Water and Energy Sustainability

Information brief

Development is a double-edged sword. Reducing poverty, triggering economic growth and building up a more inclusive society are outstanding collective achievements that come with new and bigger social and environmental challenges and with the need to reconcile the different objectives in the continuous quest of a sustainable development path[1]. Success in economic growth requires harnessing the potential of ecosystems to satisfy the demands of water and energy which are essential for life as well as for the functioning of the many production and consumption processes where water and energy intervene as irreplaceable inputs.

Total energy consumption is already six times what it was in 1950 (WWDR), and is projected to grow by as much as 55% by 2030 as the combined effect of population growth and the improvement of living standards. It's hard to overestimate the combined effect of more people with better consumption boxes over water and energy resources: it takes 1.5 cubic meters of water and almost 10 megajoules of energy to produce 1 kg of wheat and around ten times more water and 20 times more energy to produce 1 kg of beef. The combined effect in a business as usual scenario might have outstanding effects over the environment and will put at risk maintaining the economic and social advances obtained: to feed the world in 2050 food production may need to grow by 70% which may require 50% more water but by 2025 two in every three countries will be water stressed and 2.4 billion people will face "absolute water scarcity".

Managing the environmental impacts of water and energy

The benefits of water and energy provision to poverty alleviation and economic progress are often accompanied by impairment of ecosystems with potentially harmful effects over nature and significant but unquantified costs. These benefits comes with increasing water scarcity, higher exposure to droughts and with extended impacts over the natural ecosystems that are increasingly transformed.

Global warming, population growth, urbanization and growing consumption of water and energy continue to disrupt our already fragile ecosystem. These unsustainable trends are reinforced by market and political drivers that still tend to favor further developments of water intensive activities in arid and semiarid areas where there is not much water available. As an example 56% of irrigated agriculture is located in areas of high to extremely high water stress (WRI, 2013). This is also a trend in emerging economies some of them in Asia and Africa are dangerously short of water. For example China has 20% of the world's population but only 7% of its fresh water and half the population and most of the agricultural and manufacturing growth tend to concentrate in the Northern half where water resources per head are only 200 cubic meters per year per person only one fifth of what is conceived as a safe standard.

1. The outcome document of the United Nations Conference on Sustainable Development, held in Rio de Janeiro from 20 to 22 June 2012, entitled "The future we want", acknowledges the need to further mainstream sustainable development at all levels, integrating economic, social and environmental aspects and recognizing their interconnectivity, so as to achieve sustainable development in all its dimensions.

But infrastructures are only one part of the assets required for the provision of the water and energy services we depend on. Human development depends also on the environment which is a complex collective asset that ultimately provides the water and energy services, on which life and the economy depends on. Moreover increasing and competing demands on water and energy as well as the changes required to cope with them may compromise the potential of nature to sustain economic progress and continue providing other valuable environmental services.

A recent study on the impact of multi-stressors over river systems shows that nearly 80% of the world population in 2000 already lived in areas where either biodiversity or water access threats exceeded the 75% percentile. Over 30 of the 47 largest river systems which discharged half of the global runoff to the oceans show at least moderate threat levels with eight rivers (for water access) and 14 (for biodiversity) showing a ver high threat[2].

Further, environmental degradation, competition for water and scaling energy prices may aggravate the already and inequitable access to water, both in urban and rural settings. These trends will always greater affect those without access to affordable alternatives or cost-effective means of coping, adding to the driving factor behind poverty. Failure to address these key issues will result in increasing ill health for children and the elderly and growing inequity and further marginalization of the poor and vulnerable, particularly women.

Some environmental effects of of water and energy

- One of the most important and visible forms of the impact of pollution is the acidification of water – "acid rain"– resulting from the combustion of fossil fuels primarily used for generation of electricity, which is a major problem in many parts of the world. The resulting changes in the chemical composition of water affect agricultural productivity and disrupt ecosystems.
- Sedimentation of waterways through the loss of topsoil caused by fuel wood harvesting also affects many hilly regions and degrades ecosystems. The effects of climate change caused by burning fossil fuels disrupts existing water resources and supplies, displaces people and undermines their livelihoods. Pollution knows no borders either.
- Up to 90% of wastewater in developing countries flows untreated into rivers, lakes and highly productive coastal zones, threatening health, food access and access to safe drinking and bathing water. Over 80% of used water worldwide is not collected or treated (Corcoran et al., 2010). Improved wastewater treatment will require increased energy use.

