Environmental Impact Assessment of Dikrong (Pare) Hydroelectric Project, Papumpare District, Arunachal Pradesh

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Abstract

Comprehensive Environmental Impact Assessment study is an integral aspect for setting up hydroelectric projects. Dikrong (Pare) Hydroelectric Project in Papumpare District, A.P., has been subjected to this study. The project envisages construction of a 61m high concrete gravity dam across Dikrong river. It is expected to generate 110 MW power availing 75m gross head.

The intake structure, a headrace tunnel, 2.96 km long, would form a major component. Belonging to the Upper Siwalik Group, the main rock type is sandstone. Major tectonic features namely MCT, MBT and MFT surround the site area.

Forests form the main land cover and is the habitat for plant and animal species. Quantification of the effects of human activity in the area is thus mandatory. Any unplanned execution may have an adverse impact on the fabric of the site area, disturbing its ecological balance.

Measures to carry out systematic quarrying operations to reduce its ill effect on habitat, proper selection of storage sites to minimize disturbance to flora, fauna and human population is thus imperative. Waste and sewage disposal sites may be finalized in advance. Slope protection measures to mitigate development of slides should be on priority. Specifications for blasting operations may be planned well in advance for final environmental assessment.

Introduction

Hydroelectric Project not only leads to the desired benefits, but at places, can also entail some adverse environmental impacts. It is always imperative to postulate the status of environment during construction as well as operation phases and prepare an environmental Management Plan as it helps to anticipate the adverse impacts and their amelioration. The Environmental Impact Assessment study has been now made obligatory by the Ministry of Environment and Forest for all the proposed hydroelectric projects involving estimated cost of more than 100 Crores. Detailed study of environment impact on ecosystem at the Dikrong Hydroelectric Project proposed in the northeastern Himalaya, considering various factors related to layout and type of appurtenance structure, geological set-up and seismic status of the area, disturbance due to construction activities, impounded reservoir condition, landuse pattern and precipitation etc., are discussed.

Project Layout

Dikrong (Pare) Hydroelectric Project is a run of the river scheme proposed to utilise tailrace discharge of 160 cumecs of already commissioned Ranganadi Hydroelectric Project Stage-I (405 MW) along with discharge of Dikrong river itself. It envisages construction of 61m high 158m long concrete gravity dam across Dikrong river near Jhumpa village, a 6.8m dia 2.96 km long HRT on the right bank, located at the right bank, 34.4m dia 50m deep surge shaft

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surface penstock of 6.8m dia and 220m length bifurcating into two each of 4.8m dia using gross head of 75m for generating 110 MW (2 x 55 MW) of power, using Francis turbine.

Geological Set-up

The Project area falls in upper Siwaliks of Tertiary age comprising brownish and grey coloured, medium to fine grained concretionary, soft, friable pebble impregnated salt and pepper textured sandstone, sand rock and pebble beds of Siwalik Group. Rocks are moderately jointed and strike is NE-SW with 55° to 75° dip towards north west. MCT, Bomdila Thrust, MBT, MFT are the conspicuous discontinuity planes occurring in proximity of the project area. These are disposed in NE-SW and NNE-SSW direction. Brahmaputra lineament is the most important lineament. Most concentrations of lineaments and faults trend NW- SE are confined to north of Brahmaputra river. The Project area lies in the Eastern Himalayas, which is seismotectonically most active. As per the seismic zoning map of India the Project area falls in Zone-V.

Water Resources

Dikrong river, a fifth order stream is formed by Par, Niorchi and Pachin rivers. It flows from west to southeast and passing through Itanagar region and finally merges with Brahmaputra in Lakhimpur District of Assam. Catchment area of the project up to dam site is 824 sq km. Physiographically catchment falls in sub Himalayan region where relative relief is in the range of 300m to 1700m. Topography and terrain consists of mountainous range sloping down to Assam plain. Drainage pattern is sub-dendritic to sub parallel. Drainage density is medium and relief of river basin is very high in rugged terrain. Important tributaries joining Dikrong are long and straight due to either following long lineament/fault or step like hill slopes covered by thick overburden or loose incompetent mass.

