.

This is described in [Box 8](#) and [Reference 10](#). Provisions for the poor can be made through various means, such as cross-subsidies within utility operations or targeted government subsidies. Both PPWSA and Manila Water make specific provisions for the poor.

(iii) **Communication with customers on the need to finance good service:** Experience has shown that people are prepared to pay more for a good service if they understand why they need to pay. This is the experience in Karnataka, India where all residents, including the poor, were willing to pay after service had been improved to provide continuous supplies twenty four hours a day ([Reference 11](#)).

At SWULF, George Hawkins, General Manager of the District of Columbia (Washington DC) Water and Sewer Authority, described how he explains the need for increases in charges at public meetings (see [Box 9](#) and [Reference 12](#)). We should help the public to understand that investments in old infrastructure are needed to

minimise failures of supply or water main burst incidents. One option is to leverage such events.

However, willingness to pay is also associated with the quality of service. Service standards need to be good enough for people to be willing to pay.

09

DC WATER AND SEWER AUTHORITY: ACHIEVING PUBLIC UNDERSTANDING ON TARIFFS

Each year, George Hawkins, the General Manager of Washington DC Water and Sewer Authority, hosts a series of town-hall meetings with customers across the city to present the proposed budget for the next year and the proposed new rates for water and sewer services. Details are given to explain why rates are increasing, typically by 9% per year. The approach aims to ensure that the public understands the scale and significance of the capital projects currently underway, as well as other cost drivers.

One of the key messages is that much of the water and sewer infrastructure in the ground was installed in the late 1800s, and maintenance of the overall system has been deferred for a long time.

Refurbishment investment cannot be delayed any longer and the cost has to be borne by current customers. Without any action now, the service would deteriorate. This message is reinforced during incidents like a major burst main. Focus is also given to the environmental benefits of the most expensive capital projects, reminding customers that the cost of the service is still low compared with that of many other services, such as mobile phones.



Effective Asset Management to Avoid Incurring Higher Costs

Assets have to be managed for both present and future generations. In planning, consideration has to be given to

- (1) achieving and maintaining serviceability of the current system and
- (2) the development of the infrastructure to serve growing communities, whether in urban or rural areas.

Western Australia integrates asset management into the planning system to ensure both objectives are met (see [Box 10](#) and [Reference 13](#)).



The discussions stressed that delay in investment in assets only results in higher costs later. Assets have to be maintained or replaced so that they continue to meet service standards. In many parts of the world, cost recovery has been too low to make provision for replacement or refurbishment of assets, particularly the underground water mains and sewers. There has also been a tendency to delay such investments as severe losses of service do not often occur immediately. Ultimately, these problems have to be faced. Where investment in supply systems has not kept pace with growing demand, and rationing by hours of day or week has been introduced, depressurising and re-pressurising water mains only accelerates the deterioration of systems. This ultimately impacts leakage levels and thus revenue generally.

