

## **SECTION I:PROJECT DESCRIPTION ( Seoni-Bina 765 KV Transmission System )**

### **1.0 BACKGROUND:**

In India, major energy resources for electrical power are concentrated in Eastern Region (mainly thermal resources) and North-Eastern Region (mainly hydro resources), whereas power demand is spread all over the country. To transfer power from these resource-rich Regions to distant part of the country, it is envisaged to develop high capacity National Grid by interconnecting Eastern, Northern and Western Regions through high capacity transmission links. In this direction, 2x765 kV Sipat - Seoni lines are being constructed as a part of transmission system associated with Sipat stage-I generation project. This corridor shall also be used to transfer power imported at Sipat from Eastern Region projects through Ranchi-Sipat 400kV D/c line, planned with Eastern Region generation projects. To disperse power from Seoni to Northern part of Western Region and to complete the transmission corridor of National Grid in Western Region, Seoni-Bina 765 kV line has been envisaged.

### **1.1 BENEFITS OF THE PROJECT:**

The objective of this line is to connect major load centre in Northern part of M.P. to power pool point at Seoni as well as to complete the 765kV kV ring interconnecting Eastern, Western and Northern Regions as part of development of National grid. This will help export of surplus power from Eastern Region to Western & Northern Regions and strengthen the transmission system within Western Region for secure & reliable supply of power.

### **1.2 PROJECT DESCRIPTION**

In Western Region, Seoni, in the central part of Madhya Pradesh is being developed as a major power pooling station at 765kV level. Seoni shall be directly connected with Sipat generation complex through two (02) nos. 765kV line between Sipat and Seoni. Also, power from Kahalgaon-II generation project in Eastern Region would be imported at Sipat generation complex which would be transferred to Western Region beneficiaries mainly through Seoni substation. In this way, Sipat-Seoni would be a major transmission corridor in Western Region (WR) over which large quantum of power would flow. To disperse power to different load centres in WR from Seoni onwards, there is a necessity to develop transmission corridor of adequate capacity to meet the immediate as well as future requirement.

A high capacity 765kV line between Bina and Gwalior is proposed, as a part of Sipat-II Transmission system to supply power towards Gwalior area. The interconnection at Gwalior would be further extended upto Agra by a 765kV link for power exchange between Western and Northern Regions as a part of transmission system of Kahalgaon-II generation project. Therefore, Seoni-Bina along with Bina-Gwalior-Agra line would be a part of 765kV ring interconnecting ER, NR and WR. In this way, this transmission line would enable exchange of power between NR and WR.

In addition, a parallel transmission corridor between eastern part of the region and Gujarat in western part of the region is being developed through 400kV Bina-Nagda - Dehgam line. The Seoni-Bina line would interconnect the two parallel transmission corridors between eastern and western part of WR. In case of outage of lines in any one of these corridors, the Seoni – Bina inter-connection would provide alternate path for power transfer from eastern part to western part of WR.

Considering above network configuration and long-term power transfer requirement from eastern part of the region towards western part, construction of 765kV Seoni – Bina S/c line is proposed. This shall develop a high capacity transmission corridor right from Seoni towards Gujarat as well as towards northern part of M.P. It would also facilitate development of transmission corridor between Agra in NR and Seoni in WR.

The Transmission line has been designed with 765kV parameters whereas the associated bay extension would be at 400kV level. This type of construction has been designed as the transmission line is a part of 765kV ring interconnecting ER-NR-WR. The power flow over this corridor would progressively increase with more generation addition in ER and NER having beneficiaries in WR. As the power flow over this line initially would be less, the operation of the line has been proposed at 400kV level initially. This would defer the investment for 765kV equipment and would conserve the Right-of-Way (ROW). With the increase in power flow requirement in future, the line shall be operated at 765kV level.

### **Project Highlights**

a)	Project Name	:	Seoni-Bina 765 KV Transmission System
b)	Location	:	Madhya Pradesh
c)	Beneficiary States	:	Constituents of Western and Northern Region
d)	Project Cost	:	US \$ 79.41 million (including IDC)

### **Scope of work**

#### **Transmission Lines**

(i) Seoni – Bina 765kV S/C (initially to be operated at 400kV) – 292 km.

#### **Substations:**

Extension of existing 800 KV substation at Seoni and 400 KV at Bina

**(Not in the scope of The World Bank funding to be funded by POWERGRID).**

A power map showing the transmission grid of Western Region highlighting the above scope of works is Placed as **Annexure-1**.

## SECTION II: BASE LINE DATA

**2.0** The project is located in the State of Madhya Pradesh in India. The basic details of the area under project is given below:

### **2.1 MADHYA PRADESH:**

**PHYSIOGRAPHY:** Madhya Pradesh as its name implies, lies in the heart of India. It consists of a geographical area of 3,08,300 sq. km which constitutes 9.38% of the land area of the country & bordering the states - Uttar Pradesh, Chhattisgarh, Maharashtra, Gujarat and Rajasthan. It lies between lat.  $21^{\circ} 04'$  &  $26^{\circ} 52'N$  and long.  $74^{\circ} 02'$  &  $82^{\circ} 49' E$ .

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

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

**Temperature:** During the winter average temperatures range from  $10^{\circ}$  to  $27^{\circ}$  C. Summers are hot, with an average temperature of  $29^{\circ}$  C and a high temperature that at times reaches  $48^{\circ}$  C. During the monsoon season temperatures average  $19^{\circ}$  to  $30^{\circ}$  C.

**Rainfall:** Annual rainfall tends to decrease from south to north and from east to west. The average rainfall in the different regions of the state ranges from 450 to 900 mm. The annual mean total rainfall recorded at Ujjain is 934.1 mm (1960 – 1980 data period) with almost 45 rainy days. The heaviest rainfall in 24 hours has been recorded as 239 mm at Ujjain.

**Wind:** The mean wind speed at Ujjain is 10 km/hr though the wind speeds are normally recorded to exist between 4 km/hr to 20 km/hr.

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

**Mineral Resources:** Madhya Pradesh is one of the major mineral producing states of the country. It has large deposits of a variety of minerals. Important among them are bauxite, copper, manganese, coal, dolomite and limestone.

