

# Initial Environmental Examination

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June 2017

IND: Green Energy Corridor and Grid Strengthening Project

(320 kV VSC-HVDC power transmission lines between Pugalur, Tamil Nadu and North Trichur, Kerala)

Main Report

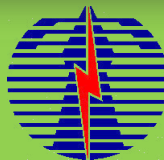
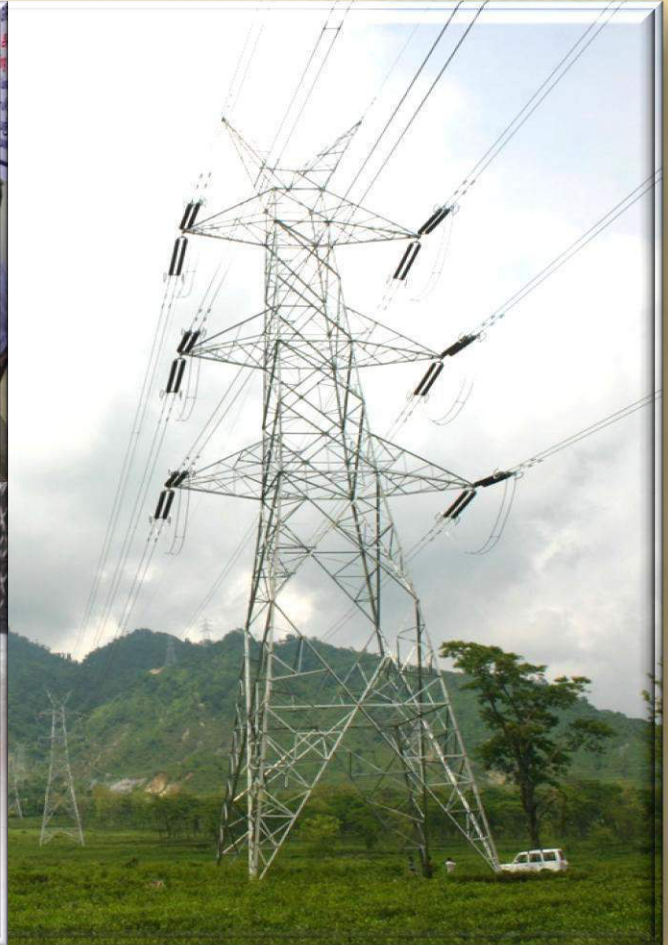
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# **INITIAL ENVIRONMENT EXAMINATION REPORT (IEER)**

**FOR**

**± 320KV HVDC BIPOLE LINK BETWEEN  
PUGALUR – NORTH TRISSUR**



**ENVIRONMENT AND SOCIAL MANAGEMENT**

**POWER GRID CORPORATION OF INDIA LTD.**

**( A GOVERNMENT OF INDIA ENTERPRISE )**

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# SECTION - I : PROJECT DESCRIPTION

## 1.0 BACKGROUND

The Southern Region (SR) of the country is facing power deficit mainly due to (i) delay/deferment of anticipated generation projects and (ii) due to non-availability of gas for existing gas projects in Southern Region (SR). As on date maximum power demand of SR is about 39000 MW and faces a deficit of about 3400 MW in spite of import capacity of about 4920 MW from NEW (North East Western) grid. As per 18<sup>th</sup> Electric Power Survey (EPS) of Central Electricity Authority (CEA) the expected power demand of Southern region by the end of XII and XIII plan would be about 57,200 MW and 82,200 MW respectively. Envisaged generation addition indicates power transfer requirement to Southern Region is expected to increase in coming years particularly under certain scenarios. Therefore, in view of large deficit and requirement of transmission system to meet future requirements, the implementation of High Voltage Direct Current (HVDC) link has been proposed with a capacity of 6000 MW. Also, considering conservation of RoW problem in Kerala and dispersal of power beyond Pugalur, establishment of VSC (Voltage Source Converter) based 2000 MW HVDC link between Pugalur and North Thrissur\* (Kerala) has also been proposed. As decided during the standing committee meeting the project shall be built as three separate schemes as follows:

Scheme # 1 : Raigarh -Pugalur 6000 MW HVDC System;

Scheme # 2 : AC System strengthening at Pugalur end;

Scheme # 3 : Pugalur- Thrissur 2000 MW VSC Based HVDC System.

The scheme has been discussed and agreed in the 37<sup>th</sup> & 38<sup>th</sup> meeting of Standing Committee on Power System Planning in Southern Region held on 31<sup>st</sup> July, 2014 & 7<sup>th</sup> March, 2015 and in the 26<sup>th</sup> meeting of Southern Region Power Committee (SRPC) held on 20<sup>th</sup> December, 2014. Further, the scheme has been discussed and agreed in the Joint meeting of the Standing Committee on Power System Planning of Southern Region meeting and Western Region (WR) held on 20<sup>th</sup> April, 2015. Ministry of Power (MoP) vide letter dated 10/12/2014 has approved the implementation of the scheme by Power Grid Corporation of India Limited (POWERGRID) under compressed time schedule through regulated tariff mechanism. Further, the scheme has also been discussed and agreed in the 34<sup>th</sup> Empowered Committee Meeting on Transmission held on 13<sup>th</sup> April, 2015 for implementation of the scheme under regulated Tariff mechanism.

## 1.1 PROJECT OBJECTIVE:

The objective is to improve import capability of Southern Region.

## 1.2 PROJECT JUSTIFICATION

Southern Region is facing power deficit which has arisen mainly due to – (i) delay/deferment of anticipated generation projects for example, Krishnapattam Ultra Mega Power Project (UMPP) (4000 MW), Cheyyur UMPP(4000 MW), Udangudi TPS, IPP projects in Nagapatanam/ Cuddalore area (3000 to 4000 MW), Kundankulam APP (2000MW), Kalpakkam PFBR (500 MW), East coast project in Srikakulam (1320 MW), Gas based projects in Vemagiri (about 3000 MW) etc. and (ii) due to non-availability of gas for existing gas projects in Southern Region.

As on date maximum power demand of Southern region is about 39000 MW. As per 18<sup>th</sup> EPS of CEA the expected power demand of Southern region by the end of XII and

XIII plan would be about 57,200 MW and 82,200 MW respectively. Hence power transfer requirement to SR is expected to increase in coming years. Presently the existing/planned system can facilitate import of about 9000- 10000 MW into Southern Region. However expected power transfer requirement is about 16000 MW by 2018-19 under certain scenarios. Accordingly, to facilitate the import of about 16000 MW of power to Southern region and considering the long distance, it has been proposed that power from Independent Power Producer (IPP) generation projects in Chhattisgarh (about 15000-16000 MW) can be transferred over HVDC system along with the associated A.C Transmission system at 400 kV level. Accordingly  $\pm 800$  KV 6000 MW HVDC link with terminal each at Raigarh & Pugalur along with VSC based 2000 MW HVDC link between Pugalur and North Thrissur (Kerala) has been proposed. As decided during the Joint meeting of the Standing Committee on Power System Planning of Southern Region and Western Region held on 20<sup>th</sup> April, 2015 the scheme is to be implemented as three separate schemes.

The present report deals with transmission system to be implemented under Scheme-3 i.e. Pugalur- Thrissur 2000 MW VSC Based HVDC System. The proposed system would help in direct supply to Tamil Nadu and Kerala relieving the tie line flow from NEW grid to Southern region and tie line flow between S1-S2. HVDC with its control features shall provide flexibility during operation and help in controlling the power flow on parallel AC lines and provide damping as and when need arises.

### 1.3 PROJECT HIGHLIGHTS

a)	Project Name	:	HVDC Bipole link between Western region (Raigarh, Chhattisgarh) and Southern region (Pugalur, Tamil Nadu)- North Thrissur (Kerala) - Scheme # 3: Pugalur- Thrissur 2000 MW VSC Based HVDC System
b)	Location	:	Southern Region
c)	Beneficiary States/UT	:	Southern Region Constituents
d)	Project Cost	:	Rs 1473.80 Crores
e)	Commissioning Schedule	:	2019

### 1.4 PROJECT SCOPE & PRESENT STUDY

The present Initial Environment Examination Report (IEER) is a document developed to identify possible environmental and social issues associated with construction of 2000 MW HVDC link between Pugalur and North Thrissur covered under "Scheme #3 of HVDC project. The route of proposed line involves Thrissur & Palakkad districts of Kerala and Coimbatore & Tirupur districts of Tamil Nadu State. The IEER provides insight on possible environment & social issues and list management measures to minimize/mitigate them based on POWERGRID's Environment and Social Policy & Procedures (ESPP) and ADB's Safeguard Policy Statement (SPS) 2009. The present IEER covers the following scope of work;

1. Establishment of  $\pm 320$ kV VSC based 2000 MW HVDC link between Pugalur (Tamil Nadu) and North Thrissur (Kerala) including underground portion-153.5 km approx. ( 26.5 km underground portion + 127 km overhead portion);
2. LILO of North Thrissur – Cochin 400 kV (Quad) D/C line at North Thrissur HVDC Station- approx. 0.4 km;



The proposed project activities include the survey for finalizing the route alignment and construction of transmission lines. Lattice towers are erected on designated places using normal excavation and foundations, thereafter conductors are strung across these using manual/stringing machines. For Underground (UG) lines, laying of UG cable is done either by open trenching method or by Horizontal Directional Drilling (HDD) method.

The schematic showing the transmission grid of Southern Region highlighting the proposed line covered under the subject IEER is placed as **Exhibit - I**.



## SECTION - II: BASELINE DATA

**2.0** The proposed project is an interstate one and is located in Thrissur, Palakkad and Coimbatore, Tirupur districts of Kerala & Tamil Nadu State respectively. The basic environmental settings of these States and subproject districts in particular areas are discussed below:

### **2.1 KERALA:**

Kerala has a geographic area of 3.89 million ha. It lies on the west coast between latitude 8°17' and 12°47'N and longitude 74°52' and 77°24'E. Physiographically, the state can be divided into the coastal, the midland and the highland zones.

#### **Coastal Belt**

This strip near the coastline is comparatively plain. Extensive paddy fields, thick groves of coconut trees and picturesque backwaters, interconnected with canals and rivers, are the features of this region. In the southern and northern parts of the state, the coastal belt also has some hills and valleys.

#### **Midland Plains**

In this central region, the hills are not very steep and the valleys are wide. The valleys have been developed as paddy fields and the elevated lands and hill slopes, converted into estates of rubber, fruit trees and other cash crops like pepper, tapioca, etc.

#### **Hills & Valleys**

This strip of land on the eastern edge, close to the Ghats, comprises of steep mountains and deep valleys, covered with dense forests. Almost all the rivers of the state originate here. Tea and coffee estates have cropped up in the high ranges during the last two centuries.

The **Western Ghats**, bordering the eastern boundary of the State, form an almost continuous mountain wall, except near Palakkad where there is a natural mountain pass known as the Palakkad Gap. The average elevation of the Ghats is about 1500 meters above sea level, occasionally soaring to peaks of 2000 to 2500 m. From the Ghats, the land slopes to west on to the plains, into an unbroken coastline. The detailed land use pattern of the State is given in **Table 2.1**.

**Table-2.1 Land use Pattern**

Land use	Area in '000 ha	Percentage
Total geographical area	3,886	
Reporting area for land utilization	3,886	100.00
Forests	1,082	27.84
Not available for cultivation	531	13.66
Permanent pasture & other grazing lands	0	0.00
Land under misc. tree crops & groves	3	0.08
Culturable wasteland	95	2.44
Fallow land other than current fallows	58	1.49
Current fallows	77	1.98
Net area sown	2,040	52.50

*Source: Land use statistics, Ministry of Agriculture, Govt, 2011-12*

Thrissur district is located in the Central part of Kerala and lies between latitude 10°10' and 10°46' and longitude 76°0' and 76°55'. The district is bounded by Malappuram and Palakkad districts in the North, Ernakulam and Idukki districts in the South, Arabian Sea

in the West and Coimbatore district of Tamilnadu and Palakkad district of Kerala in the East. The district has an area of 3032 sq km, which constitute 7.8% of the total area of the State.

Palakkad district is located in the central part of Kerala and lies between 10°21' N and 11°14' N latitude 76°02'E and 76°54'E longitude. The district is surrounded by Malappuram district in the North, by Coimbatore district of Tamilnadu in the East, by Thrissur district in the south and by Thrissur and Malappuram districts in the west. Total geographic area of the district is 4480 sq km, constituting about 11.53% of the State's geographical area.

