

SUSTAINABLE HYDROPOWER – INFORMATION AND COMMUNICATION ON GOOD PRACTICE

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Abstract

The Sustainable Hydro Power website is a learning and demonstration forum to assist with sustainable development and operation of hydropower projects. This website, when live, will be an easily accessible platform that provides basic information on the aspects of sustainability relevant to the hydropower industry, and identifies management and mitigation approaches for each aspect. 25 sustainability aspects of importance to the hydropower industry are grouped broadly under environmental (10 aspects), social (8 aspects) and economic (7 aspects). Under each aspect, the website identifies and summarises schemes that have put the identified management approaches into practice, and allows for additions of schemes over time. Schemes on the site will be audited using the International Hydropower Association's Compliance Protocol (a sustainability assessment mechanism for hydropower projects) and approved by an independent Reference Panel. This website is at an advanced stage of development as of October 2004, and feedback, scheme nominations, major sponsors and endorsing organisations are being sought.

Keywords

hydropower, sustainable, sustainability, website, good practice

1 Introduction

Hydropower can play an increasingly important role in enabling communities around the world to meet their power needs and sustainability objectives. By definition, sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Report of the World Commission on Environment and Development, 1987). Sustainable development requires the integration of three components – economic development, social development and environmental protection – as interdependent, mutually reinforcing pillars.

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. These 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) report¹ of equity, efficiency, participatory decision-making, sustainability and accountability.

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

Further to the Guidelines, the IHA has developed a Compliance Protocol, which 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.

Further to these initiatives, the Sustainable Hydro Power website is under development to provide a learning and demonstration forum to assist with sustainable development and operation of hydropower projects. This website, when live, will be an easily accessible platform that provides basic information on the aspects of sustainability relevant to the hydropower industry, and identifies management and mitigation approaches for each aspect. 25 sustainability aspects of importance to the hydropower industry are grouped broadly under environmental (10 aspects), social (8 aspects) and economic (7 aspects). Under each aspect, the website identifies and summarises schemes that have put the identified management approaches into practice, and allows for additions of schemes over time.

2 Web Site Development

The Sustainable Hydro Power website has been developed for distribution as a CD as of October 2004, for demonstration purposes only. The information contained on the demonstration site has been based entirely on a broad assessment of information available in the public domain.

At the initial stage, key aspects of sustainability were determined, and summaries of the issue and management for each aspect were written. Guidance at this stage was most primarily sourced from the International Hydropower Association's Sustainability Guidelines and Compliance Protocol; the International Energy Agency's technical reports from the Implementing Agreement for Hydropower Technologies and Programmes; the World Commission on Dams knowledge base; and several other key references in the literature.

A search for example schemes resulted in more than 100 scheme names short-listed for further investigation. Sources of scheme names to be considered were:

- International Energy Agency's technical reports from the Implementing Agreement for Hydropower Technologies and Programmes;
- World Commission on Dams knowledge base;
- Dams and Development Project's database;
- New Energy Foundation's Best Practices and Success Stories project;
- World Bank documents and reports;
- World Wildlife Fund's good case studies;
- Schemes recognised by certification programs such as Low Impact Hydropower Institute and the Swiss label '*Naturemade*';
- Schemes recognised by awards, such as the US 'Outstanding Stewardship of American Rivers' awards and the IHA Blue Planet Prize;
- literature and web searches.

15 schemes have been summarised on the demonstration site to illustrate the type of information that can be included for each scheme. These summaries have been drawn from information in the public domain and are provided as examples only, as they have not been reviewed by the scheme owner/operators nor have they been through the process for scheme assessment and approval outlined for this website (see Section 4).

3 Key Sustainability Aspects

25 sustainability aspects of importance to the hydropower industry are grouped broadly under environmental (10 aspects), social (8 aspects) and economic (7 aspects). In defining specific aspects for consideration, it is well-recognised 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.

3.1 Environmental Aspects

Hydropower schemes alter existing hydrological regimes and the aquatic ecosystems that are dependent on them, and so require sound planning, investigation, siting, design, mitigation, monitoring and adaptive management. The creation of a new reservoir drowns existing terrestrial habitats and can create issues with water quality, sedimentation, and quality of habitat. Regulated flow regimes downstream of power stations, and reduced flow regimes downstream of diversions, fundamentally alter the ecosystem balance for aquatic species. The challenges are to adequately understand ecosystem components and function, minimise creation of new impacts through siting and design, to include mitigating measures for issues of concern at the construction stage, and to monitor and respond to issues as they arise. The interlinkages with social and economic aspects of sustainable hydropower must be well understood.

