

SECTION I: PROJECT DESCRIPTION

1.0 BACKGROUND:

POWERGRID, the Central Transmission Utility (CTU) of the country, is engaged in power transmission with the mandate for planning, co-ordination, supervision and control over complete inter-State transmission system. As on March '11 POWERGRID has established about 82,335 ckt kms of transmission lines at 765 kV, 400 kV, 220 kV & 132 kV EHVAC & ± 500 kV HVDC levels and 135 sub-stations with transformation capacity of about 92,735 MVA. This transmission network, spread over length and breadth of the country, is consistently maintained at an availability of over 99% through deployment of state-of-the-art Operation & Maintenance techniques at par with global standards. More than 40% of total power generated in the country is wheeled through this transmission network.

POWERGRID has been contributing significantly towards development of Indian power sector by undertaking coordinated development of power transmission network along with effective and transparent operation of regional grids and through continuous innovations in technical & managerial fields.

POWERGRID has received a nos. of Long-Term Open Access (LTOA) applications from IPP generation projects coming up in Chhattisgarh for transfer of power to different target regions viz. Western and Northern region. Based on overall capacity addition programme for IPPs in Chhattisgarh, a comprehensive transmission system was evolved. Subsequently, review of progress of IPP projects in Chhattisgarh was made in various meetings, wherein it emerged that transmission system for transfer of power from the generation projects with good progress and commissioning schedule by the end of 11th Plan/early 12th plan, who have been granted LTOA, may be considered for implementation. It may be mentioned that above generation projects are mainly coming up in Raigarh (near Kotra), Champa-Janjgir and Raigarh (Near Tamnar) complex.

Based on the discussion with IPPs and CEA as well in the 29th & 30th Standing Committee meeting on Power System planning in Western region/11th meeting of WR constituents regarding LTOA application in WR, transmission system for above generation projects in Chhattisgarh with power transfer requirement to target regions was agreed. Copy of the minutes of meeting in this regard is enclosed as **Annexure- I**. Looking at the transmission system requirement for transfer of power to Northern/Western region from generation projects coming up in Chhattisgarh, a comprehensive transmission scheme on system strengthening in Western- Northern inter-regional HVDC transmission corridor is proposed. Considering the hybrid nature of above scheme, scheme is divided into following two parts :

Part A : WR – NR Interconnector for IPP Projects in Chhattisgarh and

Part B : Transmission System Strengthening in Northern region for IPP Projects in Chhattisgarh

To meet the funding requirement for the proposed project, POWERGRID is negotiating a loan of USD 750 million (USD 500 million as Sovereign & USD 250 million as Non-Sovereign) with Asian Development Bank (ADB) for implementation of HVDC Sub- Station at Champa & Kurukshetra and some equipment of the HVDC

transmission line. The funding for the remaining part will be met from POWERGRID's own Internal Resources (IR).

1.2 PROJECT JUSTIFICATION

As per the Long-Term Open Access applications and subsequent review on the preparedness of generation projects, it is estimated that IPP generation projects with long-term power transfer requirement of about 15000-16000 MW is coming up in Raigarh (Kotra), Champa, Raigarh (Tamnar) and Raipur generation complex in Chhattisgarh progressively in next 3-4 years. Out of the 15000-16000 MW quantum of power transfer requirement, about 5000 MW power is indicated for transfer to Northern region as the target region and balance power is to be transferred to the Western region. For evacuation and transfer of power from these generation projects, 765/400kV High Capacity Pooling stations viz. at Raigarh (Kotra), Raigarh (Tamnar), Raipur and Champa is proposed. However, considering the quantum of power transfer requirement (about 5000 MW) to Northern region, it is proposed that a new high capacity transmission corridor may be developed to effect above transfer.

Considering the long distance as well quantum of power transfer requirement to NR from IPP generation projects in Chhattisgarh, it is proposed that power from IPP generation projects in Chhattisgarh can be transferred over HVDC system instead of HVAC system. Development of such HVDC transmission corridors shall facilitate in establishing transmission corridors with hybrid technology. This shall also facilitate in meeting controlled power flow requirement, flexibility of operation as well as maintaining system parameters within limits through its control mechanism.

For this ± 800 kV, 3000 MW HVDC bipole between Champa Pooling Station and Kurukshetra, a major load center in NR is proposed. For power transfer from Kurukshetra onwards, a 400 kV transmission corridor towards Nakodar/ Jalandhar in Punjab is proposed. It is also proposed that provision should be kept to upgrade above HVDC Bipole to 6000 MW at a later date with increased power transfer requirement to Northern region.

1.3 BENEFITS OF THE PROJECT:

The proposed scheme shall facilitate strengthening of North-West transmission corridor for inter-regional transfer of power from IPP generation projects proposed in Chhattisgarh with reliability and security. Additionally, the project is likely to generate direct and indirect employment opportunities, promote industrial growth and stimulate overall development of the region. POWERGRID, as a responsible corporate entity, always undertakes community development works around the location of its substations. Hence, the basic infrastructure around the proposed substation will also improve substantially.

1.4 PROJECT OBJECTIVE

The objective of the project is to establish transmission arrangement between Western and Northern Regions to facilitate transfer of power from future IPP generation projects in the State of Chhattisgarh.

1.5 PROJECT HIGHLIGHTS

a)	Project	:	WR-NR HVDC Interconnector for IPP Projects in Chhattisgarh
b)	Location of the Project	:	Western Region
c)	Beneficiary States	:	Western/Northern Region Constituents
d)	Project Cost	:	Rs. 7674.09 Crores at 4 th Quarter 2010 Price Level (including IDC of Rs. 545.82 Crores)
d)	Commissioning schedule	:	Within 48 months from the date of investment approval.

1.6 PROJECT SCOPE

The transmission lines and Substation to be implemented under the scope of Part-A scheme: **WR – NR HVDC Interconnector for IPP Projects in Chhattisgarh** are as follows:

Transmission line

- a) A ± 800 kV, 3000 MW HVDC bipole between Champa Pooling Station – Kurukshetra (NR) [provision to upgrade the HVDC terminals to 6000 MW at a later date]

Substation

- a) Establishment of 3000 MW 800 kV HVDC bipole terminal station each at Champa Pooling station and Kurukshetra (NR) respectively (provision to upgrade the terminals at 6000 MW at a later date).

A power map showing the transmission grid of Western and Northern Region highlighting the above scope of works is placed as **Exhibit-1**.

SECTION II: BASE LINE DATA

2.0 The proposed transmission system project is a Multi-State one and the transmission line will pass through the States of Chhattisgarh, Madhya Pradesh, Uttar Pradesh and Haryana in India. The basic details of environment and socio-economic status of these areas are delineated below:

2.1 CHHATTISGARH

Chhattisgarh, the 26th State of India, was carved out of Madhya Pradesh on November 1, 2000. Located in central India it covers an area of 135,191 sq km. Chhattisgarh is bordered by Bihar, Jharkhand and Uttar Pradesh in the north, Andhra Pradesh in the south, Orissa in the east and Madhya Pradesh in the west. The state lies at 17°47'N to 24°06'N latitude and 80°15'E to 84°24'E longitude. **Physiographically**, the State can be divided into many divisions. The Indo-Gangetic plain in the state is very fertile. The Satpura Range, Vindhya Mountain Range and the Maikal Range form the hilly terrain of Chhattisgarh. The Chhota Nagpur Plateau is another important topographical division of Chhattisgarh. The general land use pattern of the state is given below:

Table-2.1 Land Use Pattern

Land use	Area in '000 ha	Percentage
Total Geographic Area	13,519	
Reporting area for land utilization	13,790	100.00
Forests	6,355	46.08
Not available for land cultivation	996	7.22
Permanent pastures and other grazing lands	857	6.21
Land under misc. tree crops & groves	1	0.01
Culturable Wastelands	350	2.54
Fallow land other than current fallows	238	1.73
Current fallows	271	1.97
Net area sown	4,772	34.24

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2006

Climate: The climate of Chhattisgarh is mainly tropical. It is hot and humid because of its proximity to the Tropic of Cancer. During the summer which prevails April to middle of June, the temperature varies from 40 degree to 42.5 degree Celsius. The winter season is mainly felt in Chhattisgarh during months of December and January and temperature drops up to 10 to 15 degree Celsius. Monsoon is experienced during the end of June or July to last week of August.

Rainfall: Rainfall in this state is mainly brought by South West monsoonal winds. The annual rainfall varies from 1,100 mm to 1,700 mm.

Soil: The soil of the State is rich and is known for its red color. The soil in the riverine plains. The higher areas of the state have light colored soil and the areas adjoining the river valleys have smooth fertile soil.

