

# Initial Environmental Examination (Draft)

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October 2014

## IND: National Grid Improvement Project

Prepared by Power Grid Corporation of India Ltd. for the Asian Development Bank

The initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

**INITIAL ENVIRONMENT EXAMINATION REPORT  
(IEER)  
FOR  
INTER-REGIONAL SYSTEM STRENGTHENING  
SCHEME IN WR-NR (Part-B)**



**ENVIRONMENT AND SOCIAL MANAGEMENT**  
**POWER GRID CORPORATION OF INDIA LTD.**  
( A GOVERNMENT OF INDIA ENTERPRISE )

## **CURRENCY EQUIVALENTS**

(as of 1 October 2014)

Currency Unit - India rupee/s (INR)

Rupee 1.00 = \$0.01623

\$1.00 = INR 61.61

## **ABBREVIATIONS**

ADB	-	Asian Development Bank
APs	-	Affected Persons
CEA	-	Central Electricity Authority
DC	-	District Collector
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
ESMU	-	Environment and Social Management Unit
FGD	-	Focus Group Discussions
GoI	-	Government of India
GRC	-	Grievance Redress Committee
IEE	-	Initial Environmental Examination
PMU	-	Project Management Unit
WR	-	Western Region
NR	-	Northern Region

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## EXECUTIVE SUMMARY

In 2011, the Asian Development Bank (ADB) has approved a loan of \$750 million (\$500 million as sovereign and \$250 million as non-sovereign) to the Government of India (GOI) to support continued investment, specifically for strengthening interregional transmission system.<sup>1</sup>The Power Grid Corporation of India Limited (POWERGRID) is the Executing Agency (EA) for the loan.

During loan administration, there was substantial savings of about \$160 million. POWERGRID requested ADB to use the loan savings to finance the following additional components, which is part of the Inter-Regional System Strengthening Scheme in Western Region (WR) - Northern Region (NR) Part B as follows:

- (i) Orai – Aligarh 765kV D/C transmission line – 320 km
- (ii) Orai – Orai (UPPTCL) 400 kV D/C (Quad) transmission line – 38 km
- (iii) LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh substation (S/S) – 4.1 km
- (iv) LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh S/S –10.6 km

All the four additional transmission lines will be located in Uttar Pradesh, the most populous state in India.

Transmission line projects are considered environmentally-friendly in India and are exempted by the Ministry of Environment and Forests (MoEF) from the requirements of the Environment (Protection) Act 1986. However, when transmission projects pass through forest land, clearance has to be obtained from relevant authorities under the Forest (Conservation) Act, 1980.

To address the environmental and social issues related to its power transmission projects, POWERGRID has developed its corporate environmental and social policy and procedures (ESPP) based on the principles of avoidance, minimization, and mitigation. The ESPP had been updated and revised in 2009 consistent with the World Bank policy of Use of Country System policy<sup>2</sup>, and applicable laws, legislation and guidelines of Gol.

Environment category B was retained for the additional components according to ADB's Safeguard Policy Statement (SPS) 2009 which requires the preparation of an initial environmental examination (IEE). Thus, this IEE was prepared to meet the requirements of SPS 2009.

Environmental impacts associated with the four additional components are restricted to the clearing and maintenance of the right-of-way (RoW). With the development of innovative tower design being implemented by POWERGRID, the RoW requirements have been reduced from 85 m to 64 m for 765 kV S/C line and from 52 m to 46 m for 400 kV D/C line. Even with ESPP and innovative design, some residual impacts cannot be entirely avoided as about 10.7 hectares of land designated as forest (Plantation along road and canal crossing) by Government of India (Gol) will be affected by the four additional components.

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<sup>1</sup>ADB. 2011. Loan 2787/2788-IND: National Grid Improvement Project. Manila.

<sup>2</sup> Power Grid Corporation of India Ltd. Environment and Social Management Department. *Environmental and Social Policy & Procedures (ESPP)*, p5, CC/ESMD/ESPP-09.

Under the Forest (Conservation) Act 1980, prior approval from the MoEF shall be obtained for affected areas classified as forest that will be traversed by the transmission line after detailed survey and finalization of route through forest area in consultation with local forest authorities. Most of the forests that will be traversed by the transmission line routes are already degraded and the wildlife species present are those who have been already adapted to open or disturbed habitat.

Public consultations were conducted between January to March 2014 and will continue throughout the project cycle. The grievance redress mechanism will be according to the ESPP procedures which are consistent with multilateral banks such as the World Bank and the relevant national regulations.

An environmental management plan with cost estimates included in the budget as well as environmental monitoring plan are integral part of this IEE. A semiannual environmental monitoring report will be submitted to ADB and will be disclosed publicly at the ADB website.

## 1.0 INTRODUCTION

In 2011, the Asian Development Bank (ADB) has approved a loan of \$750 million (\$500 million as sovereign and \$250 million as non-sovereign) to the Government of India (GOI) to support continued investment, specifically for strengthening interregional transmission system.<sup>3</sup>The Power Grid Corporation of India Limited (POWERGRID) is the Executing Agency (EA) for the loan.

The loan partly financed the project on expansion and augmentation of the interregional transmission networks. The investments are necessary to: (i) optimize transnational power supply and promote country-wide power transfer in an efficient manner; (ii) facilitate increased power transfers to accommodate increased demand and economic growth; (iii) have a low carbon investment. The Project consists of the following:

**Component 1:** HVDC interregional transmission system between the Western and Northern regions (Chhattisgarh and Haryana)

- (i) A 800kV HVDC transmission line (approx. 1287km) between Champa in Chhattisgarh and Kurukshetra in Haryana;
- (ii) Expansion of a substation at Champa; and,
- (iii) Establishment of 800kV HVDC terminals at Champa and Kurukshetra.

**Component 2:** Transmission system strengthening in the Northern region (Haryana and Punjab)

- (i) A 400kV double circuit transmission line (approx. 264 km) between the substations at Kurukshetra in Haryana and at Jalandhar via Nakodar in Punjab;
- (ii) A 400kV double circuit Line-In Line-Out (LILO) transmission line (approx. 32 km) from Kurukshetra to Abdullapur and Sonepa; and,
- (iii) Establishment of a substation at Kurukshetra.

Only **Component 1** was financed by ADB. The project was classified as Category B on environment according to the Safeguard Policy Statement (SPS) 2009 of ADB requiring the preparation of an initial environmental examination (IEE). However, since **Component 2** is considered as an associated facility within the context of project's area of influence, environmental due diligence was also conducted following SPS 2009. The IEE was publicly disclosed to ADB website on 15 July 2011.

During loan administration, there was substantial savings of about \$160 million. POWERGRID requested ADB to use the loan savings to finance the following additional components, which is part of the Inter-Regional System Strengthening Scheme in Western Region (WR) - Northern Region (NR) Part B as follows:

- Orai – Aligarh 765kV D/C transmission line – 320 km
- Orai – Orai (UPPTCL) 400 kV D/C (Quad) transmission line – 38 km
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<sup>3</sup>ADB. 2011. Loan 2787/2788-IND: National Grid Improvement Project. Manila.



- LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh S/S –10.6 km

The additional components are within the original scope of Component 1 - HVDC interregional transmission system strengthening scheme between the Western and Northern regions (Chhattisgarh and Haryana). Category B was retained by ADB for the additional components and this IEE, covering the additional components, was prepared following SPS 2009. This IEE describes the environmental issues that might arise due to setting up of the four additional components in the State of Uttar Pradesh and the mitigation measures that will be undertaken by POWERGRID during design, construction and maintenance stages.

## **1.1 Background**

POWERGRID, the Central Transmission Utility (CTU) of India is engaged in power transmission with the mandate for planning, coordination, supervision and control over complete Inter-State transmission system. As on 28 February 2014, POWERGRID has established about 105,343 circuit-kilometer (Ckt-km) of transmission lines at 765 kV, 400 kV, 220 kV and 132 kV extra high voltage alternating current (EHV AC), and 500 kV high voltage direct current (HVDC) levels and 178 substations (S/S) with transformation capacity of about 197,648 MVA. This transmission network, spread over length and breadth of India, is consistently maintained at an availability of over 99% through deployment of state-of-the-art Operation & Maintenance techniques at par with global standards. About 50% of total power generated in India is wheeled through transmission network.

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

Power demand in NR is growing exponentially. The maximum peak demand of NR has reached 45,900 MW. The demand of the region is expected to continue growing. As per the 18<sup>th</sup> Electric Power Survey (EPS) of the Central Electrical Authority (CEA), the power demand of NR would be 61,000 MW and 86,500 MW by 2016-2017 and 2021-2022, respectively. From the present generation scenario, it is observed that more and more generation is coming up in WR and imports from WR to NR are increasing. With the growth in power demand, it is expected that power transfer requirements from WR would increase. Further, during the two grid disturbances in July 2012, it was observed that there is a need to provide strengthening between NR and WR. Accordingly, the present scheme has been proposed for Strengthening of Inter-regional System between NR and WR.

The system was discussed and agreed during the 31<sup>st</sup> Standing Committee Meeting of NR held on 2 January 2013. The system was also discussed and approved during the 35<sup>th</sup> Meeting of Standing Committee of WR held on 3 January 2013. The scheme has also been agreed by the constituents in the 22<sup>nd</sup> Western Regional Power Committee meeting held on 26 February 2013 and the 28<sup>th</sup> Northern Regional Power Committee meeting held on 26 April 2013.

## **2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK**

Power transmission activity is undertaken within the purview of GOI's laws keeping in mind appropriate international obligations and directives and guidelines with respect to environmental and social considerations of funding agencies. The following is a brief description of relevant laws and regulations:

### **2.1 National Environmental Requirements**

#### **a) Constitutional Provisions**

Subsequent to the 1<sup>st</sup> 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 42<sup>nd</sup> Amendment Act 1976 by inserting Article 48-A and 51-A (g) for protection and promotion of the environment under the Directive Principles of State Policy and the Fundamental Duties respectively. The amendment, inter alia provides:

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

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

Article 21 of the constitution provides that, "no person shall be deprived of his life or personal liberty except according to procedure established by law". This article 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 guarantees fundamental right to life – a life of dignity to be lived in a proper environment, free of danger of disease and infection.

Recently, the Supreme Court has broadly and liberally interpreted the Article 21, transgressed into the area of protection of environment, and held that the protection of environment and citizens' right to live in eco-friendly atmosphere are to be interpreted as the basic right guaranteed under Article 21. Thus, the Indian Constitution has now two fold provisions. First, it gives directive to the State for the protection and improvement of environment and second, the citizens owe a constitutional duty to protect and to improve the natural environment.

#### **b) Mandatory Requirements (National)**

- **Ministry of Power (MoP) order/sanction under the Electricity Act of 2003**

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

**Rights-of-Way (ROW) and Compensation under the Electricity Act of 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.

- **Forest Clearance under the Forest (Conservation) Act of 1980**

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

- **Environmental Clearances under the Environment (Protection) Act of 1986**

Transmission line projects are environmentally-clean and its operations do not involve any disposal of solid waste, effluents and hazardous substances in land, air and water. As such, transmission line projects are kept out of the purview of the Environment (Protection) Act 1986.

In its notification in September 2006, the Ministry of Environment and Forests (MoEF), GoI has exempted transmission line projects from environmental clearances due to the non-polluting nature of its activities. However, forest clearances under the Forest Conservation Act 1980 will be necessary in the event that transmission line passes through forest areas.

In the recent amendment of the Environment (Protection) Act 1986, it was required to obtain clearance from the MoEF for power transmission projects in two districts in the Aravalis: Alwar in Rajasthan and Gurgaon in Haryana.

- **Batteries (Management and Handling) Rules of 2001**

MoEF, vide its notification on 16 May 2001 under the section of 6, 8 and 25 of the Environment (Protection) Act 1986, has put certain restrictions on disposal of used batteries and its handling. The notification provides that 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 of 2003**

MoEF, vide its notification on 20 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 requires proper handling and disposal. The notification provides that all used oil should be

auctioned and/or sold to registered recyclers only and to file annual return on prescribed form to the concerned State Pollution Control Board.

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

MoEF, vide its notification on 17 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 the Montreal Protocol adopted by GOI on 16 September 1987. The notification provides for certain controls and regulations to be imposed on manufacturing, import, export, and use of these compounds. POWERGRID is following the provisions of the notification and is phasing out all equipment which uses these substances and planning to achieve CFC-free organization in the near future.

