ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT HYDROELECTRIC PROJECTS OF JAMMU AND KASHMIR AN OVERVEIW

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ABSTRACT

Development of water resources is of prime importance for the survival of mankind, due to its alarming increase in population growth. A stable eco-system and increase in food production in long terms require the development of water resources projects. Which are linked with changes in Environment due to the construction of hydro-electric projects, reservoirs, irrigation and water supply schemes, etc. Thereby submergence of land, displacement of population including flora and fauna and settlement in the surrounding catchments, denudation of forests, water quality and ground water table, etc. are in constant transition. Environmental Impact Assessment is a formal process for identifying the likely effects of a particular activity or project on the Environment and on human health and welfare. The Environment includes the biological, physical Environment and the socio-economic Environment. Environmental Impact Assessment also encompasses the development and mitigation measures.

Social Impact Assessment (SIA) is a methodology used for examining social changes due to existing sources especially specific development project, governmental policies, technological changes and social processes and anything that has a social impact.

The interpretation of term, "Environment" is provided by 'National Environmental Policy Act (NEPA) of Federal Govt. of USA, (1969) [1].

The impacts of the conditions are assessed through Environmental Impact Analysis. Major steps in EIA processes are Screening, Scoping, EIA Report, Review, Post Audit and Evaluation.

Types of Environmental Impacts may be 'primary' and 'secondary'. The primary impacts are in fact the first round impacts associated with projects, programs & other activities of man such as air pollution, water pollution and employment generation, etc. From such impacts one may link several types of induced effects subsequently.

Environmental Impacts are classified as 'short term' and 'long term'. Narmada dam in India displaced people in the short-term, submerged a large tract of forests and other damages, but it brought economic prosperity in the long-run.

Criteria for identification of 'significant impacts' are reported as,
i. Significance based on Institutional recognition like public laws, treaties and other government standards. ii. Significance based on Public recognition. iii. Significance based on Technical recognition**.**

Impact Prediction involves forecasting the characteristics of any change to the environment that may occur as a consequence of a policy or project. Such changes identified are described in temporal and spatial terms.

The environment base line conditions need to be established for both the present and the future. Baseline conditions are also important in evaluating impacts and setting operational standards during operation of a project.

The term “Methodology” refers to structured approaches for accomplishing one or more steps required within the impact assessment process. Since the national environment policy act became effective in the United States of America in 1970, several methodologies have been developed for conducting EIA studies. Singh, et.al, (1985) [8], lists them as 1.Environmental Indices. 2. Matrix Methodology. 3. Checklist Methodology.4.Network Methodology. 5. Computer aided Approach.

Due to diversity of impact studies, indices can be divided as (i) Resource Indices, (ii) Ecological Indices, (iii) Socio-economic and cultural Indices.

Establishment of indices system also helps baseline data collection. Most EIA studies contain list of indices ranging in between 50 to 1000, majority having from 50 to 100 indices (Canter 1991) [9].

The main utility of matrix lies in its use in communicating complex information in simplified and easily assimilated form.

The EIA's guidelines (FPCO 1992) [2] require scoring of the impacts.

The impact scoring chart has been developed considering the relevant aspects such as magnitude of change, scale of change, frequency, duration, probability and the significance (Shagoofta 2011) [3].

In the Weighted Matrices, when preparing the impact matrix one indicates the relative magnitudes by numbers e.g. on scale of 1 to 10, rather than by symbols or letters.
Thus the total impact of *i*th component/activity is discussed. Also the overall relative impact of the project is shown mathematically.

"Checklist Methodologies" range from simple listing of environmental elements to sophisticated techniques, where a weighting factor is assigned to each element according to its importance, and then evaluate the impact from each alternative solution. There are a large number of descriptive checklists formulated according to the nature of proposed development. A checklist of 62 environmental factors related to environmental quality, was developed by Canter and Hill (1979) [4]. A simple example of weighing checklist is the water quality Index (WQI) developed by National Sanitation Foundation.

