International Chamber of Commerce
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Briefing note
Water for Energy

Objectives

This paper aims at identifying and recommending best practices and policies from global business to address the water-energy nexus, while outlining potential drivers of innovation.

Background

Water is critical for most operations related to the production of energy, including as:

- a primary source of energy,
- a cooling source for thermal electricity production,
- a by-product in oil and gas production,
- a necessary component in shale gas and oil sands production
- an input for bio-fuel production,
- an energy storage medium via pumping stations.

Conversely, energy is needed to enhance access to water as well as for sanitation purposes, water pumping and treatment activities, and desalination processes.

This two-way water-energy nexus raises several key issues that impact water quality and water quantity aspects, particularly:

- making water available to secure energy supply in a water scarcity context;
- making energy available for the supply of water and sanitation while optimising energy efficiency and the use of renewable energies.

As global forecasts indicate growing energy demand over the next several decades, it is also important to consider the potential for a proportional increase in water needs for energy production as well.

Moreover, it is becoming more widely recognized that there also exists a water-energy-agriculture nexus in view of the major contribution of water and energy to the agricultural sector and of agriculture increasingly becoming a provider of energy sources, through biofuels for example. .

Social issues are also crucial as access to energy and water are key aspects of poverty alleviation policies. Biodiversity related considerations are also significant because fresh and ocean waters are impacted by human activities which can lead to environmental problems.

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All these issues have been clearly identified as major factors of development at the 2002 World Summit on Sustainable Development in Johannesburg, in the subsequent work of United Nations Commission on Sustainable Development (UNCSD) and they are part of the Millennium Development Goals (MDG's)

The upcoming June 2012 Rio+20 Conference, with poverty reduction already a critical factor on the agenda in the context of a transition towards a green economy will revisit many of these issues and look at the water and energy nexus.

Finally and most importantly these issues are raised under a global context of an increase in the demand for food, water and energy influenced by population growth and economic development, for example via a projected 50% increase in energy demand by 2030, and a 50% increase in water demand by 2025 for developing countries alone.

For all these reasons, the interaction between water and energy is a very important consideration. While the question of water stewardship, and more generally water and sanitation have been discussed in many forums, including UNCSD, Stockholm Water Week and the World Water Forums, the importance of water for energy production has not always been fully recognized. Consequently, water management and policies should fully integrate this dimension, taking into account its specific constraints.

Key Policy recommendations based on best practices

Governments should shape their policies to focus on:

1. Not only scarcity of water resources but also on constraints to water usage in regards to its availability, both in terms of water flow and water quality;
2. As water is a resource to be shared between various users all stakeholders should be involved in the policy-making process;
3. Organising water management for energy purposes within a watershed/catchment scale:
4. Technological developments that may bring new solutions to problems raised by impacts and constraints in the management of water and energy;

1. Focus not only on scarcity of the water resource but also on constraints on water usage with regards to its availability both in terms of water flow and water quality

Water is not a global commodity, it does not have the same value everywhere due to differences in availability and usages. Primarily it is a local issue with economic, environmental, social and cultural dimensions.

Different regions are endowed with different levels of renewable fresh water resources, so the economic and social value of water can differ significantly depending on local dynamics.

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In some arid or semi-arid regions, the potential water demand for energy production exceeds its availability, and is in competition with other requirements.

Furthermore it is critical to not take the availability of water for granted. Even where water is not considered to be scarce, climate variability and potential climate change impacts are likely to reduce water availability in some areas and at certain times. For instance, recent droughts in European countries or in the United States have led to energy disruption highlighting the vulnerability of the energy-production industry to water shortage.

