THE ROLE OF SEA IN INTEGRATING THE ENVIRONMENTAL CONSIDERATIONS INTO THE PLANNING OF HYDROENERGETIC PLANTS

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ABSTRACT. – The role of SEA in integrating the environmental considerations into the planning of hydroenergetic plants. The present paper offers an analysis of the concept of SEA and its role in the development of hydroenergetic plant planning. The article provides information related to the institutional aspects of the strategic environmental assessment processes, at the same time outlining the potential benefits of the procedure in the assessment and management of environmental effects. In addition, the paper offers useful information consisting of relevant issues to be considered when elaborating Environmental Reports for hydroenergetic plans, as well as environmental targets to be achieved in relation to the management of water resources.

Keywords: strategic environmental assessment, hydroenergetic planning, environmental effects.

1. INTRODUCTION

Strategic Environmental Assessment (SEA) is a systematic, pro-active and participative decision support process aiming to ensure that environmental aspects are effectively considered in policy making, in drafting and developing of strategies, plans and programs. Given the goal of the modern world to succeed in creating premises for sustainable societies, decision-making factors are challeged to effectively incorporate environmental considerations into the planning processes, in order to ensure a balaced and transparent relationship between economical, social and environmental interests. Practice has proved that even countries with longer tradition of environmental appraisal still face challenges with regards to successfully applying this process.

The present paper addresses the role of SEA in the planning process, providing the decision-making authorities and stakeholders with useful advice on how to comply with the European and national legislation requirements in the environmental permitting process for hydroelectric power plans. At the same time, it points out useful information for practitioners in the field of the strategic

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environmental assessment in the elaboration of the Environmental Report, as the key factor in the procedure.

2. THEORETICAL AND PROCEDURAL APPROACH OF SEA

Since firstly introduced in 1969 in the USA, the environmental impact assessment (EIA) systems became an important tool for the environmental protection in the projects planning process. However, the emphasis on individual development projects leads to a inadequate assessment of cumulative, synergetic and indirect effects, as EIA largely reacts to development proposals after fundamental decisions have been taken (Caratti, P., et al., 2004). SEA provides the opportunity of addressing cumulative impacts, alternatives and mitigations at an early stage in the planning process, thereby counteracting some of the limitations of the enviromental impact assessment (EIA) of projects (Caratti, P., et al., 2004). SEA usually focuses on maintaining a desired level of environmental quality, mirrored into relevant environmental objectives, rather that finding mitigation measures for the anticipated impacts.

In order to legally endorse the forementioned concept, SEA Directive entered into force in 2001, binding the EU member states to transpose its content by July 2004. In Romania, the content of the Directive was transposed into the legislation through Government Decision no.1076/2004 regarding the environmental assessment for plans and programs. The main purpose of the procedure resides in ensuring that environmental consequences of certain plans and programs are identified and assessed during the preparation stage and before they are adopted. Participation and consultation rights deserve a special attention in this context (Corpade, A., et al., 2012).

The document in which the potentially significant enviromental effects resulting from the implementation of the plan or program in question are identified, described and assessed is the Environmental Report. According to Annex I of SEA Directive, among other aspects, the following information is to be included in the Environmental Report:

- the enviromental objectives relevant to the plan or program;
- the relevant aspects of the current state of the environment (biodiversity, population, soil, water, air, cultural heritage, landscape, etc.);
- the assessment of the likely significant effects on the environmental factors;
- analysis of the alternatives;
- aspects regarding the plan implementation monitoring.

As previously mentioned, one important aspect of the procedure resides in the public participation and the stakeholder consultation. In this regard, the public and the authorities likely to be concerned by the environmental effects associated with the implementation of the plan or program are to be consulted. The consultation of these interested factors contributes to a transparent decision making process and ensures that the information submitted to the assessment is comprehensive and

reliable. The role of SEA is therefore to complement the environmental impact assessment for projects, the added value of this process residing in the following arguments (Partidario, M., 2000):

- helps to incorporate the principles of sustainable development in the decision making process and in the process of formulating policies, plans and programs;
- contributes to the development of a context in which the economic, social, and environmental dimensions are integrated into the process of formulating policies, plans and programs;
- facilitates a sequential programming of environmental actions;
- provides a better context for the assessment of cumulative, induced, synergic and global impacts;
- provides a scoping context for the EIA of specific projects;
- makes it possible to anticipate the potential impacts at the project scale, and thus to improve the subsequent EIA of specific projects.