- **The Biological Diversity Act, 2002**

Under the United Nations Convention on Biological Diversity, signed at Rio de Janeiro on 5 June 1992 of which India is a party, MoEF has enacted the Biological Diversity Act of 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. According to the Act, certain areas which are rich in biodiversity and encompass unique and representative ecosystems are identified and designated as Biosphere Reserve to facilitate its conservation. All restrictions applicable to protected areas like national park and sanctuaries are also applicable to these reserves. POWERGRID will abide by the provisions of act, wherever applicable, and try to totally avoid these biosphere reserves in selecting the final route alignment.

### **2.1.1 Relevant Policies**

- National Conservation Strategy and Policy Statement on Environment and Development of 1992
- National Environment Policy of 2006
- Policy Statement for Abatement of Pollution of 1992

## **2.2 POWERGRID's Environmental and Social Policy and Procedures**

To address the environmental and social issues related to its power transmission projects, POWERGRID has developed its corporate environmental and social policy and procedures (ESPP) in 1998 based on the principles of avoidance, minimization, and mitigation. The ESPP had been updated and revised in 2009 consistent with the World Bank policy of Use of Country System policy<sup>4</sup>, and applicable laws, legislation and guidelines of GoI. This is now referred to by POWERGRID as the ESPP 2009.

ESPP 2009 outlines POWERGRID's approach and commitment in dealing with the environmental and social issues relating to its transmission projects, lays down the management procedures and protocols for the purpose that includes the framework for identification, assessment, and management of environmental and social concerns at both organizational and project levels.

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<sup>4</sup> Power Grid Corporation of India Ltd. Environment and Social Management Department. *Environmental and Social Policy & Procedures (ESPP)*, p5, CC/ESMD/ESPP-09.

Specifically on environment, the following criteria and approach are considered in the ESPP:

- (i) Avoid operations in environmentally-sensitive areas, eco-sensitive zones, forests, sanctuaries, national parks, tiger/biosphere reserves, and Coastal Regulation Zone covered coastal areas;
- (ii) Consider environmental implications of location, terrain, and sensitive areas in impact identification and mitigate these with innovative and practical engineering solutions;
- (iii) Application of efficient and safe technology practices;
- (iv) Abate pollution in all activities and operations; and,
- (v) Minimize energy losses and promote energy efficiency.

### **2.3 ADB's Environmental Requirements**

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 additional components of Loan 2787/2788, the environment category was retained as B requiring the preparation of an IEE.

### **2.4 Comparison of POWERGRID's ESPP and the ADB's SPS 2009**

The table below presents a brief comparison of ESPP 2009 and SPS 2009.

**Table 2.1 Comparison of ESPP 2009 and SPS 2009**

<b>Project Stage</b>	<b>ADB Safeguard Policy Statement 2009</b>	<b>POWERGRID's ESPP</b>	<b>Remarks</b>
Project identification and categorization	Screening of each proposed project at initial stage using checklists and categorize the project as A,B,C,FI based on potential environmental impacts	POWERGRID does not categorize a project, and has no legislative provision <sup>5</sup> for screening and categorization to define the depth of environmental assessment. However, it conducts an environmental and social screening at Project conceptualization in line with international good practices.	<ul style="list-style-type: none"> <li>• Under the national policy, it is not required for POWERGRID to categorize their projects to identify the environmental assessment needed</li> </ul>
Conduct Environmental Assessment (i.e., EIA or IEE)	Assessment of all potential impacts on physical, ecological, sociological, and cultural resources.	<ul style="list-style-type: none"> <li>• Undertakes environmental assessment for all projects as a standard management procedure (an Initial Environment Assessment Report)</li> <li>• Prepares Environmental Assessment and Management Plan (EAMP) in consultation with State Forest Dept. and Revenue Authority if transmission line route will pass through forest areas</li> <li>• Operates within permissible standards of ambient air quality and noise levels as prescribed by national laws and international regulations</li> <li>• Conducts cost-benefit analysis as part of Forest Clearance applications</li> <li>• Use environmental and social risk management framework as part of environmental and social management strategies – creating funds to absorb risks and prepare for contingencies, maintains insurance schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Prepares Initial Environment Assessment Report (IEAR)/Initial Environment Examination Report (IEER) of transmission projects</li> <li>• Content of IEAR is generally aligned with the IEE.</li> </ul>
Assessment of Alternatives	Assessment of feasible alternatives (technical, siting, routing, etc as appropriate)	<ul style="list-style-type: none"> <li>• During project planning, conducts “Bee” line survey to select the most optimum route with the least environmental impacts</li> <li>• Uses GPS/GIS and government-published data and/or reports such as Survey of India topography sheets, Forest Atlas, etc. to select three “alternative routes for analysis and select the best route (final) for detailed</li> </ul>	Prepares two or three route alternatives for detailed study and therefore, aligned with ADB's requirements

<sup>5</sup> The applicable legal provisions under the Electricity Act 2003 are as follows: Section 68(1) - sanction from the Ministry of Power (MOP) is a mandatory requirement for taking up any new transmission project. The sanction authorizes POWERGRID to plan and coordinate activities to commission new project. Section 164(B) – under this section of the Act, POWERGRID has all the powers that the telegraph authority possesses and can erect and construct towers without actually acquiring the land.

Project Stage	ADB Safeguard Policy Statement 2009	POWERGRID's ESPP	Remarks
		survey study in consultation with relevant government agencies	
Prepare environmental management plan with budget estimates	Develop and implement Environmental Management Plans (EMP), Environmental Monitoring Plans and define institutional arrangement to achieve defined plans	Develop, implement, and monitor Environmental Management Plans (EMP) with proper institutional arrangement	Aligned with ADB's requirements
Public consultation	Public consultations (stakeholders including project affected groups, local NGOs, etc.) throughout the project cycle	<ul style="list-style-type: none"> <li>• Informal consultations are done during walkover survey for transmission line and tower spotting, during construction, and maintenance (e.g., landowners, people along the route, etc)</li> <li>•</li> </ul>	Aligned with ADB's requirements
Information disclosure	Environmental documents publicly disclosed at ADB website: <ul style="list-style-type: none"> <li>• 120-day prior to ADB Board consideration of the project for Category A (an EIA is required)</li> <li>• New/updated environmental assessment and corrective plan prepared during implementation</li> <li>• Environmental monitoring reports</li> </ul>	<ul style="list-style-type: none"> <li>• IEE document placed in public domain for information. Project details and EMP translated into local language and made available at the village/community level</li> <li>• Copies of EMP available at local level for stakeholders' inputs (as needed)</li> </ul>	Aligned with ADB's requirements

Based on the brief comparison given in **Table 2.1**, except for categorization of projects, ESPP 2009 is generally aligned with the requirements of ADB's SPS 2009.

### 3.0 DESCRIPTION OF THE PROJECT

#### 3.1 Project Justification

The maximum peak demand of NR has reached 45,900 MW and according to the 18<sup>th</sup> EPS of the CEA, the power demand of NR would be 61,000 MW and 86,500 MW by 2016-2017 and 2021-2022, respectively. The present generation scenario indicates that more generation is coming up from WR and power imports from WR to NR are increasing and given the recent two grid disturbances in 2012, there is a need to strengthen power transmission systems between NR and WR. Considering the other system developments already in progress, the following transmission projects have been agreed to cover the System Strengthening Scheme:

- Jabalpur Pooling station - Orai 765 kV double circuit (D/C) transmission line
- Orai – Aligarh 765 kV D/C transmission line
- Orai – Orai (UPPTCL) 400 kV D/C (Quad) transmission line
- LILO of one circuit of Satna-Gwalior 765 kV D/C transmission line at Orai substation (S/S)
- 2x1000 MVA, 765/400 kV substation at Orai S/S
- LILO of Agra-Meerut 765 kV single circuit (S/C) transmission line at Aligarh S/S
- 765 kV Switching Station at Aligarh (GIS)
- LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh S/S

Jabalpur is an important pooling station in WR. At Jabalpur, in addition to power from IPPs in Orissa and Chhattisgarh, power from generating stations of MB power (2x600 MW), Jhabua (2x600 MW) and SJK Power Gen (2x660 MW) are being pooled.

Satna is another important substation and is connected to Vindhayachal/Sasan generating station through the 756 kV network. To transfer power from WR to NR, the Jabalpur Pooling station - Orai 765 kV D/C transmission line and LILO of one circuit of Satna - Gwalior 765 kV line at Orai S/S is proposed. To transfer power beyond Orai, the Orai – Aligarh 765 kV D/C transmission line has been envisaged, in addition to 400 kV lines. With LILO of Agra-Meerut 765 kV S/C and Kanpur – Jhatikara 765 kV S/C at Aligarh substation, 765 kV network would be available for transfer of power to National Capital Region (NCR) area and beyond.

#### 3.2 Objective and Benefits of the Project

The additional components aim to facilitate the efficient and reliable power transfer between NR and WR. In addition, they are likely to generate direct and indirect employment opportunities, promote industrial growth, and stimulate overall development of the area.

#### 3.3 Project Highlights

	<b>Title</b>	<b>:</b>	<b>Description</b>
a)	Project	:	Inter-Regional System Strengthening Scheme In WR-NR (Part-B)
b)	Location of the Project	:	Northern Region and Western Region
c)	Beneficiary States	:	Northern and Western Region Constituents



	<b>Title</b>	<b>:</b>	<b>Description</b>
d)	Project Cost	:	<b>INRs 5606.38 Crores</b> at August 2013 Price Level (including IDC of INRs 318.84 Crores)
e)	Commissioning schedule	:	Transmission system is proposed to be implemented within 36 months from the date of investment approval

### 3.4 Scope of Work

The complete scope of the transmission system strengthening to be implemented under the scheme is as follows:

#### **Sub-Station (Not under ADB funding)**

- 765/400 kV Jabalpur Pooling Station Extension
- 2x1000 MVA, 765/400 kV substation at Orai S/S
- 765 kV Switching station (GIS) at Aligarh
- 765 kV Jhatikara Substation Extension
- 400 kV Orai (UPPTCL) Substation Extension