While it is quite common to talk about the “water footprint” of a product (from a production chain), drawing a parallel with the concept of “carbon footprint”, such comparison is not relevant for source of energy. Indeed, if a tonne of carbon saved in a place can offset a tonne of carbon emitted somewhere else regarding their respective impacts on global warming, the same thing cannot be said of water as sound water-management in one region does not have any impact on the availability of water in another part of the world. It is why an initiative was proposed and accepted at the 6th World Water Forum[1]. The purpose of this initiative is “By 2015, establish a conceptual and analytical framework for evaluation and reporting of the energy impacts on water”. It aims to establish widely agreed definitions for the terminologies commonly used (use, withdrawal, consumption, evaporation, water footprint, etc.) and to establish a comprehensive evaluation framework for energy impacts on water[2].

When designing policies to determine the most appropriate energy mix for a country, policy-makers should always consider the available water supply. The appropriateness of a technology depends on the local situation. For example, energy production technologies that are efficient from a carbon-emission standpoint may also be very water-intensive making these technologies appropriate for regions where water is abundant, but not in those suffering from water scarcity. Coal-powered power plants have significant differences in terms of water consumption varying between 30% and 90% per net MWH when CO2 capture is added. An adequate water pricing policy that reflects the real cost of water should be concretely implemented as it would likely impact water management schemes and consumption as well as encourage a broader use of alternative and sustainable technology solutions.

Availability of water for energy must also be considered with regard to the quality of water released at the end of the industrial cycle. Sometimes, water returned to the environment after use in energy production is inadequate for human consumption (chemical composition) or endangers biodiversity (water temperature, oxygen contents). Furthermore, different sectors and technologies differ widely in the amount of water consumed, in both water withdrawal and consumptive use. This point must be considered.

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[1] World Water Forum 6 - Target and solutions Group 2.3.4 Report
[2] Water footprint – ‘direct and indirect water use coupled with water risk mapping to account for local water scarcity” (OECD Glossary)

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2. As water is a resource to be shared between various users all stakeholders should be involved in the policy-making process

Water is needed for multiple uses (drinking water and sanitation, agriculture, industry, energy, transportation, etc.). At the same time, water, before being a resource, is a part of the natural environment with extremely rich ecosystems, so that its exploitation must take into account the needs of these ecosystems. In this context, and given the climate change impact on water availability, perception of the different uses of water by populations in developed countries often places energy at the bottom of the list (drinking water > water for food > water for environment and biodiversity > water for energy).

In the coming years, users are likely to face greater competition for their water supply, as well as increasing public scrutiny with respect to the way they deal with water issues. Under these circumstances, energy producers will have to carry on integrated dialogues with all stakeholders: public institutions, agricultural interests, unions and civil society. Indeed, the involvement of all actors is crucial to develop comprehensive and strategic options that address prevailing economic, social and ecosystem conditions with available governance, infrastructure, financial, technical, human and operational resources in different communities.

In order to do so, it is necessary for public authorities to provide the appropriate political leadership and enabling frameworks, since sound stakeholder dialogues can only take place in a strong and stable legal, regulatory and economic context.

3. Water management for energy purposes must be organized within a watershed/catchment scale

As water issues are local, it is fundamental to look for solutions at the local level. At the same time, water resources rarely respect national borders and are often shared across borders, making regional and international cooperation essential.

Given this reality, appropriate management strategies should be developed watershed by watershed rather than country by country. This is needed at the level of each and every watershed, taking into account all users and utilising an Integrated Water Resource Management (IWRM). It is also the appropriate place to consider opportunities of water reuse, given the level of quality required by each type of users. Use of water for energy must comply with this approach.

An example is the European Union, where integrated river basin management, (in which resource issues, water pollution and biodiversity are managed together, river basin by river basin) is now a mandatory requirement.

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Example of water-management by river-basin: the International Commission for Danube

The case of the management of the Danube is a typical one, since the Danube is the most "international" river of the world: it goes through ten states, and its basin affects around twenty countries, from different languages, cultures and histories. It is a strategic channel in the region, joining Western and Eastern Europe and, for some landlocked countries, constitutes the only maritime access.