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

**ECOLOGICAL RESOURCES:** The forest cover of the state based on the satellite data of October-December, 1999, is 77,265 Sq. km. which constitutes 25.07% of the geographic area (**Map-1**). Out of these dense forest accounts for 44,384 sq.km. having crown density of more than 40% and open or degraded forest of 32,881 sq.km. having crown density ranging between 10-40%. By legal status Reserve Forest constitutes 61.69%, Protected Forest 37.36% and unclassified

Forest 0.95%. The forests are the main source of supply of fodder and fuel and subsistence for the poorest sections of the people and tribal population in the interior under-developed areas of the state. There are four forest types:

- Tropical Moist Deciduous
- Tropical Dry Deciduous
- Tropical Thorn and
- Sub Tropical Broadleaved Hill Forests.

Forests are largely distributed in central, southern and eastern parts of the undivided state of Madhya Pradesh. Northern and western parts of the state are deficient in forest vegetation. Teak and Sal are the two most important forest formations of the state, covering 18.0% and 16.7% forest area, respectively while miscellaneous forests cover 65.3%. Madhya Pradesh forest reserves are logged for Teak, Sal, Bamboo and Salai. These forests catered to the needs of the people and cattle for generations, largely because they contained good cropping species. However, population explosion and developmental needs have exerted a steadily increasing demand on the ever-diminishing extent of forests. Over-exploitation resulted in reduction of area under forests. The maximum forest cover is recorded in the district Sheopur having 56.75% of forest cover and minimum in the Ujjain district having only 0.61%. There are 11 National Parks (NP) and 32 Wild Life Sanctuaries in the state however the Kanha tiger reserve in Jabalpur district is the most important National Park of the state.

The lines of proposed transmission system shall pass through mainly five district of this state having forest cover ranging from 25 % to 38 %. It may be noted from the table below that in all five districts the forest cover is a good mixture of both dense and open/degraded forest nature this warrant extra precaution in routing of line through forest area. Details of forest cover of these districts are as follows:

**In sq. Km.**

<b>District</b>	<b>Geographic area</b>	<b>Dense forest</b>	<b>open forest</b>	<b>Total</b>	<b>% forest Cover</b>
Seoni	8,758	2,237	910	3,147	35.93
Narshimhapur	5,133	812	500	1,312	25.56
Chindwara	11,815	2,631	1,864	4,545	38.47
Raisen	8,466	1,589	1,107	2,696	31.85
Sagar	10,252	1,292	1,525	2,817	27.48

### **HUMAN AND ECONOMIC DEVELOPMENT:**

The total population of Madhya Pradesh based on 1991 census is 6,03,85,118 out of which 73.3% is rural and 26.7 % is urban. The state supports 5.9% of country's total population. The population density is 196 persons per sq.km. Sex ratio is females per thousand males are 920. Literacy in males=76.80% & in females 50.28%. Madhya Pradesh in its present form came into existence on November 1, 2000 following its bifurcation to create a new state of Chhattisgarh.

Agriculture is the mainstay of the state's economy and 74.73% of the people are rural. Almost 49% of the land area is cultivable. Madhya Pradesh consists largely of a plateau streaked with the hill ranges of the Vindhyas and the Satpuras with the Chhattisgarh plains to the east. The hills give rise to the main river systems - the Narmada and the Tapti, running from east to west, and the Chambal, Sone, Betwa, Mahanadi, and the Indravati west to east. Intersected by these meandering rivers and dotted with hills and lakes, the state has a varied natural setting of great beauty. Madhya Pradesh is one of the leading states in the country in mineral production 26 percent of total Minerals of India are found in M.P. The share of M.P, in India's production of such vital minerals as diamond (100%), dolomite (39%), bauxite (28%), iron ore (24%), coal (23%), and limestone (23%). In short about 30 different types of minerals are known to occur in the state. Recently deposits of tin and uranium have been located in this state. Rich and varied mineral deposits have been surveyed and identified in this state. Nearly 4 lac sq. Kms. area has been surveyed and mapped geologically. Minerals worth Rs.2813 crore were produced in 1992-93. In the arena of high tech industries Madhya Pradesh has excelled well. Electronics, telecommunication, automobiles are prominent among them. The state is also producing substantial amount of optical fibre for telecommunication needs. A large number of automobile industries have been established at Pithambore near Indore. M.P is rich in low-grade coal suitable for power generation and has also got immense potential of hydro-energy. The total installed power generation capacity in year 2000-2001 was 2900 MW. There are eight hydro-electric power stations with installed capacity 747.5 MW. A total of 50,271 out of 51,806 villages have been electrified by 2000-2001. Power generation is 14023.7 m Kwh. The Govt. of M.P has formed a joint venture (Narmada Hydro Electric Development Corporation) with National Hydro-Electric Power Corporation, a Govt. of India undertaking for execution of 1000MW Power from Indira Sagar Hydro-Electric Project and 520 MW Omkareshwar Hydro-Electric Power Project. The state is also famous for its traditional handicrafts and handloom cloths manufactured in Chanderi and Maheshwar. The total length of roads in the state is 1,00,600 km. The length of National Highways in the state is 4,882 km while State Highways extend to 9,882 km. The main rail route linking Northern India with Southern India passes through Madhya Pradesh. The main junctions in the state are Bhopal, Bina, Gwalior, Indore, Itarsi, Jabalpur, Katni, Ratlam, and Ujjain etc. Panchmarhi, the hill station; Dhuandhar Fall at Bhedaghat, Kanha National Park near Jabalpur are some of the major tourist attractions of the state. Maheshwar, Omkareshwar, Ujjain, Chitrakoot and Amarkantak are major centers of pilgrimage. The unique temple of Khajuraho are famous all over the world.