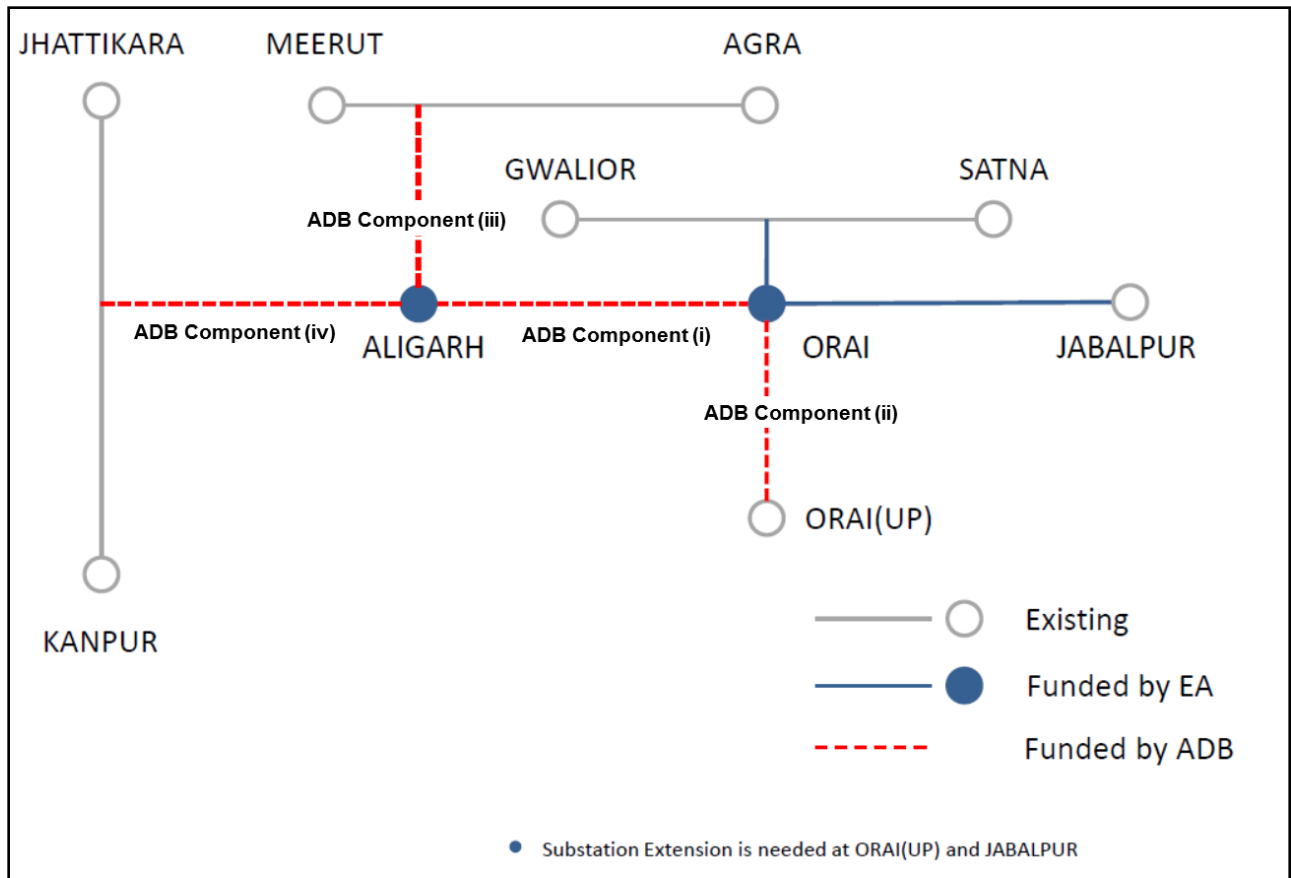
#### **Transmission Line**

- Jabalpur Pooling station - Orai 765 kV D/C transmission line – 419 km
- Orai – Aligarh 765 kV D/C transmission line – 320 km
- Orai – Orai (UPPTCL) 400 kV D/C (Quad) transmission line – 38 km
- LILO of one circuit of Satna-Gwalior 765 kV D/C transmission line at Orai S/S – 80 km
- LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S – 4.1 km
- LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh S/S – 10.6 km

**The transmission lines proposed for ADB funding are as follows:**

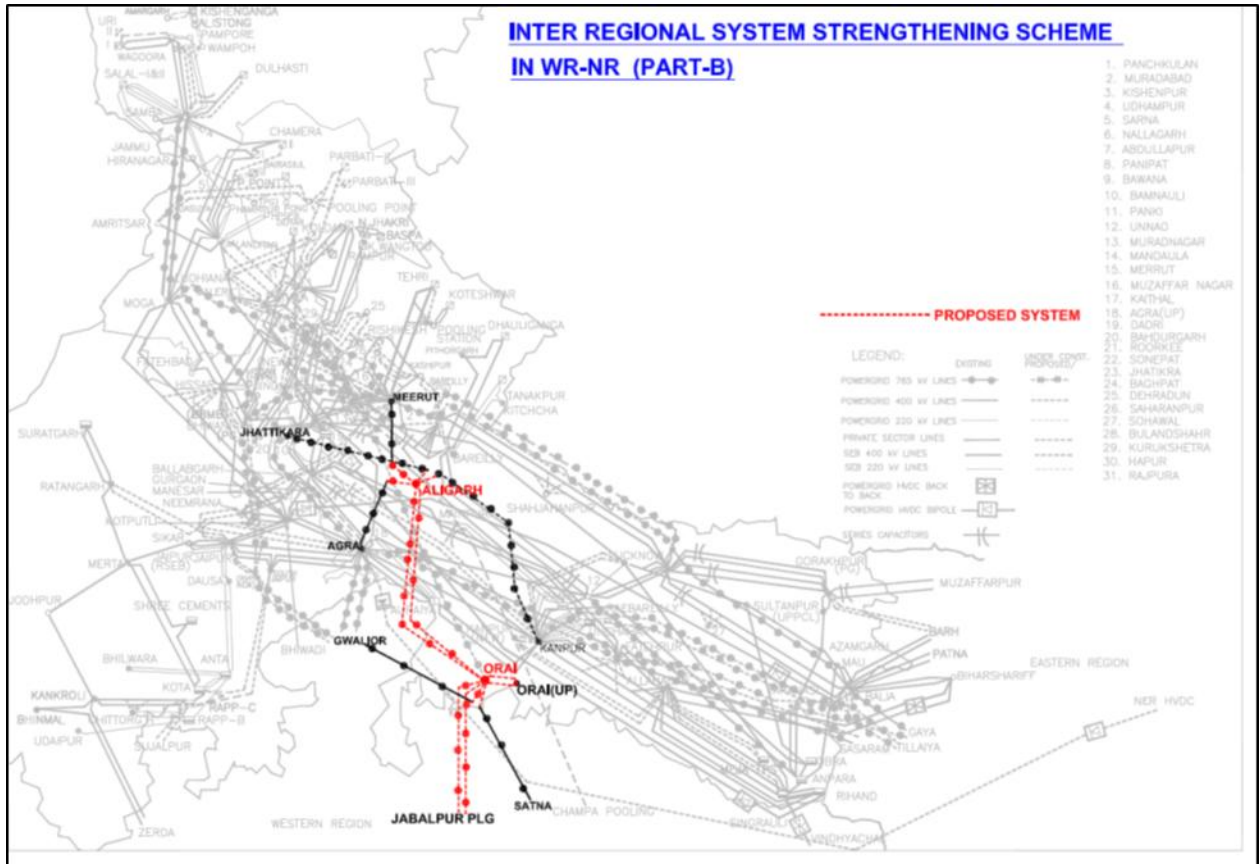
- (i) Orai – Aligarh 765 kV D/C transmission line – 320 km
- (ii) Orai – Orai (UPPTCL) 400 kV D/C (Quad) transmission line – 38 km
- (iii) LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S – 4.1 km
- (iv) LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh S/S – 10.6 km

**Figure 3.1** presents the power system of additional components showing the transmission lines to be funded by ADB. Remaining scope of works shall be implemented through domestic funding.



**Figure 3.1 Power System of Additional Components**

A power map showing the transmission grid of the Inter-Regional System Strengthening Scheme in WR-NR (Part-B) highlighting the above scope of works is given in **Figure 3.2**.



**Figure 3.2 Inter-Regional System Strengthening Scheme in WR-NR (Part-B)**

## 4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The proposed ADB funding scope involves four transmission lines, i.e. Orai – Aligarh 765kV D/C transmission line, Orai – Orai (UPPTCL) 400 kV D/C (Quad) line, LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S, LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh and two new substations at Orai and Aligarh are located in the state of Uttar Pradesh. The existing environment is described at the state level of Uttar Pradesh.

### 4.1 Physiography

Uttar Pradesh, the most populous state of the country, has a geographical area of about 240,928 km<sup>2</sup> which constitutes 7.3% of the total area of India. It shares border with nine states as well as international border with Nepal. Uttar Pradesh is situated between 23°52' N -30°24' N latitude and 77°05'E - 84°38'E longitude. The state is divided into two physiographic zones:

- Vast Gangetic Plains having highly fertile alluvial soil
- Smaller Southern Hill Plateau

The land use pattern of the state is given in **Table 4.1**.

**Table 4.1 Land use in Uttar Pradesh**

Land use	Area in ' 000 ha	Percentage
Total Geographical area	24,093	
Reporting Area for land utilization	24,170	100.00
Forests	1,658	6.86
Not available for land cultivation	3,268	13.52
Permanent pasture and other grazing land	65	0.27
Land under miscellaneous tree crops and groves	374	1.55
Culturable waste land	440	1.82
Fallow land other than current fallows	540	2.23
Current fallows	1,408	5.83
Net area Sown	16,417	67.92

*Source: Land use statistics, Ministry of Agriculture, GOI, 2008-2009*

### 4.2 Climate

The climate in Uttar Pradesh varies substantially. The Gangetic plain, which covers three-quarters of the state, is dry and dusty in summer. But, during the monsoons between June and September, it is transformed into carpets of lush green fields. The monsoons also spell disaster for some regions, when the Ganga and its tributaries overflow their banks and flood large tracts of land.

Winter is severe, the Gangetic plains are fairly cold with temperatures coming down as low as 3°C though average temperatures remain around a pleasant 18°C. Summers are extremely hot in the plains with maximum temperature reaching as high as 45°C. The intensity of the summer months is magnified by the hot winds called 'loo' that blows across the plains in May and June, the hottest months of the year. The average annual rainfall varies from 1,000 mm to 1,200 mm while the temperature ranges from a maximum of 45°C to 35°C during summer and 25°C to 3°C during winter.

### **4.3 Soil**

Transmission lines are passing through Indo-Gangetic plains. Predominant soil in the area is alluvial soil.

### **4.4 Water resources**

The main rivers of the state from west to east are the Yamuna, Ganga, Ramganga, Gomati and Ghaghara. All the rivers, except the Gomati River, emerge from the Himalayas. The Yamuna River and the Ganga River flow from north-east to south-west in their upper mountainous courses, from north to the south in western parts of the state and thereafter from north-west to south-east joining at Allahabad.

### **4.5 Mineral resources**

The state is poor in mineral resources. Only considerable deposits are of limestone, red sandstone in Mirzapur, Dolomite occurs in small quantities in Banda and Varanasi. Pyrophyllite and diaspore in Jhansi and Hamirpur districts. Coal is available in Sonebhadra.

### **4.6 Protected areas**

According to Protected Area Network of India, Ministry of Environment and Forests (MoEF), Uttar Pradesh has one National Park and 23 Wildlife Sanctuaries (WLS) covering 5,712 km<sup>2</sup> which constitutes 2.37% of the state's geographical area.<sup>6</sup> The oldest Wild Life Sanctuary of the country, the Chandraprabha Wild Life Sanctuary is located in Uttar Pradesh. Uttar Pradesh has one Tiger Reserve namely, Dudhwa Katerniaghat (extension) which is also famous for Swamp Deer and Rhinoceros.

Of these protected areas, the proposed transmission lines shall pass through the districts of Etah, Etawah and Mainpuri where the National Chambal WLS (Agra and Etawah Districts), Patna WLS (Etah District), and Saman Bird WLS (Mainpuri District) but they are nowhere near any of these protected areas. The nearest protected area is Patna WL Sanctuary, which is about 25 kms from proposed transmission line.

### **4.7 Forest Cover**

Based on interpretation of satellite data from October 2008 until January 2009 (as per Forest Survey of India 2011), it shows that forest cover is 14,338 km<sup>2</sup> which is 5.95% of the state's geographical area. In terms of forest canopy density classes, the state has 1,626 km<sup>2</sup> under very dense forest; 4,559 km<sup>2</sup> under moderately dense forest and 8,153 km<sup>2</sup> under open forest.

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<sup>6</sup> Protected Area Network in India. <http://www.moef.nic.in/downloads/public-information/protected-area-network.pdf>

The state has 27 forest types which belong to five forest type groups, viz. Tropical Semi Evergreen, Tropical Moist Deciduous, Littoral and Swamp, Tropical Dry Deciduous and Tropical Thorn Forests.

Orai – Aligarh 765 kV D/C transmission line shall pass through the districts of Jalaun, Auraiya/Etawah, Mainpuri, Etah, Firozabad, Hathras, and Aligarh.

Orai – Orai (UPPTCL) 400 kV D/C transmission line shall pass through Jalaun district.

LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S shall pass through Aligarh district.

LILO of Kanpur – Jhatikara 765 kV S/C transmission line at Aligarh S/S shall pass through Aligarh district.

These transmission lines will have minimum impact on forest cover as areas through which lines are proposed to pass has forest cover ranging from 0.51% to 8.05% of the total geographical area only. Details of forest cover of these districts are given in **Table 4.2**.

