Environmental Impacts of Mini Hydropower Projects in Sri Lanka

B.W.H. Akbo Rupasinghe and S.N. de Silva
Royal College, Colombo, Sri Lanka
E-mail: akbo911@yahoo.com

ABSTRACT

Sri Lanka is experiencing a high rate of increase in electricity demand. Electricity demand is met by hydropower and thermal power generation. Country has exploited almost all major hydropower sites. Government has allowed private sector investments in mini hydropower projects.

Public protests in the recent past against hydropower development projects have challenged the validity of the common belief that hydropower was environment friendly. Sri Lanka has enacted legislations to safeguard the environment. Central Environment Authority (CEA) is a strong institution established for the protection and management of the environment.

This study attempts to identify the impacts of mini hydropower projects on the social and ecological environments. It examines the adequacy of the prevailing laws to protect the environment. CEA approval for Environment Impact Assessment (EIA) is a legal requirement before starting a mini hydropower project. Central Environmental Authority sets the terms of reference for the EIA. This study examines the adequacy of the EIA and suggests solutions to overcome the shortcomings.

It also examines the problems at different stages of approval process of EIA. Suggested solutions for the identified problems are given at the end of the discussion of each step. Intention of the study is to attract the attention of the relevant authorities who can take corrective actions.

1 INTRODUCTION

As a developing country Sri Lanka is experiencing a high rate of increase of electricity demand. This demand was met by hydropower until a few decades ago. Continued high rate of increase of electricity demand has lead thermal power based on fossil fuel to be the main source of electricity generation.

Hydropower had been considered the most environmentally friendly and economical source of energy; in comparison with fossil fuel. So the government took measures to increase the investments in mini hydropower generation in order to get the maximum of the limited opportunities. In the recent past there have been protests by various environmental groups and the residents of the locality of proposed hydropower projects, against these projects. This aroused awareness in the public, of the question ‘Is hydropower generation as environmentally friendly as it had been commented’?

This study focuses on

• Identifying the possible environmental, both social and ecological, impacts of mini hydropower projects.
• Identifying the legal measures taken by the government to ensure minimum disturbance to the environment and the effectiveness of such measures.
• Finding solutions to the deficiencies in such measures
• Finding ways to make the public aware of the environmental impacts of mini hydropower projects.
2 BACKGROUND

2.1 Electrical Energy - Supply & Demand

Sri Lanka has been facing a high rate of increase of energy demand throughout the past decades. Originally this demand was met by hydropower; mainly through large scale hydropower plants i.e. power plants of Kelani basin and Mahaweli Multipurpose scheme. But this supply could not meet the increasing demand. Therefore the government of Sri Lanka had to take the thermal power as the only option to meet the demand.

2.2 Role of Hydropower

Total installed capacity of hydropower is about 1250 MW, excluding privately owned mini hydro power plants. Another 150 MW will be added to this figure in the near future after the completion of Upper Kotmale power project, which will be the last large scale hydropower project in Sri Lanka.

2.3 Mini Hydro

Hydropower projects below 10 MW capacity are defined as mini hydropower projects. Mini hydropower plants were connected to the national grid for the first time in 1996. Total capacity of mini hydro connected to the grid during that year was 1 MW. Since then a number of mini hydro plants have been connected to the grid adding a total capacity of about 80MW, power purchase agreements have been signed for about 35 more plants with a total capacity of about 95MW. Letters of intent have been issued to about another 250 developers. More than 100 applicants are awaiting letters of intents.

Investments in mini hydro gives a reasonably high return, therefore investors are attracted to it. The developers are guaranteed a price of 90% of the price declared at the time of signing the power purchase agreements. However, economically attractive sites are limited. Therefore competition among investors for mini hydro sites is very high.

2.4 Protests

Though hydropower was considered as the most effective energy source with the least impact on the environment, there have been public protests in the recent past against hydropower projects. One very prominent case was that against Upper Kotmale Hydropower project.