Managing the environmental impacts of water and energy

Recognizing that ecosystems provide a variety of services to the water–energy nexus can help the management of trade-offs and ensure that short-term gains do not undermine services that are critical for resilience and long-term environmental sustainability. Development impacts threaten clean water provision, food provision, climate stability and water regulation. Above all reaching sustainability means tackling the joint transformations that providing water and energy to fuel and feeding economic progress might have over the environment. But not recognizing the water environment as an important asset for the provision of water and energy and for the control of its own quality, in particular when water is already scarce, may lead to the wrong combination of natural and man-made capital with important consequences for human development.

2. Vörosmarty, C.J.; McIntyre, P.B. et. Al. (2010) Global Threats to Human Water Security and River Biodiversity. Nature. Vol. 467. September.

Implementing the water and energy nexus sustainably

Never miss the opportunity a good crisis provides. Biodiversity losses, alteration of river systems and other forms of environmental degradation have rarely proven to be a decisive factor in taking immediate and drastic action. But development trends provide evidence for the importance of preserving the environment on the basis of water, energy, food access as well as providing an economically comparative advantage through making use of water sustainability in the long term. Sound economic, even financial and market driven thinking may be a powerful lever to push up water ecosystems conservation to the top of both water and energy policy agenda.

Objectives of water and energy policies need to be reconciled. When put together water and energy challenges provide an outstanding opportunity to create a dialogue in favor of preserving the water environment based upon the economic importance of the services it provides. This dialogue is also essential to avoid the risk of sorting out one problem at the expense of the other or even worse pursuing unsustainable trends in water and energy at the expense of the environment and then of current and future generations.

In 2001, energy production in São Paulo, Brazil was highly constrained as a result of both severe drought and government energy tariff policies. In order to prevent blackouts, the government imposed quotas aimed at reducing energy consumption by 10-35 percent. Many plants and industries in Brazil's southeast were plagued by reductions in operational capacity, production delays, or increased production costs.

Water and energy strategies need to be simultaneously rewired for the long term. Though important in the short term current deficits and unsatisfied demands of water and energy cannot shade or relegate long term priorities and in particular the objective to rely in a sustainable mix of both water and energy resources as a condition for building a sustainable future. The traditional options to put more and more water and energy into use are as exhaustible as the water and energy sources themselves. A transition need to be made from non-renewable to renewable options, from increasing supply to a wise management of the resources available and from infrastructure development to a more balanced mix of infrastructures and ecosystems for the production of the valuable water and energy services people, the economy and the environment depends on.

Restoring the balance between natural and human made infrastructures needs to be recognized as an important element to reconstruct water and energy access. Restoring impaired ecosystems by recovering some of the basic functions performed in the past can be a valid cost effective alternative to reduce risks and exposure in many different ways. For instance, instead of using traditional infrastructures alone, flood risks can be controlled by recovering rivers' flood plains and by good livestock, forestry and agricultural practices on slopes that maximize their ability to retain water for infiltration and soil formation. The recovery of aquifers might substantially reduce drought exposure by building buffer stocks and green infrastructures, such sustainable urban drainage systems may serve to storm management while increasing runoff and control temperature. All these measures intended to recover natural assets and the functions they perform might result in the simultaneous saving of substantial amounts of energy, important reductions in water provision and treatment costs and significant benefits for ecosystems and the services they provide.

Maintaining environmental flows is fundamental for decoupling economic growth from water uses and water pollution. Maintaining environmental flows provide important ecosystem servicesDecoupling economic growth require proactive measures to ensure adequate allocation of water to the natural environment, in addition to the traditional economic sectors and drinking water.

Building resilience and Managing uncertainty: Climate change has the capacity to make a significant impact on the hydrological cycle, leading to a rise in extreme weather events such as floods and droughts. This fluctuation disturbs the energy management system and represent a genuine threat to energy and water access can emerge.

Water and Energy Sustainability: tools for improvement

Economic instruments

- Promote private public partnership to foster the redevelopment of long term business strategies and not just short-term strategies. This implies building networks to build water sustainability (preserving or recovering water sources, empowerment to local communities, promote innovation and technology development and diffusion, share risks, etc,). access Public commitment to reduce water and energy scarcity might then create the conditions for sustainable long term public and private investments and employment opportunities.

MED TEST (Transfer of Environmentally Sound Technologies): UNIDO green industry platform in partnership with Carlsberg / Baltika Breweries's comprehensive investment programme. The partnership is designed to serve the objective of catalyzing market transformation of breweries from a natural resource consuming industry to a pro-active steward for resource efficient cleaner production.

Carlsberg and UNIDO, as a part of public-private partnership, have devised this programme for the breweries and the stakeholder communities to reduce pressure on natural resources, reducing greenhouse gas emissions and other forms of pollution thereby making the process sustainable.

