Netherlands Commission for
Environmental Assessment

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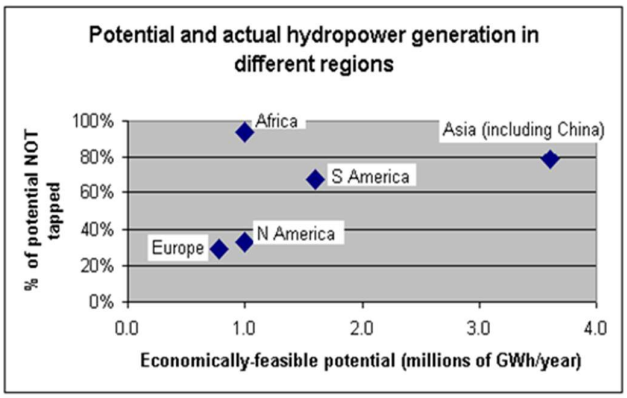
ESIA and SEA for Sustainable Hydropower Development

Decisions on many hydropower projects have been affected by controversies around environmental and social effects. The purpose of this case is to provide information on experiences in the use of environmental and social impact assessment[1] (ESIA) and strategic environmental assessment (SEA) in supporting sustainable hydropower development at (inter)national and local levels.

For the time being, hydropower is the most widely used form of renewable energy, accounting for 16% of global electricity generation, expected to increase by approximately 3% each year for the next 25 years. Over the last two decades the global hydropower generation has increased by 50%. This includes all types and sizes of hydropower, micro-hydro as well as large dams.

While the role of ESIA in assessing, avoiding, mitigating and compensating the impacts of large hydropower projects is fairly well known, the positive role of SEA in developing a broader energy sector vision and in determining the role of hydropower within such sector vision, is only recently becoming visible.



This document is relevant for:

- Government authorities responsible for the energy sector;
- Regional development planning authorities in regions with prospected hydropower potential;
- Authorities with responsibilities for protection of environment, biodiversity, human rights and social justice;
- International finance institutes and donors supporting hydropower development;
- Civil society organisations representing stakeholders and/or biodiversity (potentially) affected by hydropower activities;
- Energy companies.

[1] To emphasise the inclusive nature of impact assessment, social impacts are becoming increasingly important in impact assessment. Consequently, multilateral development banks, a growing number of countries and the NCEA have decided to use the term Environmental and Social Impact Assessment (ESIA). The term EIA is still used in most national legal contexts and in CBD texts.

The hydropower sector

Globally, around 20% of the technically exploitable hydropower potential has been developed. Although climate change may affect water resources and may lead to significant variations of the potential for hydropower at country level, these variations are expected to level out at global scale, leaving the overall potential virtually unaffected. However, how much of this untapped technical potential is economically, environmentally and socially feasible is subject to time-dependent economic conditions, and depends on sustainability concerns and related policies.

World Bank (WB) lending for hydropower bottomed out in 1999 due to growing opposition from non-governmental organisations (NGOs) and donor responses to inadequate dealing with social and environmental risks. In response to controversies the following mechanisms have been adopted by international finance institutions (IFIs), the private sector and countries in order to avoid, mitigate and compensate those effects:

- ESIA is conditional for environmental permitting of hydropower projects in nearly all countries.
- SEA is adopted by a growing number of countries to support more sustainable planning, including hydropower planning;
- Safeguards such as ESIA are conditional for funding by international finance institutes (IFIs); SEA is increasingly adopted by those institutes;
- Equator Principles, comparable to the IFI requirements, are applied voluntarily by commercial banks who are signatory to these principles;
- The International Hydropower Association, a private sector branch organisation, has developed a protocol that aims to measure and improve performance in the hydropower sector;
- Payment for ecosystem services (PES) mechanisms are increasingly adopted by countries and recommended by IFIs, to increase the environmental and social acceptability of hydropower;
- Social development, resettlement and biodiversity offsets are increasingly pivotal pillars in hydropower development.