**Table 4.2 Forest cover in districts within the project area**

District	Geographic area (GA), km <sup>2</sup>	2011 Assessment (km <sup>2</sup> )				% of G.A
		Very dense forest	Moderately dense forest	Open forest	Total	
<b>1. Orai – Aligarh 765 kV D/C transmission line</b>						
Jalaun	4,565	0	65	179	244	5.35
Etawah	2,311	0	44	142	186	8.05
Mainpuri	2,760	0	1	13	14	0.51
Etah	4,446	0	9	90	99	2.23
Firozabad	2,361	0	4	43	47	1.99
Hathras	1,840	0	1	22	23	1.25
Aligarh	3,650	0	7	59	66	1.81
<b>2. Orai – Orai (UPPTCL) 400 kV D/C transmission line</b>						
Jalaun	4,565	0	65	179	244	5.35
<b>3. LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S</b>						
Aligarh	3,650	0	7	59	66	1.81
<b>4. LILO of Kanpur – Jhatikara 765 kV S/C transmission line at Aligarh S/S</b>						
Aligarh	3,650	0	7	59	66	1.81

Source: Forest Survey Report 2011

#### 4.8 Population

Based on Census 2011, the population of Uttar Pradesh is 199.58 million representing about 16.49% of the country's population. The rural and urban population is 77.72% and 22.28%, respectively. Population density is 828 persons per km<sup>2</sup>.

The livestock population of the state is 60.27 million (Livestock Census 2007).

#### **4.9 Economy**

Uttar Pradesh is rich in human and natural resources. Most of State's farm land is well watered and naturally fertile. It is the largest producer of food grains and oilseeds in the country. It leads all the states in India in the production of wheat, maize, barley, gram, sugarcane and potatoes. Wheat, rice, sugar cane, pulses, oil seeds and potatoes are its main products. Sugar cane is an important cash crop almost throughout the state and sugar mills and other cane crushers who produce Gur and Khandsari are common throughout the state. Uttar Pradesh is an important state as far as horticulture is concerned.

There are different types of minerals and several industries have come up based on these minerals. There are cement plants in the Mirzapur area in the Vindhya region, a bauxite-based aluminum plant in the Banda area, coal deposits are found in the Singrauli area. The industries include a large printing establishment units engaged in manufacturing of scales, locks, letter boxes, furniture, badges and belts, leather goods, scissors, etc. Handloom, carpet, glass, electrical goods, electro-plating, building material industries are also found in this State.

## 5.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 5.1 Project's Area of Influence

The project's area of influence covers the primary project sites, that is, the four additional components, and the associated facilities. Direct impacts result from the four additional components as follows:

- (i) Orai – Aligarh 765 kV D/C transmission line – 320 km
- (ii) Orai – Orai (UPPTCL) 400 kV D/C (Quad) transmission line – 38 km
- (iii) LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S – 4.1 km
- (iv) LILO of Kanpur – Jhatikara 765 kV S/C at Aligarh S/S –10.6 km

Associated facilities, as defined by ADB's SPS 2009 (Appendix 1, para. 6, p.31), "are not funded as part of the project (funding may be provided separately by the borrower/client or by third parties), and whose viability and existence depend exclusively on the project and whose goods or service are essential for successful operation of the project..."

Within this context, the associated facilities are:

- **A** - The 765 kV switching station (GIS) at Aligarh is an associated facility for additional components (i), (iii) and (iv).
- **B** - The 2x1000 MVA 765/400 kV substation at Orai is an associated facility to additional component (i) and (ii)

Figure 5.1 presents the project's area of influence.

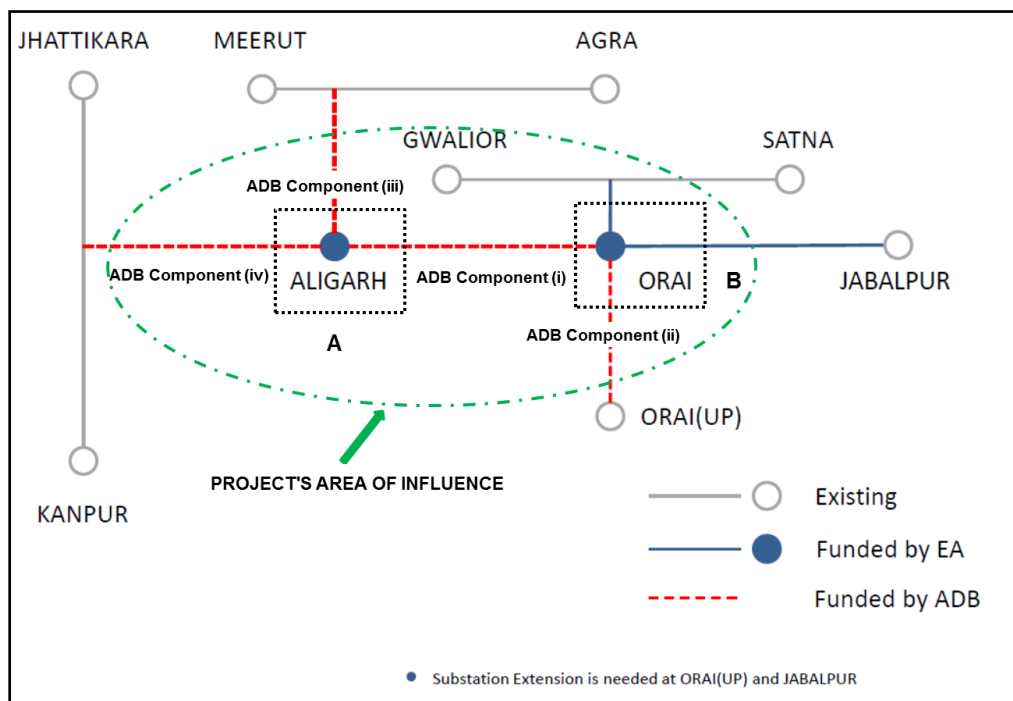


Figure 5.1 Project's area of influence

### 5.2 Impacts and mitigation measures due to location and design



Environmental impacts of transmission line projects are mostly localized to the right-of-way (RoW) and can be minimized by careful route selection. To get the latest information and further optimization of route selection, modern survey techniques/tools like GIS, GPS, and aerial photography are also applied. The availability of various details, constraints like topographical and geotechnical details, forest and environmental details, etc. help in planning the effective mitigation measures including engineering variations depending upon the situation of the sites. All possible measures have been taken during the finalization of route alignment for the proposed transmission systems. However, due to the peculiarity in terrain and demography of the area, some residual environmental impacts occur as described below:

**(i) Land value depreciation**

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

**(ii) Historical/cultural monuments/value**

POWERGRID's policy of route selection is to avoid all historical and cultural monuments. As per the preliminary assessment carried out during finalization of route alignment in consultation with State revenue authorities and Archeological Survey of India (ASI), . The determination of the final alignment was done in consultation with State revenue authorities and Archeological Survey of India (ASI) to ensure that no cultural or historical monuments are coming in the proposed route alignment.

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

All precautions have been taken to avoid routing of transmission line through forest and ecologically-sensitive areas such as national park and sanctuaries. However, complete avoidance of forest area was not possible. The routes of the proposed transmission lines have been finalized in consultation with the Forest Department to ensure that forest area that may be traversed will be minimal.

**• Orai – Aligarh 765 kV D/C transmission line**

Out of total transmission line length of 320 km, about 1.34 km (or 0.41% of the entire length) shall pass through areas designated as forest consisting of about 9 ha. The designated forest land is not natural forest but only a strip plantation along road and canal crossing.

**• Orai – Orai (UPPTCL) 400 kV D/C transmission line**

Out of total transmission line length of 38 km, about 0.108 km (or 0.28% of the entire length) shall pass through land designated as forest consisting a total of 0.5 ha. The area is not a natural forest but only a strip plantation along road and canal crossing.

**• LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S**

Out of total transmission line length of 4.102 km, about 0.059 km (or 1.45% of the entire length) shall pass through land designated as forest consisting a total of 0.4 ha. The area traversed is not a natural forest but only a strip plantation along road and canal crossing.

- **LILO of Kanpur – Jhatikara 765 kV S/C transmission line at Aligarh S/S**

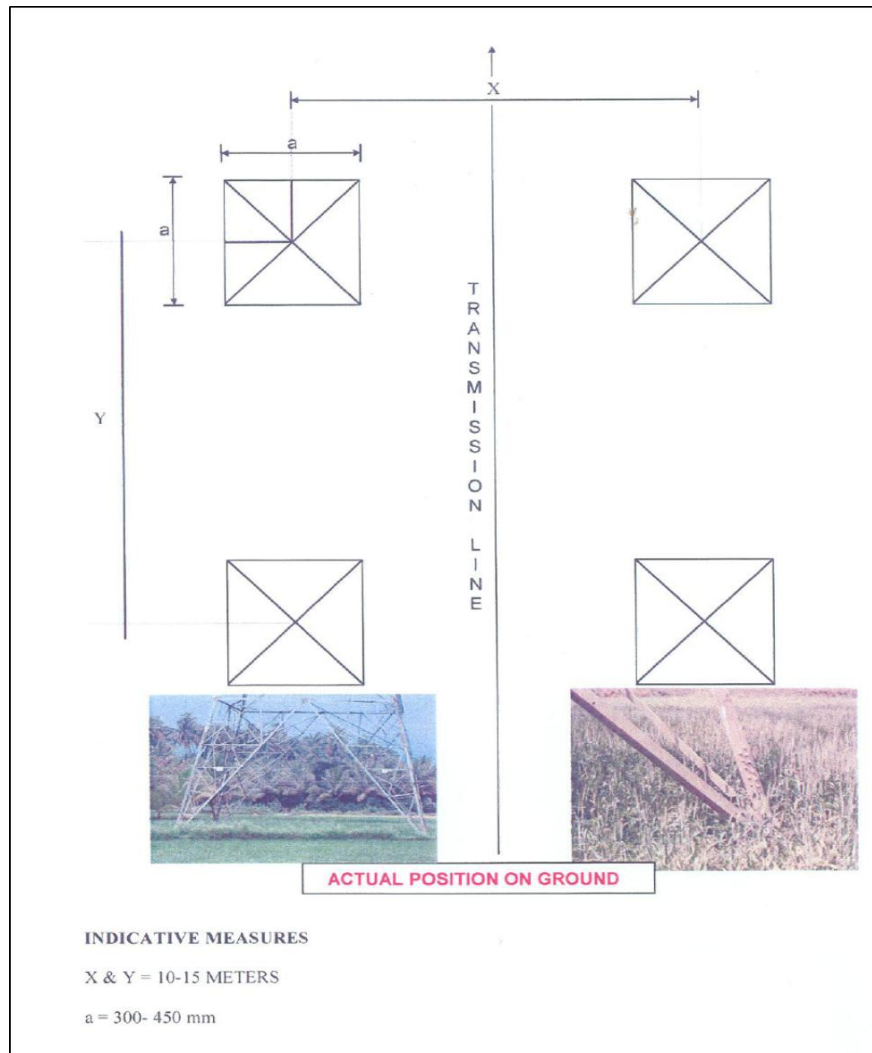
Out of total transmission line length of 10.631 km, about 0.119 km (or 1.12% of the entire length) shall pass through areas classified as forest consisting a total of 0.8 ha. The area affected is not a natural forest but only a strip plantation along road and canal crossing.

Under the Forest (Conservation) Act 1980, prior approval from the MoEF shall be obtained for affected areas classified as forest that will be traversed by the transmission line after detailed survey and finalization of route through forest area in consultation with local forest authorities.

Most of the forests that will be traversed by the transmission line routes are already degraded and the wildlife species present are those who have been already adapted to open or disturbed habitat. With the provision of Compensatory Afforestation, the overall forest status is expected to improve. A budget provision of INRs 119.07 lakhs for Orai – Aligarh 765 kV D/C transmission line, INRs 6.61 lakhs for Orai – Orai (UPPTCL) 400 kV D/C transmission line, INRs 5.29 lakhs for LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S and, INRs 10.58 lakhs for LILO of Kanpur – Jhatikara 765 kV S/C transmission line at Aligarh S/S has been included in the project cost estimates to meet the requirements of Compensatory Afforestation and Net Present Value. **Annexure 1** presents the details of the budget estimates.

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

Impacts on agricultural land will be restricted during the construction phase and when large-scale maintenance measures are required during the operation phase. Some stretch of the transmission line will pass through agricultural fields. Agricultural land will be lost at the base of the tower, which is estimated to be about 0.2-1.0 m<sup>2</sup> per average farm holding (see **Figure 5.2**).



