

EXECUTIVE SUMMARY



1.0 Introduction

The total installed capacity of the Integrated Nepal Power System (INPS) is approximately 585 MW. To meet present increasing demand of power generation the existing capacity of the transmission needs to be upgraded or new transmission line should be constructed. The Power Development Projects, of which Khimti-Dhalkebar 220 kV project is a component, financed by World Bank aims to meet the objectives of HMG/N in extending access to electricity supply to a larger percentage of the population by supporting the development of Nepal's power sector.

In view of future system development plan Nepal Electricity Authority (NEA) proposed Khimti - Dhalkebar 220 kV Transmission Line Project to evacuate the power generated from Tamakoshi and other hydropower projects in the region. This transmission line will also be connected with two existing Independent Power Producer (IPP) plants, Khimti and Bhotekoshi, with a view to exporting power to India as well as to serve the eastern region of the country. NEA an undertaking of HMG Nepal is a national level organization established in 2042 B.S. is the largest corporate body responsible for the power generation, transmission and distribution of the electric power in different parts of the country.

All major projects of Nepal are now being considered for application of environmental studies since the enforcement of Environment Protection Rule (EPR) 1997 and first amendment 1999. As per EPR 1997 an Environmental Impact Assessment (EIA) study of the proposed Transmission Line Project is mandatory since voltage level of the project is more than 66 kV. The EIA of the proposed project is conducted as per the EPR 97 and approved terms of reference. The terms of reference was approved by former Ministry of Population and Environment (MoPE) on 2061/1/24 (May 6, 2004). EIA report is prepared by Environmental and Social Studies Department (ESSD) of NEA as per the contract signed between Transmission Line/Substation Construction Department and ESSD.

The Ministry of Water Resources has granted a survey license for the proposed Khimti Dhalkebar 220 kV Transmission Line Project. The survey license was issued on 2059/9/5 B.S.

The main objective of the study is to establish baseline condition of the project area, identify impacts, suggest mitigation measures for the adverse impact and develop environment management and monitoring plan. The scope of the study is to prepare EIA report for implementation of the proposed project.

2.0 Study Methodology

Desk study, field study and impact identification through impact assessment matrix was the main methodology applied for this study. The desk study includes the review of technical reports of the project, topo maps of 1:25,000 scale, district profiles, VDC profiles, meteorological data and EIA report of similar projects. Quadrate sampling, line transect survey, questionnaire & checklist, survey, focused group discussion and interview of local leaders, VDC representatives and other

intellectuals were the other method utilized for EIA study. The recommendation letters of concerned VDCs were collected and incorporated in the report.

The field investigation was carried out by a multi-disciplinary team, which comprised of Environmentalist, Geologist, Civil Engineer, Electrical Engineer, Botanist, Zoologist, Sociologist and Economist. The fieldwork was conducted from April to June and lasted for about 40 days. Team traversed in project area to collect information on existing physical, biological and socio-economic & cultural environment of the area.

The notice regarding the program was published in Gorkhapatra daily on 2061/5/25. The copy of the notice along with request letter for participation in the program was sent to concerned ministries and departments, DDC office, local VDCs and district level line agencies and Muchulka of the notice receive is collected. Audio record was made for the entire program and written concerns of the participants were collected.

Public hearing program for this study was conducted at Manthali of Ramechhap district (2004) and Dhalkebar of Dhanusha district (2004) in order to provide opportunity for the maximum participation of local people and to discuss the findings of the EIA study and to collect the issues/ concerns of local people. The relevant issues raised by local people and representatives of the VDCs and line agencies are incorporated in report.