Landuse Pattern and Life Forms

The project area has a typical mountainous terrain with moderate to high relief. Altitude varies from 200m to over 2000 m from mean sea level. Forests are the major landuse category and occupy a prominent place in the economy of the area. In lower reaches, tropical semi evergreen forest occurs. However, in upper reaches, subtropical evergreen forest and subtropical grassland exists in the catchment area. Grasslands are found to coexist with subtropical forests and it appears that grasslands owe their origin to the practice of shifting cultivation. At higher elevations, bamboo forests are found up to 2000m and grow most in pure strands with very few associated species. Project area provides habitation and sustenance for numerous fauna. There is no national park or sanctuary in the project area. Earlier this area used to have a good forest cover. However, with increase in human interference and clearing of forests for Jhum cultivation, forests and wildlife are coming under increasing threat.

Demography

Project area comes in Doimukh circle of Papumpare District. Total population of the district is 1,21,732 with population density 35 persons/ sq km. Houses are dispersed over hillside and people live in small scattered villages. Agriculture is the main occupation of the people of project area with Jhum or shifting cultivation as the principal method.

Prediction of Impact on Environment

Based on the project details and baseline environmental status, potential impacts as a result of construction and operation of the proposed project have been given as follows:

A. Impacts on land environment

(1) *Quarrying operations*: A project of magnitude like Dikrong, would require significant amount of construction material. Procurement of material from various sites by unplanned exploitation will disturb the existing environment.

(2) Problems of muck disposal: A large quantity of muck is expected to be generated as a result of tunnelling operation, construction of access roads etc. Muck so generated, if not disposed off properly, can lead to significant adverse impacts on environment. Normally muck is disposed along the river bank, which ultimately finds its way in to water body, leading to adverse impact on riverine ecology. However, the muck can be used for road construction and platform surfaces for powerhouse.

(3) *Soil erosion*: Runoff from the construction sites will have a natural tendency to flow towards Dikrong river or its tributaries. For some distance downstream of major construction sites such as dam, powerhouse, etc., there is a possibility of increased sediment levels leading to reduction in light penetration, which may have an Impact on primary biological productivity of the affected stretch of receiving water body. Since Dikrong river has sufficient discharge, the impact on this account is not expected to be significant. However, some minor adverse impacts are anticipated on streams and *nalas*, which have low discharge during lean season.

(4) *Operation of construction equipment*: During construction phase, various types of equipment will be brought to the site. These include crushers, batching plants, drilling rigs, earth movers, rock bolters, etc. Space will be required for storing various construction equipments and materials for workshops. In addition, land will be temporarily required for storage of the quarried material before crushing, crushed material, cement, rubble, etc.

(5) *Environmental degradation due to immigration:* Congregation of human force is likely to create problems of sewage disposal, solid waste management and felling of trees for meeting fuel requirements.

(6) *Road construction*: Topography of the project area has steep to precipitous slopes which descends rapidly into narrow valleys. Construction of roads in such area can give rise to erosion hazards due to net downhill movement of soil aggregates if adequate protection measures are not undertaken. Project construction would entail significant vehicular movement for transportation of large construction material, heavy construction equipment. Some of the roads in project area would require widening. New roads may lead to removal of trees on slopes in immediate vicinity of road, which may lead to landslides, soil erosion, gully formation, etc.

B. Impact on water resources

Construction of dam, diversion of discharge for hydel power generation would lead to reduction in downstream discharge, up to the tailrace outfall. Since there are no users in intervening stretch, the reduction of discharge will not have significant impact on downstream users. However, reduction in discharge is likely to have marginal impact or riverine ecology, as the discharge from *nalas* and streams in intervening stretch will reduce the possibility of adverse impact.

(1) *Impact on water quality:* Construction phase activities lead to mushrooming of various allied activities to meet the demands of immigrant population in the project area. Total quantum of sewage generated is expected to be of the order of 6.45 mld. But it will reduce to 0.03 mld during operation phase and BOD load contributed by domestic sources will be about 200 kg/ day. Quantum of BOD loading as well as sewage

is not high, and is not expected to cause any major adverse impacts on ground or riverine water quality.

(2) *Impact on reservoir water quality:* Enrichment of impounded water with organic and inorganic nutrients due to decomposition of vegetative matter in the submerged area may affect the water quality immediately on commencement of operation and is likely to continue in initial years of operation.

(3) *Entrophication risks:* Fertiliser use in the project area is negligible as such cutrophication risks which are primarily caused by enrichment of nutrients in water is not anticipated.

C. Impact on life habitats

During the Project construction phase, land, in addition to reservoir submergence will also be required temporarily for location of appurtenance structure, construction equipments, storage of construction material, muck disposal, widening of existing roads and construction of new roads. Total land required for the project is about 190 ha and out of this about 112 ha is riverbed and the rest may be forestland. During Project Operation phase, accessibility of the area will improve, which in turn, may increase human interferences leading to marginal adverse impacts on the terrestrial ecosystem. Since significant increase in human population is not anticipated during Project operation phase, adverse impacts of interference are therefore, likely to be marginal.

