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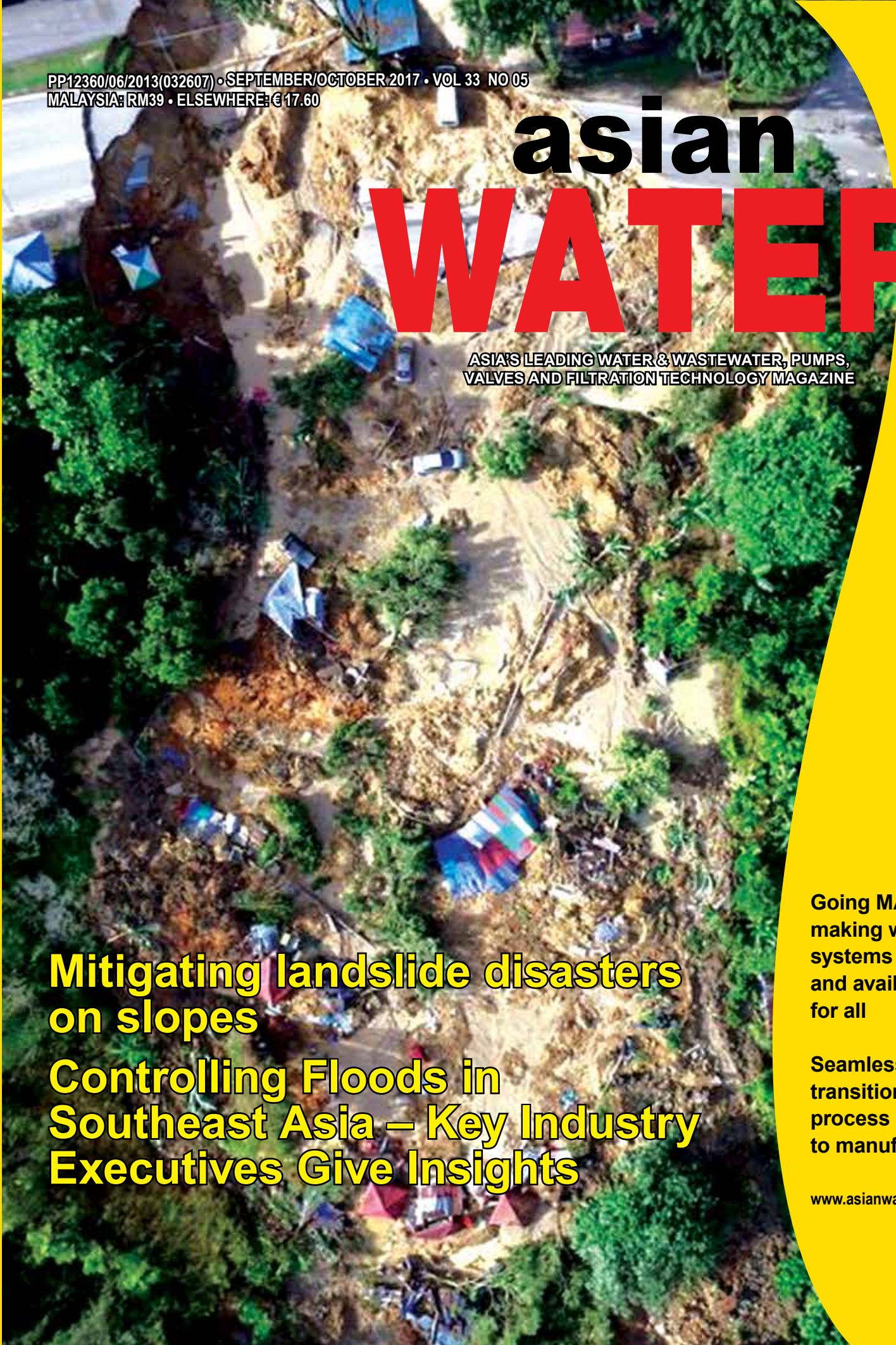

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When Harvey wreaked its havoc

I am back from Texas after getting a first hand insight into tropical storms and the perils of living in a warming world.

Helping my daughter move to her off campus apartment at Austin turned out to be an adventure full of suspense and emergency decision-making. We managed to get out of Houston just in time before Hurricane Harvey (later downgraded to Tropical Storm) made landfall.

As we watched the disaster unfolding on TV from Austin, it seemed like a documentary on climate change. All those editorials I had penned over the years began to play in my mind. Those debates on whether the earth would warm by an average of 1.5^{0}C or 4.5^{0}C by the end of the century. The quibbling about the ppm of CO_2, the millimetres of rainfall and the metres of sea-level rise. The fighting over how much greenhouse gas emissions each country was entitled to. The bickering over economic growth. The Titanic whose executives had agonised about their company's bottom lines even as the ship hurtled towards a killer iceberg. It was all so bewildering.

I know it is unwise to connect climate change to Harvey or any other storm. Storms have always lashed the earth and they will not stop. But it cannot be denied that global warming has made ever-increasing quantities of moisture available to storm engines, which is making extreme rainfall events more intense and frequent. Harvey dropped some 50 inches of rainfall in just a few days, which, on an average, would have spread out over one year. Had the stormwater got drained away, there would have been no problem but concrete cities like Houston are causing water levels to rise in their confined environs.

There has been much damage, which will take long to recoup. The swirling waters made no distinction between the homes of the rich and poor. Roads became treacherous rivers and given that Houston averages more than 800 sewage overflows in a year and badly needs to upgrade its pipes, it was not safe to be in the water.

However, the damage would have been much worse if the suburbs of Houston, where plenty of land is available, had not invested in swales, parks and other permeable surfaces which were designed to store and delay runoff. These measures saved many areas.

Flooding is also a time when littering, garbage disposal and solids in wastewater become more significant than ever. In addition, Texans are struggling with the disposal of flood debris – damages sofas, carpets, flooring, shoes and other articles.

Despite all the anxiety of my recent trip, I will remember Harvey for the generosity of people and businesses. I lost count of friends who opened up their houses to shelter other families. Doctors, lawyers, engineers – everyone reached out to render services free of charge. Plumbers and construction professionals have been flying to Houston from all over the US to meet the huge demand.

If only we had been this collaborative in planning our urban spaces and in reducing carbon emissions which led to climate change!

Sahana Singh,
Editor

Asian Water comes in 6 issues a year, giving you the latest relevant information. Also, we have a solid 32-year track record in connecting buyers and sellers in the region, having a controlled-circulation of 7,000 decision makers.

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Preferred bidder for Singapore's fifth desalination plant is announced

Jurong Island which houses top companies in Singapore's chemal industryu will be the location for the fifth desalination plant

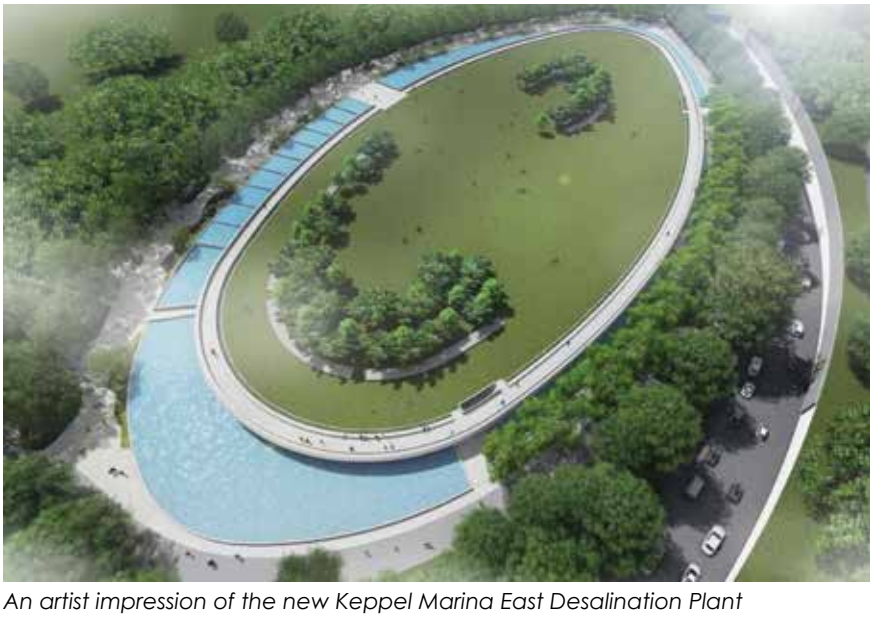
PUB, Singapore's National Water Agency, has selected Tuas Power – Singapore Technologies Marine Consortium (TP-STM) as the 'Preferred Bidder' for Singapore's fifth desalination plant, to be located on Jurong Island. As the Preferred Bidder, TP-STM will form a concession company to enter into a Water Purchase Agreement (WPA) with PUB by October 2017. The WPA will take full effect once all agreements have been finalised and executed, and the concession company achieves financial close.

The desalination plant on Jurong Island is expected to commence operations in 2020 and will add 30 million gallons (mgd) or approximately 137,000 cubic metres of water per day to the nation's water supply. The seawater reverse-osmosis desalination plant will be co-located with Tuas Power's existing Tembusu Multi-Utilities Complex to derive synergies in resources such as seawater intake and outfall structures, and energy from the in-plant generation facilities.

In February 2017, four pre-qualified applicants were invited to submit their proposals for the desalination plant. These applicants possessed suitable land for the plant, and demonstrated synergies with co-located facilities on Jurong Island. Of these, eight bids were submitted by three applicants, namely TP-STM, Keppel Infrastructure Holdings and Sembcorp Utilities – SUEZ International Consortium. At a first-year price of S$0.91 (US$0.84) per cubic metre, TP-STM offered the most competitive tariff among the three bidders. It will supply desalinated water to PUB over a 25-year period from 2020 to 2045.

The desalination plant on Jurong Island is PUB's seventh Design-Build-Own-Operateproject between PUB and the private sector. The first six are the 30 mgd SingSpringDesalination Plant, the 32 mgd Keppel-Seghers Ulu Pandan NEWater Plant, the 50mgd SembCorp NEWater Plant, the 70 mgd TuaSpring Desalination Plant, the 50 mgd BEWG-UESH NEWater Plant and more recently, the 30 mgd Keppel Marina East.

Desalination Plant, which is currently under construction. **AW**



An artist impression of the new Keppel Marina East Desalination Plant

PUB awards contracts for constructing DTSS Phase 2

Singapore is now moving to the next stage of its acclaimed water recycling programme. The country's water agency PUB has appointed three contractors – Ed Zublin AG (Singapore Branch), Penta-Ocean Construction Company Company Limited and Koh Brothers Building & Civil Engineering Contractor Private Limited Joint Venture, and Leighton Contractors (Asia) Limited (Singapore Branch) – to design and build the first batch of 30 km of deep tunnels and link sewers for the Deep Tunnel Sewerage System (DTSS) Phase 2. These are part of a network of 40 km of deep tunnels and 60 km of link sewers for DTSS Phase 2 which will be built using the tunneling method. The subsequent contracts to build the rest of the deep tunnels and link sewers will be awarded from 2018.

The contractors were appointed following a pre-qualification and tender exercise in mid- 2016, with the three contracts valued at a total of S$1.51 billion. Over the next seven years, they will develop the detailed design and construct some 30 km of deep tunnels and link sewers as well as the associated ancillary structures.

In a press release, Yong Wei Hin, Director DTSS Phase 2 said: "The deep tunnels are an integral part of the DTSS, conveying every drop of used water for treatment and channelling it for further reclamation into NEWater. As the backbone of NEWater production, the DTSS ensures the sustainability and resilience of the used water network to facilitate large-scale water recycling in Singapore, and contributes to the goal of increasing the overall water recycling rate from 40% to up to 55% of total water demand in the long term. We are happy to partner these three experienced contractors and Lead Consultant Black & Veatch + AECOM Joint Venture to construct this major component of DTSS Phase 2," said Yong Wei Hin, Director, DTSS Phase 2, PUB.

This network of 100 km of deep tunnels and link sewers will connect to the Tuas Water Reclamation Plant, which is expected to be completed in 2025. By then, the whole of Singapore will be served by the DTSS. Used water will be conveyed from the DTSS via gravity to three centralised water reclamation plants for treatment, before it undergoes further purification to produce NEWater, or discharged into the sea. **AW**

New tool to measure and report greenhouse gas emissions from urban water services launched

A new holistic tool to measure and report greenhouse gas emissions from urban water services has been developed by the International Water Association (IWA), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Catalan Institute for Water Research (ICRA).

In a press release, IWA said the Energy Performance and Carbon Emissions Assessment and Monitoring (ECAM) tool enables water utilities to measure and manage their greenhouse gas (GHG) emissions and energy consumption at a system-wide level. By identifying areas to reduce GHG emissions, increase energy savings and improve overall efficiencies to reduce costs, ECAM offers a holistic approach for urban water utilities to shift to low energy, low carbon water management.