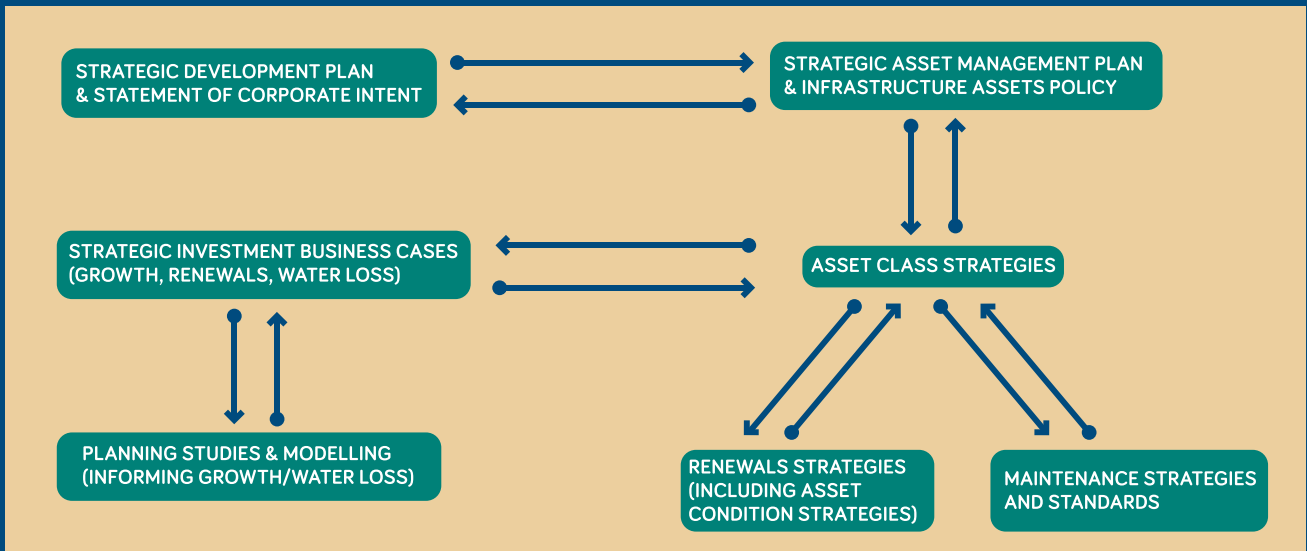
A good asset management system is hence necessary to enable utilities to react to changes or failures in their assets before there is irrevocable damage to the systems. Effective asset management involves balancing technical competence and robust stakeholder engagement:

- (i) **Technical competencies:** Predictive performance maintenance, or conditional assessment, is part of asset management. Cost-benefit analysis can be used to compare the cost of scheduled plant maintenance with the consequential costs of fire-fighting.
- (ii) **Robust stakeholder engagement:** Utilities should use clear and easily understandable language in communicating asset management practices/rationale to politicians and the public. Both need to understand the relationship between investment (or lack of it) with levels of service.

ASSET MANAGEMENT IN WESTERN AUSTRALIA

The Water Corporation of Western Australia is striving to achieve a vision of 'Water Forever, Zero Footprint and Great Place'. This is highly demanding in an area where average rainfall is decreasing and the population is estimated to double in 50 years. It requires achieving a balance between providing water for the long term, reducing the environmental impact of operations, whilst supporting the growth and prosperity of the State and communities. The Water Corporation's 50-year plan takes an integrated approach to mitigate the risks to water service security, in which asset management is a key component. This is illustrated in the figure below.

The COO of the Water Corporation, Peter Moore, indicates that "The Water Corporation takes a holistic approach to asset management. This included a comprehensive understanding of the requirements, understanding the condition of our existing assets and looking for the most cost-effective innovative long-term solutions while working with our customers and stakeholders."



(III) STAKEHOLDER ENGAGEMENT

Heartware: Public Communication, Support and Understanding

A utility's relationship with the public, i.e., its customers, is critical for a number of reasons. To a varying extent, the public influences public policies, and ultimately one way or another, the public pays for the services. With greater education and advancement in infocommunications technologies, the public increasingly wishes to be informed of and exercise influence on water and environmental matters. Some utility leaders who are struggling with many problems, with little political support, may feel reluctant to involve the public. However, utilities need to recognise that public support is important in making improvements as well as to encourage conservation which would ultimately help to achieve a more sustainable water resource management. The public is not just the 'person in the street' but includes all stakeholders like the industry and grassroots leaders – and their education and involvement are essential. Education programmes should also include schools as the young are not only the next generation of leaders but they can influence their families. Some tips for public engagement include:

- (i) **Make open and transparent communication a continuous process:** The Forum's overriding message was that transparency and timely information on a continuous basis provides for understanding, builds trust and generates willingness to support utility actions, including encouraging conservation of water and necessary increases in water charges. "The Macao Marine and Water Bureau has continuously engaged the public to conserve water through promotion of water-saving devices, World Water Day and community water conservation patrols. In a recent survey, it showed that the public has a good grasp of water conservation habits and understands the role of a tariff structure in encouraging conservation (see [Box 11](#)). In Singapore, national water agency PUB motivates citizens to cherish and guard the country's water resources through the award-winning ABC (Active, Beautiful, Clean) Waters Programme. Through ABC Waters, PUB works with the community to not just develop water bodies beyond their traditional functions into aesthetic spaces integrated with the surroundings, but also educate others about their role in ensuring water sustainability (see [Box 12](#)).

