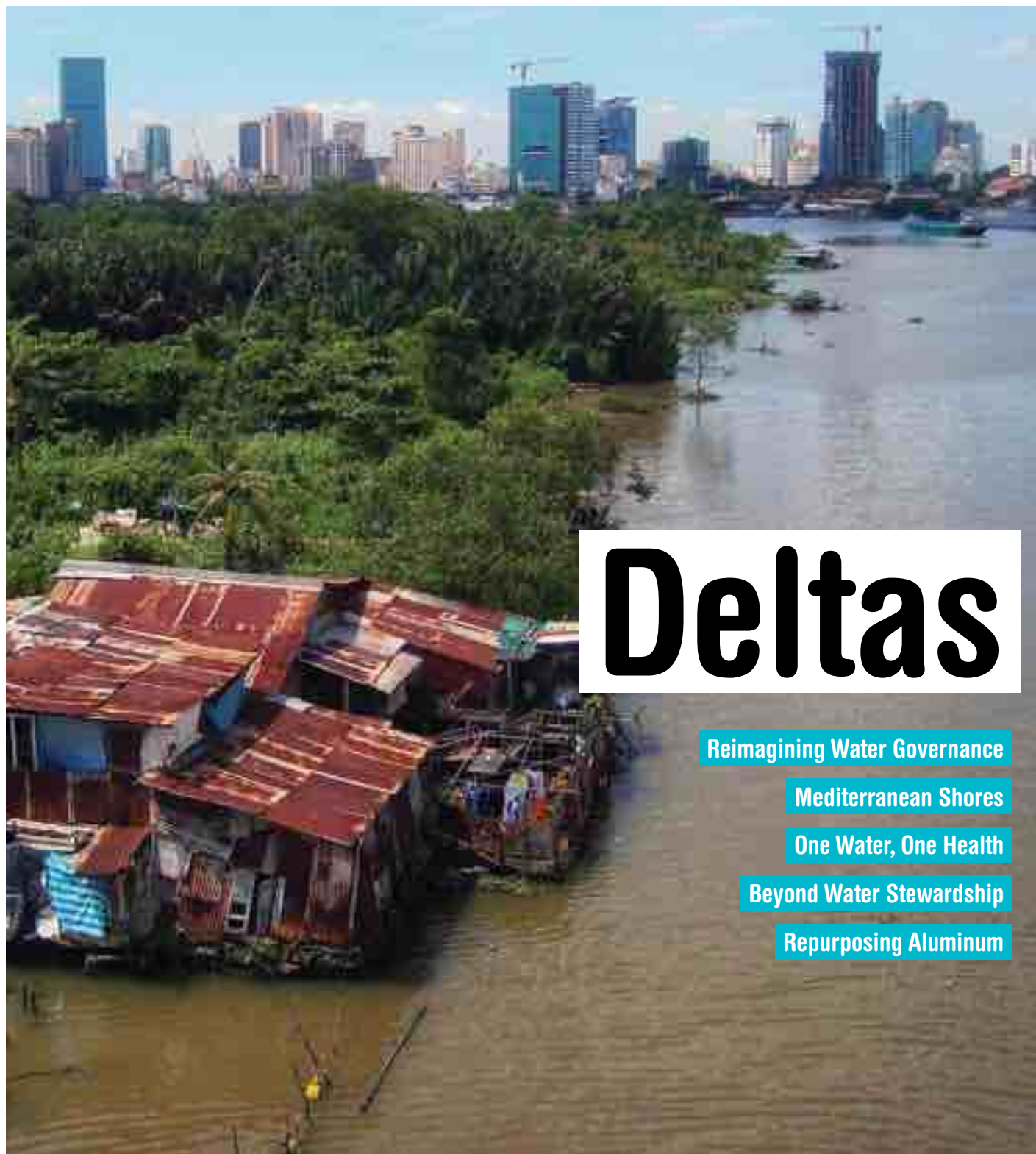


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Water



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Revolve Media is a limited liability partnership (LLP) registered in Belgium (BE 0463.843.607) at Rue d'Arlon 63-67, 1040 Brussels, and fully-owns its international publication on sustainability (ISSN 2033-2912).

To view all our publications, visit: issuu.com/revolve-magazine

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COVER IMAGE: THU THIÊM AREA, HO CHI MINH CITY, VIETNAM
SOURCE: JOEP JANSSEN



Let nature do the job



WRITER:

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The head of WWAP sheds light on the power of nature-based solutions for sustainable water management

The role of ecosystems and the concept and application of nature-based solutions (NBS) for sustainable water management is not new. Indeed, the use of natural processes to manage water spans millennia, but “nature-based solutions” terminology

emerged only recently. NBS are increasingly recognized as important to address complex challenges in water management – water scarcity, quality and disaster risk reduction – and can be used to support development goals in multiple policy areas

The next edition of the UN World Water Development Report (WWDR) 2018, entitled “Nature-based solutions for water” aims to show the importance of considering

NBS (in parallel with alternative/classical approaches) more fully in water management policy and practice, to assist Member States in the implementation of the 2030 Agenda for Sustainable Development. The WWDR series are UN-Water reports produced by the UN World Water Assessment Programme of UNESCO in close cooperation with several UN-Water members and partners.

NBS use natural processes to contribute to improving the management of water. The defining feature of a nature-based solution is not whether an ecosystem being used is completely natural (or even pristine), but rather whether the natural processes can be proactively managed to achieve water management-related objectives.

For example: both natural and constructed wetlands can play an important role in increasing water storage, improving water quality and reducing disaster risk. They can act as natural barriers or retention areas, working as a natural “sponges” by trapping rainwater surface runoffs and by controlling land erosion.



Ecosystems provide natural (“green”) infrastructure that can perform similar functions to, and therefore partially substitute or augment, built (“grey”) infrastructure. Combining “green” and “grey” infrastructure effectively, for example, in the context of integrated flood and drought risk management in a river basin, can lead to cost savings compared to grey infrastructure solutions alone. In addition, green infrastructure provides additional functions and co-benefits that can directly improve the overall performance, such as improving water quality, recharging groundwater, providing habitat for fauna and generating jobs and additional revenues.

Achieving multiple purposes through nature-based solutions is exemplified by the ‘Sponge City’ project, recently initiated by the central Government of China to improve water availability and reduce water risks in urban settlements. The ‘Sponge City’ concept uses a combination of NBS and grey infrastructure to retain urban runoff for eventual reuse. Measures include the installation of green roofs, walls and permeable pavements, as well as the revitalization of degraded lakes and wetlands, which absorb excess rainwater, thus mitigating floods. Rain gardens and bio-retention swales collect runoff and remove pollutants. Some of this water is then released back to the environment and stored to ensure the availability of water for irrigation and other uses during water scarcity situations (Horn and Xu, 2017).

Despite several advantages of NBS for water resources, there are also many challenges to enable them to meet their full potential. The main obstacles revolve around the uncertainties of performance and cost-effectiveness, regulatory and legal

Nature-based solutions are becoming increasingly recognized as an important opportunity for addressing complex challenges in water management.

constraints and limited access to information and guidance on design, implementation, monitoring and assessment.

NBS are widely claimed to be “cost-effective”. Indeed, there are many examples of where this is clearly the case, but this does not mean they are always cheap or that there will be a significant return on investment. The actual costs of NBS vary considerably according to scale, location, socio-economic boundary conditions and type of application. Financial incentives to adopt NBS, such as ‘payment for environmental services (PES) schemes’, can help improve the NBS business case and facilitate decision-making, but they remain highly under-utilized in practice. A more nuanced approach is needed that includes additional grey infrastructure in harmony with green infrastructure.

The UN World Water Development Report (WWDR) 2018 will be launched on World Water Day (22 March) in different locations around the world, including the global launch at the World Water Forum in Brasilia. WWDR 2018 highlights opportunities for nature-based solutions with caveats that

they are not a panacea and need to be considered on a case-by-case basis depending on local conditions (environmental, economic, and societal). The focus is on finding the correct balance and identifying opportunities to apply NBS more broadly – a key challenge to develop European water management more sustainably. ☺



WWW.UNESCO.ORG/WATER/WWAP

A Testimony of Water Challenges in Southeast Asia



WRITER:

Joep Janssen

Urban growth, temperature rise and melting glaciers threaten river deltas around the world. Southeast Asia – from India to China – in particular will be severely affected. Large numbers of people live in poverty, countries are densely-populated and coastlines are long. According to the Asian Development Bank (ADB), the chance that people in this region will be affected by water-related disasters is [about 25 times greater than in Europe](#). How are people tackling water challenges in Asia?

When I visited Vietnam's Mekong Delta, I found a village erected amongst the rice fields; it was built by the government after the severe flood of 2000. The villagers received me with a warm welcome. I asked them if they were happy with their safe place to live. "We no longer have to be afraid that our children will drown," one of the farmers told me over a cup of tea. "However, our commute time has increased." He explained that the housing project is three kilometres away from the place most inhabitants originally came from. He told me his old boss stopped

calling him because there were workers that lived closer to work. "We used to have work, but unsafe living conditions. Now it is the opposite."

Moving water, moving people

The farmer's story illustrates that large numbers of people will start to migrate if something happens in densely-populated, water-logged areas. This is an important trend in Vietnam, but also in other low-lying coastal countries like Bangladesh and Myanmar.





Southeast Asia is the frontline in the battle against climate change.

MEKONG DELTA, CHÂU ĐỐC, VIETNAM.

A small change in global temperatures can have big effects on people in this region. For people who live on the fringe, who invested all their savings in a rice field that is washed away after a flood, 10 days of rain can make the difference between life and penury. These people will pay the bill first.

Southeast Asia is the frontline in the battle against climate change. You will see the impact earlier here. That's ironic because these coastal residents often live a very sustainable life. However, if rice and fruit crops are damaged by saltwater, floods or

severe warming, it means a huge loss of income and people are then forced to move to the slums of Ho Chi Minh City, Dhaka or Yangon – in the worst case they cross borders; they become climate migrants.

Climate change and urbanization

Southeast Asian deltas are wedged between the Third Pole (Himalaya and Tibetan Plateau) and the Indian Ocean and are

formed by mighty rivers like the Mekong, Brahmaputra and Ayeyarwady. These rivers supply fertile sediment for agriculture, but they also bring flooding and embankment erosion. Without dikes, a large part of these countries becomes submerged during the rainy season.

Researchers predict that mean annual river discharge is expected to increase due to melting ice in the Third Pole, which is a major source of freshwater to millions of people. At least a third of Asian glaciers will disappear by 2100, according to new ►

Deltas in Southeast Asia

- research from the [University of Utrecht](#). Flood frequencies and magnitudes will increase due to higher upstream inflows and sea-level rise.

Both population growth and rapid urbanization are associated with increased electricity use and food consumption. Upstream dams are used to fuel the urban growth by generating power and providing irrigation water for food. Although dams could balance the dramatic variability of river flows between the dry and wet season, fish migration and sediment transport will be reduced. The sediment load of the Mekong River, for example, has decreased from 150 million tonnes in 1990 to just 75 tonnes in 2014 and has resulted in 300 hectares (600 soccer fields) losses of coastal area per year.

Southeast Asians face a dilemma between ecological and economic development.

The impact of upstream dams is strengthened by sand mining to develop fast growing cities along the rivers. But overexploiting sand brings the water table down, threatening rice fields and safety as destabilized riverbanks cause damage. Besides this, raising the heights of dikes to keep all flood waters, and their organic matter, out of the fields, may cause water to pass through the delta faster, and so have also great erosive impacts downstream.

Dams, sand mining and high dikes, with the added pressure of rising temperature,



1 ▲



2 ▲



3 ▲



4 ▲

mean that soil fertility and rice yields will decline. This results in farmers using larger amounts of fertilizer, higher input costs, more rice produced, stagnant farm gate prices, and continued poverty for farmers. Their lands are also subsiding mostly due to groundwater extraction, which has increased because of growing agricultural, industrial and domestic demands. In some areas, the rate of land subsidence has now reached several centimetres a year, which is a lot higher than the global sea-level rise of a few millimeters a year.

Land subsidence is a global phenomenon and occurs when the land-surface area is lowered due to changes that take place underground. The subsurface movement could be the result of anthropogenic actions, such as drilling for oil or fracking for gas, or just part of the natural movement of earth materials.



5 ▲

People leave their homes as the situation gets worse: storm intensity, temperature rise, flooding, coastal erosion, land subsidence, salinization and shortage of freshwater. Large areas of Southeast Asian deltas may be wiped out in 100 years if drastic measures are not taken. ►



6 ▲

1. DHAKA KORAIL SLUM, BANGLADESH.
2. HO CHI MINH CITY, VIETNAM.
3. MEKONG DELTA, LONG XUYEN, VIETNAM.
4. HO CHI MINH CITY, VIETNAM.
5. RURAL PEOPLE LIVING IN THE RIVER DELTA, KHULNA, BANGLADESH.
6. SAND MINING, MEKONG DELTA, VIETNAM.

► Taming the rivers

Southeast Asian countries just started to tame the mighty rivers, because of recent wars and political struggles. The countries understand that if they fail now, they remain poor, because water-related disasters will be very costly for infrastructure, agriculture and industries. They also know that their environmental delta dynamics are much more complicated than Europe's Rhine-Meuse Delta: the average discharge of the main river in the Netherlands is just 2,300 cubic meters per second which is minor when compared to the main rivers in the Mekong (16,000 m³/s) and the Bangladesh (30,000 m³/s) deltas.

**1/3 of Asian
glaciers will
disappear by
2100.**

The governments of Vietnam (2009), Bangladesh (2013) and Myanmar (2013) have asked the Netherlands to cooperate to make a delta plan for safe, prosperous and sustainable deltas. The Dutch government came up with their own Delta Plan in 2008 to upgrade flood defences and introduce adaptation measures to reduce the effects of climate change. The plan included much more than the upgrading of thousands of kilometres of dams and dikes; it was a comprehensive strategy on water safety, the future scarcity of freshwater, flood risk management, and spatial planning of new urban areas and infrastructure.

The Netherlands and other European countries are now exporting these delta plans and soft approaches to Southeast Asian countries. However, Europe has a long

history of constructing massive chains of flood protection structures like dams and barriers. Europe has embraced the **"Building with Nature concept"** based on ecological and engineering design principles. The emphasis is no longer on hard measures against the water but instead on flexible, soft structures in harmony with the water, like gently sloping riverbanks and room for river projects.

China is also very eager to help to develop Southeast Asian delta countries. China brings in the hard infrastructure development which contains projects for ports, railways, and inland waterways. European countries are trying to influence and cooperate with local knowledge and governmental institutes and decision-makers.

