

# Comparison of Environmental Impact Assessment Processes for Hydropower Plants

## Hidroelektrik Santraller için Çevresel Etki Değerlendirmelerinin Karşılaştırılması

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### Abstract

Energy is considered to be a key player in the generation of wealth and also a significant component in economic development. This makes energy resources extremely significant in the world. Efforts to prevent negative impacts of Hydroelectric Power Plants (HEPP) or to evaluate the measures to be taken to minimize these impacts are carried out within the scope of Environmental Impact Assessment (EIA). However, the existing EIA process in the environment has become inadequate to provide environmental standards. This has made it necessary to develop the Cumulative (CEIA) and Strategic (SEA) Environmental Assessments, which are the advanced stages of the traditional EIA. The CEIA is the assessment of the effects of an action along with other human activities in the past, present or future, leading to environmental impacts. The SEA, a tool for the implementation of sustainable development, is defined as the process of evaluation of possible negative effects of plans, programs and policies on the environment and the process of reducing these impacts. In this study, the problems and inadequacies encountered in the implementation of EIA in HEPP projects have been examined and the innovations brought by CEIA and SEA to environmental management and the necessity of these processes have been evaluated with case studies. At the end of the study, some suggestions have been made to better implement the CEIA and SEA processes.

**Keywords:** Hydroelectric Power Plants, EIA, CEIA, SEA

### Özet

Enerji ülkelerin ekonomik büyümesi ve kalkınmasında kilit öneme sahip olarak görülmektedir. Bu durum da enerji kaynaklarını dünyada son derece önemli kılmaktadır. Hidroelektrik Santrallerin (HES) olumsuz etkilerinin önlenmesi veya bu etkilerin en aza indirilmesi için alınacak tedbirlerin değerlendirilmesi çalışmaları Çevresel Etki Değerlendirmesi (ÇED) kapsamında yürütülmektedir. Ancak mevcut ÇED standartları karşılamakta yetersiz kalmaya başlamıştır. Bu durum, ÇED'in ileri aşamaları olan Kümülatif (KÇD) ve Stratejik (SÇD) Çevre Değerlendirmelerini gerekli kılmıştır. KÇD insanlığın geçmişte, bugün ve gelecekteki aktiviteleri ile birlikte bir durumun çevresel etkisini birlikte incelemektedir. Sürdürülebilir kalkınmanın uygulamaya dönük bir aracı olan SÇD ise; plan, program ve politikaların çevre üzerindeki olası olumsuz etkilerinin değerlendirilmesi ve bu etkilerin en aza indirgenmesi süreci olarak tanımlanmaktadır. Bu çalışmada, HES projelerinde ÇED uygulamasında karşılaşılan sorunlar ve yetersizlikler incelenmiş, KÇD ve SÇD'nin çevre yönetimine getirdiği yenilikler ve bu süreçlerin gerekliliği vaka çalışmaları ile değerlendirilmiştir. Çalışmanın sonunda KÇD ve SÇD süreçlerinin daha iyi uygulanabilmesi için bazı önerilerde bulunulmuştur.

**Anahtar Kelimeler:** Hidroelektrik Enerji Santrali, ÇED, KÇD, SÇD

## 1. INTRODUCTION

Energy is considered to be a key player in the generation of wealth and also a significant component in economic development. This makes energy resources extremely significant in the world and energy market reform has focused primarily on the electricity sector and to a lesser extent on gas [11]. Rapid increase of population and industrialization in the 20th century has resulted in a huge energy demand. According to United States Department of Energy, total world consumption of marketed energy is projected to increase by additional 57% from 2004 to 2030 [13].

The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly need to be based on efficiency in energy production, transmission, distribution and consumption. Fossil fuel-oriented energy sector has been accused of being the main source of global warming. Increased awareness of climate change and international agreements such as Kyoto Protocol have forced the governments to search for alternative energy sources; and increased oil prices have also accelerated this process. Within this conjuncture, governments have started to pay more attention to renewable energy technologies and investors are encouraged to develop renewable energy technologies. Among these technologies, hydropower, a renewable energy source based on the natural water cycle, has been considered to be the cheapest and the most widely used technology that is available. Hydropower has been used for more than a century and it has become the major source of electricity for 55 countries [13].

The increase in the greenhouse gas concentration in the atmosphere accelerates the negative effects of climate change. It is known that the increase in the negative effects of climate change will affect hydropower production. Increasing temperatures and changing precipitation regimes in the future will reduce hydropower production [4]. Hydropower has very few greenhouse gas emissions compared with other large-scale energy options. On the other hand, hydropower projects do not export impacts such as acid rain or atmospheric pollution [11].