Network Methodology uses the metric approach by extending it further to take into account the primary as well as the secondary impacts in the **cause action** cumulative effects network. The network is presented in the form of a tree which is called the Relevance Tree or the Impact Tree (Shagoofta 2011) [3].

With the emergence and popularity of computers there has been a significant change in the Field of EIA. Several approaches are developed. One of the modern methods employed is computerized overlay method. This is basically a geographical approach originally developed by Mc Harg (1968) [5].

The profound influences of population growth, high density of population and urbanization, industrial expansion, resource exploitation, large projects like nuclear and hydrostatic power projects, etc create and perpetuate conditions under which man and nature can exist in productive harmony and fulfill the social, economic and other requirements of people. Wolf (1974) [6] did a pioneering work on SIA and gave its definition.

SIA should take into account the Demographic effects, Socio-Economic impacts, Institutional impacts, Cultural impacts, Gender impacts (Glasson, et al. 1993) [7]. SIA pays attention to vulnerable section of population, such as elderly, the poor, the children and the minority groups in terms of cultural and religious beliefs.

The adverse impacts on socio-economic environment of a place can be mitigated by providing more houses, more hospitals, more schools, more transit routes, more social services, proper arrangement of policing, city planning and management of the townships. Role of NGOs is perhaps very much important in improving social climate of an area.

Finally an Overview Study of Hydro Electric Projects constructed and under construction in Jammu and Kashmir are discussed; taking cases of two hydroelectric power stations, Uri1 and Uri II, located on the downstream of river Jehlum, and five power houses on upstream and downstream of river Chinab, three hydro electric power houses on river Sind. The actual inspection of the construction and some after effects are discussed.

CONCEPT OF ENVIRONMENT

The dictionary meaning of the term "Environment" is a "Surrounding". How, the nature and the man together create the environment is not a simple mechanism to understand. It is a complex one having a two way relationship indicating nature's influence on man and man's on the nature. The natural factors like land-forms, soil, climate, vegetation, minerals, water, air etc. together influence the human factors or conditions like demography, economy and even the history of the mankind. Human factors are in turn responsible for developing the technology and hence greater and better use of the earth and the other resources at the disposal of the man. This leads to a change in land- use patterns which affect the ecological or natural factors.

The interpretation of term, "Environment" provided by 'National Environmental Policy Act(NEPA) of Federal Govt. of USA, (1969) [1], include the whole complex of physical, chemical, social, cultural, economic and aesthetic factors which affect individuals and communities and ultimately determine their form, character, relationship and survival. Thus any natural or manmade change in the environment such as air pollution, land use patterns, deforestation, excessive rise in population, technological changes, earthquakes, cyclones, drifting of mountains, rise in sea level etc. will eventually affect the environment which intern affects the living beings and change their life styles or patterns of behavior and survival.

ENVIRONMENTAL IMPACT ANALYSIS (EIA)

The environmental conditions vary according to nature, scale and location of the action or actions. The impacts of the conditions are assessed through "Environmental Impact Assessment" called in common terminology or "Environmental Impact Analysis" called in scientific terminology. The EIA is an activity designed to identify and predict the impacts on bio-geographical environment, on man's health and well being,

of the legislature, proposals, policies, programs, projects and operations, procedures and to interpret and communicate information about impacts.

Major steps in EIA processes are as follows.

a. Screening comprising of decisions on the level and parameters to be looked at under EIA.
b. Scoping comprising of development of items of references for EIA and the Formalization.
c. EIA Report comprising of analysis and assessment of impacts, mitigation measures, monitoring plan, environmental management plan.
d. Review comprising of review of EIA report, terms and conditions for environmental protection and monitoring programs.
e. Post Audit and Evaluation comprising of the check on degree of implementation of provisional management plan and the evaluation of the successes of the mitigation measures.

