Draft Initial Environmental Assessment Report

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IND: Solar Transmission Sector Project

(Transmission System associated with Solar Power Park at Banaskantha, Gujarat)

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

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ABBREVIATIONS

Aps	–	Affected Persons
ASI	–	Archaeological Survey of India
ADB	–	Asian Development Bank
CPCB	–	Central Pollution Control Board
CPRI	–	Central Power Research Institute
CTU	–	Central Transmission Utility
Ckt-km	–	Circuit Kilometer
DC	–	District Collector
D/C	–	Double Circuit
EAMP	–	Environmental Assessment Management Plan*
EMP	–	Environment Management Plan
EMF	–	Electro Magnetic Field
ESMC	–	Environment and Social Management Cell
ESMD	–	Environment and Social Management Department
ESMU	–	Environment and Social Management Unit
ESPP	–	Environmental and Social Policy and Procedures
EIA	–	Environmental Impact Assessment
EHV	–	Extra High Voltage
GIS	–	Gas Insulated Switchgear
GoI	–	Government of India
GRC	–	Grievance Redress Committee
IA	–	Implementing Agency
IEAR		Initial Environment Assessment Report
ISTS	–	Inter State Transmission Scheme
ICNIRP	–	International Commission on Non-Ionising Radiation Protection
MSL	–	Mean Sea Level
MVA	–	Mega Volt Ampere
MSME	–	Micro Small and Medium Enterprises
MoEF&CC	–	Ministry of Environment, Forests and Climate Change
MoP	–	Ministry of Power
NH	–	National Highway
NR	–	Northern Region
O & M	–	Operation & Maintenance
POWERGRID or PGCIL	–	Power Grid Corporation of India Ltd.
PTCC	–	Power Telecom Co-ordination Committee
PMU	–	Project Management Unit
GETCO	–	Gujarat Energy Transmission Corporation Limited
RoW	–	Right of Way
SPS	–	Safeguard Policy Statement

SPP	–	Solar Power Parks
SPPD	–	Solar Power Park Developers
SSI	–	Small Scale Industry
SCM	–	Standing Committee Meeting
SH	–	State Highway
STU	–	State Transmission Utility
SF6	–	Sulphur Hexafluoride
UMPP	–	Ultra Mega Power Project
WR	–	Western Region

NOTE
In this report, "$" refers to US dollars.
“Rs” refers to Indian Rupees

* “Environment Assessment Management Plan (EAMP)” & “Environment Management Plan (EMP)” are synonyms and hence EAMP should be read as “EMP” in this document.

EXECUTIVE SUMMARY

1. To address the environmental and social issues related to its power transmission projects, POWERGRID has developed its corporate Environmental and Social Policy & 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, and applicable laws, legislation and guidelines of Government of India (GoI).

2. This Initial Environmental Assessment Report (IEAR)[1] has been prepared based on POWERGRID's ESPP and the Action Plan for Safeguards (Annexure 10) development for the use of Country Safeguard System (CSS). Given potential environmental impacts are mostly temporary, predictable, and reversible, and can be mitigated through adherence to national and international standards, and/or implementation of Environmental AssessmentManagement Plan (EAMP)[2] (nee. Emvironment Management Plan (EMP), refer ESPP Appendix- XXX-A), no environmental impact assessment (EIA) is required.

3. The Project components for transmission system for solar power park at Banaskantha, Gujarat under ADBfinancing will include the following transmission line and extension of substation in the state of Gujarat:

Transmission Line:

- 95.00 kilometers of 400 kV D/c Radhanesda {Gujarat Energy Transmission Corporation Limited (GETCO)} – Banaskantha {Power Grid Corporation of India Limited (POWERGRID)} line (having 46 m as Right of Way (RoW) and estimated 257 tower footings).

Substation Extension:

- 2 nos. 400 kV line bays at Banaskantha (PG) substation

4. Transmission line projects are environmentally clean and do not involve any disposal of solid waste, effluents and hazardous substances in land, air and water, and hence these were kept out of the purview of different pollution laws and Environment (Protection) Act, 1986 except in two districts viz. Alwar in Rajasthan & Gurgaon in Haryana. Transmission Projects are also kept out of the purview of Environment Impact Assessment (EIA) Notification of 1994 and 2006. However, when transmission line projects pass through forest land, clearance has to be obtained from relevant authorities under the Forest (Conservation) Act, 1980. As per preliminary survey, no forest area is involved along the route of proposed transmission line.

5. Other mandatory requirements include sanction of MoP under section 68(1) of the Electricity Act, 2003; Regulations on Batteries (Management and Handling) Rules, 2001 regarding disposal of used batteries, Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 regarding disposal of used transformer oil, Ozone Depleting Substances (Regulation and Control) Rules, 2000 putting restrictions on use of ozone depleting substances come into force and required voluntary enforcement and provisions under Biological Diversity Act, 2002, E-waste (Management and Handling) Rules, 2011 regarding maintaining records & handling of electronic wastes, the Scheduled Tribes & Other Traditional

[1] Equivalent to the safeguard document required for ADB's environment category B projects. This IEAR has met the requirements of ADB's Safeguard Policy Statement 2009.