- (ii) **Utilise all relevant avenues:** To ensure that messages will be effectively passed on in a timely manner, it is important to consider the interests of different stakeholders, and pitch the messages at the appropriate level and through the relevant channels. In Hong Kong, disruptive work programmes, such as replacement of water mains, are communicated through local authorities who post work programmes and progress updates on their websites. An example of a progress report can be found in [Reference 15](#).

Communication with the public involves every member of a utility's staff; in particular, those at the front line have most direct contact with the public and they must use simple, understandable language. Furthermore, we should note that social media is becoming more and more important and can be used by pressure groups, either with a lack of understanding, or to deliberately spread misinformation.

Consequently, utilities should ensure that social media is used as a route for continuous and reliable information transfer. Having younger staff helps, as they have competencies in popular communication methods such as social media. In Singapore, PUB strives to enhance its public engagement by providing water-related information on interactive platforms such as Facebook, Twitter, and its mobile application MyWaters (see [Box 12](#)).

SURVEY ON AWARENESS AND BEHAVIOUR OF WATER CONSERVATION IN MACAO

In 2013, the University of Macau, appointed by the Macao Marine and Water Bureau, completed a survey to

- (i) analyse the awareness and behaviour of water conservation among Macao citizens and social sectors, and
- (ii) to review the current water pricing mechanism. The survey has resulted in over 1,000 successfully completed questionnaires from randomly selected customers from "domestic", another 28 from "special" and 47 from "general non-domestic" categories.

Results show that respondents from the "domestic" category generally have good awareness and habits with regard to water conservation. They possess a basic understanding of the new water price mechanism characterized by the category and tier principles. Most respondents agree that the three tiers of domestic tariff could reflect the "use-more, pay-more" principle.

The use of water-saving devices is very common among respondents from the "general non-domestic" and "special" categories. They show good understanding of the new water price mechanism, but believe the impact of tariff categorisation on water usage habits is relatively small.

Overall results indicate that respondents generally agree on the pricing principles of the new water pricing mechanism, and that this mechanism could help promote water conservation. The Marine and Water Bureau places high value on the findings of this survey, and will conduct more in-depth analyses as a reference for future adjustments of tariff mechanisms.

Susanna Wong Soi Man, Director of Macao Marine and Water Bureau shared, "The Macao Marine and Water Bureau has been taking a proactive approach in communicating our developments with the general public and the press. With regard to new tariff implementation and water conservation, we have

made known our developments via various channels such as press release, press meetings, propaganda materials such as flyers, outdoor promotional activities, radio announcements, annual water resource reports for distribution and download, exhibition booths at conventions, etc. All these are carried out in accordance with our 'Macao Water Conservation Master Plan' formulated in June 2010."



ENGAGING THE PUBLIC IN SINGAPORE'S WATER MANAGEMENT

In Singapore, national water agency PUB believes that to make its water supply truly sustainable, citizens have to see water services as a self service, where they do their part to ensure water does not run out. While PUB ensures a sustainable and diversified supply of water, it encourages everyone in the 3P (People, Public, and Private) sectors to take joint ownership of Singapore's water resources by conserving water, keeping the raw water sources unpolluted and building a relationship with water through enjoying various activities at reservoirs.

One way is through the Active, Beautiful, Clean Waters (ABC Waters) Programme, a long-term initiative to transform Singapore's water bodies beyond their traditional functions of drainage, flood control and water storage into beautiful streams, rivers and lakes that are integrated with the surrounding parks and spaces. This will bring people closer to water, so that they can appreciate and cherish water. Over 100 projects will be implemented over 15 to 20 years, turning Singapore into a vibrant City of Gardens and Water.

