Environmental Assessment Report

Draft Summary Initial Environmental Examination
Project Number: 39630
August 2007

India: National Power Grid Development Investment Program

Prepared by Power Grid Corporation of India Limited (POWERGRID) for the Asian Development Bank (ADB).

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION
TRANCHE 1
Project 2

NATIONAL POWER GRID DEVELOPMENT INVESTMENT PROGRAM

IN

INDIA

August 9, 2007

This report was prepared by Power Grid Corporation of India Limited (POWERGRID).

ABBREVIATIONS

ADB	–	Asian Development Bank
EMF	–	Electromagnetic fields
EMP	–	Environmental monitoring plan
IEE	–	Initial environment examination
MOEF	–	Ministry of Environment and Forests
SIEE	–	Summary initial environmental examination
ESMD/CC	–	Environmental & Social Management Department/Corporate Centre, POWERGRID
EIU	–	Environmental Implementation Unit

Electrical Terminology

V	(Volt)	-	Unit of voltage
kV	(kilovolt)	-	1,000 volts
W	(Watt)	-	Unit of active power
kW	(kilowatt)	-	1,000 watts
MW	(Megawatt)	-	1,000 kW
kWh	(kilowatt-hour)	-	Unit of Energy
MWh	(Megawatt-hour)	-	1,000 kWh
VA	(Volt-ampere)	-	Unit of apparent power
MVA	(Million volt-ampere)	-	10^6 VA
Transmission System		-	400 kV or 220 kV line supplying (incoming & outgoing feeder) grid substations (Substation) with primary voltage of 400 or 220 kV
LILO			Loop-in-Loop-out

CONTENTS

I. INTRODUCTION

1. This Summary Initial Environmental Examination (SIEE) report for the National Power Grid Development Investment Program (the Investment Program) in India analyzes the environmental impacts that may occur during the construction and operation of projects undertaken as part of the proposed Investment Program. To utilize effectively the UA-UP transmission corridor, the Chicken neck area, and the difficult terrain of the NER (North Eastern Region), it is necessary to plan an evacuation system of major hydropower and gas based projects in the NER and Bhutan in a comprehensive manner keeping in view future generation expansion. The power generation addition scenarios of the Northern (NR), Western (WR) and Southern (SR) Regions indicate that these regions would remain in deficit situation during 11th Plan and beyond. Therefore, power from the North Eastern region generating sources would have to be transmitted to the load centers of NR, WR and SR over long distances through the narrow corridor in north of West Bengal. The project comprises establishment of a 1817 km long high capacity transmission system for evacuation & transfer of about 3000 MW of power from hydro projects under construction – the 2000 MW Lower Subansiri hydro project, 600 MW Kameng Hydro Project, and about 500 MW surplus power available in the region. For transmission of power from NER/Sikkim/Bhutan to NR/WR, different transmission options i.e. high voltage HVDC and 765kV AC were examined and a hybrid system of ± 800kV HVDC with 400kV AC system was proposed to be the most optimal.

2. The Program will improve reliability and security in this region and transmit additional power generated from the region by establishment of a high capacity transmission system emanating from the NE region. The objective of the Tranche 1 Projects is to strengthen and enhance the economy and efficiency of intra- and inter-regional high capacity transmission development, including operation and maintenance services, without causing any major environmental and social problems. The full initial environmental examination (IEE) reports prepared for the whole Investment Program, comprising of one continuous transmission line divided into four segments by the Power Grid Corporation of India Limited (POWERGRID) are available upon request.

3. The Ministry of Environment and Forests (MOEF) of India exempts transmission line projects from the requirement to prepare an environmental impact assessment (EIA). However, for transmission lines traversing through forests, the project-implementing agency is required to obtain forest clearances from the MOEF. For the present Investment Program the line segments are passing through mostly government owned land, wasteland, agricultural land and grazing land, and do not traverse any forestlands, wild forests and/or planted forests. Therefore, the requirement to obtain forest clearances from the MOEF are for any of the identified project components.

4. Transmission line projects are classified as Category B projects under the Asian Development Bank's (ADB) classification of environmental impacts. POWERGRID has prepared IEE reports incorporating the expected environmental impacts and mitigating measures. The initial identification and walkover surveys for the selection of alternative alignments/routes for these transmission lines have been completed, and a preliminary survey of the three ROW alternatives for each of the transmission line segments has been completed.

5. The conducted environmental assessments on the proposed route selection for the transmission lines were prepared in accordance with the ADB's Environmental Policy, and Environmental Assessment Guidelines, 2003, the Indian environmental assessment guidelines

and regulations, and the POWERGRID's Environmental and Social Policy & Procedure (ESPP'04). POWERGRID teams have carried out desk reviews and walkover surveys to identify the proposed alignments. The final selection of the alignments is in progress. The entire stretch of the proposed alignments for total transmission line is accessible and does not entail construction of additional access roads. The preliminary consultations and interviews with local communities and government authorities on the rout selection took place prior to the finalization of the Program design. The consultation process was completed during the implementation of the detailed/check surveys.

6. Based on the findings of the IEE, the Investment Program is classified as an Environmental Category B. The preparation of an EIA is not required for the Program.

II. DESCRIPTION OF THE SUBPROJECTS ASSESSED

7. Generation addition during the XIth Plan from NER is mainly going to come from Lower Subansiri (8x250MW=2000MW) and Kameng (4x150MW=600MW) Hydro Electric Projects in Arunachal Pradesh/Assam with beneficiaries being mainly the NER, NR & WR. Evacuation of power from these Hydro Electric Projects has been envisaged with 400kV D/C Transmission systems at Biswanath Chariyali in Assam where 220/400/765kV HVAC power pooling point & ± 800kV HVDC Terminal is proposed. Transfer of bulk power from this Terminal Station (Biswanath Chariyali) has been proposed through ± 800kV HVDC Transmission line to Agra in Uttar Pradesh in Northern Grid for further dispersal to National Grid.

a)	Project Name	:	+ 800 kV, 6000 MW HVDC bi-pole Transmission Line from Biswanath Chariyali (Assam) to Agra (Uttar Pradesh) including Earth Electrode Lines at both end, Length-1817 KM.
b)	Location	:	Assam, West Bengal, Bihar and Uttar Pradesh
c)	Beneficiary	:	Constituent States of North East, Northern & Western Regions.

8. Bulk power would be transferred uninterruptedly over a long distance with much more transmission reliability and stability. It will also facilitate inter-state trading of exportable power of State sector generation apart from evacuation of power from the central sector generation. Moreover, it will increase the capacity of National Grid - the per capita consumption of electricity (presently about 370 units) is likely to increase by 2 to 3 % on an average, main beneficiaries being consumers of rural India including agricultural sector, industry, commercial sectors with improved electricity supply with stability. National Grid of about 10,000MW inter-regional capacity is already in place comprising of HVDC back-to-back links, +500 kV 2000 MW HVDC bipole and 400/220 kV AC transmission lines. POWERGRID is working towards establishment of a "National Grid" having capacity of about 37,000 MW, by connecting various regions of India in next 5 years time in a phased manner. Keeping in view the constraints of right-of-ways (ROW), POWERGRID has adopted environment-friendly design of transmission lines like compact towers, 400kV multi-circuit towers to accommodate 4 circuits, 400kV tall tower pole structure, upgrading/ up rating of existing lines etc.

9. Under the project, it is proposed to adopt HVDC system which is flexible to accommodate modular development in different phases matching the power transfer requirement. Accordingly, a ±800 kV, 6000 MW modular HVDC bipole line from NER pooling station to Agra has been planned. HVDC is a well proven and efficient technology for long

distance bulk power transmission, but is a technology that has not been used in India at the scale which will be applied in this project. The voltage level as well as conductor size & their numbers have been selected to minimize the transmission losses.

10. This project will support Government's strategy for continued poverty reduction through sustained economic growth by development of power transmission projects that would ensure sufficient and stable power supply for the southern region in India, which is one of the key economic zones. The project will also improve system stability and security, reduce losses, and improve reliability. The length of Biswanath Chariyali to Agra ± 800 kV, 6000 MW HVDC bi-pole line is too long. Preliminary investigation/survey has been carried out in 4 (four packages) to estimate/arrive at for selection of one best feasible alignment route out of at least 3 alternative alignments studied, for detailed survey to be undertaken during execution of main contracts. Therefore, to facilitate preparation of initial Environment Examination (IEE), entire project (Line) has been sectioned (in 4 parts) matching Preliminary investigation/survey as under:

S.No.	Name of segment	Length in Kms	Sub-projects	Contract Description
1.	Biswanath Chairiyali to Bongaigaon	*320.566 + 50	A1	Part-I B'chariyali-B'gaon HVDC line-160 Km with Earth Electrode line-50 Km.
			A2	Part-II B'chariyali-B'gaon HVDC line-165 Km
2.	Bongaigaon to Saharsa	*463.0	A3	Part-I B'gaon-Purnea HVDC line -194 Km
			A4	Part-II B'gaon-Purnea HVDC line-194 Km
3.	Saharsa to Gorakhpur	*363.528	A5	Purnea-Muzaffarpur HVDC line - 241Km
			A6	Muzaffarpur-Gorakhpur HVDC line-261 Km
4.	Gorakhpur to Agra via Lucknow	*580.0 + 40	A7	Part-I Gorakhpur-Agra HVDC line-200 Km
			A8	Part-II Gorakhpur-Agra HVDC line-200 Km
			A9	Part-III Gorakhpur-Agra HVDC line-200 Km with Earth Electrode line-40 Km.

* Length as per preliminary/GIS Survey, may not match with the contract packages as above.

11. The environmental assessment and review procedures, as well as the selection criteria, for these line segments are also described in detail under section VII. Details of the associated hydro power facilities, GHG emission reduction and cumulative impacts assessment in view of the nature and scale of the projects is not necessary; however an observation is included in the report.

III. DESCRIPTION OF THE ENVIRONMENT

12. Arunachal Pradesh in North Eastern Region, Sikkim and Bhutan are endowed with large hydro potential. Generation addition of about 35,000 MW in Arunachal Pradesh and 15,000 MW in Sikkim & Bhutan is expected in future. Considering the growth of power demand of NER including Sikkim and Bhutan, it is estimated that power to the order of about 42,000-45,000 MW would be surplus in these areas. The proposed transmission line is approximately 1817 km in length, comprising of four segments, traverses mainly through four states – Assam, West Bengal, Bihar and Uttar Pradesh. These four proposed segments are normally occupied by non forest agricultural fields and avoid densely populated areas.

A. Physical Resources

State	Geographic Area	Latitude and Longitude of project
Assam	78,438 sq km	Lat. 24°57' to 28°00' N and long. 89° 42' to 96° 02'E
West Bengal	88,752 sq km	21°31' and 27°14' North Latitude at the head of the Bay of Bengal and 86°35' and 89°53' East Longitude
Bihar	94,163 sq. km	Between 83°-30' to 88°-00' longitude
Uttar Pradesh	2,40,928 sq km	Lat.23º52' and 31º28' N and Long.77º5' and 84º38'E.

Natural Environment

13. Assam, topographically, can be divided into three parts - Brahmaputra valley, the Surma valley and the Assam range. The first two parts are plain areas, while the Assam range is a mountainous region. West Bengal is strategically placed with three international frontiers of 1600-km long with Bangladesh, Nepal and Bhutan and a hinge between the bulk of Indian Territory and the north-east of the country. West Bengal stretches from the Himalayas to the Bay of Benga with the Tropic of Cancer running through it. Northern part comprises the sub-Himalayan region called the Terai, while the rest of the state forms part of the Indo-Gangetic plain. The Terai region has some of the finest tea plantations in India. From the Terai, the Himalayan mountain ranges rise abruptly along the state's northern boundary. Mount Kanchenjunga overlooks Darjeeling in north-west Bengal. Ganga meets the ocean forming well-known mangrove forests in Sundarbans, mainly embraces the fertile alluvial Gangetic plains. The deep alluvial soil of the Gangetic plain is very suitable for agriculture. The course of the river Ganges, much of which lies now in Bangladesh, has for centuries been shifting eastward. Very little of its water now goes to the sea via its western distributaries, the principal one being the Hooghly that flows by Calcutta. Bihar is located in the eastern part of the country. It is an entirely land–locked state and it lies mid-way between the humid West Bengal in the east and the sub humid Uttar Pradesh in the west which provides it with a transitional position in respect of climate, economy and culture. It is bounded by Nepal in the north and by Jharkhand in the south. The Bihar plain is divided into two unequal halves by the river Ganga which flows through the middle from west to east. Uttar Pradesh is bounded by Uttarakhand and Nepal in North, Madhya Pradesh and Chhattisgarh in South, Rajasthan, Haryana and Delhi in West and Bihar and Jharkhand in east. Physiographically Uttar Pradesh can be divided in to two distinct regions i) Indo-gangetic plain ii) Southern hills. General land use pattern of the states is given in Table 1. Population statistics for the states is given in Table 2.

Land use Pattern

Table 1: Land Use

Land Use	Assam		West Bengal		Bihar		Uttar Pradesh	
	Area in '000 ha	Percentage	Area in '000 ha	Percentage	Area in '000 ha	Percentage	Area in '000 ha	Percentage
Total geographical area	7844		8875		17388		29441	
Reported area for land utilization	7850	100.00	8696	100.00	17330	100	29794	100
Forests	1930	24.58	1195	13.74	2949	17.02	5150	17.29
Not available for cultivation	2,493	31.76	1659	19.08	3390	19.56	3516	11.80

Land Use	Assam		West Bengal		Bihar		Uttar Pradesh	
	Area in '000 ha	Percentage	Area in '000 ha	Percentage	Area in '000 ha	Percentage	Area in '000 ha	Percentage
Permanent pasture & grazing land	170	2.17	8	0.09	107	0.62	296	0.99
Land under misc. tree and crops	243	3.09	80	0.92	337	1.94	513	1.72
Culturable waste land	87	1.11	50	0.58	353	2.04	945	3.17
Fallow land & other than current fallows	69	0.88	29	0.33	962	1.94	832	2.79
Current fallows	114	1.45	212	2.44	1895	10.93	1067	3.58
Net area sown	2744	34.96	5,463	62.82	7337	42.34	17475	58.65

Source: Land use statistics At a Glance 1996-97, Ministry of Agriculture, GOI, 2000

Population

Table 2: Population

	Assam	West Bengal	Bihar	Uttar Pradesh
Population	26,638,407	80,221,171	82,878,796	166,052,859
Female	12,850,608	38,733,477	39,724,832	78,586,558
Male	13,787,799	4,14,87,694	43,153.964	87,466,301
Density (Persons per Sq. KM)	340	904	880	689
Urban Population	12.72%	28.03%	10.47%	20.78%
Sex Ratio (Females per thousand males)	932	934	921	898
Literacy	64.28%	69.22%	47.53%	57.36%
Males	71.93%	77.58%	60.32%	70.23%
Females	56.03%	60.22%	33.57%	42.98%

Source: 2001 census

Climate

14. Assam's climate is sub tropical - October to April offer a mild and moderate climate. West Bengal has a tropical climate - the plains are hot except during the short winter season. The mountainous region in the north is cold on account of its altitude but the humidity is high. The classical tradition speaks of six seasons-springs, summer, the Rainy, autumn, mild winter and severe winter. Bihar has varied climate - only four clearly marked seasons with a brief interregnum of spring are observed, namely the hot season, the rainy season, the post monsoon season corresponding to autumn and the cold season. The hot winds of Bihar plains blow during April and May. Like the rest of the northern India, Bihar also experiences dust-storms, thunder-storms and dust raising winds during the hot season. This hot wind greatly affects human comfort during this season. The cold weather commences early in November and comes to an end in the middle of March. Uttar Pradesh's climate varies substantially. The Gangetic plain, which covers three-quarters of the state, is dry and dusty in summer. But during the monsoons between June and September, it is transformed into carpets of lush green fields.