[2] "Environment Assessment Management Plan (EAMP)" & "Environment Management Plan (EMP)" are synonyms and hence EAMP should be read as "EMP" in this document.

Forest Dwellers (Recognition of Forest Rights) Act, 2006.

6. Environmental impacts associated with the project components are mostly localized to the clearing and maintenance of the 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. However, with the implementation the transmission line of 95 km, some residual impacts cannot be entirely avoided. As estimated 5,800 trees[3] (5,600 private trees and 200 government trees) shall be affected by the proposed transmission line.

7. Careful route selection has completely avoided involvement of forest and protected areas/other environmentally sensitive areas in the proposed line route. A comprehensive EMP detailing all possible anticipated impacts along with mitigation measures, monitoring and implementation schedule has been developed and shall be made part of bidding/contract document for proper implementation by the Contractor. Best available technology and international best practices are also built-in to the project design to minimize the impacts.

8. Public participation and community consultations have been taken up as an integral part of the project's environmental assessment process. The 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, are consulted. There were altogether 11 consultations (1 public consultations and 10 informal group meetings) held in July 2016 during preliminary survey/investigations of the entire routes of transmission lines. The program was arranged in an interactive way and queries on subject such as crop compensation, route alignment, etc. were addressed. The consultation processes was appreciated by the villagers who 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. POWERGRID has already conducted consultations with some representation of women. Since public consultation is a continuous process, major emphasis on women representation shall be provided in subsequent consultations. Relevant information is provided in Hindi and English to stakeholders.

9. GRM is an integral part of project implementation, operation and maintenance stage of the project. For handling grievance, Grievance Redress Committee (GRC) will be established at two places, one at the project level and another at corporate level. The GRCs shall include members from POWERGRID, Local Administration, Panchayat Members, Affected Persons representative and reputed persons from the society on nomination basis under the chairmanship of project head. The composition of GRC shall be disclosed in Panchayat offices and concerned district headquarter for wider coverage. In case of any complaint, GRC meeting shall be convened within 15 days. If project level GRC not able to take decision it may refer the complaint to corporate GRC for solution. GRC endeavor will be to pronounce its decision within 30-45 days of receiving grievances. In case complainant/appellant is not satisfied with the decision of project level GRC they can make an appeal to corporate GRC for review. The proposed mechanism does not impede access to the country's judicial or administrative remedies at any stage. Grievances will be included in the monitoring reports.

[3] Above trees are tentative and based upon preliminary survey. However, exact nos. of tree to be affected shall be ascertained only after detail/check survey.

10. POWERGRID will be the Implementing Agency (IA) for the Project. The implementation and monitoring are critical activities shall be followed as per the project implementation chart/schedule. Monitoring is a continuous process for POWERGRID projects at all the stages of project cycle. POWERGRID has a separate Environment and Social Management Department (ESMD) at Corporate Center and Environment and Social Management Cell (ESMC) at Regional Head Quarter (RHQ) to monitor environment and social issues. At site level, Environment and Social Management Team (ESMT) shall be responsible for implementation and monitoring of environmental aspects. However, all project components will be implemented and monitored in line with the ESPP of POWERGRID and the Action Plan for Safeguards developed for the use of CSS. The project shall not have environmentally significant impacts, and is classified as environment category B as per ADB safeguard category.

11. An EMP including budget estimate as well as an environmental monitoring plan is an integral part of this IEAR. The EMP will be implemented by POWERGRID and Contractors as required. A semi-annual environmental monitoring report reflecting the status of EMP implementation and corrective actions if any, will be prepared and disclosed on POWERGRID's website. The monitoring report will also be submitted to ADB for disclosing on its website. The IEAR, the EMP, and revisions & updates, if any will also be disclosed.

1.0 INTRODUCTION

1. In 2015, the Asian Development Bank (ADB) has approved a loan to the Government of India (GOI) to support continued investment, specifically for implementation of transmission systems for solar power arks.

1.1 Background

2. 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 31st May 2016, POWERGRID has established about 1,30,020 circuit-kilometer (Ckt-km) of transmission lines at 765 kV, 400 kV, 220 kV and 132 kV Extra High Voltage Alternating Current (EHVAC), and 500 kV high voltage direct current (HVDC) levels and 210 substations with transformation capacity of about 2,59,163 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 and Maintenance techniques at par with global standards. About 50 % of total power generated in India is wheeled through transmission network.

