

# Eia report on hydropower project

Business



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Hydro pvt. ltd is the proponent of the Sunkoshi Hydropower Project (SHP). It is the hydropower plant which is being made for the complete usage of the water of the irrigation plant to fulfill the deficit of bagmati irrigation project. This hydropower plant is intended to build near khurkot. The detail of the proponent and their contact address is given below: Sunkoshi hydro power Address: Tel: Mailing address: 1.

2 Organization responsible for preparing the report CAI Engineering consultancy Pvt. LTD a known name in the field of engineering sector , as a consultant has undertaken the Environmental Impact Assessment (EIA) of sunkoshi hydropower plant. It renders services in many areas such as hydropower, tunnel, irrigation, environment, road, bridge, building and other various fields of civil engineering considering design, supervision, planning and so on. Since its inception, the firm was primarily involved in the design of the bridges and building, but now it has gain a lot experience in the field of hydropower feasibility study and planning. This company has performed a lot of environmental impact assessment of various construction works.

Today, CAI is recognized as a leading consulting organization in Nepal and is able to provide consulting services in multi-disciplinary projects. The detail address of the consultants is given below: CAI engineering consultancy Pvt. LTD. Lagankhel, lalitpur Tel: 9849136089 Email address: [www. cai. info](http://www.cai.info) 2  
GENERAL INTRODUCTION OF THE PROJECT 2.

1 Background Nepal's theoretical hydroelectric potential is billed at 83, 000 MW and an stablished inventory of feasible sites total about one third of the above figure (MoWR 1981). A whole generation in Nepal has been consumed

by this seductive dream of hydro potential that the cascading water of this land is supposed to hold and the hydro-dollar bonanza it is supposed to get after exporting to India. The chimera endured for almost 40 years, but is now showing signs of turning into a cruel nightmare of recurring load shedding and backbreaking electricity price hikes . However, to date, Nepal has managed to develop only about 688 MW<sup>1</sup> of hydropower. In retrospect, Nepal's failure to develop hydropower seems to follow from being mesmerized with the physics of falling water while ignoring the social institutions that must harness and harvest the natural bounty.

In 2049 BS, the Government of Nepal (GoN) introduced the Hydropower Development Policy, along with the endorsement of the Water Resources Act, 1993, the Electricity Act, 1992 and the Electricity Regulation, 1993, which paved the way for private sectors in developing hydroelectric projects in Nepal. The objective behind such a move by the government is to rationally maximize harvesting of the water resource for electricity production.

2. 2 General introduction of the project

The sunkoshi hydropower project is a huge project which is intended to build for the proper usage of the water that is discharged into the marine khola from sunkoshi river through a tunnel of about 7 kms long. The bagmati irrigation project requires a certain minimum discharge which cannot be fulfilled by the water of bagmati itself. So to overcome the amount of deficit water in the bagmati river, the sunkoshi plant is planned.

About 84 cumecs of water is discharged through sunkoshi river into the marine khola and ultimately to the bagmati river. So it is decided to built a hydropower plant from the water needed for the irrigation project, in which

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surveying and field investigation along with the feasibility and pre-feasibility studies are going on. The catchment area of the SunKosi basin is about 19,000 sq. km. The SunKosi River originates in the mountain range east of Barhabise called Kalinchowk, and flows in a westerly direction with steep river gradients of 1: 10 to meet the BhoteKosi at Barhabise.

The BhoteKosi originates from a glacier on the south slope of Mt. Xixabangma Feng, in the southern part of the Himalayan range in the Tibetan plateau. The catchment area at the confluence point is about 2,375 km<sup>2</sup> of which about 2000 sq. km lies in Tibet. The average gradient in the upper reach is 1: 8, while in the lower reach it is about 1: 31.

The SunKosi flows in a south-east direction up to Dolalghat, the confluence point of the SunKosi with the Indrawati River, with an average gradient of 1: 130. The Indrawati River, one of the main tributaries of the SunKosi River, originates in the Himalayan range and flows in a south, south-east direction to meet with the River SunKosi at Dolalghat. The average gradient of this river is about 1: 34 in the upper reach and 1: 194 in the lower reach. The total catchment area of the Indrawati at the confluence with the SunKosi River is about 1,175 sq. km. The SunKosi River, after the confluence with Indrawati River, flows in a south-east direction up to Tribeni with an average gradient of 1: 450.