## SECTION III: POLICY , LEGAL & REGULATORY FRAMEWORK

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

### **3.1 ENVIRONMENTAL**

#### **3.1.1 MANDATORY REQUIREMENTS (NATIONAL)**

- **MOP order/sanction under The Electricity Act, 2003:**  
Sanction of MOP, GOI is a mandatory requirement for taking up any new transmission project under the section 68(1) of The Electricity Act, 2003. The sanction authorize POWERGRID to plan and coordinate activities to commission the new project. 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 MOEF, Government of India 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. However, the recent amendment in the Environment (Protection) Act, 1986 made it necessary to obtain clearance from MoEF for power transmission projects in two districts in the Aravalis (*viz.*, Alwar in Rajasthan and Gurgaon in Haryana). The Aravali range, in these two areas, is heavily degraded, hence, any industrial activity there becomes critical. Environment Impact Notification, 1994 lays down specific project categories that require clearance from MoEF Power transmission projects are not included in this list.

- **Batteries (Management and Handling) Rules, 2001:**  
MOEF vide its notification dt. 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 and Handling)Amendment Rules, 2003:**  
MOEF vide its notification dt. 20<sup>th</sup> May, 2003 under the section of 6,8 and 25 of the Environment (Protection) Act, 1986 has put used mineral oil under the category of hazardous waste which require proper handling and disposal. As per the notification, all used oil is to be auctioned/sold to registered recyclers only and file annual return on prescribed form to the concerned State Pollution Control Board.
- **Ozone Depleting Substances (Regulation and Control) Rules, 2000:**  
MOEF vide its notification dt. 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 16th September 1987. As per the notification certain control and regulation has been imposed on manufacturing, import, export and use of these compound. POWERGRID is following provisions of notification and is phasing out all equipment which uses these substances and planning to achieve CFC free organisation in near future.
- **The Biological Diversity Act, 2002:**  
Under the United Nations Convention on Biological Diversity signed at Rio de Janeiro on the 5th day of June, 1992 of which India is also a party, MoEF has enacted the Biological Diversity Act, 2002 to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith. As per the provision of act certain area which are rich in biodiversity and encompasses unique and representative ecosystems are identified and designated as Biosphere Reserve to facilitate its conservation. All restrictions applicable to protected areas like National Park & Sanctuaries are also applicable to these reserves. POWERGRID will abide by the provision of act wherever applicable and try to totally avoid these biosphere reserves while finalizing the route alignment.

### 3.1.2 FUNDING AGENCIES:

**WB** Operational Policies (OP) 4.01/**ADB's** Operations Manuals (OM)- F1/BP and **JBIC** Environmental Guidelines: These outlines funding agencies policy and procedures for environmental assessment (EA) of different developmental projects. All these guidelines classified developmental projects

into three categories (A-C) based on its possible environmental and social impacts though WB & ADB has another category F1 applicable only to projects involving a credit line through a financial intermediary.

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

### **3.1.3 PRESCRIPTIVE FRAMEWORK (NATIONAL)**

- Constitutional Guarantees
- Applicable Legislations

### **3.1.4 RELEVANT POLICIES**

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

## **3.2.0 SOCIAL**

### **3.2.1 MANDATORY REQUIREMENTS (NATIONAL)**

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



- **Rights of Way And Compensation Under Electricity Act,2003:**  
The act has a provision for notifying transmission company under section 164 (B) to avail benefits of eminent domain provided under the Indian Telegraph Act, 1885. MOP, GOI vide gazette notification dt 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.
- **Provisions Under Land Acquisition Act, 1894, as amended in 1984:**  
When land is acquired for sub-stations, POWERGRID will follow procedures laid down under the Land Acquisition Act (LA Act), 1894. POWERGRID sub-stations have never resulted in large scale displacement or loss of livelihoods. There have been only marginal impacts due to flexibility exercised by POWERGRID in selecting sites. The LA Act specifies that in all cases of land acquisition, no award of land can be made by the government authorities unless all compensation has been paid.

### 3.2.2 FUNDING AGENCIES

For POWERGRID, mandatory requirements *vis-à-vis* Funding Agencies are comprehensive Resettlement and Rehabilitation (R&R) guidelines and an entitlement framework as per World Bank Operational Directives 4.30 (OP-4.12) and 4.20 and ADB's Operations Manual OM-F2/BP.

- **World Bank OD 4.30(OP-4.12): Involuntary Resettlement:**  
This directive describes Bank Policy and procedures on involuntary resettlement as well as conditions that borrowers are expected to meet during operations involving resettlement of affected groups. It requires a entitlement framework aimed at restoration, replacement and participation of affected groups. A detailed social assessment and development of an action plan having list of measures for betterment/restoration of lost assets/income is required to be submitted to bank before start of project work. However where only a few people (e.g. about 100-200 individuals) are to be relocated at a particular location, appropriate compensation for assets, logistical support for moving and a relocation grant may be the only requirements but the principle on which compensation is to be based will remain same as for larger groups.
- **World Bank OD 4.20: Indigenous People (IP):**  
This directive describes World Bank policies and procedures for projects that affect indigenous people. The objective is to ensure that development benefits are socially and culturally compatible and that the IPs are consulted. Thus, the Indigenous People Development Plan/Tribal Development Plan is to be prepared as a prerequisite. POWERGRID will not only incorporate the IP

component whenever necessary, but will also pay attention to marginalized groups such as women, children, etc.

- **ADB Operations Manual –F2/BP: *Involuntary Resettlement:***

The OP describes Bank Policy and procedures on involuntary resettlement as well as conditions that borrowers are expected to meet during operations involving resettlement. Its objective is to avoid such resettlement as far as possible if unavoidable measures like assistance to affected persons for restoration of their assets/livelihood as would have been in the absence of project. It also classified project into three categories like category-A where resettlement is significant and involve physical displacement of more than 200 persons, which require a detailed resettlement plan. Category-B where resettlement is not that significant and requires a short resettlement plan. Category-C where no resettlement of peoples are foreseen and neither require resettlement plan nor a resettlement framework.

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

### **3.2.3 PRESCRIPTIVE FRAMEWORK (NATIONAL)**

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

### **3.2.4 RELEVANT POLICIES**

- The Orissa Resettlement and Rehabilitation of Project Affected Persons Policy, 1994 (water resources projects)
- Resettlement & Rehabilitation Policy – NTPC

## SECTION-IV: POWERGRID APPROACH FOR ROUTE SELSCTION

### 4.0 ROUTE SELECTION - (ASSESSMENT & MANAGEMENT PROCESS)

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

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

#### 4.1.1 STUDY OF ALTERNATIVES

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

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

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

- Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.

