ENVIRONMENT IMPACT OF HYDEL POWER PROJECTS IN HIMACHAL PRADESH (A CASE STUDY OF DISTT KULLU)

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ABSTRACT

The study was conducted in District Kullu to find out the environmental impact of hydro power projects in eight different locations. The projects selected are operational at Aleo, Baragran, Kothi, Lag Valley, Malana, Palchan and Prini. Since eight different sites had been taken for the study, twenty respondents were selected from each site. For the project employees, unstructured interview method was administered. The interview questions were framed to detect the participants' experience and outcome by story telling – describing some strategic issues they encountered and how they were dealt within their organizations. The main aim was to probe participants' experience in terms of the pre and post construction phases of the project and practices that drive what and how strategic decisions were made and implemented in their projects with respect to the environmental impact. Therefore to know the responses of the employees of the respective hydel project three respondents were selected from each site. The sample size that has been selected for the study was 184 respondents to whom the survey was administered. This survey schedule was pre-tested in the field, prior to start of the socio-economic survey. The filled-in survey schedules were scrutinized. Data analysis was undertaken using Statistical Package for Social Sciences (SPSS) computer software. The analyzed outputs have been used in reporting the findings of the socio-economic survey. The study revealed that the environmental condition has not been affected by any of the project activities.

Key words: *hydel power projects, impact, environment.*

1. INTRODUCTION

Based on the project details and the baseline environmental status, potential impacts as a result of the construction and operation of the proposed hydroelectric projects have been identified. The basic concepts and methodological approach for conducting a scientifically based analysis of the potential impacts likely to accrue as a result of the hydel power projects have been addressed. The construction and operation phase comprises of various activities each of which is likely to have an impact on environment. The key activities have been categorized for construction and operation phases.

The various project activities and associated potential environmental impacts on various environmental parameters have been identified and categorized as below:

- Impacts on Water Environment
- Impacts on Air Environment
- Impacts on Noise Environment
- Impacts on Land Environment

2. IMPACTS ON WATER ENVIRONMENT

2.1. Construction phase

The major sources of surface water pollution during project construction phase are as follows:

2.1.1. Sewage from labour camps: The project construction is likely to last for a period of 6 years (74 months). The peak labour strength likely to be employed during project construction phase depends upon the capacity of the project. Thus during the project construction phase, some of the locals may get employment. It has been observed during construction phase of many of the projects the major works are contracted out, who bring their own skilled labour. However, it is only in the unskilled category that locals get employment. The construction phase, also leads to mushrooming of various allied activities to meet the demands of the immigrant labour population in the project area. It is assumed that about 80% of the water supplied for domestic use in projects is generated as sewage. In the proposed projects, sewage is proposed to be treated, prior to disposal.

2.1.2. Effluent from crushers: During construction phase, crushers will be commissioned at the quarry site by the contractors involved in construction activities. It is proposed only crushed material would be brought at construction site. Water is required to wash the boulders and to lower the temperature of the crushing edge. About 0.1 m3 of water is required per ton of material crushed. The effluent from the crusher would contain high-suspended solids. About 12-15 m3/hr of wastewater is expected to be generated from each crusher. The effluent, if disposed without treatment can lead to marginal increase in the turbidity levels in the receiving water bodies. Even then, it is proposed to treat the effluent from crushers in settling tank before disposal so as to ameliorate even the marginal impacts likely to accrue on this account.

2.1.3. Pollution due to muck disposal: The major impact on the water quality arises when the muck is disposed along the river bank. The project authorities identify suitable muck disposal sites which are located near the river channel. The muck will essentially come from the road-building activity, tunneling and other excavation works. The unsorted waste going into the river channel will greatly contribute to the turbidity of water continuously for long time periods. The high turbidity is known to reduce the photosynthetic efficiency of primary producers in the river and as a result, the biological productivity will be greatly reduced. Therefore, the prolonged turbid conditions would have negative impact on the aquatic life. Therefore, muck disposal is done in line with the Muck Disposal Plan to avoid any negative impact.