Mineral Resources: The State accounts for more than 13 per cent of India's total mineral production. Twenty-three per cent of the country's iron- ore deposits, 14 per

cent of the dolomite deposits, and 6.6 per cent of the limestone deposits are found here. It has also 18 percent of coal reserves of the country, and the state is ranked third after Jharkhand and Orissa.

Water Resources: The important rivers of the state are the Mahanadi, the Indravati and the Godavari, which drains most of the state along with their many tributaries. The other rivers are Rihand, Sukha, Hasdo, Arpa, Shivnath, Mand, Eb, Jonk, Pary, Kelo, Udanti.

Ecological Resources: The forest cover of the state based on the satellite data of November-December, 2006, is 55,870 Sq. km. which constitutes 41.33% of the geographic area. Out of these 4.162 sq. km is very dense forest and 35,038 sq. km constitutes moderately dense forest and 16,670 sq. km open or degraded forest of 36,046 sq. km. As per recorded data, the forest area of the State is 59,772 sq. km. Reserve Forests constitutes 43.13%, Protected Forests 40.21% and Unclassified Forests 16.65 %. Forest Map is enclosed as **Map-1**. Further, 12% of India's forests are in Chhattisgarh, and 44% of the State's land is under forests. Identified as one of the richest bio-diversity habitats, has the densest forests in India, and rich wildlife. Over 200 non-timber forest products, with tremendous potential for value addition are produced in the state.

The forests are the main source of supply of fodder and fuel and subsistence for the poorest sections of the people and tribal population in the interior under-developed areas of the state. The State forest can be broadly classified in to 2 forest type groups :

- Tropical Moist Deciduous
- Tropical Dry Deciduous and

There are 3 National Parks (NP) and 11 Wildlife Sanctuaries covering an area of 0.29 million ha. and 0.36 million ha. respectively. Thus a total of 0.65 million ha. area constituting 4.79 % of the State's geographical area under the protected area network.

The T/L of proposed transmission system shall pass through three districts of this state having forest cover ranging from 4.08 % to 50.83 % of geographical area of districts. It may be noted from the table below that in all three districts, the forest cover is a good mixture of both dense and open/degraded forest nature this warrant extra precaution in routing of line through forest area. Details of forest cover of these districts are as follows:

(Area in Sq. Km.)						
District	Geographic area	Dense forest	Mod. forest	Open forest	Total	% forest Cover
Janjgir-Champa	3,852	4	26	127	157	4.08
Korba	6,599	204	2,308	842	3,354	50.83
Bilaspur	8,270	336	1,631	531	2,498	30.21

Human and Economic Development: The State constitutes of 20.795 million as per the census of 2001 with a population density of 154 per square kilometer. Agriculture is the main occupation of the people of Chhattisgarh where nearly 80% of the population is engaged in cultivation. The major crop grown in Chhattisgarh is

paddy especially in the central plains of the state, popularly known as rice bowl of central India. Apart from paddy other crops grown here are oilseeds, wheat, coarse grains, groundnut, maize and pulses. The soil of the state is suitable for the cultivation of horticultural plants guava, mango, banana etc. and a various types of vegetables. Forests cover nearly 44% of the total area of the state. It is also rich in mineral resources and about 20 percent of the country's steel and cement are produced here. So forest products and mining are the other sources of income. It has large supply of power which can be easily transmitted to any of the four grids of India. About 90 percent of the villages in Chhattisgarh have been electrified.

2.2 MADHYA PRADESH

Madhya Pradesh as its name implies, lies in the heart of India. The State has total geographical area of 3,08,245 sq. km which constitutes 9.38% of the land area of the country & bordering the States - Uttar Pradesh, Chhattisgarh, Maharashtra, Gujarat and Rajasthan. It lies between latitude $21^{\circ} 17'$ & $26^{\circ} 52'N$ and longitude $74^{\circ} 08'$ & $82^{\circ} 49' E$. **Physiographically**, the State can be divided into four regions viz. the low lying areas in the north and north-west of Gwalior, Malwa Plateau, Satpura and Vindhyan ranges. The general land use pattern of the state is given below:

Table-2.2 Land Use Pattern

Land use	Area in '000 ha	Percentage
Total Geographic Area	30,825	
Reporting area for land utilization	30,756	100.00
Forests	8,699	28.28
Not available for land cultivation	3,398	11.05
Permanent pastures and other grazing lands	1,348	4.38
Land under misc. tree crops & groves	19	0.06
Culturable Wastelands	1,177	3.83
Fallow land other than current fallows	612	1.99
Current fallows	769	2.50
Net area sown	14,735	47.91

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2006

Climate: The climatic condition is generally Sub-Tropical wet and dry. MP state has three main seasons:

- Winter (November through February);
- Summer (March through May); and
- Monsoon season (June through September).

Temperature: During the winter average temperatures range from 10° to 27° C. Summers are hot, with an average temperature of 29° C and a high temperature that at times reaches 48° C. During the monsoon season temp. average 19° to 30° C.

Rainfall : The average rainfall in the different regions of the state ranges from 450 to 900 mm. The annual mean total rainfall recorded at Ujjain is 934.1 mm (1960 – 1980 data period) with almost 45 rainy days.

Soil: Red, Yellow and black soils are generally available in the state.

Mineral Resources: Madhya Pradesh is one of the major mineral producing states of the country. It has large deposits of a variety of minerals. Important among them

are bauxite, copper, manganese, coal, dolomite and limestone. The State is also country's only producer of tin ore.

Water Resources: The important rivers of the state are Chambal, the Betwa, the Sone and the Narmada.

Ecological Resources: The forest cover of the state based on the satellite data of October-December, 2006, is 77,700 Sq. km. which constitutes 25.21% of the geographic area. Out of these 6, 647 sq. km is very dense forest and 35, 007 sq. km constitute moderately dense forest which are having crown density of more than 40% and open or degraded forest of 36,046 sq. km. having crown density ranging between 10-40%. As per recorded data, the forest area of the State is 94, 689 sq. km. Reserve Forests constitutes 65.36%, Protected Forests 32.84% and Unclassified Forests 1.8 %. Forest Map is enclosed as **Map-2**. The forests are the main source of supply of fodder and fuel and subsistence for the poorest sections of the people and tribal population in the interior under-developed areas of the state. The State forest can be broadly classified in to 3 forest type groups :

- Tropical Moist Deciduous
- Tropical Dry Deciduous and
- Tropical Thorn

Forests are largely distributed in central, southern and eastern parts of the undivided state of Madhya Pradesh. Northern and western parts of the state are deficient in forest vegetation. Teak and Sal are the two most important forest formations of the state, covering 18.0% and 16.7% forest area, respectively while miscellaneous forests cover 65.3%. Madhya Pradesh forest reserves are logged for Teak, Sal, Bamboo and Salai. These forests catered to the needs of the people and cattle for generations, largely because they contained good cropping species. However, population explosion and developmental needs have exerted a steadily increasing demand on the ever-diminishing extent of forests. Over-exploitation resulted in reduction of area under forests. There are 9 National Parks (NP) and 25 Wildlife Sanctuaries covering an area of 10, 814 sq. km. which constitutes 3.51 % of the State's geographical area. There are 5 Tiger Reserves. Kanha tiger reserve in Jabalpur district is the most important National Park of the state.

The T/L of proposed transmission system shall pass through mainly six districts of this state namely Anuppur, Dindori, Jabalpur, Damoh, Mandla & Chhatarpur having forest cover ranging from 20.12 % to 37.04 % of geographical area. Details of forest cover of these districts are as follows:

(Area in Sq. Km.)						
District	Geographic area	Dense forest	Mod. Forest	Open forest	Total	% forest Cover
Anuppur						Not Available
Dindori	7,470	1,033	1,175	559	2,767	37.04
Jabalpur	5,211	36	514	619	1,169	22.43
Damoh	7,036	2	862	1,741	2,605	35.66
Mandla	5,800	751	1,207	876	2,834	48.86
Chhatarpur	9,687	184	822	742	1748	20.12

Human and Economic Development : The total population of Madhya Pradesh based on 2001 census is 60.385 million out of which 73.3% is rural and 26.7 % is urban. The state supports 5.9% of country's total population. The population density is 196 persons per sq.km. Sex ratio is females per thousand males are 920. Literacy in males 76.80% & in females 50.28%. Madhya Pradesh in its present form came into existence on November 01, 2000 following its bifurcation to create a new state of Chhattisgarh.

Agriculture is the mainstay of the state's economy and 73.3 % of the people are rural. Almost 49% of the land area is cultivable. Madhya Pradesh is one of the leading states in the country in mineral production 26 percent of total Minerals of India are found in M.P. The share of M.P, in India's production of such vital minerals as diamond (100%), dolomite (39%), bauxite (28%), iron ore (24%), coal (23%), and limestone (23%). In short about 30 different types of minerals are known to occur in the state. M.P is rich in low-grade coal suitable for power generation and has also got immense potential of hydro-energy.