The water sector can make significant contributions to the Paris agreement target of keeping global temperature rise to well below 2°, and the respective Nationally Determined Contributions, although awareness of this opportunity is currently limited.

"The contribution of the water sector to greenhouse gas emissions is complex and therefore often under-recognised", said Astrid Michels, Project Manager of the Water and Wastewater Companies for Climate Mitigation (WaCCliM) project that has developed the ECAM tool. "ECAM helps utilities develop an emissions baseline, identify areas of improvement to reduce indirect and direct emissions, and monitor progress over time."

ECAM is a free and open source tool that has been successfully piloted by utilities in Jordan, Mexico, Peru and Thailand that participate in the WaCCliM project, to achieve dramatic reductions in GHG emissions:

San Francisco del Rincón, Mexico, has achieved almost a 50% reduction of its total GHG emissions compared to the baseline established with ECAM in 2014. This has been achieved through treating more wastewater to reduce methane emissions and improving pumping efficiency. Additional measures have been identified that would lead to a reduction of 65% in total emissions.

Cusco, Peru, has saved 5,300 tonnes CO2 emissions per year, representing 20% of its total carbon emissions. A total GHG reduction potential of 30% has been identified through greater pumping efficiency and wastewater reuse.

Chiang Mai, Thailand, has used ECAM to establish a baseline for municipal wastewater treatment and identify a 12% GHG reduction potential.

Madaba, Jordan joined WaCCliM in 2016 and is using ECAM to assess its carbon footprint to unlock financing for low carbon water and wastewater infrastructure to help meet its GHG reduction potential.

In addition to the pilots, utilities in over 20 cities have now used the ECAM tool to assess and drive GHG reductions. ECAM was recently endorsed by the C40 Cities Climate Leadership Group as a means to empower cities around the world to measure the emissions of their urban water, identify and plan reduction measures, and shift to a low-carbon, resilient future.

Ricardo Cepeda-Marquez, Head of the Water & Waste Initiative at C40 CITIES, said: "As cities and water utilities recognize the significant opportunities to reduce GHG emissions, improve service quality, water and energy efficiency in water supply and wastewater treatment, tools like ECAM are helping them to focus on the areas of largest potential impact and economic return."

The C40 Cities organization is collaborating on the WaCCliM Project to increase the ambition of cities and water utilities to reduce emissions in the water sector and to contribute towards meeting the Paris Agreement targets. **AW**

French company to upgrade Cambodian WTP

Phnom Penh Water Supply Authority (PPWSA) has signed a US$23.5 million project on Chamkarmon water plant restoration and expansion with Vinci Construction Grands Projects (VCGP) from France, starting in September 2017 with a 24-month construction period.

Restoration and expansion project of the water plant is the first project of PPWSA in the 2016-2030 Phase 3 Master Plan, being implemented from September 2017. This phase of the Master Plan is co-financed by PPWSA and the Government of France.

The project aims to increase capacity of the water treatment from 20,000m³ to 52,000m³ per day, using advanced technology. It also includes the demolition of the old buildings and the resurgence of the same location.

French development bank AFD will provide €30 million to cover 75% of all projects, which will be spent on construction costs as well as the expansion of the channels over the next two years.

VCGP has earlier worked with PPWSA on the construction of Niroth Water Treatment Plant II. **AW**

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Jacobs Engineering enters water sector with acquisition of CH2M Hill

Jacobs Engineering Group and CH2M HILL have announced that they have entered into a definitive agreement under which Jacobs will acquire all of the outstanding shares of CH2M in a cash and stock transaction with an enterprise value of approximately US$3.27 billion, including approximately US$416 million of CH2M net debt.

According to a press release this combination will unite two industry-leading, innovative companies with complementary capabilities, cultures and relationships, resulting in a differentiated, end-to-end value proposition for clients and an enhanced platform for sustainable, profitable growth.

With trailing twelve-month (TTM) revenues of US$4.4 billion and a team of 20,000 employees, CH2M has been a leader in key infrastructure and government service sectors that Jacobs has previously targeted for growth, including water, transportation, environmental and nuclear. Applying CH2M's advanced design, technical and program management expertise across Jacobs' global footprint will enable the combined company to deliver more solutions to more clients in both the government and private sector.

Jacobs is already a global leader in the resource-constrained US$300 billion transportation sector, which includes highways, rail, aviation and ports, and is growing 4% to 5% on a compounded annual rate. This sector has large spend and significant momentum given population growth and associated need for all transportation modes in multiple geographies, particularly in the United States, Australia, New Zealand, Southeast Asia, the Middle East and the United Kingdom. Jacobs' premier position in transportation with CH2M is expected to make the combined company an employer of choice, enabling it to better attract and retain talent and address the sector's resource constraints. **AW**

Breakthrough reported in nano technology to clean wastewater

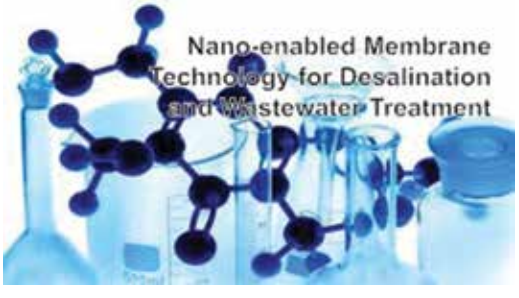
Researchers from Edith Cowan University, an Australian public university located in Perth, Western Australia, have reported a breakthrough in using nano technology in developing a way to modify the atomic structure of iron to create a metal that can strip impurities from water in just a few minutes.

The breakthrough, recently published in the journal 'Advanced Functional Materials', offers new applications in the mining, textile and other industries where large amounts of wastewater are produced.

Associate Professor Laichang Zhang from ECU's School of Engineering was able to change the atomic structure of iron to form what is known as metallic glass. Metallic glass gets its name not from the fact that it is transparent and can be used in windows, but because its atomic structure resembles that of glass.

A thin strip of the iron-based metallic glass developed by Dr Zhang can remove impurities such as dyes or heavy metals from even highly polluted water in just minutes.

"It works by binding the atoms of the dye or heavy metals to the ribbon, leaving behind useable water," Dr Zhang said. He explained that this offers a number of benefits compared to the current method of using iron powder to treat wastewater – firstly, using iron powder leaves you with a large amount of iron sludge that must be stored and secondly it is expensive to produce and can only be used once. In contrast, the iron-based metallic glass developed can be reused up to 20 times, produces no waste iron sludge and can be produced as cheaply a few dollars per kilogram.



Dr Zhang said the technology could have significant applications in the textile and mining industries. "Mining and textile production produces huge amounts of water that is contaminated with heavy metals and dyes respectively. We have already had significant interest from companies in both China and Australia who are keen to work with us to develop this technology, including Ausino Drilling Services, whose clients include Rio Tinto and the Aluminium Corporation of China," he added. **AW**

Honolulu renews environmental water-reuse partnership with Veolia

The Honolulu Board of Water Supply (HBWS) is extending its partnership with Veolia Water North America through 2038. The extension, in effect on July 1, 2017, will continue to deliver value and environmental benefits to rate payers, business and industry near and around the Honouliuli Water Reclamation Facility.

The City and County of Honolulu hired Veolia in 1998 to build the reclamation plant and operate it. The facility is designed to treat 13 million gallons of wastewater effluent to produce 12 million gallons of reclaimed water for beneficial reuse. The facility is the largest reclamation plant of its type in the Hawaiian Islands and employs state-of-the-art technology to treat secondary effluent previously discharged into the Pacific Ocean.

The processes generate two qualities of water; high-purity reverse osmosis (RO) water, which is sold to industrial users for power and petrol-refining uses at nearby Campbell Industrial Park; and R1 water, which is used for irrigation of golf courses and communal areas in nearby developments including the burgeoning city of Kapolei.

By dedicating this non-drinkable supply to industries that can use it, the community is preserving its limited potable water resources through stringent treatment and reuse of wastewater, generating a lasting benefit for rate payers, the city, the environment and a number of businesses that will have a guaranteed supply of quality water.

"The environment, our ratepayers and local business and industry have seen the benefits of our long-term relationship with Veolia," said Barry Usagawa, Program Administrator, HBWS Water Resources Division in a press release. "This extension allows us to continue to protect valuable water resources and, at the same time, remain an environmental leader, demonstrating how creative thinking and resource management can be a win for everybody."

The initial contract with Veolia allowed the City and County to meet the terms of the 1995 consent decree signed with the U.S. EPA, spread construction and mobilisation costs out over the life of the agreement, and saved an estimated US$35 million. The industrial customers benefit from considerable cost savings using reclaimed water by lowering operating costs of chemicals and labour.

The circular economy is based on designing out waste and reusing and recycling everything produced.

In Honolulu, this critical infrastructure and forward thinking allows the surrounding community to grow without lacking in potable water and endure potential shortages brought on by changing climates.

The HWRF has been recognised by the WateReuse Association through its 2003 award for Outstanding Contribution to Sustainable Water Use, and also by the U.S. Conference of Mayors, which honored the project with its 2002 Outstanding Achievement Award.

Stephen McCaffrey receives 2017 Stockholm Water Prize.

Professor Stephen McCaffrey has been awarded the Stockholm Water Prize for his unparalleled contribution to the evolution and progressive realization of international water law. The prize was presented to Stephen McCaffrey by Carl XVI Gustaf, King of Sweden, at a ceremony in Stockholm City Hall during the World Water Week.

In its citation, the Stockholm Water Prize Nominating Committee recognised Professor McCaffrey's "path-breaking leadership and legal scholarship in international water law. He has made a unique contribution in three specific areas: his seminal work on Treaty negotiation; his major scholarly works, including his book The Law of International Watercourses and; his leadership providing expert legal advice, wise counsel, training and facilitation of complex negotiations with a wide range of stakeholders."

On receiving the Prize, Professor McCaffrey said: "I accept this very special award not only on my own behalf, but also on the behalf of the many women and men who work so hard in the field to ensure that fresh water can be brought to people in ways that do not strain international relations, but which in fact affirmatively produce win-win solutions for countries and people on the ground in accordance with law".

Stephen McCaffrey, Distinguished Professor of Law at the University of the Pacific, McGeorge School of Law, in Sacramento, California, is the single most respected authority on International Water Law. His work continues to influence scholars, legal practitioners and policy-makers and contribute to the sustainable and peaceful management of shared waters.

Dr Letitia Obeng, Member of the Stockholm Water Prize Nominating Committee, said: "Professor McCaffrey is an internationally respected pioneer in water law and in diplomacy. Today's international lawyers stand on his shoulders".

Water flows where it will and has no regard for national or regionally drawn boundaries. Beneficial hydrological, social, and economic linkages can be fostered among countries which share transboundary waters, with their equitable use promoting peace and development.

Nearly 40 per cent of the world's population lives in countries that share river basins. Increasing stress on water resources globally will require the reasonable and equitable use of transboundary waters. Improved management of transboundary waters reduces the potential for conflict, fosters socio-economic development, promotes shared benefits, and supports healthy ecosystems and services.

"Cooperation over shared waters is becoming increasingly important, as we witness higher demand coupled with growing scarcity. Stephen McCaffrey is a true inspiration for us in this area, as well as and an important guide, through his works and his wisdom", said SIWI's Executive Director Torgny Holmgren.

Professor McCaffrey has been acting as legal counsel to states in several negotiations concerning international watercourses. He has served as counsel in many inter-state disputes over shared water resources, for example between Argentina and Uruguay, Pakistan and India, and Slovakia and Hungary, which have been heard by international courts and tribunals.

He has guided, often multi-year negotiation processes among riparian countries with respect to transboundary water law, for example, on the Nile, Mekong, and Ganges, some with numerous countries involved.

In earlier writings, Professor McCaffrey articulated the human right to water which was later recognized by the UN General Embassy as a right in 2010. Additionally, he has provided critical insights, linking water law to policy, conflict resolution, benefit sharing, and environmental protection over the years. **AW**

Darco and InfraCo to work on WTPs in Vietnam

The Straits Times reports that Darco Water Technologies and InfraCo Asia Development have teamed up for four municipal water-treatment projects in Vietnam on a Design, Build, Own and Operate (DBOO) model.

According to the paper this will be Darco's first DBOO project in Vietnam and marks its transformation to an asset ownership model for its overseas growth. It mentioned that the move was facilitated by government trade agency International Enterprise (IE) Singapore, which brought in InfraCo Asia, an infrastructure development firm, to bridge the company's gaps in funding, leadership and experience in DBOO deal structuring. It also supported Darco in its feasibility studies.

The paper quoted a joint statement made by Darco and IE Singapore that the four projects in Vietnam aim to provide up to 62,000 cubic metres of water that will benefit approximately 500,000 residents across the country. The first project is reportedly planned in the Ben Tre province which will begin construction in the fourth quarter of 2017, and will provide 15,000 cubic metres of water a day to industries and about 15,000 households. The other projects will start next year. **AW**

The art of public engagement

The success of potable reuse depends on the ability to gain public confidence and trust. A recent report from WHO outlines the key components of a potable reuse public engagement plan, and makes use of data from case studies.