Issues concerning the change of habitats and livelihood, disappearance of waterfalls and risk of landslides and floods were raised. Strong political back up were evident in these protests. Even though the critics comment that the protests had hidden agenda, those protests would not have been that strong had not there been real issues.

Similar types of protests came up against many mini hydropower projects. Basis for such protests on three different hydropower projects in Deraniyagala are as follows:

Project 1
• The resource belonged to the local people is being exploited by some investors who are strangers. Only the citizens in the city get the benefit while the student in the affected village do not have a single electric bulb to study at night.
• The Sri Pada Adawiya (Adam's Peak), a sacred mountain for Buddhists is disturbed
• Deforestation
• Natural topography is changed

Project 2
• The buildings in the vicinity are affected by the rock blasting at the construction stage.

Project 3
• A few deaths occurred when villagers were bathing in the fore bay, due to emergency spilling.
3 LEGAL STEPS TO MINIMIZE THE ENVIRONMENTAL IMPACT

The National Environmental Act (NEA) No. 47 of 1980 is Sri Lanka's national charter for protection and management of the environment. This Act establishes a strong institution called the Central Environmental Authority (CEA) for the protection and management of the environment. The Act is further strengthened with a provision to prevail over any other written law in the event of any conflict or inconsistency.

3.1 The Central Environmental Authority (CEA)

The NEA clearly states that the CEA has the sole responsibility and the authority to
- conduct researches
- making policies and standards
- raising public awareness
- co-ordinating with other organizations whose objective is the same or similar to that of CEA
- prevention of violating acts, harmful to the environment in order to protect and maintain the standards of environment.

3.2 Initial Environmental Examination (IEE) & Environmental Impact Assessment (EIA)

The NEA was amended by Act No. 56 of 1988 to include a provision relating to Environmental Impact Assessment (EIA). The NEA has identified two levels in the EIA process. The first level - i.e. the Initial Environmental Examination (IEE) is a report where possible impacts of a prescribed project are assessed with a view to determining whether the impacts are significant or not. An IEE must address the possible impacts and the intensity of such impacts. The second level: the EIA report is a more comprehensive document. Significant parts of the EIA report are study of the proposed alternatives and identification of the option with lease impact on the environment. The EIA process will be implemented through designated Project Approving Agencies (PAA) as prescribed under the provision of the Act. The CEA is the agency charged with the responsibility of implementing the above provisions of the NEA.

The EIA process is the strongest and the most scientific and methodical provision as we see in the NEA to maintain a balance between development and conservation of the environment.

4 RESEARCH METHODOLOGY

Fig. 1 shows the sources of information for this study.

Sample Projects: i. Magala Ganga Mini Hydropower Project
ii. Bambarabatu Oya Mini Hydropower Project
iii. Atabage Mini Hydropower Project

![Diagram of Sources of Information]

Fig 1 : Sources of Information
The questionnaire to the villagers: is this hydropower project good for the village?
1) If yes why? If not why?
2) Did the villagers got involve in any public hearing before the project?
3) Are you asked questions on the present status of the project by any monitoring party?
4) Is the flow released at the weir enough for your day to day needs?(Only if the villager lives downstream and between the weir and the powerhouse)

- The other oral sources are reached by interviews targeted at interviewee’s scope.

5 PROBLEMS & SOLUTIONS

5.1 Why Does a Mini Hydropower Plant has Impacts on the Environment?

Almost all mini hydropower plants constructed in Sri Lanka are of Diversion Type (Fig. 2). The main necessity is a rich flow of water and prominent drop. These topographical features are available in the up country wet zone which has a sensitive tropical ecology. This fact leads to the following identified impacts.