In addition, care is also taken to avoid National parks and sanctuaries and any other forest area rich in wild life.

Keeping above in mind the routes of proposed line under Seoni - Bina 765 KV transmission System has been so aligned that it takes care of above factors. As such different alternatives were studied with the help of Govt. published data like Forest atlas, Survey of India topo maps etc. to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental & social impacts for their proper management.

#### 4.1.2 Evaluation of alternatives Route Alignment of 765 KV S/C Seoni- Bina Line:

Four different alignments (**Map-2**) 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 these three alternatives are as follows:

S.NO.	DESCRIPTIONS	ALTERNATE ROUTE R1	ALTERNATE ROUTE R1A	ALTERNATE ROUTE R2	ALTERNATE ROUTE R3
1	Route particulars				
	(i) Length	288.98 Kms	294.96 Kms	281.940 Kms	281.430 Kms
	(ii) Terrain	42% of the line passes through hilly terrain and the remain 58% passes through plain terrain	40% of the line passes through hilly terrain and the remain 60% passes through plain terrain	52% of the line passes through hilly terrain and the remain 48% passes through plain terrain	70% of the line passes through hilly terrain and the remain 30% passes through plain terrain
2.	Environmental impact				
	(i) Town limites	The line is routed avoiding towns. Due to scattered nature of settlements, the line has to be routed close to certain towns namely Seoni, Harai, Kareli, Tendhekere, Khurai, Bina	The line is routed avoiding towns. Due to scattered nature of settlements, the line has to be routed close to certain towns namely Seoni, Harai, Kareli, Tendhekere, Khurai, Bina	The line is routed avoiding crossing of any towns. Due to scattered nature of settlements, the line has to be routed close to certain towns namely Seoni, Harai, Kareli, Tendhekere, Khurai, Bina	The line is routed avoiding crossing of any towns. Due to scattered nature of settlements, the line has to be routed close to certain towns namely Seoni, Harai, Kareli, Tendhekere, Khurai, Bina
	(ii) Houses within R.O.W	R.O.W is almost free from houses etc.	R.O.W is almost free from houses etc.	Some scattered hutments are falling in R.O.W	Some scattered hutments are falling in R.O.W
	(iii) Tree/Crop and its extent of damage	Damage to crops in wet cultivation area is unavoidable during cultivation season. There are certain scattered sugarcane and wheat cultivation area which may be affected. However, extent of damage to crop and trees can only be assessed during tower spotting time.	Damage to crops in wet cultivation area is unavoidable during cultivation season. There are certain scattered sugarcane and wheat cultivation area which may be affected. However, extent of damage to crop and trees can only be assessed during tower spotting time.	Damage to crops in wet cultivation area is unavoidable during cultivation season. There are certain scattered sugarcane area, wheat etc. Some scattered Palma rah, non fruit bearing trees and some Rvenue trees along with State Highways are required to be cut.	Damage to crops in wet cultivation area is unavoidable during cultivation season. There are certain scattered sugarcane area, wheat etc. Some scattered Palma rah, non fruit bearing trees and some Rvenue trees along State Highways, are required to be cut.

	(iv) Forest involvement				
	a) Length of forest area	The 29.69 Kms of line length passes through forest areas .	The 24.45 Kms of line length passes through forest areas .	The 35.4 Kms of line length passes through forest areas .	The 45.63 Kms of line length passes through forest areas .
	b) Type of forest	Reserved forest, Protected forests, etc.	Reserved forest, Protected forests, etc.	Reserved forest, Protected forests, etc.	Reserved forest, Protected forests, etc.
	c) Density of forest	30%	29% Thick	45% (Dense)	50% (Dense)
	d) Type of Fauna & Flora	Flora: Teak, Banyan, Neem, Tamarinds	Flora: Teak, Banyan, Neem, Tamarinds	Flora: Teak, Banyan, Neem, Tamarinds	Flora: Teak, Banyan, Neem, Tamarinds
		Fauna : Dear, Bear, Indian wild dog, pig etc.	Fauna : Dear, Bear, Indian wild dog, pig etc.	Fauna : Dear, Bear, Indian wild dog, pig etc.	Fauna : Dear, Bear, Indian wild dog, pig etc.
	e) Endangered Species if any	Nil	Nil	Nil	Nil
	f) Historical/ Cultural	Nil	Nil	Nil	Nil
	g) Details of Tribal areas if any	Nil	Nil	Nil	Nil
3.	Major Crossings :				
	River	1	1	1	1
	Power line	7	7	7	7
	Railway line	2	2	2	2
	National highway	2	2	2	4
4.	Construction problems	Right of way problems are less due to less forest area, less damage of trees/crops. less hilly area, easy accessibility	Right of way problems are less due to less forest area, less damage of trees/crops. Less damage of trees/crops, less hilly area, easy and existing accessibility	Right of way problems are more due to more forest area, more damage of trees/crops. more hilly area without accessibility at many places which require new access roads.	Right of way problems are acute due to heavy and very dense forest area, involving huge tree felling and longest hilly terrain without accessibility.
5	O&M problems	O&M problems are less in this alignment due to more approach roads, less forest area, less city limits and more plain areas	O&M problems are minimum in this alignment due to more approach roads, less forest area, less city limits and more plain areas	O&M problems are comparatively more in this alignment due to non availability of approach roads,	O&M problems are maximum in this alignment due to huge forest involvement and excess tree felling no approach roads in 70% of the route may also pose a limiting factor.
6	Over all remarks/ Recommendation	-	This alignment is most preferable & hence recommended	-	-

It may be seen from above that Alternative-II (R1A) is the most optimum route though it is the longest route but involve minimum ecological sensitive areas like forest having lesser density devoid of any endangered or endemic sp. whereas other alternatives are shorter in line length but involve more forest and may require heavy tree felling that may cause serious environmental problem. Hence alternative –II has been found to be most optimum and recommended for detailed survey.