Biodiversity Convention perspective on biodiversity mainstreaming through ESIA/SEA

Mainstreaming. The CBD Conference of Parties decided to consider the mainstreaming of biodiversity into the sectors of energy and mining, infrastructure, manufacturing and processing, and health (Decision XIII/3). From the perspective of the Convention, a key aim of mainstreaming biodiversity in these sectors is to avoid, reduce or mitigate any negative impacts, while maximizing any potential benefits to biodiversity. Article 6(b) of the Convention calls for Parties to "integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies".

ESIA and SEA. Two of the most important tools for addressing the impacts from the infrastructure, energy and mining sectors, and to a lesser extent, the manufacturing and processing sectors, are environmental and social impact assessment (ESIA) and strategic environmental assessment (SEA)(CBD/SBSTTA/21/5). Convention Article 14 asks for the use of impact assessment, elaborated in "Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment" (Decision VIII/28), further detailed for marine and coastal areas in Decision XI/18.

The 2030 Agenda for Sustainable Development includes a number of goals that are closely related to the above mentioned sectors. Given the indivisible nature of the 2030 Agenda, these goals and targets must be achieved while also achieving the goals for biodiversity, climate action, as well as multiple targets for sustainability. ESIA and SEA are internationally practised, often legally embedded, instruments capable of assessing the consequences of policies, plans programmes and projects from an integrated SDG perspective.

An evaluation of the application of the World Bank safeguard policies concluded that in practice the safeguard mechanisms are not always fully applied due to the following interlinked factors:

- Within the World Bank group there is no full support of the safeguards as they are perceived as costly and time consuming.
- In client countries the rule of law is weak due to corruption and lack of transparency and accountability.
- At project level the opportunity to study alternatives (e.g. siting, capacity) is limited because decisions have

been taken earlier in the planning process, before safeguard policies are applied.
- A fundamental problem remains that the capacity to conduct sound ESIA and SEA is low.

Issues linked to hydropower

Hydropower projects can range from micro-hydropower facilities that hardly occupy land and have virtually no influence on river hydrology, to large mega-dams with reservoirs covering hundreds to thousands of square kilometres. In this document we will focus on larger interventions. The nature of the impacts of large dams on ecosystems is generally well known. The World Commission on Dams (2001) described the following categories of impacts:

Ecosystem impacts include:
- Impacts of reservoirs on terrestrial ecosystems and biodiversity, leading to potentially irreversible loss of species populations and ecosystems;
- Emission of greenhouse gases associated with reservoirs (believed to be much stronger in tropical areas);
- Impacts of altered downstream flows on aquatic ecosystems, on the natural flood cycle of downstream floodplains and on the salt/freshwater balance in estuaries;
- Upsetting of sediment balance of rivers and coastal ecosystems leading to coastal erosion;
- Barrier effect of dams on migratory species and fisheries in the upstream, reservoir and downstream areas;
- Enhancement of ecosystem services through reservoir creation (e.g. fisheries, dry season agriculture);
- Cumulative impacts of a series of dams on a river system.

Social and economic impacts include:
- Delay between the start of planning and (uncertain) construction makes governments, businesses, farmers reluctant to invest in potentially flooded areas.
- Temporary Influx of construction workers during construction; related social tensions;
- Displacement of people and livelihoods: the larger the number of displaced people, the less likely it is that livelihoods can be restored; disruption of downstream livelihoods through changes in provision of ecosystem services;
- Indigenous and tribal peoples and vulnerable ethnic minorities have suffered disproportionate levels of displacement and negative impacts on livelihood, culture and spiritual existence;
- Numerous vector-borne diseases are associated with reservoir development in tropical areas, such as malaria, schistosomiasis river valley fever, Japanese encephalitis.
- Loss of cultural heritage
- Mismatch in the distribution of the gains and losses of a project across different societal groups.