- Mini hydropower plants are bound to be located in highly sensitive ecosystems in the tropical forests with vast bio diversity.
- Such sites are mostly found far from the main transport system and the Transmission Line of the National Electrical Grid.
- The waterway is essentially blocked at a weir, causing to disturb the sensitive ecosystem. This blockade causes disturbance of traditional usage of water down stream.
- A massive construction site occupies the vicinity, disturbing the sensitive ecosystem.
- The villagers are compelled to adapt themselves to the changed environment. Such adaptation has a tendency for inappropriate behavior, which would be harmful to the society and the environment.

When investigated the cause of the protests that came up it was clear that there are ecological and social impacts by any kind of hydropower project. Some of the impacts are given below.

* Deforestation
* Change of water flow
* Threat to flora and fauna
* Disturbance to the sediments flow
* Disturbance to the traditional usage of water
Further investigations showed that precautions and legal provisions to ensure the conservation of the environment have already been taken. But their effectiveness is questionable. Unfortunately there were no other studies to review the effectiveness of the measures taken to protect the environment i.e. Environmental Impact Assessment regarding hydropower generation.

5.2 Problems of the EIA procedure

Problems occur at several stages of the EIA process (EIA procedure is outlined in Fig. 3)

![EIA Procedure Diagram](image)

Figure 3. :EIA Procedure

5.2.1 Stage 1: Preparation of EIA report and its adequacy.

5.2.2 a) Identified problems

The EIA must address a broad range of issues i.e. impacts on wild life, health, water, land use, tourism etc. Terms of Reference (TOR) is set by the CEA for mini hydropower projects in order to direct the experts preparing the EIAs. Adequacy of the EIA is questionable when considering highly sensitive issues.

Eg.: A list of flora and fauna should be submitted with the EIA report. It is required to indicate the endemic, rare, threatened and endangered species and "if possible " to mention their relative occupancy elsewhere in the country. The CEA as the Project Approving Agency does not take action to make sure that these facts are true and complete. It is possible even a renowned professional would miss a particular species of flora and fauna whose contribution to the bio diversity is immense. This happens as there are not enough ecological studies done in the dense rain forests which have the suitable sites for mini hydropower projects. Further the CEA does not have sufficient resources to carry out such ecological studies in the respective sites at each request of project proponents.

This situation eventually directs to the conclusion that EIA is unreliable and inadequate at the preparation level.
Other environmental information given below, presented in an EIA, are not targeted at the final objective of EIA.

- Information on the topography
- Information about the land use
- Information about the flow rate of the river
- Information about the general geology of the weir site
- Information about the possible disasters
- Information about the socio-economic status of the local communities

Investigations revealed that the CEA depends on the reputation of the professionals who prepare the EIAs.

### 5.2.1 b) Suggested Solutions

I. The CEA must demand the true and complete facts irrespective of possible scarcity of the required information.

II. The CEA can facilitate the project proponent with professional assistance at the preparation stage of the EIA report, in order to ensure the adequacy of the EIA report.

III. The CEA can take action to recognize voluntary environmental agencies and environmental activists. These recognized parties could be given access to the EIA process at the preparation, public participation, decision making and monitoring stages.

IV. Environmental activists have specific knowledge and resources on local ecology as they conduct independent studies. A system to recognize these bodies would surely encourage the extension of their studies and other services.

### 5.2.2 Stage 2: Public Participation and its Effectiveness

#### 5.2.2 a) Identified problems

The involvement of the public is one of the crucial aspects of the EIA process. NEA has made provisions for public participation. The notice of availability of the EIA report for public review must be publicized and 30 days are allowed for public review.

I. Though the NEA provide necessary provisions the effectiveness of this step is questionable.

   Only the members of the public who have a natural interest about the project are expected to submit comments. And that particular faction of the public need not essentially be knowledgeable about the scientific aspects. Even an affected villager may not be aware of the real damage to his environment.

II. Any protests or comments may be carried out under personal or political agenda by which the real impact may be hidden from the public.

#### 5.2.2 b) Suggested Solutions

The affected community can be empowered by the CEA with the help of voluntary environmental groups in order to enhance the awareness in the community, of the possible threats. This could be done by reaching the schools, temples or churches and educated members of the community. The CEA should not conceal any information about any possible threats, but should educate the affected community to the furthest extent so that the public participation would be more effective.