Central to the success of any potable reuse project is the ability to gain public confidence and trust through a productive, two-way engagement process with key stakeholders. There is ample research and documented case studies worldwide that support this. A sustained and comprehensive public communication plan that addresses the health, safety and quality concerns throughout the various stages, from planning to implementation, is an essential tool to advance the success of projects.

Effective engagement involves an intimate understanding of water and how humans rely on it. It involves careful selection of terminology to inform communities about the contaminants found in water and how treatment technology can remove them to produce safe drinking-water. The goal is not to obtain public acceptance but to generate expanded and meaningful interactions with the community – interactions that produce understanding.

In the absence of understanding about water use and reuse, a sustainable water future will remain out of reach. There is no magic formula that yields public acceptance, but it has become clear that strong, imaginative information programmes and early and consistent two-way engagement are necessary to open the door to more sustainable water management. This is the art of attaining the level of public understanding that is essential to the success of any potable reuse programme.

We will outline the key components of the potable reuse public engagement plan, and how it can be used to and social needs and circumstances from country to country and city to city, an engagement programme for potable reuse cannot be a one-size-fits-all approach.

However, there are some key aspects that need to be considered and included for an effective engagement programme. These can be adapted to suit the needs of different communities. The list is by no means exhaustive, but it covers key factors that have led to successful public engagement.

Information is paramount. Information needs to be made readily available to the public in a suitable form to support understanding of potable reuse proposals. The first step in any engagement plan is to provide information readily to the public so that they understand the background, context and options available. Understanding rather than acceptance should be the goal. An uninformed public cannot have informed opinions and is vulnerable to having knowledge vacuums filled with misconceptions. Although not all members of the community will have the time or inclination to absorb the information provided, the knowledge that it is available is reassuring and extremely important to effective engagement.

Those who are interested should be able to gain sufficient knowledge, which may help to reassure those they know who have doubts about the safety of potable reuse. Access to information is therefore important to enable the subsequent dialogue between the utility and the stakeholders to take place in a productive manner. Table 7.1 illustrates the key information areas

Table 7.1 Communication of information to the public

Key information area	Communication plan
Water supply options available	When formulating a water resources plan, it is important that problems of water shortages are clearly communicated and that all options are identified and evaluated. If the community thinks that some options have been overlooked, they will not trust the process. The goal of an engagement programme is not to promote potable reuse, but to ensure that it is understood, so that it can be considered a suitable option for augmenting drinking-water supplies.
Planned vs unplanned potable reuse	The public is generally aware of the natural water cycle, but some are not aware of the practice of discharging treated or untreated wastewater into rivers (unplanned potable reuse) for use by downstream communities as sources of drinking-water.
Contaminants (pathogens and chemicals) in drinking-water from potable reuse systems	The communicators must be prepared to answer technical questions about the nature of the contaminants (including pathogens and chemicals) in water. They need basic knowledge to be able to explain how control measures, including treatment technologies, can be used in multiple-barrier processes to inactivate or minimize contaminants. Community health officials and physicians should be included in the outreach process.
Technology	Advanced treatment processes must be clearly explained in simple terms so that the public of all ages are able to fully comprehend what the technology can do and how contaminants in water are removed.

Table 7.2 Tactics for communicating messages on potable reuse

Message	Communication tactics
Make potable reuse familiar – showcase the experience of other countries and cities	To make potable reuse familiar, it is useful to present case studies that clearly demonstrate how many communities are already drinking "reused water" without always being aware of it. Research has shown that communicating the success of potable reuse projects elsewhere helps to create a sense of familiarity. Telling the stories of early adopters helps quell fears. Their stories should emphasize the need for the water, the benefit of the projects, the fundamentals of treatment and the safety/reliability of the product water.
Quality, not history	Terminology and messages must focus on the quality of the water, not the history of where the water has been, i.e. not its source as wastewater or how it has been used, but what the water can safely be used for. Explain how monitoring ensures safety. The main concern of the public is the safety and quality of drinking-water from potable reuse. For reassurance, it is important to emphasize the amount of monitoring and tests that will be undertaken. Emphasizing reliability and monitoring is part of the hallmark of quality. Explain that the water will meet appropriate national and international standards and that the scheme has the support of the relevant regulatory agency.
Benefits of potable reuse	Because supplies of wastewater are not subject to the variability of weather, potable reuse is a sustainable, drought-proof source of water that has an invaluable role to play in strategies to address the global water crisis. Potable reuse has benefits for the environment because it reduces discharges of nutrients into waterways. The technology is proven to be effective and well understood and can be affordable, considering some of the alternatives. Wastewater is the only source of water that increases with population.

about available water supplies should be provided well in advance of discussion about potable reuse. Table 7.2 summarises useful communication tactics to consider when presenting messages on potable reuse.

When dealing with difficult questions associated with the health, safety and environmental impacts of potable reuse it is essential to be open and transparent. An open and interactive channel for information sharing is important to demonstrate that the utility or agency values the views of the public, and is involving the public in the implementation process, as opposed to going ahead with the decision without seeking any feedback.

One approach is to provide a website and social media tools that present information and allow the community to engage by asking questions. It is important to have mechanisms to deal with unexpected questions from the community. A plan needs to be in place to provide rapid responses by a trusted expert.

Clear and consistent messages are important in communication plans. The key messages should build confidence in potable reuse as a viable and sustainable water supply option and communicate its key benefits. Examples of key messages are outlined below.

- Potable reuse is a safe, reliable and sustainable source of drinking-water.
- Using recycled water is good for the environment.
- Potable reuse is a valuable and drought-proof water supply source capable of strengthening water supply resilience, especially against weather extremities like dry spells and droughts.

Messages alone are not sufficient – communication plans must include information about the approaches to show the pollutants in water and the advanced technologies that remove them. Stakeholders need to be able to see that water gets cleaner and cleaner as it goes through the various treatment processes. Information included in Box 7.2 showcases messages that are memorable and have visual appeal.

Consider terminology – words matter. Use positive, non-stigmatizing terms and avoid terminology that is not well understood. The meaning of words is closely linked to the feelings they convey; they can influence behaviour and attitudes. Although there are numerous dictionaries and glossaries that aid in defining water reuse terms, most are written for engineers, scientists and other water professionals and thus require some technical knowledge. Effective engagement involves careful selection of terminology to inform communities about the contaminants found in water and how treatment technologies can remove them to produce safe drinking-water.

This can be more challenging in countries with religious practices where water has specific religious and historically spiritual connotations. It is imperative to use terms that are consistent with the significance of water to people of various faiths, while still being mindful to use terms that do not stigmatize reuse.

Consistency is also important, for example, there are several terms used to refer to treated wastewater. Agreement should be reached on a single positive term,

or phrasing that is appropriate to the country and its setting.

Even though words like "wastewater" and "sewage" are internationally recognized terms within the water industry and are used in this guidance and other WHO texts on wastewater reuse (WHO, 2006), they have a negative connotation that reminds people of their source, and their use adds to the psychological aversion. It is worthwhile to consider replacing technical terms with words that are neutral and factual.

For example, "wastewater" and "sewage" can be referred to as "used water". This also better reflects treated wastewater's true value as a resource within the water cycle. Water can be used and reused, similar to the natural water cycle – it is not wastewater to be "thrown away." "Water reclamation plants" or "used water treatment plants" can be used in place of "sewage treatment plants" or "WWTPs" as these plants are not merely treating sewage, but are now part of the process that reclaims the used water for further reuse. Treated sewage could be referred to as "purified water".

The communication strategy is to identify and engage with key stakeholder groups such as media and opinion leaders in the political, social and community spheres so that they can help to garner more public support. Key to the campaign to win public confidence and acceptance is the way an organization relates to and communicates with its various groups of stakeholders.

This must be done in a meaningful, thoughtful, and trustworthy manner, so that the public can see the proposal and its issues in context and be able to consider and discuss the points made by its advocates and opponents.

Opinion leaders are important because they influence the attitudes, beliefs, motivations and behavior of others. They influence community opinions by raising awareness, persuading others, establishing or reinforcing norms, and leveraging resources. They usually are highly visible in the community and have a defined constituency, which increases the likelihood that others will adopt their behavior. It is therefore vitally important that considerable attention be paid to ensure that opinion leaders are aware of the need to increase water supply sources and are knowledgeable about the technical processes associated with water management.

Political, religious, medical and university leaders can serve as key opinion leaders because of their visibility and the influence they exert on the community and nation they serve.

Engaging the media is important as it is another critical stakeholder group, as they often act as the watchdog for the community and question authorities on their plans and policies. A well thought out media plan is needed to get journalists to understand and potentially support a project.

Bringing the media on a tour of the potable reuse facility and giving them a first-hand look at the advanced technology employed in the process will aid their understanding of potable reuse. Designating a primary contact point for the media will help to ensure prompt replies are provided.

Independent expert testimony is an effective way to provide answers to difficult and challenging questions on health, safety and quality. Having a panel of international and local water experts in the various related fields of engineering, biomedical sciences, chemistry and water technology to provide independent expert testimony and address health, safety and quality issues is an effective way to provide answers to frequently asked questions.

As specialists in their own areas of research, who are also familiar with water recycling projects elsewhere, experts have the credibility and are best suited to address safety and health concerns – the public's top priority. The expert panel's reports can be captured on video and shown in a visitor centre, on agency websites and reported by the media. Independent scientific panels can also garner news coverage that the agency may not.

Employ visitor centres, demonstration centres, online (virtual) and plant tours as learning experiences. Visitor centres, demonstration centres, and tours provide an appealing information dissemination alternative that can frequently become a multi-objective destination.

Even online virtual tours provide insight and images that can be game changing for audiences unfamiliar with advanced technologies. They are an alternative to public meetings and even to the typical classroom experience because they can provide spaces and exhibits that are novel, stimulating, evidence-rich, multisensory, and fun.

Visitor centres can vary in size and expense. They can be in a stand-alone building, a building associated with a treatment plant or public spaces. Visitor centres are ideal for school tours.

Present water tasting opportunities, where possible as there is nothing more convincing than the public trying the product. Recycled water can be bottled in attractive packaging so that the public can sample how pure the water is. The water samples can be distributed at events, tours and at visitor centres.

Tasting of the water samples by opinion leaders, including politicians and other trusted community leaders, can build trust and reinforce the safety of the product.

Leverage social media channels to tell the potable reuse story in a fun and engaging manner. Social media is an increasingly important platform for sharing information and seeding conversations. Social media is a space where people share their everyday lives. Communication efforts need to engage in the spaces where people communicate and create opportunities for engagement and interactivity.

Conversational approaches and the use of visual imagery rather than just factual messaging and language resonate with digitally literate people. Using short, sharp animations and videos that can be shared in the social media space can enhance understanding. Engaging in online conversations is also critical to demonstrate the willingness to listen to and respond to negative comments that are raised in social media forums in a timely, positive

and helpful way. There are many guidance documents on the use of social media that can be consulted when crafting an education and engagement strategy.

Water utilities should continue to explore how best to communicate and connect with various demographics in their communities using social media platforms. Dialogue can run both ways, and efforts to reach and engage hard-to-reach audiences are expanded by developing a broader communication platform that goes beyond traditional mediums of print, radio, email and television.

To be effective, an education/communication plan must be designed so that it attracts and holds attention. Information must appeal to people who have a range of learning preferences – some learn by hearing, others prefer to read either in a printed form or on their computer.

All benefit from seeing the processes in action and it should always be remembered that the use of humour is a powerful way to gain attention and stimulate the memory. A utility's communications toolbox should include a range of products, including:

- Informative factsheets
- Infographics
- Animations
- Videos, virtual tours and documentaries
- Interactive computer programmes
- Media outreach programmes and visits to water reuse facilities
- Social media channels
- Visitor centres, demonstration centres, displays and plant tours
- Water tastings.

Information/communication programmes should be evaluated, not only for the impact of their terminology and messaging but also for their ability to attract and hold attention. Pre- and post-surveys can be very helpful in determining and measuring whether educational experiences are having an impact.

Evaluation can be used as a planning tool; building an evaluation phase into the very beginning of a project or programme will ensure that it happens. Finally, it is important to realize that education and engagement to promote change can take time and should be continued. Consistency is essential; it is advisable not to start and stop outreach efforts for political expediency.

An evaluation programme will allow the utility to determine whether messages are being understood and reinforced. Because the education/communication programme is about changing behaviour, the evaluation process will help determine if it is succeeding and inform the design of new communication techniques. There are various techniques for evaluation, such as gathering responses pre- and post-experiences in a visitor space or online.

It is important to understand that not everyone has comparable knowledge and experience with potable reuse. An effective evaluation programme will help to identify how a specified education/engagement experience uniquely affects an individual's attitude about potable reuse.