Ten environmental aspects are considered on the Sustainable Hydro Power website: environmental assessment and monitoring; siting and design; construction impacts; erosion and sedimentation; seismic; water quality; passage of aquatic species; biodiversity and threatened species; pest species; and environmental flows, as follows:

Environmental assessment and monitoring - Environmental assessments are conducted in advance of development to identify the likely effects of a project and should be based on factual information with the environmental data collected being used for subsequent baseline monitoring once a scheme is operational.

Siting and design - The siting and design of a project affects the size of the environmental footprint; it needs to be assessed in relation to the associated aquatic and terrestrial ecological impacts and the degree to which they can be mitigated or, where necessary, compensated.

Construction impacts - Construction needs to be carried out so as to minimise environmental and social impacts, best achieved through a construction environmental management plan.

Erosion and sedimentation - Since reservoir sedimentation can be tackled at both catchment and reservoir levels dam construction should be geared to ensuring minimum disturbance and appropriate rehabilitation to avoid sedimentation and erosion risks up and down stream of the project site.

Seismic - The determination of seismic risk is important for siting, design and construction decisions in the planning of hydropower schemes as well as for financial reasons.

Water quality - There are a number of design and operational systems that can be used to minimise negative water quality impacts of a hydro power scheme within a reservoir and down stream that begin with adequate data collection and a comprehensive environmental assessment process.

Passage of aquatic species - The impact of hydropower schemes on the annual migration of significant fish species must be adequately assessed; where unavoidable, fish ladders or other mitigation strategies should be utilised to minimise mortalities or fish injury.

Biodiversity and threatened species - Protection of biodiversity, and threatened species conservation through habitat identification and management, is a key issue for consideration in environmental impact assessment as well as during power scheme construction and management.

Pest species - Pest species can have major adverse impacts on waterways and reservoirs by preying on native species or reducing food supplies, however risks can be minimised through comprehensive environmental assessment and identification of avoidance, mitigation or management options.

Environmental flows - Environmental flows can be set to ensure protection of instream values; they require a sound understanding of ecosystem function, and should be derived through a consultative process to establish the environmental and social values to be protected.

3.2 Social Aspects

With identification and sound management of social issues, hydropower schemes have the capacity to significantly reduce poverty and enhance the quality of life in the communities they serve. The challenge is to ensure that individuals and communities affected by a hydropower development benefit in areas such as improved living conditions, public health facilities, equitable distribution of benefits, social compensation measures. New developments require comprehensive social impact assessment, genuine community engagement, public acceptance, and monitoring of outcomes. The interlinkages with environmental and economic aspects of sustainable hydropower must be well understood.

Eight social aspects are considered on the Sustainable Hydro Power website: social impact assessment; community engagement and acceptance; multiple use benefits; public health; safety; population displacement; vulnerable social groups; and heritage, as follows:

Social impact assessment - Generally conducted as part of the environmental impact assessment process, social impact assessment aims to identify who will be affected by a hydropower scheme, and in what way, so that siting, design and project planning can adequately address any potential social issues.

Community engagement and acceptance - Acceptance of change by people affected by hydropower scheme developments depends on community engagement, participation in decision-making processes, and the demonstrated manifestation of positive benefit from the development.

Multiple use benefits - Hydropower schemes can deliver multiple use benefits over and above electricity generation such as irrigation, flood mitigation, water supply and recreation; these benefits need to be realistically assessed and planned in a holistic fashion.

Public health - Hydropower projects can provide significant new public health benefits to previously impoverished areas, but at the same time it is essential that they adequately assess, plan for and mitigate against any potential negative human health impacts.

Safety - Dam safety, together with the protection of life, property and the environment from the consequences of dam failure, is a major priority for any hydropower project.

Population displacement - Communities or individuals who are affected by a project, and subject to displacement, should be adequately compensated and their rights need to be communicated and options for resettlement negotiated during the process of project development.

Vulnerable social groups - Maintaining cultural and spiritual identity, and social and economic integrity, requires specific measures to be implemented throughout the project life cycle to ensure that indigenous communities are not socially and economically marginalised and disadvantaged.

Heritage - Developers should make every effort to avoid alterations to sites of exceptional national and international heritage value.

3.3 Economic Aspects

As part of a regional energy strategy and with sound legal and institutional arrangements, hydropower projects can be considered as a tool for economic development, due to its longevity, favourable energy payback periods, their pivotal role in integrated energy systems, and their multi-purpose character. The challenge is to demonstrate sound and equitable distribution of economic benefits at all stages of scheme development and operation. All

significant hydro costs occur at the construction stage; once constructed, a hydropower project is virtually immune from further inflationary pressures and usually has a very long economic life. The interlinkages with environmental and social aspects of sustainable hydropower must be well understood.