## **SECTION-V: SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT, EVALUATION AND ITS MANAGEMENT**

### **5.0 Impact Due to Project Location and Design**

Environmental impact of transmission line projects are not far reaching and are mostly localized to ROW. However, transmission line project has some affects on natural and socio-culture resources. These impacts can be minimized by careful route selection. In order to get latest information and further optimization of route modern survey techniques/tools like GIS, GPS aerial photography are also applied. Introduction of GIS and GPS in route selection result in access to updated/latest information, through satellite images and further optimization of route having minimal environmental impact. Moreover, availability of various details, constraints like topographical and geotechnical details, forest and environmental details etc. help in planning the effective mitigative measures including engineering variations depending upon the site situation/location. In the instant project 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 line but due to peculiarity of terrain and demography of the area where project is being implemented, some environmental impacts may be there. The explanations in brief with regard to specific environment review criteria based on preliminary survey are as follows:

#### **(i) Resettlement**

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

The proposed project do not envisages construction of any new substation and extension of only two existing substation is involved where sufficient land is already available for proposed bays. Hence no fresh land acquisition or R&R issues are involved in the present projects.

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

Based on past experience land prices are generally expected to rise in the areas receiving power. Further, transmission lines generally pass through uninhabited area, agriculture fields and forests, where the land-use is not going to change in foreseeable future. Therefore, the value of land will not be adversely affected to a significant degree.

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

As per the POWERGRID's policy of route selection only that route alignment is finalized this avoids all the historical and cultural monuments. As per the preliminary assessment carried out during finalization of route alignment in consultation with

State revenue authorities and ASI, no such monuments are coming in the proposed route alignment.

**(iv) Encroachment into precious ecological areas**

As already explained all precautions have been taken to avoid routing of line through forest and ecological sensitive areas and National park/Sanctuaries. However, complete avoidance of forest area was not possible though National Park/Sanctuary or any other protective areas have been completely avoided. But the routes of proposed transmission line is so finalized that it affect minimum forest area, which has also been certified by concerned Divisional Forest Officer (DFO). It may be seen from the above referred tables (para-4.1.2) that out of total transmission line length of about 294 Km about 24 Km (8% only) length shall pass through forest land consisting of 156 Ha. forest area in the states of Madhya Pradesh. Prior approval of GOI/MOEF shall be obtained for affected forest under Forest (Conservation) Act, 1980 after detail survey and finalization of route through forest area in consultation with local forest authorities. Most of the forests to be traversed by the lines are already heavily degraded and the wildlife species present are those who have been adapted to open or disturbed habitat. Therefore with provision of Compensatory Afforestation the overall forest status will in many cases improve. Nonetheless, to mitigate losses to existing forests, clearing of the transmission line Right-of-way will be done under supervision of Forest Department, and some low canopy seed trees and shrubs may be kept intact if they do not interfere with tower erection and line installation. The wood will be sold by the Forest Department, who will also retain the sale proceeds. Three-meter wide strips of land under each conductor will be cleared and maintained as maintenance rows, but the remaining land will be allowed to regenerate. Lopping of trees to maintain line clearance will be done under the direction of Forest Department. POWERGRID will provide construction crews with fuel wood or alternative fuels as a precaution against collection of fuel wood from nearby forest.

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

**(v) Encroachment into other valuable lands**

Impacts on agricultural land will be restricted to the construction phase and when large-scale maintenance measures are required. Some stretch of the line will pass through Agricultural fields. Agricultural land will be lost at the base of the tower, which is estimated to be 0.2-1 sq. m per average farm holding (**Fig-1**).

In areas where lines will traverse agricultural land, compensation will be paid to owners for any crop damage incurred as a result of construction activities.

POWERGRID field staff will consult affected villagers and local revenue department and apprise him about the project and tower location, which shall be erected in the agricultural land, for compensation. Revenue department after evaluating the loss due to construction activity and productivity of land arrives at the compensation cost which is paid to farmer. 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. Budgetary provision Rs. 294 lakh @ Rs. 1.00 Lakh per Km 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 and is shared by POWERGRID and Telecom Department on the basis of prevailing norms and guidelines. Though the exact cost to mitigate the impacts of induction in neighboring telecom circuits would vary from case to case, the cost on an average works out to be Rs.50000/- per km for POWERGRID. Provision to meet these expenses has been made in the cost estimate for the same.

Wherever transmission line crosses the railways, clearance is taken from that department. In general, the system is planned and executed in such a way that adequate clearance is maintained between transmission lines on the one hand, and railways, civil aviation and defense installations on the other. Wherever the transmission lines pass by the airports the towers beyond specified height are painted in alternate orange and white stripes for easy visibility and warning lights are placed atop these towers.

**(vii) Interference with drainage pattern**

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



## **5.1 Environmental Problems Due to Design**

### **(i) Escape of polluting materials**

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

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

During the survey and site selection for transmission lines and sub-stations, it has been ensured that these are kept away from oil/gas pipelines and other sites with potential for creating explosions or fires.

Fires due to flashover from lines can be a more serious problem in forest. However, adequate safety measures shall be taken to avoid such incidence besides this forest authorities also incorporate measures like making fire lines to prevent spreading of fire in the affected forest area.

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

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

### **(iv) Environmental aesthetics**

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

### **(v) Noise/vibration nuisances**

The equipment installed at sub-station are mostly static and are so designed that the noise level always remains within permissible limits i.e. 85 dB as per Indian 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 sub-stations 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**

Since the line is passing through mostly agricultural, wasteland and the affected forest area is also not a migration path of wild life hence, possibility of disturbance to wild life are nil/remote.

**5.2 Environmental Problems During Construction Phase**

(i) **Uncontrolled silt runoff**

The Project involves only small scale excavation for tower foundations at scattered locations that are re-filled with excavated material therefore uncontrolled silt run off is not expected.

(ii) **Nuisance to nearby properties**

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

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

Access to the site will be along existing roads or village paths; minor improvements to paths may be made where necessary, but no major construction of roads will be necessary either during construction or as a part of maintenance procedures.

As and when a transmission line crosses any road/ railways line, the terminal towers are located at sufficient distance so as not to cause any hindrance to the movement of traffic. Stringing at the construction stage is carried out during lean traffic period in consultation with the concerned authorities and angle towers are planted to facilitate execution of work in different stages.