The river's modern history starting from the 18th century is marked by rivalry among major powers and political oppositions. However, this has not prevented the slow assertion of essential principles governing the use of navigable channels. As early as 1856 was created the European Commission of the Danube, in charge of organizing free-circulation on the lower part of the river. Until World War II, the river's governance organs were characterized by their fragmentation and, in 1948, the new Commission that was created excluded non-communist countries.

At the beginning of the 1980's, environmental concerns started to be taken into account. In 1985, the Declaration of Bucharest set the objective of improving the quality of the Danube's waters, and, in 1991, the Environmental Program for the Danube basin was launched, partly financed by the European Union.

The cooperation agreement for the protection and the sustainable use of the Danube, which was signed in 1994 in Sofia, set the foundations for the beginning of a true and international cooperation on this issue. It created the International Commission for the Protection of the Danube River (ICPDR), the headquarters of which are in Vienna. The Commission became effective in 1998 and, since then it has grown into one of the largest and most active international bodies of river basin management expertise in Europe. It brings together 15 members states and 21 official observers.

The commission is an intergovernmental platform, composed primarily of national delegations that meet and confer twice a year. In addition, much of the work of the ICPDR is done by Expert Groups, panels of specialists from the member countries and official observers. As an example, in October 2010, when an accident in an aluminium plant in Hungary caused a flood of toxic red mud on local villages, the ICPDR was immediately able to coordinate the evaluation of the catastrophe's consequences on the Danube River.

French water basin agencies[3]

France has developed a specific way of dealing with these issues, through the creation of water basin agencies for six large combined watershed districts covering the national territory. The agencies, financed by water users, are in charge of ensuring that the resource is rationally and efficiently managed; they are also in charge of protecting the environment: fighting against water pollution, preserving aquatic biodiversity, etc.

[3] http://www.lesagencesdeleau.fr

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4. Technological developments may bring new solutions to problems raised by impacts and constraints in the management of water and energy

While there is a growing and legitimate interest in the water-energy relationship only a limited number of publications or scenarios address the various issues relevant to this relationship to a significant extent, though research and knowledge have progressed. The subject still lacks in-depth analysis, which should be pursued to develop a better understanding of the complexity of the links governing the "water-energy nexus". It is thus very important to encourage research and demonstration via appropriate public and private incentives.

Cooperation on this topic has to be increased at the regional and international levels, between the energy industry, other businesses, public authorities and interested independent institutions. Every country should improve its level of knowledge on the water-energy relationship based on appropriate indicators taking into account the specificities of water.

It is also very important for businesses as well as for public authorities to be able to rely upon existing data of the various uses of water by the relevant energy production techniques. This survey could then be the basis of "best practice" exchanges, since comparison of similar techniques can help companies determine if they operate in the most water-efficient manner possible to produce energy, given the local environment and situation.

For example, technology and innovation can help reduce bio-energies' impact on water at many different levels:

- By the selection of crop and agricultural practices and by the development of second generation agro-fuels derived from the lingo-cellulosic part of the plants processed.
- By the use of sea water for new forms of energy production, for example tidal power, until recently, was deemed costly and limited to a small number of sites, but recent technological progress in turbines (new axial turbines and cross flow turbines) may change that situation.
- Stream energy technologies with new kind of watermills placed in rivers, manmade channels, tidal waters or ocean currents are very adapted to isolated sites.
- Potential for the application of brackish water on energy crops. It should also be noted that major improvements have been made in agricultural water use in sectors such as bioenergy.

The private sector needs public authorities to support R&D activities through incentives, supporting cross-border technology transfers, maintaining strong intellectual property rights and providing a R&D friendly environment.

Joint policies in the water for energy field should always take into account their social impact on local communities

Businesses are committed to creating adaptable, affordable and effective solutions, corresponding to the various watershed specific geographic, social and economic contexts. In order to do so, businesses are willing to work with employees, local communities, customers and other stakeholders.