In the absence of understanding about water use and reuse, a sustainable water future will remain out of reach. There is no panacea or magic formula that yields public acceptance, but it has become clear that strong, imaginative information programmes and early and consistent two-way engagement are powerful and effective strategies – strategies necessary to open the door to more sustainable water management. This is the art of attaining the public understanding that is the critical ingredient to the success of any water reuse programme.

In some instances, officials have called off plans to implement potable reuse after they faced public opposition and outcry. Although these projects were well designed with sound engineering principles, supported by extensive laboratory tests to ensure water quality, the lack of a well thought out public communications programme combining science/technology and art/social science considerations to garner public support dealt them a huge blow.

Headlines like "toilet to tap," that play on the psychological and emotional aspects of the human mind, were shown to cloud logical reasoning.

The result was public resistance to potable reuse. But slowly, things are changing. In recent years, more cities are implementing schemes, fuelled in part by prolonged dry spells and droughts. **AW**

Republished with permission from "Potable reuse: Guidance for producing safe drinking-water. Geneva: World Health Organization; 2017.

Mitigating landslide disasters on slopes

"We take a look at how soil water content can be estimated in slopes using soil water index and how early warnings can be given for landslides in Malaysia"

by Mitsuru Yabe, Eriko Motoyama, Abdul Razak Bahrom and Zafrul Fazry Hj. Mohd. Fauzi

Unprecedented heavy rainfall in recent years has struck many regions the world over causing natural disasters, including large-scale sediment-related disasters.

This year alone, countries such as India, Nepal, Bangladesh, China, Japan, Colombia and Peru have suffered natural disasters have been seriously afflicted by debris flows and landslides and the toll on human lives has been catastrophic. And scores of people are still missing. In light of extreme rain events, evidence is mounting that one of the factors to these disasters is climate change.

Unfortunately, the financial resources available for disaster prevention and mitigation are not in keeping with the frequency and scale of these disasters in not only the developed countries, but in developing nations as well. As disasters strike people from all walks of life, stakeholders for disaster mitigation should include engineers, policy makers, government planning and response teams, researchers, politicians, and communities to address and solve problems collectively. These actions are in line with the wellbeing, sustainable cities and climate action components of the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda.

This article presents a case study whereby a municipal government, a non-governmental organization and a private company have come together to mitigate slope disaster, specifically through water management on slopes, in Ulu Klang, Malaysia.

Figure 1

BACKGROUND OF ACTIVITIES ON DISASTER MITIGATION

Over the past twenty years, residential developments have been sprouting on hills throughout Malaysia, in particular the Klang Valley.

Among the many attractions that the capital city of Kuala Lumpur holds, the lush greenery of tropical rainforests provides a scenic backdrop to the cityscape. Radiating from the city to the suburbs, the verdant lushness of the Ulu Klang area, located northeast of Kuala Lumpur as shown in Figure 1, has undergone rapid residential development as a growing suburb of Kuala Lumpur since the 1990's. Ulu Klang, along the foothills of the Titiwangsa Range, is a hilly area 150 to 200 meters above sea level. The geological condition in the area is mainly residual soil of weathered granite with a thickness of over 30 meters. And it is well known that the residual soil of weathered granite tends to become weak owing to rainfall infiltration as mentioned by the previous research paper (Chigira et al. (2001)).

Due to its geological condition, geomorphology and past substandard construction practices, this location have been afflicted by a number of landslides over the years. The most notable one was the 1993 Highland Towers disasters that killed 44 people including a Japanese resident (Figure2).

Figure 2

Following a string of high-profile landslides, the Malaysian Government set up a dedicated slope engineering branch within the Public Works Department in 2004 and drafted the National Slope Master Plan, which encouraged public participation by residential communities through awareness and preparedness programs to mitigate slope disasters. A non-governmental organization, SlopeWatch, was formed in 2009 to work with the communities and government in creating

Figure 3

awareness and providing education on monitoring as well as reporting on the early signs of landslides in Ulu Klang. It collaborates with local authority Majilis Perbandaran Ampang Jaya (MPAJ) for mitigation action following any reports from SlopeWatch.

Providing technical and scientific support is Oyo Corporation, a Japanese engineering consulting firm that offers solutions and technologies for water management on slopes. In this particular case study, it provides rainfall observation and analysis of the previous records on landslide incidents in Ulu Klang.

THE NEED FOR WATER MANAGEMENT ON SLOPES

In many cases of landslides in Malaysia, most are ultimately triggered by water, such as heavy rainfall during the monsoon season. As such, prevention of infiltration of runoff on slopes is essential. Civil engineers and contractors must design and build proper drainage systems on slopes to prevent infiltration of rainfall in urban developments.

Contributing to the occurrence of landslides are underlying factors such as poor design and maintenance of drainage systems. Due to these contributing factors, the groundwater level in slopes can reach critical levels that compromise slope stability, hence, constant monitoring and inspection of drainage systems and follow-up maintenance measures such as repair of broken drains is paramount.

In Ulu Klang, monitoring and inspection activities are carried out by the residents themselves, who report any signs to the local authority or to the slope owners. Working collaboratively with SlopeWatch and MPAJ, residents are able to monitor flow of surface water on slopes and reduce the risk of landslides through proactive measures (Figure 3).

Taking the monitoring and reporting initiative one step further, observation of slope conditions specifically during rainy seasons was initiated by a project team comprising MPAJ, Oyo Corporation and SlopeWatch. The objective was to determine what changes in the slope environment or signs of failure would start appearing depending on the rainfall volume.

By correlating the signs and the rainfall volume, thresholds for failure can be established. Any changes in the slope conditions or signs would be reported by

Mitsuru Yabe

The chief representative of Malaysia Representative Office of OYO and has been with the company for 27 years. He has experience in planning, management and data analysis for field monitoring especially for slope disasters such as landslides, debris flows and rockfalls. His experience in the prevention and mitigation of slope disasters in Malaysia includes a JICA project called Research and Development for Reducing Geo-Hazard Damage in Malaysia caused by Landslide and Flood (SATREPS, 2011-2016) as a specialist in slope monitoring.

Figure 4

the community members via a crowdsourcing platform, making this project a demonstration of citizen science in disaster management (Figure 4). Thresholds for slope failure can also be derived using a method called the soil water index. It shows the correlation between soil water content due to rainwater infiltration and the occurrence of landslides. A method used in Japan for issuing early warning of landslides, a soil water index application in Ulu Klang shows promising results, as explained as follows.

METHODOLOGY TO ESTIMATE SOIL WATER CONTENT ON SLOPES

In this case study, the Soil Water Index (SWI) method was used to estimate soil water content in slopes. SWI, which was developed by Japanese hydrologists, was adopted by the Japan Meteorological Agency to estimate the amount of soil moisture in slopes for issuing early warning of sediment-related disasters in Japan. As shown in Figure 5, using a three-series tank model for run-off, seepage from surface layer and groundwater, water storage phenomenon in slopes can be expressed as the total water storage of three tanks.

A rainfall observation station was installed at ground zero of a 2008 landslide site in Bukit Antarabangsa, Ulu Klang to observe the rainfall characteristics in the area as shown in Figure 4. The rainfall observation station consists of a tipping bucket-type rain gauge and a wireless data logger for transmission via a mobile network to a remote server that calculates SWI in real time.

Eriko Motoyama

Programme director and co-founder of SlopeWatch which teaches non-technical audiences how to monitor for signs of landslides. As SlopeWatch's programme director, she creates awareness and educational programmes for various target audiences. In addition, she has set up and is carrying out a system of standard operating procedures that local authorities, community leaders and residents can follow for smooth implementation of the monitoring and reporting process.

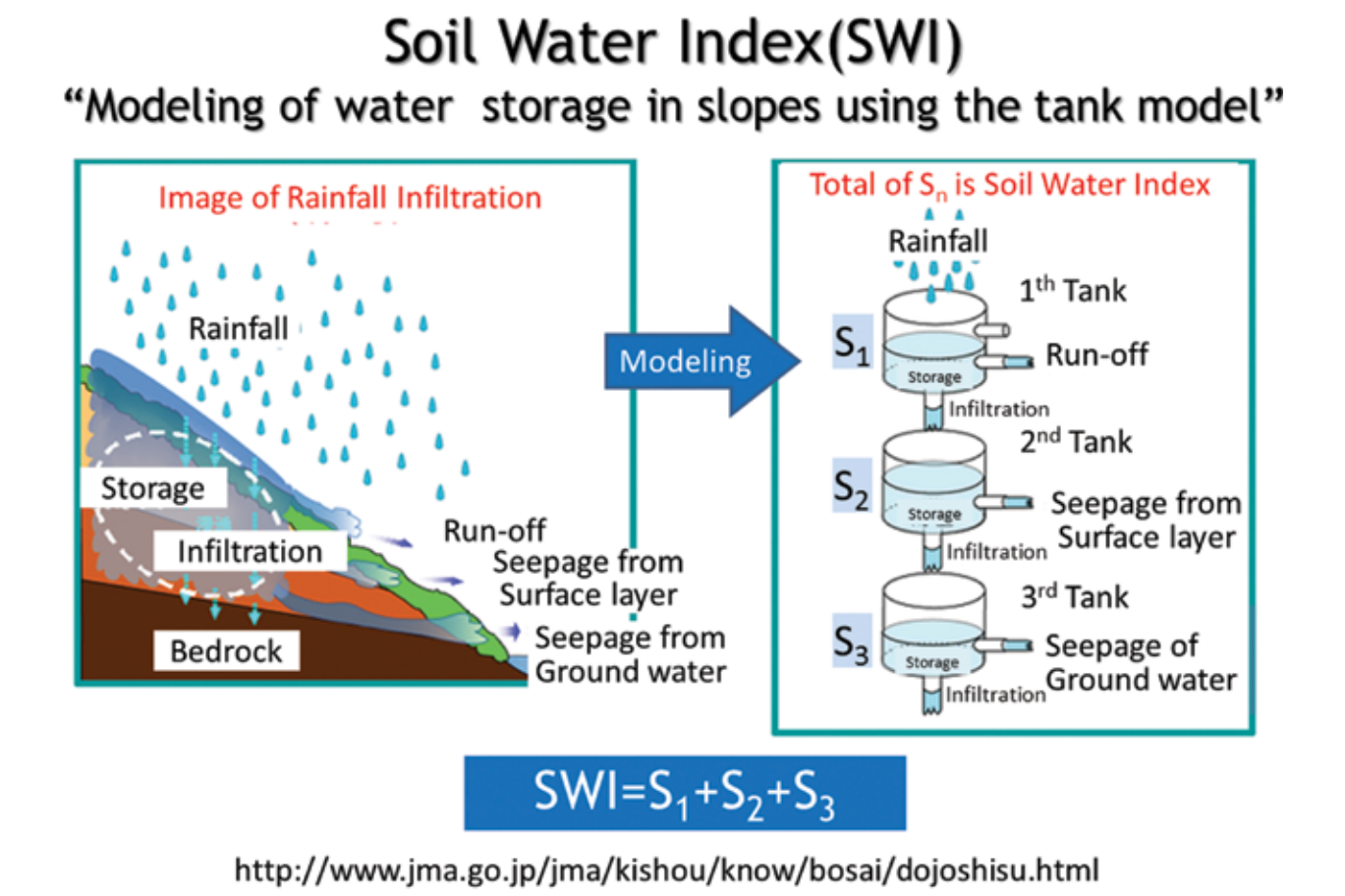


Figure 5

CORRELATION BETWEEN SWI AND LANDSLIDE INCIDENTS AND DETERMINATION OF THRESHOLD OF EARLY WARNING

The rainfall observation started in November 2015. Figure 6 shows changes in SWI and rainfall intensity based on data from the rainfall station at Bukit Antarabangsa from November 2015 to February 2017. A top five ranking of SWI values are shown in Figure 6. The maximum SWI within the observation period was 135.9, which occurred on 1st June 2016 during the entire observation period.

During the observation period, periods of high-intensity rain with over 100 SWI had no reported landslide incidents. According to previous research on SWI (Mukhlisin et al. (2015)), the maximum SWI when landslide incidents occurred in Ulu Klang was approximately 160. There were some exceptions where slopes failed at lower values, most likely due to poor design and no maintenance of drainage systems. It is suggested that the value of 160 SWI is the critical level of capability of water retention on slopes before the occurrence of landslides with little influence of contributing factors such as construction works.

On the basis of the above observation and knowledge, the thresholds of early warning to trigger actions by the community such as heightened surveillance within the neighborhood and evacuation were determined as following:

- "Watch": SWI=100
- "Warning": SWI=125
- "Evacuation": SWI=150

Abdul Razak Bahrom

He is the co-founder and chairman of SlopeWatch. Like all of SlopeWatch's committee members, his neighbourhood was afflicted by the 2008 Bukit Antarabangsa landslide. His background is computer science, mathematics and artificial intelligence. His professional expertise is computational hydrology, a skill that he brings to SlopeWatch in carrying out various applied research projects with other public and private bodies. Together with the Programme Director, these projects are carried out in collaboration with residents living in hillside communities.