**Figure 5.2 Typical plan of transmission tower footings**

It is estimated that for Orai - Aligarh 765 kV D/C transmission line (320 km), a total of 800 towers will result in the loss of approx. 800 m<sup>2</sup> or 0.08 ha of land. For Orai - Orai (UPPTCL) 400 kV D/C transmission line (38 km), approx. 95 towers will result in the total loss of approx. 95 m<sup>2</sup> or 0.0095 ha of land. For LILO of Agra - Meerut 765 kV S/C transmission line at Aligarh S/S (4.102 km), approx 11 towers will result in total loss of approx.11 m<sup>2</sup> or 0.0011 ha of land. For LILO of Kanpur - Jhatikara 765 kV S/C transmission line at Aligarh S/S (10.631 km), approx. 27 towers will result in a total loss of approx. 27 m<sup>2</sup> or 0.0027 ha of land. Therefore, the total number of towers of the additional components will be 933 towers resulting to a total land loss estimated to be about 0.0933 ha. This loss of land is considered negligible and will not adversely affect the land holding.

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 them about the project and tower location, which shall be erected in the agricultural land. The Revenue Department, after evaluating the loss due to construction activity and productivity of land, will calculate the amount of compensation that will be paid to farmers.

Agricultural activities will be allowed to continue following the construction period. If bunds or other on-farm works are disturbed during construction or maintenance works, 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(s) in an amount determined by the estimated loss of products from the tree over an eight year period (for fruit bearing trees) and for other trees compensation is finalized in consultation with local forest authorities.

Agricultural lands under private ownership will be identified, and in accordance with normal POWERGRID procedures compensation will be paid to the affected villagers (**Annexure 2 – Tree/crop compensation**). Budgetary provision of INRs 1855.51 lakhs (i.e., INRs. 1593.28 lakhs for Orai – Aligarh 765 kV D/C transmission line, INRs. 189.46 lakhs for Orai – Orai (UPPTCL) 400 kV D/C transmission line, INRs. 20.21 lakhs for LILO of Agra-Meerut 765 kV S/C transmission line at Aligarh S/S and INRs. 52.56 lakhs for LILO of Kanpur – Jhatikara 765 kV S/C transmission line at Aligarh S/S) is made in the project cost estimates to meet these expenses.

#### **(v) Interference with other utilities and traffic**

As per regulations enacted by GoI, it is mandatory for POWERGRID to seek clearance from the Department of Railways and Telecommunications prior to construction, and wherever necessary, from the aviation authorities that are likely to be affected by the construction of the transmission lines.

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 GoI 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. PTCC 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 PTCC and is shared by POWERGRID and the 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 INRs 50,000/per km for POWERGRID. Provision to meet these expenses has been made in the cost estimate.

In general, the power transmission 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 (aviation) are placed atop these towers.

#### **(vi) 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 drainage is affected, flow will be trained and guided to safe zones.

### **(vii) 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. Since the forest areas that will be traversed by the transmission line routes are mostly degraded and scattered within the entire alignments, fire from flashover will be unlikely. Department of Forest also incorporate safety measures such as making fire lines to prevent spreading of fire in the affected forest area.

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

The additional project components will not be making use of any natural resources occurring in the area during construction and operation. The construction materials 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.

### **(ix) Endangering of species**

No endangered species of flora and fauna are found to exist within the areas affected by the additional project components.

### **(x) Promoting undesirable rural-to urban migration**

The additional project components will not result to 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.

## **5.3 Impacts and mitigation measures during construction phase**

### **(i) Clearing of vegetation**

During construction of transmission lines, clearing of vegetation will be done along the RoW. With the development of innovative tower design, RoW requirements have been reduced from 85 m to 64 m for 765 kV and from 52 m to 46 m for 400 kV D/C line. Apart from this, installation of pole type structure for 400 kV transmission line in densely populated urban area has not only reduced the RoW and base width requirement, but also improved aesthetics compared to the conventional lattice type structure.

Clearing of vegetation along the RoW will be done under the supervision of the Forest Department.<sup>7</sup> Low canopy seed trees and shrubs will be spared during vegetation clearing if they do not interfere with tower erection and line installation. The wood harvested will be sold by the Forest Department to interested parties and will retain the sale proceeds. Three-meter wide strips of land under each conductor will be cleared and maintained as maintenance

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<sup>7</sup> IS: 5613, 1989, Bureau of Indian Standards, Code of Practice for Design, Installation and Maintenance of Overhead Power Lines.

rows, but the remaining land will be allowed to regenerate. Lopping of trees to maintain line clearance for safety will be done also under the direction of the Forest Department. POWERGRID will provide construction crews with fuel wood or alternative fuels as a precaution against collection of fuel wood from nearby forest.

**(ii) Uncontrolled silt runoff**

The proposed projects 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.

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

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) Nuisance to nearby properties**

During the site selection, due care was 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 such as tractors and manual labour, therefore, nuisance to nearby properties from the use of heavy equipment and vehicles, if any, is not expected.

**(v) Interference with utilities, 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 required either during construction or as a part of maintenance procedures.

As and when a transmission line crosses any road or 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.

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

The proposed lines are to be constructed mostly 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 while the back cut slopes and downhill slopes will be treated with revetments.

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 such as provision of breast walls and retaining walls, and sowing of soil-binding grasses around the site. Construction works are generally undertaken outside the rainy season to prevent soil erosion. The proposed line is mostly passing through plain area; hence these problems are not anticipated.

### **(vii) Inadequate disposition of borrow areas**

Transmission tower foundations involve excavations on small scale basis and the excavated soil is utilized for back-filling. In case of sub-stations, the sites generally are selected in such a way that the volume of cutting is equal to the volume of filling to avoid borrow areas. Therefore, acquisition and/or opening of borrow area is not needed.

### **(viii) Protection of worker's health and safety**

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

As a deterrent or to minimize accidents during construction, a provision in the contract has been added that stipulates a fine or penalty of INRs 10 lakhs for each accidental death and INR 1.0 lakh per any injury incurred and is deducted from the contractor's payment and paid to the deceased or affected family (see **Annexure 3**, ESPP and EMP as part of the Contract Document).

POWERGRID has a dedicated unit to oversee all health and safety aspects of their projects under the Operations Service Department. POWERGRID 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 both during construction and operation (see **Annexure 4**, Health and Safety Checklist). This is monitored regularly by site in-charge and corporate Operations Services.

In addition, training will be conducted to the workers on fire-fighting and safety measures. Safety tools like helmet, safety belt, gloves etc. will be provided to workers in accordance with the Safety Manual. First aid facilities will be made available to workers, and doctors will be called in from nearby towns when necessary. The number of outside (skilled) labourers is expected to be about 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*. Regular health checkups will be 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 such as HIV/AIDS, etc. POWERGRID will conduct awareness building programs on such issues for the construction workers.

## **5.4 Impacts and mitigation measures during operation phase**

### **(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 transmission lines and substations. For long distance transmission lines such as this project, there are monitoring/maintenance offices which are located at various points en-route. Monitoring measures include patrolling and thermo-vision scanning.

The supervisors and managers entrusted with O&M responsibilities are trained for necessary skills and expertise in 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.

#### **(ii) Noise and vibration nuisance**

The equipment installed at substations are mostly static and are designed to keep the noise level within the permissible limits of 85 dB as per Indian standards 7194. POWERGRID had monitored noise/sound levels at different places in and at around reactor and transformer. The noise levels reported during normal operating conditions ranged from 60 dB to 70 dB at 2 m from the equipment.

To contain the noise levels within the permissible limits in case of exceedences, measures such as providing sound and vibration dampers, and rectification of equipment will be undertaken. Planting of sound-absorbing species like *Casuarinas*, tamarind, and Neem will be done at the substations to reduce the sound level appreciably. It was reported that a belt of trees dense enough can reduce noise levels by as much as 6-8 dB for every 30 m-width of woodland.<sup>8</sup>

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

Equipment that will be installed on transmission lines and substations are static in nature and do not generate any fumes or waste materials.

#### **(iv) Blockage of wildlife passage**

Transmission lines are constructed aerially and usually run above 8.8 m-13 m (Ground Clearance for different Voltage 400 kV – 765 kV) from ground level. The blockage of ground surface is limited to the area of tower footings which are very small and are placed far away from each other.

Areas that will be traversed by the transmission lines are mostly agricultural, wasteland, and strip plantations along the road and canal crossing. The areas are not migration path of wildlife, therefore, the possibility of disturbance to wild life passage is nil/ remote.

#### **(v) Environmental aesthetics**

Normal spacing between the towers is approx. 300-400 m. This spread is not expected to cause visual aesthetics to the local areas. POWERGRID plants trees at and around their substations to buffer the visual effects and to provide better living conditions.

Whenever POWERGRID considers 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.

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<sup>8</sup> R. E. Leonard and S. B. Parr, "Tree as a Sound Barrier," Journal of Forestry, 1970.



#### **(vi) Exposure to electromagnetic fields (EMF)**

There have been some concerns about possible increased risk of cancer from exposure to electromagnetic radiation from overhead transmission lines and researches have been undertaken worldwide. A World Health Organization (WHO) review was held in 1996 as part of an international EMF Project and concluded that, "from the current scientific literature, there is no convincing evidence that exposure to radiation field shortens the life span of humans or induces or promotes cancer."

No EMF exposure guidelines have been drawn in India although exposure guidelines have been drawn up outside of India such as the State Transmission Lines Standards and Guidelines (USA), International Commission on Non-Ionizing Radiation Protection (ICNIRP); US National Council on Radiation, the American Conference on Government and Industrial Hygienist (ACGIH).

The magnetic field below 400 kV overhead power transmission lines is estimated at a maximum value of 40  $\mu$ T. The ICNIRP guidelines present limiting exposure to EMFs, although it adds that the levels quoted should not be interpreted as distinguishing 'safe' from 'unsafe' EMF levels. The ICNIRP guideline for the general public (up to 24 hours a day) is maximum exposure levels of 1,000 mG or 100  $\mu$  T.

A study carried out by Central Power Research Institute (CPRI) on POWERGRID lines reveals that the EMF about 1 m above ground near a 400 kV single circuit transmission line range from 3-7.2  $\mu$ T in the ROW.

The impact of EMF is also dependent on the duration of exposure and therefore no significant adverse impact is envisaged. POWERGRID complies with international norms for field strength limits which are certified by Power Technologies Inc, USA.

POWERGRID is following the approved international standards and design, which are absolutely safe. Based on the studies carried out by different countries on the safety of EHV lines in reference to EMF effects, POWERGRID has also carried out such studies with the help of PTI, USA and CPRI, Bangalore on their design. The studies inferred that 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.

## **6.0 ANALYSIS OF ALTERNATIVES**

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

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

### **6.1 Environmental Criteria for Route Selection**

POWERGRID takes into consideration the following environmental criteria in selecting the optimum route:

- a) The route of the proposed transmission lines does not involve any human rehabilitation.
- b) Any monument of cultural or historical importance is not affected by the route of the transmission line.
- c) The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community.
- d) The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments, etc.
- e) The line route does not pass through any sanctuaries, national park, etc.
- f) The line route does not infringe with area of natural resources.

To achieve this, POWERGRID undertakes route selection for individual transmission lines in close consultation with representatives from the MoEF and the Department of Revenue. Although under national law, POWERGRID has the right of eminent domain to put a tower in private land (Section 63 of the Electricity Act 2003) yet alternative alignments are considered keeping in mind the site/route selection criteria to avoid environmentally sensitive areas and settlements at execution stage.

As a rule, alignments are generally sited 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 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, national parks and sanctuaries, both for financial and environmental reasons.