TYPES OF ENVIRONMENTAL IMPACTS AND IMPORTANCE OF ASSESSMENT

1. Environmental impacts may be 'primary' and 'secondary'. The primary impacts are in fact the first round impacts associated with projects, programs & other activities of man such as noise pollution, displacement of people & business etc. From such impacts one may link several types of induced effects in the subsequent rounds. For example if people are displaced, there might be several consequences in due course of time for their socioeconomic conditions which might change overtime. Construction of highways, airports, dams, power houses and other large projects would generate several types of primary inputs but the investments in such projects induce several other types of investments and consequences. So inputs cause primary impacts and its outputs cause 'secondary impacts'. Most of the socio-economic environmental changes fall in the category of 'secondary' or 'induced effects' or 'impacts'.

2. Environmental impacts can be 'short term' and 'long term'. The impacts which are felt in the shorter period of time such as during construction period of projects and its early phase of operation are short term in nature and impacts which are felt in a longer period of time are defined as 'long term' impacts.

Considering the nature of the short-term and long-term environmental impacts, positive or negative, one may find a trade-off between them. Short term gains or losses might be counteracted by the opposite consequences in the long-term. A project like Narmada dam in India displaced people in the short-term, submerged a large tract of forests and created all kinds of construction damages, but it brought economic prosperity in the long-run. Likewise the green revolution in short term improves farm productivity and enhances incomes of farmers, but in the long run one may find a declining fertility of farms due to excessive chemicals used as fertilizers and insecticides. Such chemicals may also be cited as sources of several diseases like cancer as they enter in human body through food grains produced with the help of chemical fertilizers based farm technology under green revolution.

Thus through proper environmental impacts analysis one may get a clear idea of such trade-offs and suggest appropriate mitigation measures to minimize them.

CRITERIA FOR IDENTIFICATION OF 'SIGNIFICANT IMPACTS'

Normally three bases are used for this purpose. These are

i. Significance based on Institutional recognition
ii. Significance based on Public recognition
iii. Significance based on Technical recognition.

The institutional recognition takes into account public laws, executive orders, rules and regulations, treaties and other government standards related to the maintenance of the environmental quality, such provisions cannot be violated. For example killing of wild animals in India is legally banned.

By "Public Recognition" we mean that some segments of the general public recognize the importance of the environmental quality, although there might be no government laws to protect it normally. We see controversies, protests and agitations, etc from public on several environmental issues related to Projects and actions of the governments or private parties e.g., Narmada Bachao Andholan of India, Protection of Temples and other religious places. Protections of Historical places, etc are all based on public recognition of their utility and quality from environmental point of view.

The third category i.e. significance based on technical recognition implies that environmental quality is to be maintained on scientific and technical knowledge or judgment of the critical resources. Environmental quality of Antarctic is to be maintained because it provides a good setting for scientific study of geological formation, climate and other related aspects.

IMPACT PREDICTION AND METHODOLOGIES OF EIA

Impact Prediction

Impact prediction involves forecasting the characteristics of any change to the environment that may occur as a consequence of a policy, plan, program or project. Such changes identified are described in temporal and spatial terms and associated with particular activities. Prior to predicting impacts it is important that sufficient information is available on the baseline environment i.e. the situation without the project, since the dimensions of any potential changes to the environment should be placed in the context through a comparison with the baseline.

The environment base line conditions need to be established for both the present and future and should take into account potential changes attributable to both human activities and natural events indicating trends and pressures. It is important that the scenario is realistic and reflects ongoing influences and trends which will influence baseline conditions even without proposal being implemented. Actual changes which occur after project implementation can be measured by monitoring.

Baseline conditions are also important in evaluating impacts and setting operational standards during operation of a project. Impact prediction is a critical activity in environmental assessment in that it provides a basis for evaluating the significance of any environmental changes attributable to a project.

EIA Methodologies

The term "methodology" refers to structured approaches for accomplishing one or more steps required within the impact assessment process. Since the national environment policy act became effective in the United States of America in 1970, several methodologies have been developed for conducting EIA studies (Singh et. al. 1985) [8].

The methodologies of EIA are:
Environmental Indices
Matrix Methodology
Checklist Methodology
Network Methodology
Computer aided Approach

Environmental Indices

Index is considered to be quantified limit of a specific environmental element; quantification in this case can be simple "yes" or "no". Depending on the project, a certain number of indices must be incorporated into the impact study.
Due to diversity of impact studies, indices can be divided as follows:
(i)Resource Indices: These show the change of potential of the system with components.
(ii)Ecological Indices: These show the change of biotic and a-biotic environmental components.
(iii)Socio-economic and cultural indices: These show the changes towards the improvement of living conditions.