2.1.4. Effluent from other sources: Substantial quantities of water would be used in the construction activities. With regard to water quality, waste water from construction activities and runoff from construction site would mostly contain suspended impurities. Adequate care should be taken so that excess suspended solids in the wastewater are removed before discharge into water body. The effluent is proposed to be treated by collecting the waste water and runoff from construction sites and treating the same in settling tanks.

2.2 Operation phase

The major sources of water pollution during project operation phase include:

2.2.1Effluent from project colony: During project operation phase, due to absence of any large-scale construction activity, the cause and source of water pollution will be much different. Since, only a small number of staff resides in the area in a well-designed colony with sewage treatment plant and other infrastructure facilities, the problems of water pollution due to disposal of sewage are not anticipated.

In the operation phase, several families reside in the project colony proposed to be developed at various locations and thus sewage will be generated. . It is proposed to provide biological treatment facilities including secondary treatment units for sewage so generated from the BOD load after treatment will reduce to 10 to 12 kg/day. It is ensured that sewage from the project colony be treated in a sewage treatment plant so as to meet the disposal standards for effluent. Thus, with commissioning of facilities for sewage treatment, no impact on receiving water body is anticipated. Thus, no impacts are anticipated as a result of disposal of effluents from the project colony.

2.2.2 Impacts on reservoir water quality: The flooding of previously forest and agricultural land in the submergence area will increase the availability of nutrients resulting from decomposition of vegetative matter. Phytoplankton productivity can supersaturate the euphotic zone with oxygen before contributing to the accommodation of organic matter in the sediments. Enrichment of impounded water with organic and inorganic nutrients will be the main water quality problem immediately on commencement of the operation. However, this phenomenon is likely to last for a short duration of few years from the filling up of the reservoir. Thus, in the proposed projects, no significant reduction in D.O. level in the reservoir water is anticipated.

2.2.3. Eutrophication risks: Another significant impact observed in the reservoir is the problem of eutrophication, which occurs mainly due to the disposal of nutrient rich effluents from the agricultural fields. However, in the present case, fertilizer use in the project area is negligible, hence, the runoff at present does not contain significant amount of nutrients. Even in the post-project phase, use of fertilizers in the project catchment area is not expected to rise significantly. Another factor to be considered is that the proposed project is envisaged as a run off the river scheme, with significant diurnal variations in reservoir water level. Thus, residence time would be of the order of few days, which is too small to cause any eutrophication. Thus, in project operation phase, problems of eutrophication, which is primarily caused by enrichment of nutrients in water, are not anticipated.

2.2.4. Impacts on river bed stability: During the construction phase a large quantity of construction material like stones, pebbles, gravel and sand would be needed. Significant amount of material is available in the river bed. It is proposed to extract construction material from borrow areas in the river bed. The extraction of construction material leads to formation of pits. Normally, deposition of material takes place at sites where velocity reduces on account of flattening of slopes, increase in cross-sectional area. Such sites are used for extraction of construction material. The pits at sites after extraction of construction material will be under constant action on account of erosion in high flows and deposition under low flows. These pits with passage of time will be stabilized due to settlement of silt and sediments in the pits created on the river bed. Thus, no major impacts are anticipated on this account.

3. IMPACTS ON AIR ENVIRONMENT:

In a water resources project, air pollution occurs mainly during project construction phase. The major sources of air pollution during construction phase are:

3.1. Emissions from crushers: The operation of the crusher during the construction phase is likely to generate fugitive emissions, which can move even up to 1 km in predominant wind direction. During construction phase, one crusher each is likely to be commissioned at proposed dam and proposed power house sites. During crushing operations, fugitive emissions comprising mainly the suspended particulate will be generated. Since, there are no major settlements close to the dam and power house, hence no major adverse impacts on this account are anticipated. However, during the layout design, care should be taken to ensure that the labour camps, colonies, etc. are located on the leeward side and outside the impact zone (say about 2 km on the wind direction) of the crushers.

3.2. Fugitive Emissions from various sources: During construction phase, there will be increased vehicular movement. Lot of construction material like sand, fine aggregate are stored at various sites, during the project construction phase. Normally, due to blowing of winds, especially when the environment is dry, some of the stored material can get entrained in the atmosphere. However, such impacts are visible only in and around the storage sites. The impacts on this account are generally, insignificant in nature.