3.0 Project Description

The Khimti Dhalkebar 220 kV transmission line starts from Kirnetar village of Dolakha district and will cross Ramechhap, Sindhuli and Mahottari districts and finally reaches the Dhalkebar substation of Dhanusha district. For the purpose of the EIA study, the study area is defined as the project area consisting of the right of way, substation area site as well as the area that will be impacted due to the construction and operation of the project. The proposed project will cover 16 VDCs and one Municipality of the five districts. The alignment passes through Sahare VDC of Dolakha district, Gelu, Khimti, Tilpung, Kathjore, Manthali & Bhaluwajore VDCs of Ramechhap district and Bhimeshwar, Ratanchura, Jalkanya, Bhadrakali & Ranichuri VDCs of Sindhuli district. Similarly the transmission line will also cover Kamlamai Municipality of Sindhuli district, Gauribash VDC of Mahottari district and Tulshi Bahunmara, Beghadabar & Dhalkebar VDCs of Dhanusha district. The project area does not fall into National Park, Wildlife Sanctuary, Conservation Area, and Buffer Zone area.

The right of way of the proposed project will be 15 meter each side from the centerline and approximately 12.5m x 12.5-m area will be required for tower foundation. In most of the areas span of the tower will be 350 meter and in total 230 towers will be constructed in 73- km alignment. The number of angle points is 53 and tower is steel lattice structure, self supported type. The project component also includes extension of two 132 kV line bays, one each at Khimti and Dhalkebar existing substations. The estimated cost for the proposed project is 22 million US\$ which will be jointly funded by World Bank, HMG/N and NEA. The proposed project is national priority project.

In order to carry out the project works the entire stretch of the line route will be segmented into two work sections and will be controlled from two ends. The working group of each section will be more or less mobile; hence small size temporary camp will be constructed for the implementation of

project. Altogether 225 people will be employed in the project which includes 50 skilled, 65 semi skilled and 110 unskilled.

4.0 Existing Environmental Condition of the Project Area

4.1 Physical Environment

The proposed transmission line passes mainly through Middle Mountain (AP-0 to AP-28), Churia range (AP-29 to AP-47) and plains of Terai (AP-48 to AP-53). The maximum elevation is about 1451.76 m (Sola Bhanjyang) and minimum elevation is about 173.74 m (Dhalkebar S/S) from mean sea level. The main land use pattern in the RoW is forest and bush, cultivated land, river and rivulets, road and barren land. The maximum temperature experienced in the Terai region of transmission line alignment is 36° C and minimum temperature in the hilly region of the alignment is 7.3 °C and annual rainfall ranges from 1500- 2200mm.

The general geology from Khimti to Dhalkebar T/L alignment is metasedimentary and granitic rocks of midland zone in the north of Main Boundary Thrust (MBT), Sedimentary rocks in Siwaliks and Quaternary alluvium in Terai plain. Different types of soil and rock materials as boulders, gravel, sand and clay deposit by fluvial processes in valley area, weathered boulder mixed soil and red clay deposit and rock cliff in hilly area and thick quaternary alluvium in Terai area encountered in the alignment. The angle points AP-6, AP-11, AP-23 to AP-24, AP-28, AP-29, AP-34 to AP-38 and AP-43 to AP-46 are located in unstable slope. The angle points AP-3, AP-20, AP-30, AP-35, AP-40 and AP-43 are in flood plain.

4.2 Biological Environment

The transmission line-encompassing zone is characterized by the tropical, sub-tropical and temperate ecological zone that provides good habitats for a wide variety of plant species. Altogether 171 species of plant are recorded from the project area belonging to 142 genera of 74 families. Among the recorded species 85 are trees, 40 shrubs, 34 herbs and grasses and 12 species are climbers.

The major tree species found in the alignment and nearby area are Rani Salla (*Pinus roxburghii*), Chilaune (*Schima wallichii*), Saj (*Terminalia alata*), Mauwa (*Engelhardtia spicata*) and Bot dhaero (*Lagestromia parviflora*), Phadiyori (*Syzygium cumini*), Lampate (*Duabanga grandiflora*), Kali Kath (*Myrsine semierrata*), Maledo (*Macaranga indica*), Gurans (*Rhododendron arboretum*), Uttis (*Alnus nepalensis*), Sal (*Shorea robusta*), Simal (*Bombax ceiba*) and Khair (*Acacia catechu*) are the protected species of plants found in the project area. Twenty-seven community forests are found in RoW of the transmission line alignment in which Ramechhap, Sindhuli, Mahottari and Dhanusha districts includes 8, 14, 1 and 4 respectively.