### **Climate:**

The climate of Kerala is characterized by high rainfall and humidity. The monsoons and summer are two marked seasons of the state, while winter is characterized by only a small decline in temperature. Season wise, the climate of Kerala can be divided into four seasons. End of November to middle of February are generally considered as winter period. Though, the temperature is relatively lower during this period, but as such, there is no marked variation from other seasons except for the fact that this period receives lowest amount of rainfall. Maximum and minimum temperature during this period is 28°C and 18°C respectively, while average rainfall is 25 mm. Summer in Kerala starts from end of February and continues till May. The maximum and minimum temperature are 36°C and 32°C respectively and average rainfall during this season is 135 mm. Southwest Monsoon is the prominent rainy season of the state accounting for around 70% of annual rainfall of the state. It starts from end of May and continues till September. 30°C and 19°C are the maximum and minimum temperature during this period. Heavy rains averaging around 2250-2500mm occurs during these months. North east monsoon is also called retreating monsoon or the reverse monsoon and causes rains during the months of October and November. Maximum temperature is 35°C and minimum temperature is 29°C and average rainfall is 450-500 mm.

The Thrissur district is characterized by wet type of climate and there are four types of identified seasons. The hot summer season from March to May, the southwest monsoon season from June to September, the northeast monsoon season from October to December and a general cool and salubrious climate period during January and February. The average annual rainfall ranges between 2310 mm and 3955mm in the district. The maximum rainfall occurs during the period June to September (SW monsoon) and nearly 71.24% of the total rainfall is received during the season. 16.27% of the total rainfall is received during North East monsoon between October and December, 12.1% of the total rainfall is received during March to May and the balance 0.37% is accounted for during January and February months. The month of July is the wettest month. The average annual maximum temperature is 32°C and minimum temperature 23°C.

Palakkad district experiences humid type of climate. The district receives maximum rainfall during the south west monsoon followed by the north east monsoon. The temperature is pleasant from December to February. The district receives on an average 2362 mm of rainfall annually. Major rainfall is received during June to September in the southwest monsoon (71%). The northeast monsoon contributes about 18%. The western part of the district around Pattambi receives the maximum rainfall whereas in the rain shadow area of Chittur in the eastern part receives the minimum rainfall. The average annual maximum temperature is 32° C and the average annual minimum temperature is 23° C. The wind is predominantly from west and east during morning as well as in the evening hours. The wind speed is high during August (13.6 kmph). The humidity is higher during the monsoon period i.e. from June to September.

**Minerals:**

Kerala is a mineral rich state. A variety of inorganic minerals like Kaolin, Bauxite, Monazite, Zircon, Quartz and Silimanite are found in the state. The state has good quantity of China Clay or Kaolin which forms an important raw material in the production of porcelain items such as crockery and glazed tiles. It is the finest variety of Kaolin found in the entire country and is fundamental in the high tension insulators and sanitary ware producing units. Total estimated quantity of fine china clay is estimated around 80 million tonnes. Another variety of clay called Fire Clay is found in Kerala and is useful albeit of an inferior variety. Total deposit is estimated around 12 million tonnes. It forms the raw material in the production of tiles and bricks. Graphite, an allotrope of carbon which is used in the manufacture of the lead used in pencils also occurs in the state. The deposits of silica and quartz, which are used in production of glass and lens are estimated to be at 75 million tonnes in the state. The other mineral deposits found in the state are 79 million tonnes of iron ores, 25 million tonnes of limestone, 11 million tonnes of bauxite, 35 million tonnes of ilmenite, 3 million tonnes of rutile, 1 million tonnes of monazite and 0.7 million tonnes of borophite.

**Soil :**

In general, the soils of Kerala are acidic, kaolintic and gravelly with low CEC, low water holding capacity and high phosphate fixing capacity. Climate topography, vegetation and hydrological conditions are the dominant factors of soil formation. On the basis of the morphological features and physico-chemical properties, the soils of the State have been classified into red loam, laterite coastal alluvium, riverine alluvium, Onattukara alluvium, brown hydromorphic, saline hydromorphic, Kuttanad alluvium, black soil and forest loam.

In Thrissur district, majorly Sandy loam, Laterite soil and Clayey soil are found, while in Palakkad district Alluvial soil, Laterite soil and Black soil are the major soil types.

**Water Resources:**

Kerala has 44 rivers with a total yield of 70300 MCM (Million Cubic Meter) of water annually. However, the total utilizable yield is estimated to be 42000 MCM, i.e. 60% of the annual yield. Kerala possess only four medium rivers and 40 minor rivers. With respect to the national norm Kerala does not have a single major river and has only four medium rivers. The combined discharge of these four rivers is less than half of that of river Krishna. The remaining forty rivers are only minor ones, the combined discharge of all of them together is only about one-third of that of Godavari. Hence, Groundwater has been the mainstay for meeting the domestic needs of more than 80% of rural and 50% of urban population, besides, fulfilling the irrigation needs of around 50% of irrigated agriculture. The total Annual ground water availability in Kerala has been computed as 6.620 Billion Cubic Meter (BCM) and the net ground water availability in the entire state is 6.029 BCM. The rainfall recharge accounts for about 82 percent of the annual recharge. The annual ground water draft for all uses in the state is 2.809BCM. The net Ground water availability for future irrigation development in the state as in 2009 is of the order of 3.021 BCM. The overall stage of development of the State is 47 percent.

Bharatpuzha and Periyar, the two longest rivers of the state flow through Thrissur district on its northern and southern sides respectively. The other rivers of the state are Chalakudy and Karuvannur. The net ground water availability in the district is estimate as 640.60 MCM, whereas, the draft for all uses is 356.73 MCM. The Kodaungallur block falls under critical category, Ollukara block under semi critical category, while all other blocks are under safe category. The stage of ground water development is 55.69%.

Palakkad district is mainly drained by two rivers, i.e. Bharatpuzha and Bhavani. Of these, Bhavani is east flowing and forms a tributary of Cauvery river. Bharatpuzha basin can be divided into 50 watersheds and 290 mini watersheds. Other rivers of the district are Gayatripuzha, Kannadipuzha, Kalpathypuzha and Thuthapuzha. The net ground water availability in the state is estimated as 79524.78 Ham, whereas, the draft for all uses is estimated as 48417.31 Ham. The stage of Ground water development stands at 60.88%. Out of total 13 blocks, Chittur falls under Over Exploited Category, Malampuzha under Critical, while Pattambi and Thrithala are under Semi-Critical category. All other blocks are considered as safe.

### Ecological Resources:

**Forest:** The recorded forest area is 11,309 sq. km which constitutes 29.10% of the geographic area of the State. According to legal status, Reserved Forests constitute 100 % of the total forest area. There are no Protected and Unclassed Forest in the state. Forest Map of Kerala is enclosed as **Map-1**. As per Champion and Seth Classification, the state has 13 forest types which belong to the seven forest type groups, viz, Tropical Wet Evergreen, Tropical Semi Evergreen, Tropical Moist Deciduous, Littoral and Swamp, Tropical Dry Deciduous, Tropical Thorn and Montane Wet Temperate Forests. Based on interpretation of satellite data, total forest cover is 17,922 sq. km which is 46.12% of State's geographical area. In terms of forest canopy density classes, the State has 1,529 sq. km very dense forest, 9,401 sq. km moderately dense forest and 6,992 sq. km is open forest.

The proposed transmission lines shall pass through 2 districts namely Thrissur & Palakkad districts having forest cover 35.22 % & 36.34 % respectively. However, in spite of taking due care during route selection, involvement of some forest area (approx. 2.0 ha. of reserve forest.) could not be avoided for underground portion as the line is routed along existing RoW of NH-47 which already passing through forest land. The details of forest resources available in the subprojects districts are as follows:

District	Geographical area	( Area in Sq. km)				% Forest cover
		Very Dense forest	Mod. Dense forest	Open forest	Total	
Thrissur	3,032	181	447	440	1068	35.22
Palakkad	4,480	319	685	624	1628	36.34

Source: Indian State of Forest Report 2013

**Protected Areas:** There are 5 National Parks(NP), 17 Wildlife Sanctuaries(WLS) and 1 Community Reserve in the State, covering an area of 3213.24 sq km, which constitutes 8.26% of the total geographic area of the State. Two Wildlife Sanctuaries, i.e. Periyar WLS and Parambikulam WLS have been declared as Tiger Reserves. The state also has four Elephant Reserves, i.e. Wayanad, Nilambur, Anamudi and Periyar. List of protected area found in the subproject districts are provided in table below;

Sl. No.	Name of Protected Areas	Year of Establishment	Area (sq. km.)	District(s)
<b>National Parks (NP)</b>				
1.	Silent Valley	1984	89.52	Palakkad
<b>Wildlife Sanctuaries (WLS)</b>				
2.	Chimmony	1984	10.00	Thrissur
3.	Chulannur Peafowl	2007	3.42	Thrissur and Palakkad
4.	Parambikulam	1973	285.00	Palakkad
5.	Peechi-Vazhani	1958	125.00	Thrissur

As evident from the above list that five protected areas are located in the subproject districts. However, all these protected areas are completely avoided, while selecting the route of the proposed lines.

## Wetlands

In Kerala, a total of 4354 nos. of wetlands have been identified, covering an area of 160590 Ha, which constitutes 4.13% of state's geographical area. The major wetland types are river/stream (65162 Ha.) followed by Lagoons (38442 Ha.), Reservoirs (26167 Ha.) and Waterlogged (20305 Ha.). The districts where the present subprojects are envisaged have the wetland coverage as below:

District	Geographical area (sq.km.)	Wetland area (Ha.)	% of total wetland area (Ha.)	% of district geographic area
Thrissur	3032	13285	8.27	4.38
Palakkad	4480	11892	7.41	2.65

Source: National Wetland Atlas

Ashtamudi and Samsthamkotta located in Kollam district & Vembanad-Kol located in Alapuzha, Kottayam and Ernakulam districts are the three designated Ramsar sites of Kerala. In addition to this, two more wetlands i.e. Kottuli in Kozhikode district and Kadalnudi in Kozhikode and Malappuram districts have been identified by the Ministry of Environment & Forest, Government of India under National Wetland Conservation Programme. *However, none of these wetlands are getting involved/impacted in routing/RoW of proposed lines as these are not located in subproject districts.*

## Human and Economic Development

While in terms of area, Kerala forms only 1.275% of India, its population of 3.34 Crores as per 2011 census, accounts for 2.76% of India's population, resulting in a comparatively higher population density of 860 persons per sq km. Around 52.30% population of Kerala resides in rural area. Kerala has sex ratio of 1084 females per 1000 males, which is highest in the country. Similarly, the literacy rate of Kerala is highest in the country standing at 94%, whereas, same for the country is 74.04%. The population is spread across the State and as such there are no big urban agglomerations. The biggest city of Kerala, Kochi has a population of only about 0.27 million. Kerala has three predominant religions. As per 2011 Census, Christians and Muslims accounted for 19 per cent and 24.7 per cent of the population respectively with the Hindus mostly contributing the rest.

The economy of Kerala is hugely dependent on agriculture. The importance of the agricultural sector of the economy can be noted from the fact that 96% of India's entire yield of pepper and 91% of natural rubber is produced in Kerala. Other important crops in the region are coconut, tea, coffee, cashew, and spices such as cardamom, vanilla, cinnamon, and nutmeg. Rice is the staple food of the local population and is grown in abundance in the state. The agro-climatic conditions in Kerala suit the cultivation of both cash crops and food crops. Agriculture forms the raw material base for a number of agro-processing industries, such as coir, cashew, wood and edible oil. These industries continue to occupy an important place, especially in terms of employment. Coffee, tea, cardamom, ginger, pepper coconut kernels form the bulk of the exports from the state. A small segment of large modern industries based on minerals, chemicals and engineering have also come up, along with an increasing segment of small and medium industries, some based on modern technology and management, such as, textile and Electronic industries. Kerala has about 1.8 lakh small scale industries and about 511 medium sized and large scale industries. In recent years, Services sector led by IT,



Banking & Finance and Tourism has emerged as leading source of revenue and employment generation.

As per 2011 census, the population of Thrissur district is 31,21,200. The population density of the district is 1031 per square kilometer. The district has one of the best sex ratio in the country standing at 1108 females for 1000 males. With a Literacy rate of 95.08 %, the district is one of the most literate district in the country. The economy of Thrissur is largely dependent on industries, retailing and financing. With the presence of textile, timber, coir, fishery and agriculture based industries, Thrissur is considered as one of the most important Industrial centres of the state. Thrissur city is considered as one of the hub of Jewellery business in South India. Thrissur is also one of the main centre of banking and financial institutions. Headquarters of 4 scheduled banks i.e. South Indian Bank, Catholic Syrian Bank, Dhanalakshmi Bank and Lord Krishna Bank are located in Thrissur. Apart from that, city is also the headquarters of leading non banking financial institution such as Mannapuram General Finance and Leasing Ltd, Kerala State Financial Enterprise and ESAF Microfinance and Investment Ltd. The role of Agriculture in district's economy is although secondary but nevertheless, important as it provides employment to considerable number of people. The most important crop of the district is paddy followed by tapioca. These two are the chief food crop. The coconut palm dominates the garden crops of the district. Among the condiments and spices grown in the district, the areca nut is the most important. A large variety of fruit trees are also grown in the district.