3.3 Blasting Operations: Blasting will result in vibration, which shall propagate through the rocks to various degrees and may cause loosening of rocks/boulders. The overall impact due to blasting operations will be restricted well below the surface and no major impacts are envisaged at the ground level. During tunneling operations, dust will be generated during blasting. ID blowers will be provided with dust handling system to capture and generated dust. The dust will settle on vegetation, in the predominant down wind direction. Appropriate control measures have been recommended to minimize the adverse impacts on this account.

3.4. Pollution due to increased vehicular movement: During construction phase, there will be increased vehicular movement for transportation of various construction materials to the project site. Similarly, these will be increased traffic movement on account of disposal of muck or construction waste at the dumping site. Large quantity of dust is likely to be entrained due to the movement of trucks and other heavy vehicles. Similarly, marginal increase in Hydrocarbons, SO_2 and NOx levels are anticipated for a short duration. The increase in vehicular density is not expected to be significant. In addition, these ground level emissions do not travel for long distances. Thus, no major adverse impacts are anticipated on this account.

3.5. Dust emission from muck disposal The loading and unloading of muck is one of the source of dust generation. Since, muck will be mainly in form of small rock pieces, stone, etc., with very little dust particles. Significant amount of dust is not expected to be generated on this account. Thus, adverse impacts due to dust generation during muck disposal are not expected.

4. IMPACTS ON NOISE ENVIRONMENT

4.1. Construction phase

In a water resource projects, the impacts on ambient noise levels are expected only during the project construction phase, due to earth moving machinery, etc. Likewise, noise due to quarrying, blasting, vehicular movement will have some adverse impacts on the ambient noise levels in the area.

4.1.1. Impacts due to operation of construction equipment: It would be worthwhile to mention here that in absence of the data on actual location of various construction equipments, all the equipment have been assumed to operate at a common point. This assumption leads to over-estimation of the increase in noise levels. Also, it is a known fact that there is a reduction in noise level as the sound wave passes through a barrier. The walls of various houses will attenuate at least 30 dB(A) of noise. In addition there are attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric inhomogeneties.
- Vegetal cover

Thus, no increase in noise levels is anticipated as a result of various activities, during the project construction phase. The noise generated due to blasting is not likely to have any effect on habitations. However, blasting can have adverse impact on wildlife, especially along the alignment of the tunnel portion. It would be worthwhile to mention that no major wildlife is observed in and around the project sites. Hence, no significant impact is expected on this account.

4.1.2. Noise generated due to blasting: Noise generated by blasting is instantaneous, site specific and depends on type, quantity of explosives, dimension of drill hole, degree of compaction of explosives in the hole and rock. As the blasting is likely to last for 4 to 5 seconds depending on the charge, noise levels over this time would be instantaneous and short in duration. Considering attenuation due to various sources, even the instantaneous increase in noise level is not expected to 60 dB(A). Hence, noise level due to blasting is not expected to cause any significant adverse impact.

5. IMPACTS ON LAND ENVIRONMENT

5.1. Construction phase

The major impacts anticipated on land environment during construction are as follows:

5.1.1. Quarrying operations

5.1.1.1 Sand quarries: In the project area there are few locations from where sand of coarse and fine segments can be extracted. All the locations are in the river banks and nearby. The quantity of the river borne sand is not sufficient for the construction of the project and thus to be collected or transported from other locations.

Opening of the quarries will cause visual impacts because they remove a significant part of the hills. Other impacts will be the noise generated during aggregate acquisition through explosive and crushing, which could affect wildlife in the area, dust produced during the crushing operation to get the aggregates to the appropriate size and transport of the aggregates, and transport of materials.. A permanent scar is likely to be left, once quarrying activities are over.

With the passage of time, the rock from the exposed face of the quarry under the action of wind and other erosion forces, get slowly weathered and after some time, they become a potential source of landslide. Thus it is necessary to implement appropriate slope stabilization measures to prevent the possibility of soil erosion and landslides in the quarry sites.