Since the project area covers wide range of habitat fauna of both hill and Terai are found in the area. Nineteen species of mammals are recorded from the project area. In Khimti-Khurkote stretch of alignment leopard (*Panthera pardus*), porcupine (*Hystrix indica*) and fox (*Vulpes vulpes*) are reported. The presence of ghoral (*Noemarchus ghoral*), barking deer (*Muntiacus muntjak*), leopard (*Panthera pardus*), yellow throated marten (*Martes flavigula*), leopard cat (*Felis bengalensis*) and black bear (*Selenarctos thibetanus*) are found between Khurkote- Gadhi and Karkare stretch of alignment. In Mahottari and Dhanusha sectors of the alignment mangose (*Herpestes sp.*) bat (*Pteropus giganteus*) and rabbit (*Lepus nigricollis*) are found. Jackal (*Canis*



aureus), rhesus macaque (*Macaca mullatta*), common langur (*Presbytes entellus*) are found throughout the project area.

Monkey (*Macaca mullatta*), Longur Monkey (*Presbytes entellus*), Jackal (*Canis aureus*), Ghoral (*Noemarchus goral*), Malsapro (*Martes flavigula*) and Leopard (*Panthera pardus*) are the listed (CITES) mammals species found in the area. The mixed hardwood forest of the Gadhi areas, Salebas forest, Gopi gaira forest and Chaukote community forest and Kalidamar mixed forest are considered suitable habitat area for wild animals.

Thirty-seven species of birds are recorded from the project area. The common bird species reported in the northern part of alignment (Kirne to Sindhuli area) are Kokale (*Dendrociitta formosae*), Ban Kukhura (*Gallus gallus*), Chive (*Dicrurus macrocercus*), Titra (*Francolinus francolinus*), Kaliz (*Lophura leucomelana*) and Jureli (*Pycnonotus cafer*). Cuckoos (*Cuculus micropterus*), jungle crow (*Corvus macrorhynchos*) and vulture (*Gypus indicus*) are found in southern part of the alignment. None of the bird species reported from the project area are listed as protected, rare and endangered species.

4.3 Socio- economic and Cultural Environment

The total population of the project area is 114516 and number of households is 21668. The male and female populations are 56414 (49.26%) and 58102 (50.74%) respectively. Average household size varies in between 4.39 and 6.21 and total average constitutes 5.28 persons per household. Annual population growth rate in the project area is about 2%. Brahmin, Chettri, Tamang, Newar, Magar are the major ethnic groups found in the project area. 56.85 % population of the project area is literate. The literacy rate is high (68.28%) in Gauribas VDC of Mahottari district and lowest (43.40%) in Kathjore of Ramechhap district.

Krishna temple, Kalika Devi, Ram temple, Bhimeshwor temple, Dhanaugi temple and Ganesh temples are the religious places found in the project affected VDCs. Health facilities in project area are inadequate and main diseases prevalent are stomachache, diarrhea, fever, tuberculosis, hysteria, skin diseases etc. Firewood, kerosene and electricity are the main source of energy for lighting and cooking. Due to accessibility and low cost most of the house holds in the project area use firewood for cooking.

The project area includes predominantly rural economy with agriculture as a main source of livelihood and income. The other occupations include business, service, labor work and domestication of livestock. A variety of skills including mason, carpenter, tailor, blacksmith, shoemaker, weaving and driver are found in the project area.

Irrigated, unirrigated and grassland are the main land type occupied by the local people. Distribution of PAF by size of land holding reveals that most of the families cultivate less than 1 ha of land. Estimated annual income per household in project area is Rs. 72400 in which agriculture and labor/ wages contributes about 36% and 28.5 % respectively. Expenditure pattern of PAF residing along the RoW-indicates that the share of expenditure on food is about 69%, which is relatively in higher side. Expenses on energy constitute 9% followed by clothing, education and medicine. About 350 -400 m stretch of the proposed alignment passes in the vicinity of the Manthali airport at a distance about 740 m from the airport. No objection letter from the airport authority was received during the study.