As per 2011 census, the population of Palakkad district is 28,09,934, with a population density of 627 persons per square kilometer, against state's population density of 860 persons per square kilometer. The sex ratio of the district stands at 1067 females per 1000 males, which is better than corresponding National figures, however, lower than state's figure of 1084 females per 1000 males. The literacy rate of the district is 89.31%, which again is lower than corresponding figures for the state. Agriculture is the main occupation and chief source of sustenance of the people of Palakkad district. Paddy, Coconut, Rubber, Palm trees, Pulses, Areca Nut, Tapioca, Ginger, Groundnut, Sugarcane, Cotton, Banana etc are the main crops of the district. The cropping pattern in Palakkad is overwhelmingly food crops oriented. However, the share of non-food crops is showing an increasing trend gradually. Paddy is the principal crop of the district. Mangoes, Banana and Plantains are the important fresh fruits cultivated in the district. Arecanut and Sesamon are the other cash crops of the district. Cashewnut is mostly cultivated in Ottapalam and Mannarghat taluks. Tea plantations are located in Nelliampathy hills and Sholayar. Orange and Rubber are also grown in the district. The district has a conducive environment for development of industries due to several favourable factors such as availability of land, industrial labour, power, infrastructure facilities, water etc. The total number of registered industrial units in the district is 21,679, out of which 63 belong to Medium and Large Scale. The Directorate of Industries and Commerce (DIC) has developed four such Industrial Development Areas viz. (1) Industrial Development Area (IDA), Kanjikode (2) New Industrial Development Area (NIDA), Kanjikode (3) Canalpirvu and (4) Umminikulam.

## **2.2 TAMIL NADU:**

Tamil Nadu is situated on the south eastern side of the Indian peninsula. It is bounded on the east by Bay of Bengal, in the south by the Indian Ocean, in the west by the states of Kerala and Karnataka and in the north by the Karnataka and Andhra Pradesh. Tamil Nadu has a geographic area of 130,058 sq. km, which constitutes 3.96% of the land area of the country. It lies between 08°04' N and 13°34' N latitude and 76°14'E and 80°21'E longitude.

**Physiographically** the state can be divided into two natural divisions: the eastern coastal plain and the hilly region along the north and the west. Along the whole length of the western part, at a distance from the sea varying from 80 to 160 km runs the range of the Western Ghats, a steep and rugged mass averaging 1220 meters above the sea level and rising to 2440 metres at the highest point. The slopes of the Western Ghats are covered with heavy evergreen forests. The Nilgiris and the Anamalai are the hill groups with the maximum height. The general land use pattern of the State is given in **Table 2.2**.

**Table 2.2: Land use Pattern**

Land use	Area in '000 ha	Percentage
Total Geographical area	13,006	
Reporting Area for land utilization	13,033	100.00
Forests	2,125	16.30
Not available for cultivation	2,669	20.48
Permanent Pasture & Grazing land	110	0.84
Land under misc. tree crops & groves	252	1.93
Culturable waste land	329	2.52
Fallow land & other than current fallows	1,594	12.24
Current fallows	967	7.42
Net area Sown	4,986	38.26

*Source: Land use statistics, Ministry of Agriculture, GOI, 2011-12*

Coimbatore district lies between 10°10" and 11°30" N latitude and between 76° 40" and 77°30" E longitude. It has an area of 7469 sq km and is bounded by the Nilgiris on the north, Erode district on the east, Dindigul district on the south and the State of Kerala on the west.

Tiruppur district has been carved out of Coimbatore and Erode districts in the year 2008. The district has total geographical area of 5186.34 sq km and lies between 11°06'27"N-11°10'75"N latitude and 77°20'23"E-77°33'98"E longitude. Tiruppur district is bounded by Coimbatore district in the west side, Erode district to the North and northeast side and Karur district in the east side and Dindigul district in the south east side. To the south side, it is surrounded by Idukki district of Kerala.

### **Climate:**

The climate of Tamil Nadu is characterized as tropical with little variation in summer and winter temperatures. The hottest period is April-June, with the temperature rising up to 40°C. November-February is the coolest period with average temperature hovering around 20°C. Tamil Nadu gets its rain from North-East Monsoons between October and December. The average annual rainfall in Tamil Nadu ranges between 635-1905 mm. The coastal region of Tamil Nadu becomes uncomfortably warm and humid during summers; however, nights are cool and pleasant due to sea breezes.

Coimbatore district has a pleasant climate with mild winter and moderate summer. During summer, the maximum temperature goes up to 34.7°C, while minimum temperature hovers around 21°C. In winters, the recorded maximum and minimum temperatures are 32.2°C and 19.2°C respectively. Rainy season extends from September to November. Average annual rainfall is 61.22 cms.

Tiruppur has a salubrious climate, which prevents temperature going to extreme levels. March, April and May are summer months. Temperature ranges from 29°C - 35°C, which is much lower than the rest of Tamil Nadu. Monsoon season consisting of months of June, July and August is characterized by mild showers and a fall in temperature.



The average annual rainfall of the district is 700 mm. September to January is considered as Winter months. Maximum temperature during winter is 29°C, while minimum is 24°C. In the months of October and Early November, some rainfall occurs due to North-East Monsoon.

### Minerals:

Tamil Nadu is the leading holder of country's resources of vermiculite, magnetite, dunite, rutile, garnet, molybdenum and ilmenite. The State accounts for the country's 81% lignite, 75% vermiculite, 69% dunite, 59% garnet, 52% molybdenum and 30% titanium minerals resources. Important minerals and their places of occurrence are given below:

S. N.	Mineral	Districts/Places of Occurrence
1	Bauxite	Dindigul, Namakkal, Nilgiris, Salem
2	Feldspar	Coimbatore, Dindigul, Erode, Kanchipuram, Karur, Namakkal, Salem, Tiruchirapalli
3	Fireclay	Cuddalore, Kanchipuram, Perambalur, Pudukottai, Sivaganga, Tiruchirapalli, Vellore, Villupuram
4	Granite	Dharmapuri, Erode, Kanchipuram, Madurai, Salem, Thiruvannamalai, Tiruchirapalli, Tirunelveli, Vellore, Villupuram
5	Graphite	Madurai, Ramnathapuram, Shivganga, Vellore
6	Gypsum	Coimbatore, Perambalur, Ramnathapuram, Tiruchirapalli, Thoothukudi, Virudhunagar
7	Lignite	Cuddalore, Thanjavur, Thiruvarur, Nagapattinam, Ramnathapuram
8	Limestone	Coimbatore, Cuddalore, Dindigul, Kanchipuram, Karur, Madurai, Nagapattinam, Namakkal, Perambalur, Ramnathapuram, Vellore,
9	Dunite	Salem
10	Lignite	Cuddalore, Thanjavur, Thiruvarur, Nagapattinam, Ramnathapuram
11	Vermiculite	Dharmapuri, Tiruchirapalli, Vellore
12	Garnet	Ramnathapuram, Tiruchirapalli, Tiruvarur, Kanyakumari, Thanjavur, Tirunelveli
13	Molybdenum	Dharmapuri, Dindigul, Vellore
14	Titanium	Kanyakumari, Nagapattinam, Ramnathapuram, Thiruvallur, Tirunelveli, Thoothukudi



Coimbatore district is not endowed with any remarkable mineral wealth. Major minerals like limestone, soap stone, quartz, & feldspar occurs in this district in small quantities. Minor minerals rough stone, gravel, brick earth, & granite also occur in this district. Availability of huge quantities lime stone in Ettimadai & Valaiyar area of Madukkarai Block has helped the growth of cement industries in Madukkarai.

In Tirupur district colour granite is the main mineral found. Other prominent minerals of the district are Dunite, Quartz, Gypsum and Magnesite.

### **Soil:**

The major soil groups of Tamil Nadu are Red soil (62%), Black soil (12%), Laterite soil (3%) and Coastal soil (7%). As per USDA system of soil classification, the soils of Tamil Nadu are divided into six orders, out of which around 50% of total area of Tamil Nadu is occupied by Inceptisol followed by Alfisols, which occupy 30% of total state area. Vertisols cover around 7% of total state's area, Entisols cover 6% and Ultisols cover 1% of total area. Mollisols cover negligible area of Tamil Nadu.

The soils of Coimbatore district can be broadly classified into 6 major soils types viz., Red calcareous Soil, Black Soil, Red non-calcareous, Alluvial and Colluvial Soil, Brown Soil, and Forest Soil. About 60 per cent of the district is covered by red soils, of which red calcareous soil is predominant. In Tirupur district, Black soils and Red soils are the major soil types. These two soil types occupy about 96% of total area, with rest 4% shared by other soils.

### **Water Resources:**

#### *a) Surface Water:*

The total surface water potential of the state is 24864 Million Cubic Metres (MCM). There are 17 major river basins in the State with 61 reservoirs and about 41,948 tanks. Of the annual water potential of 46540 MCM, surface flows account for about half. The rivers of the state flow eastward from the Western Ghats and are entirely rain-fed. The 760 kms long Kaveri River is the longest river of Tamil Nadu. This river is popularly called the "Ganga of the South" or the "Dakshina Ganga" and divides the state in two halves. The other important rivers of the state are Palar, Cheyyar, Ponniyar, Meyar, Bhavani, Amaravati, Vaigai, Chittar and Tamaraparni, Noyil, Suruli, Gundar, Vaipar, Valparai and Varshali.

Bhavani, Noyil, Amaravathi, Palar, Aliyar, Upar etc are the main rivers of Coimbatore district. Noyyal, Amaravathi, Palar and Nallar are the main rivers of Tirupur district.

#### *b) Ground Water:*

The utilizable groundwater recharge in the state is 22,423 MCM. The current level of utilization expressed as net ground water draft of 13.558 MCM is about 60 percent of the available recharge, while 8875 MCM (40 percent) is the balance available for use. Over the last five years, the percentage of safe blocks has declined from 35.6 per cent to 25.2 percent while the semi-critical blocks have gone up by a similar percentage. Over-exploitation has already occurred in more than a third of the blocks (35.8 percent) while eight blocks (2 percent) have turned saline. The water level data reveals that the depth of the wells ranges from an average of 0.93 metres in Pudukottai district to 43.43 metres in Erode. According to the Central Groundwater Board, there has been a general decline in groundwater level in 2003 due to the complete de-saturation of shallow aquifers.

The net groundwater availability for Coimbatore district is 792.874 MCM, whereas, existing Gross draft for all uses currently stands at 821.102 MCM, which indicates 104% groundwater development. The estimation of groundwater resources for the district has shown that out of 19 blocks, 11 blocks are overexploited and 4 blocks are under critical category.

The ground water scenario in Tirupur district also not good and requires attention. Out of 13 blocks of the district, 1 block falls in Over-Exploited category and 3 blocks fall in critical category, while 8 blocks are categorized as Semi-critical. Only 1 block is falling under Safe category.

### Ecological Resources:

**Forest:** The recorded forest area is 22,877 sq. km which constitutes 17.59% of the geographic area of the State. According to legal status, Reserved Forests constitute 84.75%, Protected Forests constitute 9.54% and Un-classed Forests constitute 5.71% of the total forest area. Forest Map of Tamil Nadu is enclosed as **Map-2**. Tamil Nadu's forests are largely deciduous and thorn types and these two major types account for 87.30 % of the total forest area. Based on interpretation of satellite data, total forest cover is 23,844 sq. km which is 18.33% of State's geographical area. In terms of forest canopy density classes, the State has 2,948 sq. km of very dense forest, 10,199 sq. km of moderately dense forest and 10,697 sq. km of open forest.

