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Hydrolink

BUSINESS AND INDUSTRIAL WATER SECURITY

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Water-related Risks

Water security can be generally defined as the assurance of uninterrupted water supply in sufficient quantity and adequate quality to meet the domestic water needs of a country or a sub-national unit, and support the water-dependant economic activities that are essential for the welfare of its people. For business and the industry water security means the aversion of water related risks that may cause operation disruptions and result in economic losses either due to damages caused by flooding, or due to water shortages. Water shortages are often related to local water scarcity, but they can also result from damage to the water infrastructure by extreme natural events, accidents, or malicious acts such as sabotage or terrorism. The availability of the water supply may also be affected by administrative and regulatory changes concerning water allocation and use. Finally, efforts by a business to secure water rights or the use water management practices that are in conflict with the interests of local communities carry the risk of reputational damage.

Traditionally the risk of flooding of industrial facilities is addressed in their design which aims at ensuring that they are safe during extreme events corresponding to the highest level of acceptable risk. Failure to properly design water supply systems that can continue operating during and after extreme events can have catastrophic consequences, such as the loss of the cooling water supply at the Fukushima nuclear station after the March 11, 2011 earthquake and tsunami.

Many companies assess and report key water use and discharge data in the context of their efforts to adhere to the principles of sustainable development. The Global Reporting Initiative (GRI), a network of business, civil society, academic and other organizations, has developed sustainability reporting guidelines, that include key water parameters such as the total water withdrawal by source, water sources significantly affected by water withdrawal, the percentage and total volume of water recycled and reused, total water discharges by quality and destination, and characterization of water bodies and habitats affected by discharges of water and runoff from the reporting organization. However, this standard reporting does not include the assessment of water-related risks. In 2011 the CDP Water Disclosure project conducted a survey of 316 among the world's 500 largest companies in the FTSE Global Equity Index Series. The survey showed that 59 percent of the 190 companies that responded reported exposure to water-related risks.

A high-level initiative of the global business community was launched by the World Economic Forum (WEF) when in 2008 it declared water as a strategic issue for business. The 2011 meeting of the WEF in Davos focused specifically on water security. The discussions and conclusions of this meeting are summarized in a concise volume, which discusses water security in the context of the water-food-

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Figure 1. The Maplecroft Water Security Risk index expressing the level of water related risks in different countries around the world [2].