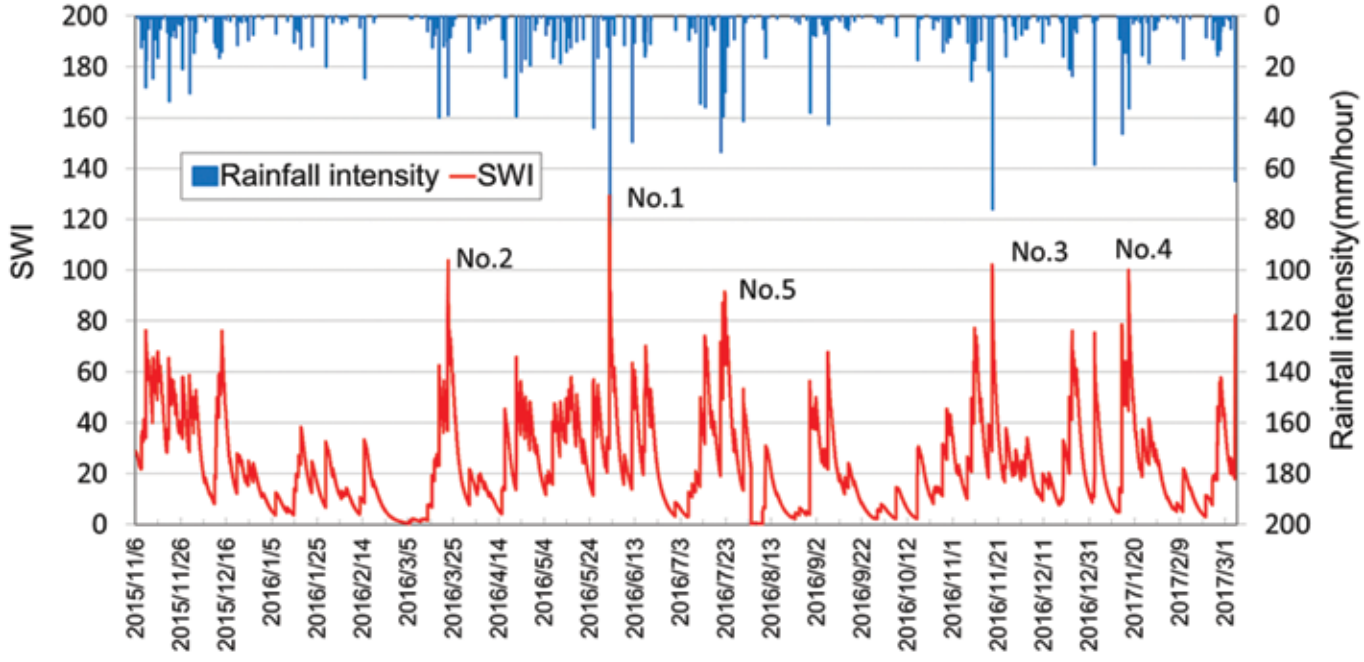


Figure 6

APPLICATION OF THRESHOLD OF EARLY WARNING ON SITE

The SWI thresholds were applied starting March 2017. Not long after that, a small-scale landslide occurred at the Riverdale Park Apartment, one of apartments in Bukit Antarabangsa about 600 meters northeast from the rainfall observation station as shown in Figure 7. As explained in the figure, the cause of the landslide was the infiltration of surface water flow into the slope due to a lack of a drainage system that ultimately caused the destabilization of the cut weathered granite slope.

Figure 8 shows the time series of SWI and rainfall intensity before and after the occurrence of landslide based on data from the rainfall observation station. SWI exceeding 100 occurred in the afternoon of 16th March and recurred in the evening of 17th March. From the established thresholds, an early warning to landslide was announced to SlopeWatch at 6 p.m. on 17th March just after SWI reached 100 for the second time in two days.

After that, a landslide occurred at around 4 p.m. on 19th March. The SWI at the time of the occurrence was 118.2. Although there was a problem in that the early warning was not issued at the first reading that exceeded

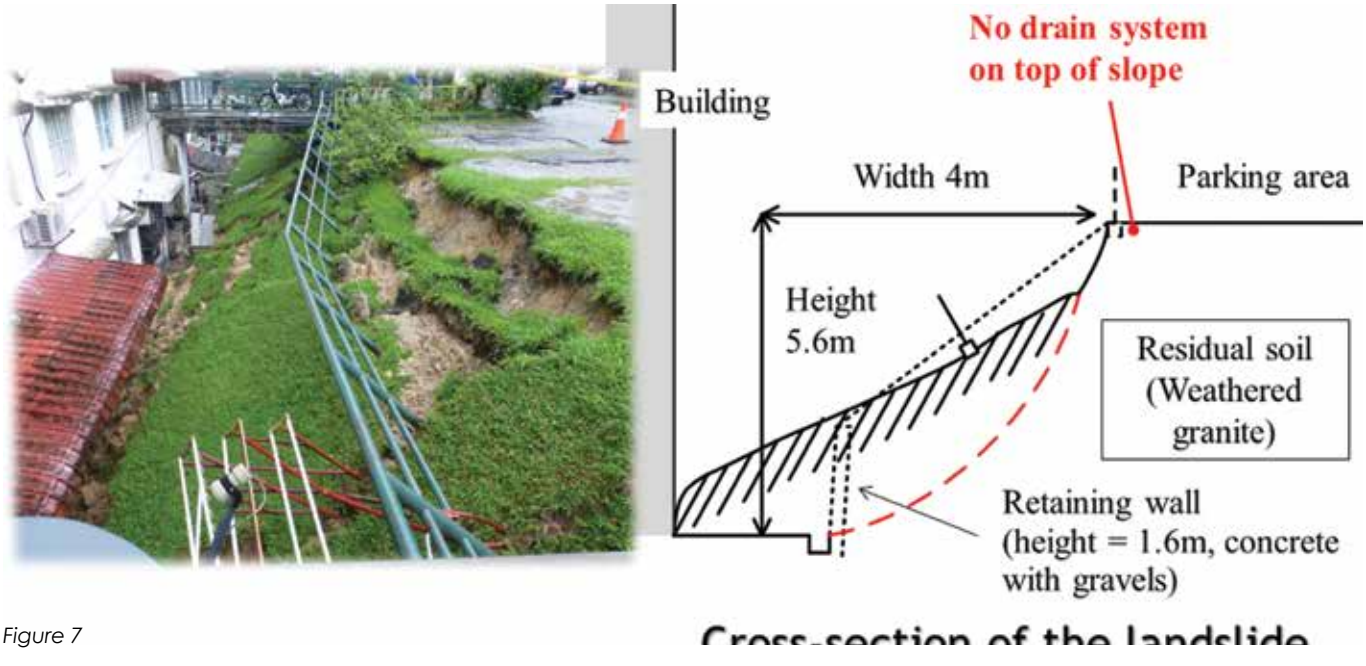


Figure 7

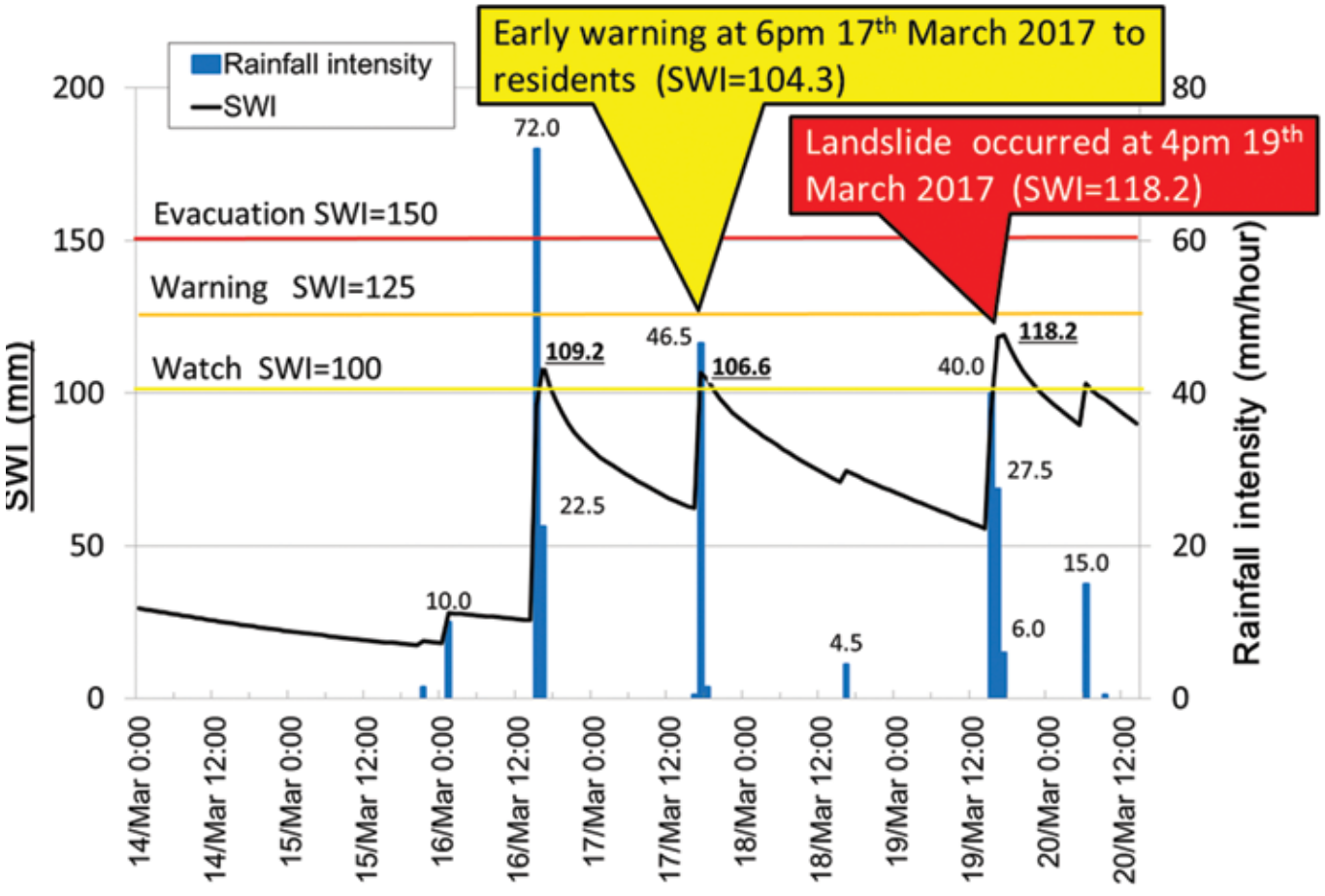


Figure 8

over 100 SWI, the exercise demonstrated that a warning could be issued to residents before a landslide occurred based on the thresholds.

Through this case study, it was concluded that the SWI approach to determine the thresholds of early warning was valid. While this experiment was an initial attempt to provide early warning in areas prone to landslides, it has proven itself to be a useful way of conveying life-saving alerts to residents prior to the occurrence of landslides.

CONCLUSION

In this paper, the soil water index, which the Japan Meteorological Agency uses for determining the threshold for early warning of sediment-related disasters, was adopted to a landslide-prone area in Ulu Klang, Malaysia as a method used in water management on slopes to mitigate landslide disasters. The threshold for early warning was determined on the basis of previous studies and rainfall data for making decisions on evacuation of residents before the occurrence of landslides. In this case study, an early warning alert was disseminated to residents one day prior to an actual failure, thus providing ample time to prepare for any slope-related emergencies. Through this experiment, it was concluded that the approach to determine the alert announcements based on the threshold was valid as the first step towards establishing an early warning system in landslide-prone areas in Malaysia based on SWI. **AW**

Ir. Zafrul Fazry Hj. Mohd. Fauzi

The Director of Engineering at MPAJ and has 22 years of experience in the construction industry. He holds a master's degree in construction project management and as a professional engineer was instrumental in the setup of the Slope Division in MPAJ in 2009. He was active in establishing a community reporting program with residents and SlopeWatch. He has also been active in disseminating knowledge about landslides through talks, seminars and outreach programs.

Going MAD in making water systems smarter and available for all

WHEN is a water system smart? At the least possible, if it produces an acceptable product while minimizing energy and other resource requirements and if it is a system that should respond rapidly to disturbances and recover quickly after a major upset.

Instrumentation, control and automation are the key ingredients of a smart system, enabling a simple framework that a control engineer calls the feedback loop. We call it the MAD approach to smart water management: M is for Measure; A for analysis; and D for Decision-making.

To measure is to know and this requires adequate data in space and in time. Data analysis is critical to understand and interpret data in a way that will turn it into useful information. This is the basis for making decisions, manually or automatic.