For more information:
http://www.unido.org/fileadmin/user_media/Services/PSD/UNIDO_business_partnerships/Carlsberg.pdf

- Improved transparency of water and energy prices and investments. The clarity in communication would encourage more professional and public engagements and public trust. . Such an engagement is vital for both the water and energy sectors, especialy in relation to the subsidies that may exist and the pricing systems to make energy and water affordable to the poor in the short term without riskingfinancial sustainability in the long term.
- Payment for ecosystem services (PES). When properly negotiated, designed and implemented these payments are instruments to enforce collective agreements and share the benefits from preserving water providing ecosystems. These agreements may serve to provide energy especially in rural areas, to promote sustainable land use practices, increase food access and create income opportunities for the poor while reducing erosion, retaining water, reducing energy needs.
- Output oriented fiscal incentives ranging from subsidies, tax deductions and price premiums that can play an important role in triggering innovation and speeding up the diffusion of innovations and newer technologies. Energy and water prices need to be revised to send signals of scarcity and promote the required change to sustainable portfolios of renewable energies and sustainable water sources.

Policy instruments

- The Integration between water management and energy strategies insuring ecosystems protection. Developing a shared diagnostic of why institutions fail to avoid unsustainable trends. This requires raising awareness and building a shared vision of the challenges and the alternatives available to build up collective water and energy access in which conservation of water related ecosystems as well as the promotion of renewable energy sources may play a key role along with further advances in the Green Economy Agenda. Private firms concerns about water access, awareness of local communities in rural areas and increasing evidence of vulnerabilities to extreme events are all ingredients to foster broader support for collective action and long term seeking water and energy policies.

- Building broad constituencies around long term vision and objectives. For Governments, firms and stakeholders must be encouraged to take a longer-term view, to invest in water conservation, and investments in new energy sources assuming higher costs in the short term in exchange for long-term benefits. Public awareness creation, public participation and education is essential to foster collective actions as well as to make individual decisions on the use of water an energy compatible with sustainable supplies.
- Improve governance through transparency and accountability: Poor governance, corruption, short sighted decisions of local and foreign players may have a dominant influence in the policy decision making process and result in missing the opportunities to foster progress before critical resources like water, energy and land are depleted. A first step in improving governance consists in development outcome oriented and performance indicators promoted both by local and international institutions.
- Improvements of regulatory bodies. A strong regulatory body would be capable of tapping the leaks and discovering room for improvement in the water and energy management systems through bechmarking and setting standards. Improvements of participation of interested parties on water and energy in the development of of policy and laws related to energy and water useso that they are more flexible and adaptable to be able to respond or/and mitigate extreme events and environmental impacts.

Assessment tools

- Integrated economic and resource accounting systems of water and energy, similar to those used by few countries.

The International Resources Panel work on water and the report on "Measuring Water Use in a Green Economy" (IRP, 2012) are good examples on how water accounting can serve as a crucial tool for the purpose of overall water management. These accounting systems are based on the generation of physical assessments alongside with GDP growth and other economy-wide indicators and the related greenhouse gas emissions. Considering ecosystem services within such resource accounting schemes and establishing the links between resource efficiency, biodiversity and the connection to the socio-economic values of water is still work in progress.

- A systematic life cycle thinking perspective, considering both direct and indirect water and energy use for products and all relevant environmental impacts at production sites along the supply chain all the way to the end user.
- Development of tools and indicators to quantify decoupling. Particularly in terms of accurate measures of water and energy use and its impacts on ecosystems. This knowledge is essential to support efforts to set targets, design policy instruments and monitor progress.
- More systematic use of tools such as Environment Assessments, and economic valuation. A systematic use would help in mapping the water and energy interdependencies better which would help in exploring different dimensions to the problem.
- Science and Industry partnerships on water and energy sustainability are more important than ever because it helps developing a strategic approach towards innovative alternative solutions derived from a better understanding of the risks and the advantages of sustainable approaches.

Technological innovations

- Green infrastructures.
- Recycling and reuse of water –including when water of different qualities is used in different subsequent uses (reducing stress on energy for extraction of water from the underground water table)

- Information and communication technologies (for tapping the energy and water leaks);
- Rainwater catchments (leading to underground water replenishment with rainwater harvesting and thus reducing the stress on energy for extracting underground water);
- Better land-management practices and technologies that improve water productivity in rain-fed and irrigated areas (thus lesser use of energy for pumping water from aquifers);
- Use of renewable energies or other innovative technologies for groundwater pumping, desalination, water purification and wastewater treatment;
- Savings in urban water use -eco-design, urban planning (leading to reduced stress on energy for extracting underground water).

Risk Management

There is now increased pressure for companies to operate in a way that reduces adverse impacts on the environment and local communities. This concern is not just about brand reputation but also about financial prudence. Energy access and water-related risks have increasingly been seen as significant in evaluating long-term business viability.

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