3. 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. POWERGRID is also playing the leadership role in technology development like Digital Substations, Remote Operation, Hotline Maintenance, Condition Monitoring Techniques to detect defects at their incipient stage such as Frequency Response Analysis (FRA), Dissolved Gas Analysis (DGA), DCRM for Circuit Breakers, Third Harmonic Resistive Current Measurement for Surge Arrestors, Thermo-vision scanning etc. for smooth operation with high reliability and availability. The map showing existing interstate transmission system of Western Region with Transmission System for Solar Power Park at Banaskantha, Gujarat is given below in **Figure 1.1.**

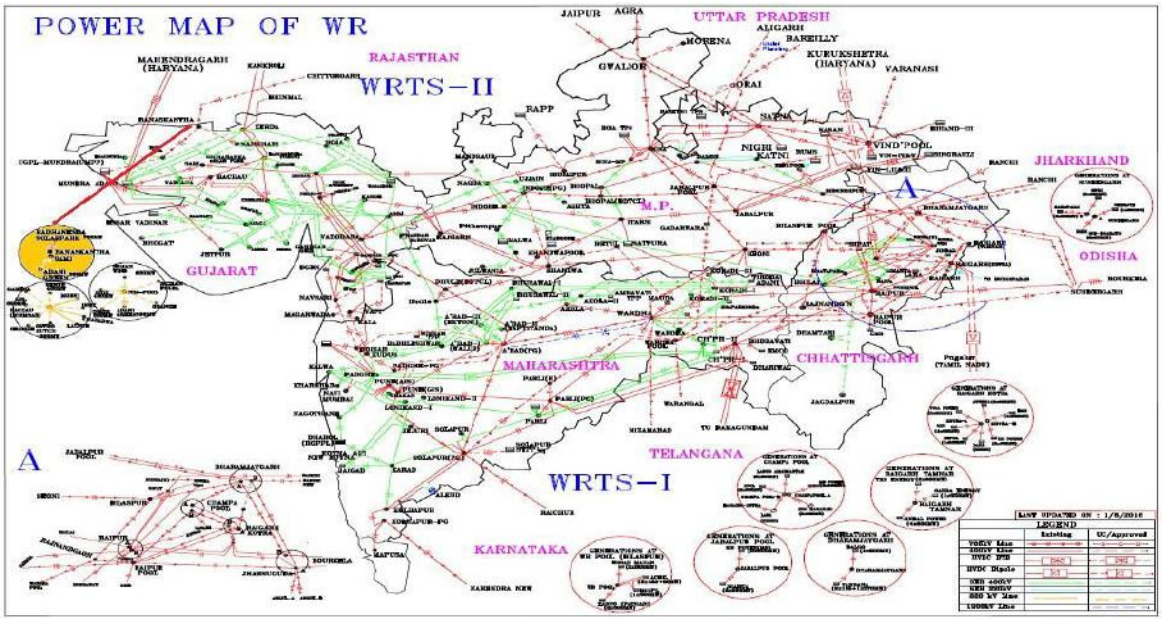


Figure 1.1: PGCIL Western Region Power Network along with proposed project.

1.2 The Project

4. The Project has the following output: (i) Transmission System for Solar Power Park at Banaskantha, Gujarat.

5. The Government of India (GoI) has requested a loan from ADB through ordinary capital resources. Implementing Agency is the POWERGRID. POWERGRID has already established a Project Management Unit (PMU), functioning under the guidance of technical committee of experts and assisted as required by implementation consultants.

6. Specific details of project investments are as follows:

(i) Transmission System For 700 MW Solar Power Park at Banaskantha, Gujarat

7. Government of India has taken an initiative for development of Solar Power Parks (SPP) in various parts of the country. As part of above initiative, setting up of ultra-mega solar park of 700 MW capacities has been envisaged by M/s Gujarat Power Corporation Limited (GPCL) at Radhanesda district Banaskantha in Gujarat. Ministry of Power (MoP) has assigned POWERGRID to implement transmission system for various solar parks including Banaskantha UMSPP (700 MW) in Gujarat on compressed time schedule basis.

8. Ministry of Power (MoP) informed that evacuation system for various solar parks (including Solar Power Park in Banaskantha, Gujarat) shall be developed by POWERGRID in compressed time schedule. The above transmission scheme was discussed and agreed in the 40th Standing Committee Meeting on Power System Planning of Western Region held on 01.06.16 and the same was ratified in the Regional Power Committee (RPC) meeting of Western region held on 20.01.16.

9. Given that the solar parks will provide power to different transmission lines and the proposed substations and transmission lines will evacuate power from different solar parks, they are not solely dependent on each other. Therefore, solar parks are not associated facilities of the Project.

10. The sub-project components under the above scheme include following transmission lines and substations:

- 400 kV D/c Radhanesda (GETCO) - Banaskantha (PG) line – 95.00 km
- 2 nos. 400 kV line bays at Bansakantha (PG) substation

11. The sub-project will have an associated facility 400 kV Radhanesda Pooling substation[4] to be constructed by GETCO, the Gujarat State Transmission Utility (STU).