The monsoons also spell disaster for some regions, when the Ganga and its tributaries overflow their banks and flood large tracts of land. Winter is severe; the Gangetic plains are fairly cold during winter. Summers are extremely hot in the plains with maximum temperatures reaching as high as 48° C. The intensity of the summer months is magnified by the hot winds in May and June, the two hottest months of the year.

Rainfall

15 Assam's rainfall, one of the highest in the world (between 178 and 305 cm), is concentrated in 4 months, June to September. The state experiences floods and droughts, Annual rainfall varying from 1,500 mm to 3,750 mm. West Bengal - the average rainfall in the State is 1750 mm. In the Himalayan Region i.e. in northern part the average rainfall ranges from 2500 - 6000 mm. In the southern part average rainfall ranges from 1125 - 1900 mm. Bihar - the rainy season begins in June and ends in September. It also experiences rainfall during retreating monsoon season. The average rainfall is about 900 mm and maximum being 1800 mm in some areas. Uttar Pradesh - the average annual rainfall ranges between 1,000 to 1,200 mm.

Temperature

16. Assam - average temperature in January ranges from 10°C to 23° C and in July it ranges from 26° C to 32° C. West Bengal's hot season lasts from mid-March to mid-June, with the day temperature ranging from 38° C to 45° C in different parts of the state. Winter, which lasts about three months, is mild over the plains, the average minimum temperature not falling 15° C. Bihar - the highest temperature is often registered in May which is the hottest month in the state. Temperature varies in the state from 38° C to 45° C during summer and 7° C to 22° C in winter. Uttar Pradesh - temperature varies maximum 45° C to 35° C during summer and 25 ° C to 3 ° C during winter.

Minerals

17. Assam continued to be the 3rd largest producer of Petroleum (crude) and natural gas in the country accounting for 16 % and 8% respectively of the total production of this mineral in the country. In Assam, coal, petroleum and natural gas, limestone and minor minerals are produced. Tertiary coal occurs in North Cachar Hills, Sivasagar and Lakhimpur districts. Assam coal is friable in nature and has high sulphur content. Low moisture, low volatile cooking coal has been discovered in Hallidayganj Singrimari area. Deposits of banded Magnetic Quartzite occurs in Kamrup and Goalpara districts, Limestone occurs in Lakhimpur, North Cachar Hills, Karbi Anglong, Nagaon and Sivasagar districts. Kaolin is found in Karbi Anglong and Lakhimpur district. The Digboi oil fields in Lakhimpur district and Moran and Rudrasagar oil fields in Sivasagar district are the major source of oil and gas. Hydrocarbons are struck in Borsilla, Changmaigaon, Kurgaon and Rajgarh in the past. Sillimanite bearing rocks occur in Karbi Anglong district. West Bengal - minerals, like rock phosphate, fire clay, iron, limestone, copper, silica, quartz, manganese and sandstone are found in a considerable amount in the state. Bihar - minerals like Mica, Basal, Dolomite, Cement Mortar are generally found. Uttar Pradesh is poor in mineral resources - Limestone, Alusite and Red Sandstone in Mirzapur, Dolomite occurs in small quantities in Bandal and Varanasi. Pyrophyllite and diaspore in Jhansi and Hamirpur districts. Coal is available in Singrauli (Mirzapur district).

Soils

18. Assam is a major tea growing state of India, occupies a geographical area of 7.8 million hectares of which total cropped area is 3.9 million hectares. Only 14.4% of the gross cultivated area are irrigated. The major soils of Assam belong to Inceptisols (49.3%), Entisols (32.3%), Alfisols (12.3%) and Ultisols (6.1%). The most typical characteristics of Assam soil is acidity, where pH of the soils generally ranges between 4.2 to 5.8. West Bengal - the soil patterns in the state are Tarai Soil and Gangetic Alluvium - found in northern part of the state along the border of Nepal. Bihar - thick alluvial mantle of drift origin overlying in most part combined with the shiwalik and older tertiary rocks. The soil is mainly young loam rejuvenated every year by constant deposition of silt, clay and sand brought by different streams. This soil is deficient in phosphoric acid, nitrogen and humus, but potash and lime are usually present in sufficient quantity. There are three major types of soil in Bihar i). Piedmont Swamp Soil-found in northwestern part of West Champaran district; ii). Terai Soil-found in northern part of the state along the border of Nepal; and iii). Gangetic Alluvium - the plain of Bihar is covered by gangetic alluvium (both new as well as old). The soil of the project corridor, in general, mostly belongs to the third category i.e., The Gangetic alluvium. Uttar Pradesh area where the transmission line is passing through Indo-Gangetic plain area. Predominant soils in the area are sandy soil.

Water Resources

19. Assam is dominated by the Brahmaputra river (length: 2900 km). Its drainage area is roughly 935,500 sq. km Brahmaputra Basin comprises of sub-basin of Subansiri, Jia Bharali, Badeng-Pubnoi, Dhansiri, Anas, Champamati, DholaiBuridihing, Disang, Kopili, Kalang and Meghna Basin comprises of sub- Basin of Barak River. The State of West Bengal falls under 3 major River Basins – i). Brahmaputra Basin - Part of Darjeeling, Jalpaiguri and Cooch bihar districts; ii). Ganga Basin - Part of Darjeeling Jalpaiguri and all the remaining districts; and iii). the Subarnarekha Basin-Parts of Purulia E&W Medinipur District. Bihar - Ganga is the main river which is joined by tributaries with their sources in the Himalayas - Saryu (Ghaghra), Gandak, Budhi Gandak, Bagmati, Kamla-Balan and Mahananda. Sone, Uttari Koyal, Punpun, Panchane and Karmnasha are some of the rivers that start from the platue area and meet in Ganges or its associate rivers after flowing towards north. Uttar Pradesh - The main rivers of the state from west to east are Yamuna, Ganga, Ramganga, Gomati and Ghaghara. All rivers, except the Gomati, emerge from the Himalaya. Yamuna and Ganga flow from north-east to south-west in their upper mountainous courses, from north to the south in western parts of the state and thereafter from north-west to south-east joining at Allahabad.

Ecological resources

Forests

20. Assam - the recorded forest area is 27,018 km (sq.) which constitutes 34.45% of the geographic area of the state. According to legal classification, Reserved Forest constitutes 18,060 km (sq.) and Un-classed Forest 8,958 km (sq.). Forest types occurring in the state are Tropical Wet Evergreen, Tropical Semi-Evergreen, Tropical Moist Deciduous, Sub Tropical Broad Leaved Hill, Sub Tropical Pine and Littoral and Swamp Forests. West Bengal - the recorded forest area is 11,879 km^2 which constitutes 13.4% of the geographic area of the state. By legal status, the Reserved Forest constitutes 7,054 km^2, Protected Forest 3,772 km^2 and Un-classed Forest 1,053 km^2. There are eight forest types in the West Bengal - Tropical Semi Evergreen, Tropical Moist Deciduous. Tropical Dry Deciduous, Subtropical Broadleaved Hill, Subtropical Pine, Himalayan Moist Temperate, Montane Wet Temperate, Littoral and Swamp forests. Forests are mainly distributed in the north, south west and south-east. Bihar - the recorded forest area is 6,473km (sq.) which constitutes 6.87% of the geographic area of the

state. By legal status, the Reserved Forest constitutes 693 km^2, Protected Forest 5,779 km^2 and Un-classed Forest 1 km^2. Main forest type in Bihar is dry deciduous. Forests are found only in southern part of Bihar adjoining Jharkhand except west Champaran forest, which is in Northern part of Bihar. In Uttar Pradesh the recorded total forest is 168.26 million ha. which is 7% of the state's area. Reserved Forest constitutes 65.9%, Protected Forest 14.4% and Un-classed Forest 19.7%. The 3 types of forests namely Tropical Moist Deciduous Tropical Dry Deciduous and Tropical Thorny Forests are found in Uttar Pradesh.

Protected Areas

21. Assam - there are 3 National Parks and 13 Wildlife Sanctuaries in the state. Total protected area is 0.21 million ha which constitutes 2.69% of the total geographic area of the state. Manas Tiger Reserve is located in the state. Manas has also been declared as a Biosphere Reserve. Kaziranga National Park and Manas Wildlife Sanctuary are also included in the World Heritage sites. West Bengal - There are 5 National Parks and 16 Wildlife sanctuaries covering an area of 0.28 million ha. It constitutes 3.15% of the geographic area of the state. The state has 2 Tiger Reserves namely Sundarbans and Buxa. Sunderbans Biosphere Reserve is one of the 11 Biosphere Reserves of the country. Sunderbans National Park is also a World Heritage site. Bihar - There is 1 National Park and 11 Wildlife Sanctuaries in the state. They cover an area of 0.24 million has, constituting 2.55% of the total geographic area of the state. Valmiki is the only tiger reserve in the state. Kabar, situation in Begusarai district with an area of 6,738 ha is an important wetland of national importance. Uttar Pradesh - there is one National park and 23 wild life sanctuaries, covering an area of 0.57 million Ha which constitutes 2.36 % of the geographic area. Dudhwa Tiger reserve is located in the state.

Human and Economic Development

22. Assam is a state rich in natural resources like natural oil, natural gas, coal, rubber, tea and some minerals like granite, limestone and kaolin and is the largest economy in the North East. It is like the gateway to the other North Eastern states with an infrastructure index (according to CMIE in 1992-93) of 93, quite close to the average of 100. Although it is more industrially developed than the other North Eastern states, it is primarily an agrian economy with 74% of its population engaged in agriculture and allied activities. In 1997-98, the contribution of the tertiary sector to the SDP is the highest. It comprised almost half of the State's SDP. Over the years, there has been a shift in the sectoral contribution from primary to the tertiary sector while the secondary sector indicates a fluctuating contribution to the SDP. The annual compound growth rate of NSDP during the period from 1980-81 to 1997-98 has been worked out at 12.41% at current prices and 3.54% at constant (1980-81) prices. Agriculture demonstrated a growth rate of 11.7% at current prices and 2.14% at constant prices over the same period. Similarly for manufacturing sector it was 12.05% at current prices and 1.99% at constant prices during the same period. Per capita income of Assam continues to lag behind the national average. Tea is a major industry. There are nearly 750 tea plantations in the state. Assam contributes 15.6% of world's tea production and 55% of the country's tea output. Assam is first state in the country where oil was struck in 1889 at Digboy. The state has two oil refineries and the third with a petrochemical complex is under way. There is also a public sector fertilizer factory at Namrup. The Numligarh refinery (3m tones capacity, cost Rs. 2350 Crore) was commissioned on July 9, 1999. Other industries are sugar, jute, silk, paper, plywood, rice and oil drilling. Important cottage industries are handloom, sericulture, manufacture of cane and bamboo articles, carpentry, smithy and manufacture of brass utensils. Assam is the largest producer in the world of the golden colored muga silk. West Bengal - the geographic area of the state is 88,752 km^2 which is 2.7% of the country's geographic area. The human population of

the state is 80.22 million, constituting 7.8% of the country's population, of which 72.0% is rural and 28.0% urban. The average population density is 904 persons per km. The tribal population is 5.6% of the state's population. The livestock population is 47.09 million, which is 7.5% of the country's livestock population. The State ranks 6th amongst States/UTs in terms of percentage of area under tree cover. Minerals, like rock phosphate, fire clay, iron, limestone, copper, silica, quartz, manganese and sandstone are found in a considerable amount in the state. Steel and alloy steel plants in Durgapur and another steel plant in Burnpur are some of the important industries of the state. Other industries include jute, tea, cotton textiles, automobiles, bicycle, footwear, leather, paper, pharmaceuticals, chemicals, aluminum, sugar, timber processing, ceramic, glass, bone metal, and dairy. Agriculture dominates both the landscape and the economy. Fifty-five percent of the population of West Bengal depends upon agriculture. In fact, agriculture makes a substantial contribution to the state's income. West Bengal accounts for 57.3% of the total jute and 24% of the total tea produced in the country. Pulses, oilseeds, barley, maize, betel leaf, tobacco and sugarcane are some of the other agricultural products of West Bengal. Moreover, there are several multipurpose irrigation schemes in West Bengal, namely, the Damodar Valley, Mayurakshi, Kangsbati and Subarnarekha Barrage. The irrigation schemes are Teesta-Mahananda link canal in Jalpaiguri district, Terageria and Turga irrigation scheme in Purulia, Hinlow irrigation scheme in Birbhum district and Sohajare scheme in Bankura district. Bihar - Agriculture is the main economic activity. Even in the area of agriculture which should be providing the economic boost to raise the level of living in the State, very inadequate investments have been made. Despite the fertile land, almost nothing has been done in the area of irrigation. Uttar Pradesh is rich in human and natural assets. Most of State's farm land is well watered and naturally fertile. U.P is the largest producer of food grains and oilseeds in the country. It leads all the states in India in the production of wheat, maize, barley, gram, sugarcane and potatoes. The state (India's sugar bowl) produces about one half of the total sugarcane output in the country. The western region of the state is more advanced in terms of agriculture. Majority of the population depends upon farming as its main occupation. Wheat, rice, sugar cane, pulses, oil seeds and potatoes are its main products. Sugar cane is an important cash crop almost through out the state and sugar mills and other cane crushers who produce Gur and Khandsari are common throughout the state.