The proposed transmission lines shall pass through Coimbatore and Tirupur districts of Tamil Nadu having 24.90% and 26.92% respectively. However, by adopting careful route selection technique, forest involvement along route lines have been completely avoided thereby minimizing ecological disturbance. The details of forest resources available in the subproject area districts are as follows:

District	Geographic area	( Area in Sq. km)				% Forest cover
		Very Dense forest	Mod. Dense forest	Open forest	Total	
Coimbatore	7,469	381	932	547	1860	24.90
Erode*	8,209	467	1341	402	2210	26.92

Source: Indian State of Forest Report 2013

\* Tiruppur district was earlier part of Erode and Coimbatore districts

### Protected Areas:

The protected areas of Tamil Nadu extend to 6,708 km<sup>2</sup> constituting 5.16% of the geographic area and 29% of the recorded forest area. Tamil Nadu ranks 14th among all the States and Union Territories of India in terms of protected area. There are 14 Wildlife sanctuaries over 5,707.13 sq. km. and 14 bird sanctuaries over 173.34 sq. km., 5 National Parks over 827.63 sq. km., 4 Tiger Reserves, 4 Elephant Reserves and 3 Biosphere Reserves for in situ conservation of wild fauna and flora. There is one Conservation Reserve in Tamil Nadu. List of protected areas in subproject districts (Coimbatore and Erode) is given below:

Sl. No	Name of Protected Areas	Year of Establishment	Area (sq km)	District(s)
<b>National Parks(NP)</b>				
1.	Indira Gandhi (Annamalai)	1989	117.10	Coimbatore
<b>Wildlife Sanctuaries(WLS)</b>				
2.	Indira Gandhi (Annamalai)	1976	841.49	Coimbatore
3.	Satyamangalam	2008	524.35	Erode

Sl. No	Name of Protected Areas	Year of Establishment	Area (sq km)	District(s)
4.	Vellode WLS	1997	0.77	Erode

As evident from the above list that four protected areas are located in the subproject districts. However, all these protected areas are completely avoided, while selecting the route of the proposed lines.

### **Wetlands:**

The total wetland area of the state is estimated around 902534 ha. (including 18,294 small wetlands of size <2.25 Ha. each) which is 6.92% of the state's geographic area. Major wetland types are Lake/Pond (316091 Ha.), Tank/Pond (237613 Ha.), River/Stream (136878 Ha) and Reservoir/Barrage (56419 Ha). The districts where the present subprojects are envisaged have the wetland coverage as below:

District	Geographical area (sq.km.)	Wetland area (Ha.)	% of total wetland area (Ha.)	% of district geographic area
Coimbatore	7469	8070	0.89	1.08
Erode	8162	13570	1.50	1.66

*Source: National Wetland Atlas*

*However, none of these wetlands are getting involved/impacted in routing/RoW of proposed lines as these are not located in subproject districts.*

### **Human and Economic Development:**

Tamil Nadu has achieved reasonable economic growth in past few years. With a population of around 7, 21,47,030 as per 2011 census, it is one of the populous states of India. The population density is 555 per square km, which is higher than the National Average. The sex ratio of the state is healthy 996 females per 1000 males, which is better than the corresponding National figure. People belonging to Schedule Castes constitute around 20% of total population, whereas, share of people belonging to Schedule Tribes is a miniscule 1.1%. The state enjoys a reasonably good literacy rate of 80.09% which is better than National Average of 74.04%. The Human Development Index of the state is 0.570, which also compares favorably with National Average of 0.467.

Agriculture is the main source of livelihood with around 5139832 ha of area under cultivation. Paddy is the main crop. It is raised in three crops. The first crop is known as 'Kuruvali' ( the short term crop) with a duration of three and a half to four months from June - July to Oct-Nov. The second crop called 'Thaladi' has a duration of 5 to 6 months Oct -Nov to Feb -March. Third is 'Samba '(the long term) crop and has a duration of almost 6 months from Aug to January. Chief sources of irrigation are the rivers tanks and wells. Other major food crops are jowar, ragi, bajra, maize and pulses. Cotton, sugarcane, coconut, tea and coffee as well as a number of horticultural products like bananas and mangoes are cash crops while ground nuts, sesame, sun flower are important oil seeds crops.

Major Industries in Tamil Nadu are cotton, heavy commercial vehicles, auto components, railway coaches, power pumps, leather tanning industries, cement, sugar, paper, automobiles and safety matches. Global auto majors Hyundai Motors, Ford, Hindustan Motors and Mitsubishi have commenced production plants. Ashok Leyland and TAFE have set up expansion plants in Chennai. The state is an important exporter of tanned skin and leather goods, yarn, tea, coffee, spices, engineering goods, tobacco,



handicrafts and black granite. Tamil Nadu contributes to 60 per cent of the tannery industry in India.

In recent times knowledge based industries like I.T. and Biotechnology have become the thrust area in the industrial scene in Tamil Nadu. TIDEL, a software technology park, has been established in Tharamani, Chennai. The software exports from the State during the year 2012-13 is expected to be around Rs. 50,000 crores with an impressive growth rate of more than 10%. Top I.T. and Telecom companies such as Nokia, Motorola, Foxcon, Flextronic and Dell have commenced production. Handloom is another important cottage industry. Silk sarees of Kancheepuram are famous all over India. Cottage units produce cotton sarees, dhoties, towels and lungies.

As per 2011 census, the total population of Coimbatore district is 34,58,045, which forms 4.79% of the state's population. The district has a population Density of 460 persons per square km. The Sex ratio of the district stands at 1000 females for every 1000 males, which is better than the corresponding National figure. The Literacy rate of the district is 83.98%, higher than National Literacy Average. Around 15.5% population belongs to Schedule Castes and just 0.82% population belongs to Schedule Tribes. Though, the economy of Coimbatore district is mainly driven by industries, Agriculture is still one of the main sources of livelihood in the district with more than 3,00,000 people are engaged in it, either as cultivators or as labourers. Sorghum, Groundnut, Rice, maize are the main crops of the district. Tomato, Tapoica, Onion, Brinjal and Bhendi are the major vegetables grown in the district. Banana is the main fruit grown in the district followed by Mango, Grapes, Sapota and Amla. Coconut is the prominent cash crop of the district, while Tea, Coffee and cotton also provide cash income in the hands of the farmers. Coimbatore is one of the most industrialized districts of Tamil Nadu. There are more than 25,000 small, medium and large sale industries. Coimbatore houses a large number of small and medium textile mills. It also has central Textile research institutes, such as South India Textile Research Association. Some of the major industries present in Coimbatore are PSG, Sakthi group of Industries, Larsen and Toubro, Lakshmi Machine Works (LMW), Premier Instruments & Control Limited (PRICOL), Premier Evolvics, ELGI Equipments, Shanti Gears, Roots Industries Ltd etc. Coimbatore is also called as the Pump City. The Major Pump industries present in the district such as Suguna pumps, Sharp Industries, CRI Pumps, Texmo Industries, Deccan Pumps & KSB Pumps are renowned worldwide. Coimbatore is also emerging as an IT and BPO city with the presence of companies like Tata Consultancy Services, Cognizant Technology, CSS Corp etc. The city also houses numerous jewelers engaged in jewellery exports and a few Wind Energy Companies.

As per 2011 census, the total population of Tirupur district is 24,79,052 which forms 3.44% of the state's population. About 38.64% of district's population lives in rural areas. The district has a population Density of 478 persons per square km. The Sex ratio of the district stands at 989 females for every 1000 males, which is better than the corresponding National figure. The Literacy rate of the district is 78.68%, higher than National Literacy Average. Around 15.97% population belongs to Schedule Castes and just 0.22% population belongs to Schedule Tribes. Though, Tirupur is largely an industrial district, Agriculture still plays an important role in its economy. In Tirupur, majority of farmers belong to small and marginal category and they play a critical role in ensuring agricultural productivity of the district. The total area of cultivation is around 2,28,556 Ha., mainly for food and commercial crops. The chief food crops of the district are paddy, millets and pulses, while cotton, oil seeds and coconut are main non food commercial crops. Coconut is one of the most important plantation crops, which occupies around 16.10% of the total cultivated area. Mango, Banana, Amla and Guava are the main fruits grown in the district. The economy of the district is largely driven by

industries specially those belonging to textile sector. There are 7068 registered industrial units in the district, out of which 69 belong to Medium and Large scale.

There are 7 Industrial Areas in the district. Textile has been the back bone of the economy of the district. It is due its textile sector, Tirupur became world famous and popularly known as T shirt town of India. There are 6250 textile based industries in the district, out of which 1500 are knitting units. Huge numbers of direct and indirect employment is generated due to textile industries in the district.

**Additional/detailed information regarding the environmental and social features along the alignment is provided in Section- IV.**

## **SECTION – III : POLICY, LEGAL & REGULATORY FRAMEWORK**

**3.0** Power transmission project 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 and State specific laws keeping in mind appropriate international obligations and directives 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* provide:

**"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country". (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". {Article 51A (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, transgressing into the area of protection of environment, and held the protection of environment and citizen's right to live in eco-friendly atmosphere as the basic right guaranteed under Article 21.

Thus the Indian Constitution has now two fold provision:

- (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 Ministry of Power (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 approval from the Central government. POWERGRID projects, when involving forest areas, undergo detailed review and approval procedures to obtain a Forest Clearance certificate from Ministry of Environment Forest & Climate Change (MoEFCC), GoI before starting any construction activity in designated forest area.

- **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 (EPA). However, amendment in the Environment (Protection) Act, 1986 on 7<sup>th</sup> May' 1992 made it necessary to obtain clearance from MoEFCC for power transmission projects in three districts in the Aravalis (*viz.*, Alwar in Rajasthan and Gurgaon & Nuh-Mewat in Haryana). The Aravali range, in these areas, is heavily degraded; hence, any industrial activity there becomes critical. Environment Impact Notification, 1994 & 2006 lays down specific project categories that require clearance from MoEFCC. Power transmission projects are not included in this list.

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

MoEFCC vide its notification dated 17<sup>th</sup> 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 16<sup>th</sup> September 1987. As per the notification certain control and regulation has been imposed on manufacturing, import, export and use of these compound. POWERGRID shall follow provisions of notification and phase out all equipments which uses these substances and planning to become a CFC free organization in near future.

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

MoEFCC vide its notification dated 16<sup>th</sup> May, 2001 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has put certain restriction 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, Handling & Transboundary Movement) Rules, 2008 :**

Vide notification dated 24<sup>th</sup> September, 2008 under the EPA, 1986, MoEFCC notified rules for environmentally sound management of hazardous wastes to ensure that the hazardous wastes are managed in a manner which shall protect health and the environment against the adverse affects that may result from such waste. The used transformer oil has been declared as hazardous wastes vide this notification. 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.

- **E-waste (Management and Handling) Rules, 2011:**

Vide notification dated 12<sup>th</sup> May 2011 under the EPA, 1986, MoEFCC notified rules for environmentally sound management of e-waste to ensure that e-waste are managed in a manner which shall protect health and the environment against the adverse effects that may result from hazardous substance contained in such wastes. Thus, it is the responsibility of the bulk consumer (POWERGRID) to ensure that e-waste generated is channelized to authorized collection center(s) or registered dismantler(s) or recycler(s) or is returned to the pick-up of take back services provided by the producer. POWERGRID, being a bulk consumer of electrical and electronics equipments shall maintain the record as per Form-2 for scrutiny by State Pollution Control Board.

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

Under the United Nations Convention on Biological Diversity signed at Rio de Janeiro on the 5<sup>th</sup> 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 provision of act certain areas which are rich in biodiversity and encompasses unique and representative ecosystems are identified and designated as Biosphere Reserves to facilitate their conservation. All restrictions applicable to protected areas like National Parks & 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.

- **The Scheduled Tribes & Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006:**

This act recognizes and vests the forest rights and occupation in forest land to forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recognized.

The definitions of forest dwelling schedule tribes, forestland, forest rights, forest villages, etc. have been included in Section 2 of the Act. The Union Ministry of Tribal Affairs (MoTA) is the nodal agency for implementation of the Act while field implementation is the responsibility of the government agencies. Its implementation has also been linked with forest clearance process under Forest (Conservation) Act, 1980 w.e.f. August 2009 by MoEFCC. POWERGRID shall abide by the provisions of the act if any portion of the transmission line is passing through forest land, in occupation of the forest dwelling scheduled tribes and other traditional forest dwellers for laying of transmission lines. However, for linear projects including transmission lines obtaining of NoC from the gram sabhas has been exempted for the requirement of FRA compliance as per MoEF circular dated 5<sup>th</sup> February 2013.

### **3.1.3 FUNDING AGENCY:**

- **ADB's Safeguard Policy Statement (SPS) 2009**

The SPS 2009 describes ADB's policy and operational procedures on three key safeguard areas: environment, involuntary resettlement, and indigenous peoples, as well as a set of specific safeguard requirements that borrowers are expected to meet when borrowing for development projects. Its objective is to ensure social and environmental sustainability of projects through avoidance, minimization, mitigation and/or compensation of adverse impacts on environment and affected peoples; and

help Borrowers to strengthen their safeguard systems and to develop their capacity in managing the environmental and social risks.

SPS 2009 includes categorization of projects based on significance of potential environmental impacts. The category is determined by the project's most environmentally-sensitive component including direct, indirect, cumulative, and induced impacts within the project's area of influence. Project categorization system is given below:

**Category A** –an environmental impact assessment (EIA) is required for a project that is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.

**Category B** –an initial environmental examination (IEE) is required for a project that is likely to have adverse environmental impacts that are less adverse than those of Category A which are site-specific, few if any of them irreversible and in most cases mitigation measures can be designed more readily than Category A.