12. Following the principles of POWERGRID's Environmental and Social Policy & Procedures (ESPP) and the Action Plan for Safeguards development for the use of CSS, an Initial Environmental Assessment Report (IEAR)[5] has been prepared for the project. This IEAR describes the environmental issues that might arise due to setting up of the project in the state of Gujarat and the mitigation measures that will be undertaken by POWERGRID during design, construction and maintenance stages.

[4] Land has been identified but not yet transferred to GETCO by State Govt.

[5] Equivalent to the safeguard document required for ADB's environment category B projects. This IEAR has also met the requirements of ADB's Safeguard Policy Statement 2009.

2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

13. Power transmission project 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

2.1.1 Constitutional Provisions

14. Subsequent to the 1st United Nations Conference on Human Environment at Stockholm in June 1972, which emphasized the need to preserve and protect the natural environment, the Constitution of India was amended through the historical 42nd Amendment Act 1976 by inserting Article 48-A and 51-A (g) for protection and promotion of the environment under the Directive Principles of State Policy and the Fundamental Duties respectively. The amendment, inter alia provides:

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

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

15. 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.

16. 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.

2.1.2 Mandatory Requirements (National)

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

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

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

18. 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, Forests and Climate Change (MoEF&CC) before starting any construction activity in the designated forest areas.

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

19. 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.

20. In its notification in September 2006, the MoEF&CC, 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.

21. The amendment of the Environment (Protection) Act, 1986 on 7th May' 1992 on the basis of Hon'ble Supreme Court direction to safeguard Aravali ranges from further degradation made it necessary to obtain clearance from MoEF&CC for power transmission projects in two districts in the Aravalis (*viz.*, Alwar in Rajasthan and Gurgaon in Haryana).

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

22. MoEF&CC, vide its notification on 17th July 2000 under the section of 6, 8 and 25 of the Environment (Protection) Act 1986, has notified rules for regulation/control of Ozone Depleting Substances under the Montreal Protocol adopted by GOI on 16th 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 line with Government of India regulations (latest amendment notified by MoEF&CC in March 2014[6]).

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

23. MoEF&CC, vide its notification on 16th May 2001 under the section of 6, 8 and 25 of the Environment (Protection) Act 1986, has put certain restrictions on disposal of used batteries and its handling. 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.

[6]http://www.ozonecell.com//downloadfile_2.jsp?filename=1399017310710-The-Gazette-Of-India-Extraordinary.pdf

- **Hazardous Wastes (Management, Handling &Transboundary Movement) Rules, 2008**

24. MoEF&CC, vide its notification on 24th September, 2008 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986, has put used transformer 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.

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

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

- **The Biological Diversity Act, 2002**

26. Under the United Nations Convention on Biological Diversity, signed at Rio de Janeiro on 5th June 1992 of which India is a party, MoEF&CC 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 Parks 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.

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

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

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

2.1.3 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 & Procedures (ESPP)

29. To address the environmental and social issues related to its power transmission projects, POWERGRID has developed its corporate ESPP in 1998 based on the principles of avoidance, minimization, and mitigation. The ESPP had been updated twice in 2005 & 2009 in line with the requirement of new enactment by Govt. of India, changed rules and guidelines including that of multilateral funding agency like World Bank, ADB, JBIC etc. and suggestion/best practices and feedback received from different sites and through wide consultation process with various stakeholders. POWERGRID's ESPP'2009 is the first comprehensively analysed by World Bank's under its 'Use of Country Systems (UCS)' policy and is certified to be compliant with Bank's environmental and social safeguards requirement.

30. 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.

31. 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 Asian Development Bank's Environmental Requirements[7]

32. 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.

[7] The safeguard requirements of ADB vis-s-vis POWERGRID's ESPP have been analyzed in detailed for use of Country Safeguards System (CSS) under ADB's SPS' 2009 and an action plan has been drawn to make it fully compliant under CSS which is enclosed as Annexure-10.

33. 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.

34. Based on the significance of the potential environmental impacts resulting from the project, the environment category was kept as ‘B’ for the preparation of an IEE.

3.0 DESCRIPTION OF THE PROJECT

3.1 Project Justification

35. Government of India has taken initiative for development of Ultra Mega Solar Parks in various parts of the country. As part of above initiative, setting up of ultra-mega solar park of 700 MW capacity has been envisaged by M/s Gujarat Power Corporation Limited (GPCL) at Radhanesda district Banaskantha in Gujarat. Ministry of Power (MoP) has assigned POWERGRID to implement transmission system for various solar parks including Banaskantha UMSPP (700 MW) in Gujarat on compressed time schedule basis.

36. Gujarat Power Corporation Limited (GPCL), the Solar Power Park Developer (SPPD) has envisaged development of an ultra mega solar power park of 700 MW capacity in Radhanesda, Banaskantha distt, Gujarat. Power from above project is envisaged to be transferred to its beneficiaries in WR including Gujarat.