Seven economic aspects are considered on the Sustainable Hydro Power website: distribution and sharing of benefits; demonstrated need; cost-benefits and economic performance; longevity of benefits; energy system benefits; local capacity building; and resource use, as follows:

Distribution and sharing of benefits - Hydropower developments should aim to provide an equitable distribution of benefits between government, project proponent and stakeholders such as traditional resource users.

Demonstrated need - Assessing the need for the project against alternative demand and supply side options for power delivery is an important part of ensuring that capital investment is appropriately targeted.

Cost-benefits and economic performance - Economic sustainability cannot be achieved without a comprehensive evaluation of the impacts on finite resources and project costs and benefits, through a process of cost-benefit analysis and assessment of long-term economic performance.

Longevity of benefits - Hydropower schemes are long-lived assets that with appropriate operation and maintenance will generate electricity for decades, thus potentially providing energy services to several generations of people; any negotiated benefits with directly affected parties should equally be sustainable in the long-term.

Energy system benefits - Hydropower schemes can deliver energy system benefits by supporting wind, solar and ancillary services such as spinning reserve.

Local capacity building - Hydropower developments should provide opportunities for local capacity building. This is particularly the case where communities have been displaced or their sources of income have been affected. Creating and maintaining educational and economic opportunities that empower communities to re-establish themselves under changed conditions is a central factor in economic sustainability.

Resource use - Hydropower, due to its potentially non-consumptive use of water, can provide for the sustainable use of a natural resource

4 Scheme Assessment and Approval

Inclusion of a scheme on the website will be dependent on the scheme demonstrating generally good environmental, social and economic performance based on the International Hydropower Association's Sustainability Guidelines, and on top of this demonstrating good management of a particular aspect that would provide an example to others in the industry. External recognition of the scheme via relevant awards or certification processes provides good evidence of generally strong performance.

Inclusion of a scheme on the website requires an independent assessment of the scheme using the International Hydropower Association's Compliance Protocol. The assessment process requires the provision of objective evidence against each of the sustainability aspects considered by the Compliance Protocol to support its rating. The assessment will comprise a personal tour of the scheme and its catchment and affected waterways, and interviews with the owner/operator, the government regulatory body, and NGOs.

Based on the Compliance Protocol assessment, a determination of what sustainability aspect the scheme best illustrates will be made, and the web based summary modified to reflect the findings of the scheme assessment. Note that the full compliance assessment of a scheme against the Protocol would not be on the website, only the summary of the

sustainability aspect. Any summary of a scheme on the website site will have been written with the awareness and sign-off of the owner/operator of the scheme.

Inclusion of a scheme requires the review and sign-off of an independent Reference Panel. Reference Panel composition is considered fundamental to the credibility of the site, and will be determined in consultation with sponsors. The Reference Panel will be convened at regular intervals throughout the year, and updates to the site provided at those set intervals.

To reflect this process, each scheme summary will have the following checklist against the scheme.

Scheme Externally Recognised	↑ <u>(will state source)</u>
IHA Compliance Protocol Assessed	↑ <u>(will state by whom & when)</u>
Summary Reviewed by Owner/Operator	↑ <u>(will state who & when)</u>
Reference Panel Approved	↑ <u>(will state when)</u>

The website has been designed so that it can be regularly updated, and it provides a forum where one can keep abreast of new knowledge and experience in the international hydropower industry. New and changing information will be continually be assessed and reviewed prior to its inclusion on this site.

5 Present status and further requirements

The Sustainable Hydro Power site is not yet a live site. A CD of the site will be available for distribution in mid-October 2004 to demonstrate what the live site will look like, and to facilitate pursuing the requirements to make this a live site – major partners, supporting organisations, funding, establishment of a Reference Panel, feedback and scheme nominations. Funding mechanisms are being investigated that will support ongoing site management, information management, independent auditing and review of schemes, and convening of the Reference Panel.

A number of organisations within and outside of the hydropower industry have expressed their support for the site, and the International Hydropower Association would like to enter into a partnership arrangement to demonstrate a collaborative and objective approach. The IHA is seeking to collaborate with major organisations interested in sustainable development and operation in the hydropower industry, and in the education of the industry and interested parties on sustainability issues and management. The home page for the site would show the major endorsing organisations, and they would be represented on the Reference Panel.

To ensure the website is developed from the best and widest-ranging knowledge sources available, efforts post-October 2004 will be directed towards seeking comments, leads on information resources, contacts, and feedback on the schemes listed on the site, as well as seeking nominations of schemes for further consideration.

Conclusion

There are a number of approaches that can and are being progressed to assist the hydropower industry to lift its performance and aspire to sustainable development and operation. One valuable approach is to identify and showcase the good performers, which will be substantially enabled through the Sustainable Hydro Power website.

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