**Category C**– no environmental assessment is required but environmental implications will be reviewed for a project that is likely to have minimal or no adverse environmental impacts.

**Category FI**–if a project involves investment of ADB funds to or through a financial intermediary.

Based on the significance of the potential environmental impacts resulting from the transmission project and SPS 2009, the project is classified as environment category “B” requiring an IEE.

Power transmission projects financed by ADB are also required to follow the World Bank Group Environmental, Health, and Safety (EHS) General Guidelines and EHS Guidelines for Electric Power Transmission and Distribution published by the International Finance Corporation, 30 April 2007.

## **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 shall implement the said constitutional provision in true spirit to fulfill its environmental and social obligations and responsibilities.

### **3.2.2 MANDATORY REQUIREMENTS (NATIONAL/STATE)**

- **The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARRA) :**

Govt. of India replaced the old Land Acquisition Act, 1894 and notified the new RFCTLARRA, 2013 which came into force from 1<sup>st</sup> January 2014. This act ensures

appropriate identification of the affected families/households, fair compensation and rehabilitation of titleholders and non-titleholders. However, the new act i.e. RFCTLARRA, 2013 authorizes State Govt. or its authorized Government agency to complete the whole process of acquisition of private land including Social Impact Assessment (SIA), Action Plan for R&R (i.e. Rehabilitation and Resettlement) & its implementation and POWERGRID's responsibility is limited to identification and selection of suitable land based on technical requirement and ensuring budget allocation.

- **Rights of Way and Compensation under Electricity Act, 2003<sup>1</sup>:**

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, Gol vide gazette notification dated 23<sup>rd</sup> 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.

### **3.2.3 FUNDING AGENCY**

- **ADB's Safeguard Policy Statement 2009**

ADB's Safeguard Policy Statement (SPS), June 2009 set out specific safeguard requirements for borrower as per its policy & operational procedures on three key safeguard areas: environment, involuntary resettlement, and indigenous peoples.

The key objective is to avoid or minimize involuntary resettlement (IR) by exploring project and design alternatives and to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels and to improve the standards of living of the displaced poor and other vulnerable groups. Regarding Indigenous People the objective of the policy is to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.

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<sup>1</sup> Ministry of Power, Govt. of India vide its notification dated 15<sup>th</sup> Oct., 2015 has issued guidelines for payment of compensation for damages in regard to RoW for transmission lines. Once the above guidelines are adopted by respective States, compensation shall be paid as per the norms.

## **SECTION IV: APPROACH FOR ROUTE/SITE 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 is detailed below:

While identifying the transmission system, preliminary route selection is done by POWERGRID based on the Survey of India Topo sheets, Forest Atlas (Govt. of India's Publication) and Google Maps etc. During route alignment all possible efforts are made to avoid the forest 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. *Presence of protected areas like National Parks, Wildlife Sanctuaries and other ecological sensitive areas are verified by superimposing the proposed alternative alignment on the Protected Area Network Geospatial Map of Wildlife Institute of India (WII), Gol.*

### **4.1 STUDY OF ALTERNATIVES**

#### **4.1.1 ENVIRONMENTAL CRITERIA FOR 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 displacement/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 National Parks, Sanctuaries 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 line in close consultation with representatives of concerned Forest Department and the Department of Revenue. Although under the law, POWERGRID has the 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 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, Sanctuaries, Eco-sensitive zones, Tiger reserves, Biosphere reserves, Elephant corridors and IBA sites etc. Keeping above in mind the routes of proposed lines under the project have been so aligned that it takes care of above factors. As such different alternatives for transmission lines were studied with the help of Govt. published data like Forest atlas, Survey of India and Google Maps 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.

## 4.2 EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR HVDC BIPOLE LINK BETWEEN NORTH THRISSUR AND PUGALUR LINE

Three different alignments (**Map-3**) were studied with the help of published data/maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of three alternatives in respect of the proposed line are as follows:

S.N	Description	Alternative-I	Alternative-II	Alternative-III
<b>1(a)</b>	<b>Route particulars - Underground(UG) Portion</b>			
i.	<i>Out of total line length of 153.5 km, approx 26.5 km of cable is proposed to be laid underground in Kerala portion to conserve the RoW and minimize the disturbance to local community. This underground cable shall be laid along the NH-47 starting from Thrissur HVDC terminal up to Vadakancheri village. For details of underground route refer section wise drawing placed at <b>Map-4</b>. As per preliminary assessment, approx. 5km (2.0 ha.) is passing through forest land in the existing RoW of NH-47 for which necessary Forest clearance under FCA, 1980 was already obtained by NHA. However, necessary permission/diversion, as applicable, shall be obtained from concerned authority before actual execution in the forest portion.</i>			
<b>1(b)</b>	<b>Route particulars- Overhead(OH) Portion</b>			
i.	Route Length (km)	130	127	131
ii.	Terrain			
	Hilly	Nil	Nil	Nil
	Plain	100%	100%	100%
<b>2.</b>	<b>Environmental impact (UG &amp; OH)</b>			
i.	Name of District(s) through which the line passes	Thrissur, Palakkad, Coimbatore & Tirupur	Thrissur, Palakkad, Coimbatore & Tirupur	Thrissur, Palakkad, Coimbatore & Tirupur
ii.	Town in alignment	Nearby towns are Thrissur, Jellipatti, Vadakancheri, Valayar, Palakkad, Arasampalayam, Allattur, Dharapuram	Nearby towns are Thrissur, Palakkad, Chittur, Nallepalli, Chenjeri, Dharapuram etc.	Nearby towns are Thrissur, Vadakancheri, Uttukuli, Nemmad, Plluchi, Animapatti, Dharapuram etc.
iii.	House within RoW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey
iv.	Forest involvement (km/ha.)	UG – 5 km/2.0 ha.) (refer 1a(i))		
		OH- Nil	OH- Nil	OH- Nil
v.	Type of Forest (RF/PF)& whether part of Wildlife Area/Elephant corridor/ Biodiversity Hotspots/ Biosphere Reserve/ Wetlands or any other environmentally sensitive area, if any	Reserve Forest	Reserve Forest	Reserve Forest

S.N	Description	Alternative-I	Alternative-II	Alternative-III
vi.	Density of Forest	Very Low	Very Low	Very Low
vii.	Type of flora	Coconut ( <i>Cocos nucifera</i> ), Neem ( <i>Azadirachta indica</i> ), Rubber( <i>Ficus elastic</i> ), Cashew ( <i>Anacardium occidentale</i> ), Paddy ( <i>Oryza sativa</i> ), Banana ( <i>Musa acuminata</i> ) & Areca Nut ( <i>Areca catechu</i> ), Cotton ( <i>Gossypium arboretum</i> ) & various bamboo species etc.	Coconut ( <i>Cocos nucifera</i> ), Neem ( <i>Azadirachta indica</i> ), Rubber( <i>Ficus elastic</i> ), Cashew ( <i>Anacardium occidentale</i> ), Paddy ( <i>Oryza sativa</i> ), Banana ( <i>Musa acuminata</i> ) & Areca Nut ( <i>Areca catechu</i> ), Cotton ( <i>Gossypium arboretum</i> ) ) & various bamboo species etc.	Coconut ( <i>Cocos nucifera</i> ), Neem ( <i>Azadirachta indica</i> ), Rubber( <i>Ficus elastic</i> ), Cashew ( <i>Anacardium occidentale</i> ), Paddy ( <i>Oryza sativa</i> ), Banana ( <i>Musa acuminata</i> ) & Areca Nut ( <i>Areca catechu</i> ), Cotton ( <i>Gossypium arboretum</i> ) & various bamboo species etc.
viii.	Type of fauna	Fox( <i>Vulpes benghalensis</i> , Wild boar ( <i>Sus scrofa</i> ) and domestic species like Goat ( <i>Capra hircus</i> ), Sheep ( <i>Ovis aries</i> ), Cow ( <i>Bos primigenius indicus</i> ), Buffalo ( <i>Bubalus bubalis</i> )	Fox ( <i>Vulpes benghalensis</i> , Wild boar ( <i>Sus scrofa</i> ) and domestic species like Goat ( <i>Capra hircus</i> ), Sheep ( <i>Ovis aries</i> ), Cow ( <i>Bos primigenius indicus</i> ), Buffalo ( <i>Bubalus bubalis</i> )	Fox ( <i>Vulpes benghalensis</i> , Wild boar ( <i>Sus scrofa</i> ) and domestic species like Goat ( <i>Capra hircus</i> ), Sheep ( <i>Ovis aries</i> ), Cow ( <i>Bos primigenius indicus</i> ), Buffalo ( <i>Bubalus bubalis</i> )
ix.	Endangered species any	Nil	Nil	Nil
x.	Historical/cultural Monuments, if any	Nil	Nil	Nil
3.	Compensation Cost:			
i.	Crop (Non Forest) (OH Portion)	650 lakhs (@ 5 lakhs/km)	635 lakhs (@ 5 lakhs/km)	655 lakhs (@ 5 lakhs/km)
ii.	Land for Tower Base & RoW Corridor (OH & UG Portion)	4310.12 lakhs (@15 lakhs/acre)	4227.95 lakhs (@15 lakhs/acre)	4337.49 (@15 lakhs/acre)
iii.	Forest (CA+NPV) (UG Portion)	20.00 lakhs (@ 10 lakhs/ha.)		
4.	Major Crossings:			
i.	Highway (NH/SH)	2	1	2
ii.	Power Line (Nos.)	10	6	8
iii.	Railway Line (Nos.)	2	2	2
iv.	River Crossing (Nos.	Nil	Nil	2 (Amaravati River & Chuliar Reservoir)
5.	Overall remarks	Line length is longest and also involve moderate RoW issues as the line route is passing through plantation area and close to habitation	Shortest in line length and involve minimum RoW problems due to avoidance of plantation and habitation area	Relatively more line length and also involve river crossing and having moderate RoW problems due to proximity of habitation area



From the above comparison of three (3) different alternatives, it is evident that although none of the studied route for overhead portion involves any forest area. Alternative- II is found to be shortest route having minimum RoW issues. Further, lesser degree of environmental impacts like minimum tree felling as well as construction and O&M problems are anticipated as the line route of Alternative- II doesn't involve any plantation and habitation area like in other two alternatives. Hence, Alternative - II is considered as the most optimized route and recommended for detailed survey.

#### 4.3 EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR LILO OF NORTH THRISSUR - COCHIN 400 KV D/C LINE AT NORTH THRISSUR HVDC STATION

Since the proposed line connects two substations in close vicinity and having line length of only 0.4 km, no alternative has been studied for this line as there is no environmental or social issues including forest area that require such studies.

#### 4.4 SUBSTATION

For substation site selection also analysis of 2-3 alternatives sites is usually carried out based on environment and social aspects and technical requirement. Such analysis considers various site specific parameters that include availability of infrastructure facilities such as access roads, water, distance from railheads, type of land (Government/ revenue/private land); social impacts such as number of families getting affected; Common Property Resources (CPR) including feasibility of acquisition. The finalization of substation land is done based on above analysis and site visit/verification. The social aspects are provided due weightage after technical requirement in decision making for selection/finalization of land for substation.

It may be noted that land for proposed underground cable transition point at Vadakancheri has been identified for purchase through willing buyer- willing seller basis on negotiated rate. Therefore, the said exercise is not so relevant for proposed project as the consent of owner is major criterion in addition to technical feasibility

**Table 4.1: Status of land availability for proposed Terminal Substation**

S. N.	Name Substation	Area (acre)	Location	Surrounding	Accessibility	Land Status
1.	Transition Station at <b>Vadakan cheri</b>	0.54	The proposed site is located at Vadakkencheri Village, Althur Taluk, Palakkad District In Kerala. The location is a low laying non cultivated/comm ercial land owned by private party.  Co-ordinates: 10°35'27.37"N 76°28'34.22"E Elevation -59m	Paddy fields are present in the surrounding land towards north and east side, on the west side is non cultivated/ commercial land. Nearest structure (a house) is at a distance of about 200m. Site is close to Vadakkencheri town. Palakkad is approx. 30km	The site is adjacent to NH-47), a 6 Lane Highway close to Vadakkencheri – Pollachi Road Jn. Nearest Railway Station is Palakkad at distance of about 30km. Nearest Airport is Kochi about 80 km. Nearest Seaport is Kochi about 90 km	Private Land identified. Purchase of land under progress through willing seller - willing buyer basis on negotiated rate

Further details about proposed substation land have been provided in Section –5.0 (i).