B. Biological Resources

Impact on Ecological sensitive Area (Forest Land)

23. Details of forest land: ± 800kV HVDC Transmission Line from Biswanath Chariyali (Assam) to Agra (Uttar Pradesh). Are given in Table 3 below:

Table 3: Forest Details

(Area in Km^2)

	State/District	Geographic Area	Forest Cover				% of Forests	% of Forest Area under project
			Very Dense	Moderately Dense	Open Forest	Total Forest		
Biswanath-Chairiyali to Bongaigaon (Assam): 320.566 Km with Earth Electrode line-50 Km								
Assam	**Barpeta**	**3,245**	**35**	**183**	**183**	**401**	**12.36**	**31.73 = 0.0082%**
	Bongaigaon (Chirang)	**2,150**	**33**	**267**	**212**	**512**	**20.40**	
	Darrang (Udalguri)	**3,481**	**17**	**121**	**375**	**513**	**14.74**	
	Kokrajhar	**3,169**	**207**	**709**	**267**	**1183**	**37.33**	
	Nalbari (Baska)	**2257**	**4**	**66**	**210**	**280**	**12.41**	

	State/District	Geographic Area	Forest Cover				% of Forests	% of Forest Area under project
			Very Dense	Moderately Dense	Open Forest	Total Forest		
	Sonitpur	5324	71	334	636	1041	19.55	
		Total				3890		
Bongaigaon (Assam) to Saharsa (Bihar): 463.0 Km								
Assam	Kokrajhar	3,169	207	709	267	1183	37.33	NIL
	Sub-Total	3,169	207	709	267	1183		
West Bengal	Jalpaiguri	6,227	607	566	1,220	2,393	38.43	3.0 Ha.= 0.0007%
	Darjeeling	3,149	472	893	856	2,221	70.53	
	Sub-Total	9376	1079	1459	2085	4614		
Bihar	Kishanganj	1,884	0	1	8	9	0.48	3.9 Ha = 0.074%
	Araria	2,830	0	14	14	28	0.99	
	Madhepura	1,788	0	6	4	10	0.56	
	Saharsa	1,680	0	5	1	6	0.36	
	Sub-Total	8182	0	26	27	53		
	Total							6.9 Ha
From Saharsa (Bihar) to Gorakhpur (Uttar Pradesh): 363.528 Km								
Bihar	Sharasa	1,680	0	5	1	6		30.05 Ha = 0.5008%
	Samstipur	2,904	0	9	3	12		
	Muzzafarpur	3172	0	2	2	4		
	Darbhanga	2,279	0	5	6	11		
	Siwan	2,219	0	1	3	4		
	Chappra (Saran)	2,641	0	7	4	11		
	Gopalgang	2,033	0	0	0	0		
	Vaishali	2,036	0	12	0	12		
	Sub-Total	18,964	0	41	19	60		
Uttar Pradesh	Deoria	2,538	0	1	16	17		11.90 Ha = 0.083%
	Gorakhpur	3,321	0	40	25	65		
	Total	5,859	0	41	41	142		41.95 Ha
From Gorakhpur-Agra via Lucknow (Uttar Pradesh): 580.0 Km with Earth Electrode line-40 Km								
Uttar Pradesh	Gorakhpur	3,321	-	40	25	65	1.96	33.05 Ha. = 0.0238%
	Sant Kabir Nagar	1,646	-	-	2	2	0.12	
	Basti	2,688	-	6	12	18	0.67	
	Faizabad	2,174	-	5	51	56	2.58	
	Barabanki	4,402	-	4	82	86	1.95	
	Lucknow	2,528	-	115	183	298	11.79	
	Unnao	4,558	-	34	197	231	5.07	
	Kanpur Nagar & Dehat	6,176	-	16	97	113	1.83	
	Etawa	2,311	-	46	139	185	8.01	
	Mainpuri	2,760	-	1	15	16	0.58	
	Firozabad	2,361	-	5	39	44	1.86	
	Agra	4,027	-	74	199	273	6.78	
	Total	60,202	0	346	1041	1387		

Forest survey report 2003

Note: State wise break up of Line Length:

1. Assam - 370.496 Km + 50 Km E/E line (Subproject-A1 & A2, Part of A3)
2. West Bengal - 207.91 Km (Subproject-A3& Part of A4)
3. Bihar - 495.97 Km (Subproject- Part of A4, A5 & Part of A6)
4. Uttar Pradesh - 652.718 Km+ 40Km E/E line (Subproject-Part of A6, A7, A8 & A9)

i.e. Total Length of ± 800kV HVDC Line= 1727.094 Km & E/E Line- 90 Km

24. Forests are mainly social forestry raised as strip plantations along road side for aesthetic look. Affected nos. of Trees/Plants would be around 2000 in the forestland of entire route. These affected trees/plants may also be avoided by raising tower height. The entire Line will

involve forest area of 112.82 Ha. (Assam-31.73 Ha., West Bengal-3 Ha., Bihar-33.95 and Uttar Pradesh-44.95 Ha.) i.e. forest stretch of about 11.83 Km (considering ROW-69 Meter) of HVDC Transmission Line and 14.55 Km of Earth Electrode Line (Considering ROW-22 Meter.) It may be seen from the above that only 11.83 Km forest stretch is involved in 1727.094 Km of HVDC Line i.e. forest land/area involvement is about 0.68 % and 14.55 Km of forest stretch is involved in 90 Km of earth Electrode Line i.e. forest land/area involvement is about 16.16%. Table 4 gives the statewide forest involvement.

Table 4: State wise forest involvement

State	Total forest Area	Total forest area in HVDC & E/E Line	% involvement of forest	Remarks
Assam	1,930,000 Ha.	31.73 Ha.	$1.64x10^{-3}$	Negligible
West Bengal	1,195,000 Ha.	3.00 Ha.	$2.5x10^{-4}$	Negligible
Bihar	2,949,000 Ha.	33.14 Ha.	$1.15x10^{-3}$	Negligible
Uttar Pradesh	5,150,000 Ha.	44.95 Ha.	$8.7x10^{-4}$	Negligible
Total	11224000 Ha.	112.82 Ha.	$1.0123x10^{-3}$	Negligible

Above table analyses that impact on ecological sensitive area is negligible.

24. No endangered or rare species of flora or fauna are reported in the project areas. There are no reported or known areas of sensitive or protected ecology or habitats along the alignments of the transmission lines proposed. A search for such sites within 2 km of the proposed routes from existing government records and other related sources was conducted by POWERGRID and no such sites were identified.

C. Socioeconomic Conditions

25. The vast agricultural base of Assam, West Bengal, Bihar and Uttar Pradesh combined with a vast labor base, the availability of natural produce, mineral and forest resources provide adequate opportunities for industrial growth. Around 70-80,000 large, medium and small-scale industries are operating in Assam, West Bengal, Bihar and Uttar Pradesh.

26. Assam - The rate of urbanization is low with urban areas accounting for only 12.8 per cent of the total population in 2001 compared to the all-India rate of 27.8 per cent. Social development indicators like literacy rate and infant mortality rates in Assam at 64 per cent and 71 per thousand respectively are just about the all-India rates in 2001. It contributes more than one-third of its NSDP (Net State Domestic Product) and supports about 70 per cent of its population. Agriculture and allied activities have overriding importance as a source of livelihood to the people of Assam. 92.6 per cent of the cultivated land is flood prone. Floods in the Brahmaputra and Barak valleys of Assam cause serious erosion, loss of life and livestock and heavy damage to infrastructure and property retarding agricultural productivity on account of risk avoidance and sand casting, disrupting communications and education and posing health hazards. The floods damage to crops, cattle, houses and utilities in Assam alone between 1953 and 1995 is estimated at Rs 4400 crore with a peak of Rs 664 crore in a single bad year. The crop productivity in the state is very low and the Assam economy supports 89 per cent rural population - this is reflected in a much higher level of the people below the poverty line (36.09 per cent against 26.10 per cent for all-India) in 1999-2000. The Industrial growth in Assam has been very poor - growing at only 2.6 per cent compared to 4.8 per cent in the country. Assam

has over 4500 km of external frontier with Bhutan, China, Myanmar and Bangladesh but no more than a slender 22 km connection with Indian hinterland through the tenuous Siliguri corridor, the Gateway to the North-East. The local market does not provide enough demand and the output has to be sold competitively in external markets. Industries in Assam and other North-Eastern states have not had adequate markets. Outside the region, they have not been able to compete because of the high transport cost. The fact that the distance between Kolkata and Agartala is 300-odd km through Bangladesh but is 1700 km via the “chicken neck” -Is a considerable market disruption, socio-economic distancing and retardation. The service sector considerably increased its share from 39.9 per cent in 1980- 81 to 50.6 per cent in 2001-02. West Bengal has the highest population density (904 persons per sq. km., 2001 census) among the states in India. The rural population was 6.11 crore and urban population 2.38 crore. That is rural population was 72.03% of the total population and urban population was 27.97%. West Bengal's per capita income (per capita SDP at constant prices) in 2003-04 increased by 6.03%. Bihar- has a population of 82.998 million according to the 2001 Census which constitutes 8.07 percent of the country with about 3 percent of the area thereof. The literacy rate in the state is 47.58% according to 2001 census as against 38.50% in 1991. The percentage of rural population in total population of the state is 89.60 percent as per 2001 census which is much higher than that in 1991. In other words, nine out every ten persons in Bihar live in villages. About 61.18% of Bihar is under cultivation as per the figures available for the year 2002-03 – the percentage of fallow land in the same year is 6.75%. Consequent upon bifurcation of the state, forest area has dwindled to a meager 6.65% from 17.01%. The forest coverage, thus compares very unfavourably with the national average which stands at around 26%. The major agricultural products of Bihar are cereals, pulses, oilseeds and cash crops. The major cereals are rice, wheat, and maize, pulses are gram, arhar, mung and masoor and major cash corps are potato, sugarcane, jute, tobacco and spices. Capital investment is low due to lower percentage of central sector investment (prior to creation of Jharkhand, percentage of central sector investment in Bihar was much higher) and very low level of private sector investment, only 1.36 % of factories are there in Bihar as compared to India. Uttar Pradesh – has a population of 16.62 crore as per 2001 census with a population density of 690 per sq.km. in 2001. The Forest area stood at 16.9 lakh ha in 2001-02. In Uttar Pradesh one of the most important promoters of economic growth is agriculture. 62.4% are employed in primary sector and 61% are employed in agriculture sector. Share of income from agriculture sector for 2003-04 is 33.7% and the share of primary sector for the corresponding period is 36.8%. The cultivated wasteland in the State is about 5.18 lakh hectares in 2001-02 and the barren and uncultivated land is about 5.95 lakh hectares and the fallow land is about 16.5 lakh hectares. The work force in the manufacturing sector in 1971 was 19.92 lakh, out of which 9.90 lakh (49.7%) were in household industries and 10.02 lakh (50.3%) in non-household industries. In 2004-2005 there were 521,835 small-scale industrial units involving a total investment of Rs. 5131 crore and employment opportunities for 20,01,000 persons. 40.9% of U.P. population was found to be below poverty line in 1993-94 - rural and urban areas the population living below poverty line was 42.38% and 35.4% respectively. 529.89 lakh persons live below poverty line out of which 412.01 lakh were in rural areas and 117.88 lakh in urban areas.

27. The major impacts will be related to temporary acquisition for erecting transmission towers and placing transmission lines. The assessment on the affected population and relating compensation packages was prepared for Tranche 1 projects and provided in the CPTD.

28. There are no sites of high social, historical, or cultural values reported within 2 km from the proposed routes.

29. The noise environment along the route of the transmission line varies depending upon the location along the line. Generally the route located through rural area would not have major

sources of noise, whereas, the proximity to other noise sources is greater for the more developed areas.

30. None of the transmission line segments are located in, or cross-areas of, wild forests. The only effected parts of the forestry resources are planted forests strips along roadsides. The Transmission segments are not located closely to any areas of significant or sensitive ecological habitats or scenic value areas.

31. There are no large water bodies located near transmission lines. There are no specific large-scale developments planned in the proximity of project funded transmission lines segments.

IV. FORECASTING ENVIRNOMENTAL IMPACTS AND MITIGATION MEASURES

A. Environmental Impacts Due to Project Location and Design

32. Environmental impact of transmission line projects are not far reaching and are mostly localized to ROW. However, transmission line con construction works have some affects on natural and socio-culture resources. These impacts can be minimized by a careful route selection. In order to get latest information and further optimization of route modern survey techniques/tools like GIS/GPS & aerial photography are also applied. Introduction of GIS / GPS in route selection has resulted access to updated/latest information, through satellite images and further optimization of route having minimal environmental impact. Moreover, availability of various details like topographical and geotechnical details, forest and environmental details etc. help in planning the effective mitigative measures including engineering variations depending upon the site situation/location. These techniques were used and detailed survey using GIS/GPS is in progress to assess possible impact and engineering /technical estimation. Physical detail survey shall be taken up during actual construction and actual impact would be known, implemented applying mitigation measure as planned and monitored/audited. All possible measures have been taken during the finalization of route alignment for the proposed transmission line keeping in view the limitations due to peculiarity of terrain and demography of the area where project is being implemented.

33. The transmission system routes will be selected to avoid the forestland and ecologically sensitive areas and would mainly pass through the government owned land, wasteland, agricultural land and grazing land. The transmission towers and conductors will be a prominent feature in the area. This is a residual impact of the Project. However, there are no important landmarks whose aesthetics would be affected by the Project.

34. Preliminary site selection was done based on the topographic sheets of the *Survey of India* and *Forest Atlas.*[1] For the selection of the optimum route or substation site, it was ensured that the route/site: (i) minimized human resettlements; (ii) did not affect monuments of cultural or historical importance; (iii) did not create a threat to the survival of any community with special reference to tribal communities; (iv) did not affect any public utility services like playgrounds or schools; (v) did not pass through any forests, sanctuaries, national parks, etc; and, (vi) minimized damage to the existing forest resources.

[1] Government of India. Survey of India *Forest Atlas* Delhi.

35. As a rule, alignments are sited 10-15 km away from major towns, whenever possible, to account for future urban expansion. Similarly, forests are avoided whenever possible. When not possible, a route that minimizes damage to the existing forest resources is selected in consultation with the local divisional forest officer. The proposed alignments for the HVDC Northeastern - North/West transmission inter-corridor will be avoiding forests, wetlands, and other ecologically sensitive areas.

36. The walkover surveys for all line segments have been undertaken by POWERGRID in order to identify the potential environmental impacts that will occur as a result of the proposed developments along the route of the proposed transmission lines. The environmental impacts will be site specific and will vary between the type and scale of development proposed and the nature of the surrounding environment at each site and alignment.

37. Alternative routes (2-3) for the alignment of the transmission lines were studied. The selection of the alignments was based on published data like the *Forest Atlas*, Survey of India topographic maps, and other related documents prior to the detailed GIS based survey and assessment of the environmental and social impacts. The final alignment would be based on the GIS based survey and detailed investigations. During execution, local slight variation is likely to occur. Similarly, the location of transmission towers is currently unknown. The line traverses about 1817 km and crosses several big and small rivers from width of about 250 m and above. For safety purposes, the foundations of the towers will be built away from dry riverbeds, if any. The towers will not have any significant impact on river flows.

38. For all the following four segments, the POWERGRID team had conducted a preliminary study for the three different alignments with the help of published data/maps and walkover survey to arrive at most optimum route for detailed survey. The salient features of the most optimal routes is given in Table 4. Table 5 gives the features for the Earth Electrode lines of 50 km and 40 km respectively at Biswanth Charyali and Agra ends.