For example: Chiang Mai in Thailand is an important city for influencing local NGOs to become the mouthpiece for European practices and 'western' ideas; or the inter-governmental river basin organization known as the Mekong River Commission, established and funded by the U.S. and other European countries. On the other hand, China is focusing on business-to-business (B2B) partnerships whereby many local companies and developers are pushing for China-backed economic development.

Southeast Asian governments want to tame their mighty rivers, like the 'West' did centuries ago, but they feel that they are starting at the wrong moment because Europe's approach has become moderate – less economic and more ecologically-driven. Southeast Asians now face a dilemma between ecological and economic development.

Cooperation is a regional solution

International funders need to improve the coordination of financial aid. This would prevent local governments from playing one party off against the other, as it would

benefit from having many separate projects that individually bring in a lot of money. Also, donor countries should set the right example and not point an accusing finger at the poor cooperation in Southeast Asian countries when international cooperation is almost non-existent.

In Bangladesh for example, the World Bank is working on heightening dikes to protect several coastal polders from sea-level rise. One polder next to it, the Blue Gold Project is being developed. It helps farmers to boost agricultural productivity and profitability through training on improved agronomic practices, value chain development and effective water management. There is no formal cooperation or knowledge exchange between both two projects which are located next to each other. There are many cases like this in Southeast Asia where cooperation between donors needs to be improved. ►

A polder is a low-lying tract of land enclosed by **dikes** that forms an artificial **hydrological** entity, meaning it has no connection with outside water other than through manually operated devices. There are three types of polder:

1. Land reclaimed from a body of water, such as a lake or the **sea bed**

2. Flood plains separated from the sea or river by a dike

3. Marshes separated from the surrounding water by a dike and subsequently drained; these are also known as **koogs** especially in Germany (SOURCE: WIKIPEDIA)

IMAGE: CANAL BONARD, HO CHI MINH CITY, VIETNAM



Deltas in Southeast Asia

- This proves difficult, because donors believe that large-scale engineering projects produce more results are economically more advantageous and accountable. Another problem is that the 'lessons learned' from small-scale initiatives are not properly transferred to local decision-makers and international delegations like the World Bank. This makes it very hard to learn from each other.

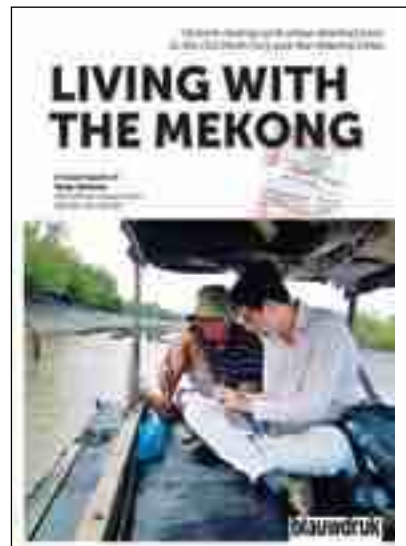
The [“Water as Leverage for Resilient Cities: Asia”](#) programme may offer some solutions. This international partnership between the Dutch Water Envoy, the Chinese established Asian Infrastructure Investment Bank (AIIB) and 100 Resilient Cities is aimed at countering water challenges based on a design-driven, multidisciplinary approach for greater coherence between funding, projects and institutions.

Water problems in Southeast Asian deltas can only be solved if government strategies and techniques are linked with tactics developed by local people and which are embedded in their culture and history. We need to listen to their stories, understand their tacit knowledge and ask: What do you

Dams, sand mining and high dikes,
plus rising temperature, means that soil
fertility and rice yields will decline.

need to cope better with climate change and urbanization?

This brings me back to the village erected on Chau Doc in Vietnam's Mekong Delta. Here, I realized that the power of water may push more and more rural people to migrate to places where they may become trapped into the vicious cycle of poverty. This should be an important motivation in the realization of plans for all those threatened delta regions in the world: to give hope and provide a new future to people who are not able to escape poverty. In other words: don't make plans to make money on the Mekong, but improve living with the Mekong. ☺



AGRICULTURE IN THE MEKONG DELTA, VIETNAM.





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The uncommon management of water

Reimagining water governance



WRITER:

Remi Cerdan & Elisa Asmelash

Despite technical solutions and international funds, universal water access is still far from being achieved. The transition from unsustainable water management practices to a better and just administration of water should go beyond the simple fiddling with management practices, and include a major renovation and reimagining of water governance.

Water is an essential resource. Sustainable Development Goal (SDG) #6: “Ensure access to water and sanitation for all” is the

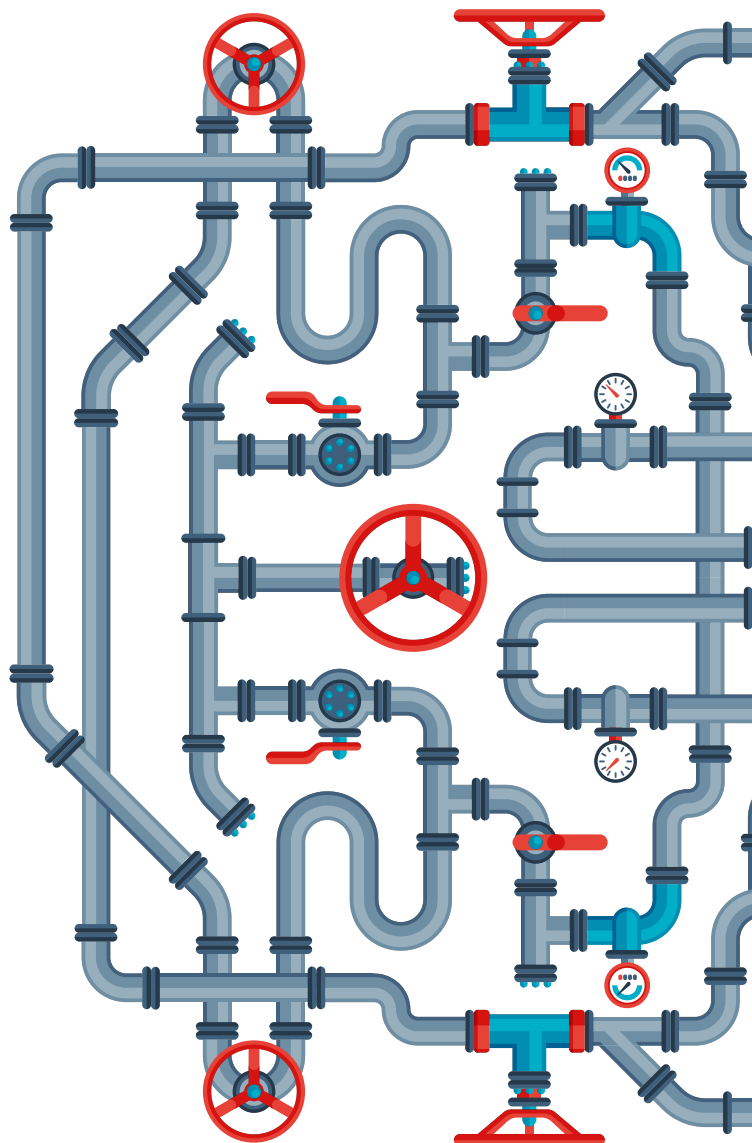
evidence of its growing global concern and recognition of its link with poverty by the international community. Regardless of the type of ownership, the affordable and universal access to clean and potable water is now indisputably considered a human right.

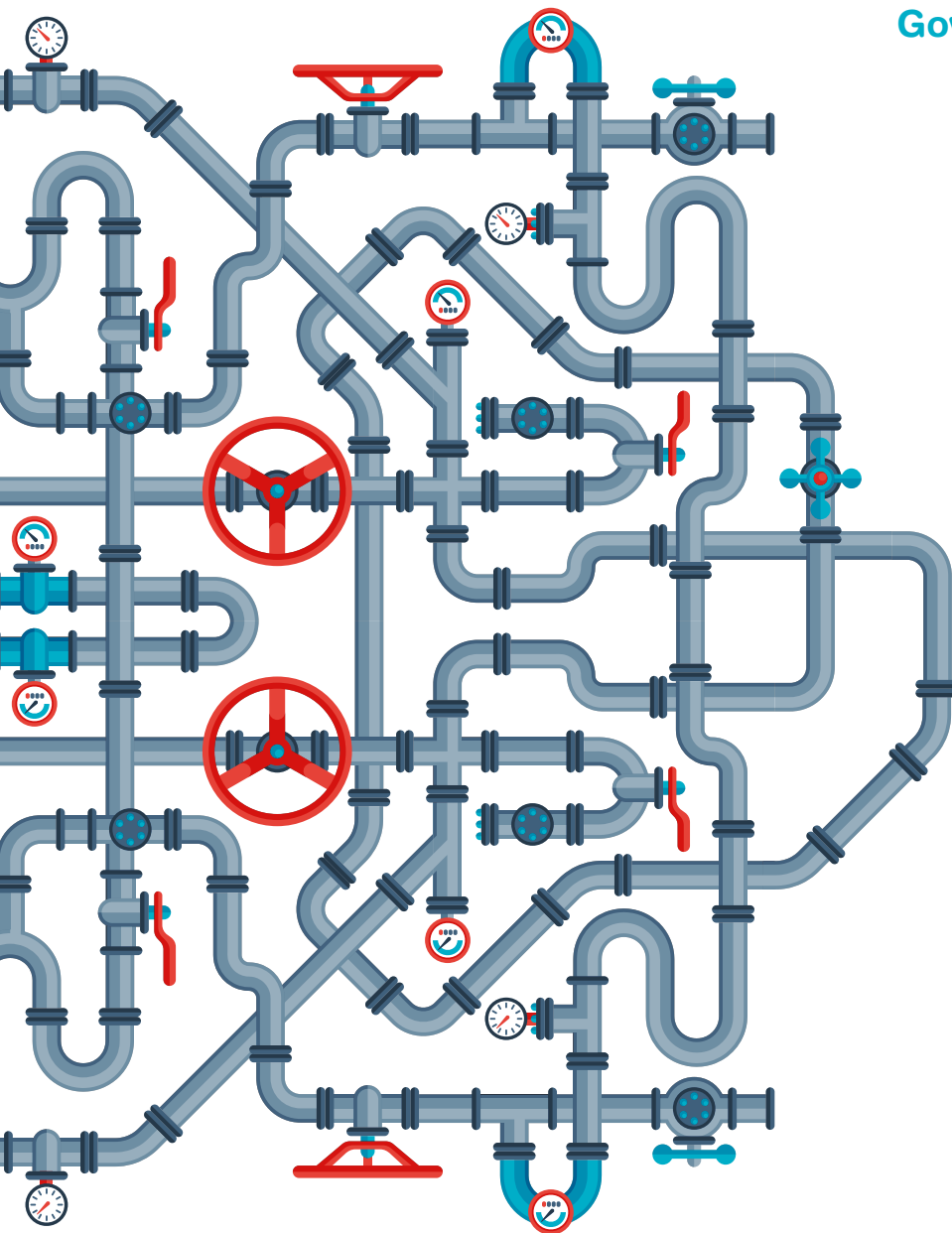
But why are there so many failures in water supply?

International donors and NGOs treated water access as a purely technical and building wells quickly became the poster child of development aid projects. Evaluations of these

projects led by development aid stakeholders show a dire situation: 30-50% of water, sanitation or hygiene projects are not operational after five years and an additional 20% are only partially functional. Global financial losses related to water, sanitation and hygiene projects over the last two decades are estimated at \$1.5 billion.

As a consequence, international donors have begun to intervene in the water management systems by considering water as an economic good. As such, water is a very unusual good: its supply is finite and locally specific, and because of positive





global wave of water privatization began in the 1980s and was driven by two key political factors.

Firstly, the ideological change represented by the privatization of water in the UK and demonstrated that it was profitable and feasible to privatize water. Secondly, the influence and persuasiveness of international donors, especially the World Bank, to promote and support the involvement of the private sector in the management, financing and ownership of water systems in developing countries. The propaganda was so central to the World Bank's policies that an official told an international conference in 2000 that "there is no alternative" to privatization.

So private companies started expanding at a global level in the 1990s and the early 21st century. The global share of private water operations grew at a considerable pace as corporate giants such as Suez and Nestle took over municipal water utilities in both developing and developed countries.

However, in the early 2000s the belief preached by water companies that only the private sector could efficiently manage water supply was exposed as unrealistic. The global wave of water privatization was therefore pushed back for three key reasons:

1. Fundamentally, the multinationals failed in general to make acceptable returns for their shareholders.

Operations, especially in developing countries, were exposed to high-level risks, such as currency devaluations, economic crises, over-optimistic projections, and resistance to price rises. These challenges add up to make profitable investments very difficult in improvements for poor households due to their inability to pay the full cost of the water supplied, without any public subsidies.

2. The intensity and degree of public and political resistance to water privatization.

The opposition group includes trade unions, environmentalists, ►

externalities it implies that its supply and demand should be managed by market forces. The solution was then to open the market to private water companies which would be able to guarantee a sustainable management of resource.

The failure of water privatization

The management and ownership of water supply services began in the 17th and 18th century and has been historically dominated

by the public sector. The municipalization of water utilities was widespread in most European countries and was seen as a way to overcome the systemic inefficiencies of private contractors. Similarly, in developing countries, the commitment to water supply as a public service was closely associated with the process of decolonization and of building independent states and thus controlled by the central governments.

The introduction of private companies into water supply services over the last 20 years has been subject to considerable political, social and academic debates. The

- ▶ consumer groups and citizens' organisations as well as political groups, all sharing the common belief that water supply is a vital service, which should be public and not left at the mercy of private companies, that would only seek to profit from their monopoly of such a vital resource. In addition, evidence and suspicion of corruption of both politicians/officials as well as multinationals exacerbated and reinforced public opposition.

3. The failure of the private sector to live up to its expectations. The private companies' inability to undertake and sustain investments in water supply infrastructures has worsened and amplified the two previous points. This failure can be seen both in developing countries, where the lack of private investment is simply because it would be bad business, as well as in developed countries, where public sector operations would be of better value.

Why are there so many failures in water supply?



Reimagining water governance

How do we reach fair, transparent and sustainable access to water resources? How do we make sure that human beings are not confronted with situations of extreme shortages of water?

These are key questions at the heart of the debate around transitioning from unsustainable water management practices to a better co-existence with nature and a more just administration of water. However, for this transition to be meaningful and effective, it should go beyond the simple fiddling with management practices, and include a major renovation and **reimagining of water governance**.

Indeed, the water crisis is not just the product of natural limitations of water supply, a lack of technology and financing, which are all important factors, but it is also the result of decades of profound failures in water governance by public and private institutions, which have long tried to place water in a market framework. Pricing is essential to operate a water system, but it must be fair in a way that higher volume, wealthier users pay more per unit and the poorest ones receive subsidized lifelines. This has hardly ever been the case, as both policy-makers and private operators have tried to make profit through users, regardless of local conditions and needs.