## SECTION – V: POTENTIAL ENVIRONMENTAL IMPACT, THEIR EVALUATION AND MANAGEMENT

### 5.0 IMPACT DUE TO PROJECT LOCATION AND DESIGN

Environmental impacts of transmission projects are not far reaching and are mostly localized to RoW (RoW width for  $\pm 320$  kV is 44 Mts.). However, transmission projects have some effects on natural and socio-culture resources. These impacts can be minimized by careful route selection. Moreover, in the instant project some portion of the said line is to be constructed underground, thus, further minimizing the adverse environmental & social impacts. In order to get latest information and further optimization of route, modern survey techniques/tools like Geographic Information System (GIS), Global Positioning System (GPS) 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. In the instant scheme also these techniques are used and detail survey using GIS/GPS is under progress. Although, all possible measures have been taken during the finalization of route alignment for the proposed transmission lines, due to peculiarity of terrain and demography of the area where subprojects are 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

Land is required for a) construction of substations and b) erection of transmission lines. In general requirement of land area for substation varies from 30 acres (for 400/220 kV) to 120 acres ( $\pm 800$  kV) depending upon voltage levels, no. of bays, topography of land and few more technical factors.

In the instant case, fresh land for proposed transition station at Vadakancheri shall be secured through “**willing seller willing buyer**” basis on market/negotiated rate. Since no acquisition of private land is involved, R & R will not be an issue in the instant project. Location details showing approach to site of proposed substations are enclosed as **Plate- 1**. The proposed scheme also involved establishment of HVDC terminal stations at Pugalur & Thrissur for which land area measuring 153.4 acres (149 Pvt. + 4.4 Govt. land) & 31.44 Acres (Kerala Agriculture University Land) respectively are also secured and possession/transferred of above land are in advance stage.

In respect of (b), no permanent acquisition is envisaged. Land for tower and right of way is not acquired as agricultural activities can continue. A typical plan of transmission line tower footing indicating the above position along with extent of damage and area of influence are depicted in **Fig.-1 & 1a** respectively. As described earlier all measures are undertaken by POWERGRID at the line routing stage itself to avoid settlements such as cities, villages etc. It may be seen from the above description of proposed route alignments and also keeping in mind that no permanent acquisition of land is involved for tower foundation as per existing law, these subprojects don't require any resettlement of villagers. However, some temporary damages/ disturbances can happen, which will be compensated as per the law of the land and applicable/prevaling guidelines.

## (ii) **Land value depreciation**

Based on past experience land prices are generally expected to rise in the areas receiving power. Generally transmission lines pass through uninhabited area, agriculture fields and forests, where the land use is not going to change in foreseeable future. Moreover, in the instant case some portion of line is to be constructed underground which will have minimum pressure/impact on land. Therefore, the value of land will not be adversely affected to a significant degree.

## (iii) **Historical/cultural monuments/value**

As per the 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 Archaeological Survey of India (ASI), no such monuments are coming in the proposed route alignments. Moreover, utmost care shall be taken during detailed survey to avoid such areas. However, during excavation, if any treasure, archaeological artifacts are found the same shall be intimated in writing to Collector/Archaeology department as per the provisions of Section-4 of "Indian Treasure Trove Act, 1878 as amended in 1949". The Collector shall initiate further action for its safe custody or its shifting to Treasury/ Secure place. The construction activity may be suspended temporarily during this process.

## (iv) **Lines into precious ecological areas**

As already explained all precautions have been taken to avoid routing of line through forest and protected areas. In the instant case also protected areas like wildlife sanctuary, national parks, biosphere reserves etc have been completely avoided. However, in spite of taking due care during route selection involvement of some forest area (approx. 2.0 ha. of reserve forest.) could not be avoided for underground portion as the line is routed along existing RoW of NH-47 which is already passing through forest land. As per regulation, necessary permission/rediversion shall be obtained under Forest (Conservation) Act, 1980 after detail survey and finalization of route through forest area in consultation with local forest authorities. Moreover, suitable management measures as specified in EMP<sup>2</sup> (refer clause- 9) like minimizing RoW requirement, use of existing tower, use of tall or extended tower etc, wherever feasible, will be undertaken to minimize the loss of vegetation.

## (v) **Lines into other valuable lands**

Impacts on agricultural land will be restricted to the construction phase and when large-scale maintenance measures are required. The proposed transmission lines will pass mostly through agricultural fields and in underground portion cable will be laid along the existing RoW of NH-47. As per existing law, land for tower and right of way is not acquired and agricultural activities are allowed to continue after construction activity. POWERGRID pays compensation for all damages as per the law of the land and applicable/prevaling guidelines. Recently, MoP has issued guidelines for payment of compensation toward damages in regard to RoW for transmission lines (**Annexure-1**). However, the said compensation shall be paid to all affected farmers/land owners in addition to normal tree and crop damage compensation, once it is adopted by respective States.

In areas where transmission lines will traverse through 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 dept. and

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<sup>2</sup> *Environment Management Plan (EMP) is placed at Table -6.1*

apprise them about the project and tower location, which shall be erected in the agricultural land. Revenue dept. after evaluating the land loss due to construction activity and crop damages based on productivity of land arrives at the compensation cost which is paid to farmer. 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. The procedure for providing compensation is described in **Annexure-2**. Budgetary provision of Rs. 4885.00 lakhs is made in the cost estimate to meet these expenses.

**(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 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. 50,000/- per km. Provision to meet these expenses has been made in the cost estimate for the same for transmission line proposed under the instant scheme.

The main approach road for accessing the construction sites including three new substations are either through National Highways, i.e. NH-47(now NH-544) or through other State/Village Roads bifurcating from these National Highways. The volume of traffic on these roads is found to be of low to medium intensity. Therefore, possibility of any steep rise in volume of traffic due to mobilization for said projects is not envisaged.

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 near to 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. However, management measures as specified in EMP (refer clause - 5 & 12) like appropriate siting of towers shall be undertaken during detailed alignment

survey and design to avoid any incidence of flooding hazards & loss of agricultural production due to interference with drainage patterns or irrigation channels. In underground portion, cable will be laid by cut and cover method and there may be temporary hindrance to drainage for which adequate care will be taken to minimize the blockage by proper diversion of its flow. Also since the lines will be laid underground in elongated channel having width 2 m and depth 2 m, dewatering is not envisaged at most places, however if any water seeps from local surface drains dewatering pump will be deployed to facilitate construction. In the infrequent instances where the natural flow/drainage is affected, flow will be trained and guided to safe zones. Moreover, no tower will be placed in the river bed as there is no major river crossing in the proposed transmission lines. Further, all proposed substations are located in plane terrain and hence no affect on drainage of the area is envisaged particularly with adequate arrangement of drainage built in all substation design.

## **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. However, detailed specification with respect to equipment design and substation sewage design has been included in tender document to avoid any incidence of land and water contamination. Apart from this, solid waste like packing materials, cables, aluminium conductor, sand, aggregate material, cements and steel generated during construction is carefully handled and removed from site. To avoid contamination of Ground water/land from leakage of transformer oil, an oil sump is constructed below each transformer to collect any oil during change over or leakage. Oil sump is a part of standard design criteria for transformer foundation.

### **(ii) Explosion/fire hazards**

During the survey and site selection for transmission lines and substations, 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 forest. However, adequate safety measures shall be taken to avoid such incidence and has been included in EMP (refer clause - 15, 23 & 52). Besides this forest authorities also incorporate measures like making fire lines to prevent spreading of fire in the affected forest area. Apart from this, states of art safety instruments are installed in the substations on both the ends so that line gets tripped within milliseconds in case of any fault.

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

The volume of soil excavated in the construction of transmission lines vary significantly, depending upon several factors including wind zone, type of towers, type of foundation, topography of the land etc. It is estimated that for construction of overhead line (i.e. for erection of approx. 325 towers) and underground cable portion, the amount of soil excavation would be around 74010 m<sup>3</sup> and 106140 m<sup>3</sup> (2m x 2m x 26535 m) respectively. Again, for construction of UG transition point at Vadakancheri approximately 8000 m<sup>3</sup> quantity of soil to be excavated. However, most of these excavated materials (about 80-90%) will be used for re-filling after construction work is over and remaining materials will be disposed properly as detailed out in EMP (refer clause - 25, 26 & 28). Moreover, the topsoil disturbed during the development of sites will be stored properly and used to restore the top surface of the platform. Left over infertile and rocky material will be dumped at carefully selected dumping areas and used as fill for foundations and leveling. Further, excavation in the hilly areas is avoided in rainy days. In hill slopes and erosion prone soils, internationally accepted engineering practices including bio-engineering techniques, wherever, feasible shall be undertaken



to prevent soil erosion. Hence, possibility of erosion of exposed area due to construction activity is negligible.

**(iv) Environmental aesthetics**

Since spacing between the towers in case of  $\pm 320\text{kV}$  transmission lines is approx. 400 meters, there will be no adverse affect on the visual aesthetics of the localities particularly when it is ensured to route the lines as far away from the localities as possible. In underground portion since the line to be constructed through underground cable, there won't be any adverse impact on visual aesthetics of the localities. However, POWERGRID takes up plantation of trees to buffer the visual effect around its substations and to provide better living conditions. Wherever POWERGRID feels 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 equipment installed at substation are mostly static and are so designed that the noise level always remains within permissible limits i.e. 85 dB as per Indian standards. The noise levels reported during normal operating conditions are about 60 to 70 dB at 2 m. distance from the equipment. 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 equipment are undertaken. In addition, plantations of sound absorbing species like Casuarinas, Tamarind and Neem are raised at the substations that reduce the sound level appreciably. It is reported that 93 m<sup>3</sup> of woodland can reduce the noise level by 8 dB. Actual noise levels measured at perimeters of existing substations are 20 to 30 dB.

**(vi) Blockage of Wildlife passage**

The proposed transmission lines are passing mostly through agricultural land, wasteland etc. Since there are no protected areas, migration path of wildlife like elephant corridors exist near the subproject project locations, possibility of any disturbance to wild life is not anticipated. Another phenomenon reported in some places viz. Bird hit/electrocution by electric lines during landing and takeoff near the water bodies, fly path of birds is also not envisaged in the instant case due to routing of line away from such areas.

## **5.2 ENVIRONMENTAL PROBLEMS DURING CONSTRUCTION PHASE**

**(i) Uncontrolled silt runoff**

As already explained, during construction limited quantity of excavated material will be generated from tower foundations/laying of underground cable and substation foundation. However, adequate measures shall be taken to store excavated materials properly for leveling and refilling after construction is over. In case of hill slopes and erosion prone soils, internationally accepted engineering practices including bio-engineering techniques, wherever, feasible shall be undertaken to prevent soil erosion. Moreover, excavation in the hilly areas is avoided in rainy days. Hence, uncontrolled silt run off is not anticipated.

**(ii) Nuisance to nearby properties**

As already described in preceding paras, during site selection due care is taken to keep the lines 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. Since all construction related activities for new substations shall be confined to existing substations which are already inaccessible for general public due to its separation/demarcation by the boundary wall. Moreover, such areas are declared as prohibited for general public as per the provisions of Electricity Act. Hence, any adverse impact arising during the construction of these substations will be temporary and limited to the boundaries of existing substations only and will neither impact nearby habitat/property nor health & safety of neighboring community

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

Transportation of construction materials will be mostly through road network. Access to the site will be along existing National/State highway or village paths. Minor improvements to paths may be made where necessary, but no major construction of roads will be needed either during construction or as a part of maintenance procedures. In case, access road is not available at some places, existing field/path may be utilized and compensation for any damage to crop or field is paid to the owner.

As and when a transmission line crosses any road/ railways line, adequate care/caution is taken 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.

POWERGRID will follow all applicable standards concerned with safety for transmission and erection of Substation. These include IS: 5613 – recommendation on safety procedures and practices in electrical work as per CEA (Measures relating to Safety and Electric Supply) Regulation, 2010 notified in the Gazette on 20th Sept. 2010. All safety measures related to OPGW /underground cable laying and installation are included in bidding document (Refer Sec VI, chapter 03 & Sec IV, chapter 15 of Technical specification respectively). Apart from this, safety precaution like barricading of work area with reflective tape/illumination and placement of visible signage, placement of PCC route markers shall be undertaken to avoid any unforeseen incident. Furthermore, speed restrictions are imposed on project vehicles in project/habitation areas. Moreover, the construction activities associated with Transmission Line projects are not so extensive and only limited excavation is involved in tower foundations/laying of underground cabling. As such, the volume of traffic and movement of construction vehicles laden with construction materials is quite limited and don't pose any safety hazards for local population as well as increase in road accidents. The construction activities in substation area are always undertaken in enclosed/confined area.

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

Since the proposed transmission lines are to be constructed in plain areas, soil erosion will not be a major issue. If due to terrain at some points towers may be placed on slopes and erosion prone soils, internationally accepted engineering practices including bio-engineering techniques wherever feasible shall 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 above 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. Further, construction is generally undertaken in dry/non-monsoon period.



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

As mentioned earlier the tower foundations & laying of underground cable 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. As such acquisition/opening of borrow area is not needed.