37. As part of Green Energy Corridor –I: Interstate Transmission scheme, 765/400/220 kV Banaskantha (PG) Substation is under implementation. M/s GPCL has informed that it is stepping up generation at 400 kV voltage level. Therefore, in order to evacuate and transfer power from above ultra mega solar power park, a 400 kV D/c interconnection between Solar Power Park through 400/220 kV Radhanesda Pooling Station to be developed by GETCO and 765/400/220 kV Banaskantha (PG) substation is proposed. In this way, proposed transmission system shall facilitate transfer of green and clean power through the 400/220 kV Radhanesda (GETCO) substation with reliability.

3.2 Objective and Benefits of the Project

38. The objective of the project is to facilitate power transfer from the Banaskantha solar power park to various beneficiaries including Gujarat. In addition, implementation of this project is likely to generate direct and indirect employment opportunities, promote industrial growth, and stimulate overall development of the area. Project highlights is given below.

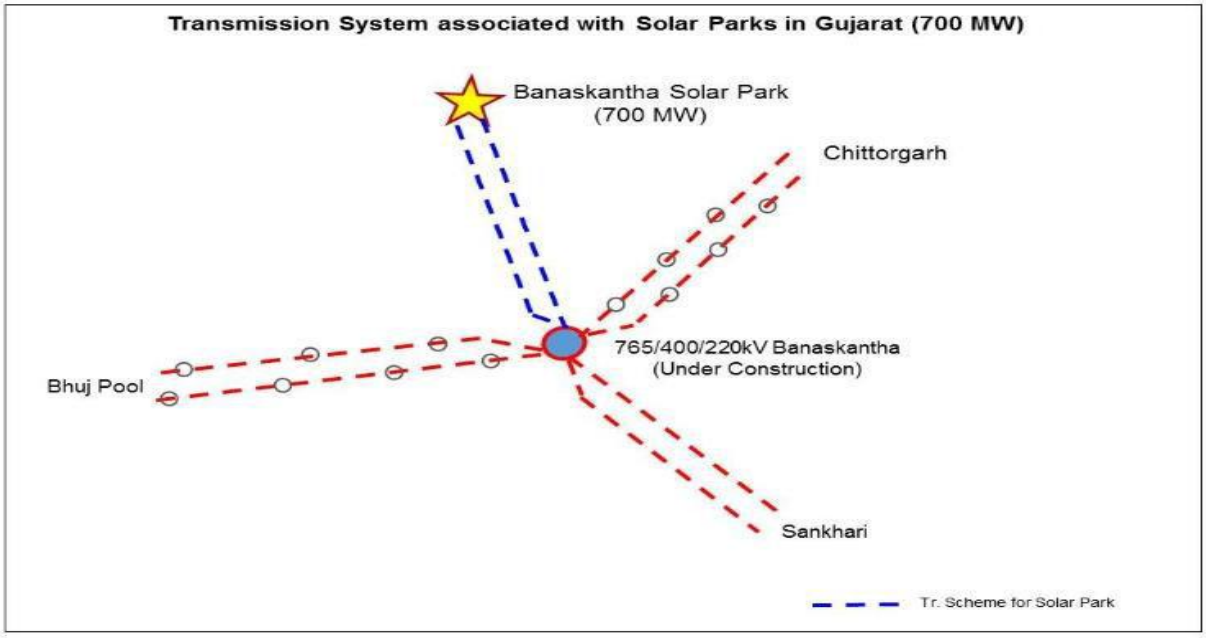
Table 3.1 Project Highlights

a)	Project	:	Transmission system for Ultra Mega Solar Power Park (700 MW) at Banaskantha, Gujarat.
b)	Location of the Project	:	Western Region
c)	Project Cost	:	Rs. 155.83 Crores at December 2015 Price Level (including IDC of Rs. 4.85 Crores)
d)	Commissioning schedule	:	Transmission System is proposed to be implemented within 16 months from the date of investment approval.

39. The above transmission scheme was discussed and agreed in the 40th Standing Committee Meeting on Power System Planning of Western Region held on 01.06.16 and the same was ratified in the Regional Power Committee (RPC) meeting of Western region held on 20.01.16.

40. The schematic of the proposed Transmission system is shown at **Figure 3.1**

Figure 3.1: Schematic Diagram of the proposed Transmission System [8]



3.3 Scope of Work

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

Transmission Lines

- 400 kV D/c Radhanesda Pooling Station (GETCO) – Banaskantha (PG) line – **95.00 km**

Substation Extension

- 2 Nos. 400 KV Line Bays at 765/400kV Banaskantha (PG) substation

3.4 Location

42. The substations are located in the state of Gujarat as shown in Figures 3.2-3.3 (listed in **Table 3.2**).

Table 3.2: Location of Substations

S.No.	Sub-Project	State	Figure
1	765/400/220 kV Banaskantha Substation (PG)	Gujarat	Figure 3.2
2	Gantry point of PG near proposed 400/220/kV Radhanesda (GETCO) Substation	Gujarat	Figure 3.3

[8] dotted lines shows under construction network

43. **Table 3.3** indicates details of the proposed Substations.