The identification, selection and classification of environmental indices is essential for successful impact assessment. Establishment of indices system also helps baseline data collection. Most EIA studies contain list of indices ranging between 50 to 1000 with majority having between 50 to 100 indices (Canter, 1991) [9].

Matrix Methodology

Matrices are useful two dimensional models for relating two sets of items represented by row-columns in the matrix. The main utility of matrix lies in its use in communicating complex information in simplified and easily assimilated form. A common use in EIA's is to relate project activities to environmental component through some quantification or ranking. The EIA's guidelines in the ordinance FPCO (1992) [2] require scoring of the impacts. The methodology described in the EIA manual (ISPAN 1994) for project impact assessment and scoring has been used in such study in developing countries. The impact assessment is generally a task of the multi-disciplinary team. A uniform well defined and a step wise structured and formal criterion is used for assessment and scoring. When an impact could not be quantifiable qualitative judgement has been used based on experience. The scoring is done within a 21 point score ranging from -1 to -10 for negative impacts and +1 to +10 for positive impacts while 0 is used in case of no impact (or neutral impact).
The impact scoring chart has been developed considering the following aspects.
1. Value of IEC in terms of rarity, economic values, importance of human etc.
2. Magnitude of change (low to high)
3. Scale of change (site-specific, local, regional, national)

4. Frequency (occurs a few times or repetitively)
5. Duration (Short, mid or long term)
6. Reversibility (Through mitigation or natural process)
7. Probability (unlikely, likely, unavoidable)
8. Significance summarizing the magnitude, frequency, duration and reversibility of the predicted impacts (Shagoofta2011) [3].

In the weighted matrices, when preparing the impact matrix one indicates the relative magnitudes by numbers e.g. on scale of 1 to 10, rather than by symbols or letters. Also one assigns a weigh or relative importance to such impact, again by numbers on a numerical scale of 1 to 10 and mention these two indicative measures in each of the relevant boxes as M/I. Of course both the magnitude and importance of the likely impact are dependent entirely on the judgment of assessing team. Simple calculations have been suggested to assess the total environmental impact of a particular project component or activity and hence to help planning mitigation measures or even the overall weighted relative impact of total project (to help compare alternative projects).

Thus the total impact of *i*th component/activity:

$$P_i = \sum_{j=1}^{j=m} (I_{ij} . M_{ij})$$

where M i j and I i j are respectively the relative magnitude and relative importance (on scale of 1 to 10) for the likely impact of *i*th component/activity on jth environmental attribute and m is the total number of environmental attributes relevant.

Also the overall relative impact of the project:

$$I = \sum_{i=1}^{i=n} P_i$$

Where n is the total number of project components/activities.

Checklist Methodology

Checklist methodologies ranges from simple listing of environmental elements to sophisticated technique where a weighting factor is assigned to each element according to its importance, and then sealing techniques evaluate the impact from each alternative solution. There is a large number of descriptive checklists formulated according to the nature of proposed development. Checklists of impacts discussed by Canter (1973) [10] and Battelle Colombus laboratories (1974) [11], were primarily proposed for water projects. A checklist of 62 environmental factors related to environmental quality, as developed by Canter and Hill (1979) [4]. A simple example of weighing checklist is the water quality Index (WQI) developed by National Sanitation Foundation.WQI is the aggregated result of nine environmental factors and it is computed as

$$WQI = \prod_{i=1}^{i=9} I_i W_i$$

where Π is the multiplication symbol, I is the sub-index value of environmental factors and 'W_i' is the assigned weighting importance. The environmental factor and their weighting importance are decided per opinion poll. The sub-index value depends on the measured value of factor through functional relationships (Barthwal 2002) [12]. WQI Unit ranges between 1 to 100, and classifies the system according as 0-25, very bad; 26-50, bad; 51-70, medium;71-90, good;91-100, excellent. A thorough discussion of checklist methods has been presented by Canter (1981) [13].