The TamaKosi River, which Originates in the southern part of the Tibetan Plateau of China, flows in a southerly direction through the Rolwalin Himalayan range and enters Nepal. Within Nepal, the river flows in a southern direction through the mountainous and hilly areas with an average

gradient of 1: 20 in the upper reach and 1: 110 in the lower reach to meet with SunKosi River at Khurkot. The TamaKosi River has total drainage area of 4, 190 sq. km at Khurkot. About 40 km downstream of Khurkot, the SunKosi River joins with the Likhu Khola. The gradient of the SunKosi River is approximately 1: 210 throughout the entire length of its course in Nepal.

The targeted potential for this project is 240 MW. SALIENT FEATURES

SUNKOSHI RIVER HYDROPOWER project| GeneralName of river: Sunkoshi

riverTypes of scheme: Runoff river | Location and address: District:

SindhuliLocation of project site: KhurkotCoordinates: Access road:| Hydrology

and meteorology: Catchment Area: 10800 km<sup>2</sup> Design 100 years flood:

Minimum monthly flow: Design discharge: 84 cumecs| Length of river to

point| 2. 3 Project Objectives Following are the project objectives To supply

the required amount of water from sunkoshi river to bagmati river to fulfill

the discharge deficit of the bagmati irrigation project. \* To utilize the water

of sunkoshi river in making a hydropower plant. 2. 4 Relevancy of the project

proposal: The primary HMG statutory requirement that has to be adhered to

for the environmental assessment, whether it is EIA or IEE, for any type of

development activities is the EPA- 2053 and EPR-2054.

The regulations took effect on 26/06/1997 which superseded the 1993

National EIA guidelines. Any development projects have some environmental

implication, whether beneficial or adverse. Therefore, it is pertinent to

identify the complications/changes apparent in the environmental condition

along with the favorable or adverse impacts resulting from the activities

associated with the project over the physical, biological, socio-economic and

cultural environment of the project area. The prevailing laws of the land and

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the nature of project have made EIA mandatory for this sunkoshi hydropower plant. ADB has also classified this project as category A in accordance with the environmental requirements of the Bank and Environmental guidelines for the selected development projects.

Under the act, it is also made mandatory to suggest and recommend the suitable mitigation measures for the control and management of the natural environment ensuring a minimum deterioration as a result of the project in the environment. Above all environmental monitoring program and its plan for the implementation is also equally important. The bagmati irrigation project which lies in sarlahi district of Nepal, played a role in the planning of this project. The bagmati irrigation project has to fulfill about 84 cumecs of water in the required area. Due to storm water in case of wet season the required amount of water is fulfilled by the bagmati irrigation project but in case of dry season the water gets deficit.

So sunkoshi project is planned in such a way that it can serve the society by both irrigation and hydropower project. The sunkoshi has required amount of discharge in case of need for the bagmati project. So, it is being planned to drop the water of sunkoshi from khurkot in marine khola from a tunnel about 7 kms which includes a hydropower plant too. Following are the major advantages of this project: I. This project fulfills the need of bagmati irrigation project during the dry season.

II. The water which is used in case of irrigation can also be used to make a hydropower plant. III. The water is discharged in marine khola which helps the nearby people in irrigating their land and an alternative way is fish

### farming. 3 APPROACH AND METHODOLOGY 3. 1 GENERAL METHODOLOGY

The IEE study for this proposed hydropower project will be based on the collection of data both primary and secondary for the impact assessment and evaluation purpose.

At all stages of IEE study, the procedural methods should comply with the provisions of EPA & EPR and related national and sectoral guidelines and other HMG acts and rules in dealing with the issues as described above. To accomplish the job, the proponent shall adopt the methodology as per the following sequence of activities. i) Determine the features and need of the project. ii) Collect the baseline information on the physical, biological and socio-economic environment of the project area. iii) Identify and predict potential impacts of the project to address the quantification on various environmental factors.

Describe and Enlist all the envisaged impacts irrespective of their implications. iv) Identify and recommend the mitigation measures with respect to potential environmental impacts basically to minimize or eliminate the adverse/negative impacts. v) Prepare environmental management plan to be implement the suggested mitigation measures during the construction activities. vi) Prepare IEE report as per the format prescribed by the National EIA guidelines (1993) and EPA-2053 and EPR-2054. 3. 2 TASK SPECIFIC METHODOLOGY 3.