Table 3.3 Location & Land Use details of Substations

A	Name of Substation	Co-ordinates	Land Use of Substation
A1	765/400/220 kV Banaskantha Substation (PG) (#)	*24º 8'27.18" N 71º59'46.49"E*	Substation under construction by PGCIL. The substation area is enclosed in boundary.
A2	400/220kV Radhanesda (GETCO) Pooling Substation (#)	24º31'22.0"N, 71º16'03.4" E	Barren land identified for substation by State Govt. Land yet to be transferred to GETCO.

(#): The project involves interconnection of both substations through a 400 kV D/C line.

Figure 3.2: 765/400/220 kV Banaskantha (PG) Substation

Figure 3.3: PG Gantry location at proposed 400/220/kV Radhanesda (GETCO) Substation

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

44. The scope of proposed ADB funding involves construction of one transmission line between 400/220 kV Radhanesda Pooling Station (GETCO) to 765/400/220 kV Banaskantha (PG) substation and extension of two bays at Banaskantha (PG) Substation. The details of proposed line is given in **Table- 4.1** below:

Table 4.1 Proposed Transmission Line & its Location

Name of Line	State	Line Length	District
400 kV D/c Radhanesda- Banaskantha	Gujarat	95.00 km	Banaskantha

45. The 400 kV Radhanesda Pooling Substation (GETCO) will be an associated facility once constructed by GETCO.

4.1 Gujarat State

46. Gujarat is situated on the western coast of the country having the longest coastline. It lies between 20°07'N - 24°43' N latitude and 68°10'E - 74°29' E longitude. The geographical area of the state is 196,022 sq. km. which constitutes 5.96 % of the country's geographical area. The state is surrounded by Pakistan & Rajasthan in North East, by Madhya Pradesh in the East, by Maharashtra and the Union territories of Diu, Daman, Dadra and Nagar Haveli in the south. The Arabian Sea is present in the West and South West border of the state.

47. Physiographically the state can be divided into three distinct regions (i) the peninsula (ii) Kuchchh (iii) the mainland, extending from the Rann of Kuchchh and the Aravalli hills to the river Damanganga and consists of plains with alluvial soil. The general land use pattern of the State is given in **Table 4.2**.

Table-4.2: Land Use Pattern

Land use	Area in ' 000 ha	Percentage
Total Geographical area	19,602	
Reporting Area for land utilization	19,069	100
Forests	1,834	9.62
Not available for cultivation	3,723	19.52
Permanent Pasture & other Grazing lands	851	4.46
Land under misc. tree crops & groves	4	0.02
Culturable waste land	1,960	10.28
Fallow land other than current fallows	16	0.08
Current fallows	379	1.99
Net area Sown	10,302	54.02

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

4.1.1 Banaskantha

48. Banaskantha district is situated in North-West part of Gujarat and lies between 23°02" and 24°45" North Latitudes and 71°21" and 73°02" East Longitudes. The district is surrounded by Rajasthan in the North, by Patan and Mehsana in the South, by Kutch district in the West and by Sabarkantha district in the East. The geographical area of the district is 12,703 sq. km consisting of 12 talukas.

Physiography

49. The district can be divided in three main parts – the hilly- mountainous region having high relief and rugged topography covering parts of Dhanera, Palanpur, Vadgaon and entire Danta taluka in the east, the piedmont zone all along the periphery of hilly area, and west and southwest of River Banas the area is flat plain with occasional undulations given rise to by sand dunes and mounds in the west. The western extension of this plain merges into the marshy area of Rann of Kutch.

50. Geomorphologically the district can be divided into six sub micro regions on the basis of physiography, climate, geology, soils and natural vegetation.

a. **Vav Sandy Plain**: It is mostly sandy plain with an altitude of 100 m above mean sea level. There are a few small channels, which merge into little Rann of Katchchh. Geologically area is composed of Alluvium, blown sand etc.

b. **Sandy Plain**: The region mainly extends over the north and north western parts of the district bounded by the state of Rajasthan in the north, Banas valley in the east and south and Vav sandy plain in west. The region has the sloppy gradient, towards the west in which the river Sukal flows. Geologically area is composed of Alluvium, blown sand etc.

c. **Banas Vally**: This region extends over the central and south-western part of the district, it is mainly formed by the Banas River which flows southwesterly direction and ultimately merges into Rann of Katchchh. Northern part of this region is high in elevation than the south and western portions. Geologically area is composed predominantly of Alluvium, blown sand etc.