Hydroelectric Power Plant (HEPP) Projects generally consist of weir, water intake structure, settling basin, water transmission lines, forebay pool, penstock and power plant units. In addition, such projects include concrete batching plant, stone crushing plant, construction site and landfill area during the construction period. Due to the fact that no hazardous wastes are generated during the operation of the HEPPs and the greenhouse gas emissions are at very low levels, they are considered as renewable energy sources together with the sources such as the sun and the wind. However, Environmental Impact Assessment (EIA) studies should be carried out through an effective evaluation filter as a result of extensive investigations considering the damages of nature and people during construction and operation periods of HEPPs [12].

The purpose of the EIA process is to identify all the adverse environmental impacts that may be caused by investment activities in advance and to take necessary measures. Due to lack of planning on the basin basis, considering all possible impacts of HEPP projects; the EIA process of HEPPs reaches controversial points. In accordance with the Environmental Impact Assessment Regulation (EIAR), published in the Official Gazette, dated 25 November 2014, the river type power plants with an installed capacity of 25 MW or more are listed in Annex-1 and the river type power plants with an installed capacity of between 0.5 MW to 25 MW are in the Annex-2 list of EIAR. Although EIA process is necessary for the projects in Annex-1, it is not necessary for the projects in the Annex-2 and a "Project Presentation File" is prepared for these projects.

In this case, the EIA process is not obligatory for each HEPP project in Turkey. In addition, transmission lines must be installed for the purpose of transporting the electricity generated in the HEPPs, but the environmental impacts and the elimination of these effects are not included in the EIA report. Therefore, the current EIAR is insufficient to prevent potential negative impacts and it is of great importance to adopt a cumulative and strategic assessment method according to the principle of sustainable environment.

Today, the Impact Assessment systems, which are one of the most effective tools for the protection of all components of the environment, has continued its

importance in different dimensions. Previously limited to identifying the environmental impacts of concrete activities and becoming widespread as EIA, this system is perceived as a tool that aims to identify and evaluate the impacts of policies, plans and projects on both the natural environment and the socio-economic environment in the long term. In this context, it is of great importance to pass into the evaluation Cumulative Environmental Impact Assessment (CEIA) and Strategic Environmental Impact Assessment (SEA) processes [8].

In this paper, the problems and inadequacies encountered in the implementation of the EIA in general in all sectors and in particular in HEPP projects are examined in the context of some selected sample projects. Both the innovations brought to environmental management and the necessity of CEIA and SEA, which are more comprehensive alternatives to the EIA, have been examined and specifically evaluated within the scope of HEPP projects. In the last part of the study, some recommendations have been presented for the better implementation of CEIA and SEA processes.

## **2. EVALUATION OF ENVIRONMENTAL IMPACT ASSESMENT PROCESS**

### **2.1 General**

Environmental Impact Assessment (EIA), which is one of the most important issues of environmental law, is a technical tool which is worldwide accepted and is taken part in the national legislation of many countries and has a broader sense of environmental impact. In the broadest sense, it is the process of examining the impacts of the activity that may occur after the construction, operation and termination of the activity by scientific methods and techniques before the decision on the project, preventing the negative effects of it if any, and determining the necessary measures, monitoring and monitoring these effects and measures in all implementation stages of the project.

The EIA means the studies to be carried out in the monitoring and control of the implementation of the projects by evaluating the measures to be taken in order to determine the positive and negative effects of the projects planned for the environment, preventing or minimizing the negative effects to the environment without any harm to the environment.

However, the EIA is not a stand-alone decision-making process, but rather a procedure that develops and supports the decision-making process. The EIA provides a more holistic decision-making process to the decision-making authorities in relation to an activity by notifying the environmental impacts that may arise from that activity prior to the decision phase, ie, taking into account multiple factors that may affect their decisions. The main objective of the EIA is to protect the environmental values against economic policies without hindering economic and social development, to ensure that all the positive and negative effects that an activity that is intended to be realized can be detected in advance and that the necessary measures are taken, in cases where the environmental impacts are unacceptable.

In this context, as a tool that aims to reconcile ecological and economic policies, the EIA plays an important role in the realization of the principle of sustainable development. Considering the practices in different countries of the world, there are two approaches to the areas in which the EIA is applied. The first is an inclusive approach based on the implementation of the EIA for all policies, plans, programs and projects, keeping the scope of the EIA quite wide. The second approach, which has a more limited scope, foresees the implementation of EIA only for [9].