5.1.2. Operation of construction equipment: During construction phase, various types of equipment will be brought to the site. These include crushers, batching plant, drillers, earthmovers, rock bolters, etc. The siting of this construction equipment would require significant amount of space. Similarly, space will be required for storing of various other construction equipments. In addition, land will also be temporarily acquired, i.e. for the duration of project construction for storage of quarried material before crushing, crushed material, cement, rubble, etc. Efforts must be made for proper siting of these facilities.

Various criteria for selection of these sites would be:

- Proximity to the site of use
- Sensitivity of forests in the nearby areas
- Proximity from habitations
- Proximity to drinking water source

Efforts must be made to site the contractor's working space in such a way that the adverse impacts on environment are minimal, i.e. to locate the construction equipment, so that impact on human and faunal population is minimal.

5.1.3. Soil erosion: The runoff from the construction sites will have a natural tendency to flow towards river or its tributaries. For some distance downstream of major construction sites, such as barrage, power house, etc. there is a possibility of increased sediment levels which will lead to reduction in light penetration, which in turn could reduces the photosynthetic activity to some extent of the aquatic plants as it depends directly on sunlight. This change is likely to have an adverse impact on the primary biological productivity of the affected stretch of river. However, runoff from construction sites, entering small streams would have significant adverse impact on their water quality. The runoff would increase the turbidity levels with corresponding adverse impacts on photosynthetic action and biological productivity. The impacts on these streams and rivulets thus, would be significant. Adequate measures are implemented as a part of Environmental Management Plan to ameliorate this adverse impact to the extent possible.

5.1.4. Muck disposal: Based on the geological nature of the rocks and engineering properties of the soil, a part of the muck can be used as construction material. However, the balance requires being suitably disposed. Normally, muck is disposed in low-lying areas or depressions. The muck shall be disposed at designated sites. Normally, muck is disposed in low-lying areas or depressions. Trees, if any, are cut before muck disposal, however, shrubs, grass or other types of undergrowth in the muck disposal at sites perish. Muck, if not securely transported and dumped at pre-designated sites, can have serious environmental impacts, such as:

• Muck, if not disposed properly, can be washed away into the main river which can cause negative impacts on the aquatic ecosystem of the river.

• Muck disposal can lead to impacts on various aspects of environment. Normally, the land is cleared before muck disposal. During clearing operations, trees are cut, and undergrowth perishes as a result of muck disposal.

• In many of the sites, muck is stacked without adequate stabilization measures. In such a scenario, the muck moves along with runoff and creates landslide like situations. Many a times, boulders/large stone pieces enter the river/water body, affecting the benthic fauna, fisheries and other components of aquatic biota.

• Normally muck disposal is done at low lying areas, which get filled up due to stacking of muck. This can sometimes affect the natural drainage pattern of the area leading to accumulation of water or partial 8-25 flooding of some area which can provide ideal breeding habitat for mosquitoes. The muck disposal sites will be suitably stabilized on completion of the muck disposal.

5.1.5. Impact due to roads: The construction of roads can lead to the following impacts:

• The topography of the project area has steep to precipitatuous slope, which descends rapidly into narrow valleys. The conditions can give rise to erosion hazards due to net downhill movement of soil aggregates.

• Removal of trees on slopes and re-working of the slopes in the immediate vicinity of roads can encourage landslides, erosion gullies, etc. With the removal of vegetal cover, erosive action of water gets pronounced and accelerates the process of soil erosion and formation of deep gullies. Consequently, the hill faces are bared of soil vegetative cover and enormous quantities of soil and rock can move down the rivers, and in some cases, the road itself may get washed out.

• Construction of new roads increases the accessibility of a hitherto undisturbed areas resulting in greater human interferences and subsequent adverse impacts on the ecosystem.

• Increased air pollution during construction phase.

CONCLUSION

The study was conducted in eight different locations of Kullu District by categorizing them based on their power producing capacity such as micro, small, medium and large. The potential impacts as a result of the construction and operation of the proposed hydroelectric projects were identified and based on these parameters, a survey was done in the project areas and the data collected was analyzed. It was found out that the people were aware of the potential environmental threats and no such impacts were observed so far due to any of the project activities.

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