An alternative approach to public and private water management is represented by the **commons-based solutions**. This type of management is not particularly innovative as it has been applied for numerous rival goods from pasture lands in medieval England to irrigation systems in Peruvian and Bolivian Andean communities. A precise definition of such a local approach is hard to reach but it implies that the resource is not possessed by any stakeholder and that the users' community gathers to jointly define management rules for its exploitation. Such an approach implies the direct participation and engagement of citizens in a broad range of issues such

as knowing the details of how the system will be financed, how the resource will be priced, and how the watershed will be protected for present and future generations.

Not only does the commons approach suggest other ways of organising the water system than those centred on private property, but it also provides a valid and comprehensive way to confront water management challenges – leading us to a society favouring participation and cooperation as well as equitable access to common goods.

The management of water resources as well as other natural resources through the commons approach is not by itself a winning one. Many economists and researchers have criticized this type of organization. The most famous one is Garrett Hardin in his 1968 article "The Tragedy of the Commons", in which he stated that free access to a resource triggers its over exploitation, as each individual seeks to get the most of it for a personal gain. The resource should be either nationalized or privatized to guarantee its conservation. However, critics of this theory have emerged since its publication fuelled by the failure of nationalized and privatized resource throughout the world. In particular, the political scientist Elinor Ostrom has worked on many examples of commons management analysing the key success factors of this type of organization. For her work, she was awarded with the Nobel Prize of Economics in 2009, becoming the first and only woman to gain such recognition. In her analysis, she highlighted eight critical factors in the success of the commons management of a resource by its users:

- The community of users of the resource has clear boundaries.
- The governing rules of the resource use match local needs and knowledge.
- The users of the resource can participate in the decision-making process and modify the rules of its use.



IRRIGATION IN NAZCA, PERU. SOURCE: SANCHO PANZA

- A monitoring system is implemented and monitors are part of the users or accountable to them.
- Violations are punished through a gradual system of sanctions.
- Arising conflicts and issues are dealt with low cost means accessible to the community.
- The rule-making rights of the community of users is recognised by higher authorities.

- In the case of large user communities, the governance is organised in several layers from the local use to the entire system.

The set of factors developed by Ostrom covers the full management system from decision-making process to sanctions and interfaces with other entities and organizations. It is based on a 'down to earth approach' that focuses on the actual enforcement of the rules rather than on a theoretical point of view. Finally, it does not deny the occurrence of conflicts between

users but stresses the need for a comprehensive and collectively made set of conflict solving processes and sanctions.

The work of Ostrom was carried out on several cases of natural resources management from pastures to fish resources but it has been applied to irrigation and clean water services highlighting the fact that a water management based on the commons approach is viable. ►

► The example of peri urban Kinshasa



The case of the city of Kinshasa is interesting from many points of view. Firstly, water is not scarce in this region thanks to abundant rainfalls and adequate geologic situation. However, despite this, the rate of households connected to the grid is still low, around 49.2% in 2013, which proves that water availability is not the real issue behind water access problems. Secondly, Kinshasa is the perfect example of the sprawling cities of the developing world that are the main driver behind the skyrocketing urbanization rate in these countries (more than 50% worldwide).

Water management is split between the REGIDESO for urban areas and the National Rural Hydraulic Service for rural areas. In 2009, the REGIDESO was turned into a commercial company fully owned by the state, based on the advice of the World Bank. Since then, no progress has been made in terms of water access, as the share of households connected to the network in the city centre of Kinshasa slightly dropped from 50.2% in 2010 to 49.2% in 2013. The service provided by REGIDESO has suffered major problems of deterioration and frequent supply disruptions and only 30% of the customers are equipped with meters (not necessarily operational), which makes water management and cost recovery very difficult. As a result, only 52% of the water volume produced by REGIDESO in Kinshasa is ultimately billed to the customer, with a rate that has not changed in the last 15 years.

The situation in peri-urban areas is even worse, as only 10% of the households ►



**BANKS OF CONGO RIVER IN KINSHASA,
DEMOCRATIC REPUBLIC OF THE CONGO.
SOURCE: SEREIN**



- ▶ are connected and among them less than 10% are equipped with meters. As a consequence, people rely on cart dealers and thus end up spending a higher share of their income for water than households in urban areas. In order to improve the situation, several engineers from the National Rural Hydraulic Service created a local organization, ADIR, to promote the creation of community based networks. This model, named ASUREP, was imported from the DRC provinces to the outskirts of Kinshasa in 2007. Since then numbers have grown. There are now 37 networks (more than 500 000 people) operated by ASUREPs. The ASUREPs are organized around a General Assembly led by a Board and a Management Unit with proper rules in place. (e.g. Board members cannot be related to Management Unit people, members have limitations in their mandates etc.). Tariff setting is determined by each ASUREP and prices are slightly higher than those of REGIDESO. However, ASUREPs' tariffs allow a full cost recovery for water management and a better-quality service which explains that only 13% of the water volume produced is not billed (compared to almost 50% for the REGIDESO). ASUREPs have also created a common federation to represent them and to exchange experiences.



EDGE OF KINSHASA, DEMOCRATIC REPUBLIC OF THE CONGO. SOURCE: FRED R.

How do we reach fair, transparent and sustainable access to water resources?

Some points are of course to be improved in the ASUREP management. For instance, ADIR is still heavily involved for decision-making process and monitoring, the interface with Congolese national authority is still to be precisely defined and the capacity of ASUREPs to finance the necessary investment to upgrade the water network is not yet established. However, the ASUREP structure applied in the context

of peri-urban Kinshasa is still quite young (10 years) and their results are much better than the existing water management public entity.

If carefully implemented, community-based organizations following the commons based approach has been proved to create a local, democratic and effective management of the water resource. They also help

to empower communities by allowing them to collectively decide the rules and principles depending on the local context, rather than a top-down approach led by national entities, the private sector or international donors. ☺



Revelle Group is a consulting company working in developing countries and emerging economies in three key sectors: energy & climate change, environment and sustainable economic & social development. Revelle works with governments and international organisations to help create visions, develop roadmaps and implement strategies that tackle today's main global challenges for a more sustainable world. Revelle strongly advocates for developing a flourishing private sector that realises the sustainable energy potential of these countries.



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When innovation meets water
scarcity challenges:

A technological and financial perspective for a better water future



WRITER:

Gaetane Suzene

Traditional water resources management strategies have focused mainly on building additional infrastructure and retrofitting existing ones. The emergence of innovative technologies and services will be game-changers for addressing water scarcity challenges, and will be a cost-effective way to manage water resources in the future.

According to the European Environment Agency (EEA), one-third of European countries have relatively low availability of water, less than 5,000 m³ of water per head per year, which equals 14 litres/day when ►

MONEGROS SEMI-DESERT, SPAIN.
SOURCE: SMOOBS



Almost half of the
EU population lives
in water-scarce
areas.



Innovation & Efficiency

- we know that the average consumption is around 100 to 140 l/day. Moreover, in Europe, even countries like Belgium, the UK, and Germany, which are considered as water-healthy are now experiencing water scarcity. The EEA claims that “water scarcity occurs where there are insufficient water resources to satisfy long-term average requirements. It refers to long-term water imbalances, combining low water availability with a level of water demand exceeding the supply capacity of the natural system”. Water scarcity is exacerbated by well-known additional factors such as the constant population growth, rising demand for water, particularly in industry and relentless urbanization.

Industry is expected to use 4% more water each year in the future, according to ING Bank. Water is starting to be seen as a potential performance differentiator for industries and has been integrated in balance sheets for business risks and asset management. The Ford Motor Company, for instance, recycles 100% of its industrial wastewater in India to offset freshwater consumption. The Coca Cola Company

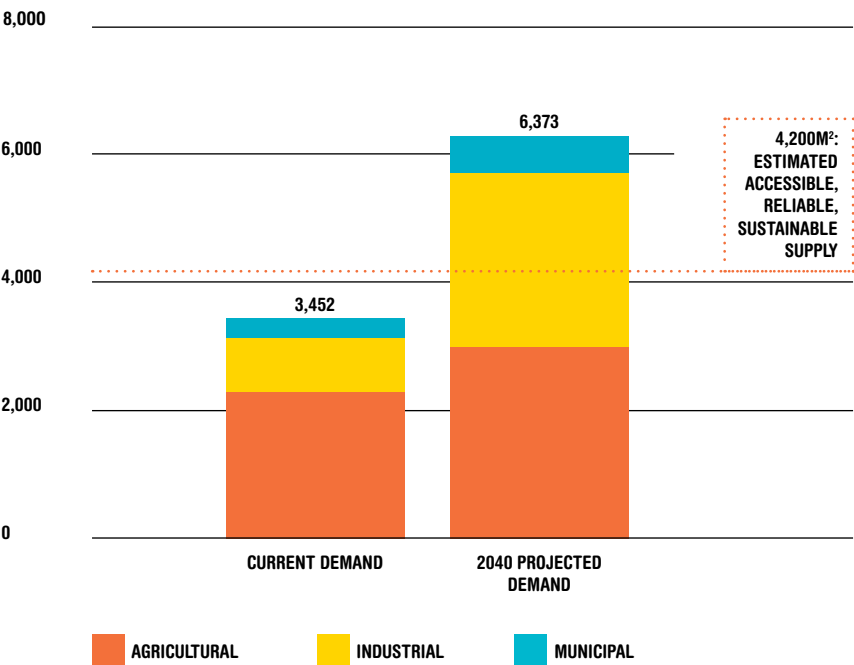


TABERNAS SEMI-DESERT, SPAIN. SOURCE: AMJAD SHEIKH



Freshwater demand keeps on rising with fastest growth in industry (BILLION M³)

SOURCE: ING CALCULATIONS, BASED ON IFPRI, AQUASTAT.



has set a similar objective to: “By 2020, safely return to communities and nature an amount of water equal to what we use in our finished beverages”.

Sustainable water resources management is an obvious response to addressing water scarcity. The implementation of innovative technologies and services that will contribute to optimize both the available water resources and the use of water can be considered as equally important now to address water scarcity challenges. ►



► Smart Water Innovations

The emergence of the Internet of Things and more generally of smart technologies has allowed the water sector to address long-standing challenges that could worsen water scarcity impacts. Many publications have already presented the benefits and opportunities of introducing artificial intelligence (AI), machine-learning and augmented reality (AR) to the water sector. As further illustrations of this phenomenon, here are some examples of successful start-ups:

1. UTILIS, an Israeli start-up, detects urban water leaks through satellite images. It use technology that was invented to detect water on other planets. The technology looks for water and not noise, as other technologies do. It means that leak management can be prioritized and non-revenue water addressed. UTILIS reports that 60-70% of non-revenue water is due to physical losses. The business model is based on “Data as a Service”.

UTILISCORP.COM

2. Improving water efficiency is not just about technology; it is equally critical to engage with customers to change behaviours. **ADVIZZO**, a UK-based start-up launched in 2015, has designed a platform that allows for engaging with water end-users and to help utilities understand their consumer base while improving operational management. The technology combines machine learning and behavioural science to identify consumer use patterns, to deliver predictive analytics of water demand to plan better for future water supplies strategy, and to engage with consumers in a more targeted and personalized way. The first results indicate that there is a 2-3% reduction in water use after a six-month period of implementing the solution, and the e-marketing conversion rate is two to three times faster than with traditional programmes.

WWW.ADVIZZO.COM



The smart water market is estimated to reach between \$15-20 billion by 2020.

3. Innovative technologies and services have entered the agricultural sector: AgTech start-ups, like [CERES IMAGING](#), [ARABLE](#), [PRECISIONHAWK](#), [SENCROP](#) and [TERRAVION](#), have developed technologies and services that range from smart sensors, drones for in-field monitoring, aerial imagery and predictive analytics. In France, [WEENAT](#)'s solution allows farmers to optimize irrigation needs by adapting water delivery according to the crop's needs and the soil water storage capacity.

WEENAT has succeeded in addressing a major barrier to market entry in agriculture, regarding the return on investment time which appears could be as fast as one year.

Less digital but with the same purpose of resource efficiency, [MOASIS](#), in the US, manufactures a soil additive that allows growers to optimize water use in agricultural soil. This hydrophilic polymer can hold 250 times its weight in water and is used as a soil amendment or seed coating. The

product holds excess water near the seeds or roots and releases it as the soil dries out, resulting in less plant stress and significantly higher crop yields, while reducing water needs. Results indicate improved crop yields by 6-15%, with up to 25% less irrigation.

Desalination Provides Water

Innovative desalination technologies are ready to topple incumbent technologies. They will make non-conventional resources more attractive and increase access to water. Thanks to technological developments, desalination has been a response to the global water deficit. In 2016, the [International Desalination Association \(IDA\)](#) estimated that there were around 20,000 desalination plants in 150 countries to supply 300 million people. In ►

PORT STANVAC DESALINATION PLANT, AUSTRALIA. SOURCE: VMENKOV



- countries such as Australia, desalination plants can provide up to 50% of drinking water.

From an economic point of view, desalination has been an expensive option – the water cost can reach up to \$5/m³. A new generation of membranes are being developed to reduce operational and capital costs by up to 15%, for example, a reverse osmosis system. **ANFIRO**, **CLEAN MEMBRANES**, **DESALITECH** are examples of start-ups that are active in this field. An early-stage Israeli start-up, **HYDROP**, has developed a “peptoid-based material” that can be embedded in the reverse osmosis membrane, without amending its structure. This material is claimed to reduce up to 30% of the energy required when using reverse osmosis processes. New technologies also target high levels of recovery for brine management (up to 98%) and reuse of water.

The development of renewable energy has been another opportunity to improve access to water. Autonomous solar seawater solutions are being developed, albeit still using membranes. Innovation in this area has mainly been directed at reducing the overall costs of desalinated water and providing an off-grid solution, so that it can stand as one of the relevant responses to water shortages in remote areas, on islands there is tremendous potential.

Emerging technologies might make desalination even more attractive. Although these are still at an R&D phase, alternatives to existing membranes are being studied. A UK-based research team succeeded in “creating a graphene-based filter capable of removing salt from seawater” and announced that they would now test them

against existing membranes, and assess the scalability. Similarly, engineers at the University of Illinois in the U.S. have been making progress in developing a saltwater desalination process that could be cheaper than conventional reverse osmosis membranes. The first results indicate that the technology could work for brackish waters, with low salinity. The next steps will focus on high-saline seawater.