2.3 UTTAR PRADESH:

Uttar Pradesh is most populous State of the country which is bounded by Uttaranchal and Nepal in North, Madhya Pradesh and Chhattisgarh in south, Rajasthan, Haryana and Delhi in West and Bihar and Jharkhand in east. It lies between latitude 23°52' and 31°28'N and longitude 77°05' and 84°38'E. **Physiographically**, the State can be divided in to two distinct regions namely Indo-gangetic plain and Southern hills. The general land use pattern of the state is given below:

Table-2.3 Land Use Pattern

Land use	Area in '000 ha	Percentage
Total Geographic Area	24,093	
Reporting area for land utilization	24,201	100
Forests	1,654	6.83
Not available for land cultivation	3,215	13.28
Permanent pastures and other grazing lands	65	0.27
Land under misc.tree crops & groves	376	1.55
Culturable Wastelands	439	1.81
Fallow land other than current fallows	550	2.27
Current fallows	1,270	5.25
Net area sown	16,633	68.73

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2006

Climate: The climate in Uttar Pradesh 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. The intensity of the summer months is magnified by the hot winds called 'loo' that blows across the plains in May and June, the two hottest months of the year.

Rainfall: The average annual rainfall ranges between 1,000 to 1,200 mm of which about 90% occurs during June to September by Southwest monsoon.

Temperature: The temperature varies maximum 45° C to 35° C during summer and 25° C to 3° C during winter.

Mineral resources: The state of Uttar Pradesh is poor in mineral resources. Only considerable deposits of limestone and red sandstone occurs 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).

Soil: The vast Indo-Gangetic plain area having fertile alluvial soil and smaller Southern Hill Plateau having predominantly rocky strata.

Water resources: The main rivers of the State are the Yamuna, the Ganga, the Ramganga, the Gomati and the Ghaghara. All the rivers, except the Gomati, emerge from the Himalaya. The Yamuna and the 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: The forest cover of the state based on the satellite data of October-December, 2006, is 14,341 Sq. km. which constitutes 5.95% of the geographic area. Out of these 1,626 sq. km is very dense forest 4,563 sq. km constitutes moderately dense forest and 8,152 sq. km open forest. The recorded total forest is 16,583 sq. km. which is 6.88% of the state's geographical area. Reserved Forest constitutes 70.31%, Protected Forest 8.56% and Un-classed Forest 21.12%. Forest Map is enclosed as **Map-3**. There are 5 types of forests namely Tropical semi evergreen, Tropical Moist Deciduous, Littoral & Swamp, Tropical Dry Deciduous and Tropical Thorny Forests are found in Uttar Pradesh.

There is one National park and 23 wild life sanctuaries, covering an area of 5,712 sq. km. which constitutes 2.37 % of the geographic area. Dudhwa Tiger reserve is located in the state.

The proposed transmission line shall pass through twelve districts of this state having forest cover ranging from 0.51 % to 8.05 % of geographical area. It may be noted from the table below that in all the districts, the forest cover is mostly open/degraded forest. Details of forest cover of these districts are as follows:

(Area in Sq. Km.)						
District	Geographic area	Dense forest	Mod. Forest	Open forest	Total	% forest Cover
Banda	4,532	0	26	77	103	2.27
Hamirpur	4,282	0	66	108	174	4.06
Jalaun	4,565	0	65	179	244	5.35
Auriya	2,054					Data Not Available
Etawa	2,311	0	44	142	186	8.05
Mainpuri	2,760	0	1	13	14	0.51
Etah	4,446	0	9	90	99	2.23
Aligarh	3,650	0	7	59	66	1.81
Bulandshahar	2,910	0	33	82	115	3.95
Ghaziabad	2,590	0	18	31	49	1.89
Meerut	2,590	0	34	32	66	2.55
Muzaffarnagar	4,008	0	14	27	41	1.02

Human and Economic Development: Uttar Pradesh is rich in human and natural assets. Population of the State is 166.05 million as per Census 2001 constituting 16.2% of country's population. Rural and urban population is 79.2% & 20.78% respectively. 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. Uttar Pradesh is an important state in so far as horticulture is concerned.

2.4 HARYANA :

Haryana has a geographic area of 44,212 sq.km.. It lies between latitude 27° 39' and 30°55'N and longitude 74°27' and 77°36'E. **Physiographically** the state is divided into two natural zones, the Shiwalik and the Aravalli hills and the Indo-Gangetic plains. The Yamuna and Ghagger rivers are the lifeline of the state. The land use pattern of the state is given below:

Table-2.4 Land Use Pattern

Land use	Area in '000 ha	Percentage
Total geographical area	4,421	
Reporting area for land utilisation	4,372	100.00
Forests	39	0.89
Not available for cultivation	524	11.99
Permanent pasture and other grazing lands	27	0.62
Land under misc. tree crops & groves	12	0.27
Cultivable wasteland	65	1.49
Fallow land other than current fallows	8	0.18
Current fallow land	141	3.23
Net area sown	3,556	81.34

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2006

Climate : The climate of **Haryana** varies too much. It is cold in winter. In the beginning of summer the climate is dry, but when rains set in it is moist in the extreme.

Rainfall : The rainfall varies from 213 mm in south-west to 1,400 mm in the north-east.

Temperature : The annual mean temperature varies between 22.5°C to 25°C.

Soil : Predominant soil found in project area is sandy soil.

Mineral Resources : The main minerals of Haryana are slate stone, lime stone, gypsum, China clay, marble, sulphur etc..

Water Resources : Haryana has no perennial rivers. The only river which flows through Haryana is the Ghaggar, which passes through the northern fringes of the

state. Haryana is a beneficiary of the multi-purpose project on Satluj with Beas, where it shares benefit with Punjab and Rajasthan. Major irrigation projects are Western Yamuna Canal, Bhakra Canal System and Gurgaon Canal. The state has completed Jui Loharu and Sewani lift irrigation schemes. Jawaharlal Nehru irrigation scheme, the biggest of its kind shall be completed soon.

Ecological Resources : Haryana, an intensively cultivated state, is deficient in natural forests. The forest cover of the state based on the satellite data of October-December, 2006, is 1,594 Sq. km. which constitutes 3.61% of the geographic area. Out of these 27 sq. km is very dense forest, 463 sq. km constitutes moderately dense forest and 1,104 sq. km open forest. The recorded forest area of the state is 1,559 sq. km. which is 3.53% of the total geographical area of the state. As per legal classification, Reserved Forest constitutes 15.97%, Protected Forest 74.28% and Unclassified Forest 9.75%. Forests are mainly distributed in the north-eastern and south-eastern districts of state. Forest map of Haryana is enclosed as **Map-4**. Three types of forest are recorded in the State.

- Tropical Dry Deciduous in the eastern part
- Tropical Moist Deciduous in the Shiwalik region
- Tropical Thorn Forests in the western part of the state.

There are 2 National Park and 8 Wildlife Sanctuaries in Haryana cover an area of 303.92 sq. km which constitutes 0.69% of the State geographical area.

The proposed transmission line shall pass through the two districts i.e. Karnal & Kurukshetra which is having a forest cover of 1.60 % & 1.90 % of geographical area of districts respectively. It may also be noted from the table below that the forest cover is mostly open/degraded forest. Details of forest cover of these districts are as follows:

(Area in Sq. Km.)						
District	Geographic area	Dense forest	Mod. forest	Open forest	Total	% forest Cover
Karnal	2,317	0	6	31	37	1.60
Kurukshetra	1,530	0	10	19	29	1.90

Human and Economic Development : Haryana lies in north-west part of country, has geographic area of 44,212 sq. Km., which is 1.3% of country geographic area. The population of state is 21.08 million (2.1% of country population) of which rural population is 71% and urban population is 29%. There is no tribal population in the state and its average population density is 477 persons per sq. Km.

Haryana has become India's fastest growing state, offering its citizens the third highest per capita income. Agricultural development in Haryana has been tremendous. The production of food grains (121 lakh tones), sugarcane (Gur), oilseeds and cotton has risen to great levels. Haryana was the 1st state to introduce crop insurances for farmers. Per capita per day availability of milk is 579 grams against the Indian average of 180 grams.

The major industries are cement, sugar, paper, cotton, textiles, glassware, brassware, cycles, tractors (largest production in the country), motorcycles,

timepieces, automobile tyres and tubes, sanitary ware, television sets, steel tubes, hand tools, cotton yarn, refrigerators, vanaspati, ghee and canvas shoes. A factory of the Hindustan Machine Tools producing tractors is located at Pinjore. Gurgaon is a fast growing industrial hub where Maruti Udyog is the central piece. There are 79,678 small scale industrial units in the state, in addition to 1,023 large and medium industries. There are five civil aerodromes in the State.

