Environmental Impact Assessment (EIA): Case Study of a Hydropower Project*

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Introduction:

EIA is a study of the probable changes in socio-economic & bio-physical characteristics of the environment that may result from a proposed action. It represents a means of evaluating & simultaneously controlling the quality of the human environment.

Phases of EIA:

I. Organizing the job – in this phase, the action or project is identified & an interdisciplinary (ID) team is constituted to conduct the analysis.

II. Performing the assessment – in this phase, two major steps are, a site visit ID team determine the possible environmental impacts of the proposed project & record the description of the environment as it exists prior to the proposed action.

III. Writing the EIS (Environmental Impact Statement) – in this phase, a major step is identifying the measures that can be taken in order to minimize the adverse effects.

IV. Review of the EIS: in this final phase, the proposed project is made available for public inspection by publicity through the press. A period of at least one month is given for public inspection & submission of comments to the EIS for final decisive comments of the competent authority. After the final review, rejection or approval of the Project plan by the authority.

A typical 100 MW hydropower project located in Kullu district, Himachal Pradesh, India was considered for the case study.

Environmental Impact Analysis (Discussions on Phase II & Phase III only):

PHASE-II

A. Description of the Environment as it Exists Prior to the Proposed Action:

i. Meteorology

The climate of the project area is characterized by cool & dry climate. Meteorologically, the year can be divided into three distinct seasons viz. Summer, Winter & Monsoon. June is the hottest month of the year, with mean maximum & minimum monthly temperatures of the order of 32.9^0C & 26.6^0C respectively. January is the coldest month of the year. The annual average rainfall in the project area is 1459.2 mm. Relative humidity is maximum (91%) during the monsoon, while it is minimum (50%) in the summer months of April-May.

ii. Seismology

The area is under the highest seismic zone in Western Himalayas as per IS: 1894: 2002. In the past, the region has been affected with a number of strong earthquakes.

iii. Soil Use:

The soil in the study area is young like any other region of Himalayas. Soil on the slope above 30 degrees, due to erosion & mass wasting processing, are generally shallow & usually have very thin surface horizons. The pH of the soil at various sites lies within neutral range.

iv. Land Use Category:

The major land use category in the study area is forestland (82%). The others are barren land (10%), agricultural land (3.3%). The areas under snow cover & water bodies accounted for 2.8% & 2.4% respectively.

v. Water Resources:

River Sainj is the major tributary of the river Beas. The total catchment area of river Sainj intercepted at the barrage site is 408 km^2 of which 176 km^2 is permanently snow covered.

vi. Noise Environment:

Baseline noise data has been measured for 3 seasons. The daytime equivalent noise level in summer, winter & monsoon at various sampling stations lie within the permissible limit specified for residential area.

vii. Ecological Aspects:

The proposed project lies in the vicinity of the Great Himalayan National Park (GHNP). The primates found are represented by rhesus macaque & common langur. Rare & endangered species have been reported in the study area. Variety of cold water fishes dominated by trout belong to the area.

viii. Socio-economic Aspects:

As per the primary survey carried out in the villages where land is proposed to be acquired for the said hydroelectric project, the total affected population of the order of 436 persons in 148 families. Males & females constitute about 54.36% & 40.82% of the total affected population respectively. About 39.45% of the project-affected population is illiterate or not going to school. The remaining is either literate or is presently continuing with their education. All the affected families reared domesticated animals. No family was houseless. About 37% of the houses were electrified.

B. Prediction of Impacts:

i. Impacts on Water Quality:

The quantum of sewage generated from labour colony is expected to be of the order of 0.18 MLD. Even at minimum flow, sufficient dilution will occur thus, no significant impact on water quality of river Sainj during the construction phase.

Effluent from crushers & other sources like conduit, tunnel would contain high suspended solids. It is proposed to treat the effluents in settling tanks. Thus, no significant impact is envisaged.

During operation phase, only a small no. of O & M (Operation & Maintenance) staffs will reside in the colony. The sewage generated would be provided biological treatment before discharge.

The proposed project is envisaged as a runoff the river scheme with a barrage. At a regular intervals, the gates of the barrage shall be opened to flush the sediment. Thus, in the proposed project, sedimentation problem is not anticipated.

The river Sainj will not be completely dry in the intervening stretch due to the contribution of flow from various streams/nallahs. The reduction in flow or drying of the river in this stretch is not likely to have any adverse impact on the downstream users as the villagers use water of small streams or nallahs flowing adjacent to the habitation.

ii. Impacts on Ambient Air:

No significant impact on ambient air quality is expected as a result of operation of various construction equipments as those would be operated through electricity & not using fossil fuel. Diesel would be used only in contingency.

During crushing operations, there would be emissions of dust particles. Minimal impact is expected during construction phase. Therefore commissioning of cyclone separator is suggested. Further, the labour camps would be located on the leeward side of the crusher with respect to predominant wind directions.

iii. Impacts on Noise Environment:

The operation of construction equipment is likely to have insignificant impact on the ambient noise level. However, blasting can have adverse impact on wildlife especially along the alignment of the tunnel portion.

iv. Impacts on Land Environment:

In a hilly terrain, quarrying is normally done by cutting a face of the hill. A permanent scar is likely to be left, once quarrying activities are over. With the passage of time, they become a potential source of landslide. Thus, it is necessary to implement appropriate slope stabilization & quarry reclaiming measures.

A large quantity of muck is expected to be generated as a result of tunneling operations, construction of roads etc. Those should be suitably disposed. Normally, muck is deposited in low lying areas or depressions.