### **6.2 Evaluation of Alternative Route Alignment of Orai - Aligarh 765 kV D/C Transmission Line**

Three different alignments were studied with the help of published data/maps such as Forest Atlas, Survey of India topographic sheets, etc. and walkover survey to arrive at the most optimum route to be considered for detailed survey and assessment. The comparative details of these alternatives are shown in the table below:

S.No.	Description	Alternative I	Alternative II	Alternative III
<b>1. Route Particulars</b>				
i)	Length (km)	320	352	360
ii)	Terrain	85% Plain 15% Undulations	80% Plain 20% Undulations	82% Plain 18% Undulations
<b>2. Environment Details</b>				
i)	Name of District/District Detail (through which the transmission line passes)	Jalaun, Auraiya/Etawah, Mainpuri, Etah, Firozabad, Hathras, Aligarh	Jalaun, Auraiya/Etawah, Mainpuri, Etah, Firozabad, Hathras, Aligarh	Jalaun, Auraiya/Etawah, Mainpuri, Etah, Firozabad, Hathras, Aligarh
ii)	Town in alignment (nearby)	Orai, Jalaun, Auraiya, Bharthana, Etawah, Karhal, Mainpuri, Giror, Jasrana, Poram, Awagarh, Nidholi, Kalan, Etah, Maho, Sasri, Iglas, Hathras, Khair, Aligarh	Orai, Jalaun, Auraiya, Bharthana, Fafood, Achalda, Karhal, Mainpuri, Sakit, Etah, Sikandra Rao, Akrabad, Khair, Aligarh	Orai, Jalaun, Auraiya, Bharthana, Fafood, Achalda, Karhal, Mainpuri, Sakit, Etah, Sikandra Rao, Akrabad, Khair, Aligarh
iii)	Forest area affected in hectare (ha)/km	9 ha/1.34 km	11 ha/1.64 km	12 ha/1.79 km
iv)	Type of forest	PF (Strip plantation along road and canal crossings)	PF (Strip plantation along road and canal crossings)	PF (Strip plantation along road and canal crossings)
v)	Density of forest	<0.5	<0.5	<0.5
vi)	Type of Flora	Kikar, Mango, Eucalyptus, Mahua, Jamun, Babool, Peepal, Bargad, Neem	Kikar, Mango, Eucalyptus, Mahua, Jamun, Babool, Peepal, Bargad, Neem	Kikar, Mango, Eucalyptus, Mahua, Jamun, Babool, Peepal, Bargad, Neem
vii)	Type of fauna	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.
viii)	Endangered species ( if any)	None	None	None
ix)	Historical/Cultural Monument	None	None	None
x)	Any other relevant information	None	None	None
<b>3. Compensation Cost ( in INRs lakhs)</b>				
i)	Crop (Non-Forest)	1,593.28	1,751.79	1,791.04
ii)	Forest (CA+NPV)	119.07	145.53	158.76
<b>4. Number of Crossing</b>				
i)	Railway line	7	7	7
ii)	Power Line	38	42	44
iii)	River Crossing, etc.	5	5	5
iv)	Highway Crossing (NH/SH)	15	15	16
5.	<b>Construction Problem</b>	<ul style="list-style-type: none"> <li>• Easy approach</li> <li>• Less forest area affected.</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate Approach</li> <li>• More forest area affected</li> <li>• Moderate RoW problems</li> </ul>	<ul style="list-style-type: none"> <li>• Maximum forest area affected</li> <li>• Moderate RoW problems</li> </ul>

S.No.	Description	Alternative I	Alternative II	Alternative III
6.	<b>O&amp;M Problem</b>	O & M shall be relatively easier due to better approaches	O & M shall be difficult due to more undulations	O & M shall be difficult due to more undulations
7.	<b>Overall Remarks</b>	Easy accessibility, less RoW problems, minimum forest area affected, and minimum crossings involved	More forest area affected, moderate RoW problems, and more crossings involved	Comparatively more forest area affected, moderate RoW problems, and maximum crossings involved

### Reasons for Selection of Final Route

From the above comparison of the three alternatives, **Alternative I** is the most suitable route and selected for detailed survey as it involves minimum forest area, has relatively less RoW problem, and easy access.

### 6.3 Evaluation of Alternative Route Alignment of Orai - Orai (UPPTCL) 400 kV D/C Transmission Line

Three different alignments were studied with the help of published data/maps and walkover survey to arrive at the most optimum route for detailed survey. The comparative details of these alternatives are given below:

S.No.	Description	Alternative I	Alternative II	Alternative III
<b>1.</b>	<b>Route Particulars</b>			
i)	Length (km)	38	39.5	40.5
ii)	Terrain	Plain	Plain and Hilly	Plain
<b>2</b>	<b>Environment Details</b>			
i)	Name of District/District Detail (through which transmission line passes)	Jalaun	Jalaun	Jalaun
ii)	Town in alignment (nearby)	Orai, Jalaun	Orai, Jalaun	Orai, Jalaun
iii)	Forest area affected in ha/km	0.5ha/0.108 km	0.5 ha/0.108 km	0.5 ha/0.108 km
iv)	Type of forest	PF (Strip plantation along road and canal crossings)	PF (Strip plantation along road and canal crossings)	PF (Strip plantation along road and canal crossings)
v)	Density of forest	<0.5	<0.5	<0.5
vi)	Type of Flora	Mango, Eucalyptus, Jamun, Neem	Mango, Eucalyptus, Jamun, Neem	Mango, Eucalyptus, Jamun, Neem
vii)	Type of fauna	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.
viii)	Endangered species( if any)	None	None	None
ix)	Historical/Cultural Monument	None	None	None
x)	Any other relevant information	None	None	None
<b>3.</b>	<b>Compensation Cost ( in INRs lakhs)</b>			
i)	Crop (Non-Forest)	189.46	196.96	201.96

S.No.	Description	Alternative I	Alternative II	Alternative III
ii)	Forest (CA+NPV)	6.61	6.61	6.61
<b>4.</b>	<b>Number of Crossing</b>			
i)	Railway line	1	1	1
ii)	Power Line	5	7	7
iii)	River Crossing, etc.	None	None	None
iv)	Highway Crossing (NH/SH)	3	3	3
<b>5.</b>	<b>Construction Problem</b>	<ul style="list-style-type: none"> <li>• Easy approach</li> <li>• Less forest area affected</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate approach</li> <li>• Moderate RoW problems</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate approach</li> <li>• Moderate RoW problems</li> </ul>
<b>6.</b>	<b>O&amp;M Problem</b>	O & M shall be relatively easier due to better approaches	O & M shall be difficult due to more undulations	O & M shall be relatively easier due to better approaches
<b>7.</b>	<b>Overall Remarks</b>	Less forest area affected, minimum crossings	Moderate RoW problems, comparatively more crossings	Moderate RoW problems, comparatively more crossings

### Reasons for Selection of Final Route

Given the above comparisons, **Alternative I** is the most suitable route and selected for detailed survey and assessment as it involves less forest area, has relatively less RoW problems, and minimum crossings.

### 6.4 Evaluation of Alternate Route of LILO of Agra-Meerut 765 kV S/C Line at Aligarh Substation

Three different alignments 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 alternatives are given below:

S.No.	Description	Alternative I	Alternative II	Alternative III
<b>1.</b>	<b>Route Particulars</b>			
i)	Length (km)	4.102	4.1055	4.395
ii)	Terrain	Plain	Plain	Plain
<b>2</b>	<b>Environment Details</b>			
i)	Name of District/District Detail (through which line passes)	Aligarh	Aligarh	Aligarh
ii)	Town in alignment (nearby)	Khair	Khair	Khair
iii)	Forest area affected in ha/km	0.4 ha/0.059 km	0.5 ha/0.074 km	0.6 ha/0.089 km
iv)	Type of forest	PF (Strip plantation along road & canal crossings)	PF (Strip plantation along road & canal crossings)	PF (Strip plantation along road & canal crossings)
v)	Density of forest	<0.5	<0.5	<0.5
vi)	Type of Flora	Kikar, Mango, Eucalyptus	Kikar, Mango, Eucalyptus	Kikar, Mango, Eucalyptus
vii)	Type of fauna	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.

S.No.	Description	Alternative I	Alternative II	Alternative III
viii)	Endangered species( if any)	None	None	None
ix)	Historical/Cultural Monument	None	None	None
x)	Any other relevant information	None	None	None
<b>3.</b>	<b>Compensation Cost ( in INRs lakhs)</b>			
i)	Crop (Non-Forest)	20.21	20.15	21.53
ii)	Forest (CA+NPV)	5.29	6.61	7.93
<b>4.</b>	<b>Number of Crossing</b>			
i)	Railway line	None	None	None
ii)	Power Line	4	4	4
iii)	River Crossing, etc.	None	None	None
iv)	Highway Crossing (NH/SH)	1	1	1
<b>5.</b>	<b>Construction Problem</b>	<ul style="list-style-type: none"> <li>Less forest area affected</li> <li>Easily approachable</li> </ul>	<ul style="list-style-type: none"> <li>More forest area affected</li> <li>Easily approachable</li> </ul>	<ul style="list-style-type: none"> <li>Maximum forest area affected</li> <li>Difficult approach</li> </ul>
<b>6.</b>	<b>O&amp;M Problem</b>	O & M shall be easy	O & M shall be easy	O & M shall be easy
<b>7.</b>	<b>Overall Remarks</b>	Less forest area affected	More forest area affected	Maximum forest area affected

### Reasons for Selection of Final Route

Based on the comparisons above, **Alternative I** is the most suitable route and selected for detailed survey and assessment as it involves minimum forest area and is easily approachable.

### 6.5 Evaluation of Alternate Route for the LILO of Kanpur - Jhatikara 765 kV S/C Line at Aligarh S/S

Three different alignments 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 alternatives are given below:

S.No.	Description	Alternative I	Alternative II	Alternative III
<b>1.</b>	<b>Route Particulars</b>			
i)	Length (km)	10.631	10.893	10.802
ii)	Terrain	Plain	Plain	Plain
<b>2</b>	<b>Environment Details</b>			
i)	Name of District/District Detail (through which line passes)	Aligarh	Aligarh	Aligarh
ii)	Town in alignment (nearby)	Khair	Khair	Khair
iii)	Forest area affected in ha/km	0.8 ha/0.119 km	0.9 ha/0.134 km	1.0 ha/0.149 km
iv)	Type of forest	PF(Strip plantation along road & canal	PF(Strip plantation along road & canal	PF(Strip plantation along road & canal

S.No.	Description	Alternative I	Alternative II	Alternative III
		crossings)	crossings)	crossings)
v)	Density of forest	<0.5	<0.5	<0.5
vi)	Type of Flora	Kikar, Mango, Eucalyptus	Kikar, Mango, Eucalyptus	Kikar, Mango, Eucalyptus
vii)	Type of fauna	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.	Cat, Dog, Cow, etc.
viii)	Endangered species( if any)	None	None	None
ix)	Historical/Cultural Monument	None	None	None
x)	Any other relevant information	None	None	None
<b>3.</b>	<b>Compensation Cost ( in INRs lakhs)</b>			
i)	Crop (Non-Forest)	52.56	53.79	53.26
ii)	Forest (CA+NPV)	10.58	11.907	13.23
<b>4.</b>	<b>Number of Crossing</b>			
i)	Railway line	None	None	None
ii)	Power Line	5	5	5
iii)	River Crossing, etc.	None	None	None
iv)	Highway Crossing (NH/SH)	1	1	1
<b>5.</b>	<b>Construction Problem</b>	Less forest area affected	More forest area affected	Maximum forest area affected
<b>6.</b>	<b>O&amp;M Problem</b>	O & M shall be easy	O & M shall be easy	O & M shall be easy
<b>7.</b>	<b>Overall Remarks</b>	Less forest area affected	More forest area affected	Maximum forest area affected

### Reasons for Selection of Final Route

From the above comparison of three alternatives, **Alternative I** is the most suitable route and selected for detailed survey and assessment as it involves minimum forest area and is easily approachable.

## 7.0 INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

Public consultation/information is an integral part of the project implementation. Public is informed about the project at every stage of execution. During survey, 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, is consulted.

Aside from this, public consultation using different techniques like public meeting, small group meeting, and informal meeting following the POWERGRID's 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; and,
- Trees and crop compensation process.

Public meetings were also organized along the routes of transmission lines (see **Table 7.1**). To get the maximum participation during the Public Consultation Program, a notice was served well in advance to the villagers (see **Annexure 5, Details of public consultation, Plate A for photographs**). The details of lines and its importance were explained to the villagers. The villagers including the Village Panchayat representatives and POWERGRID representative participated in the program.

The program was arranged in an interactive way and queries like crop compensation, route alignment, etc. were addressed. Most of the participants were small farmers and were worried about their land through which the transmission line will pass. They were informed that POWERGRID will not acquire their land for construction of transmission lines. Only towers will be spotted in their fields where they can do farming without any fear because the tower height is very high and even tractor can pass below the tower.

Moreover, it was explained that there is no risk of passing current from the transmission line as there is foolproof system of earthing for towers. The consultation process was appreciated by the villagers and were happy to know about the transparent policy of POWERGRID for the execution of the project and promised to extend their cooperation during construction of the transmission line. The process of such consultation and its documentation shall continue during project implementation and even during O&M stage.