### **2.2 Environmental Impact Assessment in the Context of Hydroelectric Power Plant Projects**

In order to detect, prevent, minimize or eliminate the negative impacts of HEPP projects on river ecosystems, EIA reports should be prepared and implemented. However, in Turkey, this process is controversial. The problems related to the EIA stages of HEPP projects are summarized below [10]:

No Planning on Basin Basis: Since no basin-based planning has been made for HEPP investments and licensing processes, EIAs are carried out on a point-by-point basis and individually for each project. However, the cumulative effects of the projects planned in a river on the same basin or in different streams forming the basin should be presented. In this context, the water related sectors in the basin should first be identified, the natural resource, habitat and biodiversity of the basin should be determined, then an electricity production planning should be made in such a way that it does not

threaten the service and health of the river ecosystem in the basin.

The EIA is not mandatory for HEPPs below 25 MW: According to the EIAR, river type power plants with an installed capacity of 25MW and above are listed in Annex-1 and of the river type power plants with an installed capacity of 0.5 MW or more are listed in Annex-2. For HEPP projects included in Annex-1 list, EIA is mandatory, however, only a "Project Presentation File" is prepared for HEPP projects listed in Annex 2 and it is decided whether or not EIA is required. When the existing HEPPs are examined, it is seen that the HEPPs which are in the list of Annex-1 and are subject to the EIA process are only about 30% of the total HEPPs. In a HEPP project, construction of which is started by decision of "EIA is not required", public information and participation processes are completely excluded and the social impacts of HEPPs are ignored. No matter how many MW of installed capacity, during the construction of HEPP, some important detrimental activities, such as stripping of the upper soil layer, construction of channels with lengths of kilometers, laying of pipes, dynamite exploding for tunneling, and thousands of cubic meters of excavation must be carried out.

Exclusion of Electricity Transmission Lines from the EIA Scope: The environmental impacts and the elimination of these transmission lines are not included in the EIA report. However, the process of establishing transmission lines causes a lot of damage in the area, in particular the plant and upper soil layer.

### **2.3 Some Assessments from Expertise Studies**

#### **2.3.1 Introduction**

Various power plants which are in project, establishment or in operation phase in Turkey are always on agenda due to concern on possible potential damages on the natural and social environment as well as about the possible damage that can arise in the future. There are certain arguments and even confrontations that take place between the company which is constructing the power plant and the local public living near the construction. These confrontations take place and sometimes even the security forces are forced to intervene. The matter goes to the courts and the investment stops during the legal litigation [5].

The authors of this paper are frequently commissioned by administrative law judge as expert witnesses during litigation process. The main issue of the expertise is related to EIA reports, either to "document of EIA is not necessary" or to "acceptance certificate of EIA".

The main data for this paper are obtained during these viewing studies, both in field listening and noting annotations of all of the juridical sides and the people, and in office scrutinizing the field observations and case documents. Additional data have been attained by evaluating some media news, related to the subject. The observations and data have been evaluated in the context of the subject.

During this process, the main environmental impacts and reasons for public backlash to small hydropower plants (SHPs) are especially focused. Within this context, totally 29 expert reports are evaluated. During legal viewing, various kinds of questions have been asked by Judge to Experts, most of which are related to probable environmental effects of SHPs and about requisite of EIA, and if an EIA had been prepared, its suitability and acceptability.

A summary of the conclusions of the reports are presented in Table 1. As can be seen, almost all of the cases (95 %) have concluded that EIA is necessary. 6 cases, out of 10 (60 %), related to acceptance of EIA have resulted in acceptance and 4 (40 %) have concluded their rejection.

**Table 1.** Summary of the conclusions of Environmental Impact Assessment Reports

<b>Question</b>	<b>Yes</b>	<b>No</b>
Is it necessary?	18	1
Is it accepted?	6	4

#### **2.3.2 Environmental Impact Assessments Not Required Decisions**

The most important issues to be evaluated within the scope of EIA Not Required resolutions are:

- Whether the water intended to be released into the creek is necessary and sufficient for the continuation of the current ecological balance and living life in the river, whether or not the fish in the stream will have a negative

impact on their lives, and if the stream bed is likely to dry,

- Whether the HEPP will have a detrimental impact on agricultural activities in the region, whether the aquatic life in the river bed will be adversely affected, and whether the project will harm the people and animals living in the area,