A new industrial complex may have an unforeseen impact: for example, the supply of drinkable water for worker facilities, including remote camps, while water is scarce. Even if the impact is limited, it will be added to the needs of water for energy production of this industrial complex. Though in areas that are water rich (for example the US Great Lakes) water provides economic opportunity and value, not just a negative social impact.

Regardless, it is important to identify the entities in the best position to coordinate the various stakeholders' efforts: dialogues with local governments are essential to prevent water for energy use conflicts and misunderstandings.

For example, hydropower has a crucial role to play in the water, energy, food and climate change nexus as an integrator and an optimizer of the water resources in a sustainable way as demonstrated in the Nam Theun 2 project in Laos (see the box below) or earlier in France along the Durance Valley [4]. Sustainable hydropower development, based on IHA Sustainability Protocol, has been recognised as part of the solution for the new energy development roadmaps.

The existence of a high quality dialogue with stakeholders and good governance are key factors for success.

Example: Nam Theun 2 (Laos)

The 1070 MW Nam Theun 2 (NT2) hydropower project originated in a protocol signed between the Lao and Thai Governments (supply by Laos of 5000 MW). The electricity is provided both to Energy Generating Authority of Thailand (Thailand consumption) with 995 MW and to Electricité Du Laos - (for local consumption) with 75 MW. Developed and built by a consortium of private companies under a BOOT (Build, Own, Operate, Transfer) process, in association with regional firms, the scheme was commissioned in early 2010. Financers (World Bank, Asian Development Bank,) are also key stakeholders in this Public-Private-Partnership project.

The scheme is composed of a 450 km2 and 3.5 billion m3 reservoir by means of a 45m high dam. Power generation, irrigation, flood control, clean drinking water, access to reservoir for fishing, boating are the different benefits of the scheme which is a major contributor to the socio-economic development of this region. NT2 project is a unique approach towards environmental and social management: Studies of the potential environmental and social impacts of the project have been the subject of comprehensive assessment and evaluation by local and international experts and institutions under the supervision of the World Bank, the Government of the Lao PDR and the sponsors. Extensive socio-economic surveys have been performed regarding both the population living in the future reservoir area and those living downstream.

A high level of public consultation and disclosure has been a priority to ensure that all affected people are fully informed of the Project and that their views are taken into consideration. Over 250 public consultations and workshops were organized at all level (local, national, regional, international). Nam Theun 2 has benefitted and continues to benefit from a level of consultations within Laos that has not been seen before, between the local government, project developers, the Project Company and the World Bank.

[4] Water, Food & Energy nexus – High Level Panel of the 6th World Water Forum – March 2012

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The approximately 1,100 households or 7,000 people, whose current villages are situated within the area of the future reservoir, moved in a maximum 5 km area from their original habitations. New housing, schools, health and community infrastructure complete with electricity and water supply were constructed.

The NT2 project construction started in May 2005, mobilising up to 8000 workers (75% of Lao workers), and was commissioned in March 2010. A total of US$ 1.58 billion in capital commitments for NTPC was completed to finance the total base project cost of US$ 1.250 billion, contingencies and ancillary bonding facilities. Around US$ 180 million (13% of the global budget of the project) are devoted to environmental & social (E&S) issues from design to operation of the scheme. This value is higher than usual value for such a hydro project especially in a country where there is no specific regulation in regards to E&S standards.

Conclusion

Energy needs water, but water is a resource which is affected by many constraints due to increasing water scarcity and increased competition for water within a watershed.

These constraints can be reduced by a comprehensive approach of all challenges, dedicated territorial policies, pricing, introduction of new technologies and local social dialogue.

The contribution of business is an absolute requisite, but the strong support of public authorities is also needed through legislation, financial incentives, education policies and the implementation of an enabling environment.

The other side of the nexus (energy for water) should also be considered. For instance, access to clean drinking water and sanitation are key issues in developing countries as well as access to electricity which gives access to water (pumping for irrigation) in poor rural areas in developing countries - a key driver of sustainable development.

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