2. 1 Desk Study (Review of Literature) Available primary and secondary information and literature in the form of reports and maps will be collected and reviewed during the study period. The published and unpublished

reports/documents pertaining to environmental standards, Acts/ legislations/ regulations/ policies, various maps etc. for the study should be collected from following concerned organizations: i) Ministry of Science and Environment ii) Ministry of Water Resources iii) Water and Energy Commission Secretariat iv) National Planning Commission v) Centre Bureau of Statistics vi) Ministry of Land Reform and Management ii) Department of Forest viii) Department of Soil Conservation and Watershed Management ix) Department of Mines and Geology x) Department of Meteorology and Hydrology. xi) Department of Survey Meeting and discussions with the concerned design consultants on the various aspects of the project including project size, design, implementation strategy etc, will also be a good source of information for the purpose However, focus of the study will be concentrated with regard to the project and environment.

3. 2. 2 Review of Acts, Policies, Regulations and Guidelines The proposed IEE study shall review and comply with the national legislation of Nepal besides other relevant legislations. The relevant sections of the following documents, acts, guidelines, conventions etc. shall be reviewed, since Nepal is a signatory to those acts and conventions. i) Environmental Protection Act 1996 and Environmental Protection Regulation 1997 and first amendment 1999 ii) National conservation strategy for Nepal (NCS), 1988 iii) Water Resources Act, 1992 and Water Resources Regulations, 1993 iv) National Environmental Impact Assessment Guidelines, 1993 v) Land Acquisition Act, 1977 i) Forest Act, 1992 and Forestry Regulations vii) Local Self Governance Act, 1999 and Local Self Governance Regulations, 2000 viii) EIA Guidelines for Forestry Sector, 1995 ix) Conventions on international Trade in



Endangered Species of Wild Flora & Fauna, 1975 x) Conventions on Biological Diversity, 1994 3.

2. 3 Field Investigation All the personnel's, governmental and non-governmental organizations, clients and other agencies that are existed within the project area shall be contacted as and when required during the field observation. Regular coordination approach shall be adopted with the NGO assigned to this project to streamline the spirit of data/information collection. Various checklists and questionnaires shall be prepared for the field study. Direct observation, focused group discussions, participatory appraisal, informal interviews and meetings with the local government bodies and more importantly with the NGOs will be carried out in identifying the impacts. Similarly, review of secondary data/information from the past studies and other pertinent literatures shall also be taken as helpful references in identifying the impacts.

A team as mentioned in the manpower schedule shall conduct a walk-through survey of the project area for visual inspection and data collection with a focus to collect the information on social, culture, economic, physical and biological environment of the project areas. In addition to this, the socio-economic profile prepared by the NGO assigned to this project will also be taken into consideration as a valuable reference before finalization of the field study during data analysis period. The team after data collection will interact among the team members to finalize the findings of the field study. However, field investigation shall be carried out during IEE study for the assessment of the impacts on the following environs due to project activities.

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2. 3. 1 Physical Environment Following areas shall be considered during the study; i) Critical environmental areas ii) Assessment of selected site(s) a) Geology ; amp; soils b) Hydrology c) Change in land use pattern d) Air and noise quality e) Minimum discharge of the river/ water source etc f) Others 3.

2. 3. 2 Biological Environment Following areas shall be considered during the study; ) Forest and terrestrial vegetation (Flora) ii) Wildlife and terrestrial Fauna iii) Fish and aquatic life 3.

2. 3. 3 Socio-Economic ; amp; Cultural Environment Following areas shall be given due consideration during the study: i) General socio-economic conditions ii) Land use pattern of the project area iii) Water sources and consumption pattern iv) Social infrastructures including industries and commercial establishments v) Religious, cultural and historical monuments and sites vi) Women and children (Gender aspects) ii) Occupational health and safety viii) Resettlement and rehabilitation 3. 3 PUBLIC CONSULTATION

PROGRAM AND PUBLIC NOTICE Public consultation program in the project area will be organized to inform the broader communities and to collect the feedbacks and suggestions regarding the issues. This program mainly focus on the awareness about the project plans and programs, building of mutual consensus about the implementation of the project, identification of the key issues to be considered during IEE study and project design.

In this regard, a 15 days' public notice shall be issued in a national daily newspaper as well as in the VDC offices covered by the project to inform the concerned and affected stakeholders about the project and receive the related comments and feedback from them. 3. 4 TECHNIQUES TO BE

ADOPTED FOR THE IEE STUDY The techniques as literature review, field

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investigation/observation, quadrat sampling, data sheet/checklist survey, questionnaire survey, collection & identification of water quality sample etc. will be applied for the baseline information and impact prediction in biological environment. Checklists and matrix methods will be developed and used to identify the impacts of the project on the physical, biological and Socio-economic & cultural resources of the project areas during the construction and operation & maintenance phase.