Haryana produces the largest number of tractors in the country. It is well known for its handloom products. Panipat has earned the reputation of being the "weavers' city" of India for its exquisite hand- tufted woolen carpets and colourful handloom products.

Haryana became the first state in country to achieve 100 percent rural electrification. Per capita electricity consumption in the state is 530 KW. 78.50% rural house holds in the state are electrified.

SECTION III: POLICY, LEGAL & REGULATORY FRAMEWORK

3.0 POWERGRID's activities by their inherent nature and flexibility have negligible impacts on environmental and social attributes. Indian laws relating to environmental and social issues have strengthened in the last decade both due to local needs and international commitments. POWERGRID undertakes its activities within the purview of Indian laws keeping in mind appropriate international obligations and guidelines with respect to environmental and social considerations of Funding Agencies.

3.1 ENVIRONMENTAL

3.1.1 CONSTITUTIONAL PROVISIONS

Subsequent to the first United Nations Conference on Human Environment at Stockholm in June, 1972, which emphasized the need to preserve and protect the natural environment, the Constitution of India was amended through the historical 42nd Amendment Act, 1976 by inserting Article 48-A and 51-A (g) for protection and promotion of the environment under the Directive Principles of State Policy and the Fundamental Duties respectively. The amendment, *inter alia* provides:

"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country". (New Article 48A)

"It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures". (New Article 51 A(g))

Article 21 of the constitution provides, "no person shall be deprived of his life or personal liberty except according to procedure established by law".

Article 21 is the heart of the fundamental rights and has received expanded meaning from time to time after the decision of the Supreme Court in 1978. The Article 21 guarantee fundamental right to life – a life of dignity to be lived in a proper environment, free of danger of disease and infection. Recently, Supreme Court has broadly and liberally interpreted the Article 21, transgressed into the area of protection of environment, and held that the protection of environment and citizens' right to live in eco-friendly atmosphere are to be interpreted as the basic right guaranteed under Article 21.

Thus the Indian Constitution has now two fold provisions:

- (a) On the one hand, it gives directive to the State for the protection and improvement of environment.
- (b) On the other hand the citizens owe a constitutional duty to protect and improve natural environment.

3.1.2 MANDATORY REQUIREMENTS (NATIONAL)

- **MOP order/sanction under The Electricity Act, 2003:**

Sanction of MoP, GOI is a mandatory requirement for taking up any new transmission project under the section 68(1) of The Electricity Act, 2003. The sanction authorizes POWERGRID to plan and coordinate activities to commission the new projects. Electricity act does not explicitly deal with environmental implications of activities related to power transmission. However, POWERGRID always integrates environmental protection within its project activities.

- **Forest Clearance under The Forest (Conservation) Act, 1980:**

When transmission projects pass through forest land, clearance has to be obtained from relevant authorities under the Forest (Conservation) Act, 1980. This Act was enacted to prevent rapid deforestation and environmental degradation. State governments cannot de-reserve any forest land or authorize its use for any non-forest purposes without prior approval from the Central government. POWERGRID projects, when involving forest areas, undergo detailed review and approval procedures to obtain a Forest Clearance certificate from MoEF, Government of India before starting any construction activity in the designated forest areas.

- **Environmental Clearances under Environment (Protection) Act, 1986:**

Since transmission line projects are environmentally clean and do not involve any disposal of solid waste, effluents and hazardous substances in land, air and water, they are kept out of the purview of Environment (Protection) Act, 1986. However, the recent amendment in the Environment (Protection) Act, 1986 made it necessary to obtain clearance from MoEF for power transmission projects in two districts in the Aravalis (*viz.*, Alwar in Rajasthan and Gurgaon in Haryana). The Aravali ranges, in these two areas, are heavily degraded, hence, any industrial activity there becomes critical. Environment Impact Notification, 1994 lays down specific project categories that require clearance from MoEF. Power transmission projects are not included in this list.

- **Batteries (Management and Handling) Rules, 2001:**

MoEF vide its notification dt. 16th May, 2001 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has put certain restrictions on disposal of used batteries and its handling. As per the notification, it is the responsibility of bulk consumer (POWERGRID) to ensure that used batteries are not disposed of, in any manner, other than by depositing with the dealer/manufacturer/registered recycler/importer/reconditioner or at the designated collection centres – and to file half yearly return in prescribed form to the concerned State Pollution Control Board.

- **Hazardous Wastes (Management and Handling) Amendment Rules, 2009:**

MoEF vide its notification dt. 21st July, 2009 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has put used mineral oil under the category of

hazardous waste which requires proper handling and disposal. As per the notification, all used oil is to be auctioned /sold to registered recyclers only and file annual return on prescribed form to the concerned State Pollution Control Board.

- **Ozone Depleting Substances (Regulation and Control) Rules, 2000:**

MoEF vide its notification dt. 17th July, 2000 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has notified rules for regulation /control of Ozone Depleting Substances under Montreal Protocol adopted on 16th September 1987. As per the notification certain controls and regulations have been imposed on manufacturing, import, export and use of these compounds. POWERGRID is following provisions of notification and is phasing out all equipment which uses these substances and planning to achieve CFC free organisation in near future.

- **The Biological Diversity Act, 2002:**

Under the United Nations Convention on Biological Diversity signed at Rio de Janeiro on the 5th day of June, 1992 of which India is also a party, MoEF has enacted the Biological Diversity Act, 2002 to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith. As per the provisions of act certain areas which are rich in biodiversity and encompass unique and representative ecosystems are identified and designated as Biosphere Reserve to facilitate its conservation. All restrictions applicable to protected areas like National Park & Sanctuaries are also applicable to these reserves. POWERGRID will abide by the provision of act wherever applicable and try to totally avoid these biosphere reserves while finalizing the route alignment.

3.1.3 FUNDING AGENCIES:

WB Operational Policies (OP) 4.01/ADB's Safeguard Policy Statement (June 2009) and JBIC Environmental Guidelines: These outlines funding agencies policy and procedures for environmental assessment (EA) of different developmental projects. All these guidelines classified developmental projects into three categories (A-C) based on its possible environmental and social impacts. Though WB & ADB has another category F1 applicable only to projects involving a credit line through a financial intermediary.

Transmission line projects are categorized as category-B project having limited impact that can be further minimized through mitigative/management measures and would normally require only an environmental review. POWERGRID takes remedial measures to prevent, minimize, mitigate, or compensate for adverse impact and improve environmental performance. Environment Assessment will take into account the natural environment, human health and safety, social aspects and trans-boundary and global environmental aspects. During EA process, public is also informed at every stage of project execution and their views are considered during decision-making process.

3.1.4 PRESCRIPTIVE FRAMEWORK (NATIONAL)

- Applicable Legislations

3.1.5 RELEVANT POLICIES

- National Conservation Strategy and Policy Statement on Environment and Development, 1992
- Policy statement for Abatement of pollution, 1992
- National Environment Policy, 2006

3.2. SOCIAL

3.2.1 CONSTITUTIONAL PROVISIONS

Constitutional provisions in regard to social safeguards are well enshrined in the preamble such as **JUSTICE**, social, economic and political; **LIBERTY** of thought, expression, belief, faith and worship; **EQUALITY** of status and of opportunity; **FRATERNITY** assuring the dignity of the individual and the unity and integrity of the Nation. Fundamental Rights and Directive Principles guarantee the right to life and liberty. Health, safety and livelihood have been interpreted as part of this larger right. Social safeguards provisions are dealt in detail in different Article such as Article-14, 15 17, 23, 24, 25, 46, 330, 332 etc. POWERGRID, through its document, ESPP, commits itself to implementing the said constitutional provision in true spirit to fulfill its environmental and social obligations and responsibilities.

3.2.2 MANDATORY REQUIREMENTS (NATIONAL)

- **National Rehabilitation and Resettlement Policy, 2007:**

Ministry of Rural Development, Government of India has notified a National policy on R&R for PAFs in Feb'04 applicable to all developmental projects where 500 or more families enmass in plain areas or 250 or more families enmass in hilly areas are displaced due to project activity. It essentially addresses the need to provide succour to the assetless rural poor, support the rehabilitation efforts of the resources and provide a broad canvas for an effective consultation between PAFs and authorities responsible for their R&R. It has also listed R&R measures and entitlements for different category of PAFs. Though the National policy as such is not applicable to POWERGRID because transmission projects do not involve displacement of such a large numbers of families since land required for substations is quite small, however, the entitlement benefits listed in the National policy for PAFs have been adopted by POWERGRID in its "Social Entitlement Framework" that is being implemented wherever land acquisition for substations is undertaken.

