

(Energy) Business in the World of Water “the H2O Scenarios”

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1. Introduction

Water should be high on the energy business agenda because like all businesses, it depends on water. The world is not “running out of water,” but it is not always available in sufficient quantities when and where people need it. Climate, normal seasonal variations, droughts and floods can all contribute to local extreme conditions. The concept of water stress is therefore relatively simple: it applies to situations where there is not enough water for all uses, whether agricultural, industrial or domestic. Defining thresholds for stress in terms of available water per capita is more complex, however, entailing assumptions about water use and its efficiency.

Water stress will manifest itself in urban areas. In 60% of European cities with more than 100,000 people, groundwater is being used at a faster rate than it can be replenished. Even if some water remains available, it costs more and more to capture it. Cities that have experienced aquifer drops between 10 to 50 metres include Mexico City, Bangkok, Manila, Beijing, Madras and Shanghai. In 2000, the world population was 6.2 billion. The UN estimates that by 2050 there will be an additional 3 billion people with most of the growth in developing countries that already suffer water stress. Thus water stress will increase unless everyone finds ways to conserve and recycle the precious resource.

Who uses fresh water? In many developing nations, irrigation accounts for over 90% of water withdrawn from available sources for use. In England where rain is abundant year round, irrigation water used for agriculture accounts for less than 1% of human usage.

Yet even on the same continent, water used for irrigation in Spain, Portugal and Greece exceeds 70% of total usage. Irrigation has been a key component of the green revolution that has enabled many developing countries to produce enough food to feed everyone. More water and land will be needed to produce food for 3 billion more people. But increasing competition for water, inefficient irrigation practices and allocation of land for other purposes (e.g. energy crops, infrastructure) could constrain future food production. After agriculture, industry is the second largest user of water. The amount of water used varies widely from one type of industry to another. The California Energy Commission estimates that thermal power plants consume between 0.95 to 2.3 liters per kWh. This consumption includes evaporative loss, not water that is recaptured and treated for further use. As a result, current electricity consumption from fossil fuels and nuclear energy

requires 39% of all freshwater withdrawals in the United States, while China uses 15% of total water withdrawals for energy production, mainly in coal-fired thermoelectric plants. Traditionally the energy industry has not been constrained by water, however there are some trends that may indicate that the water intensity of the energy industry is increasing, competition for water can become a reality and that climate change effects can result in limitations:

- In France during a heat wave in 2003 Electricity production was reduced because of cooling water withdrawal limitations because of temperature and river flow
- To access the “unconventional” fossil fuels required to meet the future energy demand (World energy consumption is expected to double by 2035 relative to 1998 and triple by 2055¹), water/steam is often
- injected into conventional oil wells will be required to increase the recoverable barrels of oil or extract oil from unconventional oil resources such as oil shale and tar sands. In addition, these processes increase the need for treating the oil/water mix, which in turn raises energy demand.
- Hydrogen is currently extracted from gas, and can be subsequently used in fuel cells. In a potential hydrogen economy, it could be used as energy storage and a transportation medium. Large quantities of energy and water would be required to generate hydrogen from water via electrolysis.
- There is a wide range of estimates about the potential of biomass as a energy source, ranging from 0 to 1000 Exa (10^{18})J/year by 2050 (current world energy consumption is approximately 400EJ/year). Based on land and productivity constraints the current consensus is 200 EJ/year.
- Over 7% of the road transport fuels market potentially can be made from bio fuels by 2020. Not all biofuels are the same, nor are they “the perfect fuel”. Today’s bio fuels (1st Generation) are derived from food crops (sugar, corn, wheat, vegetable oils). This requires approximate 6 times the amount of water than bio fuel produced (this excludes the amount of water needed to produce the crops). By utilising the agricultural residues associated with food crops and the use of non-food biomass e.g. wood (2nd Generation) lower cost biofuels in a longer term and in a more sustainable (e.g. less water and energy intensive) and environmentally friendly manner.
- The total electricity consumption of the water and wastewater sectors will grow globally by a predicted 33% in the next 20 years.

2. The Challenge

Water is everybody's business. Yet in the "world of water" – anything from water quantity (resources, supply) to quality (pollution) to policy – is so complex, emotional and uncertain that businesses can be paralyzed when trying to act in a strategic way to solve water issues. How important is it to act now, how would a world look like if we do little or globally dispersed water management, or if we get our act together. How do businesses create insight in decisions that business has to take now to be better prepared for the future? It has taken the world community a long time to understand the complexity of Global Climate Change and develop governance structures like the Kyoto Protocol. Although water is a global problem, it manifests itself locally. Creating a global response is therefore an even greater challenge, despite that the impact in terms of development is even bigger.

For us in the energy business it is therefore timely to understand how water plays a role in energy development to ensure that we can be prudent global citizens, providing energy as clean as possible while taking good care of the natural resources.

3. Scenarios

As a first step we have been using a scenario tool. Now what are scenarios? They are stories about the future that are designed to test the mental maps that managers hold. They are also used for testing the robustness of business strategies in different imagined futures. Scenarios differ from forecasts in that they always come in sets – two, three, or more equally plausible, relevant, and challenging versions of a possible future. A forecast is based on a single interpretation of the best information we have about the present as it is extrapolated into the future. Fundamentally, a forecast assumes that the future is fairly similar to the past or that we understand with a fair degree of certainty what is likely to happen. Scenarios, in contrast, offer multiple versions of an unknowable future. Scenarios move from what is known to what is not known. In addition to changing mental maps, engaging with scenarios can reveal blind spots as well as expose areas where strategies may not be robust. Rather than offering answers, they create a common language and a shared context so that we can begin a strategic conversation.