Water scarcity challenges cannot be addressed without mentioning air-to-water technologies. A year ago, as Venture Adviser to Aster Capital, a French VC Fund, I produced a poster listing a few start-ups that have developed or are developing technologies to produce water out of air which is a billion-dollar market. An operational start-up **WATERGEN** in Israel seems to be fully successful in marketing its technologies. Two of the outstanding barriers are the energy costs, and relatedly the cost of the produced water. **WATERGEN** reckons that 10,000 of their devices could supply 25 million people. The UK-based start-up **REQUENCH** is designing a technology that is based on a desiccant technology using the principle that salt absorbs water. This drastically reduces the energy requirements making solar photovoltaic power practical with over 25% at low humidity. Water can be

produced at a relative humidity as low as 15%.

Innovation in the water sector should not be considered just a buzz word; it can be a tangible solution to address water scarcity challenges the world is facing. Economically, the technologies aim at reducing CAPEX and OPEX, which should be an additional incentive for greater market uptake. Financially, innovative technologies and services should be envisaged as investments for a sustainable water resources future. ☺

The United Nations expects 14% of the global population to receive water from desalination by 2025.



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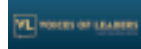


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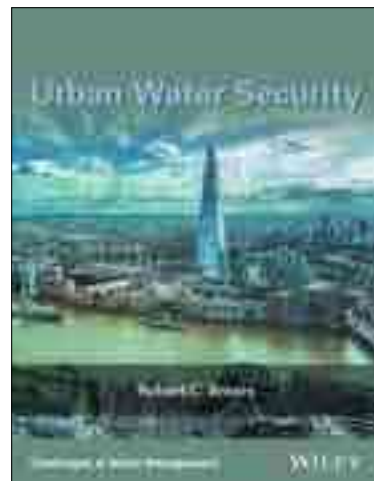
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How can cities reduce water-energy nexus pressures?



WRITER:

Robert Brears



Cities have become the driving force of the global economy. Accounting for over half the world's population and generating around **80% of global GDP**, cities provide numerous opportunities for development and growth. Cities also bring about risks and challenges to people and the environment: by 2050, demand for water is projected to increase by 55% mainly due to increased urban populations; demand for energy in providing water and wastewater treatment services will increase as well.

Water and energy interconnected

Energy and water are interlinked in two ways: 1) water is used in the production of nearly all types of energy (coal, geothermal, hydro, oil and gas, nuclear), and 2) energy is the dominant cost factor in the **provision of water and wastewater services**

(extracting and conveying water, treating water, distributing water, using water and collecting and treating wastewater). In fact, energy can account for up to 30% of total operating costs of water and wastewater utilities: in some developing countries this can be as high as 40% of the total operating cost. Meanwhile, on average, 15% of the world's total water withdrawals are used for energy production.

Reducing water-energy nexus pressures

Cities around the world have initiated innovative processes that attempt to disconnect rising urban populations from increased demand for water and energy. Examples include Dubai in the UAE and Phnom Penh in Cambodia, which use technological and management innovations to reduce urban **water-energy nexus** pressures. 

**On average 15%
of the world's total
water withdrawals
are used for energy
production.**

CONTACT: RCB.CHC@GMAIL.COM

THIS ARTICLE IS BASED ON A CONTRIBUTION FROM THE [WORLD BANK WATER BLOG](#).



Case 1: Smart meters in Dubai

In its pursuit to become [water and energy smart](#) the Dubai Electricity and Water Authority (DEWA) is installing smart meters across the Emirates, enabling customers to receive real-time information on water and energy consumption. This will enable them to monitor actual consumption to better understand and manage bills.

In addition to providing current consumption data, DEWA's smart meters will provide customers with [historical consumption data](#) and a breakdown of consumption processes that use water and energy. This will enable customers to identify water and energy efficiencies in their homes. The smart meter data is delivered to customers via DEWA's [Smart App](#), allowing them to view billing information, graphs to [check and compare consumption](#) as well as set caps for both water and electricity consumption. **DEWA aims to have 1.2 million meters installed within five years.** The installation of the smart meters will be in two stages:

1. Smart meter installation: 200,000 smart meters will be installed around Dubai which will be connected to a new advanced computerized system and software.
2. DEWA will install the remaining smart meters. Enhancements of the operating system will be performed in conjunction with increasing the number of installed meters.



SOURCE: DMITRY A. MOTT



Case 2: Phnom Penh reducing its leakage rate

Phnom Penh's Water Supply Authority has a [non-revenue water \(NRW\) rate of around 7%](#), which is one of the lowest rates in the world. To reduce leakage, as well as energy required in treating water to potable standards (nearly [45%](#) of the authority's operating cost is attributed to energy consumption) the authority has installed a telemeter system that detects high leakages and illegal connections in different zones of the water supply system. To detect leakages more efficiently the city has been divided into 58 sub-zones each with its own local leak detection system. To ensure leaks are fixed rapidly the utility has leak repair teams on standby that operate 24/7, with the response time being two hours after a leak is detected.

To ensure the utility is pro-active in detecting leaks the authority has established leak detection teams that are offered incentives to find leaks throughout the water supply system: to become more efficient in its operations incentives have become [an important element of the authority's staff remuneration](#). At the end of each year the utility's NRW Committee reviews all leakage work and analyses each leak detection team performance. The most efficient teams – based on the ratio of leaks at the start of the year with the end of the year – are rewarded monetarily with some technicians having received rewards of up to 25% of their annual salaries.

With rapid urbanization increasing demand for water and energy, cities around the world are exploring a variety of technological and management innovations to reduce urban water-energy nexus pressures. Do you know of such innovations that are taking place in your city?

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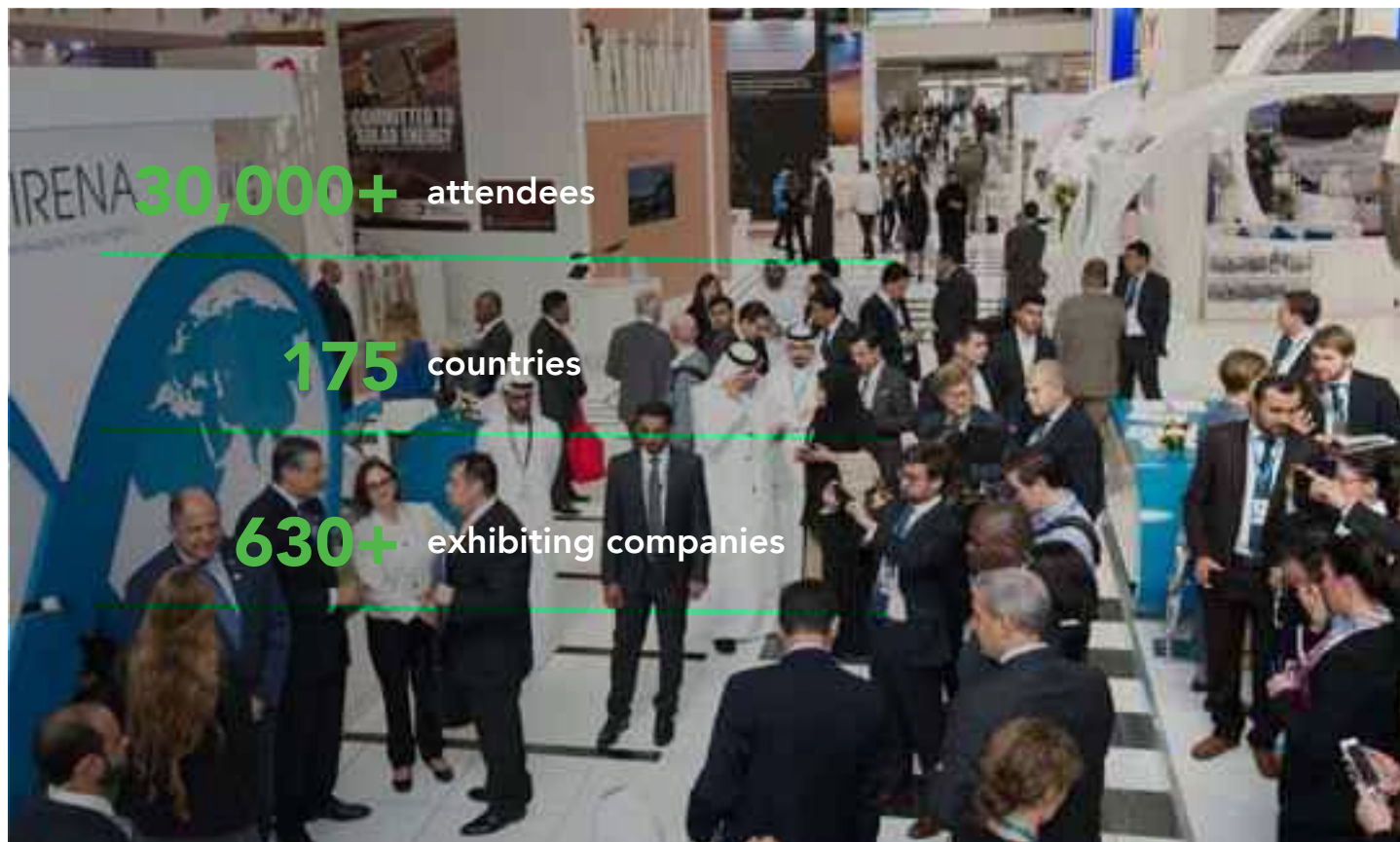
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VIEWS

**Mediterranean
shores**



Mediterranean shores

Photographer Kevin Scarlet takes us on his travels to Greece and Tunisia. Reflecting the shared waters of the Mediterranean, both countries face similar climates, environments, and socio-economic challenges. Living by the sea evokes the wander lust and a more laissez-faire lifestyle of going with the flow of the waves coming in and out. Fishing, loitering, meandering along the shores of the Mediterranean – this shared space so full of culture and history, so full of potential for sustainable development based on a richness of natural resources. We hope this VIEWS may motivate you to take a trip to enjoy the welcoming waters of the Mediterranean.

Kevin Scarlet is the double winner of the 2017 Brussels Street Photography Festival (BSPF) for best single image and best series. To view more of his work, visit:

WWW.KEVINSCARLET.COM

PREVIOUS PAGE: TUNISIA

ON THE RIGHT: GREECE









TUNISIA



TUNISIA



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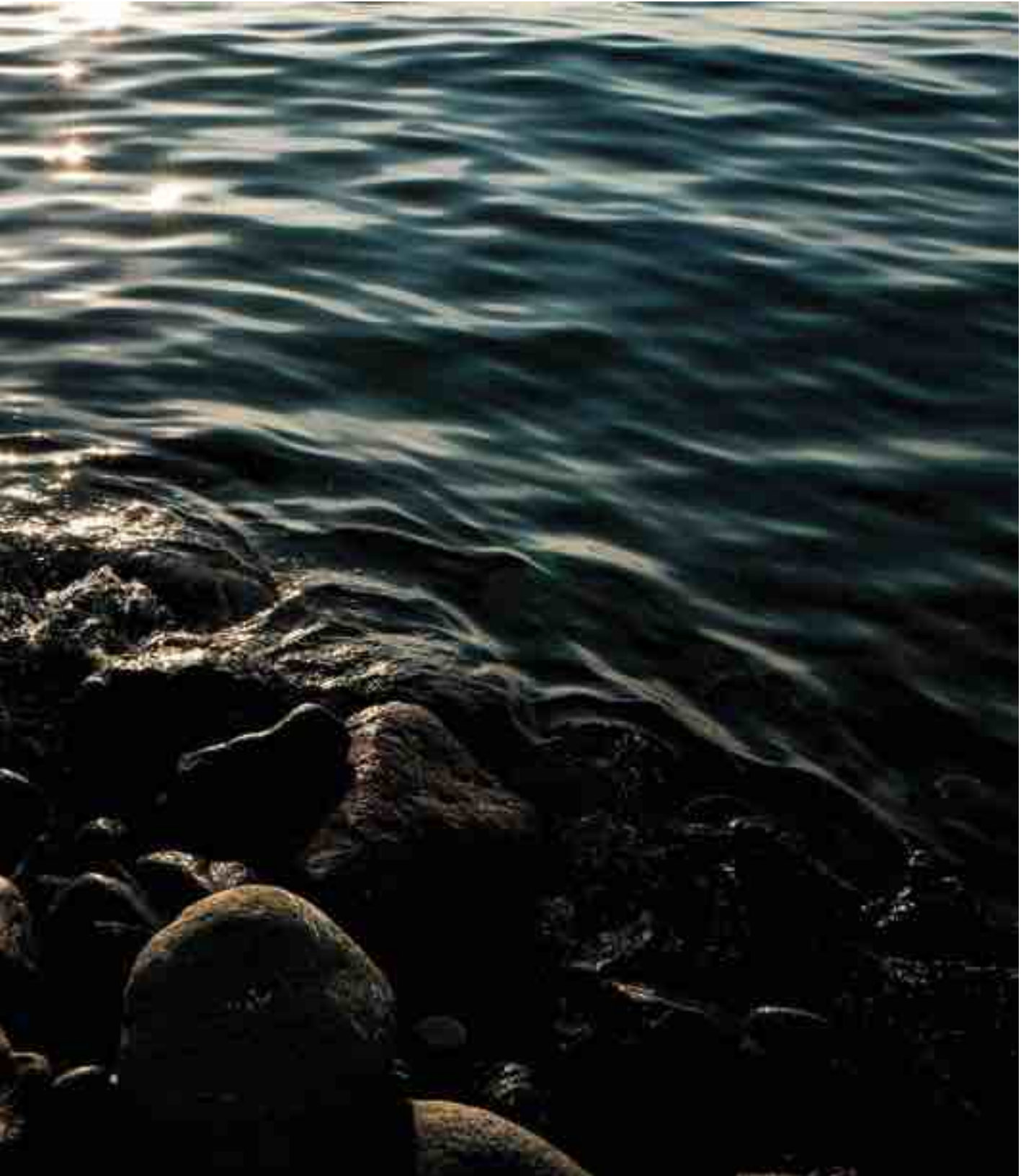