Network Methodology

This method uses the matrix approach by extending it further to take into account the primary as well as the secondary impacts in the **cause action** cumulative effects network. The network is presented in the form of a tree which is called the Relevance Tree or the Impact Tree. It is also called as Sequence Diagram. Identification of direct, indirect or short term and long term environmental impacts is crucial and in fact a basic step of making the Impact Tree. Shagoofta in 2011[3], shows the figure of Impact Tree indicating that a project action generates three primary impacts. These three primary impacts in sequence generate five secondary impacts and from these five impacts seven tertiary impacts are emerging. More than one action or primary impact may be a source of a secondary impact and so on. Impacts can be diverging or converging, overlapping or isolated. Canter (1996) [14], has provided a good overview of such impact networks. In identification of impacts in sequence, this method uses the probability that an identified impact condition would be occurring. This method is capable of providing us a summary index for assessing overall impacts of a project, though it will be qualitative index in

nature.

Computer Aided Approaches

Several approaches have been developed by means of computers. One of the modern methods employed is computerized overlay method. This is basically a geographical approach originally developed by Mc Harg (1968) [5]. This method relies on a set of maps of the project area's environmental characteristics covering physical, social, ecological and aesthetic aspects. The maps are then overlaid to produce a comprehensive description of the area's environment. Impacts are then identified by comparing the area's characteristics with a large area or region as a whole. The recent techniques of remote sensing using electromagnetic rays are increasingly used for this purpose although they are costly.

SOCIO-ECONOMIC IMPACT ANALYSIS

The term 'socio-economic' has been defined as "being of, related to, or involving combinations of social and economic factors" by Rau and Wooten (1985) [15]. The profound influences of population growth, high density of population and urbanization, industrial expansion, resource exploitation, large projects like nuclear and hydrostatic power projects, etc create and perpetuate conditions under which man and nature can exist in productive harmony and fulfill the social, economic and other requirements of people. All developmental activities are undertaken for the well being of 'man'. He is a focal point in all environmental impact studies. The influence of projects and/or programs or policies on his values, culture, living standard and institutions, etc. is included under socio-economic impacts.

To study the socio-economic impacts a new term known as 'socio impact assessment' (SIA) or 'socio-economic impact assessment' (SEIA) has been introduced. Wolf (1974) [6], did a pioneering work on SIA and defined it as 'the estimating and appraising of the conditions of society organized and changed by the large scale application of high technology'. Bowles (1981) [16], another important Pioneer of SIA provided similarly a broad definition of the term as 'the systematic advanced appraisal of impacts on the day to day quality of life of people and communities when the environment is affected by development or policy change'.

Usually secondary effects include changes in existing community facilities and activities, induce new facilities or activities in the next round and change in natural conditions. All such effects may be much more substantial than the primary impacts of the original actions. Such changes will come slowly and bulk of them will be concerned with the socio economic character of people. Consider a case of displacement of people from a project site. This implies a reduction in permanent population from the project area. All displaced people will be resettled somewhere else. This requires not only economic costs but requirements of land, housing, availability of water and public services at the new places, apart from the socio cultural and psychological adjustments to a new place by the project affected people. During construction phase of the project temporarily population (labourers and their families) will come to the project area, such people are to be adjusted in the area, they need all kinds of services for living such as living space, transportation and trade, healthcare and etc. the social environment of the area will go under changes by the influx of the temporary labour. All such changes will come under socio economic impacts of the project. They will be affecting the human environment of the area which is the basic theme of all environmental impacts studies.