### 5.2.3 Stage 3: Decision Making

#### 5.2.3 a) Identified problems

I. According to the regulations the CEA, as the Project Approving Agency, shall grant approval for the project, subject to specified conditions or refuse approval for the implementation of the project with
reasons for doing so. The decision is made based on the conclusions of an evaluation committee. It is
the EIA report that is subjected to the evaluation. Again the adequacy of the EIA report starts playing a
vital role.

II. Carrying out the necessary studies and researches makes the EIA process a mere paper qualification
that helps to go through legal and public barriers.

III. Political interference over the CEA, sometimes, force the CEA only to focus on ‘approving’ a project at
any risk. These interferences even go to the extent of questioning the scientific base of a decision. These
harassments drag the functions and duties of the CEA and its staff out of its scope.

5.2.3 b) Suggested Solutions

I. Environmental Council, which is established by the NEA as an advisory body to the CEA, has space
for three members of voluntary agencies in the field of environment. These members should be
selected without any political interference.

II. An independent body of recognized voluntary environmental agencies can be formed to assist the CEA.
This body should have the legal right to address to any issue of the CEA especially the EIA process.
The CEA can seek advice from this body.

5.2.4 Stage 4: Monitoring and its Effectiveness

5.2.4 a) Identified Problems

The success of the EIA process would be totally negated if the conditions imposed by the CEA are not
effectively monitored. The regulation state that the CEA should prepare a report which contains a plan to
monitor the implementation of every approved project within 30 days of granting such approval. This
monitoring would involve compliance with conditions and effectiveness of the mitigatory measures.
It was noted that none of the developers, officers of the CEA or the affected villagers are giving emphasis to
the monitoring process.

Eg:- There are many complaints on not releasing the recommended flow of water from the diversion weir.
The villagers downstream are directly affected by this illegal act done by the developers.

There were a few deaths reported which occurred as the villagers were not familiar with various structures of
the mini hydropower station. One such instance is described as a reason for the protests in 2.4 - Project 3.
Results of relevant monitoring should be made available to the public upon request. But authors’ request was
turned down saying that they were internal documents of the CEA.

The CEA suggests and expects the project proponent to monitor the set parameters and forward reports to the
CEA in quarterly basis. The project developers are only interested in their income. It is not practical to expect
a reliable monitoring process and reports from a project developer. In fact the CEA as the Project Approving
Agency has the responsibility to monitor the parameters set by them.

 Further investigations showed that there are no reports of the monitoring, submitted to the CEA.

5.2.4 b) Suggested Solutions

* The CEA should take the initiative to enforce all rules and regulations for the protection of the
environment.
* As stated in the regulations the monitoring must be carried out. If not, the objective of the EIA is not
met.
* Schools, universities and other research-oriented groups can be given the opportunity to contribute to
the monitoring process so that the social awareness of the issues is rouse.
* Simple routine monitoring such as the minimum flow release and riverbank erosion can be done with the
help of the villagers by making an official like the Grama Sevaka (village officer) accountable of such
monitoring.
* It is not practical to monitor flora and fauna in a quarterly basis, unless there is a prominent change. A
proper study with the help of professionals is suggested to be conducted at least annually.
* The affected community should be properly educated on post-construction stage threats so that they will be vigilant with a scientific view about any risky development.

6 THE ROLE OF THE CEA

According to the findings of our investigations it was evident that the role of the CEA regarding environmental impacts is vital.

The CEA is not only the Project Approving Agency for hydropower projects but the strongest and most important institution in Sri Lanka, established to protect the environment.

It is clear, that all solutions for the problems lies within the CEA's scope and that the easiest way to implement them is by the CEA's active involvement.