3. CASE STUDY: THE ROLE OF SEA IN PLANNING HYDROENERGETIC PLANTS

As oposed to other sectors, such as transportation, the hydroenergetic planning is perhaps less equipped to face the challenges posed by the strategic environmental assessment. As Romania shifts to renewable energy production to supply the need for carbon-based fuel, renewable energy from water will become an important source of power, in line with that produced from wind. As small hydro energy production increases, both developers and wildlife and environmental agencies have admitted the need for a system to evaluate and address the potential negative impacts of these projects on landscape or on species and habitats of concern. The generation of electricity from water is surprisingly controversial. At first glance, obtaining electricity from a free source of energy - the water - seems to be an optimum contribution to the national goal of energy independence and to solving the problem of climate warming due to greenhouse gas emissions. However, a deeper introspection results in a more complicated issue.

SEA in the hydroenergetic planning process should be conducted at different administrative levels of decision making:

- SEA at policy level: assessing strategic options in a cross-sectoral manner with respect to the achievement of overall environmental and broader sustainability aims and objectives;
- SEA at plan level: evaluating the system and options in relation to an overall identified need;
- SEA at program level: ranking of possible hydroenergetic developments in terms of potential, benefits and costs.

The planning of hydroenergetic plants in Romania is usually made at a local level, rather than regional or national. The hydroenergetic plans are normally made in order to create the framework for the development of specific projects. The authors

note the fact that according to article 5 of the Government Decision no. 1076/2004, "Are to be submitted to strategic environmental assessment all the plans and programs that a) are prepared for the following domains: agriculture, forestry, fishing and aquaculture, energy (…), and establish the framework for the issue of the upcoming environmental agreements for the projects included in annexes 1 and 2 of the Government Decision no. 445/2009 regarding the environmental impact of public and private project". Hydroenergetic plants are included in annex 2, point 3, letter i) of the Government Decision no. 445/2009, therefore the SEA procedure for plans preparing these objectives should be covered. However, most of the plans elaborated for the upcoming development of hydroenergetic plants are not submitted to the procedure. In addition, at national level, there are no strategies in relation to the development of hydroenergetic objectives, therefore the provisions of local plans are not likely to be fit into overall specific environmental targets, as they had not been established. However, even for the local plans, taking into consideration the demands of the procedure and the features of the hydroenergetic sector, main issues that should be taken into consideration in the elaboration of Environmental Reports for SEA in the hydroenergetic sector are the following:

- description of the hydroenergetic strategy, plan or program, its objectives, relationships with other plans, forecasts, etc;
- scenario analysis, description of the considered alternatives and arguments for the selected solution (system-alternatives, site-alternatives, design-alternatives, etc.);
- sustainable development and environmental objectives (plan justification, established objectives for each environmental factor considered relevant for the strategy, plan or program, targets, indicators, environmental quality standards);
- description of state of the environment in the absence of the analyzed plan (environmental assessment of the current planning area, the likely evolution of the environment and of the human health in the absence of plan implementation);
- environmental effects of the envisaged hydroenergetic systems (identification of the relevant environmental factors, establishment of the most appropriate environmental assessment methodology, identification of all potentially significant impacts, direct and indirect, cumulative or synergic, positive and negative, identification of potential conflicts between environmental and other interests, etc.);
- monitoring (objectives, targets, indicators, temporal requirements, responsabilities, remedial actions in case of unforeseen adverse effects, measures to monitor the hydroenergetic systems on various planning stages);
- recommendations for the decision-making process and for the hydroenergetic developers.

The scenario analysis is a very important step for the planning of hydroenergetic objectives, especially in the case of large-scale plants. Large hydropower infrastructure generates a great influence on the geographical and environmental factors, resulting from: withdrawal of large surface lands from the agricultural or forestry circuit, the need for settlement relocations, road construction, industrial installations, all creating brutal ecological changes; major breaks appear in the natural dynamics (Rădoane, M. and Rădoane, N., 2003). In order to minimize these effects, the scenario analysis should be made in relation to relevant objectives, residing at least in the following:

- maintain water quality;
- minimise land use;
- minimise impact on protected areas and conserve biodiversity;
- minimise impact on landscape (landscape fragmentation, visual impact);
- efficiency of the proposed mitigation measures.

The environmental targets are established by each country, and even though there are no specific national targets for the hydroenergetic sector, the environmental targets established through the energy policy may be considered (Tabel 1).

Table 1. ***Environmental targets followed in SEA for energy policy***

Environmental factor	**Targets followed in SEA**
Air	Improvement of air quality by reducing the emissions generated from the energetic sector
Running waters and underground waters	Improvement of water quality by reducing the emissions generated from the energetic system
	Maintaining the ecological functions of running waters
Soil	Limitation of the punctiform and diffuse pollution of the soil
	Maintaining the ecological functions of the soil
Climate change	Reducing the greenhouse gas emissions generated from the energetic sector
Biodiversity	Conservation of natural habitats and wild species of flora and fauna
	Maintaining and increasing the protected area network
Conservation and efficient use of natural resources	Reducing the use of exhaustible resources and facilitating the use of renewable ones
Energy efficiency	Enhancing the energy efficiency and use of energy resources
Landscape	Protection and improvement of natural landscape
Cultural heritage	In situ protection and conservation of cultural heritage values
	Preserving the local customs and traditions

The assessment of environmental effects associated with hydroenergetic strategies, plans and programs should be approached considering the issues listed in Table 2.