A new three-tiered approach

A new approach has gradually evolved in the work of IFIs and the private hydropower sector, supported by NGOs and some countries. This approach aims to embed hydropower at country level in an environmentally sound, socially acceptable and economically viable energy strategy. The three-step approach is characterised by a hierarchy of planning and decision-making steps. Application of SEA and ESIA at the consecutive steps can secure the quality, credibility and acceptability of these plans and projects. The approach is, however, not widely adopted yet by low and middle income countries.

Step1: National energy plan, supported by SEA

In a national energy plan the energy demand and supply of a country is estimated and decided upon for the long term. Such plan nearly always has an international component as most countries import and/or export energy. The plan provides information on the possible combination of energy resources (energy mix), including the estimated contribution of hydropower, based for example on a general assessment of the technical hydropower potential. SEA can make sure that the assessment of hydropower potential takes into consideration other national priorities, for example those related to biodiversity, cultural heritage and indigenous peoples, usually represented in a national biodiversity strategy and action plan (NBSAP). (See box 1 for an example)

Step 2: (Inter)national hydropower plan, supported by SEA

A hydropower plan can be developed (i) on a national scale for all river basins located within the jurisdiction of one country, or (ii) on an international scale (transboundary) for those countries that share a river basin. In a(n) (inter)national hydropower plan, decisions are made on the basis of potential for hydropower development for the short, medium and long term. In general, this plan will be revised every 5 to 10 years.

Box 1: SEA for National Power Development Plan in Vietnam

The SEA provided a mechanism to assess and understand the full range of potential risks associated with different types of power development for people and the environment. It provides a mechanism for identifying and assessing the most effective mitigation and compensation actions. The SEA started to internalize social, environmental and human health costs into the assessment of the economic feasibility of power development schemes. This is an approach that balances economic development, environmental sustainability, and social equity that has never been done before in the implementation of a master development plan for the electricity sector in Vietnam.

Hydropower is, after thermal power, the second largest source of power generation in Viet Nam. It has the potential to produce a number of adverse social and environmental impacts, including the loss of land and disruption of sensitive ecosystems, the displacement of people and effects on the culture and livelihoods of communities not physically displaced, disruption to hydrological systems and ecosystems that depend on them. One recognized positive impact of hydropower is improvement to dry season water flows, leading to benefits in agricultural production over whole river basins.

The most dangerous threat to biodiversity is fragmentation and breakdown of the ecosystem. The risks of such impacts can, however, be significantly reduced through the adoption of effective anticipatory mitigation measures, with the cost of these measures internalized into the costs of power development. Such measures require much closer links to other agencies responsible for agriculture, fisheries, protected areas, etc. The present management regimes are in general single purpose: to maximise power generation, which can cause big losses. It is necessary to take into account common interests such as flood control, water supply for agricultural activities, and the need to ensure minimum environmental flows if serious downstream impacts on ecosystems integrity are to be avoided. The analysis demonstrated the potential benefits in terms of flood protection and improvements to dry season water availability that could be accrued if more effective multipurpose management regimes are adopted.

In this (inter)national plan all potential hydropower sites and capacities are identified and compared in a participative process with all relevant stakeholders. Ideally, the hydropower potential for each basin is developed as part of a basin or catchment plan. Depending on the existing planning framework in a country, a basin plan can be developed as part of an integrated water resources management (IWRM) plan, an integrated regional land use plan, or a regional development plan.

For a growing number of transboundary river basins, river basin authorities have been established representing the national authorities. They often have a mandate to advise or decide on the allocation and use of water. In addition, they ideally have a key role in decision-making with regard to hydropower development. It is also their responsibility to take stakeholder needs seriously.