- **Rights of Way And Compensation Under Electricity Act,2003:**

The act has a provision for notifying transmission company under section 164 (B) to avail benefits of eminent domain provided under the Indian Telegraph Act, 1885. MOP,GOI vide gazette notification dated 23rd Dec'03 had already notified POWERGRID under this section of said act. Therefore, for the purpose of placing of any wires, poles, etc., POWERGRID has all the powers that the telegraph authority

possesses. Thus, POWERGRID can erect and construct towers without actually acquiring the land. However, all damages due to POWERGRID activity are compensated at market rate. Power transmission schemes are always planned in such a way that the power of eminent domain is exercised responsibly.

- **Provisions Under Land Acquisition Act, 1894, as amended in 1984:**

When land is acquired for sub-stations, POWERGRID will follow procedures laid down under the Land Acquisition Act (LA Act), 1894. POWERGRID sub-stations have never resulted in large scale displacement or loss of livelihoods. There have been only marginal impacts due to flexibility exercised by POWERGRID in selecting sites. The LA Act specifies that in all cases of land acquisition, no award of land can be made by the government authorities unless all compensation has been paid.

3.2.3 FUNDING AGENCIES

For POWERGRID, mandatory requirements *vis-à-vis* Funding Agencies are comprehensive Resettlement and Rehabilitation (R&R) guidelines and an entitlement framework as per World Bank Operational Directives 4.30 (OP-4.12) and 4.20 and ADB's Safeguard Policy Statement (June 2009).

- **World Bank OD 4.30 (OP-4.12): Involuntary Resettlement:**

This directive describes Bank Policy and procedures on involuntary resettlement as well as conditions that borrowers are expected to meet during operations involving resettlement of affected groups. It requires an entitlement framework aimed at restoration, replacement and participation of affected groups. A detailed social assessment and development of an action plan having list of measures for betterment/restoration of lost assets/income is required to be submitted to bank before start of project work. However where only a few people (e.g. about 100-200 individuals) are to be relocated at a particular location, appropriate compensation for assets, logistical support for moving and a relocation grant may be the only requirements, but the principle on which compensation is to be based will remain same as for larger groups.

- **World Bank OD 4.20: Indigenous People (IP):**

This directive describes World Bank policies and procedures for projects that affect indigenous people. The objective is to ensure that development benefits are socially and culturally compatible and that the IPs are consulted. Thus, the Indigenous People Development Plan/Tribal Development Plan is to be prepared as a prerequisite. POWERGRID will not only incorporate the IP component whenever necessary, but will also pay attention to marginalized groups such as women, children, etc.

- **ADB Safeguard Policy Statement (June 2009):**

The SPS, June 2009 describes Bank Policy and operational procedures on three key safeguard areas viz Environmental, Involuntary Resettlement and Indigenous Peoples as well as a set of specific safeguard requirements that borrowers are

expected to meet during operations when addressing social and environment impacts and risks. Its objective is to ensure social and environmental sustainability of projects through avoidance, minimization, mitigation and/or compensate of adverse impacts on environment and affected peoples. It also classified project into three categories like category-A where resettlement is significant and involve physical displacement of more than 200 persons, which require a detailed resettlement plan. Category-B where resettlement is not that significant and requires a short resettlement plan. Category-C where no resettlement of peoples are foreseen and neither require resettlement plan nor a resettlement framework.

POWERGRID emphasizes that displacement is not an issue with transmission projects because land below tower/line is not acquired and only a small piece of land is required for substations. However, all affected persons/families shall be provided compensation and rehabilitation assistance along with other measures as per POWERGRID's social entitlement framework which is based on these directives/manuals and National R&R Policy to restore income/livelihood of all affected persons.

3.2.4 PRESCRIPTIVE FRAMEWORK (NATIONAL)

- National and State-wide Laws and Policies Relating to Land Acquisition and Issues of R&R
- *Madhya Pradesh Pariyojana Ke Karan Visthapit Vyakti (Punsthapan) Adhinyam, 1985*
- *Maharashtra Project Affected persons Rehabilitation Act, 1986*

3.2.5 RELEVANT POLICIES

- Resettlement and Rehabilitation Policy- Coal India Ltd., May,2008
- Resettlement and Rehabilitation Policy- NHPC Ltd., 2007
- Policy for Rehabilitation and Resettlement of Land Owners – Land Acquisition Oustees – Haryana State, December,2007;
- The Orissa Resettlement and Rehabilitation Policy, Orissa , May, 2006;
- Resettlement and Rehabilitation Policy – NTPC Ltd., June,2005;

SECTION-IV: POWERGRID APPROACH FOR ROUTE SELECTION

4.0 ROUTE SELECTION - (ASSESSMENT & MANAGEMENT PROCESS)

At the system planning stage itself one of the factors that govern the evolution of system is the possible infringement with the forest. Wherever such infringements are substantial, different alternative options are considered. The route/ site selection criteria followed by POWERGRID is detailed below:

While identifying the transmission system for a generation project or as a part of National Power Grid, preliminary route selection is done by POWERGRID based on the topo sheets of Survey of India and Forest Atlas (Govt. of India's Publication). During route alignment all possible efforts are made to avoid the forest area involvement completely or to keep it to the barest minimum, whenever it becomes unavoidable due to the geography of terrain or heavy cost involved in avoiding it.

4.1.1 STUDY OF ALTERNATIVES

POWERGRID approach towards Route selection

For selection of optimum route, the following points are taken into consideration:

- (i) The route of the proposed transmission lines does not involve any human rehabilitation.
- (ii) Any monument of cultural or historical importance is not affected by the route of the transmission line.
- (iii) The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community.
- (iv) The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments etc.
- (v) The line route does not pass through any sanctuaries, National Park etc.
- (vi) The line route does not infringe with area of natural resources.

In order to achieve this, POWERGRID undertakes route selection for individual transmission lines in close consultation with representatives from the Ministry of Environment and Forests and the Department of Revenue. Although under National law POWERGRID has right of eminent domain yet alternative alignments are considered keeping in mind the above-mentioned factors during site selection, ***with minor alterations often added to avoid environmentally sensitive areas and settlements at execution stage.***

- As a rule, alignments are generally cited 10-15 km away from major towns, whenever possible, to account for future urban expansion.
- Similarly, forests are avoided to the extent possible, and when it is not possible, a route is selected in consultation with the local Divisional Forest Officer, that causes minimum damage to existing forest resources.

- Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.
- In addition, care is also taken to avoid National parks and Sanctuaries and any other forest area rich in wild life.

Keeping above in mind the route of proposed transmission line of ± 800 kV HVDC bipole between Champa Pooling Station and Kurukshetra has been so aligned that it takes care of above factors. As such different alternatives were studied with the help of Govt. published data like Forest atlas, Survey of India topo maps, satellite imageries etc. to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental & social impacts for their proper management.

4.1.2 EVALUATION OF ROUTE ALIGNMENT ALTERNATIVES FOR ± 800 kV HVDC BIPOLE BETWEEN CHAMPA POOLING STATION AND KURUKSHETRA :

Three different alignments were studied with the help of published data/maps and walkover survey to arrive at most optimum route for detailed survey. Region wise Map showing route alternatives (A1-WR I, A2-WR-2, A3- NR-I(Part-1), A3- NR-I(Part-2) & NR-II) are enclosed as **Map- 5**. The comparative details of these three alternatives are as follows:

S. N	DESCRIPTION	ALTERNATIVE - I	ALTERNATIVE - II	ALTERNATIVE - III
01	Route Particulars			
(i)	Route Length(Km)	1286.7	1295.3	1296
(ii)	Terrain (In %)			
a	Plain	89	86	85
b	Hilly	11	14	15
02	Environmental Details			
(i)	Name of District/District details (Through which line pass)	Chhattisgarh – Janjgir-Champa, Korba,Bilaspur Madhya Pradesh - Dindori, Jabalpur, Damoh, Chhatarpur Uttar Pradesh - Banda, Hamirpur, Muzaffarnagar, Etah Jalaun, Auriya, Aligarh, Mainpuri, Meerut, Ghaziabad, Etawa,Bulandshaha Haryana - Karnal, Kurukshetra	Chhattisgarh - Janjgir-Champa, Korba, Bilaspur Madhya Pradesh - Dindori,Jabalpur, Damoh, Chhatarpur Uttar Pradesh - Banda, Hamirpur, Jalaun, Etawa Auriya, Mainpuri, Aligarh, Etah, Bulandshahar, Meerut Ghaziabad Muzaffarnagar Haryana - Karnal, Kurukshetra	Chhattisgarh - Janjgir-Champa, Korba, Bilaspur Madhya Pradesh - Dindori,Jabalpur, Damoh, Chhatarpur Uttar Pradesh - Banda, Hamirpur, Etah, Jalaun, Etawa Mainpuri,Ghaziabad Muzaffarnagar Aligarh,Bulandshah ar, Auriya, Meerut, Haryana - Karnal, Kurukshetra
(ii)	Town in Alignment nearby	Chhattisgarh - Sipat Akaltara, Ratanpur, Belgahan, Kenda, Pendra, Venkatnagar Madhya Pradesh - Anuppur, Shahpur, Dindori, Sihora, Hatta, Damoh	Chhattisgarh - Akaltara, Sipat, Ratanpur, Belgahan, Kenda, Pendra, Venkatnagar Madhya Pradesh - Anuppur, Dindori, Shahpur, Sihora, Hatta, Damoh	Chhattisgarh - Akaltara, Sipat, Ratanpur, Belgahan, Kenda, Pendra, Venkatnagar Madhya Pradesh – Anuppur, Dindori, Shahpur, Sihora, Hatta, Damoh &