d. **Banskantha Aravalli Range**: The region spreads over the eastern part of Banaskantha district, occupying Danta and part of Palanpur and small area of Vadgaon talukas. It is bounded by the state of Rajasthan from north, Banas Valley from west, Mehsana district from south and Sabarkantha district from east. This region is highly elevated ranging between 100 and 300 m above mean sea level. Saraswati River is the main river of the region. Geologically area is composed Alluvium, blown sand etc

e. **Jasor Chhotila Hills**: The region lies in Dhanera and Palanpur taluks and is enclosed by the state of Rajasthan from three sides while Banaskantha Aravalli range makes its limit in the south. It is actually disrupted part of Aravalli range by the Banas valley. It is an undulating terrain with an elevation of 300 m above mean sea level and is covered by forest. Geologically this region is mainly composed of Eranpura granite formation.

f) **Umardasi – Sarawati Plain**: This region mainly extends over the south – eastern part of Banskantha district covering the taluks of Palanpur and Vadgaon. It is bounded by Banas valley in the west and north, Banaskantha Aravalli range in the east and Mehsana district in the south. This region is formed by the Umardasi and Saraswati River and having an elevation of 100 m above mean sea level. Geologically area is composed of alluvium, blown sand etc

Climate

51. The climate of Banaskantha district is characterized by a hot summer and dryness in the non rainy seasons. The cold season extends from December to February and is followed by the hot season from March to May. The monsoon season is from June to September. October and

November form the post monsoon season. The average annual rainfall is around 614 mm.

Water Resources

52. The surface water resources of the district are very limited. There are no perennial rivers flowing through the district. Banas, Sipu, Saraswati, Arjuni, Umaradasi, Luni and Ladabi rivers constitute the main river network of the district. Groundwater is the main source of irrigation. Important irrigation schemes (Table 4.3) of the district are as follows:

Table 4.3 Medium & Major Irrigation Schemes (000 hectares)

Sr. No	Name of scheme	Ultimate Irrigation Potential	Potential created upto March '06	Balance Irrigation Potential
1	Mukteshvar Irrigation Project	6.186	6.186	-
2	Sipu Reservoir Project	16.00	16.00	-
3	Hadmatiya Irrigation Scheme	0.792	0.792	-
4	Dantiwada	44.52	44.52	-

Source: Irrigation Department, Palanpur 2013 (Reproduced: Government of India Ministry of Water Resources Central Ground Water Board, Ground Water Scenario Banaskantha District, Gujarat, 2013)

Irrigation - Area Irrigated by different Sources

53. The area irrigated by different sources in the district is presented in **Table-4.4**, which indicate that tubewells are the main source of irrigation in the district.

Table-4.4 Area irrigated by different sources (00 hectares)

S No.	Source	Area irrigated	S No.	Source	Area irrigated
1	Govt. Canals	1950.36	6	Tubewells(Electrified)	240
2	Tanks	237	7	River Lift	_____
3	Wells		8	Other (Adbsnds Lift)	290
4	Wells (Electrified)	212	9	Net Irrigated Area	466
5	Tubewells		10	Gross Irrigated Area	474

Source: Irrigation Department Palanpur 2013 (Reproduced: Government of India Ministry of Water Resources Central Ground Water Board, Ground Water Scenario Banaskantha District, Gujarat, 2013)

Ground Water Scenario

54. **Hydrogeology** - Precambrian hard rocks, semi-consolidated Mesozoic and tertiary formations and unconsolidated quaternary alluvial deposits form multi-layer aquifer system in the district. Groundwater occurs both under phreatic and confined conditions, however its development is restricted depending upon the aquifer geometry and yield characteristic of individual aquifer and/or ground water quality of the formation water.

55. **Ground water in fissured formation (Hard rock)**: The north-eastern part of the district is mainly occupied by metasediments and Post Delhi intrusives. The occurrence and movement of ground water is governed by secondary porosity i.e. thickness and extent of weathering and size & interconnections of fractures/joints.

56. These formations generally do not form very good aquifer system. The depth of dugwells ranges from 15-30 mbgl and of borewells ranges from 100-200 mbgl. Depth to water level in the

dug wells varies from 5 -14 mbgl and in borewells from 15 to 60 mbgl. The successful borewells drilled so far, yielded in the range of 30- 1036m3 /day with an average yield of 240m3/day.

57. There is a strong evidence indicating presence of potential fracture zones at the depth below 100 m, however contribution of yield to the total yield from these zones is about 15-30% in general except at suitably identified locations i.e Karanpur in Danta taluka where contribution of yield from potential deeper zones is more than 75%.