- Whether the trees to be cut under the project will cause landslide and erosion,

- Whether the solid wastes and wastewater that may emerge within the scope of the project will damage the flora and fauna of the region,

- Whether other projects planned to be constructed in the same basin are evaluated together, whether the EIA process is operated in accordance with the legislation,

- The adequacy of the Project Introduction File (PIF) and whether the investigations, evaluations and evaluations made in this file are based on sufficient data, information and documents,

- Whether the temporary storage areas are identified, whether these areas are actually available and whether they are suitable for use as temporary storage, and if the landfill is identified,

- Whether or not an assessment and a project has been carried out on the roads to be made within the scope of the project, which areas the roads pass and whether the environmental hazards of these roads are at an acceptable level,

- Whether the adverse environmental impacts of the project are comprehensively examined in PIF and whether necessary and adequate measures can be taken to eliminate the negative impacts on the environment,

- Whether the blasting method will be used in construction activities during the realization of the project, whether there is an alternative method, how the results are calculated in the promotion file in case of blasting, whether these calculations and determinations are real,

- Whether the adverse impacts of the construction of the HEPP on and after the completion of the hydroelectric power plant have an acceptable level in accordance with

the relevant legislation and scientific principles as well as the measures to be taken,

- Whether or not it is studied in PIF how the energy to be produced as a result of the project will transfer to the national network,

- Whether the project has some deficiencies in terms of the safety of the work site and the work site activities and the security of the inhabitants, and if any, what measures can be taken to eliminate these deficiencies.

As a result of the evaluations, it has been concluded that there are negativities in many of the above issues and 18 out of the examined 19 projects require EIA. This situation shows that, the fact that during the “EIA is not required” decision, taking into consideration only the power of the facility, and not many other criteria, has resulted in significant environmental problems.

### ***2.3.3 Environmental Impact Assessment Positive Decisions***

In addition to what is required in the EIA not required decisions, the most important issues to be evaluated within the scope of EIA positive decisions are:

- Whether the commitments offered in the project are appropriate and applicable to the project site,

- Whether the natural characteristics, fauna and flora of the area, where the project will be carried out, have the typical characteristics of the area: whether there are natural landscaping and structures, natural forestry regions, endemic plant and animal populations that require special protection,

- Whether there is natural park which requires special protection, nature park, special environmental protection zone, site area etc. in the area and in the immediate vicinity,

- Whether the investigations, calculations and evaluations made in the EIA Report are based on sufficient data, information and documents; whether the negative effects of the project on the environment are examined comprehensively and whether necessary and adequate measures can be taken to eliminate the negative impacts on the environment,

- Whether the adverse impacts of the construction and completion of the HEPPs on the environment are at

acceptable levels in accordance with the relevant legislation and scientific principles as well as the measures to be taken in the EIA Report,

- Whether the EIA process is operated in accordance with the legislation, the nature of the activity area to be executed, its impact on sensitive regions, the adequacy of the EIA report and the positive or negative impact of the determinations in this report on the environment and ecological balance,
- Whether the adverse impacts of the construction and operation of the HEPP, are acceptable in accordance with the relevant legislation and scientific principles.

Significant deficiencies in the aforementioned issues have been identified in the most of the studied EIA Reports. In addition to these, in the preparation of the reports, despite the presence of the experts mentioned in the EIA Regulation, it has been determined that experts were not employed in some areas requiring special expertise such as hydrology and hydraulic sciences, and expert opinion was not taken and that some very basic calculations were made wrongly. For example, in determining the amount of environmental flow, a minimum discharge is required for some living things, which is a basic hydraulic knowledge that the velocity increases as the water depth increases. However, in some EIA reports, completely incorrect information and evaluations based on them were found such as "water velocity will remain constant as water depth increases". Similar errors have been observed in other EIA reports.

In summary, very important problems are encountered in the EIA processes of HEPP facilities and new approaches are required to solve these problems.

### **3. APPROACH OF CUMULATIVE ENVIRONMENTAL IMPACT ASSESMENT**

#### **3.1. Introduction**

Cumulative impacts are changes to the environment caused by an action (project or project activity) in combination with other past, present, and future human actions. A CEIA is an assessment of these impacts. It should be noted that the terms "impact" and "effect" are often used interchangeably in this guideline. In general, both of these terms aim to describe any change that the project may cause in the environment.