		Chhatarpur Uttar Pradesh - Naraini, Banda, Rijor Nougaw, Mahoba, Beri, Moudah, Kalpi, Jalaun Kuthoindh, Etah, Auriya, Bagi Ajitmal, Bakevar, Bharthana, Ghairoir, Pilawa, Kauda, Kalan, Manpur, Chausana Haryana - Jhijnhaja, Tana, Bhadeo, Shamli, Banat, Ghiar, Sisauli, Barwala, Satheri, Kheri, Lawar NP, Machhra, Debai, Alamgeepur, Udaipur, Atruali, Khanpur, Bansalu, Jahagirabad, Marehara, Makhan Bhadshon, Majra, Butan Kheri	Chhatarpur Uttar Pradesh - Naraini, Banda, Nougaw, Mahoba, Kalpi, Moudah Beri, Kuthoindh, Jalaun, Auriya, Ajitmal, Bakevar, Karahal Bharthana, Ghairoir, Bagi, Rijoir, Etah, Pilawa, Khudan, , Kalan, Chausana Haryana - Jhijnhaja, Tana, Bhadeo, Shamli, Banat, Sisauli, Barwala, Satheri, Lawar NP, Machhra, Debai, Atruali Alamgeepur, Udaipur, , Khanpur, Jahagirabad, Marehara, Ghiar, Kheri, Bhadshon, Bibipur, Jatan, Butan Kheri, Bhadshon	Chhatarpur Uttar Pradesh- Naraini, Banda, Rijor Nougaw, Mahoba, Beri, Kalpi, Etah, Jalaun, Kuthoindh, Auriya, Ajitmal, Bakevar, Karahal, Lachhmipura Bharthana, Ghairoir, Rijoir, Chausana Pilawa, Haryana - Jhijnhaja, Tana, Bhadeo, Shamli, Banat, Sisauli, Majra, Barwala, Satheri, Lawar NP, Debai Machhra, Udaipur Alamgeepur, Atruali, Ghiar, Khanpur, Jahagirabad, Kheri, Marehara, Bhadshon, Khirajpur, Moghal, Baragaon, Gari Gurjan
(iii)	House within ROW	Nil	Nil	Nil
(iv)	Forest in Km/Ha.	75.565 Km (521.398 Ha.)	120.02 Km (828.138 Ha.)	117.39 Km (809.991 Ha.)
(v)	Type of forest Reserve/ Protected /Mangrove/Wild life /Biosphere Res./ any other environ. sensitive area	Reserve Forest/ Protected Forest/ Revenue Forest/ Social Forest	Reserve Forest/ Protected Forest/ Revenue Forest/ Social Forest	Reserve Forest/ Protected Forest/ Revenue Forest/ Social Forest
(vi)	Density of Forest	0.1-0.6	0.1-0.6	0.1-0.6
(vii)	Type of fauna	Dog, Crow, Fox, Monkey, Sparrow, Pigeon, Squirrel Bear, Jackal, Snake	Dog, Crow, Fox, Monkey, Sparrow, Pigeon, Squirrel Bear, Jackal, Snake	Dog, Crow, Fox, Monkey, Sparrow, Pigeon, Squirrel Bear, Jackal, Snake
(viii)	Flora	Sal, Mango, Tendu, Saja, Teak, Orchard, Babul, Spruce, Neem, Eucalyptus, Sunflower,	Sal, Mango, Tendu, Saja, Teak, Orchard, Babul, Spruce, Neem, Eucalyptus, Sunflower,	Sal, Mango, Tendu, Saja, Teak, Orchard, Babul, Spruce, Neem, Eucalyptus, Sunflower,
(ix)	Endangered species if any	Nil	Nil	Nil
(x)	Historical/Cultural monument	Nil	Nil	Nil
(xi)	Any other relevant information	Nil	Nil	Nil
03	Compensation Cost			
(i)	Crop (In Lakhs)	1212 Lakhs (Approx.)	1174 Lakhs (Approx.)	1178 Lakhs (Approx.)
(ii)	Forest & NPV (In Lakhs)	5960 Lakhs (Approx.)	9464 Lakhs (Approx.)	9258 Lakhs (Approx.)
04	No. of Crossing			
(i)	Railway	17	18	19

(ii)	Power Line	174	182	180
(iii)	River Xing etc.	15	17	17
05	Construction problem	Less problem as this line route is easily approachable through available roads, and also passing mostly through plain area with less involvement of forest area and river & power line crossing	Less problem as this line is approachable through state highway, village roads but line is passing through more hilly terrain, forest area and river crossing	Comparatively more problems as approach road is far away and also relatively more hilly terrain, forest area and nos. of river & power line crossing are more in the route alignment
06	O & M Problem	Very less as most part of the line is approachable and almost parallel to approach road	Less as most part of the line is approachable and near to state highway, road	Difficult as approach road are far away and hilly terrain involved
07	Overall Remarks	Construction and O & M will be comparatively easier.	Construction and O & M will be comparatively difficult	Construction and O & M will be comparatively more difficult

It may be seen from above that Alternative-I is the most optimum route as it involves minimum ecological sensitive areas like forest and has a shorter line length compared to the other alternative. Hence **Alternative-I** has been recommended for detailed survey.

SECTION-V: SCREENING OF POTENTIAL ENVIRONMENT IMPACT AND ITS MANAGEMENT

5.0 IMPACT DUE TO PROJECT LOCATION AND DESIGN

Environmental impact of transmission line projects are not far reaching and are mostly localized to ROW. However, transmission line project has some affects on natural and socio-culture resources. These impacts can be minimized by 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 and GPS in route selection result in access to updated/latest information, through satellite images and further optimization of route having minimal environmental impact. Moreover, availability of various details, constraints 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. Although, all possible measures have been taken during the finalization of route alignment for the proposed transmission line but due to peculiarity of terrain and demography of the area where project is being implemented, some environmental impacts may be there. The explanations in brief with regard to specific environment review criteria based on preliminary survey are as follows:

(i) Resettlement

As described earlier all measures are undertaken by POWERGRID at line routing stage itself to avoid settlements such as cities, villages etc. It may be seen from the above description of proposed route alignment and also keeping in mind that no land is acquired for tower foundation as per existing law, the project does not require any resettlement of villagers. However, land for construction substation is required

The proposed project involves construction of terminal station at each end. After exploring various alternatives, land area of 40.9 ha. (28.63 ha. Govt & 12.27 ha. Pvt.) and 70.85 ha. (56.68 ha. Govt & 14.17 ha. Pvt.) selected for establishment of Substation at Champa and Kurukshetra respectively. Since lands to be acquired are mostly Govt. land, the no. of affected persons due to above project will be minimum. It is envisaged that acquisition of Private land of 12.26 ha. at Champa will affect a total of 25 families involving 125 persons and incase of Kurukshetra acquisition of 14.17 ha. Private land will affect a total of 30 families involving 150 persons. However, Rehabilitation & Resettlement issues for the PAPs related to substation land shall be dealt separately as per provisions of ESPP and agreed entitlement matrix with ADB.

(ii) Land value depreciation

Based on past experience land prices are generally expected to rise in the areas receiving power. Further, transmission lines generally pass through uninhabited area, agriculture fields and forests, 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 degree.

(iii) Historical/cultural monuments/value

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 finalization of route alignment in consultation with State revenue authorities and ASI, no such physical/cultural monuments are coming in the proposed route alignment.