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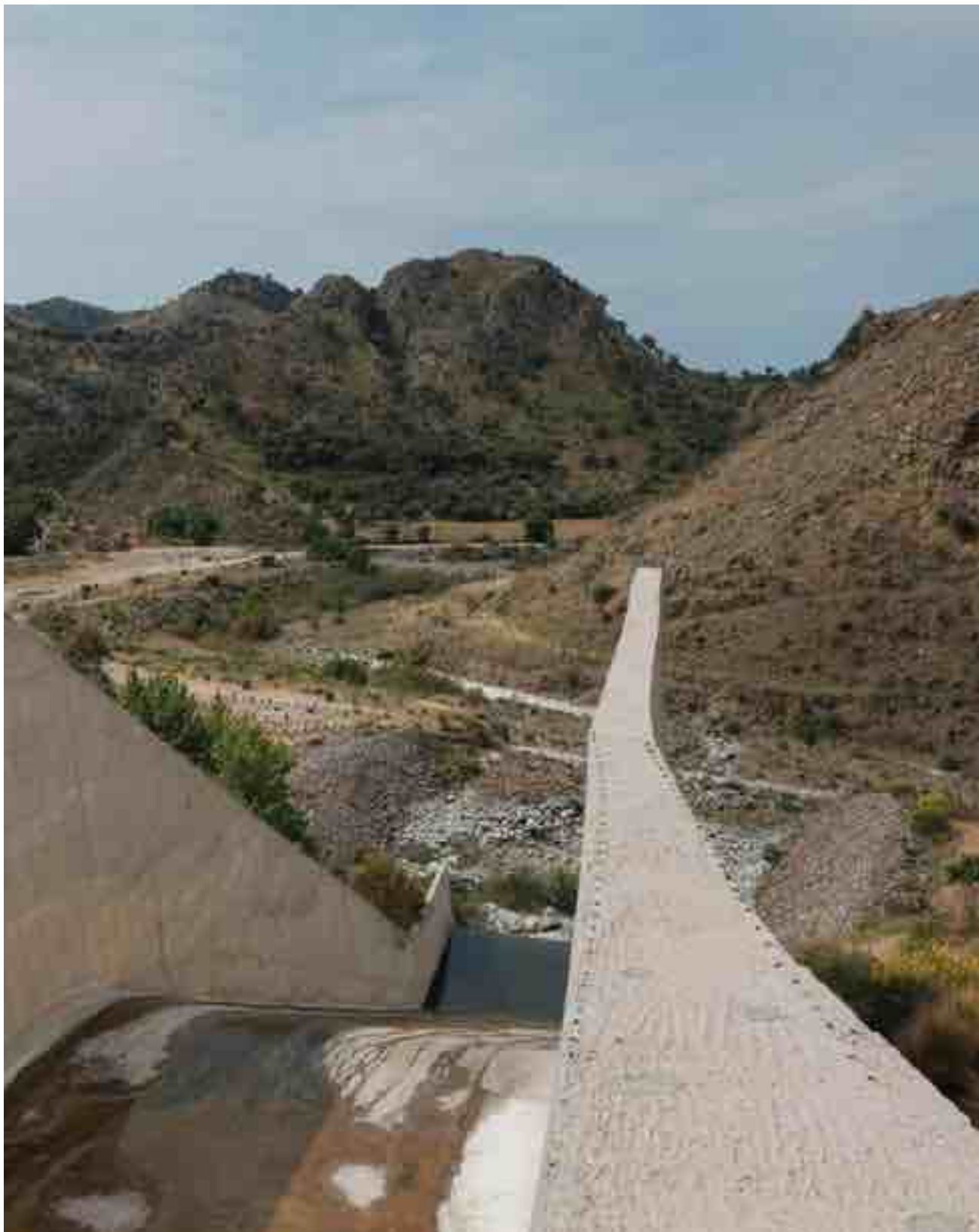


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Charting the Course to Water Wisdom



WRITERS:

Carlos Campos, Paul Fleming, Hong Li,

Per Halkjær Nielsen, Joan B. Rose, Willy Verstraete

The UN Sustainable Development Goals (SDGs) provide a framework to address water challenges and put water at the centre of the global agenda on sustainable development, but greater awareness is still needed of the hot topics, innovations and global trends in water science, research and management.

Climate change, rapid urbanization, increasing consumption and demand for food and energy will leave few countries and communities unaffected. The global

water challenge is unprecedented: demand for water and sanitation services is greater than it has ever been. The UN SDGs put water at the centre of the global agenda and provide a framework to address water challenges. This presents opportunities for the water sector to develop innovative solutions and to scale-up best practices. [The Global Trends and Challenges in Water Science](#), Research and Management compendium draws upon the expertise of the Specialist Groups in the [International Water Association \(IWA\)](#) which includes the hot topics, innovations and global trends in water science, ►







PER HALKJÆR NIELSEN

**The rapid development
of new DNA technologies
now allows us to study
microbial communities
in much greater detail.**

- research and management that will help solve water challenges. The compendium highlights a diversity of approaches from detailed technical and scientific aspects to more integrated approaches, including booming bio-technologies, water and health, resources recovery from water, smart utilities and urban resilience, which are highlighted below.

A revolution in water and wastewater systems with bio-technology and DNA tools

“This is a fantastic time to work in the field of environmental bio-technology! The novel DNA tools are revolutionizing our capabilities to understand the microbial systems and they provide the basis for informed actions in all areas, where microbes are key players: from human health to resource recovery.” ~ Per Halkjær Nielsen

Environmental bio-technology relies on the application of microbes to solve environmental and human health problems. Most facilities handling water and wastewater have been developed and operated without a good understanding of the microbiology. The rapid development of new DNA technologies now allows us to study microbial communities in much greater detail. Microbes carrying out critical processes, such as nitrogen and phosphorus removal, bio-energy production, and the recovery of resources such as bio-plastics and phosphorus can now be studied based on their DNA fingerprint and various culture-independent methods. Viruses and pathogens can be detected and quantified, and possible contamination sources tracked in potable and reclaimed water. The majority of microbes in nature remain unknown and undescribed, and consisting of millions of different species, they represent a fantastic unharnessed potential in the sustainable bio-tech industry.

The development in DNA sequencing technologies is advancing impressively: soon we will be able to identify all microbes, including protozoans, on-site in any ecosystem within minutes and at a very low cost. “Online” surveillance and controlling microbial communities will be possible as it will be possible to obtain complete genomes of all important microbes in relevant ecosystems. This will provide information about identity, physiology and interactions, leading to a much better understanding of entire ecosystems. We still need to be predictive and apply selective principles to control certain populations and for efficient management of the microbial communities. Wastewater treatment is becoming part of the circular sustainability development that integrates energy production and resource recovery into clean water supply. Microbial biotechnology, along with other technologies, is essential in this development with exciting perspectives in optimizing existing systems and developing new ones. ►



► **One Water One Health is Supported by Health-Related Water Microbiology Science**

“Water quality is health. Our global health (as the bio-health of the planet) is at risk like no other time in history. Water quality is depleting. This is a wickedly complex problem. The status of water quality data is dismal, but we now have the tools to tackle this problem.” ~~~ Joan Rose

Water quality is deteriorating in rivers, lakes and marine coastlines, groundwater and water at the tap because of human-activity and due to the increasing number of agricultural-based animals (FAO reports

animal manure is now the number one cause of pollution) affecting the degradation of natural infrastructure. Hundreds of microbial hazards, antibiotic resistance, and toxic algal blooms (more than 150) cause waterborne diarrhea heart disease, kidney failure, cancer, reactive arthritis, paralytic disease and pneumonia. Globally, unsafe drinking water, inadequate water for hygiene, and lack of sanitation contribute to about 88% of deaths from just diarrheal diseases (about 2,200 children dying daily).

Health-related water micro-biology is advancing with:

- microbial risk assessment frameworks

and the necessary data to address exposure assessment and hazards control

- the use of next generation sequencing to define the water micro-biome in all water environments
- improved water quality diagnostics in particular by promoting “Microbial Source Tracking”
- the global mapping of pathogen emissions and concentrations

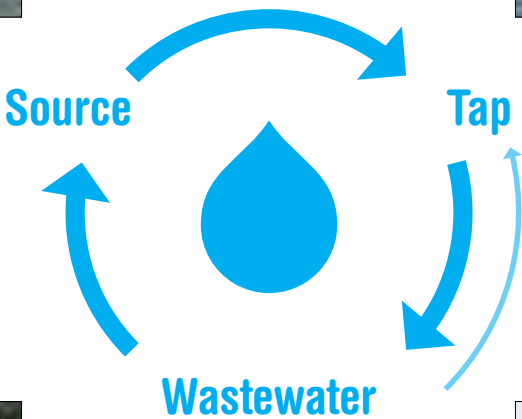
The “One Water” concept is highlights the importance of addressing climate change impacts on water scarcity and more specifically on flooding, which cost



RECREATIONAL LAKE/RIVERS



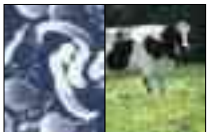
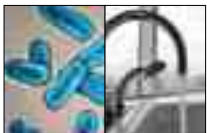
One Water One Health



STORM WATER



COMMUNITY WATER





up to \$432 billion/year (Lloyds City Index of Risk). One Water is needed to address the SDGs and improve global wellbeing. We are building interactive databases now using microbiological skill sets, technical and scientific developments, providing quantitative information on pathogens in water and global maps of emissions, concentrations and risk.

New tools allow us to map and diffuse sources and specific hazards improving targeted monitoring and management strategies. The data will assist investments to move sewage treatment toward resource recovery which will

provide energy, nutrients and fresh water. Implementing a risk-based approach with adequate data will be more important than ever to mitigate effectively the impacts of an aging infrastructure (or lack thereof) and the global changes that are now occurring. Recommendations to improve the bio-health of the planet include:

- Support the development of water diagnostic laboratories around the world.
- Use the latest technologies to understand spatial and temporal changes in pathogen concentrations and removals by innovative technologies.

- Develop microbial databases for all waters.
- Support data gaps in developing regions of the world.

The Boundaries of Resource Recovery from Water

“There is an urgent need to have more and better views on the hidden and externalized costs of what the reclaimed materials have to compete with.” ~ Willy Verstraete ►

- We all have our moments of excitement: a new process route, a new way to distil, strip, filter, precipitate, (bio)synthesize. We are convinced of the necessity to stop the dissipation and recover resources. Yet the harsh part comes when we have to deal with the counterfactuals: what are the normal routes and what are the characteristics of the products which reclaimed materials have to compete with (including hidden externalized environmental costs). For instance, it has been estimated that the externalized costs of nitrogen fertilizers are of the same order as the current cost price to the farmer. Clearly, such facts are needed to better support recovery lines for nitrogen from water and to fuel the debate against the conventional approach of nitrogen removal via the nitrification-denitrification-anammox process lines.

But recovery has another boundary. At regular intervals, we see that the limits of analytical detection are extended. Suddenly, one discovers a compound or an agent in a food or feed at values which are statistically correct, but at levels which were not measurable before. Yet, the facts indicate that the public has been exposed to a compound which is not allowed in the food chain or the environment because it is not listed and hence no concentration whatsoever is acceptable. At that moment, the regulators point to the producers and quite often the responsible politician resigns. Yet, in numerous cases plenty of calculations clearly indicate that any citizen being in contact for a whole lifetime with the compound at the levels found still does not show negative effects. Such situations have been documented, for instance, for PCBs and dioxins; they will occur more and most of us comprehend the irrationality of the cases. Clearly, in the domain of recycling, we are aware that a multitude of trace compounds can be present in what we recover. There is an urgent need if we believe in the value of the circular economy, to set up risk assessment schemes and models for adequate decision-making at the governmental level to preempt the next outbreak of irrational fear of contamination.



JANICKI OMNIPROCESSOR, DAKAR, SENEGAL



Embracing the Digital Future

“As all industrial sectors, water utilities are also going digital. And by digital, we mean not only digitizing the interaction between the utility and the citizens, but also transforming the operating processes through the introduction of digital-enabling technologies.” ~ Carlos Campos

Four value-creation drivers explain this evolution:

1. Reducing overall operating costs, which introduces both instrumentation and operation hypervisors capable of integrating multiple data sources, all relevant for optimum operations;

2. Ensuring sustainable resource utilization of water and energy – this explains why we see many utilities introducing energy optimization expert systems in their sustainability roadmaps;

3. Under severe CAPEX restriction, water infrastructure assets need to do “more with less”, which means **optimizing asset utilization** and this is being done increasingly through the use of both all asset data and dedicated analytics; and

4. Enhancing consumer experience beyond traditional customer care, we see the emergence of applications, for example, to interpret meter data to benchmark water consumption.

As in any transformation process, adopting digital solutions requires an adoption process which includes barriers identified by utilities when implementing these solutions, such as: the interoperability of the devices and systems in the vertical stack, security and data privacy, uncertain return on investment, lack of maturity of some technologies, and lack of knowledge and skilled workers. Our experience shows that the best strategy to overcome these barriers is to develop the proper Pathfinder Projects where the various technologies can be proven, their value demonstrated, and where operators can learn to use them: Welcome to the Utility of the Future. ►

SUEZ SMART OPERATION CENTRE, LE PECQ FRANCE. SOURCE: @SUEZ / XAVIER SCHWEBEL



► Urban Resilience: Building Water-Wise Cities

“One way to test the resilience of an urban area is to see how it deals with water – how it functions when it has too much, or too little.” — Paul Fleming

Urban resilience is a means to explore the capacity of systems, organizations and people of an urban area to anticipate, manage and adjust to chronic stresses and acute shocks. Water systems attempt to make reliable what is inherently variable and therefore are great test cases for resilience given their role as connectors for public health, economic development and urban vitality but many challenges constrain the contribution of water systems to urban resilience:

Urban areas with reliable water systems can face affordability issues regarding the replacement of aging infrastructure and the need to meet regulations and community needs while under-served areas grapple with overcoming impediments to achieving reliable access to water and sanitation. Urbanization contributes to a “tyranny of now” mindset where immediate demands precede longer term thinking while the altered water cycle and extreme events introduced by climate change raises

questions about what future conditions will water systems need to adapt to? The differentiation of water into separate regulatory, governance and management silos also constrains innovative approaches that rely on leveraging integrated approaches to water management.

These challenges are loaded with opportunities to reimagine and reframe water

make water management not just a water utility’s responsibility but also critical component of land use and urban planning. Water utilities, recognizing that the projected climate-driven changes in extreme events, rainfall intensities and droughts have serious implications, are collaborating actively with each other and the research community to co-produce actionable science, assess how to embrace uncertainty and plan for multiple plausible futures.



The transformative implications of decentralization, which is gaining ground in the energy sector, has yet to play out in the water sector. Strategies for managing water at the parcel or neighborhood scale have been embraced by some utilities and developers with the potential to complement the traditional centralized system through nested systems and built-in redundancy. Partnership models that combine different actors with distinct but complementary interests offer a great opportunity for joint investments to bring multiple benefits for society, the environment and business – the triple bottom-line of sustainability. ☯

management and urban resilience. An awareness of the fundamental relationship between land management and water management is driving strategies that

**ABOVE: PRINCIPLE FOR WATER WISE CITIES.
SOURCE: INTERNATIONAL WATER ASSOCIATION**



Interview with Diana D'Arras

President of the
International Association
of Water (IWA)



What are the key challenges to combat water scarcity in the Mediterranean region and worldwide? Is there a difference?

