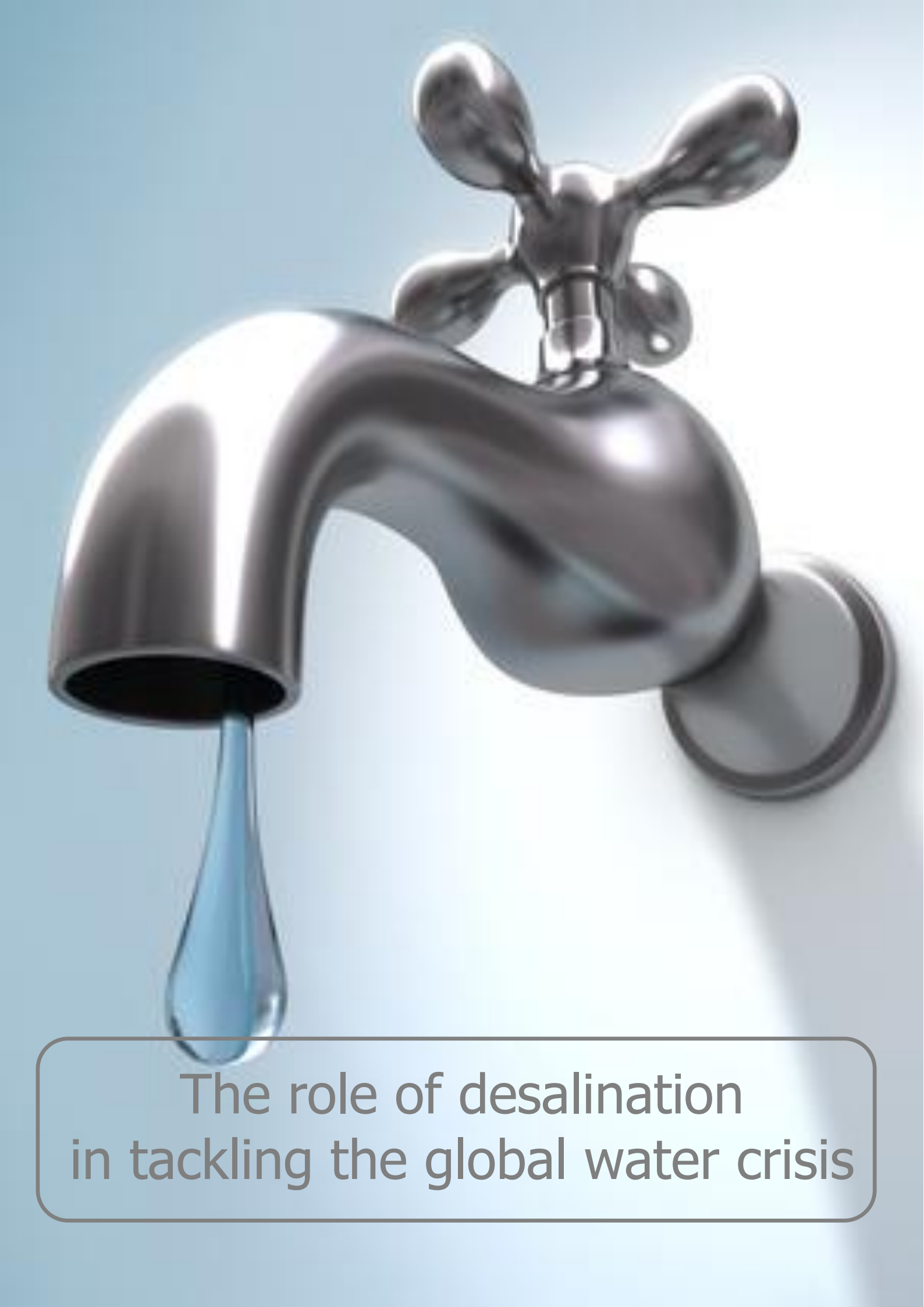

The role of desalination in tackling the global water crisis

Introduction

The human right to water

The right to water is a human right. In the 1948 Universal Declaration of Human Rights, water is implicitly mentioned as a key component of, for instance, the rights to life, to health, to housing and food.[1] Kofi Annan, former United Nations General Secretary, once declared that "access to safe water is a fundamental human need and therefore a basic human right."[2] Since 2002, the United Nations International Covenant on Economic, Social and Cultural Rights (ICESCR), ratified by 145 countries, adopted the General Comment on the right to water, and explicitly recognised it as a fundamental human right. Hence, "the human right to water entitles everyone to sufficient; affordable; physically accessible; safe and acceptable water for personal and domestic uses".[3] However, more than 25% of the world's population is still denied access to safe drinking water; and 8 million people in the world die each year of unsafe water-related deaths.[4] In fact, the United Nations Millennium Development Goals (target 7c) urge world leaders to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation." [5] Developing appropriate water technologies then becomes critical to supporting human rights globally.