Based on the information available and assessment of the studies, project induced positive and negative environmental impacts will be categorically identified as short, medium and long term in terms of duration, low, medium and high in terms of magnitude and site specific, local, regional/national in terms of extent. These impacts dictate the preventive and mitigation measures. 3. 5 DATA ANALYSIS The data collected shall be analyzed to identify both the negative and positive impacts of the project on the existing environment. During this stage, the socio-economic profile prepared by the NGO shall also be considered for further verification before finalization of the field study for identifying and predicting the possible impacts both the adverse and beneficial.

4 REQUIREMENTS OF THE STUDY 4. 1 TIME SCHEDULE FOR IEE STUDY Time Schedule envisaged for the IEE study is as follows: Time Schedule for IEE of sunkoshi hydropower project Activities Remarks 1. Desk Study 7 days a. Literature review (4 days) b. Preparation of TOR (2 days) c. Submission of TOR(1 day) 2.

Approval of TOR from related field 28 days 3. Public Notice 15 days 4. Field Investigation 5 days 5. Report Preparation 20 days a. Data Compilation and its analysis (4 days) b.

Draft Report Preparation (5 days) c. Public hearing & Stakeholder consultation (3 days) d. Draft report submission (1 day) . Collection of Comments and Suggestions (5 days) f. Final Report Preparation and Submission (2 days) 5

IDENTIFICATION & PREDICTION OF THE IMPACTS The impacts shall be identified mainly for the two activities i.

e. project construction and post construction (O& M) phase on the existing physical, biological and socio-economic resources. The study shall distinguish between positive & negative impacts, direct & indirect impacts. The impacts shall be characterized as i) low, high & medium in terms of magnitude, ii) long term, short term & medium term in terms of duration and iii) site specific, local & regional/national in terms of extent. As a part of the study, enhancement of the positive impacts shall also be carried out.

The potential impacts that shall be assessed are grouped into three major impacts as follows: 5. 1 PHYSICAL IMPACTS i) Land: The possible changes in the land use pattern of the area shall be studied giving focus to landslide, erosion, and environmental aesthetics degradation. Besides, the study shall also taken into consideration about the compensation for the acquired land if any. ii) Water: The possibility of negative impacts on surface water, ground water, wastewater problems and obstruction to natural drainage shall be studied carefully. Apart from this, the study shall also focus on the source dispute and water use conflicts if exist. iii) Soils & Geology: The degradation

in the soils and geological status of the project area due to the project and its associated activities shall be studied.

The consequences of the erosion and landslides due to the project shall also be studied. iv) Hydrology: The modification that will be brought by the implementation of the project in the river hydrology will be studied along with the consequences (adverse or positive) resulted from the project. In addition, the riparian flow as well as minimum discharge of the river /water source after abstraction of the design flow will be studied in accordance with the requirements of the environmental flow envisaged by the acts and regulations. i) Others: Other parameters, if any, such as: quarry site impact, spoil disposal impact, waste materials disposal impact etc. , identified during the study shall be incorporated in the report.

In addition to this, cumulative impacts shall also be considered during the identification of the impacts of the project on the natural settings of the environment. 5. 2 BIOLOGICAL IMPACTS i) Flora (Forest & Terrestrial Vegetation): Change in forest cover/forest clearance, extinction of rare and endangered species of floral species, timber exploitation, firewood extraction etc. ue to the project shall be studied to assess the losses to the vegetation and to suggest suitable mitigation measures. ii) Wildlife and Terrestrial Fauna: Change in the terrestrial wildlife, fauna and aquatic life including fish, extinction of rare and endangered species, loss of habitat, sensitive habitat, migratory routes, construction disturbances, hunting and poaching by workforce, destruction of spawning and rearing of ground of fish, impact on fishermen etc.

ue to the project shall be suitably incorporated in the IEE report. iii) Others: Other parameters, if any, such as permanent disturbances to the vegetation coverage, local wildlife, fish migration, fish entrainment, and riparian release etc. identified during the study shall be incorporated in the report along with their cumulative effects on the environment.

### 5. 3 SOCIO-ECONOMIC AND CULTURAL IMPACTS

The socio-economic and cultural impacts can be wide ranging in their nature. So the study shall incorporate the factors like; occupational health and safety impact, Health and sanitation impact, land acquisition and compensation impact, Impact on women and vulnerable, impact on local economy, migration problem, resettlement & rehabilitation problems, change in land use pattern, change in nearby land values, impact on education, encroachment of cultural sites, law and order problem, generation of employment, impacts due to influx of workers and resulting cultural differences hazards.