Table 4: Salient Features of the Optimal Route Alignment of Biswanath Chariyali-Bogaigaon–Saharsa-Gorakhpur- Lucknow-Agra ± 800kV HVDC Transmission line

S. No.	Description	Biswanath Chariyali-Bogaigaon	Bogaigaon-Saharasa	Saharasa-Gorakhpur	Gorakhpur-Agra via Lucknow
1.	Route Particulars				
i)	Length	320.566 Km	463 Km	363.528	580 Km
				Bihar, Uttar Pradesh	
2.	Terrain				
a)	Plain	320.566 Km	463.171	Almost Plain	Plain area
b)	Hill	Nil	NIL	NIL	Nil
iii)	Agriculture	The major portion of the line will pass over agriculture land (75 % of the ROW area). etc.	Paddy, wheat jute, potato, Green Vegetable	90% Agriculture	
iv)	Wet/ Marsh	10 %	Wet		
iii)	Other Type of Land	15 % Tea Garden and Sub Urban area	Agricultural land		
3.	Environmental Details				

S. No.	Description	Biswanath Chariyali-Bogaigaon	Bogaigaon-Saharasa	Saharasa-Gorakhpur	Gorakhpur-Agra via Lucknow
	Name of District	Sonitpur, Udalguri, Baska, Barpeta, Chirang, Kokrajhar	Kokrajhar in Assam, Jalpaiguri, Darjeeling, Uttar Dinajpur in West Bengal & Kishenganj, Araria, Madhepura and Saharsa in Bihar Darjeeling Darjeeling	Saharsa, Samastipur, Muzaffarpur, Darbhanga, Siwan, Chhapra, Gopalganj, Vaishali, Deoria, Gorakhpur	Gorakhpur, Santkabirnagar, Basti, Faizabad, Barabanki,Lucknow, Unnao, Kanpur Nagar & Dehat, Etawa, Mainpuri, Firozabad, Agra
	Town Near Alignment	Biswanath Chariali, Sotia, Jamuguri, Balipara, Dhekiajuli, Rowta, Udalguri, Tangla, Barama, Tamulpur, Dhamdhama, Pathsala, Barpeta Road, Sarbhog, Bijni,Dhaligaon,Basugaon, Kokrajhar	Kokrajhar,Barobisa, Alipurduar,Falakata, Dupguri, Jalpaiguri, Siliguri, Islampur, Kishenganj, Araria, Raniganj,Murliganj, Madhepura, Saharsa	Saharsa, Samastipur, Muzaffarpur, Darbhanga, Siwan, Chhapra, Gopalganj, Vaishali, Deoria, Gorakhpur	Rudrapur,Hariharpur, Mahuli,Jagannathpur, Tanda, Mayabazar, Sahganj, Vindwa, Mohanlalganj, Arjun Mau, Navaganj, Unnao, Etawah, Fatehabad, Samasabad
iv)	Huts/Houses/Other structure/APs within ROW	353	11	NIL	NIL
v)	Forest (In Kms)	0.25 Km road side plantation	1.00	6.08	4.5
	(In Ha.)	1.73	6.9	41.95	31.05
c)	Type of Forest-reserve/Protected / Mangrove/ Protected area/ Wild Life area/ Biosphere reserve/any other Sensitive area	Road side Plantation (Social Forestry)	NIL	Social Forestry located along NH, Railway , River Crossing ROW)	Reserved Forest (RF)
b)	Density of Forest	0.3	NIL	0.1	0.3
c)	Type of Flora	Beetle-Nut, Banana, Mango, Jackfruit, Jamun, Tea Plantation etc.	Eucalyptus, Shessam, Mango,Neem etc.	Mango, Lichi, Sheesam , Khajoor, Eucalyptus	Mango, Jamun, Acacia, Neem, Eucalyptus
	Type of Fauna	Crow, Sparrow, Pigeon, Fox, Squirrel	Elephant, Monkeys, Fox, Jackals, Reptiles	Jackal, Fox, Snake, Crow	Crow, Squirrel, Rabbit, Fox etc.
d)	Endangered	Nil	Nil	Nil	Nil
e)	Historical/ Cultural Monuments	Nil	Nil	Nil	Nil
f)	Any other relevant Information	-	Less densely Populated Area.		
4.	Compensation Cost	(Rs. in Lacs.)	Rs. In lakhs	(Rs. in Lacs.)	(Rs. in Lacs.)
i)	Forest				
	Compensatory Afforestation cost	1.56	6.21	37.76	27.95

S. No.	Description	Biswanath Chariyali-Bogaigaon	Bogaigaon-Saharasa	Saharasa-Gorakhpur	Gorakhpur-Agra via Lucknow
	NPV (Net Present Value)	15.92	6.21	377.55	279.45
ii)	Crop Compensation	320.31	462.00	358	575.5
iii)	Huts/Houses/APs/ Other Structure in ROW	300.00			
	Total	637.79	530.31	773.31	882.90
5.	No of Crossing		12		
	Road (NH)		6 HN, 5 SH		7
i)	Railway	4 Nos.	12	7	5
ii)	Transmission line crossings	6 Nos	4 (400VK) 2 (220 KV) 9 (132 KV) 1 (66 KV)	9	13
iii)	Major River Crossing	15 Nos	7 major 26 minor	5	4
6.	Construction Problem	i) Better approach roads available almost along the alignment. ii) Less ROW problem.	Most of portion is connected with metal roads and easily accessible	i) Approach road is not available at most of locations. ii) Proposed line is passing parallel to existing 400 KV DC Purnia-Muzaffarpur-Gorakhpur TL which is recently constructed. iii) Less forest area involvement. iv) Avoidance of houses within ROW. v) Construction of line is easy as compare to other alternative.	i. No Water log areas and terrain is plain ii. Maximum route is passing near by Cart Track.
7.	O&M problem	Due to better approach roads, maintenance of the line will become easier.	Not anticipated	Not anticipated due to availability of approaches. This line section is parallel to existing 400 KV D/C Purnia-Muzaffarpur-Gorakhpur TL. So, O&M activity will be easy.	NIL
	Comparison with Alternatives	Involved less forest area and density in comparison Alternative II & III. Alternative-I is also easily approachable in all seasons	Line length is shorter than Alternative II&III and involves less forest in comparison to Alternative-II & Alternative-III. Forest density is also less in comparison to Alternative-II & Alternative-III. Locations	Involves minimum forest in comparison to Alternative-II and III. Due to availability of approach road, avoidance of houses within ROW and alignment almost parallel to existing 400 KV Purnea-Muzaffarpur-Gorakhpur Transmission Line for O&M purpose	Involves minimum forest in comparison to Alternative-II and III. Available of approach road, alignment passing almost parallel to existing 400 KV Purnea-Muzaffarpur-Gorakhpur

S. No.	Description	Biswanath Chariyali-Bogaigaon	Bogaigaon-Saharasa	Saharasa-Gorakhpur	Gorakhpur-Agra via Lucknow
			are approachable in comparison to other alternatives.		Transmission Line-easy to carry out O&M activity, Avoidance of houses /water logging area with in ROW and less forest involvement
8.	Additional Remarks.	Better approach roads are available through out the alignment making it is easy for construction and O&M works in future. The line traverses mostly over agricultural land and avoiding thick populated area. However, some unavoidable small huts will be encountered within the ROW corridor. At few places tribal area shall be encountered.	Optimum Route is suitable based on economic viabilities and other important features.	-Approach paths available in all weather conditions. -Almost Parallel to existing line, No maintenance problem -No house/structure in ROW -Less forest area -Less Row problem during construction	This route is most suitable

Table 5: Salient Features of the Earth Electrode line at Biswanath Chariyali end and Agra ± 800kV end of HVDC Transmission line

	Earth Electrode Line at Biswanath Chariyali end (Associated with ± 800kV HVDC Terminal in Assam) – 50 Km	Earth Electrode Line at Agra end (Associated with ± 800kV HVDC Terminal in Uttar Pradesh) – 40 Km.
Total Length	50 km in Plain area including 13.08 km in forest area	40 Km in almost plain area, 2.0 km is to cross forest land
Forest Area	30 Ha. of forestland devoid of tree in Balipur RF of Sonitpur West Division	4.4 Ha. of forestland in Agra District of Uttar Pradesh
compensatory afforestion Cost	Rs. 24.4 Lakhs	Rs. 4.4 Lakhs
Net Present value (NPV)	Rs.199.36 lakhs	Rs.36.5 lakhs
Crop/tree compensation	Rs.50.0 lakhs	Rs.24.45

Resettlement

39. POWERGRID has taken measures during the initial route survey stage to avoid settlements such as cities, villages etc. As per the proposed route alignment no land ill be acquired for construction of tower bases, and the Program does not involve any resettlement of villagers.

Land value depreciation

40. Based on past experience, the nearby land prices are generally expected to rise in the areas receiving power. However, the sell values of plots, which have towers constructed, are expected to be lower than the market values even though the land use pattern (especially agricultural) remains the same. Further, the transmission lines generally pass through uninhabited area and agriculture fields, where the land-use is not going to change in foreseeable future. Therefore, the value of land will not be adversely affected to a significant level.

Historical, cultural monuments and value

41. As per the POWERGRID's policy of route selection, only that route alignment is finalized which avoids all the historical and cultural monuments. As per the preliminary assessment carried out during walkover surveys for route alignments in consultation with state revenue authorities and ASI, no such monuments are coming in the proposed route alignments.

Encroachment into ecological areas

42. POWERGRID has taken all precautions to avoid routing of line through forest, ecological sensitive areas, national parks and sanctuaries. Since proposed project area is also not rich in forest cover, it was possible to achieve the same while determining the routing of proposed lines.

Encroachment into precious ecological areas

43. All precautions have been taken to avoid routing of line through forest and ecological sensitive areas and National park/Sanctuaries. In spite of this it was not possible to avoid forest completely in this project though National park and Sanctuaries have been avoided completely. However, the route of proposed HVDC transmission line/Earth Electrode Line is finalized so that it affects minimum forest area. Tables 4 depicts that out of entire HVDC transmission line length of about **1727.094 Km** only about **11.83 Km (0.68%)** length shall pass through forest land consisting of **81.63 Ha.** forest area in the states of Assam, West-Bengal, Bihar and Uttar Pradesh. Table 5 depicts that from a total length of **90 Km** of Earth Electrode Line about **14.55 Km** length shall pass through forestland consisting **32 Ha.** forest area in the state of Assam and Uttar Pradesh.

44. About 90% of the total forest area is strip plantations raised along road and canal side only. The forests to be traversed by the lines are already degraded and the wildlife species may be present are those who have been adapted to open or disturbed habitat. Therefore with the provision of Compensatory Afforestation, the overall forest status will improve. In forest area, tree felling, if necessary for Right-of-way (ROW) of transmission line will be done under the supervision of Forest Department and some low canopy seed trees and shrubs may be kept intact, if they do not interfere with tower erection and line installation. Seven (7) meter wide strips of forestland under each conductor will be cleared and maintained as maintenance rows, but the remaining land will be allowed to regenerate to a permissible height (2 to 3 meter maximum). Lopping of trees to maintain required electrical clearance will be done under the direction of Forest Department. POWERGRID will provide to construction crews with fuel wood or alternative fuels as a precaution to deter them from collection of fuel wood from nearby forest.

Encroachment into other valuable lands

45. Impacts on agricultural land will be restricted to the construction phase and when large-scale maintenance measures are required - some stretch of the line will pass through Agricultural fields. Agricultural land will be lost at the base of the tower, which is estimated to be 0.2-1 sq. m per average farm holding**.** The proposed project envisages constructing 1727 Km of HVDC Line which involves approximately 4320 towers. Construction of these towers will result in loss of approx. **4320 sq. m. or 0.4320 ha. of land**. For Earth Electrode Line of 90 Km, about 240 towers of 220kV class shall be used and construction of these towers will result in loss of approx. **240sq. m. or 0.024 ha.** of land. Thus, total Land loss would be **0.456 Ha**. only including forest land which is insignificant.

46. In areas where line will traverse agricultural land, compensation will be paid to owners for any crop damage or any other temporary damages incurred as a result of construction activities. POWERGRID field staff will consult affected villagers and local revenue department and apprise him about the project and tower location, which shall be erected in the agricultural land, for compensation. Revenue department, after evaluating the loss due to construction activity and productivity of land arrives at the compensation cost which is paid to farmers. Based on preliminary survey, **Rs. 2125.62 lakhs** has been estimated towards cost compensation of crops/tree or any other temporary damages during construction in the state of Assam, West Bengal, Bihar and Uttar Pradesh. Agricultural activities will be allowed to continue following the construction period. If bunds or other on-farm works are disturbed during construction or maintenance, they will be restored to the owner's satisfaction following cessation of construction or maintenance activities. In the event that private trees are felled during construction or maintenance operations, compensation will be paid to the owner in an amount determined by the estimated loss from the tree/plant to be assessed by Revenue/Forest authority. For fruit bearing trees, estimation of loss of products would be done over an eight year period. Agricultural lands under private ownership will be identified, and in accordance with normal POWERGRID procedures compensation will be paid to the affected villagers as per compensation plan for temporary damages (CPTD) prepared separately.

Interference with other utilities and traffic

47. As per regulations enacted by Government of India, it is mandatory for POWERGRID to seek clearance prior to construction from department of Railways, Telecommunications and wherever necessary from aviation authorities that are likely to be affected by the construction of transmission lines. The transmission line affects nearby telecommunication circuits by causing electrical interference. A standing committee -- Power Telecom Co-ordination Committee (P.T.C.C.) has been constituted by Government of India to plan and implement the mitigating measures for the induced voltage which may occur to nearby telecom circuit and suggest necessary protection measures to be adopted. The committee suggests measures like re-routing of the telecom circuits, conversion of overhead telecom circuits into cables etc. to minimize the interference.

48. The cost of such measures is determined by the Committee and is shared by POWERGRID and Telecom Department on the basis of prevailing norms and guidelines. Though the exact cost to mitigate the impacts of induction in neighboring telecom circuits would vary from case to case, the cost on an average works out to be Rs.50000/- per km for POWERGRID. Wherever transmission line crosses the railways, clearance is taken from that department. In general, the system is planned and executed in such a way that adequate clearance is maintained between transmission lines on the one hand, and railways, civil aviation and defense installations on the other. Wherever the transmission line passes near the airports

the towers beyond specified height are painted in alternate orange and white stripes for easy visibility and warning lights (aviation) are placed atop these towers.

Interference with drainage pattern

49. As the transmission lines are constructed aerially and the blockage of ground surface is limited to area of tower footings which is very small, there is little possibility of affecting drainage pattern. In the infrequent instances where the drainage is affected, flow will be trained and guided to safe zones.

B. Environmental Problems Due to Design

Escape of polluting materials

50. The equipments installed on lines and substations are static in nature and do not generate any fumes or waste materials.

Explosion and fire hazards

51. During the survey and site selection for transmission lines, it has been ensured that these are kept away from oil/gas pipelines and other sites with potential for creating explosions or fires. Fires due to flashover from lines can be a more serious problem in deciduous forest. Since forest involved is mostly degraded and scattered in the proposed project it is not going to be a problem. Apart from this state of art safety instruments are installed in the substations on both the ends so that line gets tripped within milliseconds in case of any fault.

Erosion hazards due to inadequate provision for resurfacing of exposed area

52. Adequate measures are taken to re-surface the area where excavation works are done. Topsoil disturbed during the development of sites will be used to restore the surface of the platform. Infertile and rocky material will be dumped at carefully selected dumping areas and used as fill for tower foundations.