Yes, there is a difference. People do not use the same amount of water around the world – it depends where they are located. In fact, water scarcity is the relation between the need and the availability of water. Therefore, the notion of scarcity is relative. Scarcity occurs, if a country is not about to provide enough water for agriculture, industry, personal use and sanitary water. For example, surprisingly Belgium or parts of England, despite for being known as rainy,

they face water stress because of the high amount of people living on a relatively small area. In such cases, countries import water and the concept of virtual water comes into play, meaning that the export of goods such as corn is related to the export of water. Water scarcity is a challenge – in the sense of understanding and organization of demand and supply of water.

What are the solutions for these water challenges?

The first solution is raising awareness with politicians, professionals and society about the importance of water. Everybody should know about water saving, for example in terms of sanitation as well as food. Other industries showcase that it is possible to raise awareness. The energy sector has developed an understanding of energy saving in all areas. By developing awareness and understanding we can be more water efficient. Utilities have started to increase the awareness of their clients about water issues. Building consciousness is done by sharing data – not just consumption at the tap, but also water used for food production. There is no need for everyone to become vegetarian, but it is important for people to be aware of the amount of water in meat production. The second solution is to develop water technologies like recycling and reusing. Many of IWA members are not in favour of recycling water of the personal use, but rather reusing it for agriculture and industrial uses.

At the EIP Water Conference 2017, you claimed that it is highly important to work together to improve water conditions. What does good collaboration mean in the water sector?

Start sharing experiences. From developing the technology over pilots and demonstration projects up to commercialization it is necessary to spread the experience – the constraints and next steps. There are two ways of sharing. First, it is necessary to share outcomes from research projects, for example WssTP shares knowledge from

developing technology. Second, international project implementation, introducing pilots together with players from different countries, is a very good method to share knowledge. Every industry does it. The problem in the water sector is that every step takes 10 or 15 years. Regarding the slow nature of the water sector it is important to share knowledge and experience from the beginning about how to introduce water innovations efficiently. Working together can be challenging and it takes time, but in the end there is the advantage of a common buy-in and it is more likely to spread water innovations and have long-term impact.

How do you evaluate water scarcity coverage in the media? Do you think it should be a bigger topic?

I would be happy to see water scarcity presented by the media, but it has to be done the right way. Water topics should be presented with good and simple figures. Many people do not know the price and measurement of water, water consumption for personal use, agriculture, industry and environment. Complex data is useless for explaining these topics and even creates fear. For effective communication, tangible figures and data are essential. IWA has developed the report “The Principle of Water-wise Cities” that demonstrates the steps to develop water-wise cities. ☺

**Water scarcity is
the relation between
the need and the
availability of water.**

Water Stewardship: Creating 21st Century Abundance



WRITER:

William Sarni

Corporate water strategies to address water scarcity and quality range from managing water risks within direct operations to more expansive strategies to address water risks across a company's value chain. These expansive strategies are referred to as water stewardship which now refers to moving beyond water management whereby companies are working with their supply chains, customers and consumers to address water risks. For many of these companies they are focused on watershed level programmes to have a positive impact beyond their value chain footprint.

Water stewardship is a generally-accepted term for the proactive adoption of an economically, environmentally, and socially-responsible water strategy. Water stewardship strives to achieve water security for all stakeholders, including ecosystems within a watershed. Water stewardship emphasizes effective resource sharing as well as efficient resource use, and seeks to engage stakeholders across the value chain, collaborating with suppliers and/or customers (including end users) to help manage their collective risk.

There are several non-governmental organizations and consulting firms that have ►

Let's examine the current state of water stewardship and explore strategies that add value and impact beyond water stewardship to create abundance from scarcity.

KANGSO YAKSU MINERAL WATER BOTTLING PLANT,
NORTH KOREA. SOURCE: CLAY GILLILAND





- ▶ developed water stewardship frameworks and published articles on the value of water stewardship. These include WWF, The Nature Conservancy (TNC), IUCN, WRI, World Business Council for Sustainable Development (WBCSD), the CEO Water Mandate, The Pacific Institute and The Alliance for Water Stewardship. Leading businesses work with these NGOs to develop practical and cost-effective water stewardship strategies to address water scarcity and its related impacts. These impacts include constraints on economic growth and the public health effects of limited access to clean water.

A very simple view of water stewardship which aligns with WWF and other frameworks such as AWS can be found in [Getting Ahead of the Ripple Effect: A Framework for Water Stewardship Strategy](#) (Deloitte University Press,

2013). A simplified view of both the risks and opportunities in implementing a water stewardship strategy. With regards to risk, a water stewardship strategy should give companies the ability to anticipate, manage, and mitigate current and potential impacts, such as higher water costs, disruption to water-dependent operations, evolving regulatory and pricing changes, and loss of social license to operate.

The framework is straightforward and consists of preservation, engagement and innovation (Figure 1). **Preservation** includes activities that reduce impact on water resources by decreasing water consumption and/or preserving water quality. **Engagement** refers to water-related activities that involve stakeholders outside the company itself. And **innovation** is defined as the creation and/or adoption of new technologies, processes, and/or

partnerships to pursue water-related goals.

[The Alliance for Water Stewardship \(AWS\)](#) has developed a water stewardship standard that is gaining traction globally:

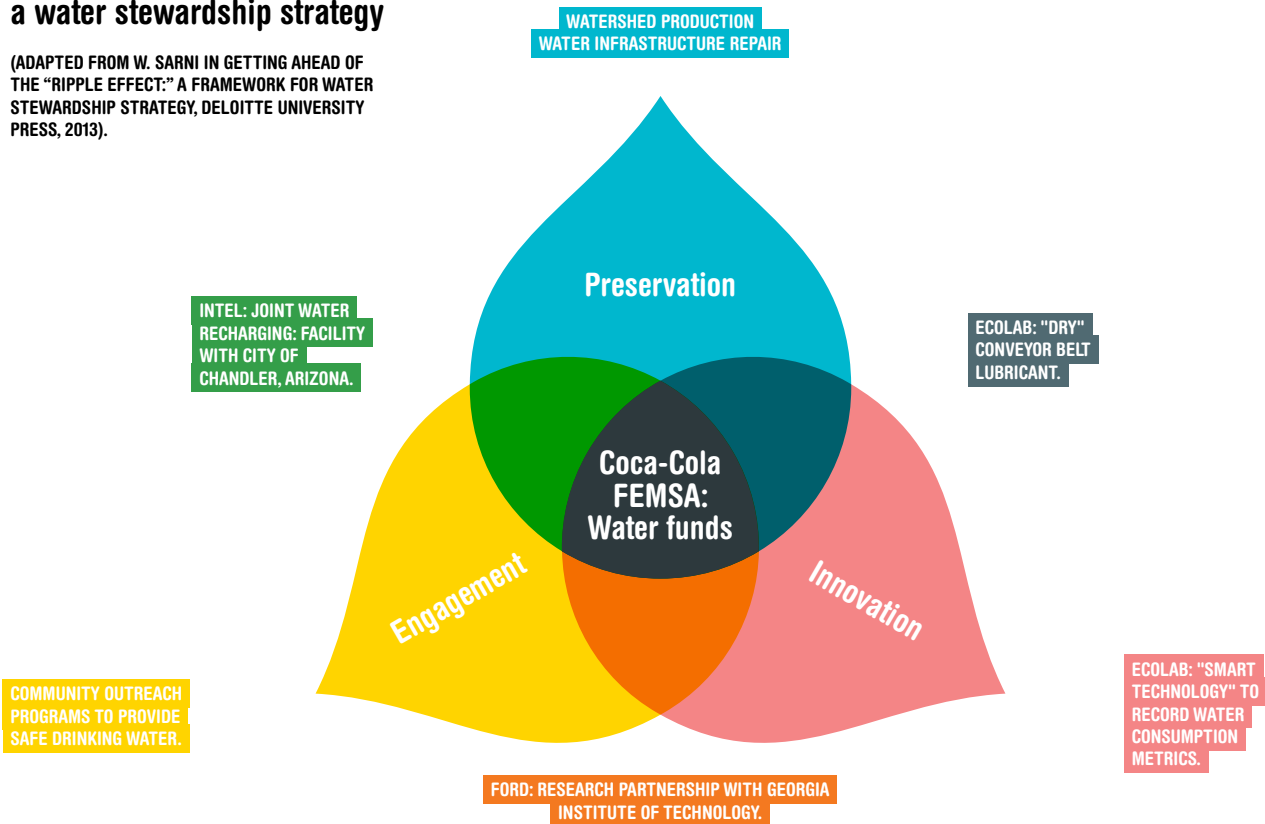
AWS is a global membership-based collaboration. We unite organizations behind our mission: To lead a global network that promotes the responsible use of freshwater that is socially and economically beneficial and environmentally sustainable.

We achieve this through [a global water stewardship system](#), centered on the International Water Stewardship Standard (the AWS Standard), that drives, recognizes and rewards good water stewardship performance.

Our vision is that water users and managers are responsible water stewards, who

Figure 1. A simplified view of a water stewardship strategy

(ADAPTED FROM W. SARNI IN GETTING AHEAD OF THE “RIPPLE EFFECT:” A FRAMEWORK FOR WATER STEWARDSHIP STRATEGY, DELOITTE UNIVERSITY PRESS, 2013).



How do companies with ambitious global growth strategies secure the water they need to fuel business growth in a world where paying more for water will not work?

protect and enhance freshwater resources for people and nature.

The AWS Standard provides a globally-applicable framework for major water users to understand their water use and impacts, and to work collaboratively and transparently for sustainable water management within a catchment context.

Another study of water stewardship, [Water Management and Stewardship: Taking Stock Of Corporate Water Behavior \(Newborne and Dalton, 2016\)](#) highlights the state of water risk and mitigation strategies. According to Newborne and Dalton: multinationals are better at understanding the “water-related contexts in which they operate” and a “few leaders” are beginning take actions as to how they manage water, but they are “mostly investing in water infrastructure within their own plants/premises.” Newbourne and

Dalton go further and state that “companies need to be aware of, and adaptable to, water issues beyond the fenceline. The examples of the greater level of engagement in collective action are, currently, exceptions to the general rule.

Below are a few other key takeaways from Newborne and Dalton’s report that provide invaluable insights into the state of water stewardship adoption:

- Companies talk about “win-wins” and not about trade-offs. In the world of water resource governance with competition for water, trade-offs are the norm, resulting in negotiated agreements with compromises. “Win-wins” are misleading and do not reflect the complexity of managing water resources within a watershed.
- The tension between short-term business goals and long-term business

uncertainty manifests itself in the status of water as “a medium risk, but low priority, to (increasingly) a medium (or high) risk and medium (or high) priority.” This is coupled with a lack of real interest from external stakeholders, such as “regulators, investors and consumers, who do not seem to be significantly influencing corporate water behaviour.”

- Reporting and disclosure are voluntary and there is a strong case to be made for regulated initiatives and scoring to support the financial sector, NGOs and other stakeholders. It appears that we are still a long way off from a time when companies will report on water risks and mitigation strategies; companies are still lagging behind on reporting on climate risks let alone water-related risks.

Newborne and Dalton conclude that “in relation to water and natural resource ►

AGRICULTURE IN ONTARIO, CANADA. SOURCE: PL77





▲ ZENICA STEEL FACTORY, BOSNIA AND HERZEGOVINA. SOURCE: DANS

▼ THE SAAB FACTORY IN TROLLHÄTTAN, SWEDEN, SEEN FROM GÖTA RIVER. SOURCE: ØYVIND HOLMSTAD



- management, that means companies need to show how they are changing their business models and practices – and do so soon.”

While several water stewardship frameworks address social license to operate, they really do not directly address the challenge of sustainable business growth. One of the more important questions is: how do companies with ambitious global growth strategies secure the water they need to fuel business growth in a world where paying more for water will not work?

This question was addressed in [“Fueling Growth” \(Deloitte, 2014\)](#) that claims that

for companies to capture additional value from water stewardship they must align with their growth strategy. This means moving beyond the price of water to take into account the various impacts of water on operations, value chain, brand, and growth prospects. As framed in the article, companies can be categorized in four stages of maturity as to how they align (or do not align) business growth to water availability (Figure 2).

The maturity model can be summarized as follows:

- **Stage 1 (No Strategy):** No stakeholder engagement; limited water efficiency

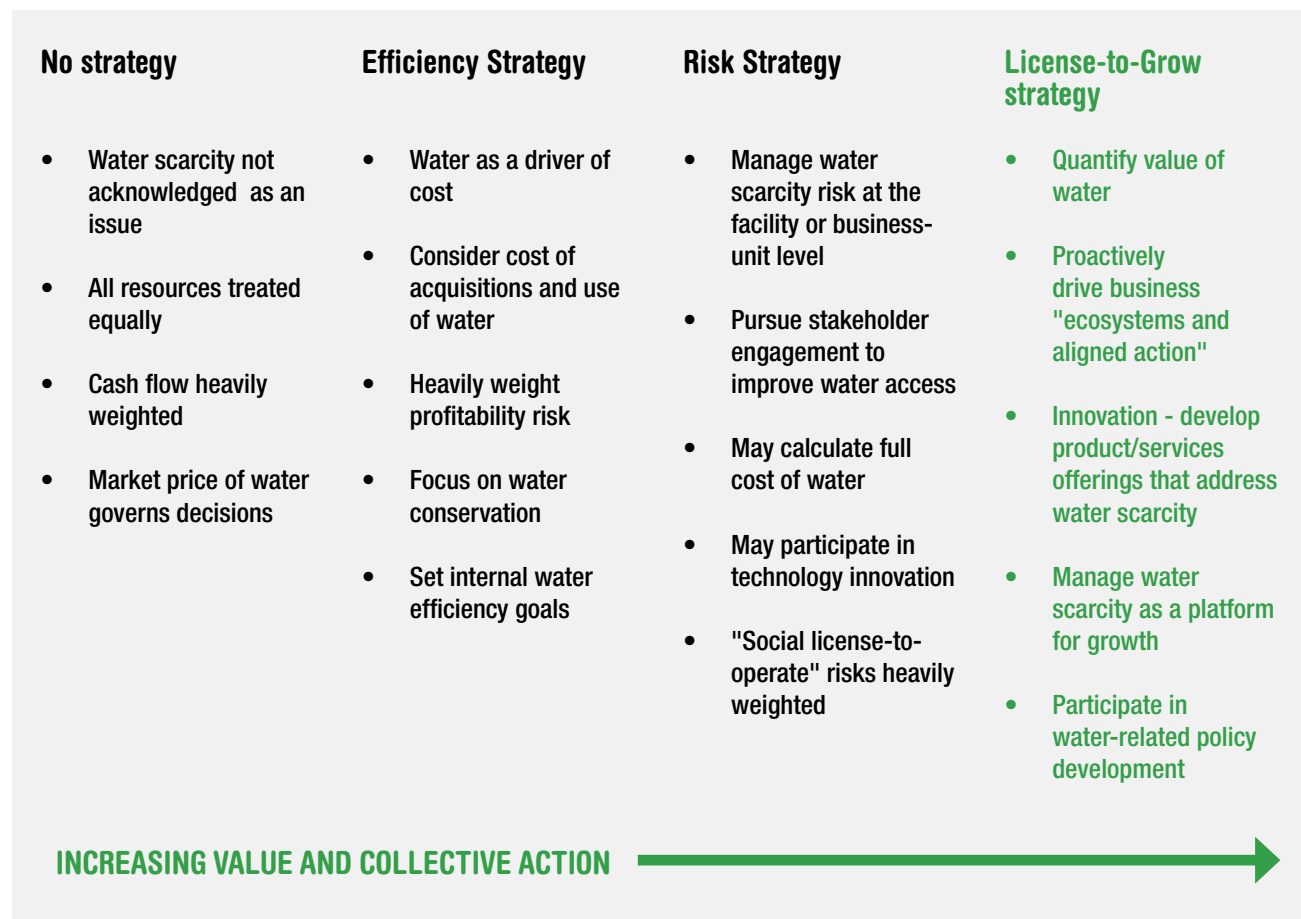
investments; no alignment of water strategy with business growth strategy.