MEASUREMENT

Sensors and instruments that provide adequate data are the basis of "smart". Measured or observed phenomena are the foundation for all feedback. Flow rates and a multitude of concentrations and quality parameters are the foundations for all operations in water systems. Instrumentation must be robust, easy to maintain and cost-effective. This is even more important in an unmanned process.

For a long time, instrumentation was considered the bottleneck for control and automation in water systems. This is no longer the case. The development of nutrient sensors in the last two decades has been impressive, and there is an interesting progress towards "smart" sensors with multiple heads, able to be placed anywhere in a process.

ANALYSIS

Unlike humans, computers are infinitely attentive and can detect abnormal patterns in operating data. Monitoring the key parameters and operational state of a process or a machine via online instrumentation reduces the risks for operational problems and other errors. Consistent monitoring of the "product quality" will prevent problems growing too large. By rapidly detecting deviations from "normal", it is possible to minimize the costs of abnormal behaviour.

Monitoring the machinery and the plant equipment forms the basic level of diagnosis. Simple indicators can warn if a motor is not running or if pressure is getting too high or too low. Alarms triggered by rapidly changing equipment behaviour or basic physical parameters – like flow rates, pressures, or levels – are essential pieces of information.

At the other extreme, biological parameters will change slowly. For example, floc settling properties depend, among other things, on the species of organisms. It is important to detect early signs of flow settling changes. Once they are apparent we may have sludge bulking, and it's too late to make simple corrections. Early warning systems are critical in biological wastewater treatment.

Any monitoring system must determine whether the acquired data are meaningful and correct. Before any analysis can be made, it is crucial to rectify or screen the data so that false conclusions are avoided. Irrelevant information – noise or extreme data points – must be removed.

DECISION (CONTROL)

Having obtained data that is getting screened and analysed, a decision can be made, either automatically or manually. Decisions can then be made based on the defined goal or purpose of the system, before being translated into action via an actuator, typically a motor, a pump, a valve or a compressor.

By adopting MAD thinking, it is possible to make water systems smarter. MAD principles are functional in all timescales, from equipment operation in the time scale of seconds, to the management of a plant in the order of months or longer.

How do we meet the other criteria for a smart system: minimizing energy and other resource requirements?

Two parallel developments have the potential to significantly transform water supply and wastewater treatment systems: renewable energy and decentralization. Renewable energy, primarily solar and wind power, is already revolutionizing the availability of affordable clean energy. The growing development of decentralized water systems is accelerating smart solutions, using adequate sensors, control and automation become critical.

The water sector is energy intensive and available, affordable electricity is critical to pump and treat water. Approximately 84% of the global population has access to electricity, implying that almost 1.2 billion people are still without it. In many regions with energy poverty, there are abundant renewable energy sources. In Africa and Asia particularly, a lot of rural areas are not connected to any grid infrastructure. Here solar and wind power offers huge opportunities, providing energy for pumping, for water re-use and purification using different technologies in decentralized systems.

Smart water supply and treatment systems that take advantage of the affordable renewable energy in combination with adequate automation, present a real opportunity to satisfy two of the UN Sustainable Development Goals: clean water and energy for all. **AW**


Gustaf Olsson

Gustaf Olsson, Lund University, Sweden, has devoted his research to applications of Industrial Automation. This includes control and automation of water systems, power production, electrical power systems and industrial processes. In recent years he has focused on the water-energy nexus, trying to comprehend how energy exploration, generation and use are related to water operations and consumption.

Gustaf has been involved in IWA activities since 1973. He has served as the editor-in-chief of Water Science and Technology, in the IWA Strategic Council, and in the IWA Board of Directors. He has received the IWA Publication Award and is an Honorary Member of IWA as well as an IWA Distinguished Fellow. During the last six years he has been mentoring IWA Young Water Professionals from all continents to develop their scientific writing skills.

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Controlling Floods in Southeast Asia – Key Industry Executives Give Insights

The frequency and severity of flooding in Southeast Asia have increased over the past decades. Asian Water recently interviewed industry executives in Malaysia to gather insights on how to manage floods effectively.

by Prem Kumar Nair

With flooding becoming an increasingly common phenomenon and accounting for nearly 40% of natural disasters, managing floods effectively has become a matter of urgency. Tan Chee Meng, Regional Business Director of Water Utility, Grundfos, Mohmad Asari, Vice President, Malaysia Water Association and Managing Director of Waterbe and Thomas Tang, Managing Director of the KL Centre for Sustainable Innovation & Corporate Sustainability Director of AECOM have many recipes to implement sustainable water management solutions.

OVERCOMING KEY CHALLENGES IN PROVIDING SUSTAINABLE CLEAN WATER TO RURAL AREAS

According to Mr Tan, with an understanding of the importance of water as a life source, his company set out to achieve its goal in implementing efficient and sustainable solutions in remote areas. This was done by deploying Grundfos Lifelink water solutions, which aims to strengthen the quality, reliability and sustainability of drinking water supply in rural and urban communities in developing countries, particularly across Southeast Asia and Africa.

Lifelink solutions combine renewable energy, proven pump technology, water treatment and intelligent water ATMs with online water management and a professional service network.

'A key challenge we found in providing sustainable clean water to rural areas is establishing a water treatment system with low energy consumption," said Mr Tan. "Delivering clean drinking water to remote areas can be energy-intensive, with its infrastructure typically expensive to install and maintain'', he added.

This is why in 2015, to improve access to clean water in rural Thailand, Grundfos Lifelink water solutions worked with the King Mongkut's Institute of Technology Ladkrabang (KMITL) to test its fully automated AQpure water treatment system, that could purify river water and surface water into potable water for the residents in 15 Thai villages, meeting the needs of around 50,000 residents.

Mr Tan also said that the water treatment system's use of hybrid power allows for low energy consumption, and thus, they were able to provide an affordable yet effective way for residents to access clean drinking water.

Remote monitoring via Grundfos Remote Management also ensures that the water supply remains reliable. Another example is the collaboration between Grundfos and eKutir, an India-based social enterprise engaged in providing solutions to the country's low-income communities. In December 2016, the company launched a unique mobile water purification in Bhubaneshwar.

This first-of-a-kind system, a mobile water purification unit is based on solutions from Grundfos Lifelink and comprises a pre-treatment unit, AQpure (Ultrafiltration and Ultraviolet water treatment system) that travels to certain identified rural pockets near Bhubaneshwar, to treat the surface water / bore well water and convert it into safe and clean drinking water. The purified water is then being dispensed employing the Grundfos Water ATM (AQtap) at an affordable price to the rural communities.

Mohmad Asari explained that there are some rural areas, which are well connected by land, air and water transportation. However, the situation that should be of greater concern is that of the rural areas with limited accessibility.

"These areas are still depending on rainwater harvesting as infrastructure cost is high," said Mr Asari. He pointed out that raw water cannot be consumed directly and needs proper treatment. "When accessibility is limited, the cost of providing infrastructure escalates," added Mr Asari.

Meanwhile, Dr Tang said that the problems in rural areas tend to be infrastructure related - getting clean water from the source to the user.

The quality of the source water is another problem as the water table in many rural countries is dropping due to water being diverted to urban areas or for industrial use; certain parts in Vietnam have naturally occurring contamination with arsenic. It is imperative that water is treated before use. In most rural cases, the technology has to be simple and easy to maintain.

Said Dr Tang: "Sometimes, just using a handheld filtration device can work. Sanitation is another challenge. That is largely related to education as well as sanitary facilities.''

According to Dr Tang, good monitoring systems have to be in place to make sure everything is working and not being abused. The problem is not so acute in rural areas but in urban areas, there are problems of non-revenue water which is due to leakage or theft.

"In the smart society we live in now, there has to be a way to use technology to get better at delivering clean and safe water,'' reflected Dr Tang.

WORKING WITH LOCAL WATER UTILITY PROVIDERS

Mr Tan explained that in recent years, water utility leaders

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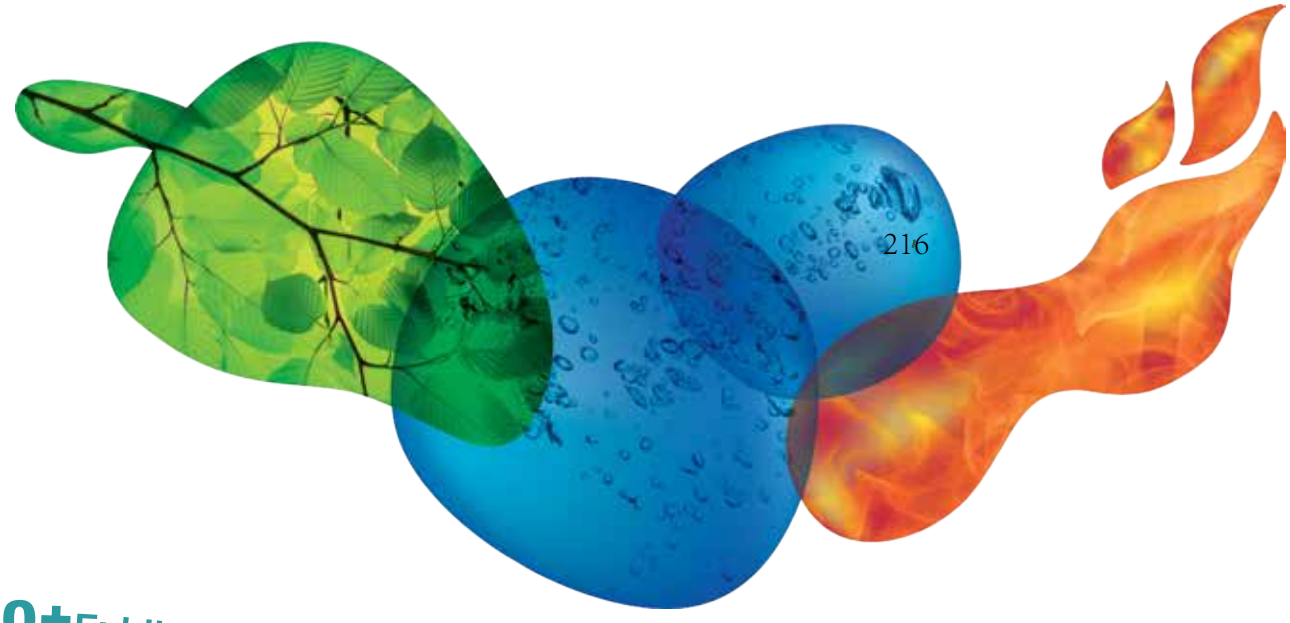

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and city planners have come to realise that climate change, new economic realities and population growth are today making water management more complex. To address this, water utility leaders across the region have been looking to digital technology, big data, and intelligent products and networks to distribute water resources efficiently and solve large-scale environmental challenges. In Cambodia, Grundfos had worked with the national water authority to address the issue of non-revenue water, an issue which has been at the top of its agenda.

"We put in place our demand-driven distribution solution, which tackled water leakage issues by using an intelligent software that automatically adjusts water flow through the use of remote sensors at the end user points of use,'' explained Mr Tan.

Meanwhile, Mr Asari pointed out that each project has its unique problems and as engineers, he and his colleagues were equally concerned about quality and quantity of water to be supplied to consumers.

Said Mr Asari: "In implementing projects we need to assess the quantity of water that can be extracted during the driest spell, usually based on 2% probability of occurrence. That will determine the maximum production. Then we will assess the quality of water over a certain period of time, usually covering the seasonal variations. Putting these as pre-requisites, the outcomes will be suitable projects with resilience against variation of the climate and demand patterns."

Dr Tang who worked with the authorities in Vietnam many years ago found that lack of funding as well as bureaucracy caused some hurdles. Said Dr Tang: "I am sure that has all changed now. For the rest of Asia, I can't really say. I know that many agencies are open to public-private partnerships, but the devil is always in the detail as both parties want to get something out of the arrangement".

PARTNERSHIP BETWEEN GOVERNMENTS AND TECHNOLOGY PROVIDERS IS THE KEY

Mr Tan quipped that each situation for flood control and water management comes with its own unique issues and usually requires a very specific approach. At the same time at an industry level, there needs to be an urgent reconsideration on how they could change the way stormwater is managed, by better leveraging technology.

Dr. Thomas Tang is the Managing Director of KLCSI Ventures Sdn. Bhd., a joint venture between AECOM and Yayasan Wilayah Persekutuan, dedicated to improving livability in Malaysian cities through sustainable and innovative community-driven solutions. Dr. Tang is also the sustainability director for AECOM Asia, a company specializing in design engineering services for infrastructure and buildings.

Dr. Tang has worked as a management consultant, an environmental consultant and for an NGO. His key strengths are in business strategy and analysis, marketing, leadership development, quality and social responsibility. As a consultant he has worked for the World Bank, APEC, the United Nations and various government agencies worldwide. He is a Faculty Associate of the Henley Business College and a visiting lecturer at many Asian colleges and universities. He has written a number of papers on topics related to sustainability and social innovation as well as co-authoring two books on sustainable cities and urban challenges.