Environmental aesthetics

53. Since normal spacing between the towers in case of ± 800 kV HVDC lines is approx. 400 meters these will not affect the visual aesthetics of the localities particularly when it is ensured to route the lines as far away from the localities as possible. POWERGRID takes up plantation of trees to buffer the visual effect around its substations and to provide better living conditions. Wherever POWERGRID feels it appropriate, discussions will be held with local Forest Department officials to determine feasibility of planting trees along roads running parallel to transmission lines to buffer visual effect in these areas. In addition, towers may be painted grey or green to merge with the background.

Noise/vibration nuisances

54. For Transmission line, noise/sound level measured in some specific case study has been found to be less than 50 dB. The equipments installed at sub-station are mostly static and are so designed that the noise level always remains within permissible limits i.e. 85 dB as per Indian and International standard-7194. POWERGRID had monitored noise/sound level by measuring it at different places in and around reactor and transformer (at 1 m distance). The

noise level was found to be ranging from 75 to 83 well within permissible limit of 85 dB. To contain the noise level within the permissible limits whenever noise level increases beyond permissible limits, measures like providing sound and vibration dampers and rectification of equipments are undertaken. In addition, plantations of sound absorbing species like Casuarinas, Tamarind, Banyan and Neem are raised at the sub-stations that reduce the sound level appreciably. It is reported that 93 m3 of woodland can reduce the noise level by 8 dB.

Blockage of wildlife passage

55. Since the transmission lines in the proposed project is passing through mostly agricultural, wasteland and no forest area or migration path of wild life is getting affected, possibilities of disturbance to wild life are remote.

Endangering of species

56. No endangered species of flora and fauna exist in the project area as well as no reserve forest is getting affected thus there is no possibility of endangering/causing extinction of any species.

C. Environmental Impacts Related to Construction

Uncontrolled silt runoff

57. The Project involves only small scale excavation for tower foundations at scattered locations that are re-filled with excavated material therefore uncontrolled silt run off is not expected. The terrain is almost flat and no huge quantities of earthwork are envisaged.

Nuisance to nearby properties

58. As already described in preceding paragraphs, during site selection due care has been taken to keep the transmission lines away from settlements. The nearest settlement reported from the transmission lines is about 70 m away. Further, all the construction activities will be undertaken through the use of small mechanical devices and manual labor therefore nuisance to the nearby properties if any, will be minimized.

Interference with utilities, traffic and blockage of access way

59. The access to the site will be along existing roads or village paths; minor improvements to paths may be made where necessary, but no major construction of roads will be necessary either during construction or as a part of maintenance procedures. As and when a transmission line crosses any road/railways line, the terminal towers will be located at sufficient distance so as not to cause any hindrance to the movement of traffic. Stringing at the construction stage will be carried out during lean traffic period in consultation with the concerned authorities and angle towers are planted to facilitate execution of work in different construction stages.

Inadequate resurfacing for erosion control

60. Since proposed transmission lines are to be constructed in plain area, erosion problem is not anticipated. However, if due to terrain at some points transmission towers may be required to be placed on slopes and erosion prone soils, internationally accepted best

engineering practices will be undertaken to prevent soil erosion. This will include cutting and filling slopes wherever necessary. The back cut slopes and downhill slopes will be treated with revetments. Adequate steps will be taken to resurface the area after construction. Wherever sites are likely to be affected by active erosion or landslides, both biological and engineering treatment will be carried out, such as provision of retaining walls, and sowing soil binding grasses around the site. Furthermore, construction will be generally undertaken outside the rainy season.

Inadequate disposition of borrow area

62. As mentioned earlier the transmission tower foundations involve excavations on small-scale basis and the excavated soil is utilized for back filling. The sites have been selected in such a manner that the borrowing of the area is avoided.

Protection of workers health and safety

63. Provisions for workers' health and safety will be guided by the safety regulations/safety manual of POWERGRID, and included in the tender documents. Various aspects such as, work and safety regulations, workmen's compensation, insurance shall be adequately covered under the Erection Conditions of Contract (ECC), a part of bidding documents. In addition training will be imparted to the workers (especially machine operators) in safety procedures, precautions and measures and fire fighting. Safety tools like helmet, safety belt, gloves etc. will be provided to them. First aid facilities will be made available with the labor gangs, and doctors called in from nearby towns when necessary. Remedial actions consistent with Indian standards will be taken immediately when safety violations are discovered. The number of outside (skilled) labourers will be quite small, of the order of 25-30 people per group. The remaining workforce of unskilled labourers will be comprised of local people. Workers are also covered by the statutory *Workmen (Compensation) Act*. POWERGRID has a dedicated unit to oversee all health and safety aspects of its project under the Operation Services. POWERGRID has framed guidelines/checklist for workers' safety as its personnel are exposed to live EHV apparatus and transmission lines. This guidelines/checklist includes work permits and safety precautions for work on the transmission lines both during construction and operation and is monitored regularly by site in-charge and corporate Operation Services.

64. A regular health team is proposed to conduct routine health checkups for construction workers on regular basis. The construction sites and construction workers' houses will be disinfected regularly.

65. During the construction period, there is also a risk of in-coming workers spreading socially transmitted diseases (e.g. HIV/AIDS). POWERGRID will conduct awareness-building programs for the construction workers.

Land Loss

66. Impacts on agricultural land will be restricted to the construction phase and when large-scale maintenance measures are required. Some stretch of the line will pass through Agricultural fields. Agricultural land will be lost at the foundation base of the tower, which is estimated to be approximately 0.4 sq. meters per tower for the identified core subprojects. The transmission projects do not involve any large scale excavation and land is lost to the extent of 0.2-1 sq m only for each foundation. As the portions of lines in the subject project are passing through only degraded forest (for HVDC Line-11.83 Km and earth electrode Line-14.55 Km)

forest land loss would be around 68 m^2 or 0.0068 Ha which is negligible/insignificant. However, compensatory afforestation raised over double the area of degraded forest not only mitigates the impact but also increases the forest cover, thus overall improvement of Environment

Noise and Vibration

67. The main noise sources during the construction phase will include equipment and transportation vehicles. Based on the range of works to be carried out for foundation of towers, the need of blasting or heavy equipment is not envisaged. In addition to choosing equipment of low noise and vibration, the construction activities with noisy equipment will be scheduled to avoid school class hours and those taking place near residential areas will avoid the use of noisy equipment at night. With such good engineering practices and management measures, no significant disturbance to local communities from construction related activities is anticipated.

Water Environment

68. During the construction phase, the wastewater will comprise domestic sewage from construction camps and staff quarters, and wastewater from washing of construction equipment and vehicles. The construction contractors will be required to adopt water-saving construction practices and conduct training of construction workers to minimize the discharge of wastewater. The small quantities of domestic sewage from staff quarters and construction camp will be treated in local soak pits. The clarified overflow will be used for horticulture /plantation at the substations. Small settlement ponds will be used for treatment of washings of vehicles before it is discharged. The construction sites will be located at least 100 m away from the nearby water bodies.

Air Quality

69. Since all the proposed alignments are accessible, no construction of access roads is envisaged thereby avoiding any airborne dust pollution in the vicinity.

70. Air quality impacts will be restricted to the construction phase as there will be no emissions to air during ordinary operations of the transmission lines. Impacts on air quality due to airborne dust in the vicinity of the work sites (at points along the route of the transmission line where towers are required to be located) have the potential to occur as a result mainly of excavation and construction activities and tail gases from construction equipment and vehicles. During excavation and material handling activities dust and particulates may be generated. The dust will settle on trees and crops and can cause respiratory problems to local residents. The scale of the impact will be determined by the proximity of any residential properties (that could be affected by dusts etc.) to the work sites, the nature of the material being excavated, its soil water/moisture content and the prevailing weather conditions at the time of excavation. Experience has shown that frequent spraying of water in construction sites and on exposed earth surfaces, covering of transportation vehicles with tarpaulins and training of equipment operators and drivers in fuel efficiency and anti-idling can effectively reduce the air emissions. With the adoption of these mitigation measures for the Project, the residual atmospheric impact is anticipated to be temporary and minimal.

71. For the erection of the transmission line, excavations will be necessary for the construction of foundations for each of the four legs of each tower along the route. In addition, depending on the nature of the topography at each tower site, additional earth works may be necessary to either elevate the base above the surrounding ground or to level the site to allow

subsequent foundation excavation and placement. This will result in the potential for dust and particulates to be generated that could be emitted to the air. However, these works will be of a small scale at each site and taking only a matter of days to construct. The impacts will therefore be of a small scale, be localized to the nearby area and of a temporary nature. As such, impacts on air quality from construction activities associated with the transmission line are considered to be insignificant.

D. Environmental Impacts During Operation

72. Three meter wide strips of land under each conductor will be cleared during construction and out of which one three meter wide strip will be kept clear as maintenance RoWs. The other strips will be allowed to be afforested. Lopping of trees will be carried out with the assistance of the state forest department to ensure that the required clearances from the top of tree to the conductor are maintained throughout the stretch of the transmission lines. This will reduce the chances of forest fires due to electric sparks. Since the transmission line does not traverse through forestland, the need for clearing three-meter wide strips in forests does not arise.

73. To minimize the risk of accidents and exposure to electric fields, houses will not be allowed within the RoW.

O&M staff skills less than acceptable resulting in variety of adverse effects

74. The O&M program in POWERGRID will be implemented by personnel for the transmission lines. However in respect of the long distance transmission lines, monitoring offices located at various points en-route will be responsible. Monitoring measures employed include patrolling and thermo-vision scanning. The supervisors and managers entrusted with O&M responsibilities will be intensively trained for necessary skills and expertise for handling these aspects. A monthly preventive maintenance program will be carried out to disclose problems related to cooling oil, gaskets, circuit breakers, vibration measurements, contact resistance, condensers, air handling units, electrical panels and compressors. Any sign of soil erosion will also be reported and rectified. Monitoring results will be published monthly, including a report of corrective action taken and a schedule for future action.

Poly-chlorinated biphenyls (PCBs) management

75. Poly Chlorinated Biphenyls (PCBs) due to its high heat capacity, low flammability and low electrical conductivity was extensively used as insulating material in capacitors and transformers. But after the finding that these PCBs are non-biodegradable and has carcinogenic tendency, its use in electrical equipments as insulating medium has been banned all over the world long back. However, it has been reported in some studies that chances of contamination of oil with PCB is possible. Keeping that in mind, POWERGRID has taken all possible steps in association with NGC, UK and setup Regional testing laboratories for testing of existing oil for PCB traces and results of this suggests that PCB contamination is not an issue with POWERGRID.

76. POWERGRID has discontinued procurement of poly-chlorinated biphenyls (PCBs) transformer oil and pure hydrocarbon mineral oil is being used. New transformers and capacitors to be purchased will not have any adverse environmental impacts. Used transformer oil will be collected and reclaimed by authorized contractors. Scrap will be collected and disposed of in compliance with the Environmental Protection Act, 1986, and applicable regulations and rules. POWERGRID's current technical specification for transformer oil and

practices of reclamation of used transformer oil shows its capability of handling process-generated wastes to minimize adverse environmental effects. POWERGRID will comply with India's Environmental Protection Act and other applicable regulations for the handling of used transformer oil. All new transformer and capacitors purchased by POWERGRID will be PCB-free and specifications in the bidding documents will be made accordingly. POWERGRID has set up regional testing laboratories for testing of existing oil for PCB traces. No significant concentrations of PCBs have been detected.

Chlorofluorocarbons (CFCs) management

77. Similarly processes, equipment and central cooling systems involving the use or potential release to the environment of chlorofluorocarbons (CFCs), including halon, shall not be installed, and their use, if any, in existing processes and systems will be phased out and these will be disposed of in a manner consistent with the requirements of the Government of India.

Electromagnetic fields (EMF)

78. POWERGRID is following the approved international standards and design, which are safe. Based on the studies carried out by different countries on the safety of extra high voltage (EHV) lines in reference to EMF effect, POWERGRID has carried out such studies on its design with Central Power Research Institute (CPRI), Bangalore and Power Technologies Inc (PTI), USA. The studies inferred that the designs are safe and follow the required international standards.

79. Because of issues relating to need to ensure health and safety relating to the line such as fire safety, safe voltages on metallic parts of buildings, and safety clearances to avoid flashover, the transmission lines will not pass directly over any residential properties and as such the potential for EMF effects to occur will be further diminished. Given that it will be necessary to ensure that there are no properties in the RoW beneath and to the sides of the overhead line, automatic mitigation against EMF will be provided between the source of potentially high strengths (the transmission line) and the residential properties.

80. The magnetic field below 400 kV overhead power transmission lines is estimated at 40 µT. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines present limiting exposure to EMFs, although it adds that the levels quoted should not be interpreted as distinguishing ‘safe’ from ‘unsafe’ EMF levels. The ICNIRP guideline for the general public (up to 24 hours a day) is maximum exposure levels of 1,000 mG or µ100 T. A study carried out by Central Power Research Institute (CPRI) on POWERGRID lines reveals that the EMF about 1 m above ground near a 400 kV single circuit transmission line range from 3-7.2 µT in the ROW. The impact of EMF is also dependent on the duration of exposure and therefore no significant adverse impact is envisaged. POWERGRID complies with international norms for field strength limits which are certified by Power Technologies Inc, USA. POWERGRID is following the approved international standards and design, which are absolutely safe.

Noise and Vibration

81. During the operational phase, the noise will come from the switchyard equipment only and not from the Transmission lines. The anticipated levels at a distance of 2 m from the equipment are about 60 to 70 dB. Since the new substations sites are planned to be away by at least 70 to 100 m away from the villages /schools and with adequate greenbelt by planting

bushes and trees along the substation perimeters, no significant additions are expected to the existing noise levels. However, the nearest village for the existing substation is about 70 m away from the substation site and therefore, no significant impacts are envisaged. The maximum noise level expected from the lines is about 40 dB.

Waste Management

82. Currently for the substation colony plantation the pesticides and herbicides are used as advised by the experts. It is recommended that POWERGRID adopt the usage of neem based or other bio-pesticides in place of chemical based pesticides and herbicides. This would prevent any groundwater and soil contamination.

83. Storage and liquid impoundment areas for fuels, raw and in-process materials, solvents, wastes and finished products will be designed with secondary containment (e.g. dykes) to prevent spills and the contamination of soil, groundwater and surface waters.

84. Normal operation of the substation sites will result in the generation of relatively small amounts of commercial type waste including paper, cardboard, plastics, food waste, etc., which will be disposed of properly.

Promoting undesirable rural-to urban migration

85. The project will not cause any submergence or loss of land holdings that normally trigger migration. It also does not involve acquisition of any private land holdings. Hence, there is no possibility of any migration.