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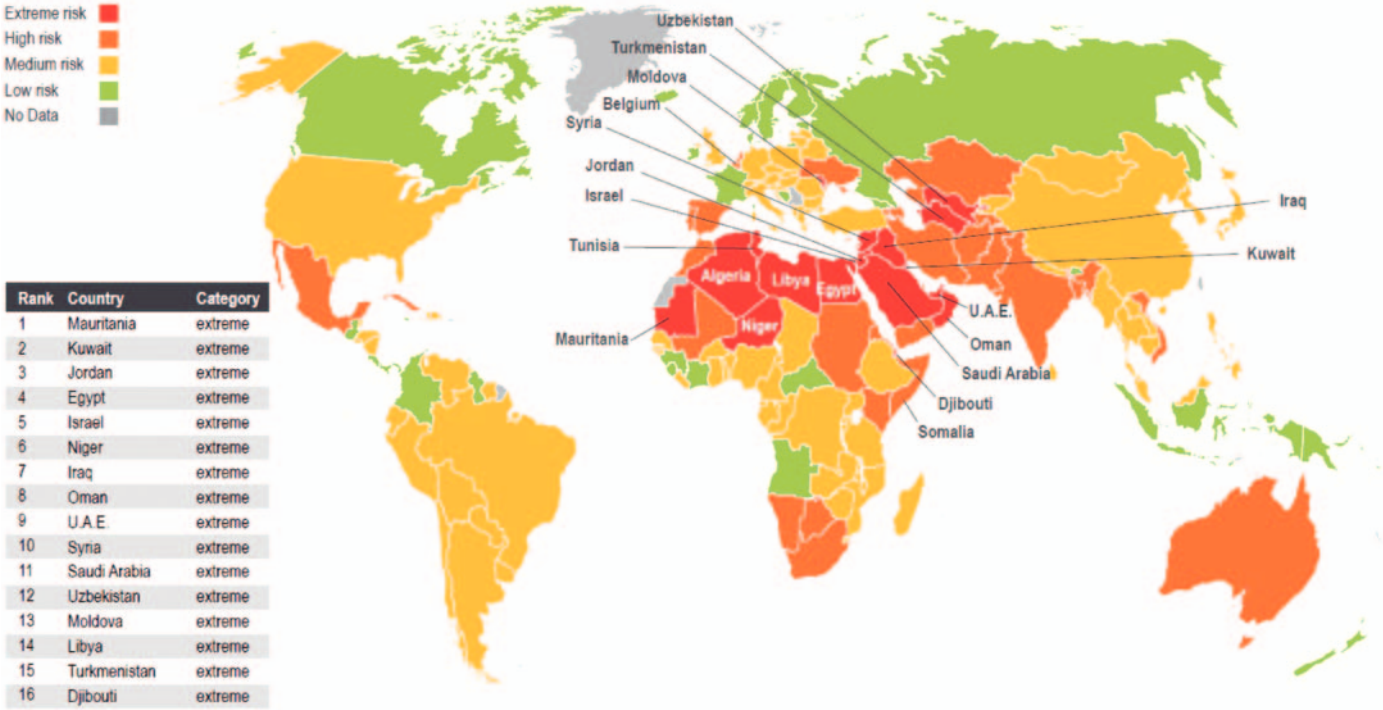
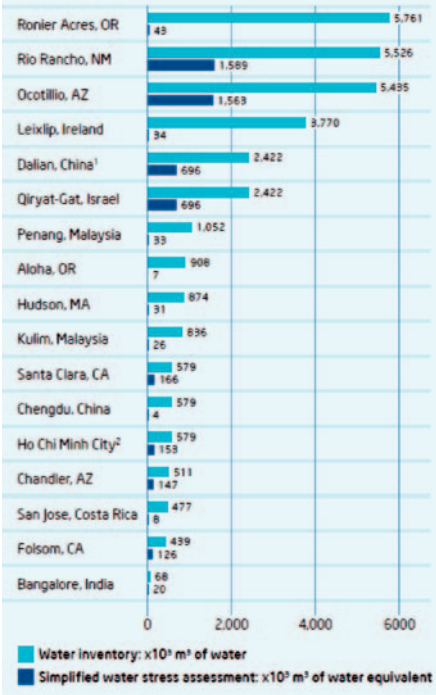


Rank	Country	Category
1	Mauritania	extreme
2	Kuwait	extreme
3	Jordan	extreme
4	Egypt	extreme
5	Israel	extreme
6	Niger	extreme
7	Iraq	extreme
8	Oman	extreme
9	U.A.E.	extreme
10	Syria	extreme
11	Saudi Arabia	extreme
12	Uzbekistan	extreme
13	Moldova	extreme
14	Libya	extreme
15	Turkmenistan	extreme
16	Djibouti	extreme
17	Tunisia	extreme
18	Algeria	extreme
19	Belgium	high
20	Somalia	high

Figure 2. Comparison of water inventory and water stress assessment of different facilities of Intel Corporation at various locations [3].

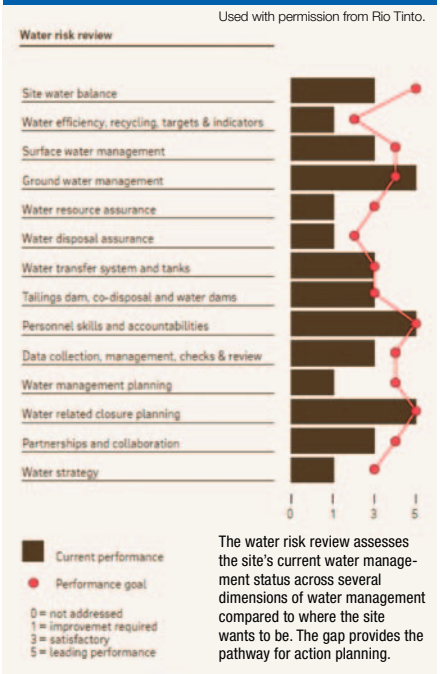
Used with permission from Intel.