An SEA can support the development of national as well as international hydropower plans. In a consistency analysis each potential site can be assessed against applicable national and international policies and regulations. Environmental, social and economic values of the basin(s) are taken into consideration. If an SEA process is executed in a participatory and transparent manner, the ultimate decisions may be more acceptable to affected stakeholder groups. (See box 2 for an example)

Step 3: (Inter)national hydropower projects, supported by ESIA

The above planning cycle has resulted in the selection of sustainable, viable and feasible hydropower projects. ESIA and its resulting environmental management plan can serve to apply international best practice standards, including:

- Compensation of affected persons and communities for example through payment for ecosystem services lost, establishing management and tenure by affected people;
- Compensation of biodiversity loss, for example through strengthening or extension of existing protected areas and conservation offset measures;
- Enhancement of environmental stability through soil and slope conservation measures.

To improve the credibility, acceptability and representativeness of affected stakeholders, an independent panel of experts can be established to advise on the quality of the process and project documents.

Compensation of impacts. Adverse environmental and social impacts cannot always be avoided nor mitigated. It has therefore become good practice to compensate for those impacts. A growing number of countries are adopting compensation policies defining the rights of affected

Box 2: Hydropower development in Georgia

In the first half of 2013, the NCEA was asked by the Georgian Minister of Environment to review the quality of the ESIA report for the 700 MW Khudoni hydropower project, located in the Enguri Basin, a UNESCO World Heritage Site bordering Abchazia in Western Georgia. The NCEA's advisory report was publicly discussed and has impacted decision making on the Khudoni project. The project still causes a lot of discussion, especially in the area were people are planned to be resettled.

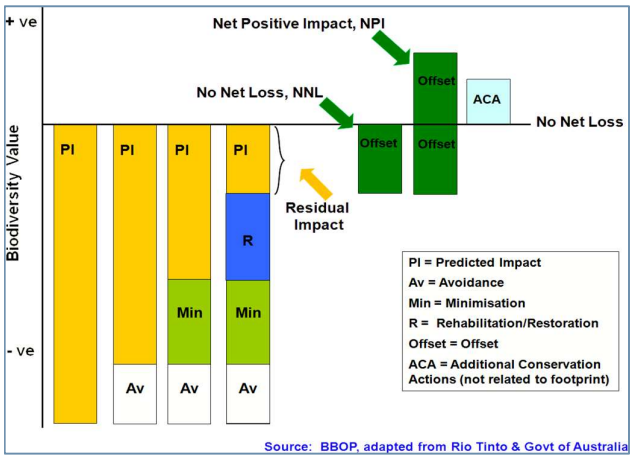
In its advisory report the NCEA provided project level and strategic level recommendations. Given the ratio between loss of land and the potential power generation capacity, the dam site was considered very efficient. Yet, significant improvements in resettlement planning were needed. Also, the loss of biodiversity by the reservoir should be better compensated. The forested upstream parts of the basin were unprotected. Unsustainable activities in this area resulted in a significant flow of sediments into the planned reservoir. To compensate the loss of biodiversity and to curb the increasing erosion problem it was suggested to restore and protect the forested hillsides in the upstream catchment as part of the existing world heritage area. Funding should be guaranteed by the hydropower project.

At strategic level the NCEA recommended to develop a national hydropower plan and initiate a strategic discussion with all stakeholders at national level on the actual need for hydropower development, including a discussion on the scale of interventions in the fragile Caucasus environment (e.g. assess the alternative of many small hydropower projects against one big project). The advice was based on the tiered approach as presented in this document. Based on such national (hydro)power strategy, optimal choices can be made on project investments. In the second half of 2013, the Ministries of Energy and Environment, supported by World Bank funding, jointly started the development of such plan, supported by an SEA.

stakeholders, including regulatory rules and a compliance mechanism.

For the loss of biodiversity, the 'no net loss principle' is usually applied. In case this loss is affecting protected areas the adoption of additional conservation actions resulting in a net positive impact has become best prac
tice. Compensation for biodiversity loss is illustrated by the figure.