To encourage the co-creation of ABC Waters projects, PUB engages the community from the early stages of project development to ensure that the sites are built based on what the community wants, keeps them updated about project progress, and works with them to make the sites more meaningful to the community. For example, educational panels at Lorong Halus Wetland were developed in collaboration with Nature Society (Singapore), Horizon Primary School, Rivervale Primary School, Sengkang Secondary School and Serangoon Junior College.

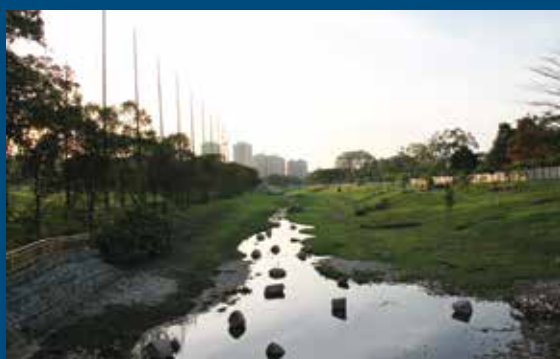
Upon completion of the projects, ABC Waters sites serve as educational sites for the community to learn more about their role in the water cycle. PUB works with the Ministry of Education and schools that have adopted the sites to develop ABC Waters Learning Trails at various water bodies, and the adoptor schools and/or fellow community groups are trained to conduct the trails. For example, at Bishan-Ang Mo Kio Park, students and teachers from Raffles Institution created an interactive learning trail highlighting the park's

features and biodiversity, and conduct the trail for the community. Participants of these learning trails have benefitted greatly through experiential learning at these ABC Waters sites, and also gain a better appreciation of Singapore's water resources.

Besides the ABC Waters Programme, PUB also engages the public through the use of social media. Singapore has one of the highest Internet penetration rates in the region, which presents opportunities to communicate and interact with the public. PUB looks for ways to enhance its online engagement and create more value for different audiences. For example, its mobile application MyWaters provides timely water-related information and engages users in a fun and light-hearted manner. Users can learn more about Singapore's water story through a 'Water Trivia' pursuit, embark on a self-guided 'eTour' at the Marina Barrage, upload photos of beautiful waterscapes around the island, or provide feedback via a dedicated channel.

In addition, PUB harnesses media platforms like Facebook and Twitter to share industry news, stories and operational updates like locations of pipe repair works, and heavy rain and flash flood notifications. It also leverages platforms like Flickr, Pinterest, Instagram and YouTube to share multimedia content; and empowers the public to be advocates for water causes through "Water Chatter" – a blog that publishes written works from students, industry experts, water champions and like-minded individuals. Such unique engagement is a way to nurture ground-up efforts to spread water-related messages. More recently, PUB unveiled a mobile app version of its award-winning lifestyle magazine on water – PURE.

George Madhavan, PUB's Director of 3P Network, says, "PUB leverages a variety of platforms to engage our various stakeholders on PUB's policies and projects. At the same time, by raising the public's consciousness of water as a precious resource, we hope to encourage everyone to play a part in ensuring the sustainability of our water supply."



Staff Matters

Stakeholder engagement can also be understood to encompass a utility's staff, as there are many staff issues facing utility managers, such as how to:

- Attract and retain good staff;
- Utilise the experience of long-standing staff and blend this experience with that of younger staff who are more familiar with new technologies;
- Capture the corporate information which resides with one's workforce, especially when records are poor;
- Train front line staff to communicate with the general public;
- Manage the introduction of new methods and technology which require fewer workers, without compromising staff requirements in emergencies; and
- Engender a climate of continuous improvement in the workplace.

The participants further mentioned that matters concerning technology are relatively easy – the main challenge is having the right people to implement new thinking and getting them to adapt to new methods and technologies. Operators play an important role in maximising the benefits of new technologies, and hence require sufficient and effective training. In some areas, employment conditions do not attract new and younger staff, with the result that there are utilities relying on an ageing workforce. Some solutions to consider include:

- (i) **Increasing a utility's attractiveness as an employer:**
The attractiveness of an organisation is associated with whether or not it is seen to be modern in outlook and methods. This is especially important to attract younger staff. One key way of attracting and retaining staff is to make sure that public-sector working conditions are comparable to those of the private sector. Transforming a utility's image into one that emphasises job satisfaction, modern outlook and forward-looking methods is also crucial to attract good staff, who may not be satisfied with mere remuneration and pensions.