V. ASSOCIATED FACILITIES, GHG EMISSION REDUCTION AND CUMULATIVE IMPACTS

Associated Facilities: Lower Subansiri-I And Kameng Hydro-Generation Project

85. National Hydro Electric Power Corporation-NHPC, a Government of India Undertaking has undertaken construction of Lower Subansiri-I Hydro-Electric Project (8x250 MW) in Arunachal Pradesh and Assam and North Eastern Electric Power Corporation, NEEPCO, a Government of India Undertaking has undertaken construction of Kameng Hydro-Electric Project (4x150 MW) in Arunachal Pradesh for generation of electricity. Public hearing is mandatory for all projects, as per Govt. of India. Notification no. 244 dtd 10 April 1997 covered under Schedule-1 of Environmental Protection Act, 1986 and still continue to be there under notification dt.14.09.06. Copies of Environment clearance and forest Clearance letters for both projects are available with POWERGRID.

Lower Subanshri-I Hydro-Electric Project

86. The Environmental proposal of Lower Subansiri was discussed before Appraisal Committee at Ministry of Environment and Forests (MOE&F)/GOI, New Delhi. On the recommendation of the committee, MOEF has issued *Environmental clearance on 16.07.2003 to* NHPC. It involves 3999 Ha. of Forest area. Ministry of Environment and Forests (MOEF) has issued in-principle (i.e.1st Stage) forest clearance to NHPC on 10.6.2003 and final clearance (i.e. 2nd Stage) on 12.10.2004 after compliance of condition stipulated in 1st Stage clearance for diversion of 3999 Ha. forest area (Arunachal Pradesh-3183.0 ha. & Assam-816.3). Out of 3183.0 ha.of forest area in Arunachal Pradesh, Tale Valley wild life sanctuary area-42 Ha. is

also involved for which MEOF has accorded wild life clearance on 27.05.2003 after having IBWL (Indian Board for Wild Life) and Hon'ble Supreme Court (SC) concurrences as prior permission from SC is required for any activity on Wildlife Sanctuary/National park. NHPC undertook EIA study and EIA report was submitted to MOEF, New Delhi. Public hearings were also conducted in Arunanchal Pradesh and Assam.

Kameng Hydro Electric Project

87. The Environmental proposal of Kameng Hydro Electric Project was discussed before Appraisal Committee at Ministry of Environment and Forests (MOE&F) New Delhi. On the recommendation of the committee, MOEF has issued *Environmental clearance on 29.03.2001 to* NEEPCO. It involves 710 Ha Forest areas. NEEPCO has taken Forest clearance from MoE&F on 03.08.2000. There is no Wildlife Sanctuary/National Park involved in this project. NEEPCO undertook EIA study and EIA report was submitted to MoE&F, New Delhi and public hearing was conducted in Arunachal Pradesh.

88. The details of public consultation of the both projects are given below table 6.

Table 6: Consultations at Associated Facilities

S.No.	Place/State	Date
A.	**Lower Subansiri Hydro Electric Project (NHPC)**	
	Arunachal Pradesh	
1.	Zerhopoli	17.08.2001
2.	Daponjo	20.08.2001
3.	Along	20.08.2001
4.	Papumpure	24.08.2001
	Assam	
5.	Gerukhamuk NHPC complex/Assam	04.09.2001
B.	**Kameng Hydro Electric project (NEEPCO)**	
	Arunanchal Pradesh	
1.	Bomdila	17.11.1999

Green House Gas Emissions Reduction Potential

89. Specific global and local environmental benefits of the project include: Transfer of clean and green hydro power (Renewable energy) to load centres through displacement of highly polluting thermal power as well as improving energy efficiency by introduction of new technology that will reduce transmission losses.

90. The proposed project will reduce CO_2 emissions by replacing thermal generation at the demand site (Northern and Western regions) by transmitting about 3,100 MW of clean/green hydro power generated in phases in the remote and under developed North-eastern region of the country with negligible environment impact. It is estimated that about 257 million tons of CO_2 emission shall be reduced during the 30 year lifecycle of the transmission project based on about 3,100 MW of power transmission. However it may go up to 497 million tons of CO_2 in phased manner if proposed additional 3000 MW capacity is added. Revenue from carbon finance will therefore be a large percentage of annual interest payments and initial O&M costs while the system is being stabilized in the first several years.

91. While marginal costs of power generation from hydro is very low, due to the capital-intensive nature of this project the transmission tariff is expected to be high, especially in the early years when new hydro projects designed for the line are still being commissioned.

Therefore, the Ministry of Power has decided to assign all rights to the carbon finance revenue from hydro power generation and transmission to Powergrid as a means of offsetting this high transmission tariff cost. This will result in more competitive power delivered at the demand site, as compared to locally generated thermal power. This is especially important in light of recently announced mega-projects for thermal generation which are expected to have very low costs of power generation. State-level distribution companies are responsible for selecting the lowest cost option for power provision and this will help in ensuring that low emissions power from the NE region is as competitive as possible in states comprising the N and W grids.

92. Besides, alternatives for evacuating power from the NE region are limited, as the only connections that exist are lower capacity, lower voltage AC systems designed for localized links. They do not have the capacity at the current time to handle the large-scale evacuation of power, so without this project it is likely that the large-scale development of hydro power development in the NE region would not occur. Due to the "chicken neck" corridor, geography between the NE and E regions, it is unlikely that right-of-ways for enough AC lines could even be obtained through the corridor.

93. Table 7 gives the estimates of GHG Emissions abated:

Table 7: Estimate of Greenhouse Gases abatement

1	Indicative CER/ERU or VER Price (subject to negotiation)		US $ 6 per ton
2	Total Emission Reduction Purchase Agreement (ERPA) Value	CO2 Sequestered (in metric tons of CO2-equivalent) Annual:	
3	A period until 2012 (end of the first budget period)	8.55 million tons of CO2 using an emissions factor for the Northern grid of India of 0.7 kgCO2e / kWh (estimate) and up to and including 2012: 12.8 million tons CO2-equivalent	77 million US$*
4	A period of 10 years	85.5 million tons CO2-equivalent (that will go up to 166 million tons CO2-equivalent with addition of 3000 MW	513 million US$*
5	A period of 7 years	59.9 million tonsCO2-equivalent (that will go up to 115.9 million tons CO2-equivalent with addition of 3000 MW Hydro projects	359 million US$*
6	A period of 14 years (2 * 7 years)	119.8 million tonsCO2-equivalent (that will go up to 232 million tons CO2-equivalent with addition of 3000 MW Hydro projects	719 million US$*

- Basis of calculation 3100 MW only.
- Basis of calculation full planned capacity of 6000 MW.

Potential Cumulative and Induced Impacts

94. The proposed Investment Program does entail potential cumulative and induced impacts, which are considered largely positive. POWERGRID will transfer low-carbon energy from hydropower plants in Assam to state-level transmission companies (TRANSCOs), that, in turn, will wheel energy to distribution companies (DISCOMs). Direct negative impacts might result from (i) acquisition of additional right-of-way (RoW) and land by TRANSCOs and DISCOMs for transmission lines and substations, and (ii) impacts associated with hydropower and future gas based plants in Assam and other states.

95. Positive impacts include (i) expansion of low-carbon energy, offsetting emissions from thermal power plants, (ii) transmission system efficiency improvements and renewable energy, and (iii) economic growth related to improved power supplies to millions of consumers. The

cumulative emissions offsets are estimated as follows: (i) 257 million tons of carbon dioxide equivalent that may go up to 497 million tons of carbon dioxide equivalent in thirty years, (ii) 2.8 million tons of sulfur dioxide, (iii) 1.4 million tons of nitrogen oxides, and (iv) 0.5 million tons of particulate matter (each in twenty years). These emissions offsets will ameliorate negative impacts of local, regional, and global air pollution.

Socio-economic aspects

96. Direct benefits include employment creation, capital required, foreign exchange effects etc. Direct employment opportunities in the project shall be limited but indirectly the project will create thousands of employment opportunities for local people of the regions due to POWERGRID's policy is to provide preference for local people for unskilled and semi-skilled job through its contractor. Apart from these many other avenues will be opened for entire population of the area for their livelihood including other infrastructure facilities like roads, hospitals, school etc. The project will bring much needed clean/green hydro power from far-flung area of the country to the most densely populated region of the country. The development of hydro project as well as the present transmission project shall enable creation of employment for local people which shall help in uplifting the economic status of people at both ends of the project spectrum.

97. In northern region, the availability of power will push the desired improvement in infrastructure and industrial growth which is hampered due to non availability of reliable power in the region. These industrial activities shall help in creation of employment for local people which shall boost their economic status. Since the proposed project is for development of reliable power network all communities will get the benefit of proposed project.

VI. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MANAGEMENT PLAN

98. An outline environmental management and monitoring plan (EMP) has been prepared based on best practices and to ensure that the occurred impacts are minimized wherever possible. A summary of the impacts environmental impacts and associated mitigation measures are provided the enclosed EMP. The EMP considers impacts during the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. More detailed, site-specific mitigation measures and monitoring plans for all the subprojects were provided in the IEE report prepared by POWERGRID. A summary of monitoring requirements to indicate monitoring indexes and monitoring schedule. The details of the relevant environmental legislations applicable to the project activities are provided in the IEE report.

99. Monitoring the implementation of environmental mitigation measures is required to ensure that these are undertaken in accordance with the EMP, and to enable mitigation to be adapted and refined as required. Auditing the success of implemented mitigation is also required to identify ineffective measures or implementation procedures, and thus enabling the design and incorporation of improved measures and the implementation of corrective actions. Estimated costs are envisaged for the monitoring elements. Independent audit costs have been subsequently identified (Table 10).

100. A summary of the environmental mitigation measures and monitoring requirements is given in Table 8 below.

TABLE 8: ENVIRONMENTAL MANAGEMENT PLAN

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
Pre-construction						
Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and line alignment selection with respect to nearest dwellings	Setback distances to nearest houses – once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems not to use chlorofluorocarbons (CFCs), including halon, and their use, if any, in existing processes and systems should be phased out and to be disposed of in a manner consistent with the requirements of the Government	Process, equipment and system design	Exclusion of CFCs stated in tender specification – once	POWERGRID	Part of tender specifications for the equipment
				Phase out schedule to be prepared in case still in use – once		Part of equipment and process design
Transmission line design	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference from overhead power lines	Electromagnetic field strength for proposed line design	Line design compliance with relevant standards - once	POWERGRID	Part of detailed alignment survey and design
Location of transmission towers and transmission line alignment and design	Impact on water bodies and land	Consideration of tower location at where they could be located to avoid water bodies or agricultural land.	Tower location and line alignment selection (distance to water and/or agricultural land)	Consultation with local authorities and land owners - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
	Social inequities	Careful route selection to avoid existing settlements	Tower location and line alignment selection (distance to nearest dwellings or social institutions)	Consultation with local authorities and land owners - once	POWERGRID	Part of detailed tower siting and alignment survey and design

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Minimise need to acquire agricultural land	Tower location and line alignment selection (distance to agricultural land)	Consultation with local authorities and land owners - once	POWERGRID	Part of detailed tower siting and alignment survey and design
Involuntary resettlement or land acquisition	Social inequities	Compensation paid for temporary/ permanent loss of productive land as per LAA & its process	RAP implementation	Consultation with affected parties – once in a quarter	POWERGRID	Prior to construction phase
Encroachment into precious ecological areas	Loss of precious ecological values/ damage to precious species	Avoid encroachment by careful site and alignment selection	Tower location and line alignment selection (distance to nearest designated ecological protection area)	Consultation with local authorities - once	POWERGRID	Part of detailed siting and alignment survey /design
		Minimise the need by using existing towers and RoW wherever possible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed siting and alignment survey/design
Transmission line through forestland	Deforestation and loss of biodiversity	Avoid encroachment by careful site and alignment selection	Tower location and line alignment selection (distance to nearest protected or reserved forest)	Consultation with local authorities - once	POWERGRID	Part of detailed siting and alignment survey/design
		Minimise the need by using existing towers, tall towers and RoW, wherever possible		Consultation with local authorities and design engineers - once		
		Obtain statutory clearances from the Government	Statutory approvals from Government	Compliance with regulations – once for each subproject		
Encroachment into farmland	Loss of agricultural productivity	Use existing tower footings/towers wherever possible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed alignment survey and design
		Avoid siting new towers on farmland wherever feasible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once		Part of detailed siting and alignment survey /design

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Farmers compensated for any permanent loss of productive land	Design of Implementation of Crop Compensation (based on affected area)	Consultation with affected parties – once in a quarter		Prior to construction phase
		Farmers/landowners compensated for significant trees that need to be trimmed/ removed along RoW.	Design of Implementation of Tree compensation (estimated area to be trimmed/removed)	Consultation with affected parties – once in a quarter		Prior to construction phase
			Statutory approvals for tree trimming /removal	Compliance with regulations – once for each subproject		Part of detailed siting and alignment survey /design
Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a nuisance.	Noise levels	Noise levels to be specified in tender documents - once	POWERGRID	Part of detailed equipment design
Interference with drainage patterns/Irrigation channels	Flooding hazards/loss of agricultural production	Appropriate siting of towers to avoid channel interference	Tower location and line alignment selection (distance to nearest flood zone)	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed alignment survey and design
Escape of polluting materials	Environmental pollution	Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill cleanup equipment.	Equipment specifications with respect to potential pollutants	Tender document to mention specifications - once	POWERGRID	Part of detailed equipment design /drawings
Equipment submerged under flood	Contamination of receptors (land, water)	Substations constructed above the high flood level (HFL) by raising the foundation pad.	Design to account for HFL (elevation with respect to HFL elevation)	Base height as per flood design - once	POWERGRID	Part of detailed substation layout and design /drawings
Explosions/Fire	Hazards to life	Design to include modern fire control systems/firewalls.	Design compliance with fire prevention and control codes	Tender document to mention detailed	POWERGRID	Part of detailed layout and design /drawings

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Provision of fire fighting equipment to be located close to transformers.		specifications - once		
Construction						
Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection seeking to minimize ground disturbance.	Construction techniques and machinery	Construction techniques and machinery creating minimal ground disturbance - once at the start of each construction phase	POWERGRID (Contractor through contract provisions)	Construction period
Physical construction	Disturbed farming activity	Construction activities on cropping land timed to avoid disturbance of field crops (within one month of harvest wherever possible).	Timing of start of construction	Crop disturbance –Post harvest as soon as possible but before next crop - once per site	POWERGRID (Contractor through contract provisions)	Construction period
Mechanized construction	Noise, vibration and operator safety, efficient operation	Construction equipment to be well maintained.	Construction equipment – estimated noise emissions	Complaints received by local authorities - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
	Noise, vibration, equipment wear and tear	Turning off plant not in use.	Construction equipment – estimated noise emissions and operating schedules	Complaints received by local authorities - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Construction of roads for accessibility	Increase in airborne dust particles	Existing roads and tracks used for construction and maintenance access to the line wherever possible.	Access roads, routes (length and width of new access roads to be constructed)	Use of established roads wherever possible - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
	Increased land requirement for temporary accessibility	New access ways restricted to a single carriageway width within the RoW.	Access width (meters)	Access restricted to single carriageway width within RoW - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
Temporary blockage of utilities	Overflows, reduced discharge	Temporary placement of fill in drains/canals not permitted.	Temporary fill placement (m^3)	Absence of fill in sensitive drainage areas - every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m^2)	Clearance strictly limited to target vegetation - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Trimming/cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in meters)	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period
	Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period
		Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies.	Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m^2)	Use or intended use of vegetation as approved by the statutory authorities – once per site	POWERGRID (Contractor through contract provisions)	Construction period
Wood/vegetation harvesting	Loss of vegetation and deforestation	Construction workers prohibited from harvesting wood in the project area during their employment, (apart from locally employed staff continuing current legal activities).	Illegal wood /vegetation harvesting (area in m^2, number of incidents reported)	Complaints by local people or other evidence of illegal harvesting - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings disposed of by placement along roadsides, or at nearby house blocks if requested by landowners.	Soil disposal locations and volume (m^3)	Acceptable soil disposal sites - every 2 weeks	POWER GRID (Contractor through contract provisions)	Construction period