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

All health and safety issues and its management aspects are integral part of project/contract specific safety plan (**Annexure-3**) which is also part of contract condition. Various aspects such as work and safety regulations, workmen's compensation, insurance are adequately covered under the General Conditions of Contract (GCC), a part of bidding documents. Project is executed as per the approved plan and is regularly monitored by dedicated Safety personnel. Moreover, for strict compliance of safety standard/plan a special provision as a deterrent has been added in the contract which provides for a heavy penalty of Rs.10 lakhs for each accidental death and Rs1.0 lakh/each for any injury and is deducted from the contractor's payment and paid to the deceased/affected family (**Annexure – 4**).

POWERGRID maintains safety as a top priority and has framed guidelines/checklist for workers' safety as its personnel are exposed to live EHV apparatus and transmission lines. These guidelines/checklists include work permits and safety precautions for work on the transmission lines and substation both during construction and operation (**Annexure-5**) and is regularly monitored by site in-charge. In addition training is imparted to the workers in fire fighting and safety measures. Standard safety tools like helmet, safety belt, gloves etc. are provided to them in accordance to the provisions of Safety Rules. 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 and remaining workforce of unskilled labourers will be comprised of mostly local people. As per policy/norms preference shall be given to the eligible local labor having required skills a specific clause has been incorporated in contract conditions (refer clause- 22.2.1 of GCC) for compliance of same by Contractor. Workers are also covered by the statutory Workmen (Compensation) Act. 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 substation personnel for both, the lines as well as substations. However in respect of the long distance transmission lines, there are monitoring offices that are located at various points en-route. Monitoring measures employed include patrolling and ground based thermo-vision scanning. Aerial scanning through helicopters is not so prevalent in the country. Moreover, most of the important faunal species are normally confined either to forest or wildlife areas, where scanning by helicopters is also not feasible due to thick forest canopy.

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.

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 (for details refer **Annexure- 6**).

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

**“Power Grid was 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. In overhead line land is affected to the extent 278 sq. m below the tower base whereas underground lines are constructed in elongated channels of 2m x 2m dimension, for which compensation is paid to land owner.

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

The subject project will not be making use of any natural resources occurring in the area during construction as well as maintenance phases. The construction materials such as tower members, cement etc. shall come from factories while the excavated soil shall be used for leveling and backfilling to restore the surface. During construction of line, very small quantity of water is required which is met from nearby existing source or through takers. However, for substation water requirement is met mostly by ground water derived by digging a borewell during construction as well as for operational stage. Moreover, provision of rain water harvesting in all proposed new substations under the present scheme has been made to conserve precious water resources and enhance the ground water level. Hence, it may be seen that the activities associated with implementation of subject project shall not cause any accelerated use of resources for short term gain.

### **(iii) Endangering of species**

As described earlier, no endangered species of flora and fauna exist in the subprojects area is getting affected thus there is no possibility of endangering/ causing extinction of any species.

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

The subprojects 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 POWERGRID project cycle. POWERGRID follows a well defined procedure for conducting public consultation involving different techniques as laid down in its ESPP, which is also approved by The World Bank under the Use of Country System (UCS). There are 10 different techniques which are used either independently or in combination appropriately at different milestones of the project depending on field conditions.(for details refer **Annexure -7**). The location for public meeting is usually selected at every 50-100 km involving major villages/habitated area en-route of line. However, in other villages/parts, informal group meetings or other techniques are applied for consultation. The consultation and feedback process is a continuous one and implemented regularly at different milestone of project cycle.

The process of consultation and information dissemination begins even before the start of work as POWERGRID informs the general public by publishing in 2 (Two) local newspapers in vernacular language on implementation of project indicating the route of final alignment with name of the town /villages its passing through about the project and invites their suggestion, if any. During survey also POWERGRID site officials meet people and inform them about the routing of transmission lines. During construction, every individual, on whose land line is constructed and people affected by RoW, are consulted. Apart from this, Public consultation using different technique like Public Meeting, Small Group Meeting with special focus on women, and vulnerable groups, Informal Meeting shall also be carried out during different activities of project cycle. During such consultation the public are 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);
- 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 approach to minimizing and solving them;
- Trees and crop compensation process.

Additionally, questions, doubts and apprehensions of members of public are heard and answered to the extent possible. Queries raised by participants were mostly concentrated on improvement in power availability to their village, safety and RoW compensation. Some of the queries raised are presented below:

- ✓ Whether this line will improve the power supplies in our village and remove frequent interruption/outage;
- ✓ Whether these lines are safe for the nearby dwellers without any problems of electrocution while working in the fields;

- ✓ What is compensation policy for the standing crops damaged and compensation for the land occupied by the tower footings;
- ✓ What about employment for local people and procedure for same;
- ✓ What is the width of RoW for cutting tree. How much compensation for the trees will be given and when.

In the instant scheme also, many group meetings were organized (informally and formally) in all villages where the interventions are likely to happen. Such consultation culminated in public meeting organized at different locations as provided in **Table- 5.3**. These meetings were attended by Gram Panchayat leaders/members, Village heads, interested villagers/general public and representatives from POWERGRID. Village women folk also actively participated in consultation. To ensure maximum participation, prior intimation in local language was given and such notices were also displayed at prominent places/panchayat office etc. During the public consultation details of line and its importance were explained to the villagers by the officials of POWERGRID. The consultation was arranged in interactive manner in local language and queries like tree/crop compensation, engagement of local people in construction activity, health & safety, improvement of power scenario in region etc. were addressed. The initiative was appreciated by the villagers and they assured their cooperation for construction of the said lines. The process of such consultation shall continue during different stage of project implementation and even during O& M stage. Details of above public consultation meetings including public notice, list of participants, photographs and public queries & answers are enclosed as **Annexure -8**.

**Table -5.3: Public Consultation en-route of Transmission Lines**

Sl. No.	Date & time of Consultation	Venue	Person Attended
1.	15 <sup>th</sup> Dec.' 15, 2.00 PM	At- Panchayat Auditorium, Village- Nalleppilly, District- Palakkad State- Kerala	Total 38 persons including Panchayat President & Secretary, interested villagers/ general public and representatives from POWERGRID
2.	16 <sup>th</sup> Dec.' 15, 3.00 PM	At- Grampanchayat Community Hall, Village- Arasampalayam District- Coimbatore, State- Tamil Nadu	Total 25 persons including Village heads, interested villagers/ general public and representatives from POWERGRID

## 5.6 CONCLUSIONS:

From the above discussion, it seems that the area is rich in natural forest resources. But careful route selection following the principle of avoidance, ecologically sensitive areas like National Park / Wildlife Sanctuaries have been avoided completely but complete avoidance of forest could not be achieved due to geographical constraints. In the instant case there is only 2.0 ha. forest involvement in the underground cable portion only which is unavoidable as the line is routed along the existing RoW of NH-47 passing through forest land. Since the area is already disturbed and there will be nil/ bare minimum felling of trees felling, the anticipated environment impacts will be minimum. 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 subject scheme for overall development of the area and on another hand suggests that a detailed EIA may not be necessary as per the provisions of existing regulations.

## **SECTION – VI: PROJECT IMPLEMENTATION ARRANGEMENT & MONITORING**

### **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 & Managing Director of the Corporation. The progress of various on-going projects is also informed to the Board of Directors. Flow chart showing institutional arrangement for implementation ESPP is placed as **Exhibit-2**. A three tier support structure has also been developed at corporate, regional and site level with following functions for effective implementation of environment and social safeguard measures.

#### **6.1.1 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 en-route;
- 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 MoEFCC 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.

#### **6.1.2 Regional Level**

At its Regional Office POWERGRID has a 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 transmission lines considering the environmental and social factors that could arise en-route;
- To follow-up forest clearances and land acquisition processes with state forest offices and other state departments for various ongoing and new projects;



- Acting as a focal point for interaction with the ESMD and site on various environmental and social aspects.

### 6.1.3 Site Office

At the Divisional Headquarters level, POWERGRID has made the head of the division responsible for implementing the Environmental and Social aspect of project and are 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 & Interact with Revenue Authorities for land acquisition;
- Interact with the Forest Departments to make the forest proposal and follow it up for MoEFCC clearance;
- Implementation of Environment Management Plan (EMP);
- Monitoring of EMP & producing periodic reports on the same.

From above, 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 and Protected areas like Wildlife Sanctuaries or National Parks, 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. Since many provisions of EMP are to be implemented by contractor, hence for proper monitoring EMP has been included in the contract document. A budget estimate towards tree/crop compensation and EMP implementation is prepared and is placed at **Annexure-9**. A summary of the same is presented below:

S. N.	Budgetary Head	Amount (Rs. Lakhs)
1	Forest compensation	20.00
2	Tree & Crop Compensation	637.00
3	Land Compensation for Tower Base and RoW Corridor	4228.00
4	EMP Implementation, Monitoring & Audit	40.39
<b>Total</b>		<b>4925.39</b>

Any other measures like provision of bird guards, spike guards, barbed wire fencing or any other arrangement for addressing the issues like bird hit/animal/elephant scratching etc. shall be finalized only after detailed/ check survey and finalization of route alignment. Since the detailed/ check survey is part of main package requirement of such measures, its extent and estimated cost shall be incorporated in the revised cost estimate proposal which is normally prepared for all projects as there is a considerable time gap between planning and actual implementation. However, as per the preliminary assessment such additional measures may not be required in the instant scheme as no such impact are envisaged due to routing of lines far away from such sensitive areas.

## 6.2 GRIEVANCE REDRESSAL MECHANISM (GRM)

Grievance Redress Mechanism (GRM) is an integral and important mechanism for addressing/resolving the concern and grievances in a transparent and swift manner. Many minor concerns of peoples are addressed during public consultation process



initiated at the beginning of the project. For handling grievance, Grievance Redress Committee (GRC) will be established at two places, one at the project/scheme level and another at Corporate/HQ level. The GRCs shall include members from POWERGRID, Local Administration, Panchayat Members, Affected Persons representative and reputed persons from the society on nomination basis under the chairmanship of project head. The composition of GRC shall be disclosed in Panchayat/Village council offices and concerned district headquarter for wider coverage.

The complainant will also be allowed to submit its complaint to local project official who will pass it to GRC immediately but not more than 5 days of receiving such complaint. The first meeting of GRC will be organized within 15 days of its constitution/disclosure to formulate procedure and frequency of meeting. However, GRC meeting shall be convened within 15 days of receiving a grievance for its solution. GRC endeavor will be to pronounce its decision/ may also refer it to corporate GRC for solution within 30-45 days of receiving grievances. In case complainant/appellant is not satisfied with the decision of GRC they can approach POWERGRID Corporate Level Committee/District Collector or Court of law for solution.

The corporate level GRC shall function under the chairmanship of Director (Project) who will nominate other members of GRC including one representative from corporate ESMC who is conversant with the environment & social issues. The meeting of Corporate GRC shall be convened within 7-10 days of receiving the reference from project GRC or complainant directly and pronounce its decision within next 15 days.

### **6.3 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. A semi-annual environmental monitoring report reflecting the status of EMP implementation and corrective actions if any, will be prepared and disclosed on POWERGRID's website. The monitoring report will also be submitted to ADB for disclosing on its website. The IEE, the EMP, and revisions and updates, if any will also be disclosed. The format of environmental monitoring report is shown in Annex 10. Besides, an 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**

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
<b>Pre-construction</b>							
1	Location of line towers and line alignment and design	Exposure to safety related risks	Setback of dwellings to line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites	Tower location and alignment selection with respect to nearest dwellings	Setback distances to nearest houses – once	POWERGRID	Part of tower sitting survey and detailed alignment survey & design
2	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
3	Transmission line design	Exposure to electromagnetic interference	Line design to comply with the limits of electromagnetic interference from power lines including those of ICNIRP	Electromagnetic field strength for proposed line design	Line design compliance with relevant standards – once	POWERGRID	Part of design parameters
4	Substation location and design	Exposure to noise	Design of plant enclosures to comply with National ambient noise standards which are also compatible with the EHS guidelines of the World Bank.	Expected noise emissions based on substation design	Compliance with regulations - once	POWERGRID	Part of detailed sitting survey and design
		Social inequities	Careful selection of site to avoid encroachment of socially, culturally and archaeological sensitive areas (i.e. sacred groves, graveyard, religious worship place, monuments etc.)	Selection of substation location (distance to sensitive area).	Consultation with local authorities -once	POWERGRID	Part of detailed sitting survey and design

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
5	Location of line towers & line alignment and design	Impact on water bodies	Avoidance of such water bodies to the extent possible. Avoidance of placement of tower inside water bodies to the extent of possible	Tower location and line alignment selection (distance to water bodies)	Consultation with local authorities– once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
		Social inequities	Careful route selection to avoid existing settlements and sensitive locations	Tower location and line alignment selection (distance to nearest dwellings or social institutions)	Consultation with local authorities and land owners – once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
			Minimise impact on agricultural land	Tower location and line alignment selection (distance to agricultural land)	Consultation with local authorities and land owners – once		
			Careful selection of site and route alignment to avoid encroachment of socially, culturally & archaeological sensitive areas (i. g. sacred groves, graveyard, religious worship place, monuments etc.)	Tower location and line alignment selection (distance to sensitive area)	Consultation with local authorities -once		
6	Securing lands for substations.	Loss of land/ income change in social status etc.	In the case of Involuntary Acquisitions, Compensation and R&R measures are extended as per provision of RFCTLARRA, 2013 <sup>3</sup>	Compensation and monetary R&R amounts/ facilities extended before possession of land.	As per provisions laid out in the act	POWERGRID	Prior to award/start of substation construction.
7	Line through protected area/ precious ecological area	Loss of precious ecological values/ damage to precious species	Avoid siting of lines through such areas by careful site and alignment selection (National Parks, Wildlife Sanctuary, Biosphere Reserves/ Biodiversity Hotspots)	Tower location and line alignment selection (distance to nearest designated ecological protected/ sensitive areas)	Consultation with local forest authorities - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design

<sup>3</sup> In the instant case no Involuntary acquisition of land (permanent) is involved, hence this clause shall not be applicable.