- **Stage 2 (Efficiency Strategy):** Focused on water efficiency (water price drives actions); no stakeholder engagement; no quantification of the value of water.

- **Stage 3 (Risk Strategy):** Risk focus; targets are set for water efficiency/reuse; pursues stakeholder engagement focused on managing social license to operate; limited understanding of the value of water as a driver for investment decisions to support growth; limited alignment of water strategy with business growth strategy. ►

Figure 2. A “License-to-Grow Strategy

(ADAPTED FROM W. SARNI, DELOITTE UNIVERSITY PRESS, 2014).



- • **Stage 4 (License-To-Grow Strategy):** Growth focus; mature efficiency/reuse initiatives; leads stakeholder engagement initiatives focused on securing long-term access to water; quantifies the value of water (and business value at risk) to drive CAPEX/OPEX investments; water strategy well aligned with business growth strategy.

While water stewardship creates value and impact, what strategies could potentially create greater value and impact? What is beyond water stewardship and how do we create abundance from scarcity?

Beyond Water Stewardship

Innovation is the next phase of water stewardship which has the potential to create additional value in economic development, business growth, social well-being and ecosystem health.

Innovation will take us from 19th and 20th century public policy and infrastructure to 21st century solutions by leveraging exponential technologies (such as material science, internet of things, etc.), crowd-sourcing and prize competitions (for example: ImagineH2O), innovative business models (like: water as a service) and financing (with green bonds and socially responsible investing), and new stakeholder ecosystems (such as [The Coca-Cola Company's Replenish Africa Initiative – RAIN](#)).

Let's focus on ways to promote innovation and scale solutions in these areas of innovation. The most exciting developments are in water technology innovation hubs/accelerators and programs that bring

We are still a long way off from a time when companies will report on water risks and climate mitigation strategies.

in entrepreneurs from outside the water sector. There is significant promise in the ability of these hubs/accelerators and entrepreneurial programmes to solve water scarcity and quality impacts.

Two organizations that I have been involved with are [ImagineH2O](#) and [101010](#). ImagineH2O is a water technology accelerator that in addition to an annual prize competition, supports the scaling of innovative technologies for the private and public sectors. 101010 is an innovative programmes that brings together ten entrepreneurs for ten days to address ten "wicked problems" ([Water as a Wicked Problem](#)). In October, 101010 ran a Cities – Infrastructure and Water Program and watch for [ImagineH2O 2018 Accelerator Program](#).

We should view water strategy more broadly to include the value created from leveraging exponential technologies (IoT and nanomaterials), new financing models (green bonds) and frameworks (closed loop value chains). If the private sector can be tapped to drive innovation, we will be in a better position to address 21st century water risks. More importantly, we can

collectively create economic, social, business and environmental value.

To bring this to scale, recommendations will need to address the following:

- Shifting our thinking from water scarcity to abundance to attract new ideas and stakeholders to solve complex ('wicked') water challenges.
- Scaling innovation and entrepreneurial programmes such as 101010 and prize competitions such as ImagineH2O.
- Developing and implementing new financing models such as blended finance.
- Leveraging the speed and scale of entrepreneurs and multinationals to invest in water solutions in addition to their water stewardship programs.
- Proactively engaging with successful entrepreneurs and businesses from outside the water sector. ☺



WATER FOUNDRY TEAM is a trusted advisor to multinationals, non-governmental organizations, public sector agencies and innovative water technology companies in the development and implementation of water strategies. These strategies range from corporate water strategies, public policy to market entry strategies for water technology companies. Water Foundry has been at the forefront working on collective action programs with diverse stakeholder groups and quantifying the business value of water strategies.

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Improving Water Management in Tourism Facilities



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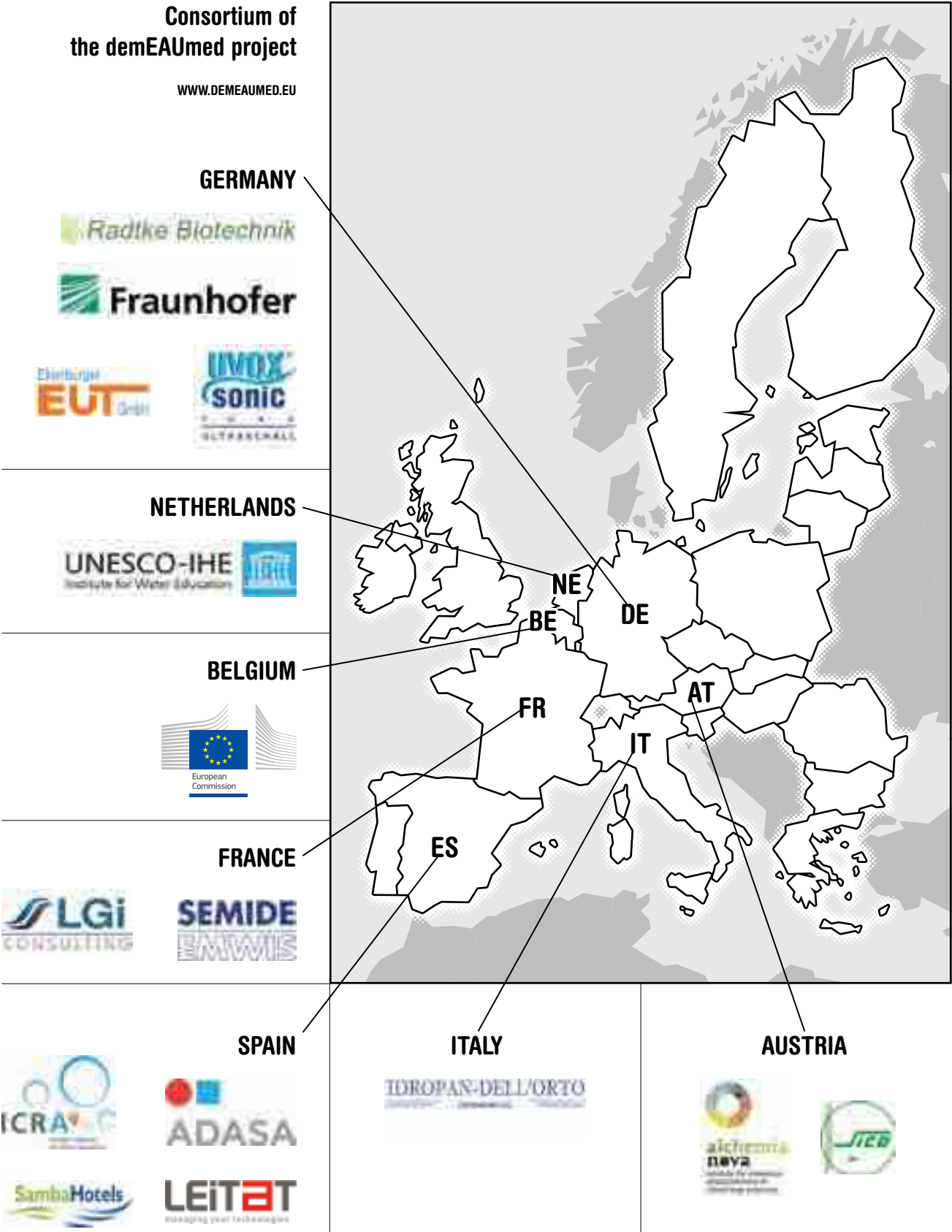
Coupled with growing water scarcity around the Mediterranean, high water and energy consumption is a major challenge for the sustainable development of the tourism industry and has become a limiting factor for economic growth at large. Highlights of demEAUmed – an EU-funded FP7 success story.

Tourist establishments use potable water for room services, as well as for the kitchen, the laundry, for irrigation, for the swimming pools or spas, and other services associated with water. For this reason, the possibility of optimizing the use of water without increasing the pressure on the client, but

seeking alternative water resources (rain-water, sea water), and applying innovative technologies to treat the wastewater generated and enhance its reuse within the installation itself, is presented as the best alternative to boost the tourism sector and increase the sustainable economy of its management. The efficiency and practices in water management in the hotel sector are very little studied (Gabarda-Mallorqui et al 2017; Hadjikakouet, 2013, Rico-Amoros et al 2009). Specifically, there are hardly any indicators for daily consumption or occupied space depending on the hotel category, without taking into account many of the variables that could affect the hotel water cycle, such as measures of efficiency, type of treatments applied, etc. ►









HOTEL SAMBA, DEMO SITE OF DEMAUMED PROJECT, SPAIN. (WWW.HOTELSAMBA.ES)

- The Catalan Water Partnership and its members are working to improve the water management and quality of tourism facilities, pointing out, as an example, the demEAUMed project with the participation of three CWP members (ICRA, LEITAT and ADASA) and the Hotel Samba located in Lloret de Mar outside Barcelona.

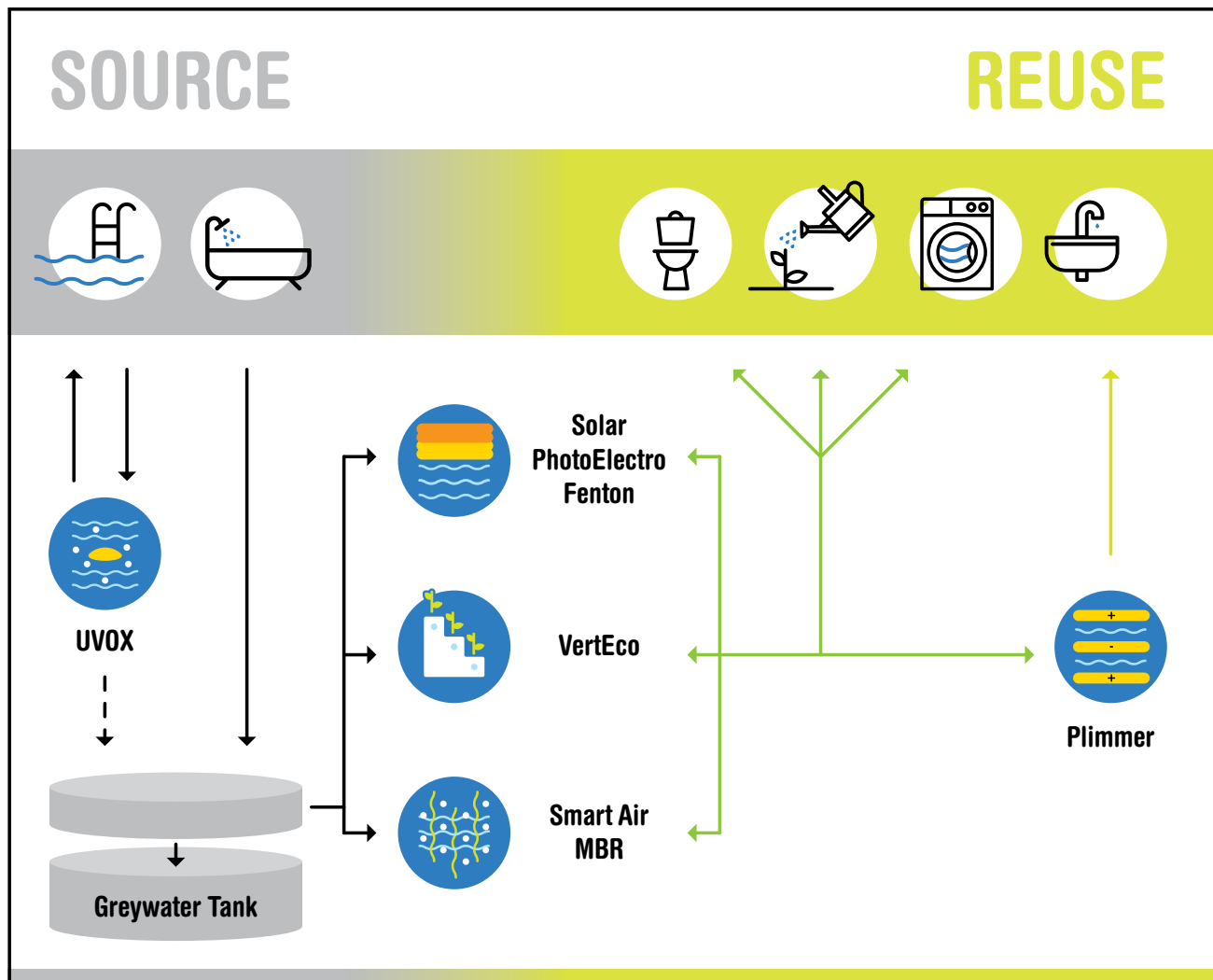
demEAUMed was been an EU-funded Seventh Framework Programme project from January 2014 to June 2017 involving seven countries: Austria, Belgium, France, Germany, Italy, Netherlands, and Spain. demEAUMed addressed two key challenges: the importance of the tourism economy and water scarcity in the Mediterranean area. demEAUMed has been a critical platform for promoting the use of sustainable and innovative technologies in other Euro-Mediterranean tourism facilities as a point of reference for the global tourism market.

The aim of demEAUMed was to involve industry representatives, stakeholders, policy-makers and diverse technical and scientific experts in demonstrating and promoting innovative technologies for an optimal and safe closed water cycle in Euro-Mediterranean tourism facilities, leading to their eventual market uptake. A representative resort (Hotel Samba) was considered as the demonstration site of the project, where a part of all inlet and outlet waters were treated with proper innovative technologies and reused to reduce the carbon footprint of water management in an integrated approach at demonstration level.