(ii) **Providing adequate and varied training:** To capture the benefits of experience and new methods, cross-mentoring between older and younger employees is necessary. Field experience and technological knowledge can be shared. Training programmes on all aspects of operations and public communications

are essential. Larger utilities can even offer a training service to others. One such example is the Vodokanal of Saint Petersburg, which is providing a highly developed training programme for its staff as well as other companies' personnel (see [Box 13](#) and [Reference 16](#)).

13

TRAINING IN SAINT PETERSBURG

At the Vodokanal of Saint Petersburg, a water and wastewater utility, training and staff development is seen as a vital component in the development of organisation performance. In its annual report, the Vodokanal states that: "The Company is continuously improving its system of incentives and developing its recognition and awards system for the personnel at all levels. ... Due to a systematic approach to the personnel training and development the employees can enhance their knowledge, are given opportunities for professional development and are motivated to self-education. ... Professional skills contests and the best innovative project contests are targeted to achieve and maintain a high professional level of the personnel."

The material and technical facilities are used not only for training of newcomers, but for advanced training and retraining of the regular employees. There is cooperation with a 'Professional College', which has established simulation facilities for many aspects of operations, including emergency repairs.

Moreover, the Vodokanal has partnerships with Petersburg State University of Water Communications, State University of Architecture and Civil Engineering and St. Petersburg State Transport University.

In addition to its own personnel training, the Information & Training Center provides seminars and courses for other companies' personnel as well as for other interested specialists.



(IV) DRIVING INNOVATION

According to a British philosopher, “The art of progress is to preserve order amid change and to preserve change amid order.” This reflects the situation facing water utility leaders: to make progress, they must innovate or adopt innovations, but they have to ensure that water services remain secure. The subject of innovation arose throughout SWULF, not just in technology with which it is most associated, but also in planning, finance, operational management and communications. One barrier to innovation and introducing new methods and technologies is the risk of failure, and the following are some potential answers to this issue:



(i) **Differentiate risks:** The discussions stressed the difference in taking risks which might adversely affect a utility’s finances (for example, an overrun on a project cost or underperformance of a new method), and risks directly affecting water consumers, (for example, those linked to drinking water quality). Utilities are right to be risk-averse when consumers are at risk. However, this does not mean that new approaches should not be adopted (in re-using water, for instance). Instead, extensive safeguards should be taken to minimise risks.

(ii) **Leadership to encourage innovation:** Leadership plays a key role in differentiating risks, and introducing and maintaining a culture that stimulates innovation. This includes introducing innovative thinking garnered from outside the utility, such as that from international conferences or exchanges with other utilities or sectors. Conventional thinking should be constantly challenged. Water utilities, in partnership with suppliers, regulators and other key players, should take the lead in encouraging innovation directed at problems and opportunities for improvement. Part of the process includes building trust among stakeholders in justifying innovation and R&D. Stakeholders have to understand the objectives, how innovation will improve performance and affect potential risks, and where and how the money is spent. Singapore leads the way in stimulating innovation and in application of innovative solutions (see [Box 14](#) and [Reference 17](#)).



SINGAPORE'S APPROACH TO INNOVATION THROUGH COLLABORATION

Water innovation in Singapore is led by the national water agency, PUB, which takes on a leading role in the inter-agency body, Environment and Water Industry Programme Office (EWI). EWI integrates policy and implementation frameworks across various government agencies involved in the development of the water industry. PUB collaborates with academia and private industry, and acts as a bridge between research and downstream application. PUB establishes R&D collaborations with local and international research organisations, with other utilities and with technology solution providers.

