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About Sustainability in the Hydropower Industry

Sustainability Challenges

Nearly one-third of the world's population has no access to electricity. Without concerted action at least 3.5 billion people, nearly 50% of the global community will face water scarcity by 2025. At the same time the world's energy systems, substantially based on fossil fuels, account for a significant proportion of the greenhouse gas emissions that are leading to climate change and global warming.

How to promote socio-economic development and eradicate poverty, whilst simultaneously halting environmental degradation, is one of the greatest challenges at the start of the 21st century. This challenge is most conspicuous in the policy for water and energy, as both are essential elements for human life. From Stockholm in 1972 to Rio de Janeiro in 1992 and Johannesburg in 2002, world leaders have increasingly concluded that these elements must be considered in an integrated way.

The hydropower sector, encapsulated by both water and energy policy, has often found itself at the centre of the debate on sustainability. The World Commission on Dams (1998-2000) concluded that water infrastructure projects, including hydropower schemes, had 'too often' been developed at an environmentally or socially unacceptable cost. However, the Commission did not recommend that hydropower should be discouraged in the future, or that only the smallest of schemes should be developed. Instead, a more inclusive process was recommended in the planning, development and management of water and energy schemes.

There is no single solution to the world's quest for more, cleaner energy and effective water management. Energy and water for sustainable development depend not only on supply choices, but also on how these choices are implemented.

Role of Hydropower

Hydropower contributes one-fifth of the world's power generation, and provides the majority of supply in 55 countries. For several countries, hydropower is the only domestic energy resource. Its present role in electricity generation is substantially greater than any other renewable technology, and the remaining potential, especially in the less developed countries, is vast.

Hydropower can be developed on a wide range of scales to meet diverse needs and market conditions. Small-scale, decentralized development has been responsible for bringing light and power to remote and rural communities throughout the world. Larger hydropower schemes feed the regional grid systems, substantially reducing the combustion of coal, which is the predominant power supply source.

Hydropower Strengths and Weaknesses

After more than a century of experience, hydropower's strengths and weaknesses are equally well understood. Hydropower's negative impacts are well understood and, although not all can be eliminated, much can be done to mitigate them. These are summarised for economic, social and environmental aspects of hydropower in the following tables:

ECONOMIC ASPECTS	
ADVANTAGES	DISADVANTAGES
Provides low operating and maintenance costs Provides long life span (50 to 100 years and more) Meets load flexibly (i.e hydro with reservoir) Provides reliable service Includes proven technology Can instigate and foster regional development Provides highest energy efficiency rate (payback ratio and conversion process) Can generate revenues to sustain other water uses Creates employment opportunities Saves fuel Can provide energy independence by exploiting national resources Optimizes power supply of other generating options (thermal and intermittent renewables)	High upfront investment Precipitation dependent In some cases, the storage capacity of reservoirs may decrease due to sedimentation Requires long-term planning Requires long-term agreements Requires multidisciplinary involvement Often requires foreign contractors and funding

SOCIAL ASPECTS	
ADVANTAGES	**DISADVANTAGES**
Leaves water available for other uses Often provides flood protection May enhance navigation conditions Often enhances recreational facilities Enhances accessibility of the territory and its resources (access roads and ramps, bridges) Provides opportunities for construction and operation with a high percentage of local manpower Improves living conditions Sustains livelihoods (freshwater, food supply)	May involve resettlement May restrict navigation Local land use patterns will be modified Waterborne disease vectors may occur Requires management of competing water uses Effects on impacted peoples' livelihoods need to be addressed, with particular attention to vulnerable social groups Effects on cultural heritage may need to be addressed

ENVIRONMENTAL ASPECTS	
ADVANTAGES	DISADVANTAGES
Produces no atmospheric pollutants Neither consumes nor pollutes the water it uses for electricity generation purposes Produces no waste Avoids depleting non-renewable fuel resources (i.e., coal, gas, oil) Very few greenhouse gas emissions relative to other large-scale energy options Can create new freshwater ecosystems with increased productivity Enhances knowledge and improves management of valued species due to study results Can result in increased attention to existing environmental issues in the affected area.	Inundation of terrestrial habitat Modification of hydrological regimes Modification of aquatic habitats Water quality needs to be monitored/managed Greenhouse gas emissions can arise under certain conditions in tropical reservoirs Temporary introduction of methylmercury into the food chain needs to be monitored/managed Species activities and populations need to be monitored/managed Barriers for fish migration, fish entrainment Sediment composition and transport may need to be monitored/managed Introduction of pest species needs to be monitored/managed

Hydropower Industry Sustainability Initiatives

The International Hydropower Association is a non-governmental professional association founded in 1995 under the auspices of UNESCO. Today, it is represented through corporate and individual membership in 83 countries spanning six continents.

The International Hydropower Association (IHA) has produced Sustainability Guidelines to promote greater integration of environmental, social and economic aspects in the sustainability assessment of new hydro projects and the management and operation of existing power schemes. In adopting their own sustainability guidelines, the members of the International Hydropower Association are committed to developing and operating their projects, in collaboration with all stakeholders, in a way that is environmentally friendly, socially responsible and economically efficient so that hydropower projects can make a major contribution to achieving sustainable energy and resource development.

The IHA Sustainability Guidelines outline a number of broad sustainability principles for the hydropower industry. The guidelines recognise the core values identified in the World Commission on Dams (WCD) report [1] of equity, efficiency, participatory decision-making, sustainability and accountability.

The IHA Sustainability Guidelines emphasise the importance of a preliminary assessment that demonstrates the need for a new hydropower project. This should be followed by a comprehensive assessment incorporating environmental, social and economic aspects. These assessments are facilitated where comprehensive national or regional energy development strategies have been developed.

The guidelines identify that sustainable development of hydropower schemes is best achieved where sound governance, and solid legal and institutional arrangements are in place. The guidelines also make the point that each development is unique, and therefore it is difficult to extrapolate sound approaches for one scheme to other regions or locations.

Further to the Guidelines, the IHA has developed a *Sustainability Assessment Protocol* which is essentially an auditing tool. The Sustainability Assessment provides a mechanism to assess sustainability of new and existing hydropower schemes, by requiring objective evidence to support ratings of each of the key sustainability aspects.

It should be emphasised that issues and management of aspects of sustainability need to be considered individually but do not exist in isolation. For a hydropower scheme to be sustainable it must address all three aspects of economic, social and environmental sustainability.

[1] Dams and Development: a New Framework for Decision-Making. The report of the World Commission on Dams, Earthscan Publications Ltd, November 2000.