Present state of affairs

Strategies and technologies to enhance water sustainability have included enhancing water efficiency (e.g. efficient taps/showers), monitoring water use (e.g. meters), promoting water conservation and re-using water (e.g. vehicle wash water reclaim units) for instance.[6] Many strategies have been implemented to increase the volume and access to drinking water in deprived areas, including filtering non-drinking water [7] or disinfecting it.[8] When people in these areas run out of options, we see an emergence of more wastewater treatment plants inland and of desalination plants around the coastal areas around the world.[1] Driven by a growing world population, the water crisis, in addition to depriving some populations of clean drinkable water, could result in rationing or importing strategies, as water enters the commodities market.[1] Taking in consideration that 98% of global water reserves are saltwater, desalination may then become a sustainable water source for coastal areas.[1] The following case study evaluates the pros and cons of desalination in regards to tackling the water crisis. It first focuses on financial and technological aspects of desalination, and then on environmental and human factors.

The desalination industry & technology

The background of desalination

Historically, desalination has been seen as a very energy intensive and cost-prohibitive process, mostly because of its intense energy use. Recently however, costs have decreased thanks to new technologies and as the market for desalinated water widens. The recent development of energy recovery devices has allowed for the cost of freshwater production to go down and to reduce the carbon footprint; by allowing plants to cut on their electricity bills,[1] which typically amount to 44% of all plant costs.[1] Environmental friendliness of the plants as well as energy costs also depend upon energy sources: plants may be powered by wind farms;[1] by solar energy[1] or by nuclear energy [1] for instance. The main strategy employed to make the process more cost-effective is producing energy while desalinating water: sea water is pushed through a membrane using high pressure ("reverse osmosis") and produces clean water by parting salt molecules from the water. In addition, an energy recovery system uses the waste, high-pressure concentrated saltwater, to generate energy. This way, plants may recuperate 89% of the input energy using a turbine; or up to 96% with hydraulic pumps; and hence reduce their energy costs. Although the water produced is still not as cheap as to be used in agriculture, a cubic meter of desalinated water can now be

bought for as low as US$0.46.[1] The industry contributes to enhancing human rights inasmuch as it provides extra resources for people in need of water and allows for better access to safe water in coastal areas.

The future of the industry

A 2010 study conducted by GlobeScan and Sustainability [14] revealed energy efficient desalination plants as one of the most promising water technologies in the next ten years. According to sustainability experts, water scarcity will shift our perception of water from a commodity to a valuable resource, hence prompting global industrial transformation to protect human right to water and the wellbeing of both people and the economy. In addition, investment and subsidies for water conservation and efficiency improvements have a high potential in sustainably reducing water shortages, 83% of experts agree.[15]

Desalination plants are present worldwide, and 75% of the global desalination capacity is located in the Middle East because of water scarcity there, the presence of seas around many middle-eastern countries and access to capital.[11] Since the global desalination market is expected to grow and reach $30 billion by 2015,[12] conglomerates are now competing on such markets, including GE and Zenon, and are buying up competition to obtain larger market shares on a promising market.[13]

Industry Focus

The emphasis of the industry seems to be mostly on developing technologies to reduce electricity use and improve its carbon footprint. In addition to energy recovery systems, cogeneration strategies use the heat produced by the "reverse osmosis" process and convert it into energy; or winds turbines or use photovoltaic systems as a source of electricity.[17] Effectively, the uncertain environmental impacts of desalination failed to stop desalination projects around the world, in spite of cases of concern about boron levels blocking plant permits in the USA.[18]

Environmental and human factors

Ecosystems

It is worth noting that, in spite of enhancing access to safe water sources and the human right to water, desalination comes with an environmental cost. Some environmental groups, including the WWF[9] oppose desalination because of its impact of marine ecosystems when sourcing saltwater (e.g. removing plankton from the habitat) and of the plants releasing concentrated saltwater waste, which can be toxic to humans because of a chemical element called boron, naturally present in seawater. Many plants choose to mitigate the impact of waste by rejecting it in brackish water (saltier than fresh water, less salty than sea water, typically found where rivers meet the sea) rather than sea water.[10]