D. Impact on noise environment

In a Hydroelectric Project, slight increase in noise levels is anticipated during construction phase due to operation of various equipments, increased vehicular movement and blasting etc. Nearest settlements, Jampa and Chapo villages are about 0.5-1.5 km from dam site and powerhouse sites respectively. Increased noise level due to blasting could scare away wildlife from the area. It has been observed during construction of similar Projects – "that wildlife migrated from such areas and returned after cessation of construction activities".

E. Air pollution

In Hydroelectric project, impacts on ambient air quality are anticipated only during Project Construction phase. Impacts occur due to fuel consumption during operation of various construction equipment and emissions from various crushers. Normally, diesel is used in construction equipment. Major pollutant, which gets emitted as a result of diesel combustion, is SO_2. SPM emissions are minimal due to low ash content in diesel. Model studies conducted for various projects with similar fuel combustion level, indicate that the short term increase in SO_2, even assuming that all the equipment are operating at a common point is quite low. Thus, no major impact is anticipated on this account. During crusher operation, fugitive emissions comprising of suspended particles will be generated. Since there are settlements close to the Project site, some adverse impacts on this account are anticipated. The location of crusher will therefore, has to be selected away from settlements.

Environmental management plan

In order to minimise the adverse environmental impacts and safeguard the ecosystem in the project area, the following measures may be planned in advance :

(i) Drinking water should be collected from river/streams flowing upstream of camps and stored in tanks and supplied for use. Water quality in this area is generally good and does not require any elaborate treatment, except

disinfectant, prior to its supply for domestic use.

(ii) Sewage generated from labour camps, as proposed to be treated in septic camps and dispend by discharging into Dikrong river. In Project operation phase, a plant colony with 200 quarters is likely to be set up. Sewage so generated would be treated through sewage treatment plant, equipped with secondary treatment units shall be commissioned to ameliorate whatever marginal impact – that is expected to occur.

(iii) Community habitat will generate substantial amount of municipal waters. Adequate facilities for collection, conveyance of municipal waters to the disposal site shall be developed. A suitable land fill site will be identified with the help of District Administration for disposal of Municipal Water from Project Township, labour colonies etc.

(iv) Approach roads will have to be constructed on slopes as a part of the access to the construction site. Steep slopes in overburden are liable to fail and cause landslides during rains, which can largely be controlled by provision of suitable drainage, protection measures by way of retaining structures and growing vegetation on surface. Failures of unstable steep slopes in rock cutting along road/ project site can also be checked by installation of rock bolts, wire mesh and shotcreting.

(v) Generated muck is proposed to be utilised for construction works after crushing it into the coarse and fine aggregates. Balance quantum of muck shall be disposed in low-lying areas and to form flat ground, which can be put to some use. Balance requirement of construction material can be met by quarrying activities in the riverbed as a sufficient quantity of river borne material comprising boulders, pebbles, and sand is available. This will reduce the acquisition of forestland and minimise adverse impact on flora and fauna

(vi) About 140ha of forestland need to be acquired for siting of different project appurtenances, construction of road and submergence area. As mitigation measures double the area equivalent to the forestland will be afforested.

(vii) Crushers at dam site and powerhouse sites shall be equipped with cyclones to control the dust generated, while crushing the stone aggregates.

Conclusions

The Environmental Impact Assessment study of the Dikrong Hydroelectric Project has been carried out as obligation under the notification by the Ministry of Environment and Forest. Such type of study is essential for all the hydroelectric projects involving estimated cost of more than 100 crores.

The project is located in northeastern Himalaya occupied by the Siwalik Group of rocks comprising sandstone, siltstone, pebble beds and sand rock, etc. The area lies in seismic Zone-V of the Seismic Zoning Map of India. The study has been carried out considering all those factors, which have direct bearing on causes responsible for adverse effect on environment, leading to the disturbances of ecosystem. The assessment made so far has revealed that there may be few environmental hazards during the construction period and it may be minimised by adopting the proposals for amelioration given in the suggested Environmental Plan.

Acknowledgements

The author expresses his gratitude to Shri T.C. Lahiri, Deputy Director General, for his kind permission to publish the paper. Thanks are due to Shri K.N. Nanda, Director, for his constant encouragement.

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