Table 2. ***Issues to be approached in the assessment of the environmental effects of hydroenergetic strategies and plans***

Relevant environmental factor	Variables that may cause environmental problems	Indicators showing the current environmental condition	Indicators describing likely environmental effects	Mitigation measures
Air	Transport from maintenance activities	Emissions	Deteriorated air quality	Use of least polluting vehicles
Water	Fluctuations of water flow rate	Flow rate Saprobic index	Deteriorated water quality Deteriorated aquatic flora and fauna	Permanent assurance of servitude flow Proper collection, treatment and disposal of waste water
Soil/Subsoil	Triggering of some slope processes	Soil usability Geological parameters	Changes of soil usability Geological parameters	Minimise land usage Minimise topographical interventions
Biodiversity	Deterioration of the living environment (fragmentation or partial sealing of habitats, soil, water, etc.)	Number of endangered species	Remaining habitat areas capable of carrying the population with the existing biodiversity	Compensatory areas Access restrictions to some sensitive areas
Population and human health	Number and type of maintenance vehicles passing by	Persons affected by certain emission levels	Distance to other human activities and objectives	Access restrictions to some sensitive areas
Cultural heritage	Sealing	Number, state and size of archaeological sites which the plan interferes with	Reduction/ damage of archaeological sites	Preserving archaeological heritage sites
Landscape	Built infrastructure	Visual quality	Deteriorated visual quality	Adequate architecture Use of techniques to screen the infrastructure from sensitive sites

Even if substantial progress has been made in designing hydroenergetic projects and managing their environmental impacts, challenges still remain to be addressed. These are the main environmental issues that SEA should address at a strategic level and then EIA should continue at the project level (IEA Report, 2000):

- biodiversity preservation: the need to preserve biodiversity and to minimise the loss of ecologically valuable habitats poses new challenges to hydroenergetic project designers. Issues to be addressed include the conservation of rare or protected species, maintaining aquatic ecosystems, minimising habitat fragmentation and identifying better biophysical indicators;
- optimising flow regimes downstream of a reservoir: optimising flow regimes downstream of a reservoir stirrs complex technical and political problems. Such optimisation should take into account water uses upstream and downstream of the dam, power generation requirements and the needs of aquatic habitats;
- improving fish passages for valuable migratory species at hydroenergetic dam sites: improvements in turbine, spillway, overflow design, fish ladders or fishways have proven to be highly successful in minimising fish mortality and injury;
- improving sedimentation management in reservoirs: in general, small dams and reservoirs are designed for an operating life of about 30 years, but even in case of such short life cycles, sedimentation problems are likely to appear. Avoiding the siting of dams in areas characterised by high erosion rates, and the planting and conservation of forested areas in upstream catchment areas can also reduce sedimentation in reservoirs, but is not always easy to sustain on a long-term basis. The lack of a strategic approach to the planning process together with the prioritization of economical aspects at the expense of morphological and environmental factors led to problems in the operation of hydroenergetic facilities, with significant consequences. Such is the case of several cascading reservoirs (e.g. Oieşti reservoir on Argeş River, Pângăraţi reservoir on Bistriţa River), experiencing severe silting (Rădoane, M. and Rădoane, N., 2003).
- limiting water quality problems through good site selection: When a reservoir is located in dense forest areas, a very large amount of biomass and soils may be submerged. In certain conditions, this may lead to oxygen depletion and to anoxic conditions in the reservoir. Even if pre-impoundment forest clearing and water storage management measures (such as selective multi-level intakes) can reduce such problems, further consideration must be given to reservoir water quality management at the early design stage of a project through good site selection, the use of better predictive modelling and more widespread reservoir water quality monitoring.

4. CONCLUSIONS

One of the issues worth to be mentioned is the fact that, as oposed to policies in other EU member states, no strategic documents for the development of large-scale and/or small-scale hydroenergetic plants are available, hence the lack of vision in relation to the environmental effects anticipated by developments in the field.

Given the nature, scope and functionalities of hydroenergetic plants, an integrated approach in relation to the extent of the water catchment areas is necessary in order to ensure the balaced relationship between the factors involved.

The lack of guidelines on how to assess, mitigate and monitor the environmental impact of hydro energy projects in Romania, the minimal legiferation of these projects from the environmental point of view, the renewable energy projects fever that has described Romania during the last years, a lot of them located within areas with increased natural capital, have generated concern among environmental conservation associations and difficulties to the environmental evaluators and to the environmental agencies in the permitting process.

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