Workshop 7 (synthesis): integrating the water and energy sectors

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Abstract Integration of the water and energy sectors is a key issue for effective resource management. However, everything that seems to make sense cannot always be easily accomplished. Barriers are ultimately related to political will where a variety of "instruments" is needed to make such coordination effective.

Keywords Competing interests; energy sector; joint management; shared infrastructure; water sector

There is a considerable potential for achieving better resource and risk management in society through interlinked management of infrastructure systems. The energy and water sectors represent the most obvious case already closely related by the different interests established in river basins. Hydro power production, water supply, irrigation and flood mitigation can be seen as competing needs, but better as representing different components in a possible water sharing program operated to be balanced and coordinated for the best of all interests. Potential synergies in water and energy management have often been neglected or not properly identified. Existing national policies, for instance, do not to any substantial degree include such potential of linking infrastructure systems.

Nevertheless there are many characteristics of the water and energy sectors that can provide a basis for a discussion on the possibilities for merging the two systems together to increase the overall effectiveness.

The workshop had identified some starting points that together with the different presentations opened up for lively discussions. These dialogue entry points were:

(a) Issues of similarity of the two sectors
   • Management of often scarce resources
   • Competing interests to be balanced
   • Relatively similar infrastructures
   • Environmental and social impacts to be considered

(b) Interlinkages between water and energy sectors
   • Primarily – energy needed for water/wastewater management!
   • Particularly in poor communities water and energy availability are closely and very directly related

(c) Barriers
   • Cultural differences of the two sectors
   • Professionals have different educational backgrounds
   • Pricing and value-related attitudes are different
   • Economic constraints – poor countries can not afford energy demanding, effective water treatment

(d) The implementation of a strategy for such sector integration raises questions such as
   • How can management of basic natural resources meet increasing demands for ecological and cost-effective sustainable infrastructure systems?
• In periods of rapid societal development, how can low-income population groups take benefit from such transitions?
• In what way can technological progress and international joint efforts provide better conditions for developing new management strategies?
• Are mixing of small-scale and large-scale systems components a way of achieving more flexibility in the integration of the water and energy sectors?
• Can a more integrated resource management, for instance in human, material and natural resource pooling, improve communication and hence also incentives for better handling of water and energy demands?

The implementation of integrated water and energy management strategies depends on political incentives but driving forces linked to ownership, local initiatives and public participation are also essential. The workshop discussed micro-hydrological systems and the tendency of governments to prefer large projects instead of decentralized solutions. Funding and maintenance are key aspects together with awareness and training for the success of decentralized solutions. Advanced technology integrating waste treatment and energy use in a biogas concept was discussed and the applicability in developing countries was considered. Other conditions for implementing solutions were training of personnel and consultant attitudes, which often lead to technical solutions which are not sustainable in developing countries. The important role of flexible management at different levels was emphasized in various case studies in Costa Rica, Vietnam, Uzbekistan and Nepal where different projects were presented.

Modern hydropower was introduced in Nepal in the beginning of the 1990s. In spite of continued intervention over 60 per cent of the micro-hydro systems in the rural and remote hills of Nepal have failed to meet expected output on various technical and economic grounds. The case study of the workshop concluded that the success of micro-hydro schemes in Nepal primarily depended on the capacity to enhance rural livelihoods by interfacing with local agricultural needs.

There was a critical analysis of basic resource management in India. Water resources and energy development is generally undertaken without considering the sector linkages of the two systems. Conventional development and operation approaches are standard. Considering the needs within the power sector, multipurpose projects tend to be developed almost independently and on an ad hoc basis. Means for improvement have to consider systems planning in order to modernize the two sectors. The water resources management and water storage regulation strategies have to be flexible to achieve a more effective use of available resources.

The objectives of water resources management in India have, from the British regime up to the middle of the nineteenth century, been to stabilize sustainable agriculture and mitigate famines. It meant construction of diversion canals to provide irrigation for the winter period crops. There were very few storage projects. Hydropower was developed later starting in the 1930s. Surface water provides both water and energy while groundwater is a negative reservoir providing water and demanding energy. The power generation can be increased considerably and reliable surface water supplies can be provided if conjunctive surface and groundwater development is undertaken. Demand management through appropriate cropping patterns and regulation of irrigation intensity can further enhance the overall systems performance. The central issue is institutional, reflecting the crucial role of cultural traditions. There is almost no long-term planning and both the water and energy sectors have serious financial problems.

The U.S. Agency for International Development (USAID) has expanded its experience and developed its conceptual framework in the water-energy nexus. The Agency is exploring different options to break “vicious cycles” of inefficiency to maximize benefits in joint
energy-water management in the agricultural, municipal and industrial sectors of the developing world. These opportunities are appearing in both directions – in the use of water to produce energy and in the consumption of energy to make more efficient use of water. It is often achieved by applying demand-side management simultaneously in the two sectors. Examples from India, Brazil, South Africa and elsewhere demonstrate the potential of integrated programs that jointly address water and energy consumption by municipal governments.

The concept of hydro-solidarity was discussed and questioned in an example of resource management in the Syr Darya River Basin in Central Asia. During the Soviet period the Central Asian countries were tied together through the management of the common pool of resources such as water, energy and food products. After independence the new states agreed to continue with the former sharing principles of water resources. However, the other resources and goods did not continue to be part of the sharing equation and the independent states started to focus on national strategies to fill the gaps. The focus on water alone resulted in more conflicts than the previous wider solidarity framework due to sub-optimization of national interests. The solution seems to be issue-linkages between different resources and markets. This promises to be more efficient and sustainable than the implementation of sharing principles of one single resource.

Another report from the region emphasized the serious shortage of water resources in Uzbekistan, located between the Amu Darya and Syr Darya Rivers. As a consequence of the new situation described above, changes in the water and energy sectors caused a negative influence on all water users, especially in the irrigated agriculture. The change of the Toktogul hydropower unit to a power generation regime providing for increase of winter release from the reservoir resulted in a reduction of water supply for irrigation downstream of the reservoir during summer.

A critical revision of the existing problem-solving approach and a strengthening of the interstate cooperation and interrelation between the water and energy sectors is needed for better balancing the sectors, ensuring socio-economic and ecological interests of national and regional communities.

A multipurpose scheme in Vietnam developed a water reservoir for hydropower generation, irrigation and fish farming purposes. The project included a major component of training in basic ecology and environmental management, environmental monitoring, analysis of environmental data as well as sedimentation and soil erosion monitoring. Still much effort is needed to achieve complete institutional capacity in environmental management and full use of the multipurpose benefits.

Two studies had a bearing on hydrology and climate change. National planning of water and energy in Sri Lanka is focusing on drought conditions that are frequently repeated, threatening the continuous supply of food, water and power. Hydropower development in all river basins needs maximum storage capacity, primarily by large dam schemes. Rapid urbanization and waste of groundwater has to be discouraged. Finally, climate change was addressed in an assessment of future hydropower production in Scandinavia and it was discussed if the high production in recent years is a result of global warming.