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## Respect, Renew, Rethink

Tackling the global water crisis will require innovative thinking, integration of disciplines and a holistic approach to water issues. Water is so integral to our lives and our livelihoods. Sustainable water management contributes to many of the UN Sustainable Development Goals. It is therefore vital that, as an industry, we understand, appreciate and tackle this very important challenge.

Water needs to be considered in its broadest sense. From the catchments and the rivers to the oceans and groundwater through to the urban collection and distribution systems. This means considering, agricultural water, industrial water, urban water, environmental water, allocation of water, water reuse, water and wastewater treatment. All of these elements are part of the water equation and all aspects need careful consideration and management to ensure we are sustainably managing this critical resource. Increasingly, necessities of this challenge are causing a recourse to disruptive technologies and paradigm-shifts, such as applying innovative devices to generate water from ambient air moisture and cloud seeding to name a few.

Climate change is having a clear impact on water – the extremes of droughts and floods have been experienced in many countries, at severities and frequencies not seen before. These extremes threaten the security of water supplies in times of drought and also threaten homes and lives during flood events.

Coastal inundation due to sea level rise could displace 200 million people by 2100 as homes fall permanently below the high tide line<sup>1</sup>. That's just one lifetime away. The implications of such a change are enormous. Exacerbated coastal hazards are of course proven to be a direct consequence of the climate change which aside from sea level rise include but are not limited to the following major social, economic and environmental risks: falling water levels of great inland lakes and drying up of wetlands, more intense tropical storms with wider-reaching trajectories thus imperiling previously out of reach geographical locations, increased storm surges causing more severe coastal-flooding especially near some major cities, more energetic wave climates in most places worldwide impacting existing coastal and marine structures which were not initially designed to withstand such loads.

A successively more agitated sea-state, as is predicted to occur over the next few decades according to UNEP/ IPCC predictions, is almost consensually expected to generate more significant morphological changes of the shorelines around the world leading to more severe coastal erosion. Moreover, an increased probability of occurrence of the so-called meteo-tsunami, which is caused by a sudden change in atmospheric pressure generating a rapid long-wave radially impacting all reachable near and far coasts, much like a more conventional tsunami caused by earthquakes and land-slides, can be devastating indeed for coastal communities and facilities which were not previously perceived to be in such a jeopardy and therefore are utterly unprotected against meteo-tsunami inundation and destructive loads.

As far as risks to marine bio-diversity are concerned, it can for instance be pointed out that a stark reality is faced in some land-locked regions of the globe like the Persian Gulf and the Gulf of Oman where fish are deprived of a water path to naturally migrate to cooler waters toward the north or south pole as the case may be depending on the hemisphere and therefore some species face certain extinction due to inevitable rising seawater temperatures. Of course, the above account is by no means an exhaustive list and many other perils related to climate change are worth noting like the loss of operational days at ports due to bad weather, both due lack of harbor tranquility and rain preventing handling of certain cargo like grains, disrupting global transport and reducing port revenues.

For many years, engineers have tried to 'manage' water – to tame rivers, build dams, protect coastal areas, pump and treat water and harness water for power. But we are increasingly understanding the power of nature and the variability of our climatic conditions (which is increasing). Now, adaptation and resilience are a key focus for water systems and solutions, integrating changes in climate into their design, asset management and investment.

There is recognition that we don't know what the future looks like, so planning for a range of scenarios and adopting solutions which can best adapt to this variability are preferred. All options need to be considered when planning water systems, including stormwater harvesting, water recycling and potable reuse. Clearly, solutions emphasising 'adaptive planning' are sought for and it may be strived to turn this sustainability quest into an historic opportunity for mankind by looking into multifaceted solutions whenever possible with added benefits. For example, using mariculture systems such as fish cages which have the potential to empower coastal communities can also be used to mitigate the impacts of depleted water bodies in the face of biodiversity threats by growing out more resilient species at sea to also cater to food security needs.

Currently, some design codes of coastal defence and breakwater structures are being revised with a view to apply circular economy principles which is expected to yield more sustainable solutions to work with nature in protecting from coastal hazards.

Generally, the full range of 'soft' and 'hard' coastal protection strategies against flooding considering all options including retreat and relocation are to be weighed properly in the context of a benefit/cost analysis before rushing to implementing a design. For example, aiming to reap the great rewards of the 'blue economy' by tapping into marine renewable energies at the same time as implementing coastal flood protection is becoming increasingly more achievable now that the technologies to harness wave and current energies into electricity are becoming more mature and some of such devices can be installed together with smarter structures for coastal protection.

As we see a broader consideration of sustainability in projects, new approaches to address water issues have emerged. Projects that are carbon neutral, projects that enhance the environment and support biodiversity and projects that close the loop through a circular economy approach. It feeds from a **respect** for the precious resources that is water, a **renewed** focus on taking a holistic and collaborative approach to solving water issues and by **rethinking** solutions to better prepare for climate change and to promote a sustainable future.