Development issues

In addition, a 2007 WWF report warns of the indirect environmental impacts of desalination: energy use and the subsequent carbon footprint, as already mentioned; but also development issues, as offering manufactured water tends to promote unsustainable behaviours rather than encouraging efforts in water conservation, efficient water use and recycling wastewater. In consequence, the "WWF believes that better economic and environmental outcomes would flow from improved and consistent processes to assess water needs and the optimum mix of both supply and demand side measures that could be deployed to meet them. Where seawater desalination is established to be a part of meeting a real water need in the most cost effective and least damaging way, desalination plants need to be sited, constructed and operated to best minimise or mitigate their environmental impacts."[16]

Freshwater production for developing countries

As far as human populations are concerned, if the relief desalination brings does not tend to encourage sustainable behaviours among individuals, does it benefit them anyway? Access to safe improved drinking water, by way of desalination or other technology, tends to

reach quite high levels in developed countries such as the USA or Australia; while certain parts of Africa or Asia suffer a lack of improved drinking water that threaten their right to access safe water, if not their lives. Taking into consideration desalination alone, the development of plants has historically been linked to capital-intensive investments, and hence was once reserved to rich but water-deprived areas such as Gulf states. As costs went down and pressure on water supply increased, the countries that desalinate and reuse water now include developing countries such as Algeria or Ghana. Fresh water production in 2009 hit a record 9,5-million cubic meters a day, according to analysts Global Water Intelligence.[19]

Innovation: Design Technology & Irrigation Ltd

Although desalination plants do not currently represent an economically viable source of water for agriculture, Design Technology & Irrigation Ltd[1] developed an award-winning [1] technology that enables the use of desalinated water in agricultural processes. Rather than desalinating the water using a costly and energy-intensive plant, they use creative alternative devices. The Dutyion Root Hydration System™ uses sub surface pipes to irrigate crops: the water, from whatever source including brackish or waste water, goes through the walls of the pipes rather than through holes or emitters. [1] It is water-efficient and provides an ideal amount of fresh water to plants, while retaining salt, waste and contaminants within the pipes. Such technology has the potential for allowing agricultural crops to grow where there once could not exist because of a lack of fresh water, including in arid and desertic environments, [1] and in places where installing desalination plants is not a likely option.[1] It hence provide local populations with ways to enhance self-subsistence strategies through agriculture, and contribute to enhancing human rights while preserving the environment.

Desalination and food production

Water-intensive industries, such as soft drinks producers, would rather combine small improvements in systems and in crop-growing to save water rather than use pricier manufactured water. The same applies for millions of farmers worldwide (70% of water use is agricultural[1]) who cannot afford the cost of manufactured water, in comparison with "free" water. Some countries such as Jordan would rather implement cheaper and less technology-intensive solutions, like improving irrigation, collecting water managing crops, or reusing wastewater for irrigation rather than desalinating sea water. [1] In spite of decreasing operating costs, desalination is still a more expensive solution than water conservation and sustainable behaviours in using water.

Conclusion

To conclude, while the water crisis deprives many of the basic human right to access to safe drinking water, desalination plants, along with sustainable behaviours, may be used as a way to enhance access to safe drinking water for populations. It is unlikely however that it becomes as effective a response to the water crisis as sustainable behaviours such as ensuring water conservation or seeking water efficiency. Therefore, desalination represents part of the solution to the water crisis, but in constrained situations. It seems most efficient for local use around coastal areas rather than to be transported inland but seems to become more mainstream in poorer countries as capital requirements go down in comparison with the high cost of lacking water. Technology advances are to look out for as well, following the example of Design Technology & Irrigation Ltd, as they further reduce the cost of desalinated water and make it suitable for a number of uses including agriculture. For investors and for the water industry, desalination may well represent a new business opportunity in a high-tech sector that has the benefit of enhancing human rights and contributing to their corporate social responsibility credentials. In the meantime, desalination plants and existing technologies provide a much needed relief for populations in urgent need of solutions to limited access to water.

[1] http://
[2] http://www.righttowater.info/
[3] http://www.wateryear2003.org/en/ev.php-URL_ID=4087&URL_DO=DO_TOPIC&URL_SECTION=201.html
[4] http://www.suez-environnement.com/en/sustainable-development/approch/challenges/access-to-water-is-a-basic-human-right/
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