In practice, assessment of cumulative impacts requires consideration of other assessment concepts, which are different from the conventional approaches used in EIA. Some of these concepts are the following [6]:

- Assessment of impacts during a longer period of time into the past and future;
- Consideration of impacts on valued ecosystem components (VECs) due to both the project of concern and interactions with other past, existing, and reasonably foreseeable future actions;
- Evaluation of significance in the consideration of other than just local and direct effects (such as indirect impacts, cumulative impacts, and impact interactions); and assessment of impacts over a larger (i.e., "regional") area.

The impact of human activity or a project on an environmental resource or ecosystem can be considered insignificant when evaluated separately, but it can become meaningful when it is considered in terms of past, present and predictable future effects. Cumulative impacts are changes in the environment in which an action takes place with past, present and future human actions. CEIA covers the assessment of these impacts.

#### **3.2. Cumulative Environmental Impact Assessment and Environmental Impact Assessment**

Cumulative impacts may not always be very different from the effects examined in an EIA and are often similar. Many EIAs focus on a local scale, taking into account the area or area covered by each project component. A CEIA expands the scale of the assessment to a more regional level. The challenge for the practitioner is to determine the extent of the area around the action and the interplay of complex interactions between actions. In all other respects, the CEIA is basically the same as the EIA and is mostly based on the identified EIA practices [1]. The assessment of cumulative impacts should not be considered separately from the EIA process. Indeed, the assessment of such impacts should be an integral part of all stages of the process. The potential for occurrence of these impacts should be considered in the following stages: Scoping, collection of key data, evaluation of impacts, development of mitigation measures, analysis of alternatives and development of management and monitoring plans. For the implementation of EIA studies, the following requirements may be included in the EIA

reference requirements in view of the cumulative impacts of the projects [2]:

- Describe the currently planned, in progress or in a reasonably foreseeable future project activity, which can contribute to the cumulative impacts on VECs;
- Identify the project's impact area (may vary for different types of potential impacts).
- Identify the time limit of the study, taking into account actions, for the foreseeable future (eg, a concurrent construction period or operation). Especially when there is uncertainty, scenarios can be developed to determine temporal boundaries.
- Identify possible VECs in or near the project's impact zone.
- Identify project-specific standards including relevant regulatory and / or international standards.

When the requirements for the assessment of cumulative impacts are included in the project-specific EIA format, the adequacy of the cumulative impact assessment in the EIA report should be checked during the review phase.

### **3.3. Implementation status of Cumulative Environmental Impact Assessment in Turkey**

The Government of the Republic of Turkey, has encouraged to invest in the project. on the environmental and other impacts of climate change on energy production technologies and also hydroelectric power plant as a policy priority for the observance of compliance with EU legislation, about HEPP, has been encouraged to invest in the project. The rapid growth in investments brings with it concerns about the importance of multiple HEPP projects on river basins. Despite its importance, the CEIA does not find the value it deserves in its applications, almost all of the HEPS facilities are designed separately and the cumulative impacts of a project on the other or the related environment, as well as the cumulative impacts of a series of projects are not taken into account. In the context of the cumulative impacts of SHPs, an important concept has emerged as the, carrying capacity which is the maximum capacity a field can carry without disturbing its basic environmental characteristics. This concept is mostly related to the number and / or physical properties (power, flow, impact area, etc.) of the HEPPs. However, in Turkey, no

remarkable study is carried out about carrying capacity of the basins, sub-basins and regions. As a result of this insensitivity, uncontrolled and unrestricted number of HEPPs have been constructed / constructed or planned in most hydrological basins.

## **4. STRATEGIC ENVIRONMENTAL IMPACT ASSESMENT APPROACH**

The Impact Assessment systems, which are one of the most effective tools for the protection of all components of the environment, continue their importance in different dimensions. At first, limited to identifying the environmental impacts of concrete activities and spreading as an EIA, this system is nowadays perceived as a tool that aims to identify and evaluate the impacts of policies, plans and projects on both the natural environment and the socio-economic environment. EIA is an impact assessment system that provides a more holistic approach to environmental management, including the Social Impact Assessment (SIA), the Environmental Risk Assessment (ERA), the Health Impact Assessment (HIA).

Strategic Environmental Impact Assessment (SEA) is defined as a systematic process that evaluates the environmental consequences of any proposed policy, plan or program, taking into account the economic and social consequences of the project [14]. Although the contribution of the EIA applied at the project level to the environmental impacts of individual activities is accepted, its inadequacy has also been discussed.