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Minimize the need by using RoW wherever possible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once	POWERGRID	Part of tower siting survey & detailed alignment survey and design
8	Line through identified Elephant corridor / Migratory bird	Damage to the Wildlife/ Birds and also to line	Study of earmarked elephant corridors to avoid such corridors, Adequate ground clearance, Fault clearing by Circuit Breaker, Barbed wire wrapping on towers, reduced spans etc., if applicable	Tower location and line alignment selection.  Minimum/maximum ground clearance	Consultation with local forest authorities – once.  Monitoring – quarterly basis	POWERGRID	Part of tower siting and detailed alignment survey & design and Operation
			Avoidance of established/ identified migration path (Birds & Bats). Provision of flight diverter/ reflectors, bird guard, elevated perches, insulating jumper loops, obstructive perch deterrents, raptor hoods etc <sup>4</sup> ., if applicable	Tower location and line alignment selection	Consultation with local forest authorities - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
9	Line through forestland	Deforestation and loss of biodiversity edge effect	Avoid locating lines in forest land by careful site and alignment selection	Tower location and line alignment selection (distance to nearest protected or reserved forest)	Consultation with local authorities – once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
			Minimise the need by using existing towers, tall towers and RoW, wherever possible		Consultation with local authorities and design engineers – once		
			Measures to avoid invasion of alien species	Intrusion of invasive species	Consultation with local forest authorities - once		
			Obtain statutory clearances from the Government	Statutory approvals from Government	Compliance with regulations – once for each subproject		

<sup>4</sup> As per International/National best practices and in consultation with concerned forest/wildlife Authority.

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
10	Lines through farmland	Loss of agricultural production/ change in cropping pattern	Use existing tower or footings 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 sitting new towers on farmland wherever feasible	Tower location and line alignment selection	Consultation with local authorities and design engineers – once		Part of detailed sitting & alignment survey /design
11	Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a nuisance and shall comply with National Ambient Noise Standards, which are also compatible with the EHS guidelines of the World Bank.	Noise levels	Noise levels to be specified in tender documents – once	POWERGRID	Part of detailed equipment design
12	Interference with drainage patterns/ irrigation channels	Flooding hazards/ loss of agricultural production	Appropriate sitting 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
13	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
14	Equipments submerged under flood	Contamination of receptors	Substations constructed above the high flood level(HFL) by raising the foundation pad	Substation design to account for HFL (elevation with respect to HFL elevation)	Base height as per flood design- once	POWERGRID	Part of detailed substation layout and design/drawings

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
15	Explosions /Fire	Hazards to life	Design of substations to include modern fire fighting equipment Provision of fire fighting equipment to be located close to transformers	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
<b>Construction</b>							
16	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
17	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
18	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
19	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



Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & 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 carriage –way width within RoW – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
20	Construction activities	Safety of local villagers	Coordination with local communities for construction schedules, Barricading the construction area and spreading awareness among locals	Periodic and regular reporting /supervision of safety arrangement	No. of incidents- once every week	POWERGRID (Contractor through contract provisions)	Construction period
		Local traffic obstruction	Coordination with local authority, requisite permission for smooth flow of traffic. Imposing speed limits on Project vehicles in project/habitation areas.	Traffic flow (Interruption of traffic)	Frequency (time span)- on daily basis	POWERGRID (Contractor through contract provisions)	Construction period
21	Temporary blockage of utilities	Overflows, reduced discharge	Measure in place to avoid dumping of fill materials in sensitive drainage area	Temporary fill placement (m <sup>3</sup> )	Absence of fill in sensitive drainage areas – every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
22	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 <sup>2</sup> )	Clearance strictly limited to target vegetation – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
			No use of herbicides and pesticides				
23	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 max. 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

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & 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 <sup>2</sup> )	Use or intended use of vegetation as approved by the statutory authorities – once per site	POWERGRID (Contractor through contract provisions)	Construction period
24	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 <sup>2</sup> , number of incidents reported)	Complaints by local people or other evidence of illegal harvesting – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
25	Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings/ substation foundation disposed of by placement along roadsides, or at nearby house blocks if requested by landowners	Soil disposal locations and volume (m <sup>3</sup> )	Acceptable soil disposal sites – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
26	Substation construction	Loss of soil	Loss of soil is not a major issue as excavated soil will be mostly reused for leveling and re-filling. However, in case of requirement of excess soil the same will be met from existing quarry or through deep excavation of existing pond or other nearby barren land with agreement of local communities	Borrow area sitting (area of site in m <sup>2</sup> and estimated volume in m <sup>3</sup> )	Acceptable soil borrow areas that provide a benefit - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
		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(P <sup>H</sup> , BOD /COD, Suspended solids, others )	Timing of major disturbance activities – prior to start of construction activities	POWERGRID (Contractor through contract provisions))	Construction period
27	Site clearance	Vegetation	Tree clearances for easement establishment to only involve cutting trees off at ground level	Ground disturbance during vegetation clearance (area, m <sup>2</sup> )	Amount of ground disturbance – every 2 weeks	POWERGRID (Contractor through	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed	Statutory approvals	Statutory approvals for tree clearances – once for each site	contract provisions)	
28	Tower erection Substation foundation- disposal of surplus earthwork/fill	Waste disposal	Excess fill from substation/tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner.	Location and amount (m <sup>3</sup> ) of fill disposal	Appropriate fill disposal locations – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
29	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 <sup>3</sup> ) 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
30	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
31	Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities – once each new facility	POWERGRID (Contractor through contract provisions)	Construction period
32	Influx of migratory workers	Conflict with local population to share local resources	Using local workers for appropriate tasks	Avoidance/reduction of conflict through enhancement/ augmentation of resource requirements	Observation & supervision – on weekly basis	POWERGRID (Contractor through contract provisions)	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
33	Lines through 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 <sup>3</sup> )			
			Repair /reinstate damaged bunds etc after construction	Status of facilities (earthwork in m <sup>3</sup> )			
		Loss of income.	Land owners/ farmers compensated for any temporary loss of productive land as per existing regulation.	Process of Crop/tree compensation in consultation with forest dept.(for timber yielding tree) and Horticulture deptt. (for fruit bearing tree)	Consultation with affected land owner prior to implementation and during execution.	POWERGRID	During construction
34	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 <sup>2</sup> ; amount of bunds constructed [length in meter, area in m <sup>2</sup> , or volume in m <sup>3</sup> ])	Incorporating good design and construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
			Limit site clearing to work areas				
			Regeneration of vegetation to stabilise works areas on completion (where applicable)				
			Avoidance of excavation in wet season				
			Water courses protected from siltation through use of bunds and sediment ponds				
35	Nuisance to nearby properties	Losses to neighbouring land uses/	Contract clauses specifying careful construction practices.	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
		values	As much as possible existing access ways will be used	Design basis and layout	Incorporating good design engineering practices– once for each site	contract provisions)	
			Productive land will be reinstated following completion of construction	Reinstatement of land status (area affected, m <sup>2</sup> )	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
36	Flooding hazards due to construction impediments of natural drainage	Flooding and loss of soils, contamination of receptors (land, water)	Avoid natural drainage pattern/ facilities being disturbed/blocked/ diverted by on-going construction activities	Contract clauses (e.g. suspended solids and BOD/COD in receiving water)	Incorporating good construction management practices-once for each site	POWERGRID (Contractor through contract provisions)	Construction period
37	Equipment submerged under flood	Contamination of receptors (land, water)	Equipment stored at secure place above the high flood level(HFL)	Store room level to be above HFL (elevation difference in meters)	Store room level as per flood design-once	POWERGRID	Construction period
38	Inadequate siting of borrow areas (quarry areas)	Loss of land values	Existing borrow sites will be used to source aggregates, therefore, no need to develop new sources of aggregates	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions))	Construction period
39	Health and safety	Injury and sickness of workers and members of the public	Safety equipment's (PPEs) for construction workers	Contract clauses (18.1.3, 18.3.1.1, 18.3.1.4 etc) (requirements of worker camp, number of incidents and total lost-work days caused by injuries and sickness)	Contract clauses compliance – once every quarter	POWERGRID (Contractor through contract provisions)	Construction period
			Contract provisions specifying minimum requirements for construction workers camps				
			Contractor to prepare and implement a health and safety plan.				

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Contractor to arrange for health and safety training sessions				
40	Inadequate construction stage monitoring	Likely to maximise damages	Training of environmental monitoring personnel	Training schedules	No. of programs attended by each person – once a year	POWERGRID	Routinely throughout construction period
			Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements	Respective contract checklists and remedial actions taken thereof.	Submission of duly completed checklists of all contracts for each site - once		
			Appropriate contact clauses to ensure satisfactory implementation of contractual environmental mitigation measures.	Compliance report related to environmental aspects for the contract	Submission of duly completed compliance report for each contract – once		
Operation and Maintenance							
41	Location of line towers and line alignment & design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Compliance with setback distances (“as-built” diagrams)	Setback distances to nearest houses – once in quarter	POWERGRID	During operations
42	Line through identified bird flyways, migratory path	Injury/ mortality to birds, bats etc due to collision and electrocution	Avoidance of established/ identified migration path (Birds & Bats). Provision of flight diverter/reflectors, elevated perches, insulating jumper loops, obstructive perch deterrents, raptor hoods etc., if applicable	Regular monitoring for any incident of injury/mortality	No. of incidents- once every month	POWERGRID	Part of detailed siting and alignment survey /design and Operation
43	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
44	Oil spillage	Contamination of land/nearby water bodies	Each transformer has a secure and impervious underlying pit with a storage capacity of at	Substation bunding (Oil sump) (“as-built” diagrams)	Bunding (Oil sump) capacity and permeability - once	POWERGRID	During operations



Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			least 20% of the total oil volume of the transformer and the individual pits are connected to a main collection sump of capacity of 220% of largest transformer oil volume , which acts as a Secondary Containment, in case of a leakage. (refer para 8.6 of TS)				
45	SF <sub>6</sub> management	Emission of most potent GHG causing climate change	Reduction of SF6 emission through awareness, replacement of old seals, proper handling & storage by controlled inventory and use, enhance recovery and applying new technologies to reduce leakage	Leakage and gas density/level	Continuous monitoring	POWERGRID	During Operations
46	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		
47	Electric Shock Hazards	Injury/ mortality to staff and public	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (no. of injury incidents, lost	Preparedness level for using these technology in crisis- once a month	POWERGRID	Design and Operation
			Security fences around substations	Maintenance of fences	Report on maintenance – every 2		

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Barriers to prevent climbing on/dismantling of towers	Maintenance of barriers	weeks		
			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		
48	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 & 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				
49	Inadequate periodic environmental monitoring.	Diminished ecological and social values.	Staff to receive training in environmental monitoring of project O & M activities	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation
50	Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment 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 Govt.	Process, equipment and system design	Phase out schedule to be prepared in case still in use – once in a quarter	POWERGRID	Operation
51	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	Operation
52	Uncontrolled growth of vegetation	Fire hazard due to growth of tree/shrub /bamboo along RoW	Periodic pruning of vegetation to maintain requisite electrical clearance No use of herbicides/ pesticides	Requisite clearance (meters)	Assessment in consultation with forest authorities - once a year (pre/post monsoon)	POWERGRID	Operation
53	Noise related	Nuisance to neighbouring	Substations sited and designed to ensure noise will not be a	Noise levels {dB(A)}	Noise levels at boundary nearest to	POWERGRID	Operation

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
		properties	nuisance		properties & consultation with affected parties if any - once		