The total land to be acquired for the project is 56.763 hectares. A part of this land is required for labour camps, quarry sites, muck disposal, storage of construction material, silting of construction equipment which will be required temporarily & returned once the construction phase is over. Permanent acquisition of land is required for barrage axis, submergence area, project colony etc.

v. Impacts on Ecology:

Terrestrial Ecology:

Increased human interferences: A large population (3,200) is likely to congregate in the area during the project construction phase. The population residing in the area may use fuel wood if no alternate fuel is provided. Therefore, alternate fuel should be provided to save the trees. Furthermore, community kitchens must be provided using LPG or diesel as fuel.

Acquisition of forest land: The total forest land to be acquired is about 47.993 ha.

Disturbance to wildlife: The operation of various construction equipment & blasting is likely to generate noise. These activities can lead to some disturbance to wildlife population. The project area does not fall in the migratory routes of animal.

Impacts on protected areas: During project operation phase, the accessibility to the area will improve due to construction of roads, which in turn may increase human interferences leading to marginal adverse impacts on the terrestrial ecosystem. Sainj Wildlife Sanctuary (SWS) & Great Himalayan National Park (GHNP) is located within the study area. However, no land of those two protected areas is proposed to be acquired for the project.

Aquatic Ecology:

During construction phase: Due to the construction of the proposed project, about 0.8 Mm^3 of muck & debris would be generated at various construction sites. Based on the geological nature of the rock & engineering property of the soil, about 30% of the muck generated will be utilized as construction material. The remaining 70% would be dumped at designated sites.

During operation phase: The completion of the project would bring about significant changes in the riverine ecology, as the river transforms from a fast flowing water system to a quiescent lacustrine environment. Amongst the aquatic animals, it is the fish life which would be most affected.

vi. Impacts on Socio-economic Environment:

Due to influx of labour force: During the construction phase, the most important negative impact would be due to temporary settling of labour force leading to filth, in terms of domestic waste water, human waste etc.

Impact on Economy: Apart from direct employment, the opportunities for indirect employment will also be generated which would provide great impetus to the economy of the local area. Various types of business like shops, food-stalls, tea-stalls will set up. With the increase in the income levels, there will be an improvement in the infrastructure facilities in the area.

Impact due to land acquisition: About 56.763 ha of land proposed to be acquired for the project, of which about 8.77 ha is private land (un-irrigated land). It is observed that, about 216 PAFs (Project Affected Families) are likely to lose land (agricultural &/or homestead) in various proportions.

PHASE-III

Mitigation Measures:

I. Against Loss of Biodiversity:

i. Selection & implementation of appropriate conservation measures based on the EIA.
ii. Restricting the impacts on ecosystem by constructing various types of structures underground.
iii. Regeneration of vegetation by planting.
iv. Conservation of a river ecosystem by maintaining flows capable of maintaining the river.
v. Implementing measures to prevent invasion of forest species throughout the duration of project, including the construction period.

II. Against the influence of changes in Hydrological Regime:

i. Recovery of the river ecosystem by keeping flow rates required for river maintenance.
ii. Reservoir management considering the influence of local stakeholders.
iii. Raising & maintaining river levels by installing weirs around estuaries.

III. To Promote Fish Migration & To Reduce Fish Mortality Rates & Damage to Fish:

i. Installation of fish way in an existing dam.
ii. Implementation of measures to attract with a sodium lamp.
iii. Installation of measures to direct fish at the intake (acoustic type, mercury lamp).

IV. To Reduce or Eliminate Sediment Flowing into Reservoirs:

i. Reduction of sediment by constructing flood bypass tunnels going around a reservoir.
ii. Construction of small-scale weirs to trap earth & subsequent removal by dredging.

V. To Improve Water Quality in Reservoir & Downstream Areas:

i. Temperature control by considering the growth of fish by installing selective water intake facilities.
ii. Reduction in water turbidity by selecting the operation of dams & constructing bypass tunnels
iii. Elimination of the occurrence of abnormal odor or taste of the water in reservoirs by installing full thickness aeration & circulation facilities.
iv. Reduction of outbreak of red tide (algae) in reservoirs by developing fresh water red tide treatment vessel.
v. Treatment of heavy metals discharged from copper mines located upstream of dam.

VI. To Solve Problems on Impoundment of Reservoirs:

i. Reductions in the scale of regulating reservoir levels & preservation of wetlands by maintaining appropriate water level.

ii. Comparison of alternative reservoir water level reductions reflecting the results of environmental research.

VII. To Reduce Socio-economic Impacts:

Resettlement:

The resettlement programs paying attention to the following points:

i. Securement of employment opportunities so that resettled people may have a sustainable livelihood.

ii. Maintenance of social infrastructure (roads, water services, communication establishments, schools, hospitals etc.).

iii. Provision of sufficient information to communities & participation by the affected population in the resettlement process.

Public Health:

i. Deaths resulting from infectious diseases can be substantially reduced by improving various facilities including hospitals & community healthcare centres' after resettlement.

ii. Information campaigns for community inhabitants, continuous monitoring of water quality & health risk assessment can be conducted.

Conclusions:

Hydropower is a well established technology that uses water without depleting it. It is the most reliable renewable energy & emits negligible greenhouse gases. Yet, there is occasionally debate on the negative social & environmental impacts caused by some hydropower projects. EIA certainly has a crucial role to play in addressing environmental issues surrounding project development especially power projects. The integration of environment into development planning is the most important tool in achieving sustainable development for such hydropower projects. The proposed mitigation measures can be followed to make the hydropower project more environmental friendly.