(iv) Encroachment into precious ecological areas

As already explained, all precautions are taken to avoid routing of line through forest and other ecological sensitive areas like National park/Sanctuaries. In spite of this it was not possible to avoid forest completely in this project although National park and Sanctuaries have been avoided completely. However, the route of proposed HVDC transmission line is so finalised that it affects minimum forest area. Out of the entire HVDC transmission line length of 1286.7 Km about a total of 75.565 Km stretch shall pass through forest land consisting of 521.398 Ha. forest area involving about 207 ha. in Chhattisgarh, 303.6 ha. in Madhya Pradesh, 9.8 ha. in Uttar Pradesh and 1.0 ha. in Haryana state. Most of the forest stretch in which the line is proposed to be traversed are already degraded and the wildlife species may be present are those who have been adapted to open or disturbed habitat. Therefore with provision of Compensatory Afforestation(CA) 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. The wood, if any, will be sold by the Forest Department, who will also retain the sale proceeds. 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 also provide to construction crews with fuel wood or alternative fuels as a precaution against collection of fuel wood from nearby forest.

Transmission lines can serve as new access routes into previously inaccessible or poorly accessible forests, thereby accelerating forest and wildlife loss. In such cases, POWERGRID cannot take action itself, but local Forest Department personnel will normally assess the dangers and take appropriate action, such as establishing guard stations at the entrance to the forest etc. cost of which is borne by POWERGRID and is included in the compensatory afforestation scheme. Given the already easy access and degraded conditions at the proposed projects sites, this problem is not expected to be encountered. Nonetheless, POWERGRID staff will report to the Forest Department any noticeable encroachment induced by the Projects.

(v) Encroachment into other valuable lands

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 (**Fig-1**). The proposed project envisages construction of 1287 Km of line which will involve approximately 3220 towers. So construction of 3220 nos. of tower will result in a maximum possible

loss of approx. 3220 sq. m. or 0.322 ha. of land. Thus, the total land loss would be 0.322 ha. including forest land which is quite negligible. The transmission line will traverse agricultural land having crops. However, exact numbers of towers coming on such field which may impact crops and number of families likely to be impacted shall be ascertained only after detailed and check survey and fixing of tower locations. As detailed/check survey activity is part of erection contract and will be finalized only after award of contract and completion of detailed/check survey and tower spotting.

In areas where lines will traverse agricultural land, compensation will be paid to owners for any crop damage 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 farmer. A provision of Rs. 1211.13 lakhs towards crop/tree compensation is made in the cost estimate of the project to meet the requirement during construction. 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 of products from the tree over an eight year period (for fruit bearing trees). Agricultural lands under private ownership will be identified, and in accordance with normal POWERGRID procedures compensation will be paid to the affected villagers. Detailed procedure for tree/crop compensation is placed as **Annexure – II**.

(vi) **Interference with other utilities and traffic**

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 lines affect 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 rerouting of the telecom circuits, conversion of overhead telecom circuits into cables etc. to minimize the interference. 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 lines pass by the airports the towers beyond specified height are

painted in alternate orange and white stripes for easy visibility and warning lights are placed atop these towers.

(vii) Interference with drainage pattern

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.

5.1 ENVIRONMENTAL PROBLEMS DUE TO DESIGN

(i) Escape of polluting materials

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

(ii) Explosion/fire hazards

During the survey and site selection for transmission lines and sub-stations, 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 semi-evergreen 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 fault.

(iii) Erosion hazards due to inadequate provision for resurfacing of exposed area

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.

(iv) Environmental aesthetics

Since 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.

(v) Noise/vibration nuisances

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 etc. are raised at the sub-stations that reduce the sound level appreciably.

(vi) **Blockage of wildlife passage**

The transmission lines are constructed aerially and usually run above 11-12 mts. from ground level. By careful route selection process National Parks/Sanctuaries & other wildlife habitat area have been avoided completely. Moreover, due care will be taken during construction stage to avoid any such passage, if encountered any.

5.2 ENVIRONMENTAL PROBLEMS DURING CONSTRUCTION PHASE

(i) **Uncontrolled silt runoff**

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.

(ii) **Nuisance to nearby properties**

As already described in preceding paras, during site selection due care is taken to keep the transmission line and substations away from settlements. Further, all the construction activities will be undertaken through the use of small mechanical devices e.g. tractors and manual labour, therefore, nuisance to the nearby properties if any, is not expected.

(iii) **Interference with utilities and traffic and blockage of access way**

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 are located at sufficient distance so as not to cause any hindrance to the movement of traffic. Stringing at the construction stage is carried out during lean traffic period in consultation with the concerned authorities and angle towers are planted to facilitate execution of work in different stages.

(iv) **Inadequate resurfacing for erosion control**

Since proposed line is to be constructed mostly in plain area, erosion problem is not anticipated. However, if due to terrain at some points transmission towers may be placed on slopes and erosion prone soils, internationally accepted 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. As explained in above paras, adequate steps shall be taken to resurface the area after construction. Wherever sites are affected by active erosion or landslides, both biological and engineering treatment will be carried out, e.g. provision of breast walls and retaining walls, and sowing soil binding grasses around the site. Furthermore, construction is generally undertaken outside the rainy season.

(v) **Inadequate disposition of borrow area**

As mentioned earlier the transmission tower foundations involve excavations on small scale basis and the excavated soil is utilized for back filling. In case of substations generally the sites are selected in such a manner that the volume of cutting is equal to volume of filling avoiding borrowing of the area.

(vi) **Protection of Worker's health/safety**

Provisions for workers' health and safety will be guided by the Safety Regulations/Safety Manual published by POWERGRID, and included in tender documents. Various aspects such as work and safety regulations, workmen's compensation, insurance are adequately covered under the Erection Conditions of Contract (ECC) etc. are a part of bidding documents.

In addition training is imparted to the workers in fire fighting and safety measures. Safety tools like helmet, safety belt, gloves etc. are provided to them in accordance to the provisions of Safety Manual. First aid facilities will be made available with the labour gangs, and doctors called in from nearby towns when necessary. 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 Service Department. POWERGRID has framed guidelines/checklist for workers' safety as its personnel are exposed to live EHV apparatus and transmission lines. These guidelines/checklist include work permits and safety precautions for work on the transmission lines both during construction and operation (**Annexure-III**) and is monitored regularly by site in-charge and corporate Operation Services. Regular health checkups are conducted for construction workers. The construction sites and construction workers' houses will be disinfected regularly if required. In order to minimize/checking of spread of socially transmitted diseases e.g. HIV/AIDS etc. POWERGRID will conduct awareness building programs on such issues for the construction workers.

5.3 ENVIRONMENTAL PROBLEMS RESULTING FROM OPERATION

(i) **O&M Staff/Skills less than acceptable resulting in variety of adverse effects**

The O&M program in POWERGRID is normally implemented by Sub-station personnel for both the lines as well as Sub-stations. However, in respect of the long distance transmission lines there are monitoring offices which are located at various points en-route. Monitoring measures employed includes patrolling and thermo-

vision scanning. The supervisors and managers entrusted with O&M responsibilities are 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 is also reported and rectified. Monitoring results are published monthly, including a report of corrective action taken and a schedule for future action.

Exposure to Electro Magnetic Fields (EMF) There have been some concerns about possible increased risk of cancer from exposure to electromagnetic radiation from overhead transmission lines and research has been undertaken into this matter throughout the world. A World Health Organization (WHO) review also in 1996 held as part of the International EMF Project concluded that:

“From the current scientific literature there is no convincing evidence that exposure to radiation field shortens the life span of humans or induces or promotes cancer”.

No EMF exposure guidelines have been drawn in India though exposure guidelines have been drawn up outside India including:

- State Transmission Lines Standards and Guidelines in the USA;
- International Commission on Non-Ionizing Radiation Protection (ICNIRP);
- US National Council on Radiation; and
- American Conference on Government and Industrial Hygienist (ACGIH).

The 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 a maximum exposure level of 1,000 mG or 100 μ 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 μ T in the RoW. Study also reveals that the maximum value of magnetic field within RoW of 400 kV DC overhead power transmission line is approximately 40 μ T. 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. Based on the studies carried out by different countries on the safety of EHV lines in reference to EMF affect POWERGRID have also carried out such studies with the help of **PTI, USA** and **CPRI, Bangalore** on their design. The studies inferred that the POWERGRID design are safe and follow the required international standard. (*Synopsis of the Power Technologies Inc. report enclosed as Annexure – IV*)

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 discontinued procurement electrical equipments containing PCB more than 2 mg/kg and specification (as per IEC 61619 or ASTM D4059) is being stated in the tender document. POWERGRID in association with NGC, UK has setup a 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. The World Bank has also made following comments after a detailed study on Management of PCBs in India:

“ Power Grid were the most advanced in testing for PCBs of the organizations visited for this project. They have established a procedure for identification of the presence of PCBs in transformer oil and more detailed analysis for positive identification sample. To date no significant concentrations of PCBs have been detected. Power Grid do not appear to have any significant issues regarding PCB management and have initiated a testing program. The experience & laboratories of Power Grid could be used to provide a national PCB auditing service”.