Considering the theoretical framework and the basic principles of the topic, which are defined in the literature on SEA, it can be stated that in the application of such a comprehensive evaluation to the sectoral policies that concern the country in general, it is necessary to examine and analyze the decision-making mechanism for policies. The SEA is an evaluation process that should be carried out in parallel to the establishment of these policies in case it is applied to policies, unlike the EIA applied to individual projects. In Turkey, macro targets for sectoral policies are included in development plans. Therefore, the decision making process related to sectoral policies is the legal preparation process of development plans. For the legal functioning of a SEA model to be applied to sectoral policies, it is necessary to determine both the preparation process of development plans and which stages of this process will include the SEA.

The EIA and the SEA are two complementary processes and the EIA regulations and procedures are adapted to the SEA planning and programming phases. However, different from the EIA, in procedures related to SEA, environmental procedures should be consulted in the preliminary investigation stage, the scoping phase is mandatory, reasonable alternatives need to be evaluated in the report and the member countries have to carry out the monitoring phase after the implementation. The SEA carries the objectives and principles of the EIA to higher levels of decision-making, where more alternatives are still in question. In the SEA phase, large-scale and longer-term impacts that cannot be evaluated at the EIA stage can be evaluated and alternatives can be generated in a way that cannot be considered in the EIA process [7].

The scale of the evaluation and the level of participation are more satisfactory in the SEA. In addition, the SEA is an approach that provides a balance between the scientific approach and the expert opinion. The SEA should ensure that expert opinions are integrated into the environmental assessment through scientific methods. The approach adopted by the EU SEA Directive is the full SEA approach and therefore it is strictly different from the EIA process in terms of hierarchy. The scale at which the SEA ends (plan, program) and the scale at which the EIA starts (project) is clearly defined in the directive. When the directive is adapted to the country's legislation, it is important to note that; these investments, which some large-scale projects consist of many other projects and which will cause a major plan change/revision, should naturally be tied to the SEA process [3].

## 5. CONCLUSION

The EIA, which came into force with the EIA Regulation in 1993 for the first time, is a planning process and then it has passed through many revisions until today. However, most of the time, rather than the development of the EIA process; these revisions have caused more problematic progress, and decrease both in efficiency and productivity.

Turkey is one of the developing countries and today our energy dependence on energy and the increase in energy demand is a fact that should not be ignored. For these reasons, recently, investments in HEPP have increased considerably, but there has been an economic understanding that limits nature life, defines nature as a

resource, transforms it into a commercial product and advances uncontrollably. For this reason, it is very important to make strategic and holistic watershed planning where; all stakeholders related to the issue come together, the positive and negative effects of the regulations and the positive and negative effects of the arrangements to be made to the places in the region and the area are evaluated and the conditions that create a danger are evaluated in with long term reports.

In this context, the EIA process must be mandatory for each HEPP project; the CEIA process should be applied to assess the long-term and cumulative impact of larger projects. In addition to these, the transition to the SEA process, which is an approach that involves the inclusion of environmental values into the construction processes of all plans, programs and policies beyond the impacts on a point-by-point and project level, should be accelerated and projects should be carried out within the framework of high public interest.

As a result, hydroelectric power is a necessary energy type and construction of HEPPs is inevitable; however, the sustainability of the projects can only be possible by planning and implementing which take into consideration supervision and protection of the ecological characteristics of water resources. The CEIA and SEA practices are becoming increasingly widespread in the world and adopted as an accepted environmental assessment tool. It should be ensured that the works supporting the development of the CEI and SEA system on a national basis should be carried out immediately and the results should be implemented as soon as possible.

**Notes:** This article is a revised and expanded version of a paper entitled [Hidroelektrik Santraller için ÇED-KÇED-SÇD Süreçlerinin Karşılaştırılması] (in Turkish) presented at [International Congress of Energy Economy and Safety, Istanbul, Turkey, 2018]

## 6. ABBREVIATIONS

CEIA	: Cumulative Environmental Impact Assessment
ÇED	: Çevresel Etki Değerlendirmesi
EIA	: Environmental Impact Assessment
ERA	: Environmental Risk Assessment
HEPP	: Hydroelectric Power Plant
HES	: Hidroelektrik Enerji Santrali
HIA	: Health Impact Assessment

KÇD : Kümülatif Çevresel Etki Değerlendirme  
SÇD : Stratejik Çevresel Etki Değerlendirme  
SEA : Strategic Environmental Impact Assessment  
SIA : Social Impact Assessment  
VECs : Valued Ecosystem Components

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