**Table 7.1 Details of public consultation along the proposed transmission lines**

Transmission Line	Date of meeting	No. of villagers who attended	Name of Village	Remarks
Orai – Aligarh 765 kV D/C transmission line	24.01.14	8	Chawanpura	<ul style="list-style-type: none"> <li>• Village Panchayat representatives, farmers, teachers and others attended the meeting.</li> <li>• Compensation for Crops/trees, were main concerns which were clarified during meeting.</li> </ul>
	25.01.14	10	GauraSurawali	
	25.01.14	8	Gautampura	
	14.03.14	14	Andani	
	14.03.14	14	Takrau	
	15.03.14	16	Navada	
	15.03.14	12	KalharPancha	
	15.03.14	14	Padham	
	21.03.14	13	PatparNagla	
Orai – Orai (UPPTCL) 400 kV D/C transmission line	24.01.14	8	Chawanpura	<ul style="list-style-type: none"> <li>• Village Panchayat representatives, farmers, teachers and others attended the meeting.</li> <li>• Compensation for Crops/trees, were main concerns which were clarified during meeting.</li> </ul>
LILO of Agra-Meerut 765 kV S/C line at Aligarh S/S and LILO of Kanpur – Jhatikara 765 kV S/C transmission line at Aligarh S/S	01.02.14	11	Bamani	<ul style="list-style-type: none"> <li>• Village Panchayat representatives, farmers, teachers and others attended the meeting.</li> <li>• Compensation for Crops/trees, were main concerns which were clarified during meeting.</li> </ul>
	01.02.14	6	Bhanera	
	01.02.14	5	Bajidpur	
	01.02.14	10	KheraSatu	

## 8.0 GRIEVANCE REDRESS MECHANISM

Grievance redressal is normally built in the process of crop and tree compensation. However, other complaints and/or concerns related to environmental aspect and the overall project's environmental performance will also be governed by this grievance redress mechanism.

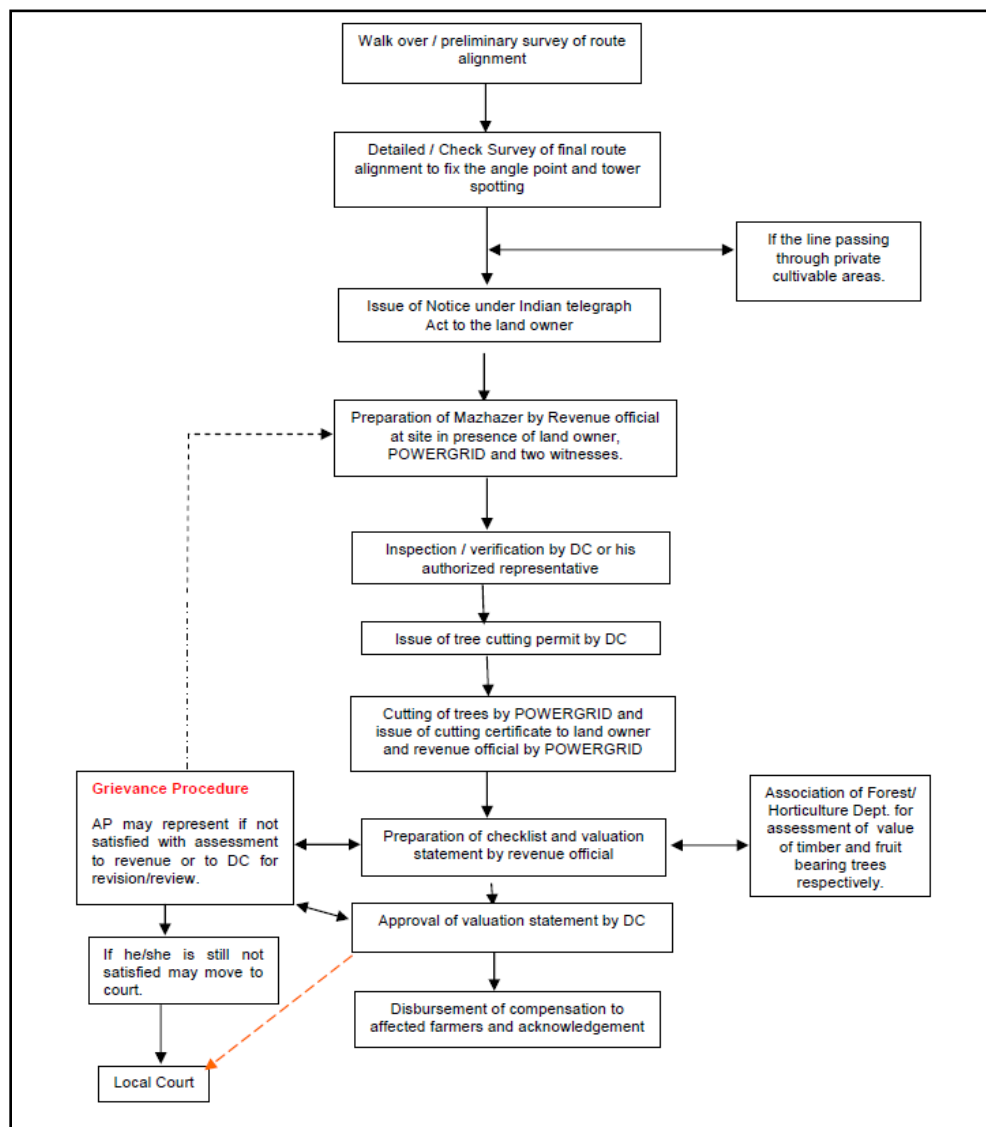
Generally for the compensation of crops and trees, a notice under the Indian Telegraph Act is served to the affected land owners informing that the proposed transmission line is being routed through the property of the individual concerned. A copy of said notice is further issued to the Revenue Officer, who has been authorized by the State Government for the purpose of assessment/valuation and disbursement of compensation to the affected parties (refer to **Figure 8.1** for POWERGRID's procedure on tree and crop compensation).

However, the owner is given a chance to substantiate the claim if he is not satisfied with the assessment. If the owner is not satisfied, he/she is allowed to access the higher authority for any grievance towards compensation that is generally addressed in an open forum and in the presence of many witnesses. Process of spot verification and random checking by the District Collector (DC) or its authorized representative also provides forum for raising the grievance towards any irregularity/complaint. Apart from this, POWERGRID officials also listen to the

complaints of affected farmers and the same are forwarded to revenue official to do what is needed.

For substation that will involve land acquisition, a Grievance Redress Committee (GRC) will be set up consisting of POWERGRID staff, representatives of local authorities, affected persons (APs), *Gram Panchayat* or any well-reputed person as mutually agreed by with the local authorities and APs.

Local people particularly the APs are informed about the existence of GRC during the consultation process. Meeting of the GRC shall be convened within 15 days of receiving a grievance for its discussion/solution. GRC aims to complete its decision within 45-90 days of receiving the grievance.



**Figure 8.1 Tree/Crop Compensation Process in POWERGRID**

## **9.0 ENVIRONMENTAL MANAGEMENT PLAN**

### **9.1 Institutional Mechanism for Mitigation and Monitoring Requirements**

Monitoring is a continuous process for POWERGRID at all the stages of its project cycle. Aside from the site managers reviewing the progress on a daily basis, regular project review meetings will be held at least on a monthly basis which will be chaired by the 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 will be submitted to the Directors and Chairman and Managing Director of POWERGRID. The progress of various ongoing projects is also informed to the Board of Directors. Following is the organization support system for proper implementation and monitoring of the environmental and social management plan. **Figure 9.1** shows the organization support structure at POWERGRID.

#### **a) 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 and Social Management Department (ESMD). A brief description of ESMD's responsibilities includes:

- 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 MoEF for expediting forest clearances and follow-ups with the Ministry of Power.
- Imparts training to POWERGRID's RHQs & Site officials on environment and social issues and their management plan.

#### **b) Regional Level**

At each Regional Office, POWERGRID has an Environmental and Social Management Cell (ESMC) to manage environmental and social issues and to coordinate between ESMD at the Corporate level and the Construction Area Office (CAO). The key functions of ESMC include:

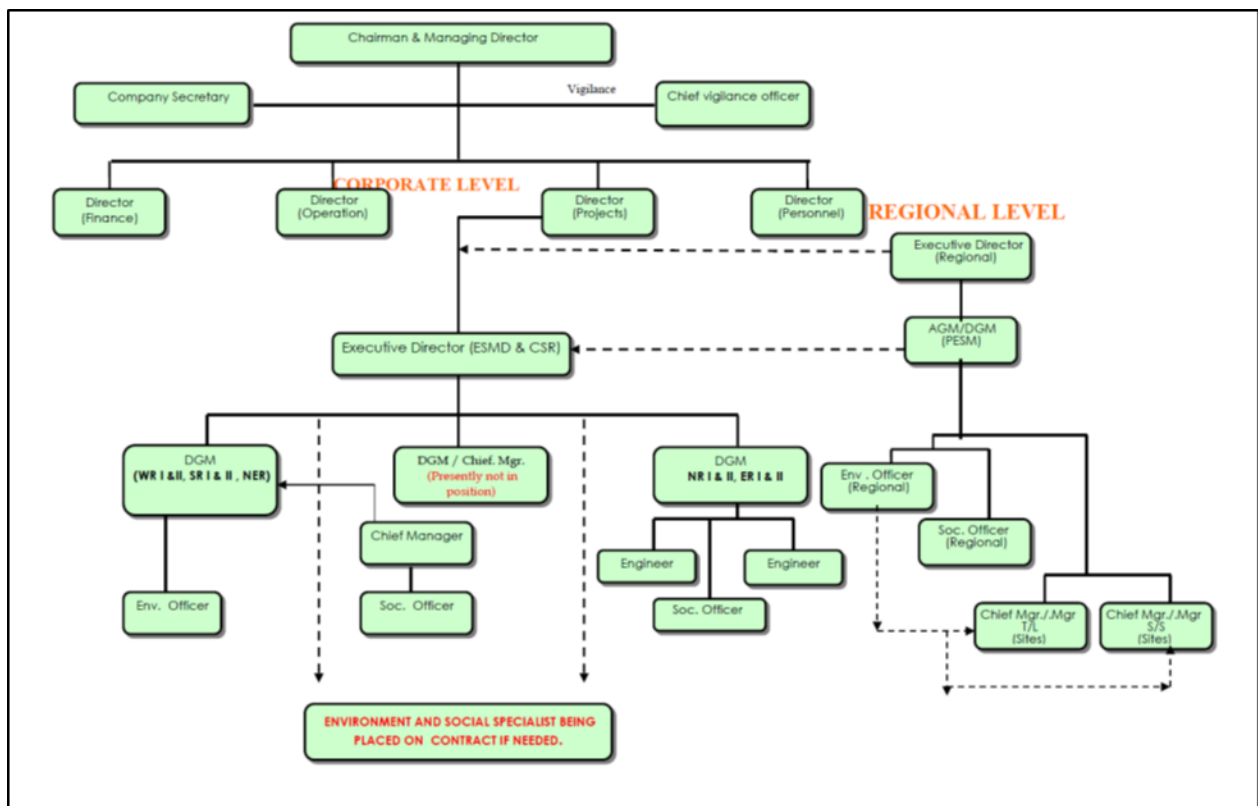
- Advising and coordinating field offices to carry out environmental and social surveys for new projects envisaged in the Corporate Investment Plan
- Assisting the ESMD and CAOs to finalize routes of entire power T/L considering the environmental and social factors that could arise en-route
- To follow-up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

### c) Site Office

At the Construction Area Office (CAO) level, POWERGRID has made the head of the site responsible for implementing the environmental and social aspects of project and is known as the Environmental and Social Management Team (ESMT). Key functions of the ESMT are:

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

POWERGRID is well equipped to implement and monitor its environment and social management plans.



**Figure 9.1 Organizational support structure for EMP implementation and monitoring**

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 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. An Environment Management Plan (EMP) including monitoring plan for all possible environmental

and social impact and its proper management is given in **Table 9.1**. Since many provisions of EMP are to be implemented by the contractor, monitoring of EMP implementation is included in the contract document.