4. H2O Scenarios

The H2O scenarios offer three stories about the role of business in relation to the growing issue of water in the world. These stories do not try to cover everything but attempt to bring to life a limited number of alternative future environments that will challenge our economic viability, social legitimacy, and global fitness in the marketplace. While the three stories together – H, 2, and O – were created in relation to each other, as part of a 'molecular set', they are intended to present mutually exclusive worlds as platforms for discussion.

Hydro is the story of efficiency (more value per drop and more drops for less). It highlights avoiding or unlocking legacies inherited from the past – in ways of thinking as well as in technologies, business practices, and public policies – to create new business opportunities in the world of water. Legacies from the past include the reluctance to use water from one process for another for example, to use oil production water for agricultural irrigation; expectation to use drinking quality water for all household purposes and the history of abundance masking awareness of water stress.

The story focuses on the ‘H’ of H₂O – ‘Huge’ economic opportunities in this new, urbanized world through innovations, especially in technology through more efficient agricultural approaches, drought-resistant crops, saline water-based biomass production, increased water-use efficiency of agricultural practices, using seawater for industry, protecting and restoring ecosystems that enhance water collection and flood mitigation, incentives for water-saving programs.

In **Hydro**, there is a strategic advantage to being the first to market. With the flexible, right-choice solutions rather than being locked out. While the geographical focus of the story is China, Hydro raises serious questions about other parts of the world.

Where else is urbanization at risk from a multitude of water challenges? Where else are governments and their societies likely to respond with market-enabled solutions? The implicit warning in this world of increasing hydro opportunities is that current business and technical solutions cannot be continually or effectively scaled up to solve the growing water stress. In addition, technical and efficiency-focused solutions are not likely to solve the resource allocation problems – that is, who should have the water?

Rivers is the story of security – enough water of sufficient quality for both the haves and the have-nots. In this story, cast in the form of a cautionary tale, business recognizes that there are many different sides to security. Some businesses increasingly risk losing the ‘license to operate’ where they are competing with basic human needs or are out of touch with political realities.

The story focuses on the ‘2’ of H₂O – 2 sides of the water question (although sometimes, of course, there are more than two sides); 2 sides of a water dispute – often, literally, on opposite banks of a river that divides one territory from another or between upstream and downstream interests; 2 ingredients for meeting future water needs – market-driven solutions and far-sighted government policies; and, most importantly, the necessity of solving water problems ‘2-gether’, in partnership with other stakeholders. How do we allocate water fairly for all users in a community, not just the highest bidders? In **Rivers**, a number of businesses create cross-sectoral partnerships with local authorities to address water access and use issues. But many of these partnerships struggle with the added challenge of taking into account the shifting foundations on which they have been built. The wider waterscape is continually shifting, in part because of conditions arising from climate change, water transfers embedded in traded goods and services, and the culmination of historical pollution legacies and over-abstraction practices. But even more unstable than these factors is the increasingly volatile local political landscape in which the issue of water is frequently used because it can trigger intense emotions. Although

local partnerships solve many local problems, in **Rivers**, upstream solutions sometimes have unintended downstream consequences. And the focus on human needs for water in the short term sometimes neglects the effects of human solutions on the long-term health of critical ecosystems.

Ocean is the story of *interconnectivity* – accounting for the sustainability of the whole system. It focuses on how business begins to recognize its role in a world of bigger, more complex, interconnected, and dynamic water challenges and natural systems in which economies, societies, cities, and individual human lives are embedded. In the world of Ocean, business realizes that it cannot help particular communities survive and prosper at the expense of causing water stress elsewhere. Ocean is a world that offers new opportunities to help societies and governments achieve more inclusive and integrated forms of security. Like the entirety of the ocean, the enormous whole round ‘O’ of the H₂O scenario set is difficult to see, much less to act in relation to – but if we could imagine.

5. Messages for the Energy Business from the scenarios

Messages from “H” – Hydro

- Water efficient energy technology is important, but only part of the solution.
- Appropriate energy solutions involve participation and partnerships and do not necessarily mean ‘high tech’.
- Relevant innovation can also be driven locally.

Messages from ‘2’ – Rivers

- Energy Business cannot buy its way out of water problems.
- Business must engage and negotiate outside its fence-line, within the territory of the ‘other’ in order to secure its activity.
- Creating trust secures the license to operate.

Messages from ‘O’ – Ocean

- Energy forecasting models need to take into account the changing water context in order to anticipate risks that stem from way outside the current business model/comfort zone.
- Connect the dots of the land, energy, water and climate to create opportunities the energy business would otherwise remain blind to.
- New level of accountability and governance is required to deal with the interlinkages

Next Steps

Building on the messages from the scenarios, there are some actions the energy business can or should undertake. The Hydro scenario focuses on the requirement water efficient energy technologies. Water must be therefore be recognized as a constraint and integrated in innovation processes. The River scenario highlights the importance of knowing your water footprint. To anticipate where engagement is required to secure its activity, the energy business should understand its present and future footprint in general. A first step already has been taken through the development of a WBCSD Global Water Inventory Tool. This tool will be developed to provide water-related information on operations, supply chain and consumer markets, to enable companies to prioritize and address current risks and evaluate longer term business investment decisions.

The Ocean scenario highlights the need for connecting the dots between land, energy, water and climate to create opportunities the energy business would otherwise remain blind to. This requires concerted action among various sectors. As a first step in that direction, the energy and climate focus area of the WBCSD has established “Energy, Water and Climate Change work stream. Lifecycle studies on the various future energy paths like bio fuels like should address implications on water and food security.