### ALTERNATIVE ANALYSIS

The alternative analysis of the project (Scheme II) in the following aspects shall be conducted during the study to minimize the possible negative environmental impacts:

#### 6. 1 PROJECT LOCATION (SETTING)

The barrage/weir site, settling basin, tunnel alignment, power house and all other associated facilities including the transmission and distribution routes may be diverted to save the natural environmental settings if arranged.

#### 6. 2 TECHNOLOGY, IMPLEMENTATION PROCEDURE AND RAW MATERIALS

The proponent shall consider the alternatives for technology, implementation procedure, and raw material requirements in close coordination with the design team. In general, choices shall be considered in the context of cost effectiveness, labor intensive and with low risks of environmental hazards.

6. 3 NO PROJECT OPTION No project option is always open. 7 MITIGATION MEASURES Suitable, cost effective and environmentally friendly mitigation measures shall be recommended during the preparation of IEE report for all the perceived impacts to minimize the environmental impacts of project implementation after the prediction of extent, magnitude and duration of the impacts. In general the following area shall be covered while preparing mitigation measures: i) Project construction phase ii) Project operation and maintenance phase Concerned agencies like Governmental organization, NEA, NGOs and local agencies, Local administration, police office shall be consulted during the implementation of mitigation measures. In order to implement the proposed mitigation measures during the project implementation, the proponent is required to prepare Environmental Management Plan and also Resettlement Action Plan, if applicable.

8 ENVIRONMENTAL MANAGEMENT & ACTION PLAN (EMAP) The EMAP shall be based on the mitigation measures for the project induced impacts. The EMAP shall include the responsibilities of different stakeholders based on preliminary plans and schedules. This program shall include measures required during the project design, construction and operational phases and shall include recommendations on allocation of components of the EMAP to the various parties involved. The EMAP shall also give due consideration to and document the involvement of affected communities. Integral to this IEE would be the implementation of a public consultation and participation program focused on the directly or indirectly affected communities and the stakeholders.

All these things shall be commenced prior to the formulation of the program.

**ENVIRONMENTAL MONITORING PLAN** Environmental monitoring plan, which is required under both EPR, 2054 – Annex 6 and NEIAG, 2050 – Chapter 10, helps to provide timely warning of the potential environmental damage and also to check the implementation of mitigation measures to see whether it confirms to the approved plan. The monitoring plan shall include the

following critical contents: i) Identification of environmental parameters/indicators ii) Development of general monitoring program for assessing the impacts of the project on the physical, biological and socio-economic environment. ii) Outline a monitoring program for public health in the project camps and surrounding communities during the construction phase Monitoring mechanism: The monitoring mechanism during construction will be of regular type whereas baseline monitoring, compliance monitoring and process monitoring shall have to be done during the operation and maintenance phase. The monitoring team shall visit the project site and monitor the effectiveness of the implementation of mitigation measures. 10 IEE REPORT CONTENTS/FORMAT IEE report shall be prepared as per this TOR and shall be submitted to respective agency through CAI engineering consultancy Pvt.

LTD. The basic format of the report will be in accordance with the EPR, 1997 and National EIA Guidelines, 1993. In the IEE report, wherever applicable maps, graphs, photographs, tables and matrix shall be presented. However, IEE report will include: i) Organization preparing IEE report with address and Title/cover page ii) Executive Summary iii) Introduction v) Project Description v) Baseline Information vi) Identification/Prediction of Potential



Environmental Impacts vii) Mitigation Measures viii) Environmental Management and Monitoring Plan ix) Review of Relevant Rules, Acts and Regulations x) Conclusion and Recommendations xi) References 11

DELIVERABLES The proponent shall submit fifteen copies of the final IEE report of this project to the concerned Ministry in accordance with Rule 10 of the Environmental Protection Rules, 2054. 2. References Following are the list of references cited in the text in preparing of this TOR 1.

Manual for Preparing Terms of Reference (TOR) for Environmental Impact Assessment (EIA) of Hydropower Projects, with Notes on EIA Report Preparation 2. Final Terms of Reference for the Environmental Impact Assessment for the Greenland Aluminum and Hydroelectric Development Project 3. Report on Initial Environmental Examination (IEE) Water Supply Sub-Project – Scheme III