The top bar shows total cubic meters of water used at each site in 2010. The bottom bar shows an "equivalent of water" figure adjusted for the water stress of the location using qualitative factors. This analysis confirms that we should prioritize our efforts and investments at our top four arid locations: New Mexico, Arizona, Israel, and China

Figure 3. Illustrative example of Rio Tinto's water risk review along different dimensions of water management [4].

Used with permission from Rio Tinto.



The water risk review assesses the site's current water management status across several dimensions of water management compared to where the site wants to be. The gap provides the pathway for action planning.

energy-climate nexus [1]. Another related high-level initiative is the UN CEO Water Mandate, launched in 2007 and designed to assist companies around the world develop, implement and disclose water sustainability policies and practices. Companies joining this initiative pledge to conduct comprehensive water-use assessments, set water conservation and waste-water treatment targets, seek to invest in and use new technologies to achieve these goals, raise awareness of water sustainability within their corporate culture, and include water sustainability considerations in business decision making.

Indicators, Tools and Methodologies

Well defined quantitative indicators, or metrics, can be used to assess progress towards water security. One of the most widely used such indicators is the water footprint, which, when applied to business, consists of two components, the operational water footprint, the freshwater volume directly used by the business, and the supply chain water footprint, the volume of freshwater used to produce the materials and external services that are inputs to the production process of the business. The Water Footprint Network, established in 2008 to coordinate efforts to further develop and disseminate knowledge on water footprint concepts, methods and tools, has prepared a global water footprint standard. In assessing water-related risks it is important to distinguish between the green, blue and grey components of the operational and supply chain water footprint. The green component of the water footprint refers to the amount of water embedded in products of rainfed agriculture. The blue component measures the use of surface water from rivers, lakes or reservoirs and groundwater. The grey water footprint component is a measure of the water pollution caused in the production process. It is estimated as the volume of water required to dilute the effluents from the production of a product to bring the receiving water body to acceptable water quality standard levels. To improve the water security of a business it is necessary to minimize the blue and grey components of its water footprint

An example of combining different indicators into an overall water security index can be found in the work of the consulting firm Maplecroft that is aimed at helping businesses and investors assess the risk of potential future disruptions to their operations associated with their water supply in different countries. Maplecroft's index is based on the key factors affecting water security including water stress, rate of population growth, dependence on water supplies originated or controlled outside the country, sustainability of water use, intensity of water use in the economy, government effectiveness and virtual water use. Figure 1 shows the result of this assessment highlighting the countries with the highest level of water-related risks. To assess water related risks in large countries with diverse geographic, demographic and water availability conditions, such as for example the United States and China, the water security assessment must be made at a regional or local scale to account for internal differences in the parameters that compose such an index.

The importance of accounting for local conditions is illustrated in an example of water use data reported by the semiconductor manufacturer Intel. Besides direct water use at different facilities, Intel also reported an adjusted equivalent water use, estimated by combining actual use with a regional water stress index at the location of each facility. This equivalent water use is a better indicator that can be used to rank different facilities based on their water security vulnerability. Figure 2, which shows these data, suggests that the ranking of various facilities based on actual and adjusted equivalent water use can be quite different. Facilities with high actual water use in places such as Oregon and Ireland where there is not much water stress, come fairly low in a ranking based on equivalent water use, while, operations in water stressed places like New Mexico, Arizona and Israel rank very high, even if their total actual use is lower.