## **9.2 Environmental Monitoring and Management Plan**

A comprehensive and a detailed Environment Management Plan (EMP) including monitoring plan for proper mitigation is given in table 9.1 for all identified environmental and social impacts has been enclosed with the subject IEE which shall be implemented during various stages of project.

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**Table 9.1 Environmental Management Plan**

Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
<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
Transmission line design	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference from overhead power lines	Electromagnetic field strength for proposed line design	Line design compliance with relevant standards - once	POWERGRID	Part of detailed alignment survey and design
Location of transmission towers and transmission line alignment and design	Impact on water bodies and land	Consideration of tower location at where they could be located to avoid water bodies or agricultural land.	Tower location and line alignment selection (distance to water and/or agricultural land)	Consultation with local authorities and land owners - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
	Social inequities	Careful route selection to avoid existing settlements	Tower location and line alignment selection (distance to nearest dwellings or social institutions)	Consultation with local authorities and land owners - once	POWERGRID	Part of detailed tower siting and alignment survey and design
		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
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	Consultation with local authorities - once	POWERGRID	Part of detailed siting and alignment

Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Minimise the need by using existing towers, tall towers and RoW, wherever possible	nearest protected or reserved forest)	Consultation with local authorities and design engineers - once		survey/design
		Obtain statutory clearances from the Government	Statutory approvals from Government	Compliance with regulations – once for each subproject		
Encroachment into farmland	Loss of agricultural productivity	Use existing tower footings/towers wherever possible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed alignment survey and design
		Avoid siting new towers on farmland wherever feasible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once		Part of detailed siting and alignment survey /design
		Farmers compensated for any permanent loss of productive land	Design of Implementation of Crop Compensation (based on affected area)	Consultation with affected parties – once in a quarter		Prior to construction phase
		Farmers/landowners compensated for significant trees that need to be trimmed/ removed along RoW.	Design of Implementation of Tree compensation (estimated area to be trimmed/removed)	Consultation with affected parties – once in a quarter		Prior to construction phase
			Statutory approvals for tree trimming /removal	Compliance with regulations – once for each subproject		Part of detailed siting and alignment survey /design
Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a nuisance.	Noise levels	Noise levels to be specified in tender documents - once	POWERGRID	Part of detailed equipment design
Interference with drainage patterns/Irrigation channels	Flooding hazards/loss of agricultural production	Appropriate siting of towers to avoid channel interference	Tower location and line alignment selection (distance to nearest flood zone)	Consultation with local authorities and design engineers - once	POWERGRID	Part of detailed alignment survey and design
<b>Construction</b>						
Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection	Construction techniques and	Construction techniques and	POWERGRID (Contractor	Construction period

Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		seeking to minimize ground disturbance.	machinery	machinery creating minimal ground disturbance - once at the start of each construction phase	through 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
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



Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
Trimming/cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in meters)	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period
	Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period
		Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies.	Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m <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
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	Waste disposal	Excess fill from tower foundation excavation	Location and amount (m <sup>3</sup> ) of fill disposal	Appropriate fill disposal	POWERGRID (Contractor)	Construction period

Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
earthwork/fill		disposed of next to roads or around houses, in agreement with the local community or landowner.		locations - every 2 weeks	through contract provisions)	
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
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> )			
		Repair /reinststate 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	Incorporating good design and construction management practices – once	POWERGRID (Contractor through contract provisions)	Construction period
		Limit site clearing to work areas				

Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		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	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> ]	for each site		
Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices.	Contract clauses	Incorporating good construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
		As much as possible existing access ways will be used.	Design basis and layout	Incorporating good design engineering practices – once for each site		
		Productive land will be reinstated following completion of construction	Reinstatement of land status (area affected, m <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 caused by	Contract clauses compliance – once every quarter	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
	public	Contractor to prepare and implement a health and safety plan. Contractor to arrange for health and safety training sessions	injuries and sickness)			
Inadequate construction stage monitoring	Likely to maximise damages	Training of POWERGRID environmental monitoring personnel	Training schedules	Number of programs attended by each person – once a year	POWERGRID	Routinely throughout construction period
		Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements	Respective contract checklists and remedial actions taken thereof.	Submission of duly completed checklists of all contracts for each site - once		
		Appropriate contract clauses to ensure satisfactory implementation of contractual environmental mitigation measures.	Compliance report related to environmental aspects for the contract	Submission of duly completed compliance report for each contract - once		
<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 supervision at sites.	Compliance with setback distances (“as-built” diagrams)	Setback distances to nearest houses – once in quarter	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				

Project activity/stage	Potential impact	Proposed mitigation measure	Parameter to be monitored	Measurement and frequency	Institutional responsibility	Implementation schedule
		Provide adequate sanitation and water supply facilities	Provision of facilities	Complaints received from staff /workers every 2 weeks		
Electric Shock Hazards	Injury/mortality to staff and public	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (number of injury incidents, lost work days)	Preparedness level for using these technologies in crisis – once a month	POWERGRID	Design and Operation
		Security fences around substations	Maintenance of fences	Report on maintenance – every 2 weeks		
		Barriers to prevent climbing on/dismantling of transmission towers	Maintenance of barriers			
		Appropriate warning signs on facilities	Maintenance of warning signs			
		Electricity safety awareness raising in project areas	Training /awareness programs and mock drills for all concerned parties	Number of programs and percent of total persons covered – once each year		
Operations and maintenance staff skills less than acceptable	Unnecessary environmental losses of various types	Adequate training in O&M to all relevant staff of substations and transmission line maintenance crews.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation
		Preparation and training in the use of O&M manuals and standard operating practices.				
Inadequate periodic environmental monitoring.	Diminished ecological and social values.	Power Grid staff to receive training in environmental monitoring of project operations and maintenance activities.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation
Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems using cholofluorocarbons (CFCs), including halon, should be phased out and to be disposed of in a manner	Process, equipment and system design	Phase out schedule to be prepared in case still in use – once in a quarter	POWERGRID	Operations

<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>
		consistent with the requirements of the Government.				
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

### **9.3 Institutional Mechanism for Reporting and Review**

POWERGRID, through the PMU, will be responsible for internal monitoring of EMP implementation, and will forward semiannual progress reports of the components financed by ADB to ADB and the GoI (if required). The reports will cover EMP implementation with attention to compliance and any needed corrective actions. Ongoing consultation measures will be incorporated in the EMP.

Construction contractors will be responsible for the implementation of mitigation measures during the construction stage.. The IEE will be made publicly available by POWERGRID on its website.

ADB will (i) review and endorse updates of IEE (if needed) and EMPs before contracts are finalized and work begins; (ii) review environmental monitoring reports; and (iii) officially disclose environmental safeguards documents on its website as necessary.

Periodic review by corporate ESMD and higher management including review by POWERGRID CMD of all environmental issues will be undertaken to ensure that EMP and other measures are implemented at site. Annual review by independent auditor under the ISO:14001 shall also be undertaken for compliance of agreed policy and management plan.

## **10. CONCLUSION AND RECOMMENDATION**

None of the four additional components is in environmentally-sensitive areas. Careful route selection has minimized involvement of forest area to the extent possible but could not be completely avoided due to terrain and other reasons such as strip plantation along the road and canal crossings. No major impact on wildlife is envisaged as the forest is not the habitat of any endangered or endemic species of fauna and flora.

The project will not result in any long-term significant adverse impacts. Minimal environmental impacts are anticipated, mostly during construction. These can be mitigated successfully by implementing the EMP with estimated costs for implementation. Environmental and social benefits of the project and long-term investment program objectives outweigh the temporary negative impacts.

## Annexure 1 Budget Estimate for Mitigation Measures

### 1. Orai – Aligarh 765 kV D/c line

Total line length: 320 Kms.

A.	Mitigation Measures/Compensation	Area (ha)	Rs. (in lakhs)
1	Compensation towards Compensatory Afforestation (9 Ha X 2 X Rs. 1,40,000)	9	25.2
2	Compensation towards Net present value (9 Ha X Rs. 10,43,000)		93.87
3	Compensation towards Crops (Non-forest area) (Rs. 5,00,000 per Km)		1593.28
4	Compensation for PTCC (320 Km x Rs. 50,000/-)		160
<b>(A)</b>			<b>1872.35</b>
<b>B.</b>	<b>Implementation Monitoring &amp; Audit</b>		
a.	Man-power involved for EMP implementation & Monitoring in entire route of Transmission lines (Rs.10,000/-x 320 Kms.)		32
b.	Independent Audit (LS) if needed		5
<b>(B)</b>	<b>a+b</b>		<b>37</b>
<b>C.</b>	<b>Contingent cost 3% (A)+(B)</b>		<b>57.28</b>
	<b>Total Cost (A+B+C)</b>		<b>1966.63</b>

### 2. Orai – Orai (UPPTCL) 400 kV D/c line

Line Length: 38 Kms

A.	Mitigation Measures/Compensation	Area (ha)	Rs. (in lakhs)
1	Compensation towards Compensatory Afforestation (0.5 Ha X 2 X Rs. 1,40,000)	0.5	1.4
2	Compensation towards Net present value (0.5 Ha X Rs. 10,43,000)		5.215
3	Compensation towards Crops (Non-forest area) (Rs. 5,00,000 per Km)		189.46
4	Compensation for PTCC (38 Km x Rs. 50,000/-)		19
<b>(A)</b>			<b>215.07</b>



<b>B.</b>	<b>Implementation Monitoring &amp; Audit</b>	
a.	Man-power involved for EMP implementation & Monitoring in entire route of Transmission lines (Rs.10,000/-x 38 Kms.)	3.8
b.	Independent Audit (LS) if needed	5
<b>(B)</b>	<b>a+b</b>	<b>8.8</b>
<b>C.</b>	<b>Contingent cost 3% (A)+(B)</b>	<b>6.72</b>
	<b>Total Cost (A+B+C)</b>	<b>230.59</b>

### 3. LILO of Agra-Meerut 765 kV S/c line at Aligarh S/s

Line Length : 4.102 kms

<b>A.</b>	<b>Mitigation Measures/Compensation</b>	<b>Area</b>	<b>Rs. (in lakhs)</b>
1	Compensation towards Compensatory Afforestation (0.4 Ha X 2 X Rs. 1,40,000)	0.4	1.12
2	Compensation towards Net present value (0.4 Ha X Rs. 10,43,000)		4.172
3	Compensation towards Crops (Non-forest area) (Rs. 5,00,000 per Km)		20.21
4	Compensation for PTCC (4.102 Km x Rs. 50,000/-)		2.051
<b>(A)</b>			<b>27.55</b>
<b>B.</b>	<b>Implementation Monitoring &amp; Audit</b>		
a.	Man-power involved for EMP implementation & Monitoring in entire route of Transmission lines (Rs.10,000/-x 4.102 Kms.)		0.4102
b.	Independent Audit (LS) if needed		5
<b>(B)</b>	<b>a+b</b>		<b>5.4102</b>
<b>C.</b>	<b>Contingent cost 3% (A)+(B)</b>		<b>0.99</b>
	<b>Total Cost (A+B+C)</b>		<b>33.95</b>

### 4. LILO of Kanpur – Jhatikara 765 kV S/c line at Aligarh S/s

Line Length : 10.631 kms

<b>A.</b>	<b>Mitigation Measures/Compensation</b>	<b>Area (ha)</b>	<b>Rs. (in lakhs)</b>
1	Compensation towards Compensatory Afforestation (0.8 Ha X 2 X Rs. 1,40,000)	0.8	2.24
2	Compensation towards Net present value		8.344

	(0.8 Ha X Rs. 10,43,000)	
3	Compensation towards Crops (Non-forest area)	52.56
	(Rs. 5,00,000 per Km)	
4	Compensation for PTCC (10.631 Km x Rs. 50,000/-)	5.3155
<b>(A)</b>		<b>68.46</b>
<b>B.</b>	<b>Implementation Monitoring &amp; Audit</b>	
a.	Man-power involved for EMP implementation & Monitoring in entire route of Transmission lines (Rs.10,000/-x 10.631 Kms.)	1.0631
b.	Independent Audit (LS) if needed	5
<b>(B)</b>	<b>a+b</b>	<b>6.06</b>
<b>C.</b>	<b>Contingent cost 3% (A)+(B)</b>	<b>2.24</b>
	<b>Total Cost (A+B+C)</b>	<b>76.76</b>