Dr. Tang is an Associate Member of the International Construction Business Management Research Group at University Technology Malaysia, a Founding Member of the Social Progress Malaysia steering committee, a member of the Research Committee for the Malaysian Green Building Council and a member of the sustainability working group for the Construction Industry Transformation Programme. Dr. Tang is also a Fellow of the Royal Society for the encouragement of the arts, manufacturing and commerce and a Fellow of the Institute for Environmental Management and Assessment.

Said Mr Tan: "The first step would be for governments and industry to share best practices on how to better manage and integrate existing technologies such as sensors, rainfall measurements, automation technologies, intelligent pumping systems, data analytics and the industrial internet of things to create a smart water grid.''

Grundfos offers a wide range of pumping solutions, which includes flood control pumps that can be engineered to provide a more customised solution. A combination of technical know-how, industry leadership and solution-oriented product development means Grundfos has the pumps and control solutions to cope with the heavy demands of flood management.

"Flooding is a major challenge, together with drought," said Mr Tan. "Of late, flooding has been more rampant and even more devastating, with some related to climate change or global warming," he added.

While the reality of flooding cannot be denied, Mr Asari believes that "there are possibilities that it is unpreparedness on our part as engineers and managers to prepare for the worst." He argues that more often than not we are not prepared to face severe flood in terms of spending. More attention must be paid to accessing urban stormwater and how to make better use of it. 'If we could keep this water somewhere it will be a sensible thing to do; perhaps pump suppliers could provide good and huge pumps to transfer large quantities of water,'' said Mr Asari.

It is also important that the private sector views a business proposition in collaborating with governments.

Said Dr Tang: "Take for example, telecom companies. Their services are essential in the event of a disaster to keep different parties connected. In exchange, they would seek some sort of concession or license to operate. This makes sense. But competition laws possibly prohibit this.

"I think these needs to be revisited so that companies like Grundfos get some benefit out of providing disaster-related equipment, as this by itself probably does not make business sense. There has to be some sort of concession arrangement worked out.''

NEW RESEARCH REPORT SURVEYS 417 SUSTAINABILITY INDUSTRY LEADERS ACROSS MALAYSIA, INDONESIA, SINGAPORE, THE PHILIPPINES, THAILAND AND VIETNAM

Mr Tan said that a recent study had revealed that 70% of respondents – business sustainability practitioners from across Southeast Asia – had predicted their home country will continue to face extreme weather events over the next decade, taking a significant toll on local economies and infrastructure.

Chee Meng Tan is currently the Regional Segment Director for Water Utility segment as well as the Product Portfolio Director for Grundfos across Asia Pacific. In his role as the Product Portfolio Director, Chee Meng leads a team of Product Managers to support product development and chart the path of growth for the same within the region. As the Water Utility Segment Director, he oversees the planning and execution of the regional strategy for Water Utility business in the Asia Pacific region, which includes Water Supply, Water Treatment, Waste Water Transport (including Flood Control) and Waste Water Treatment.
Chee Meng joined Grundfos Singapore in 1995 as an Application Engineer and has taken on different roles and responsibility in the last 22 years. Prior to taking on his current role, Chee Meng has held various positions within Grundfos such as the General Manager of Grundfos Alldos (Shanghai) Water Treatment Co, Ltd as well as the Regional Business Director for Industry Segment in Asia Pacific.
Chee Meng holds a Diploma in Electrical Engineering as well as Management Studies.

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For Malaysia, industry leaders are most concerned about their country's resources to guard against extreme weather events and floods, brought about by the country's increased risks of flooding in recent years. Meanwhile in Singapore, Mr Tan said it is found that one in four sustainability leaders believe there is a lack of public concern about climate change in Singapore – the highest when compared to other countries across Southeast Asia.

"This is of concern because, with its low-lying landscapes, Singapore is still vulnerable to climate change and extreme weather events," said Mr Tan. "The devastation flooding brings is real, 'added Tan.

Between 2000 and 2015, the region has witnessed US$76.2 billion worth of economic damages from floods alone. In order to sustain the region's economic progress over the next 50 years, Mr Tan urged that there must be a real focus on climate change – beginning at the consumer level. In this regard, the new study highlights how more focus needs to be given at the consumer level, urging greater investment in education and outreach programmes to transform the environmental habits of citizens and businesses.

Mr Asari concludes that there are huge opportunities to improve the present situation. He said: "With billions of dollars of losses, it is imperative to adopt or duplicate some of the innovations wherever possible. A better solution and higher preparedness could be achieved through more sophisticated monitoring and control."

Simulation and modelling are also made simpler and more accurate through software development. This coupled with reliable and powerful pumps could bring change to the current predicament whenever there is rain in this region. This criticality is further magnified by the unusual high intensity of rain which usually catches many by surprise.

Dr Tang said: "I am afraid I was not involved in this research. I would only hope that industry leaders recognise the need to work with agencies for the good of the community as the latter provides resources like labour and land. I know this is all part of social responsibility but I truly hope that companies think beyond window dressing and see the value in this type of work."

WHAT THE FUTURE HOLDS FOR SUSTAINABLE WATER MANAGEMENT

According to Mr Tan, there is an opportunity to adopt a more coordinated approach both at a national and regional level. As Southeast Asian nations are currently at various implementation stages of their water management and flood control systems, he believes that their whitepaper highlighted great examples of innovation adoption and planning for flood disaster response.'.

Mohmad Asari explained that in Malaysia, major improvements have been made in improving water quality produced for human consumption over the last three decades. However, a major concern of late has been the availability of good quality raw water.

The challenge lies in the way it is going to be managed. Two major strategies that were embarked upon are demand management and higher surface water utilisation. The success of this strategy lies in the participation of the public and consumers at large.

Dr Tang said as a long-term solution, alternative sources of utilising groundwater are being addressed by several states in Malaysia.

He said: "Water is always going to be a sensitive issue for Asia especially when rivers cross boundaries. You can see the effect when countries upstream dam rivers for hydroelectric purposes and the problems caused to countries downstream. Climate change is also having a significant impact on water management, sometimes too much and sometimes too little water happens.

"Careful thought must be accorded in recycling and conserving water as its resources are no longer in abundance with climate change factors affecting natural hydrological cycles.

"Pricing of water needs to be reviewed to make people more aware of the value of this resource. I think education is vital and to get people to appreciate water, we must bring them back to closer contact. We need to get governments to spend some money and put in good enforcement measures to clean up our rivers and water bodies so that they become community spaces for leisure and appreciation. In that way, we get people to respect water." **AW**

Mohmad Asari Daud had spent almost his entire working life within the waste, wastewater and environment fraternity – either as proprietor, consultant, constructor, trainer, preacher or activist.

As an engineering graduate, he specialised in lean management, water treatment and non-revenue water (NRW) management and gained vast experience in water resources and supply management.

The UTM and M.Sc graduate from Liverpool University, Ir Mohamad Asari was also involved in treatment plant assessment, trouble shooting, problem solving, upgrading and capacity building in Malaysia, Indonesia and Brunei. Prior to that, he was the District Engineer in several district managing water supply services in Malaysia. He had held the position of Chairman of Water District Engineers Action Committee from 1996 till 2002.

He conducted hands-on training at several water companies in the field of leakage control, NRW management and treatment plant operations and had trained engineers, technicians and operators in this region.

In 2014, Ir Asari led the Study on Status of Water Supply and Waste Water Management under Academy of Sciences Malaysia and participated in several Strategic Consultations of the Academy on several issues in the water industry. Prior to that, in 2004, he conducted the study on Full Cost Recovery of water industry in Malaysia for the World Bank which was presented in Bangkok and in 2008 he was involved in the International Symposium on Water Associations in Jakarta and founding committee of IWA Regional Office in Singapore.

Ir Mohmad Asari was the Malaysian Water Association Executive Director from 2006 till 2008 and Honorary Secretary General from 2013 – 2015 and a fellow of The Institution of Engineers Malaysia (IEM), Registered Professional Engineer to the Board of Engineers Malaysia, Registered Industry Expert and a Registered NOSS Panel. He sits as member at several committees and task force set to advise state and Federal agencies on water matters. Ir Asari is currently the Vice President of the Malaysian Water Association and MD of Waterbez Sdn Bhd.

WETEX 2017 invites universities to participate in the Innovation Hall

Dubai Electricity and Water Authority (DEWA) is inviting local and international universities to participate in the 19th Water, Energy Technology and Environment Exhibition (WETEX) 2017.

The exhibition, under the directives of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of the United Arab Emirates (UAE) and Ruler of Dubai, and under the patronage of HH Sheikh Hamdan bin Rashid Al Maktoum, Deputy Ruler of Dubai, Minister of Finance and President of DEWA, will be held from October 23-25 at the Dubai International Convention and Exhibition Centre.

Themed "at the forefront of sustainability", the three-day event which will host more than 14 universities, will contribute to the foundations of environmental sustainability and it is in line with the UAE Green Growth Strategy, which was unveiled by HH Sheikh Mohammed bin Rashid Al Maktoum.

The exhibition aims to transform Dubai into a global hub for clean energy and green economy. Participating universities, both local and international are encouraged to participate in the WETEX Innovation Hall to showcase their knowledge in environmental issues, and to present their research studies and innovative projects in the fields of energy, water, environment and technology.

Universities can play essential role in the progress of the energy, environment and water sectors.

"The participation of universities in the Innovation Hall during the last edition of the exhibition was influential in enriching WETEX; a global scientific platform that brings together scientists, thinkers, innovators, academics and students from all over the world," said HE Saeed Mohammed Al Tayer, MD & CEO of DEWA, and Founder and Chairman of WETEX.

He said the hall aims to enhance the participation of university students to develop their knowledge of the latest developments in the energy, water and environment sectors.

The participation of universities in WETEX strengthens its leading position in the list of the world's leading exhibitions in the fields of water, energy, environment, oil and gas, renewable and clean energy. It also promotes student participation, which is one of the most important pillars of Dubai's hosting of the World Expo 2020, and the transformation of Dubai into the smartest and happiest city in the world.

Participating universities will showcase their practical and innovative research and scientific progress in the vital areas of the exhibition. The Innovation Hall will focus on the latest innovations in energy and water efficiency, technology and green solutions for all sectors of society and stimulate innovation and promote environmentally friendly practices and raise the contribution of sustainable solutions to enhance the country's global competitiveness in environmental sustainability. **AW**

Opportunity to network and business matching

MYANMAR's leading international water supply, sanitation, water resources, industrial wastewater treatment and purification event will be held at the Tatmadaw exhibition hall in Yangon from October 26-28.

The platform provides an opportunity for networking and business matching with more than 180 exhibitors and 5,000 trade visitors.

Participating countries are from China, Germany, Israel, Japan, Malaysia, Singapore, Taiwan and Thailand. Visitors will also get a glimpse of Myanmar's water industry updates. **AW**

Visit: www.myanwater.com for more information on one of Asean's leading water industry events.

Eco Expo Asia 2017 welcomes Bavaria participation and presents the Smart Sponge City concept

Eco Expo Asia is set to present its 12th edition at AsiaWorld-Expo, Hong Kong, from 26 to 29 October 2017. Organised by Messe Frankfurt (HK) Ltd and the Hong Kong Trade Development Council (HKTDC), and co-organised by the Environment Bureau of the Hong Kong Special Administrative Region (HKSAR) Government, the expo serves as a gateway to the flourishing green market in Asia.

This year's edition of Eco Expo Asia will see the debut group participation from Bavaria. The proud south-eastern state in Germany, renowned for its unique culture and traditions, will showcase its environmental credentials, with a special focus on water quality management. Organised by Bayern International, the Bavarian Bureau for International Business Relations, the group participation will feature exhibitors including Blobel Umwelttechnik, Huy Trading, IBS Technics and Jaeger Umwelt-Technik. Recognising Hong Kong as a platform to enter new markets, Ms Maria Schmid, Manager Trade Fairs & Exhibitions, is looking forward to promoting Bavarian businesses. "Eco Expo Asia presents a wide range of products in the environmental sector and it is an exciting prospect for our Bavarian companies to attend the trade show. Hong Kong is an interesting market and offers many opportunities for companies to establish contacts."

Making a welcome return to Eco Expo Asia is the European participation, organised by the European Chamber of Commerce in Hong Kong. Exhibitors from different European countries, including Finland and Germany, will demonstrate the strength and breadth of European know-how when it comes to environmental concepts.

The Netherlands has for a long time punched above its weight when it comes to environmentally-friendly policies including its leadership in recycling initiatives and wind power development. The Netherlands Pavilion, organised by the Consulate General of the Kingdom of the Netherlands, will feature companies including Arcadis, Dutch EBS, Hyva Asia Holdings Pte Ltd, Jewel, Orgaworld Asia, Process Design Center, The Netherlands Ministry of Infrastructure and the Environment, Waste Treatment Technologies (WTT) Netherlands and WSS Asia Ltd.