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Several tools and methods for assessing water related risks have been developed in the last few years. For example, the Global Environmental Management Initiative, a non-profit organization of several major companies focusing on environmental, health and safety issues, produced the Water Sustainability Tool

designed to help individual companies build a business water strategy, and the Water Sustainability Planner designed to help convert corporate sustainability strategy to site or unit strategies for water and understand water use impacts and associated risks. The World Business Council for Sustainable Development developed the Global Water Tool to help companies and organizations map their water use and assess risks relative to their global operations and supply chains. The life cycle assessment methodology, which measures the environmental impacts of individual products from cradle to grave, has also been applied to water use. Goldman Sachs, General Electric and the World Resources Institute are also working to develop a Water Index to measure water-related risks and opportunities for companies and their investors, starting with a pilot project focusing on the thermal power industry in the Yellow River basin in China.

Examples of Industrial Actions to Improve Water security

Many industries are working to improve their water security by analyzing water-related risks and vulnerabilities, redesigning some processes to use water more efficiently, minimizing losses through leaks or evaporation, increasing water reuse and resorting to alternative supply sources.

For example, Rio Tinto, the second largest mining company in the world, has developed a water-risk review methodology that it uses to evaluate its sites across several dimensions of water management and to assess progress towards set goals. Figure 3 shows an illustrative example of Rio Tinto's comparison of actual performance with set goals in their water risk review. In Chile the copper mining industry is working to develop thickening techniques that increase concentrations of solids, therefore lowering water requirements in different steps of ore processing and tailings management. At the same time it is increasing water recycling in its processing operations and exploring the use of sea water for processing where feasible.

The power industry is moving away from once-through, or open-loop, cooling systems that use large volumes of water, and is building most new thermal powerplants with recirculation, or closed-loop, cooling systems that use much less water. Even though the consumptive use of once-through cooling systems is of the order of one percent of the withdrawn water, or less, water availability or environmental constraints on discharge water temperatures may disrupt or limit power generation during periods of drought. In addition the industry is adopting air cooling and wet/dry hybrid cooling systems. These systems are particularly attractive for concentrated solar electricity facilities, which are often located in places with limited water resources. Use of such systems can reduce water use by 80 to 90% at a relatively small penalty of increasing the electricity cost, of the order of 2 to 10% depending on the location of the plant and other factors.

The beverage industry, which is particularly sensitive about its image regarding water use sustainability, has undertaken different campaigns to publicize its progress on this subject. For example, Nestlé publishes a water management report presenting year-to-year data on specific indicators, such as the amount of freshwater used and the amount of waste-water generated per unit of product. PepsiCo recognizing water security as one among the top ten global risks to business has undertaken pilot studies in different watersheds where it has facilities aiming at using the lessons learned from these studies for the development of a strategy around corporate water risk management. Other beverage companies like Coca Cola, Molson Coors and SABMiller are also engaged in similar efforts.

Even industries that do not use much water are working to develop reliable statistics on water use and set targets to reduce it. For example, the Strategic Forum for Construction in the UK has developed an Action Plan to reduce water usage at construction sites and to develop tools and an auditing methodology for the systematic collection of relevant data on water use in construction.

In conclusion, awareness about business water security is on the rise. An increasingly larger number of businesses and industries assess their water-related risks and develop their policies and strategies to improve their water security. In the last few years, several indicators and methodologies have been developed to help businesses assess and improve their water security. As more attention is paid to water-related business risks, it is anticipated that researchers and practitioners will continue improving the tools for systematic quantitative assessments of progress towards minimizing these risks.

References

1 Waughray, D. (ed), 2011: Water Security: the water-food-energy nexus, the World Economic Forum water initiative, Island Press, Washington
2 Maplecroft, 2011: Oil producing Middle East and North African countries dominate Maplecroft water security risk list, posted on 22/03/2011
3 Intel, 2011: 2010 Corporate Responsibility Report
4 Rio Tinto, 2009: Rio Tinto and Water, Rio Tinto Limited, Melbourne, Australia