5.0 Potential Environmental Impact

Impact on 219 ha land use, likely increase in landslides and erosion, water pollution and waste & spoil disposal are the few impacts likely to occur on physical environment during construction phase. No significant impact is expected in physical environment during project operation.

The biological environmental impact includes, loss of 24173 trees (106.65 ha forest patch) of 14 species having greater than 11 cm dbh with 12, 840.4 cubic meter wood volume from 27 community forest and some government forest and likely impact on 93,000 saplings to pole size plants. The other impacts are increased demand for firewood and timber, habitat loss, construction disturbances and increased hunting and poaching. The operation phase impact on biological environment includes RoW clearance, increased access to forest, loss or alteration of wildlife habitat and avian hazards.

The socioeconomic and cultural environmental impacts likely to occur in construction phase are loss of 1.6 ha private land, relocation of 17 houses (7 double story and 10 single story), relocation of one block and toilet of Tamakoshi Higher Secondary School at Khimti besi, loss of standing crops, occupational safety impacts, likely impact on gender & vulnerable group and life style. The other impacts include changes in social and cultural practices, health and sanitation and infrastructures (access trail at AP-16). The operation phase impacts include devaluation of land in RoW, electric hazardous and electromagnetic impact, loss of agricultural production, withdrawal of economic opportunity, farming hindrance and loss of aesthetic value.

Employment to 225 people and increase in local economy is the positive impact during construction phase. The operation phase impacts include increase in local skill and national economy.

6.0 Alternative Analysis

Three different transmission line alignment routes were studied based on 13 different criteria. This alignment is selected based on the line length, project cost, distance from the nearest road/trail, forest clearance, relocation of houses and impact on cultivated land. No action alternative would comprise of power and energy deficit to the eastern part of Nepal. It will also affect the power exchange with India and thus causes adverse impact on local economy. This would result in significant losses to the production sector like industry commerce apart from inconvenience to the customers in terms of blackouts and voltage drop.

Technology to be adopted for the project development comprises of both maximum utilization of local resources and machine intensive construction methods. To minimize the forest loss due to stringing of conductors in the valleys with trees the possibilities of using helicopter for paying pilot wire prior to stringing will also considered in this project.

7.0 Mitigation Measures

Wherever possible, low productive land are proposed for temporary facilities, reclaiming land to maintain the existing land slopes and adopting bioengineering techniques to prevent erosion and landslides are the mitigation measures proposed to minimize the impact on physical environment. The other mitigation measures are water quality protection measures and proper disposal of waste materials.



Major mitigation program proposed in biological environment includes plantation of 600,000 seedlings of *Pinus roxburghii*, *Largestromia parviflora*, *Alnus nepalensis*, *Castanopsis sp.*, *Syzygium cumini*, *Terminalia* spp. and *Acacia catechu*, minimum forest clearance, maximum utilization of forest products and supply of alternative fuel. Other mitigation programs are restriction on hunting and poaching by the labor force and implementation of awareness program for forest and wildlife conservation.

In operation phase, manual clearance of vegetation in RoW is the mitigation proposed to minimize the likely impacts on biological environment. The saplings, which grow below 4 meters height will not, felled and above that height will be trimmed for safe operation of the transmission line.

Mitigation measures proposed in socioeconomic and cultural environment during construction phase include compensation for the loss of private land and houses, school block, provision of land registration fee (7% of the compensation amount or actual amount spend in land purchase which ever is low), rental allowances for 4 months, appropriate rent for leased land, temporary camp with adequate facilities for the workers, provision of first aid kits and vaccines against infectious and communicable diseases.