SCOPE OF SIA AND IDENTIFICATION OF INDICATORS

The SIA for projects, programs and policies has to be quite comprehensive in scope. It is addressed to the issue like the type of index, their duration, short term or long term and the people who are effected, its region of influence. Obviously it depends on nature of project or action or policy and it's scale. As a minimum, the SIA should take into account the following (Glasson, et. al. 1993) [7].

a) Demographic effects: This include labour force and population shift, employment and multiplier effects, displacement and relocation effects, and change in population makeup.

b) Socio-economic impacts: This includes income and multiplier effects, employment rates and patterns, price of local goods and services, taxation effects and property values.

c) Institutional impacts: including demands on government and social services NGOs in areas such as housing, schools, policing, justice, health and welfare, and recreation.

d) Cultural impacts: such as those on traditional patterns of life and work, family structure, and authority, religion, tribal factors, archaeological features, social network and community cohesion.

e) Gender impacts: including the implication of developments projects on women's role in society, income generating opportunities, access to resources and employment opportunities.

The above listing of socio-economic effects will take care of all such plausible impacts. SIA pay attention to vulnerable section of population, such as elderly, the poor, the children and the minority groups in terms of cultural and religious beliefs.

Thus citing about the projects in Mumbai, where more than 80 percent people live in miserable conditions due to overcrowding of residents, mostly workers in private sector industries and businesses. There are employments opportunities in such a city but provision for improving the quality of life of people in general are rarely made along with the projects, except by large public sector enterprises.

To mitigate the adverse impacts on socio-economic environment of such a place is difficult to say, but could be done by providing more houses, more hospitals, more schools, more transit routes, more social services, proper arrangement of policing, city planning and management of the townships. It may be quite possible to improve the socio economic environment adversely effected by developmental projects or programs. Shifting of industries from the crowded cities, encouragement of development of satellite towns in order to disperse economic activities over a wider region would be an effective strategy to protect socio- economic environment.

Role of NGOs is perhaps very much important in improving social climate of an area. Their activities must be encouraged. More emphasis should be given on informal education of the people through media and wherever is possible to enact strict laws to protect the weaker sections of the society affected adversely due to industrial and developmental projects. Constant monitoring is required about the compliance of laws and regulations of the government to maintain socio-economic environment and to improve it so that people are not affected adversely due to developmental projects.

HYDRO ELECTRIC PROJECTS IN JAMMU AND KASHMIR AN OVERVIEW

Two Hydroelectric power stations Uri1 and Uri II, are located on the downstream of river Jehlum and Gantamullah power house, in Kashmir province. Uri 1 is a runoff river scheme & utilizes a gross head of 256m. The project consists of a barrage, cut and culvert, desilting basin, an open power channel, a 10.65 Km, long head race tunnel, 2 No. of pressure shaft and underground powerhouse and 2.06 Km long tailrace tunnel without fall at the Bandi village. The project has installed capacity of 480MW (4X 120 MW each unit).

FIG 1: SATTELITE PICTURE OF URI II HYDRO-ELECTRIC PROJECT, DAM SITE, UNDER CONSTRUCTION, IN THE MOUNTAINS OF VILLAGE URI, BARAMULLA.

Uri II has a dam, constructed in a village named Uri. This power house facility too is inside of the mountain with a long head race tunnel and a substantial tail race tunnel and is still under final stages of construction. The project has installed capacity of 240MW. The inspection of this construction shows, for past few years, heavy drilling and cut of the area resulting millions of tunes of debris, soil stone masses which are dumped at several sites and compacted too. But compaction and consolidation can't be to natural limits for quite long durations resulting in the local sliding of those areas particularly in rainy and wet seasons. Further during construction phase over no of years the river Jehlum waters have become quite muddy increasing not only the turbidity levels in the river water downstream but also the chemical composition of water is tremendously changing usually reaching on to high limits. The turbid condition of the river water is realized from its satellite picture taken in 2011, shown above in fig 1, procured from Google search engine.

The same was noticed in river Chinab when Baghlier Project at Ramban, Jammu and Dulhasti I and II at kishtwar where under construction. The cut and drill in the side banks in the mountains increased the

sediment load in both the rivers, Jehlum and Chinab, which got deposited in the downstream at slow paced river areas causing the ecological changes of the areas. Further Chinab river gets silted-up upstream, it deposits the same in the reservoirs of Salal Hydroelectric projects 1 and II at Salal –Riyasi in Jammu province, at downstream, causing not only the dams capacity's to decrease but also putting the penstocks and turbines at risk of corrosion and constant maintenance etc. As the downstream power house Salal I and Salal II(each of 345MW capacity), have been constructed in 1987 and in 1996 respectively, that is prior to the recent and ongoing constructions in the upstream of river Chinab at Dulhasti power house completed in 2007and at Baghlier power house phase I completed in 2009-2010 and its phase II is still under construction. It depicts a week sense of environmental protection, at the time of phasing the construction strategy.