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

Since proposed line is to be constructed in plain area where erosion problem is not anticipated. However, if due to terrain at some points transmission towers may be placed on slopes and erosion prone soils Internationally accepted engineering practices will be undertaken to prevent soil erosion. This will include cutting and filling slopes wherever necessary. The back cut slopes and downhill slopes will be treated with revetments. As explained 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. Furthermore, construction is generally undertaken outside the rainy season.

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

As mentioned earlier the transmission tower foundations involve excavations on small scale basis and the excavated soil is utilized for back filling. In case of

substations generally the sites are selected in such a manner that the volume of cutting is equal to volume of filling avoiding borrowing of the area.

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

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

In addition training is imparted to the workers in fire fighting and safety measures. Safety tools like helmet, safety belt, gloves etc. are provided to them in accordance to the provisions of Safety Manual. First aid facilities will be made available with the labour gangs, and doctors called in from nearby towns when necessary. The number of outside (skilled) labourers will be quite small, of the order of 25-30 people per group. The remaining workforce of unskilled labourers will be comprised of local people. Workers are also covered by the statutory *Workmen (Compensation) Act*. POWERGRID has a dedicated unit to oversee all health and safety aspects of its project under the Operation Service Deptt. POWERGRID has framed guidelines/checklist for workers' safety as its personnel are exposed to live EHV apparatus and transmission lines. These guidelines/checklist include work permits and safety precautions for work on the transmission lines both during construction and operation (**Annexure-2**) and is monitored regularly by site in-charge and corporate Operation Services.

### **5.3 Environmental Problems Resulting from Operation**

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

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

The supervisors and managers entrusted with O&M responsibilities are intensively trained for necessary skills and expertise for handling these aspects.

A monthly preventive maintenance program will be carried out to disclose problems related to cooling oil, gaskets, circuit breakers, vibration measurements, contact resistance, condensers, air handling units, electrical panels and compressors. Any sign of soil erosion is also reported and rectified. Monitoring results are published monthly, including a report of corrective action taken and a schedule for future action.

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

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 and land is lost to the extent of 0.2-1 sq m only for each foundation. As the lines in the subject project are not passing through any forest area, the problem of losing natural resources in this project is not envisages.

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

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

(iii) **Endangering of species**

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

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

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

## 5.6 PUBLIC CONSULTATION:

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

Apart from this, public consultation using different technique like Public Meeting, Small Group Meeting, informal Meeting as per **Environmental Social Policy & Procedures of POWERGRID (ESPP)** shall also be carried out during different activities of project cycle. During such consultation the public will be informed about the project in general and in particular about the following:

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

Apart from organising many informal group meetings in different villages a public meeting was also organised in the village Harri of Chindwara distt. of Madhya Pradesh on 28.9.04. To get the maximum participation during the Public consultation Programme a notice was served well in advance to the villagers (**Annexure- 3**). The details of line and its importance was explained to the villagers by the Chief Manager/Seoni. About sixty villagers including Surpanchs, M/s. P. Prabhakar Reddy (Survey Agency) representative and POWERGRID representative participated in the programme (**Plate-1 &2**). Pamphlets in local language were circulated during the programme amongst the participants (**Annexure-4**). The programme was arranged in interactive way and queries like crop compensation etc. were replied. The programme was appreciated by the villagers including Sarpanch and they assured to extend their cooperation for construction of transmission project.

The process of such consultation shall continue during project implementation and even during O&M stage.

## **5.7 CONCLUSIONS :**

From the above discussion, it would seem that the area is rich in physical resources. But careful route selection has avoided involvement of any National Park/Sanctuary or protected area but involvement of forest could not be avoided due to terrain and other physiographical reasons. Thus route selected for detailed survey is the most optimum route alignment and involved minimum forest and no R&R issues are anticipated as no fresh land acquisition is involved in the proposed project. Hence, based on the criteria agreed with Bank the project is coming under the **P2 category**. The infrastructural constraints are very real and pose a limiting factor on the development of the area. The above facts while on the one hand underline the need for implementation of the project for overall development of the area and on another hand suggest that a detailed E.I.A. may not be necessary.

## SECTION-VI: MONITORING AND ORGANISATIONAL SUPPORT STRUCTURE

### 6.0 ENVIRONMENTAL MONITORING PROGRAM IN POWERGRID:

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

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

#### 6.1 Corporate Level

An Environmental Management Cell at corporate level was created within POWERGRID in 1992 and subsequently upgraded to an Environment Management Department (EMD) in 1993 and in 1997 it has been further upgraded to Environment & Social Management Deptt. (ESMD) by incorporating social aspect of project. Briefly, the ESMD's responsibilities are as follows:

- Advising and coordinating RHQs and Site to carry out environmental and social surveys for new projects.
- Assisting RHQs and site to finalize routes of entire power transmission line considering environmental and social factors that could arise enroute
- Help RHQs and Site to follow-up with the state forest offices and other state departments in expediting forest clearances and the land acquisition process of various ongoing and new projects
- Act as a focal point for interaction with the M0EF for expediting forest clearances and follow-ups with the Ministry of Power.
- Imparts training to POWERGRID's RHQs & site Officials on environment and social issues and their management plan.

#### 6.2 Regional Level

At 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 DHQs to finalise routes of entire power transmission lines considering the environmental and social factors that could arise en-route
- To follow-up forest clearances and land acquisition processes with state forest offices and other state departments for various ongoing and new projects
- Acting as a focal point for interaction with the ESMD and DHQs on various environmental and social aspects.

### 6.3 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 finalise the route for the power transmission projects
- Conduct surveys for the sites to being considered for land acquisition
- Interact with the Forest Departments to make the forest proposal and follow it up for MOEF clearance.
- Interact with Revenue Authorities for land acquisition and follow it up with Authorised Agencies for implementation of Social Management Plan (SMP).
- Implementation of Environment Management Plan (EMP) and SMP
- Monitoring of EMP and SMP and producing periodic reports on the same.