Other mitigation programs include awareness program, availability of safety equipment's and device, strong code of conduct for the outside construction workers; no discrimination to the local people on the basis of gender, cast color or place of origin in Nepal and construction of access trail to the cultural site at AP-16.

The operation phase mitigation programs include 10% compensation for the deduction of land value and occupational safety measures.

The enhancement measures proposed during construction phase include priority to the local employment, non-timber forest products training (NTFP), agro-forestry program and community support program; in operation phase local employment, implementation of NTFP program and continuation of community support program for 2 years. Due priority shall be given in rural electrification since this is prime expectation of local people from the project. The total estimated mitigation cost is NRs. 36.47 million NRs.

Nepal Electricity Authority will have prime responsibility for the implementation of recommended mitigation measures. The mitigation program will be implemented in coordination with district-level line agencies to the extent possible.

8.0 Environmental Management Plan

NEA being the proponent of the project has prime responsibility in carrying out the indicated mitigation measures and monitoring plan. Khimti-Dhalkebar 220 kV Transmission Line Environmental Management Unit will be established for the monitoring, implementation of specified mitigation measures and coordination with the concerned line agencies. This unit will be responsible for baseline, compliance and impact monitoring works. Consultant will also monitor the activities of contractor as specified in Tender Clauses. Contractor will be responsible for the implementation of mitigation measures as specified in Chapter -6. The estimated environment management cost of the proposed project is NRs. 40.39 million NRs./-(Mitigation 36.47 million NRs. /- and monitoring 3.92 million NRs. /-) which is 2.44% of the total project cost.



10.0 Review of Policies, Acts, Rules, Guidelines and Conventions

EA will be solely responsible for fulfilling provisions of all relevant policies, acts, rules/regulations, guidelines and conventions while implementing the project. Hydropower Development Policy 2001, Environment Protection Act 1997, Electricity Act, 1992, Forest Act 1993 and Local Self-Governance Act 1999 were reviewed during the preparation of EIA report. Other rules and guidelines reviewed were Environment Protection Rules 1997, Electricity Regulation 1992, Local Self-Governance Regulation 2000 and National Environmental Impact Assessment Guideline 1993. Among the conventions biodiversity convention 1992 was reviewed.

10.0 Environmental Monitoring

Baseline, impact & compliance monitoring will be conducted in different phases of the project. Environmental monitoring will be conducted for physical, biological, socioeconomic and cultural aspects. Land use pattern, forest status, changes in settlement, public health, infrastructure and compliance of the tender clauses are the major areas of monitoring. The schedule of monitoring will be daily, quarterly, half yearly and yearly depending on the parameters and type of monitoring.

NEA will have prime responsibility for the implementation of environmental monitoring. Besides NEA line agencies, will also have responsibility for environmental monitoring of the proposed project.

The Environmental and Social Studies Department on behalf of the project will conduct the pre-construction monitoring. Khimti-Dhalkebar Environmental Management Unit comprising of staff from ESSD, among others will be the institution responsible for construction phase monitoring. Grid Operation Department, NEA will conduct the operation phase monitoring of the project and ESSD will conduct some of the monitoring works on behalf of the department. The estimated monitoring cost is 3.92 million NRs. /- for both construction phase and two years operation of the project.

11.0 Environmental Impact Audit

Ministry of Environment, Science and Technology shall carry out environmental impact audit of the proposed project after two years of completion of the project as per EPR 97. The environmental audit includes physical, biological and socioeconomic & cultural environmental aspects. Environmental audit will follow the same methodology and survey sites as covered in EIA and environmental monitoring plan. The estimated cost for environmental audit is NRs. 11, 55,000 /-.

12.0 Conclusion and Recommendations

The study indicates that proposed project would have low impact on physical environment and moderate impacts on biological and socioeconomic environmental condition of the area. The study concludes that construction of the proposed Khimti-Dhalkebar 220 kV/TL Project is environmentally feasible if recommended mitigation measures and monitoring plan are implemented. It is recommended that HMG/N must facilitate for early decision regarding forest clearance and land acquisition.