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
Site clearance	Vegetation	Tree clearances for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed.	Ground disturbance during vegetation clearance (area, m^2)	Amount of ground disturbance - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
			Statutory approvals	Statutory approvals for tree clearances – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
Tower construction – disposal of surplus earthwork/fill	Waste disposal	Excess fill from tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner.	Location and amount (m^3)of fill disposal	Appropriate fill disposal locations - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Storage of chemicals and materials	Contamination of receptors (land, water, air)	Fuel and other hazardous materials securely stored above high flood level.	Location of hazardous material storage; spill reports (type of material spilled, amount (kg or m^3) and action taken to control and clean up spill)	Fuel storage in appropriate locations and receptacles - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Construction schedules	Noise nuisance to neighbouring properties	Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [dB(a)])	Daytime construction only - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities - once each new facility	POWERGRID (Contractor through contract provisions)	Construction period
Encroachment into farmland	Loss of agricultural productivity	Use existing access roads wherever possible	Usage of existing utilities	Complaints received by local people /authorities - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
		Ensure existing irrigation facilities are maintained in working condition	Status of existing facilities			

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Protect /preserve topsoil and reinstate after construction completed	Status of facilities (earthwork in m^3)			
		Repair /reinstate damaged bunds etc after construction completed	Status of facilities (earthwork in m^3)			
	Social inequities	Compensation for temporary loss in agricultural production	Implementation of Crop compensation (amount paid, dates, etc.)	Consultation with affected parties – once in a quarter	POWERGRID	Prior to construction
Uncontrolled erosion/silt runoff	Soil loss, downstream siltation;	Need for access tracks minimised, use of existing roads.	Design basis and construction procedures (suspended solids in receiving waters; area re-vegetated in m^2; amount of bunds constructed [length in meter, area in m^2, or volume in m^3])	Incorporating good design and construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
		Limit site clearing to work areas				
		Regeneration of vegetation to stabilise works areas on completion (where applicable)				
		Avoidance of excavation in wet season				
		Water courses protected from siltation through use of bunds and sediment ponds				
Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices.	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
		As much as possible existing access ways will be used.	Design basis and layout	Incorporating good design engineering practices – once for each site		

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Productive land will be reinstated following completion of construction	Reinstatement of land status (area affected, m^2)	Consultation with affected parties – twice – immediately after completion of construction and after the first harvest		
	Social inequities	Compensation will be paid for loss of production, if any.	Implementation of Tree/Crop compensation (amount paid)	Consultation with affected parties – once in a quarter	POWERGRID	Prior to construction
Flooding hazards due to construction impediments of natural drainage	Flooding and loss of soils, contamination of receptors (land, water)	Avoid natural drainage pattern /facilities being disturbed /blocked /diverted by the on-going construction activities	Contract clauses (e.g., suspended solids and BOD/COD in receiving water)	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
Equipment submerged under flood	Contamination of receptors (land, water)	Equipment stored at secure place above the high flood level (HFL).	Store room level to be above HFL (elevation difference in meters)	Store room level as per flood design - once	POWERGRID	Construction period
Inadequate siting of borrow areas	Loss of land values	Existing borrow sites will be used to source aggregates, therefore, no need to develop new sources of aggregates	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
Health and safety	Injury and sickness of workers and members of the public	Contract provisions specifying minimum requirements for construction camps	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	Contract clauses compliance – once every quarter	POWERGRID (Contractor through contract provisions)	Construction period
		Contractor to prepare and implement a health and safety plan.				
		Contractor to arrange for health and safety training sessions				

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
Inadequate construction stage monitoring	Likely to maximise damages	Training of POWERGRID environmental monitoring personnel	Training schedules	Number of programs attended by each person – once a year	POWERGRID	Routinely throughout construction period
		Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements	Respective contract checklists and remedial actions taken thereof.	Submission of duly completed checklists of all contracts for each site - once		
		Appropriate contact clauses to ensure satisfactory implementation of contractual environmental mitigation measures.	Compliance report related to environmental aspects for the contract	Submission of duly completed compliance report for each contract - once		
Operation and Maintenance						
Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Compliance with setback distances (“as-built” diagrams)	Setback distances to nearest houses – once in quarter	POWERGRID	During operations
Equipment submerged under flood	Contamination of receptors (land, water)	Equipment installed above the high flood level (HFL) by raising the foundation pad.	Substation design to account for HFL (“as-built” diagrams)	Base height as per flood design - once	POWERGRID	During operations
Oil spillage	Contamination of land/nearby water bodies	Substation transformers located within secure and impervious bunded areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substation bunding (“as-built” diagrams)	Bunding capacity and permeability - once	POWERGRID	During operations
Inadequate provision of staff/workers health and safety during operations	Injury and sickness of staff /workers	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (lost work days due to illness and injuries)	Preparedness level for using these technologies in crisis – once each year	POWERGRID	Design and operation

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Safety awareness raising for staff.	Training/awareness programs and mock drills	Number of programs and percent of staff /workers covered – once each year		
		Preparation of fire emergency action plan and training given to staff on implementing emergency action plan				
		Provide adequate sanitation and water supply facilities	Provision of facilities	Complaints received from staff /workers every 2 weeks		
Electric Shock Hazards	Injury/mortality to staff and public	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (number of injury incidents, lost work days)	Preparedness level for using these technologies in crisis – once a month	POWERGRID	Design and Operation
		Security fences around substations	Maintenance of fences	Report on maintenance – every 2 weeks		
		Barriers to prevent climbing on/dismantling of transmission towers	Maintenance of barriers			
		Appropriate warning signs on facilities	Maintenance of warning signs			
		Electricity safety awareness raising in project areas	Training /awareness programs and mock drills for all concerned parties	Number of programs and percent of total persons covered – once each year		
Operations and maintenance staff skills less than acceptable	Unnecessary environmental losses of various types	Adequate training in O&M to all relevant staff of substations and transmission line maintenance crews.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Preparation and training in the use of O&M manuals and standard operating practices.				
Inadequate periodic environmental monitoring.	Diminished ecological and social values.	Power Grid staff to receive training in environmental monitoring of project operations and maintenance activities.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation
Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems using cholofluorocarbons (CFCs), including halon, should be phased out and to be disposed of in a manner consistent with the requirements of the Government.	Process, equipment and system design	Phase out schedule to be prepared in case still in use – once in a quarter	POWERGRID	Operations
Transmission line maintenance	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference from overhead power lines	Required ground clearance (meters)	Ground clearance - once	POWERGRID	Operations
Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a nuisance.	Noise levels (dB(a))	Noise levels at boundary nearest to properties and consultation with affected parties if any - once	POWERGRID	Operations

A. Responsibilities for Monitoring

101. Monitoring is a continuous process at all the stages be it the site selection, construction or maintenance. Apart from the site managers reviewing the progress on daily basis, regular project review meetings would be held at least on monthly basis, chaired by the Executive Director of the region wherein the environmental aspects of the projects would be discussed, and remedial measures taken wherever required. The exceptions of these meetings will be submitted to the Directors and Chairman and Managing Director of POWERGRID. Following is the existing organization support system in POWERGRID for proper implementation and monitoring of environmental & social management plans:

Corporate Level

102. An Environmental Management Cell at corporate level has been created within POWERGRID in 1992 and subsequently upgraded to an Environment Management Department (EMD) in 1993 and in 1997 it has been further upgraded to Environment & Social Management Department (ESMD). Currently 8 professionals form the corporate level team (i.e. ESMD). Briefly, the ESMD's responsibilities are as follows:

- Advising and co-ordinating regional and divisional head quarters (RHQs and DHQs) to carry out environmental and social surveys for new projects.
- Assisting RHQs and DHQs to finalise routes of entire power transmission line considering environmental and social factors that could arise en-route.
- Help RHQs and DHQs to follow-up with the state forest offices and other state departments in expediting forest clearances and the land acquisition process of various ongoing and new projects.
- Act as a focal point for interaction with the MOEF for expediting forest clearances and follow-ups with the Ministry of Power.
- Imparts training to POWERGRID’s RHQs & DHQs on environment and social issues and their management plan.

Regional Level

103. At its regional office POWERGRID has an Environmental and Social Management cell (ESMC) to manage environmental and social issues and to coordinate between ESMD at the corporate level and the divisional headquarters. Currently 14 professionals from 7 regional offices form the regional level teams (i.e. ESMC). The key functions envisaged for ESMC are:

- Advising and coordinating field offices to carry out environmental and social surveys for new projects envisaged in the corporate investment plan.
- Assisting the ESMD and DHQs to finalize routes of entire power transmission lines considering the environmental and social factors that could arise en-route.
- To follow-up forest clearances and land acquisition processes with state forest offices and other state departments for various ongoing and new projects.
- Acting as a focal point for interaction with the ESMD and DHQs on various environmental and social aspects.

Site Office

104. At the divisional headquarters level, POWERGRID has made the head of the division responsible for implementing the environmental and social aspect of project and is termed as Environmental and Social Management Team (ESMT). Currently about 35 to 40 officers at various sites form the site level teams (i.e. ESMT). Key functions of the ESMT are:

- Conduct surveys on environmental and social aspects to finalize the route for the power transmission projects.
- Conduct surveys for the sites to being considered for land acquisition.
- Interact with the forest departments to make the forest proposal and follow it up for MOEF clearance.
- Interact with revenue authorities for land acquisition and follow it up with authorized agencies for implementation of social management plan (SMP).
- Implementation of environment management plan and SMP.
- Monitoring of environment management plan and SMP and producing periodic reports on the same.

Environmental Review Process

105. Periodic review by corporate ESMD and higher management including review by POWERGRID CMD of all environmental and social issues is under taken to ensure that EMP and other measures are implemented at site. Besides it annual review by independent Auditor under ISO: 14001 shall also be undertaken for compliance of agreed policy and management plan. Monitoring of impacts on ecological resources for Forest, Sanctuary or National Park, it is generally done by the concerned Divisional Forest Officer, Chief Wildlife Warden and their staff as a part of their normal duties. A monitoring system (done by the Forest Department) is also in place for compensatory forests established as part of the Project.

106. Environmental monitoring will consist of routine systematic checking that the above mitigation measures have been implemented effectively during each stage of the project.

Table 9: Summary Environmental Monitoring Plan

Environmental Monitoring Tasks[2]	Implementation Responsibility	Implementation Schedule
Pre Construction Phase		
Audit project bidding documents to ensure EMP is included.	POWERGRID through project implementation unit	Prior to issue of bidding documents.
Monitor contractor's detailed alignment survey to ensure relevant environmental mitigation measures in EMP have been included.	POWERGRID with assistance of project implementation unit	Prior to POWERGRID approval of contractor's detailed alignment survey.
Audit detailed designs of transmission lines towers to ensure standard environmental safeguards/mitigation measures (as identified in EMP) have been included.	POWERGRID with assistance of project implementation unit	Prior to POWERGRID approval of contractor's detailed designs.
Construction Phase		
Regular monitoring and reporting of contractor's compliance with contractual environmental mitigation measures.	POWERGRID with assistance of project implementation unit	Continuous throughout construction period.
Operation and Maintenance Phase		
Observations during routine maintenance inspections of transmission lines RoWs. Inspections will include monitoring implementation status of	POWERGRID	As per POWERGRID inspection schedules

[2] Monitoring of issues related to compensation of landowners for land acquisition and loss of production, etc. are addressed in the Resettlement Action Plan.

Environmental Monitoring Tasks[2]	Implementation Responsibility	Implementation Schedule
mitigation measures specified in EMP.		

107. POWERGRID is well equipped to implement and monitor its EMP. As regards to monitoring of impacts on ecological resources particularly in forest, sanctuary or national park, it is generally done by the concerned divisional forest officer, chief wildlife warden and their staff. A monitoring system (by the forest department) is also in place for compensatory forests established as part of the Project. Since no requirement of diversion of forestland is envisaged for the proposed installation of HVDC transmission lines in the Northeastern-Northern/Western Inter corridor, compensatory forestation is not presently envisaged.

108. The EMP will be reviewed by POWERGRID not less than 2 months prior to proposed commencement of work. Implementation of mitigation measures and monitoring will be supervised by POWERGRID and ensure compliance in terms of EMP and IEE commitments.

109. The POWERGRID will be the Executing Agency (EA) for the Project. A Social, Resettlement and Environment Implementation Unit (SREIU) will be established for each subproject, headed by concerned head of the region, which will be accountable and responsible for implementation of the EMP. Each unit will have a designated environment officer to co-ordinate implementation of the EMP.

110. The SREIUs will also be responsible for internal monitoring, quality control, and progress reports on implementation of the EMP. The implementation period of EMP shall be a time bound activity. The SREIU will submit a comprehensive report on the compliance of EMP to ADB in an acceptable format biannually.

.

B. Preliminary Cost Estimates

111. Cost estimate summaries for the implementation of environmental mitigation measures, and monitoring costs for the core subprojects are provided in Table 10 below.

Table 10: Summary of Estimated Costs* for EMP Implementation

Item	Sub –Item	Total Cost (Rs. in million)
Mitigation measures	As prescribed under EMP and IEE As prescribed in CPTD	196.93 212.56
Contractors scope of EMP Implementation	As prescribed in EMP	10.00
Implementation & Monitoring activities	As detailed under EMP	18.17
Independent Audit		1.82
Contingency	3 %	12.88
Total Rs. 452.34 Million		

* Estimated costs are only indicative

VII. PUBLIC CONSULTATION AND DISCLOSURE

112. As part of the walkover survey, Power Grid undertook some preliminary consultation exercises with the government authorities, local community groups, and members of the public. For the transmission line segments, the consultations were conducted by a consultant, under the supervision of POWERGRID. Further structured consultations will continue to take place during the design phase. A summary of the consultations carried out thus far is provided below in Table 11.