Water Cycle for Euro-Mediterranean resorts

First, an extensive survey was performed throughout Euro-Mediterranean resorts in order to pinpoint overall patterns and bottlenecks in existing water cycles, comparing the general Euro-Mediterranean baseline with the demo site in order to identify ►

**Water quality requirements for reuse
are not defined at the European level.**



Roadmap for greywater at the touristic facility demEAUmed project

WWW.DEMEAUMED.EU

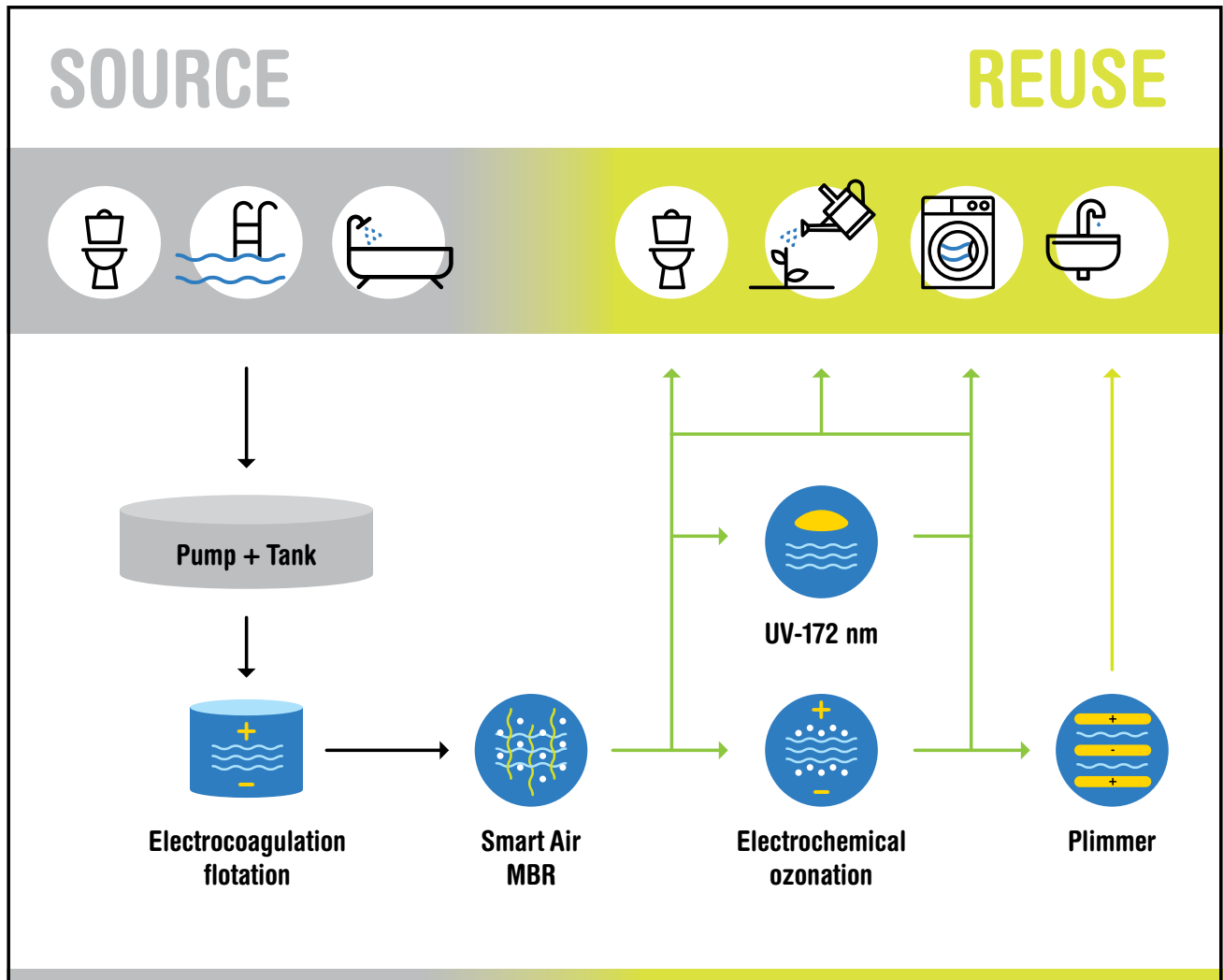
- dissimilarities. In parallel, a representative part of all inlet and outlet waters of the demo site water cycle was identified.

Water quality requirements for reuse are not defined at the European level while RD 1620/2007 is the current legislation framework in the case of Spain. A broad overview of the presence of micro-pollutants, by use and by season, was performed as well. A set of quality parameters and threshold values/ranges established in RD 1620/2007 (or proposed by the demEAUmed consortium as state-of-the-art)

as well as socio-economic or political parameters were fixed and updated throughout the project.

Analyzing both historical data and values gathered during the project life, Hotel Samba's higher water consumption was observed for its hotel rooms, kitchen, swimming pool and basement. Most of these uses are currently met in the hotel by means of drinking water, highlighting the necessity to foster water reuse in the demo site and in general in tourism installations.

The demo site water uses were organized in seven categories with decreasing water quality requirements: potable water used for human consumption, kitchens and showers/tubs; swimming pool; aquifer recharge through direct injection; irrigation of private gardens and toilet flushing; irrigation of golf courses; and aquifer recharge through localized percolation. A general roadmap taking into consideration demEAUmed's innovative treatment technologies was developed to define the water streams and the technologies to be tested.



Roadmap for wastewater at the touristic facility demEAUmed project

WWW.DEMEAUMED.EU

Innovative water treatment technologies

Three main water treatment lines (grey-water, wastewater, swimming pool water) were defined, combining the eight available technologies for deploying realistic treatment combinations for each of them and analyzing the synergies and limitations for each case, with the final aim of closing the cycle. The accomplishment of successfully integrating these technologies, evaluating the synergies among them and their

feasibility as combined treatments must be mentioned as a key achievement of the demEAUmed project.

Results obtained with SmartAir MBR, vertECO, SPEF in the greywater line were above expectations in output water quality and continuous operation robustness, also for micropollutants. Similarly, ECEF and SmartAir MBR worked in the wastewater line in a very stable and accurate way, and successfully coupled with electro-ozonation and 172nm UV technology. The integration of Plimmer technology provided

a high cost-effective alternative for further treating greywater and wastewater streams. The swimming pool water treatment line accomplished a full validation of UVOX technology, confirming it to be a competitive solution.

Monitoring and Control System

The platform shows controls, generates alarms and records the information of the different water quantity and quality throughout the hotel, introducing the use of ►

Existing barriers to reuse greywater and wastewater must be solved to reduce the environmental impact of current water consumption in Euro-Mediterranean areas.

- industrial data acquisition applications for water management in hotels and using Big Data strategies to improve efficiency and reduce the costs.

The tool applicability ranges from facilities that require efficient water management, as in the tourism sector, to other sectors such as urban use in small and remote communities or commercial buildings market, in specific water stressed areas as well as other sectors knowing, in real time, the different water flows, quality and helping in room/areas temperature, electrical consumption or machine information management.

Environmental assessment

The eight demEAUmed technologies and the seven combined strategies proposed were analyzed by means of life cycle assessment (LCA). The demEAUmed solution can result in important environmental impact savings. As a matter of fact, thanks to water reuse: the carbon footprint of demEAUmed combined strategies saved up to 136% (greywater scenario) and up to 62% (wastewater scenario). The main environmental impacts are found during the operation stage. The maintenance tasks and the use of cleaning agents have also important environmental impact

contributions as well as the construction stage in case of large amounts of metals or materials implying complex manufacturing processes. Recommendations were provided to reduce the environmental impact contributions of demEAUmed technologies.

Additionally, an analysis of the current water quality and water reuse regulation at European, national and international levels was performed within the demEAUmed project, providing a public policy brief. The analysis concludes that existing barriers to reuse greywater and wastewater must be solved to reduce the environmental

ERTECO TECHNOLOGY AT DEMAUMED DEMONSTRATION SITE (ALCHEMIA-NOVA, WWW.ALCHEMIA-NOVA.NET)



impact of current water consumption in Euro-Mediterranean areas.

Decision Support System (DSS)

DSS was developed to integrate the information gathered throughout demEAUmed project regarding the hotel water cycle, technological performance and environmental and socio-economic assessment, providing user-friendly tools for decision-making processes regarding water reuse strategies in hotel resorts.

The tool allows the user to enter hotel characteristic data to set up the corresponding water matrix, choosing among water treatment technologies to analyze possible reuse strategies to be implemented. The user then obtains the estimated performance results for the specific strategy tested, including water qualities of the different components streams of the hotel water management network and the total amount of water saved.

A tailored design of the DSS architecture, the implementation of the water cycle model for simulating water flows and quality parameters, the integration of the different water reuse technology modules, and the integration of environmental, economic and social impacts was developed.

The main conclusions of the demEAUmed project demonstrated that the reduction of fresh water consumption in hotel installations, green and recreational areas can be achieved by using alternative water



SOLAR PHOTOELECTRO-FENTON PROCESS AT DEMEAUMED DEMONSTRATION SITE (LEITAT, WWW.LEITAT.ORG)

sources, such as the reuse of treated grey-waters and/or wastewaters within a given resort. Several possibilities were considered for the resort as a whole, taking into account the specific quality/quantity requirements of water at the different areas of the demo site, as well as current/future compliance with water regulations. The incorporation of advanced monitoring and control systems, environmental and socio-economic assessment and a decision support tool supports in ultimately defining the best water management solutions.

The demEAUmed project represents the first demonstration project proving that water cycle management can address the water challenges of the tourism industry

in the Mediterranean region. In the coming years, water scarcity episodes are expected to be more frequent, replicating the know-how gained during the demEAUmed project could prove a positive solution to advancing sustainable development for tourism at large. ☺

REFOIL: reusing aluminum in the hairdressing industry



WRITER:

Fernanda Buriola

When colouring our hair, aluminum foil speeds up the chemical reactions by trapping the heat. A faster process means less damage for the hair. On the other hand, foil production requires excessive amounts of energy and water, and once in the landfill, it takes centuries to degrade, which obviously does not contribute to the health of our planet. Fortunately, in Australia, there is a solution!

In our Winter 2015/2016 issue we introduced you to **Refoil** – the first sustainable foiling industry from Australia. Refoil is re-thinking hairdressing techniques and tools by implementing a new life cycle approach with three easy steps:





Refoil products are 100% recycled and made up entirely of pre-consumer and post-consumer scrap aluminium.

crush, recycle... and repeat... again and again.

Refoil products are 100% recycled. They are composed of pre-consumer and post-consumer scrap aluminium. After being used, hairdressers only need to crush together scraps of used Refoil in big balls. The bigger the better. This way the aluminium will not tear during the separation process ensuring the whole operation. Once the refoil is crushed correctly, the balls will be sent to the Material Recovery

Facility (MRF) where they are easily sorted and then recycled.

The Refoil life cycle

These big balls of aluminum are melted down into coins before the manufacturing stage. There is no need to extract minerals and smelting in pure aluminium. A process that requires a huge amount of energy and water and releases greenhouse gas in the air. By adopting this process, Refoil saves up to 97% of water and uses only 5% of

REFOIL MISSION:

to make foil waste history through education, industry collaborations and sustainable development

- 1. REFOIL CLASSIC
- 2. REFOIL CATERING HEAVY DUTY
- 3. REFOIL CATERING LIGHT GRADE
- 4. REFOIL PRECUTS

Repurposing

- ▶ the energy necessary to smelt extracted minerals. The process also preserves landscapes as the waste is no longer going to landfills, and creates "green" jobs.

Education is the key

The cleverness of 'refoiling' is obviously the recycling mechanism. But another key component of the project is communication. Most hairdressers did not know that the foil could be recycled. In order to solve this problem, Refoil therefore launched a campaign entitled **"How big are your balls"** to show them how to crush the foil so that it could be re-used. They also support salons with valuable information to help the hairdressing industry to become more sustainable. Mojca, owner of *Kinky Curly Straight* and a happy Refoil customer, says that sustainable behaviour goes far beyond the hair salon:

"For our salon team it's a no brainer. It's something we decided to do from day one and no one ever questions it. We even started changing our team's behaviour outside of the salon."

One thing is for certain: to remain beautiful and maintain old practices, we need to reflect on new techniques and tools. By rethinking the chain of foil production, Refoil has become an admirable example of implementing a sustainable process and a fun attitude in the hairdressing industry. 🌱



REFOIL.COM.AU

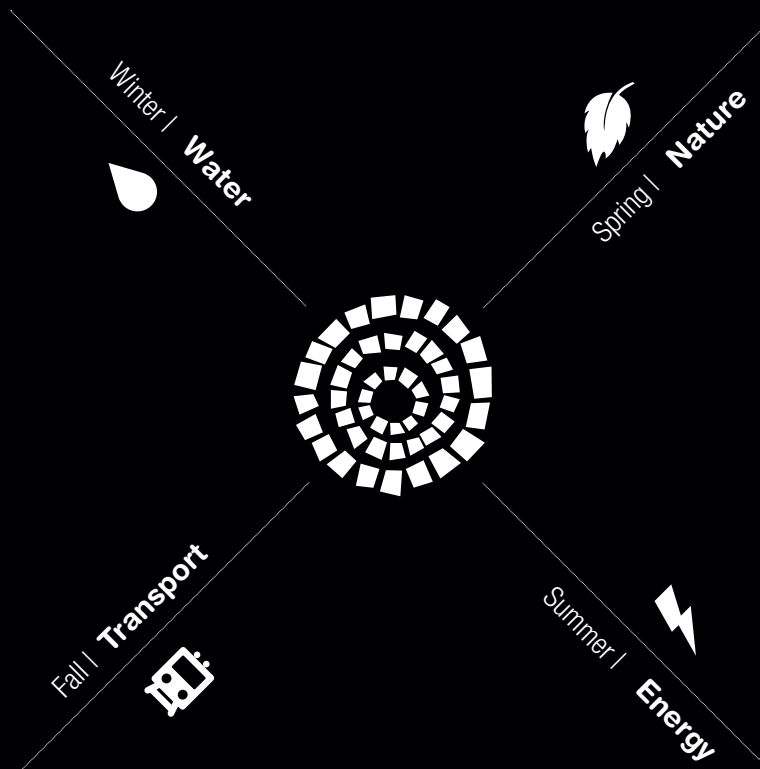
Refoil saves up to 97% of water and uses only 5% of the energy necessary to smelt extracted minerals.



VIDEO ANIMATION OF REFOIL PROCESS



REFOIL CAMPAIGN "HOW BIG ARE YOUR BALLS". DESIGN: 5ONE5ZERO



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Founded in 2010, Revolve Magazine (ISSN 2033-2912).
All inquiries can be sent to Revolve Media, Rue d'Arlon 63-67, 1040 Brussels, Belgium.
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