For the first time at Eco Expo Asia, a Startup Zone dedicated to green technologies will be established. With Hong Kong experiencing a steady upward trend in the number of startups being founded, this year's Startup Zone provides a good opportunity for a number of innovative companies to showcase their ideas to the wider industry.

Eco Expo Asia

Benjamin Chau, Deputy Executive Director of the HKTDC said: "The Startup Zone is an ideal platform for new ventures to find potential investors, buyers and manufacturers. We welcome participation from young entrepreneurs and startups from around the globe to take advantage of the expo and present their innovative products and solutions." The featured startups are tackling a number of different environmental concerns and are delivering solutions to everything from environmentally-friendly interior design services and weather resistant paint to smart thermostats and noise barriers.

THE SMART SPONGE CITY CONCEPT PROMISES TO BE AN INTRIGUING TOPIC OF DISCUSSION

In recent years, the idea of a 'sponge city' has gained traction around the world. From permeable roads and paths to rooftop gardens and underground water storage facilities, the concept could help cities not only tackle flooding but also offer solutions to water shortages. The Eco Asia Conference will for the first time see the Water Supplies Department and Drainage Services Department co-organise "Smart Sponge City – Self Sustainable Water Cycle" to explore this exciting approach to urban planning in greater depth.

Speakers include Mr Jim Schlaman, Director of Water Sources, Black & Veatch, USA, who will host a segment titled "Maximising Every Drop Through One Water Planning", while new technologies researched by local professors will also be featured.

Eco Expo Asia aims to serve as an all-inclusive platform that offers greener solutions, as well as enabling companies, government officials and individuals to connect. **AW**

Please email ecoexpo@hongkong.messefrankfurt.com or exhibitions@hktdc.org, or visit www.ecoexpoasia.com for more information.

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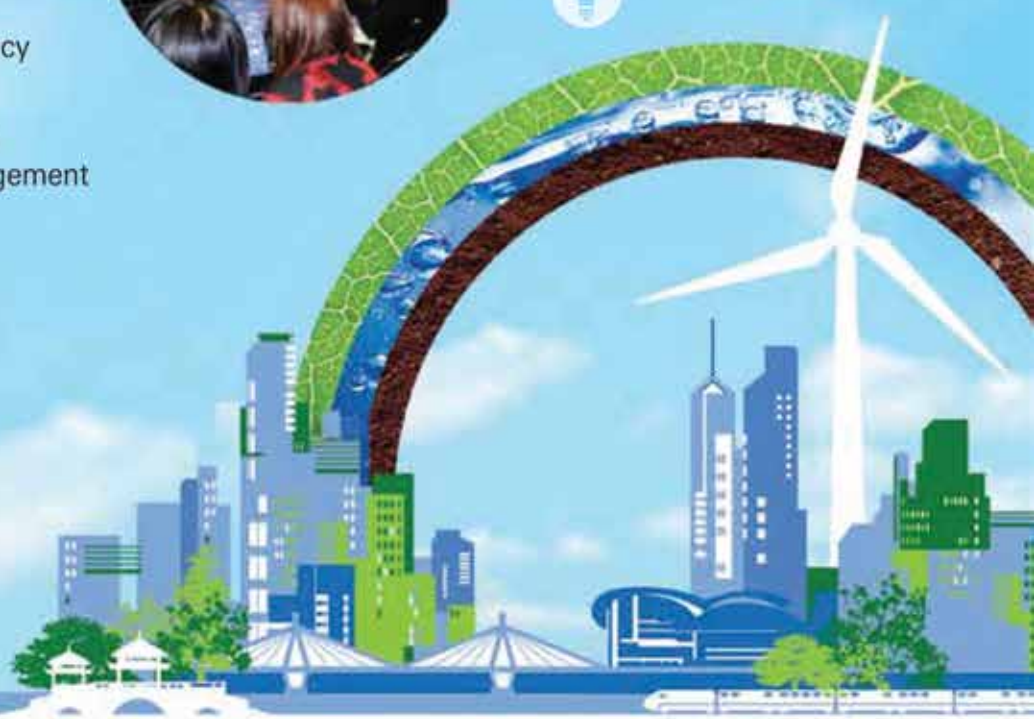

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Showcasing Water Technologies

About 500 companies from 38 countries and regions will be participating in the three-day VIETWATER 2017. The event will be held at the SECC, Ho Chi Minh City from November 8-10. It is Vietnam's leading international water supply, sanitation, water resources and purification event.

This is a specialised water trade event in Vietnam, with 14 international pavilions focusing on a wide array of technologies, innovations and solutions of boilers, coatings, desanitation systems, drill systems, filters, fittings, mixers, pumps, pipes, tanks, water supply equipment, wastewater treatment equipment and chemicals, water metres, and other services related to desalination, dewatering, sewerage and purification.

Hosted by Vietnam's Water Supply and Sewerage Association and supported by the Ministry of Construction, International Water Association, Singapore Water Association and other associations in different countries and regions, this year's event marks the 9th edition of VIETWATER.

According to H.E. Phan Thi My Linh, Vice Minister, Ministry of Construction, "VIETWATER has encouraged the transfer of innovations and technologies, strengthened business cooperation and attracted financial support from domestic and foreign organisations for the development of the water industry in Vietnam."

Themed "Toward Sustainable Water Development – International Experience", this year's event continues to provide an insightful water conference, presenting orientation on water management policies, new technologies and solutions, as well as managing international experiences. Also, during the three-day event, there will be many technical seminars featuring innovative technologies and some practical case studies.

For the first time, VIETWATER will organise the "Water Innovation Gallery" to uncover new technologies and innovation. The Gallery will showcase exhibitor's latest innovations and will help visitors to find solutions for their business.

"The objective of this gallery is to promote newly launched technologies and to help guiding trade visitors to the companies of their interest and therefore connecting exhibitors to the right and potential partners," said Ms. Eliane van Doorn, Director Business Development UBM ASEAN.

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Aquatech Amsterdam draws in the crowd

The Aquatech Amsterdam has set a new record attracting 900 exhibitors for its Oct 30 opening and organisers are looking at options to add more square meters to the already fully filled halls.

The success is primarily defined by the international reputation the show acquired since its first edition in 1964. It is the oldest and the largest trade show on water technology in the world and companies from around the world are eager to get on board.

With over 70% of visitors flying and driving in from other countries mainly from Europe and interests rising rapidly from Asia, USA and the Middle East, the event has a truly global flavor.

As always, the content at Aquatech is based on new developments and the advice of the exhibition committee, captains of industry and experts in their field.

And for the first time, Aquatech is organising guided tours for visitors with a specific interest in Circular Economy, Smart Cities, Urban Resilience and/or Innovation. Another new additional service is matchmaking. Visitors can prearrange networking and business appointments with exhibitors, as well as other visitors and speakers based on interests and profile.

For the fourth time Aquatech is part of the Amsterdam International Water Week (AIWW) a divers platform for water professionals around the world including a conference, a young professionals programme and social events. And new this year is the Floodex Europe launch event on water level management and flood control.

This subject was previously covered in the Storm Water Pavilion at Aquatech but with current climate developments demanded more attention and is now covered in a compact programme, with four elements, a Show Tour on Aquatech Amsterdam, a knowledge programme, a networking gathering and a site bus tour.

The Aquatech Amsterdam will be launched on Oct 30 and the Floodex Europe launch on Oct 31. **AW**

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Seamless transition from process to manufacturing

Industry 4.0 brings together the worlds of continuous and discrete production

Festo press photo Display Fluid and motion control 3

With the dawning of the Industry 4.0 era and the reliable automation technology it brings, seamless transitions from continuous manufacturing processes to discrete ones should no longer be a problem. Through its solutions for more energy efficiency, including real-time diagnostics, condition monitoring, decentralised intelligence and autonomous decision-making mechanisms.

Festo, a global player and an independent family-owned company with headquarters in Esslingen am Neckar, Germany, is providing its customers with the right automation tools to take advantage of this burgeoning trend. The company also supplies pneumatic and electrical automation technology to 300,000 customers of factory and process automation in over 40 industries.

Media valves from Festo control various fluids, be they gases, highly viscous fluids, pastes or granulates, in machines and systems during cooling, lubrication, cleaning, washing and sterilisation, as well as dosing and mixing. Synergy effects between fluid and motion control are achieved when Festo valve terminals and the automation platform CPX are used. Their comprehensive level of function integration means successful transporting, moving, sorting, counting, handling, gripping, vacuum and packaging operations, open-loop and closed-loop process control, and much more besides – with OPC UA for Industry 4.0 included.

MEDIA VALVES, PROCESS VALVES AND VALVE TERMINALS

Examples of the media and process valves for liquid and gaseous media, or even granulates and pastes, include the angle seat valve VZXF, the ball valve actuator unit VZBA, the proportional media valve VZQA and the solenoid valve VZWM. The range of valve terminals is based on CPX/MPA and CPX/VTSA, which ensure a seamless transition

between continuous and discrete processes and are in widespread use in factory and process automation. The extensive CPX product range comprises CPX-S as the standard version, CPX-M heavy-duty/metal, CPX-L optimised for control cabinets and CPX-P for process technology/NAMUR, plus solutions for everything from motion control to fast counters, all the way through to inputs for EX zone 0/1 as well as parameterisable digital and analogue signal detection and evaluation. Not only that, but the solution packages for fluid control provide yet more add-ons from a single source, including sensor technology, controllers, software, training and service.

Applications in which products are manufactured using a continuous process involve discrete manufacturing processes such as feed separating, filling and packaging. To accommodate this, Festo provides complete motion control solutions with six degrees of freedom up to the positioning axis, and virtually all kinematics for handling finished parts. From complex 3D handling systems to simple format changes, Festo can supply all the electric drive technology from a single source. Its portfolio ranges from electromechanical components through to motors, motor controllers, and decentralised controllers. One of the highlights is the electric cylinder EPCO with the controller CMMO-ST, which can be configured and implemented easily via the web cloud.

APPLICATION KNOWLEDGE

As partners to the process and factory automation industry, Festo's sales engineers use their product expertise and extensive application knowledge to put themselves in their customers' position and find the best ways of making systems and machines more efficient and productive – whether for car body welding, primary packaging, mixing, filling, testing, sorting, bulk material dispensing or cooling and lubricating media.

However, Industry 4.0 does not simply revolve around new automation solutions. It would be impossible for it to take place without people becoming equipped to deal with changes in the working environment. The new opportunities it is heralding require employees in industry as well as students at vocational colleges and universities to be trained specifically with this in mind.

QUALIFICATION 4.0

An understanding of fully automated digital production technologies and knowledge of the layout and programming of digital system networks is crucial. Otherwise, tomorrow's employees will not be able to operate and optimise systems or develop flexible, intelligent components, and thus make a contribution to the necessary versatility and adaptability of the systems.

Festo Didactic offers a cyber-physical learning and research platform in the form of the CP Factory. This platform models the stations in a real production plant. Learning content includes, for example, systems programming, networking, energy efficiency and data management. The platform also enables flexible software solutions to be developed and tested so that they can be used in production.

Festo's products and services are available in 176 countries. With about 18,800 employees in over 250 branch offices in 61 countries worldwide, Festo achieved a turnover of around €2.74 billion in 2016. Each year around 8 % of this turnover is invested in research and development. In this learning company, 1.5 % of turnover is invested in basic and further training. Yet training services are not only provided for Festo's own staff – Festo Didactic SE also supplies basic and further training programmes in the field of automation technology for customers, students and trainees. **AW**

Blue-White's MICRO-FLO flow verification system

MICRO-FLO Flow Verification System is designed to be used with your metering pump to provide accurate Flow Measurement and Accumulated Flow Data.

Empty chemical tanks, clogged injection fittings, lost prime, and other problems can prevent a properly working pump from injecting chemical. Always know the precise amount of chemical your metering pump is dispensing with MICR-FLO.

MICRO-FLO can be connected directly to Blue-White A-100NV and C-1100V metering pumps. It may be installed directly into the pumps discharge tubing, inline in the system after the pump, or mounted to a panel.

If chemical should fail to inject, the pump will stop and an alarm relay will close, allowing for remote alarm indication or initiation of a back-up injector pump. **AW**

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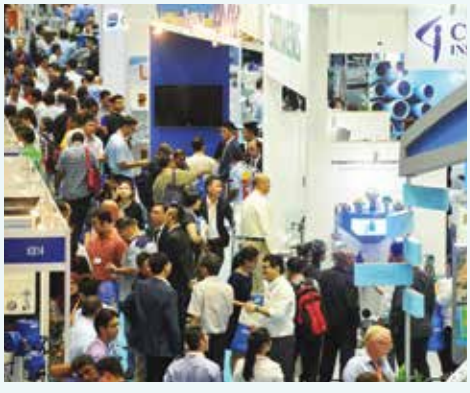

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