Table 11: Details of the Public Consultations

S. No.	Name of Transmission Line	Village	Date	No. of People	Remarks
1.	± 800 KV HVDC Biswanath Charali - Bongaigaon Transmission Line	Saikia Chuburi	03.05.07	41	Meeting attended by Gram Pradhan, School Teacher and Villagers etc.
		-Hapa Gaon (	10.06.07	29	
		Singimari	24.06.07	163	
		Jamadarbari (	10.06.07	55	
		Sarangia	10.06.07	46	
2.	± 800 KV HVDC Bongaigaon-Saharsa Transmission Line	West Barogharia	03.07.07	22	Public consultation program, pamphlets
		Sarada Pally	03.07.07	23	
		Petki	04.07.07	22	
		Lichipukuri	04.07.07	22	
3.	800 KV HVDC Saharsa – Gorakhpur TL	Rampur	04.06.2007	16	Public concentration program, pamphlets
		Singhiya Khurd	04.06.2007	16	
		Husepur	04.06.2007	16	
		Anant Kamtaul	03.06.2007	16	
		Lalu Chapra	05.06.2007	17	
		Shampur	05.06.2007	17	
		Balbhadrapatti	29.06.2007	20	
		Ramnagar	29.06.2007	18	
4.	± 800 KV HVDC Gorakhpur-Agra Transmission Line	Bhaktipur	16.06.07	17	Meeting attended by Gram Pradhan, School Teacher and Villagers etc.
		Lalpur	17.06.07	20	
		Raipur	28.06.07	12	
		Rampur	29.06.07	14	
		Nagari	27.06.07	14	
		Usraha	28.06.07	20	
		Bahaudeenpur	29.06.07	18	
		Raghu nath khera	10.05.07	8	
		Laharipurwa	12.05.07	10	
		Jaitipur	12.05.07	7	
		Fatehabad	25.04.07	15	
		Bhadan	25.04.07	10	
		Mainpuri	25.04.07	12	
		Safai	25.04.07	15	
		Bahadurpur	25.04.07	10	
		Simaria	26.04.07	10	
		Kuderkot	27.04.07	15	
		Kakwan	27.04.07	10	
		Bithur	27.04.07	07	
		Ajgian	28.04.07	10	
		Paripar	28.04.07	20	

113. The objectives of these consultations were as follows:

(i) Disseminating information on the project to the stakeholders and thereby helping them better understand the trade-offs between Project benefits and disadvantages.

(ii) Helping identify key causes of environmental problems.
(iii) Gaining a better understanding of existing environmental conditions.
(iv) Helping the stakeholders contribute meaningfully to the Project design.
(v) Gaining greater trust with the Project proponent and support for the Project.
(vi) Reducing potential conflicts and substantial delays.
(vii) Helping recognize possible alternatives.
(viii) Helping to establish a comprehensive environmental management plan by incorporating local input and know-how.
(ix) Helping to determine Project programs that fit the needs and priorities of the affected people.
(x) Ensuring the sustainability of the Project.

114. The information provided at these consultations was well received. It was clear that people in the subproject areas, in general, welcomed the Project in terms of the socio-economic benefits that it will bring. Most of the issues raised were typical for power transmission line projects. The most concerned issues identified were related to social and safety. The consultations provided an opportunity to inform stakeholders of the nature of the Project, and to clarify certain issues of concern at this early stage. Moreover, the public consultation meetings helped POWERGRID to understand the existing local conditions.

115. The plan of further public consultations is given in table 12.

Table 12: Schedule of public consultations

S.No.	Activity	Technique	Schedule
1.	Walk over Survey	Informal group discussion	Completed
2.	Preliminary / GIS Survey	Group discussion, one to one meeting	Under Progress
3.	Detailed/Check survey	Public Meeting at different places (50-100 Km) en-route final route alignment of line	1-2 such meeting during Jauary'08 to April'08
4.	Construction Phase	Localized group meeting, Pamphlet/Information brochures, Public display etc.	During entire construction period March-08-09
5.	O&M Phase	Information brochures, Operating field offices, Response to public enquiries, Press release etc.	Continuous process as and when required.

Informal Group Meetings

116. Besides the scheduled Public Consultation meetings numbers of informal group meetings with local people were conducted at different villages along the route of the proposed alignment. Large people attended the meeting and welcomed the construction of the proposed project and asked for timely payment of compensation. However, regarding their query on village electrification and free electricity supply Power Grid informed that State government distributes to the consumers/village and it is their function and Power Grid does have any direct role in this matter. As per planning of Govt. of India all villages are supposed to be electrified by 2012. Table 13 below gives details for informal discussions.

Table 13: informal Discussions

No	Name of Transmission Line	Village	Date	No. of People	Remarks
1.	± 800 KV HVDC Biswanath Charali - Bongaigaon Transmission Line	Nagshankar Dt.Sonitpur	20/11/06	25	School Teacher Villagers, Panchayat representative attended
		Kokakuli Dt.Sonitpur	05/10/06	20	
		Thelamara Dt. Sonitpur	12/12/06	19	
		Baligaon Dt. Udalgari	05/05/06	30	
		Awnajuli Dt.Udalguri	07/07/06	16	
		Batabari Dt. Udalguri	15/11/06	26	
		Udalguri Dt.Udalguri	07/06/06	29	
		Silakuti Dt. Bagsa	10/05/06	17	
		Ahompathar Dt:.Barpeta	09/09/06	22	
		Khagrabari Dt.Chirang	14/09/06	19	
2.	± 800 KV HVDC Bongaigaon-Saharsa Transmission Line	Pundibari	15.06.07	15	Includes various stack, village panchayat representative, school teacher, residents of villages etc.
		Tangramari	15.06.07	12	
		Putimari	16.06.07	13	
		Fakirpara	16.06.07	14	
		Rajganj	22.06.07	20	
		Balabari	22.06.07	20	
		West Barogharia	03.07.07	22	
		Sarada Pally	03.07.07	23	
		Petki	04.07.07	22	
		Lichipukuri	04.07.07	22	
3.	800 KV HVDC Saharsa – Gorakhpur TL	Rampur	20.05.2007	20	Includes various stack, village panchayat representative, school teacher, residents of villages etc.
		Kishanpur	20.05.2007	11	
		Khajuri	20.05.2007	16	
		Singhiya Khurd	21.05.2007	12	
		Husepur	21.05.2007	13	
		Anant Kamtaul	22.05.2007	16	
		Rasulpur	22.05.2007	15	
		Lalu Chapra	22.05.2007	17	
		Bagani	24.05.2007	16	
		Shampur	24.05.2007	19	
		Balbhadrapatti	26.05.2007	20	
		Pipra	26.05.2007	11	
		Ramnagar	29.05.2007	18	
4.	± 800 KV HVDC Gorakhpur-Agra Transmission Line	Bhaktipur	1.05.07	8	Meeting attended by Villager's and Woman of the village, School Teacher and representative of panchayat etc.
		Bhahwat pur	1.05.07	7	
		Lalganj	3.05.07	6	
		Raineya	3.05.07	9	
		Lalpur	7.05.07	12	
		Nutan purwa	7.05.07	7	
		Barapurwa	9.05.07	6	
		Akbarpur	9.05.07	5	
		Lalpal pur	10.05.07	11	
		Raipur	10.05.07	9	
		Raghu nath khera	10.05.07	8	
		Laharipurwa	12.05.07	10	
		Jaitipur	12.05.07	7	
		Fatehabad	25.04.07	15	
		Bhadan	25.04.07	10	
		Mainpuri	25.04.07	12	
		Safai	25.04.07	15	
		Bahadurpur	25.04.07	10	
		Simaria	26.04.07	10	
		Kuderkot	27.04.07	15	
		Kakwan	27.04.07	10	
		Bithur	27.04.07	07	
		Ajgian	28.04.07	10	

117. The EMP prepared for sub projects will be translated into local language(s) and made available at the village/community level. Copies of EMPs will be available at the local level to stakeholders for local inputs. A Grievance Redressal Committee (GRC) will be set up by POWERGRID in each of the sub project location to address all concerns and grievances of the local communities and affected parties (APs). The GRC will be established with the commencement of the land acquisition process. The GRC will comprise of representatives from local authorities, and village panchayat, well reputed persons from health, education sectors, as mutually agreed with the local authorities and APs. This committee will address the Project related grievances of the APs and will provide them a public forum to raise their concern or objections regarding the assistance. POWERGRID will be represented by a senior official. The GRC will be locally located and functional so as to ensure easy access to communities and APs. The EA will be responsible to disseminate information about the functional norms of the GRC. The committee will meet at least twice in a year or as and when required.

VIII. FINDINGS AND RECOMMENDATIONS

118. This SIEE has identified that, no significant environmental impacts are expected to occur during the project implementation. Environmental impacts are likely to result from the proposed development but none are considered significant. Those impacts that do occur can be reduced through the use of mitigation measures, most of which will be standard methods of working for construction sites, or through the careful selection of access road routes.

119. The Project has no emissions since only transmission lines are involved. Consequently, there will be no cumulative impacts. Further the project will neither divide animal habitats nor cause substantial change of vegetation. It has not been possible to precisely predict the impacts that are likely to occur at tower locations and those that may occur resulting from the construction of transmission lines and temporary access roads leading to sites as these have yet to be detailed. It is recommended that access control will be adopted during construction of the roads allowing high safety and low disturbance to the local community and ecosystem.

120. However, no impacts are expected beyond those already predicted that would change the conclusions of this report. Extra care will be taken during the detailed design phase to take into account the unknowns and ensure that appropriate procedures are incorporated as part of the construction works. This will be achieved through the use of an EMP, an outline of which is provided in this SIEE.

121. It is considered that with careful mitigation and monitoring, none of the environmental impacts will be of significant concern. In addition, specific selection criteria and review/assessment procedures for candidate subprojects have been specified for future subprojects under the Project to ensure minimal impacts to take place and adequate mitigation and monitoring to address them.

122. There is an element of uncertainty for some components of the construction works and as many of these will be addressed during the work still to be undertaken. Where it will not be possible to address these specifically until the detail design phase, these will be addressed as part of the EMP. This will address the issues that must be taken into account as part of the detailed design to ensure that those environmental impacts that could not be specified or identified at this stage are taken account of and mitigated where necessary as part of the construction work.

IX. CONCLUSIONS

123. From the above discussion, it would seem that the area is not rich in physical resources. Careful route selection has minimized the impacts in ecologically/environmentally sensitive areas to the barest minimum so that the project is categorized as category B as per the ADB's safeguard policy requirements and India's environmental safeguard norms/framework. The expected affect is likely to involve both short-term temporary impacts during the construction phase and potential longer-term permanent impacts resulting from the operation of the facilities. The identified short-term impacts will be adequately mitigated, and the significance of the long-term lasting impacts can be considered minimal based on the successful implementation of the mitigation measures.

124. The construction of the overhead transmission line is likely to result in short-term environmental impacts. Permanent impacts are likely to be restricted to those on landscape and visual elements, which are not considered to be significant.

125. This study has not identified any environmental impacts that would necessitate a more detailed EIA to be conducted. However, an outline EMP has been prepared in order to ensure that mitigation measures identified are successfully implemented and environmental impacts are managed in an appropriate manner during the construction phase. A detailed EMP will be prepared by the POWERGRID prior to the construction works.

126. The Project will not result in any significant environmental impacts provided that recommended mitigation measures are properly implemented. Recommended mitigation measures should be incorporated into contract documents and should be vigorously monitored throughout each phase of the project. Appropriate training in environmental management and monitoring of power transmission projects should be provided to POWERGRID staff.

127. The IEE, including the environmental management plan and monitoring program is considered sufficient to meet the environmental assessment requirements for the Project. No further environmental assessment is required.

*INITIAL BUDGET ESTIMATE FOR EMP

A.	**Mitigation measures**			
1.	Compensation towards Forestland			
	i. Compensatory Afforestation		=	Rs. 51.13 lakhs
	ii. NPV		=	Rs. 1,022.67 lakhs
2.	Crop Compensation		=	Rs. 1,790.62 lakhs
3.	Cost of Huts		=	Rs. 335.00 lakhs
4.	Compensation for PTCC (1817 Km x Rs. 50,000/-)		=	Rs. 895.50 lakhs
5.	Cost towards implementation of EMP (Contractor's Scope)		=	Rs. 100.00 lakhs
		Sub- Total	**=**	**Rs. 4,194.924**
B.	**Implementation Monitoring & Audit**			
1.	**Man-power involved for EMP implementation & Monitoring in entire route of Transmission lines (Rs.10, 000/-x 1817 Km)**		**=**	**Rs. 181.70 lakhs**
2.	Independent Audit (LS) [1]		=	Rs. 18.17 lakhs
		Sub- Total	**=**	**Rs. 199.87 lakhs**
C.	**Contingency (3 %)**		**=**	**Rs. 128.84 lakhs**
TOTAL COST (A+B+C)			**=**	**Rs. 4,523.637 lakhs**

Note: '*' Budget estimate is only indicative based on similar project experience

[1] Only for external Agency

ANNEX 1

SUMMARY OF SELECT APPLICABLE ENVIRONMENTAL LEGISLATIONS

The Regulatory Framework

The Environmental regulations, legislation, policy guidelines and control that may impact this project, are the responsibility of a variety of government agencies. The principal Environment Regulatory Agency in India is the Ministry of Environment and Forests (MoEF). MoEF formulates environmental policies and accords environmental clearances for different projects.

The Important environmental legislations in India are given below in tables:

1. Environmental (Protection) Act 1986, amended in 1991
2. Water (Prevention and Control of Pollution) Act 1975, amended in 1988
3. Forest (Conservation) Act 1980, amended in 1988
4. Air (Prevention and Control of Pollution) Act 1981, amended in 1987
5. The Wildlife (Protection) Act 1972, amended in 1993
6. The Environmental Clearance Notification, 1994
7. The National Environmental Appellate Authority Act, 1997
8. National Forest Policy, 1988
9. Noise Pollution (Regulation and Control) Rules, 2000
10. Ministry of Environment and Forest, Guidelines for EIA for River Valley Projects.
11. National policy on Resettlement and Rehabilitation for Project Affected Families 2003, MORD (2004)
12. Indian Telegraph Act 1885
13. Ambient Air Quality standards have been notified by the CPCB vide Gazette Notification dated 11th April 1994

Key Environmental Legislations

Name	Scope and Objective	Key Areas	Operational Agencies/Key Players
Water (Prevention and Control of Pollution Act, 1974)	To provide for the prevention and control of water pollution and enhancing the quality of water	Controls sewage and industrial effluent discharges	Central and State Pollution Control Board
Air (Prevention and Control of Pollution Act - 1981)	To provide for the prevention and control of air pollution	Controls emissions of air pollutants	Central and State Pollution Control Boards
Forest Act, 1927	To consolidate acquisition of common property such as forests	Regulates access to natural resources, state has a monopoly right over land, categories forests	State government, forest settlement officers
Forest Conservation Act, 1980	To halt India's rapid deforestation and resulting Environmental degradation	Restriction on de-reservation and using forest for non-forest purpose	Central Government
Wildlife Protection Act, 1980	To protect wildlife	Creates protected areas (national parks, sanctuaries) categories of wildlife which are protected	Wildlife Advisory Boards; Central Zoo Authorities
Environment Protection Act, 1986	To provide for the protection and improvement of Environment	An umbrella legislation; supplement laws	Central government nodal agency MoEF; can deplete powers to state department of Environment