Recently in ending 2011 and beginning of 2012, the daily newspapers of Kashmir valley reported that NIT Srinagar has found trace toxic elements in the waters of river "Kishenganga" subsequent to the starting of preliminary stages of construction of " Kishenganga power house , 330 MW" on Kishenganga river in Bandipora District of Kashmir province. And the local people of that area do use the waters of the river for many daily uses. Except Baghlier power project all above mentioned power stations were/are constructed by NHPC India [17].

There are three power houses on river Sind, i.e. Upper Sind, Lower Sind and Ganderbal power houses, in Kashmir province which have not been constructed by NHPC [17]. Unfortunately Upper Sind and Lower Sind power houses have become almost defunct to large ratios, while as Ganderbal power house has totally stopped due to many local, technical and administrative reasons. Thus lot of previously put in efforts and labour, money and machinery, materials and energy have gone waste for the sake of very little efforts to be put in the above mentioned line of actions. Taking the case of Ganderbal power house the turbines got corroded and finally defunct due to lot of incoming silt in spite of the screening and desilting bay provided at the end of power channel and at the start of penstocks. But the cause was the sliding of debris and too much of soil deposits from the side mountain of the power canal. Further, although the power canal was initially lined with bricks, later the linings got broken at many places causing water logging at many places, thus many animals used to die in the water logged areas. There by hampering of proper screening and silting-up and blocking of the silting bay to ultimate levels took place. So due to lack of proper maintenance the existing 12MW local power house was allowed to collapse. Thus local population had to undergo the shortage of local power supply.

Yet the short term disadvantages are outweighed by the long term advantages of those Hydro Projects. It may be established besides the fact that Daily power supply in terms of MW's got increased to the northern Power Supply Grid of India. Yet the state of Jammu and Kashmir does not get full supply of power as per the demand of full population in severe winters in Kashmir province or in scorching summers in Jammu province, because these projects are either owned by NHPC or State Govt.,- who does not afford to purchase full demanded power supply. Some of the advantages of the Uri I Hydroelectric project are numerating as follows.

1. Compensatory forestation scheme was implemented over an area of 62.7 hectare of degraded forest land.
2. Uri Catchment Area Treatment project (CAT) was implemented by J&K forest Department to treat about 4857 hectares of land.
3. On the basis of study conducted in association with the Institute of fresh Water Research Institute (FWRI), Sweden and Department of Zoology, Kashmir University, a fish ladder was constructed across the barrage to facilitate upstream and downstream migration of fishes.
4. A rehabilitation plan prepared by NHPC was implemented by the project by providing cash compensation to over 470 families affected by project for their houses, lands, rice mills, shops, etc.
5. A water supply scheme has also been executed at Buniyar, which is providing drinking water to people of Uri village.
6. Due to the construction of the project, there has been considerable uplift in the socio-economic condition of local population which includes generation of employment.
7, Widening of Baramulla-Uri National Highway (NH-1A) i.e. previously existing single lane was converted to double lane highway and construction of Bailey bridge took place. Also, the Srinagar-Sheeri National Highway was upgraded to 70 tons capacity.

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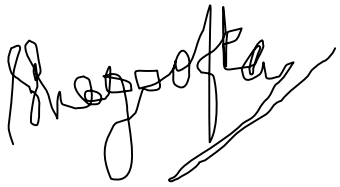
Certificate

I, Dr. Shagoofta, certify that the paper titled "_**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT HYDROELECTRIC PROJECTS OF JAMMU AND KASHMIR AN OVERVEIW**_____" and submitted for consideration for Conference on "India Water Week" to be held in New Delhi from 8 -12 April 2013 is in original and has not been published or presented at any other forum.



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