The latest development related to compensation is the use of the Payment for Ecosystem Services mechanism, known as PES. A well know example is the sustainable management of natural resources upstream of reservoirs in order to secure the continued provision of water and to keep sediment runoff under control. Custodians of these upper parts of the basin are paid for not cutting forest, or for implementing more sustainable agroforestry practices. As a result the lifespan of a reservoir will be extended. The owner of the hydropower plant contributes to a fund that is often managed by a local institution in charge of the payments. This is considered a win-win mechanism to a more sustainable hydropower development, currently tested in many countries.



Advantages of the three-tiered approach

The use of SEA and ESIA within this new approach has several advantages:

- SEA: Better understanding of the cumulative impact of a series of individual hydropower projects, and preventing costly and unnecessary mistakes;
- SEA: Better insight in the trade-offs between environmental, economic and social issues, enhancing the chance of finding win-win options;
- SEA: Easier ESIAs for hydropower projects because strategic discussions, for instance about locations and power generation capacity needs, have already been decided upon;
- SEA & ESIA: More efficient assessments due to better alignment of decisions and specific information required;
- SEA & ESIA: Enhanced credibility of the decisions in the eyes of affected stakeholders, leading to more swift implementation;
- SEA & ESIA: Easier government access to IFI funding (as SEA/ESIA are part of their safeguard requirements).

Main decisions	Main issues
National energy plan • Energy demand and supply • Composition of the combination of energy resources • Import and export of energy resources • Social cost benefit analysis (CBA) • Priority setting of investments	**SEA** • Scenarios • Alternatives for composition of the combination • Social cost benefit analysis of alternatives • Consistency analysis with biodiversity, social and other relevant policies
National hydropower plan • Capacity to be developed for each river basin • Composition of the capacity divided in micro, small, meso and macro HPP. • Preliminary selection of sites for hydropower development	**SEA** • Alternatives for capacity (macro to micro) location, size and type for each river basin • Comparison of the selected main alternatives between the river basins • Social cost benefit analysis for the main alternatives
Hydropower project • Capacity, location, type • Environmental and social impacts • Social CBA	**ESIA** • Alternatives • Mitigation, compensation and offset measures

The NCEA

The Netherlands Commission for Environmental Assessment is an independent body of experts. It advises national and international governments on the quality of environmental assessment reports in order to contribute to sound decision-making. In addition, the NCEA supports the strengthening of EA systems in low and middle income countries and makes its extensive knowledge of environmental assessment available to all.

Contact

Mr. Arend Kolhoff PhD, Technical Secretary NCEA
akolhoff@eia.nl / +31-30-2347640 / www.eia.nl

Experiences with SEA and ESIA 2000 – 2014

International hydropower plans – SEA

- SEA Hydropower plan, Mekong River
- SEA Sino-Russian hydropower development in the Amur basin
- *SEA Nile Basin Initiative, SESA of power development options in The Nile Equatorial Lkes Region*
- SESA for Eastern Nile joint multipurpose programme
- *(SEA Omo-Gibe, Ethiopia – Kenya) NOT YET*

International hydropower projects – ESIA

- *ESIA Choru-Chorokhi, Turkey – Georgia*
- *ESIA transboundary multi-purpose dam, Benin – Togo*

National plans hydropower plans – SEA

- SEA National hydropower plan, Vietnam
- SEA Quang Nam province hydropower plan, Vietnam
- SEA Uttarakhand basin plan, India
- SEA National hydropower plan, Lao PDR
- SEA Rio Madera, Bolivia
- *SEA N.W. province hydropower plan, Pakistan*
- *SEA National hydropower plan, Georgia*

National hydropower projects – ESIA

- *ESIA Nam Theun II, Lao PDR*
- *ESIA Bujagali, Uganda*
- *ESIA Mem'vele, Cameroun*
- *ESIA Khudoni, Georgia*
- *ESIA Inga III, Democratic Republic of Congo*

In italics the SEAs and ESIAs in which the NCEA was involved