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

As regards monitoring of impacts on ecological resources particularly in Forest, Sanctuary or National Park , it is generally done by the concerned Divisional Forest Officer, Chief Wildlife Warden and their staff as a part of their normal duties. A monitoring system (done by the Forest Department) is also in place for compensatory forests established as part of the Project. **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.**

**Environmental Review:** Periodic review by corporate ESMD and higher management including review by POWERGRID CMD of all environmental and social issues is under taken to ensure that EMP and other measures are implemented at site. Besides it annual review by independent Auditor under ISO: 14001 shall also be undertaken for compliance of agreed policy and management plan.



**Table-6.1 Environment Management Plan**

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
<b>Pre-construction</b>						
Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and line alignment selection with respect to nearest dwellings	Setback distances to nearest houses - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	PCBs not used in substation transformers or other project facilities or equipment.	Transformer design	Exclusion of PCBs in transformers stated in tender specification - once	POWERGRID	Part of tender specifications for the equipment
		Processes, equipment and systems not to use chlorofluorocarbons (CFCs), including halon, and their use, if any, in existing processes and systems should be phased out and to be disposed of in a manner consistent with the requirements of the Government	Process, equipment and system design	Exclusion of CFCs stated in tender specification – once	POWERGRID	Part of tender specifications for the equipment
				Phase out schedule to be prepared in case still in use – once		Part of equipment and process design
Transmission line design	Exposure to electromagnetic	Transmission line design to comply with	Electromagnetic field strength for	Line design compliance	POWERGRID	Part of detailed alignment

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
	interference	the limits of electromagnetic interference from overhead power lines	proposed line design	with relevant standards - once		survey and design
Substation location and design	Exposure to noise	Design of plant enclosures to comply with noise regulations.	Expected noise emissions based on substation design	Compliance with regulations - once	POWERGRID	Part of detailed siting survey and design
Location of transmission towers and transmission line alignment and design	Impact on water bodies and land	Consideration of tower location at where they could be located to avoid water bodies or agricultural land.	Tower location and line alignment selection (distance to water and/or agricultural land)	Consultation with local authorities and land owners - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
	Social inequities	Careful route selection to avoid existing settlements	Tower location and line alignment selection (distance to nearest dwellings or social institutions)	Consultation with local authorities and land owners - once	POWERGRID	Part of detailed tower siting and alignment survey and design
		Minimise need to acquire agricultural land	Tower location and line alignment selection (distance to agricultural land)	Consultation with local authorities and land owners - once	POWERGRID	Part of detailed tower siting and alignment survey and design

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

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
Encroachment into farmland	Loss of agricultural productivity	Use existing tower footings/towers wherever possible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed alignment survey and design
		Avoid siting new towers on farmland wherever feasible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once		Part of detailed siting and alignment survey /design
		Farmers compensated for any permanent loss of productive land	Design of Implementation of Crop Compensation (based on affected area)	Consultation with affected parties – once in a quarter		Prior to construction phase
		Farmers/landowners compensated for significant trees that need to be trimmed/ removed along RoW.	Design of Implementation of Tree compensation (estimated area to be trimmed/removed)	Consultation with affected parties – once in a quarter		Prior to construction phase
			Statutory approvals for tree trimming /removal	Compliance with regulations – once for each subproject		Part of detailed siting and alignment survey /design
Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a	Noise levels	Noise levels to be specified in tender	POWERGRID	Part of detailed equipment design

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		nuisance.		documents - once		
Interference with drainage patterns/Irrigation channels	Flooding hazards/loss of agricultural production	Appropriate siting of towers to avoid channel interference	Tower location and line alignment selection (distance to nearest flood zone)	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed alignment survey and design
Escape of polluting materials	Environmental pollution	Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill cleanup equipment.	Equipment specifications with respect to potential pollutants	Tender document to mention specifications - once	POWERGRID	Part of detailed equipment design /drawings
		Substations to include drainage and sewage disposal systems to avoid offsite land and water pollution.	Substation sewage design	Tender document to mention detailed specifications - once	POWERGRID	Part of detailed substation layout and design /drawings
Explosions/Fire	Hazards to life	Design of substations to include modern fire control systems/firewalls.	Substation design compliance with fire prevention and control codes	Tender document to mention detailed specifications - once	POWERGRID	Part of detailed substation layout and design /drawings
		Provision of fire fighting equipment to be located close to transformers.				
<b>Construction</b>						
Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection seeking to minimize	Construction techniques and machinery	Construction techniques and machinery	POWERGRID (Contractor through	Construction period

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
		ground disturbance.		creating minimal ground disturbance - once at the start of each construction phase	contract provisions)	
Physical construction	Disturbed farming activity	Construction activities on cropping land timed to avoid disturbance of field crops (within one month of harvest wherever possible).	Timing of start of construction	Crop disturbance – Post harvest as soon as possible but before next crop - once per site	POWERGRID (Contractor through contract provisions)	Construction period
Mechanized construction	Noise, vibration and operator safety, efficient operation	Construction equipment to be well maintained.	Construction equipment – estimated noise emissions	Complaints received by local authorities - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
	Noise, vibration, equipment wear and tear	Turning off plant not in use.	Construction equipment – estimated noise emissions and operating schedules	Complaints received by local authorities - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
Construction of roads for accessibility	Increase in airborne dust particles	Existing roads and tracks used for construction and maintenance access to the line wherever possible.	Access roads, routes (length and width of new access roads to be constructed)	Use of established roads wherever possible - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
	Increased land requirement for temporary accessibility	New access ways restricted to a single carriageway width within the RoW.	Access width (meters)	Access restricted to single carriageway width within RoW - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Temporary blockage of utilities	Overflows, reduced discharge	Temporary placement of fill in drains/canals not permitted.	Temporary fill placement (m <sup>3</sup> )	Absence of fill in sensitive drainage areas - every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m <sup>2</sup> )	Clearance strictly limited to target vegetation - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Trimming/cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in meters)	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
	Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period
		Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies.	Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m <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
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
Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings disposed of by placement along roadsides, or at nearby house blocks if requested by landowners.	Soil disposal locations and volume (m <sup>3</sup> )	Acceptable soil disposal sites - every 2 weeks	POWER GRID (Contractor through contract provisions)	Construction period
Substation construction	Loss of soil	Fill for the substation foundations obtained by	Borrow area siting (area of site in m <sup>2</sup> )	Acceptable borrow areas	POWERGRID (Contractor)	Construction period



Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		creating or improving local water supply ponds or drains, with the agreement of local communities.	and estimated volume in m <sup>3</sup> )	that provide a benefit - every 2 weeks	through contract provisions)	
Substation construction	Water pollution	Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season.	Seasonal start and finish of major earthworks	Timing of major disturbance activities - prior to start of construction activities	POWERGRID (Contractor through contract provisions)	Construction period
Site clearance	Vegetation	Tree clearances for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed.	Ground disturbance during vegetation clearance (area, m <sup>2</sup> )	Amount of ground disturbance - every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
			Statutory approvals	Statutory approvals for tree clearances – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
Tower construction – disposal of surplus earthwork/fill	Waste disposal	Excess fill from tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner.	Location and amount (m <sup>3</sup> )of fill disposal	Appropriate fill disposal locations - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Storage of chemicals and	Contamination of receptors	Fuel and other hazardous materials	Location of hazardous material	Fuel storage in appropriate	POWERGRID (Contractor	Construction period

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
materials	(land, water, air)	securely stored above high flood level.	storage; spill reports (type of material spilled, amount (kg or m <sup>3</sup> ) and action taken to control and clean up spill)	locations and receptacles - every 2 weeks	through contract provisions)	
Construction schedules	Noise nuisance to neighbouring properties	Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [dB(a)])	Daytime construction only - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities - once each new facility	POWERGRID (Contractor through contract provisions)	Construction period
Encroachment into farmland	Loss of agricultural productivity	Use existing access roads wherever possible	Usage of existing utilities	Complaints received by local people /authorities - every 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> )			

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Repair /reinstate damaged bunds etc after construction completed	Status of facilities (earthwork in m <sup>3</sup> )			
	Social inequities	Compensation for temporary loss in agricultural production	Implementation of Crop compensation (amount paid, dates, etc.)	Consultation with affected parties – once in a quarter	POWERGRID	Prior to construction
Uncontrolled erosion/silt runoff	Soil loss, downstream siltation;	Need for access tracks minimised, use of existing roads.	Design basis and construction procedures (suspended solids in receiving waters; area re-vegetated in m <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				
Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices.	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		As much as possible existing access ways will be used.	Design basis and layout	Incorporating good design engineering practices – once for each site		
		Productive land will be reinstated following completion of construction	Reinstatement of land status (area affected, m <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
Inadequate siting of borrow areas	Loss of land values	Existing borrow sites will be used to source aggregates, therefore, no need to develop new sources of aggregates	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
Health and safety	Injury and sickness of workers and members of the	Contract provisions specifying minimum requirements for construction camps	Contract clauses (number of incidents and total lost-work days)	Contract clauses compliance – once every	POWERGRID (Contractor through contract)	Construction period

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
	public	Contractor to prepare and implement a health and safety plan. Contractor to arrange for health and safety training sessions	caused by injuries and sickness)	quarter	provisions)	
Inadequate construction stage monitoring	Likely to maximise damages	Training of POWERGRID environmental monitoring personnel	Training schedules	Number of programs attended by each person – once a year	POWERGRID	Routinely throughout construction period
		Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements	Respective contract checklists and remedial actions taken thereof.	Submission of duly completed checklists of all contracts for each site - once		
		Appropriate contact clauses to ensure satisfactory implementation of contractual environmental mitigation measures.	Compliance report related to environmental aspects for the contract	Submission of duly completed compliance report for each contract - once		
<b>Operation and Maintenance</b>						
Location of transmission towers and transmission line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of	Compliance with setback distances (“as-built” diagrams)	Setback distances to nearest houses – once in quarter	POWERGRID	During operations

Project activity /stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		supervision at sites.				
Equipment submerged under flood	Contamination of receptors (land, water)	Equipment installed above the high flood level (HFL) by raising the foundation pad.	Substation design to account for HFL ("as-built" diagrams)	Base height as per flood design - once	POWERGRID	During operations
Oil spillage	Contamination of land/nearby water bodies	Substation transformers located within secure and impervious sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substatio bunding (Oil sump) ("as-built" diagrams)	Bunding (Oil sump) capacity and permeability - once	POWERGRID	During operations
Inadequate provision of staff/workers health and safety during operations	Injury and sickness of staff /workers	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (lost work days due to illness and injuries)	Preparedness level for using these technologies in crisis – once each year	POWERGRID	Design and operation
		Safety awareness raising for staff.	Training/awareness programs and mock drills	Number of programs and percent of staff /workers covered – once each year		
		Preparation of fire emergency action plan and training given to staff on implementing emergency action plan				
		Provide adequate sanitation and water supply facilities	Provision of facilities	Complaints received from staff /workers every 2 weeks		

<b>Project activity /stage</b>	<b>Potential impact</b>	<b>Proposed mitigation measure</b>	<b>Parameter to be monitored</b>	<b>Measurement and frequency</b>	<b>Institutional responsibility</b>	<b>Implementation schedule</b>
Electric Shock Hazards	Injury/mortality to staff and public	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (number of injury incidents, lost work days)	Preparedness level for using these technologies in crisis – once a month	POWERGRID	Design and Operation
		Security fences around substations	Maintenance of fences	Report on maintenance – every 2 weeks		
		Barriers to prevent climbing on/dismantling of transmission towers	Maintenance of barriers			
		Appropriate warning signs on facilities	Maintenance of warning signs			
		Electricity safety awareness raising in project areas	Training /awareness programs and mock drills for all concerned parties	Number of programs and percent of total persons covered – once each year		
Operations and maintenance staff skills less than acceptable	Unnecessary environmental losses of various types	Adequate training in O&M to all relevant staff of substations and transmission line maintenance crews.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation
		Preparation and training in the use of O&M manuals and standard operating practices.				
Inadequate periodic	Diminished ecological and	Power Grid staff to receive training in	Training/awareness programs and	Number of programs and	POWERGRID	Operation

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