5.4 CRITICAL ENVIRONMENTAL REVIEW CRITERIA

(i) Loss of irreplaceable resources

The transmission projects do not involve any large scale excavation work and generally land is lost to the extent of 0.2-1 sq m only for each foundation which is negligible. Topsoil disturbed during the development of sites is restored after construction. In the instant project only change of land use pattern is foreseen for 111.74 ha of substation land which will be acquired for construction of sub station both at Champa and Kurukshetra. The proposed transmission line also involves 521.398 ha of forest land. 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. Rain water harvesting system at substations to harvest roof top, run off water from colony & switchyard area shall be explored during detail design stage to help in recharging the ground water resulting in conservation of precious natural resource like water

(ii) Accelerated use of resources for short-term gains

The project will not be making use of any natural resources occurring in the area during construction as well as maintenance phases. The construction material such as tower members, cement etc shall come from factories while the excavated soil shall be used for backfilling to restore the surface. Thus the project shall not cause any accelerated use of resources for short term gains.

(iii) Endangering of species

During alignment survey, Forest officials also confirmed that no endangered species of flora and fauna exist in the project area as well as no forest having good biodiversity is getting affected. Thus, there is no possibility of endangering/causing extinction of any species.

(iv) **Promoting undesirable rural-to urban migration**

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.

5.5 PUBLIC CONSULTATION:

Public consultation/information is an integral part of the project implementation. Public is informed about the project at every stage of execution. During survey also POWERGRID's site officials meet people and inform them about the routing of transmission lines. During the construction, every individual, on whose land tower is erected and people affected by ROW would be consulted.

Since the instant project is in preliminary stage and a detailed survey is yet to be undertaken, only some kind of informal group discussion has been taken place so far during walk over survey. However, public consultation using different technique like Public Meeting, Small Group Meeting, informal Meeting as per Environmental **Social Policy & Procedures of POWERGRID (ESPP)** shall also be carried out during different activities of project cycle. During such consultation the public is informed about the project in general and in particular about the following:

- complete project plan (i.e. its route and terminating point and substations, if any, in between);
- POWERGRID design standards in relation to approved international standards;
- health impacts in relation to EMF;
- measures taken to avoid public utilities such as school, hospitals, etc.;
- other impacts associated with transmission lines and POWERGRID's approach to minimizing and solving them;
- land acquisition details, proposed R&R measures and compensation packages in line with POWERGRID's policy;
- trees and crop compensation process.

The process of such consultation will be continued during project implementation and even during O&M stage.

5.6 CONCLUSIONS:

From the above discussions, it seems that it was not possible to avoid forest completely in this project although other ecological sensitive areas like National park/Sanctuaries have been avoided completely. However, through the process of careful route selection, POWERGRID is able to avoid forest areas to the maximum extent possible. Thus, it can be concluded that the route selected is the most optimum route for the proposed transmission line. The infrastructural constraints are very real and pose a limiting factor on the development of the area. The above facts while on the one hand underline the need for implementation of the project for overall development of the area and on another hand suggests that a detailed EIA may not be necessary.

SECTION- VI : ORGANISATIONAL SUPPORT & ENVIRONMENT MANAGEMENT PLAN

6.0 ENVIRONMENTAL MONITORING PROGRAM IN POWERGRID:

Monitoring is a continuous process for POWERGRID projects at all the stages be it the site selection, construction or maintenance.

The success of POWERGRID lies in its strong monitoring systems. Apart from the site managers reviewing the progress on daily basis regular project review meetings are held at least on monthly basis which is chaired by Executive Director of the region wherein apart from construction issues the environmental aspects of the projects are discussed and remedial measures taken wherever required. The exceptions of these meetings are submitted to the Directors and Chairman and Managing Director of the Corporation. The progress of various on-going projects is also informed to the Board of Directors. Following is the organization support system for proper implementation and monitoring of Environmental & Social Management Plan. Flow chart of organization support structure is depicted in **Exhibit -2**.

6.1 CORPORATE LEVEL

An Environmental Management Cell at corporate level was 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 Deptt. (ESMD) by incorporating social aspect of project. Briefly, the ESMD's responsibilities are as follows:

- Advising and coordinating RHQs and Site to carry out environmental and social surveys for new projects.
- Assisting RHQs and site to finalize routes of entire power transmission line considering environmental and social factors that could arise enroute
- Help RHQs and Site 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 & Site officials on environment and social issues and their management plan.

6.2 REGIONAL LEVEL

At each of its 9 (nine) Regional Offices, POWERGRID has 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. 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 site to finalize routes of entire power T/L 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 site on various environmental and social aspects.

6.3 SITE OFFICE

At site, POWERGRID has made the Site-incharge responsible for implementing the Environmental and Social aspect of project and the team is termed as Environmental and Social Management Team (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 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 (EMP) and SMP
- Monitoring of EMP and SMP and producing periodic reports on the same.

It may be noted that POWERGRID is well equipped to implement and monitor its environment and Social Management plans.

As regards 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 as a part of their normal duties. A detailed Environment Management Plan (EMP) including monitoring plan for all possible environmental and social impact and its proper management has been drawn (**Table- 6.1**) and will be implemented during various stage of project execution. A budget estimate towards tree/crop compensation and EMP implementation is prepared and is placed as **Annexure - V**. Since many provisions of EMP are to be implemented by contractor, in order to ensure proper monitoring EMP has been included in the contract document. (**Annexure - VI**)

6.4 ENVIRONMENTAL REVIEW :

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.

Table-6.1 Environment 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)	PCBs not used in substation transformers or other project facilities or equipment.	Transformer design	Exclusion of PCBs in transformers stated in tender specification - once	POWERGRID	Part of tender specifications for the equipment
		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

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
Substation location and design	Exposure to noise	Design of plant enclosures to comply with noise regulations.	Expected noise emissions based on substation design	Compliance with regulations - once	POWERGRID	Part of detailed siting 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
		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 forest authorities - 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	Consultation with local authorities - once	POWERGRID	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	
		Minimise the need by using existing towers, tall towers and RoW, wherever possible	or reserved forest)	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	
		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

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
			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
		Substations to include drainage and sewage disposal systems to avoid offsite land and water pollution.	Substation sewage design	Tender document to mention detailed specifications - once	POWERGRID	Part of detailed substation layout and design /drawings
Explosions/Fire	Hazards to life	Design of substations to include modern fire control systems/firewalls.	Substation design compliance with fire prevention and control codes	Tender document to mention detailed specifications - once	POWERGRID	Part of detailed substation layout and design /drawings
		Provision of fire fighting equipment to be located close to transformers.				

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
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

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
	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
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

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		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
Substation construction	Loss of soil	Fill for the substation foundations obtained by creating or improving local water supply ponds or drains, with the agreement of local communities.	Borrow area siting (area of site in m ² and estimated volume in m ³)	Acceptable borrow areas that provide a benefit - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Substation construction	Water pollution	Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season.	Seasonal start and finish of major earthworks	Timing of major disturbance activities - prior to start of construction activities	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
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 4 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	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water	Amenities for Workforce facilities	Presence of proper sanitation,	POWERGRID (Contractor through	Construction period

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
workers		supply and waste disposal facilities.		water supply and waste disposal facilities - once each new facility	contract provisions)	
Encroachment into farmland	Loss of agricultural productivity	Use existing access roads wherever possible	Usage of existing utilities	Complaints received by local people /authorities - every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
		Ensure existing irrigation facilities are maintained in working condition	Status of existing facilities			
		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				

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		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		
		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
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 –	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
				once for each site		
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 rovisions)	Construction period
		Contractor to prepare and implement a health and safety plan.				
		Contractor to arrange for health and safety training sessions				
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 contract 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	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance	Compliance with setback distances (“as-built” diagrams)	Setback distances to nearest houses	POWERGRID	During operations

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
transmission line alignment and design		with permitted level of power frequency and the regulation of supervision at sites.		– once in quarter		
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 sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substation bunding (Oil sump) (“as-built” diagrams)	Bunding (Oil sump) 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
		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		

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
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
		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	Release of	Processes, equipment	Process, equipment	Phase out	POWERGRID	Operations

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
specifications and design parameters	chemicals and gases in receptors (air, water, land)	and systems using chlorofluorocarbons (CFCs), including halon, should be phased out and to be disposed of in a manner consistent with the requirements of the Government.	and system design	schedule to be prepared in case still in use – once in a quarter		
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