The CEA, which is established under strong NEA, should focus only to protect the environment. Promoting investments, encouraging developers and creating a smooth pass away to the developers is not supposed to be within the scope of the CEA. There are other institutions e.g. the Board of Investments to plan and implement policies and methods to attract investors.

7 ATTITUDES

There are three main parties involved in a hydropower project - the developer, the CEA and the public. Attitudes of these three parties should be environmental friendly for a better process of environmental conservation.

The developers are almost always money conscious. We were frustrated to hear some comments by them. "How can saving a frog be more important than solving the poverty of Sri Lanka", is one such question asked by developers. It is true that these type of questions leave the CEA and the public without an answer. This is a very unhealthy attitude for the environment.

The attitude of the public may vary. While the affected villages protest against the hydropower projects there are protest in the city raising the question of energy crisis. The attitude of the public depends on the effect of the project on each member of the public.

The attitudes of the CEA and its officials are most important. The CEA should have attitudes of an environmentalist who worries about the slightest disturbance to the environment. The CEA should get the majority of the public to its side. It is not by provoking the public against projects but by properly educating them and creating awareness. When the other two parties of a project is not so environmentally friendly the CEA can still take all necessary actions by going to the extremes of its scope, since it has the necessary legal back up.

Sri Lanka has untouched tropical forests whose existence run back in time to the pre-historic age. For investors, most attractive mini hydro sites are located in these rain forests. When considering the importance of protecting the bio-diversity a frog may be more important than the poverty factor.

8 CONCLUSIONS

1. Hydropower is an important factor of the energy industry in Sri Lanka. The increasing demand and the government policies have attracted investors to develop mini hydropower.
2. Recently there were protests against the mini hydropower projects. Environmental impacts were the declared reasons for the protests.
3. Most of Mini hydropower projects are located in highly sensitive ecosystems in rural hill country.
4. Strong legal provision is available to protect the environment. A strong authority known as the Central Environmental Authority (CEA) is responsible to impose these laws.
5. Environmental Impact Assessment (EIA) is used as a modern scientific method to identify impacts and
to set necessary mitigatory measures. As a concept, it can be commented as the best prevailing procedure.

6. It is identified that there are deficiencies in the EIA process in its main 4 stages.
   (i) Preparation of the EIA
   (ii) Public participation
   (iii) Decision making
   (iv) Monitoring

7. The CEA should go to its extreme within its scope to safeguard the environment. The CEA should not worry about promoting investments or eliminating poverty. The environment is the most important factor within the CEA’S scope.

8. The CEA should take action, using its strong legal backup
   * to investigate and research
   * to rouse public awareness
   * to stop projects with harmful impacts
   * to monitor closely the construction and the operation stages of projects.

9. It is not the public or voluntary environmental groups that should take action to reduce impacts by complaining to the CEA. The CEA should take the initiative.

10. The CEA should take action to reinforce itself by
    * arousing public awareness and getting the public actively participate in all stages of EIA.
    * recognizing voluntary environmental groups and giving them the opportunity to express their opinion.

REFERENCES

- Central Bank Annual Report, Central Bank of Sri Lanka, 2004
- Guidance to Environmental Impact Assessment Process No.1, No. 2 and No. 3, Central Environmental Authority of Sri Lanka
- Terms of Reference for EIA for mini hydropower projects, Central Environmental Authority of Sri Lanka
- An assessment of the Small Hydropower potential in Sri Lanka, Ceylon Electricity Board, April 1999
- Gazette Extra-ordinary No 772/22, Government of Sri Lanka, 24th June 1993
- Kukule Ganga mini hydropower project: EIA Report, Central Environmental Authority of Sri Lanka
- Kuru Ganga mini hydropower project: EIA Report Central Environmental Authority of Sri Lanka
- Magala Ganga mini hydropower project: EIA Report, Central Environmental Authority of Sri Lanka
- Magala Ganga mini hydropower project: Feasibility Report, Ceylon Electricity Board
- Naya Ganga mini hydropower project: EIA Report, Central Environmental Authority of Sri Lanka.

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