It is a big step from the laboratory to application. Singapore provides test beds across the water cycle covering all aspects of water, such as reservoirs, wastewater and re-use treatment, and water distribution and collection networks. There is extensive collaboration with the private sector, with PUB providing extensive facilities and dedicated staff to help with the transition from fundamental research to test-bedding and demonstration scale pilots. The PUB team conducts studies to develop operations which facilitate the implementation of new technologies in daily operations. Singapore's successful collaboration in the development and large-scale application of membranes has been well-documented. Innovations in other aspects of water and wastewater are less well-known. An example is the Wireless Water Sentinel (WaterWiSe), a water distribution network monitoring system:



WaterWiSe (Reference 17) continuously monitors pressure and water quality, providing the ability for continuous real-time modelling of the water supply distribution systems, for continuous and accurate monitoring. This major research project began in 2008. It involved various organisations in Singapore with expertise in sensors, modelling and IT systems, and the Massachusetts Institute of Technology (MIT), and resulted in the formation of a spin-off company, Visenti Pte Ltd. WaterWiSe was successfully piloted in two supply zones and is now being rolled-out across Singapore. In the pilots, the demand prediction capability of the system demonstrated potential energy savings of 17% through optimised load dispatch. The deployed wireless sensor network could identify leak-prone hot spots and detect pipe leaks in real time, hence improving our response time to service interruptions. The rolled-out system will encompass water quality monitoring alert system, leak detection, valve simulation and demand prediction capabilities. Technology development in this domain will enable PUB to manage an efficient water distribution system and enhance the high quality of service.

To stimulate collaboration and foster closer interaction with its research partners, PUB has set up the Singapore INnovation Gateway for Water (SINGwater), an R&D

online portal. SINGwater enables interested researchers to find out about PUB's key research initiatives, collaboration opportunities such as funding support and test-bedding of technologies at PUB's facilities, and submit new R&D proposals. PUB's research collaborators can also manage ongoing projects via SINGwater.

Harry Seah, Chief Technology Officer PUB, highlights that "innovation has to be a norm to seek out cost-effective solutions to our water issues. Faced with challenges that include rapid urbanisation, increasing energy cost, rising public expectations and climate change, just to name a few, we do not have the luxury to continue our operations business-as-usual. Applying new technologies or changing the way we do things may be un-nerving but with a systematic, step-by-step R&D approach, developing a technology from pilot to demonstration scale, to full-scale implementation, we will be able to mitigate any risks associated with applying innovation."

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ANNEX A: SIWW WATER UTILITIES LEADERS FORUM PROGRAMME

OPENING ADDRESS

Dr Vivian Balakrishnan, Minister for the Environment and Water Resources, Singapore

OVERVIEW

The Way Ahead for Water Utilities

Mr Chew Men Leong, Forum Chairperson and Chief Executive, PUB, Singapore

Looking at the Big Picture:

The Importance of Planning for Water Utilities

Chairperson: Dr Alexander Zehnder, CEO, Triple Z Ltd

Minding the Gap: Financing Water Infrastructure Gaps

Chairperson: Mr Michael Barrow, Director, Private-Sector Infrastructure Operations, Asian Development Bank

Innovation: A Cliché or a Necessity in Face of Today's Water & Wastewater Challenges?

Chairperson: Mr Jonathan Clement, CEO, PWN Technologies

Heart-ware: An Essential Component of Water Sustainability

Chairperson: Mr Ma Lee-Tak, Director of Water Supplies Department, Hong Kong

Running Like Clockwork: Good Practices for Operational Optimisation

Chairperson: Ms Diane D'Arras, Executive Vice President (Water Europe), Suez Environnement

Running Like Clockwork: Good Practices for Asset Management

Chairperson: Mr Peter Moore, Chief Operating Officer, Water Corporation, Western Australia

Are We Prepared? The Role of the Utility in Cities of the Future

Chairperson: Dr Glen Daigger, President, International Water Association

CLOSING SESSION

ANNEX B:

LIST OF PARTICIPANTS AT THE SIWW WATER UTILITIES LEADERS FORUM

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