Mineral Resources

58. The district is rich in respect of minerals resources mostly minor category minerals. The important minerals in the district are like marble Block, Rubble, Lime stone, Granite Block, Granit rubble, Court zite ordinary sand etc. (Table 4.5)

Table 4.5 Production of Mineral in 2010-11

S.N.	Name of the Mineral	Production In Tones
Major Mineral		
1	**Nil**	**-**
Minor		
1.	Marble Block	194709
2.	Rubble	453141
3.	Building Stone	695239
4.	Limestone	85069
5.	Ordinary sand	1810981
6.	Granite Block	5848
7.	Rubble	1352
8.	Quartzite	151202
	Total	**3397541**

Source: Dept of Mines & Geology, Palanpur, 2011

Soil

59. In Banaskantha district major part of the soils are sandy in nature. In general the soils are poor to medium in fertility and water retention capacity. Most soils have good aeration, porosity and permeability. The hydraulic conductivity of the soils ranges from as low as 0 for saline and alkali soils in the western part to more than 7cm/hr for calcareous sandy soils in the north and west. Soils of the district fall in five broad categories as below.

I) Saline and alkali soils: These are typically deep, grey calcareous sandy clay loams of low permeability.

II) Calcareous sandy loams: These are generally Deep, light grey or brown sandy loams of moderate to good permeability and drainage.

III) Calcareous sandy soils: These are mostly pale yellow and brown sands & loamy sands of good depth and high permeability.

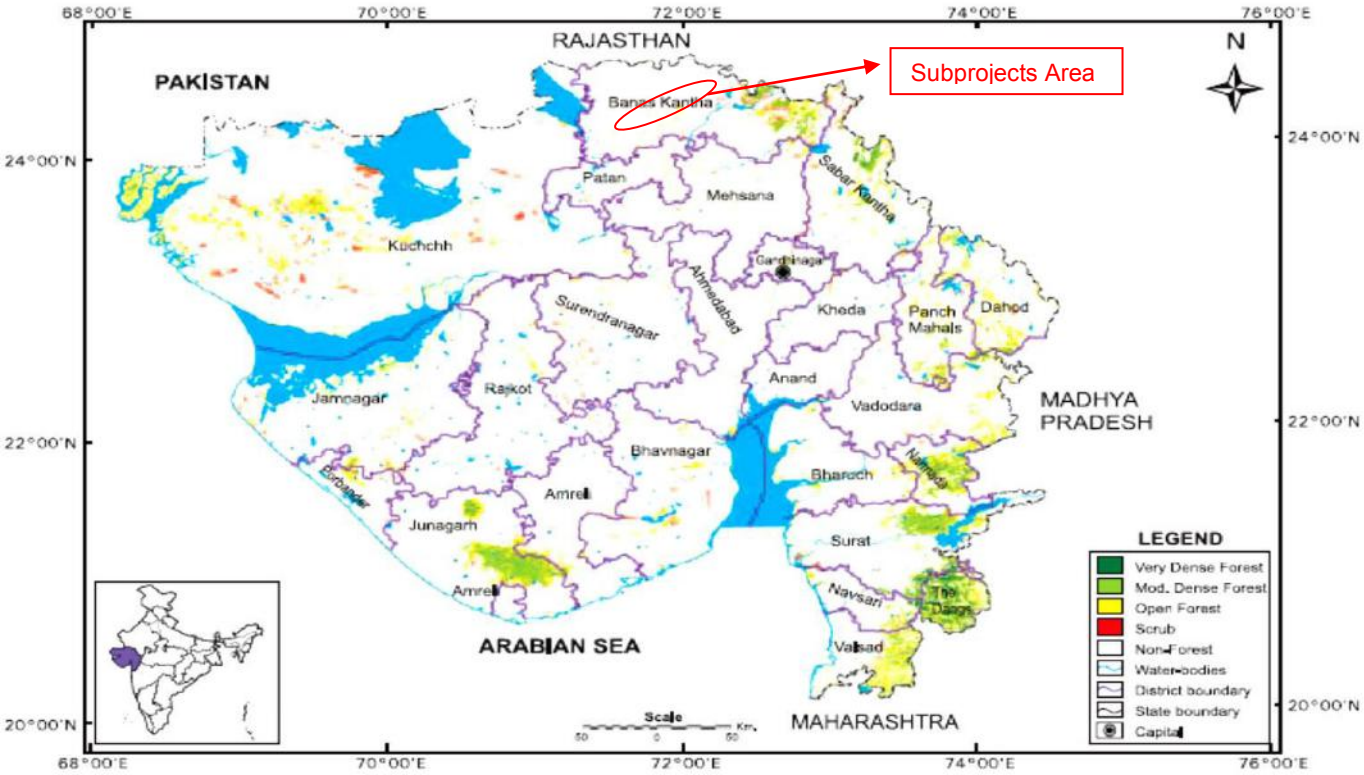
IV) Non calcic brown soils: These are characterised by pale brown to brown deep loamy sands and sandy loams of adequate to good permeability.

V) Non calcic red brown soils: These are of mixed colluvial and alluvial derivations from rocks of the Aravali system. Mostly deep loamy sands to sandy loams with adequate to good hydraulic conductivity.

Ecological Resources

60. The recorded forest area of the Guarat state is 21,647 sq. km which constitutes 11.04% of the geographic area of the State and 2.80% of India's Forest Area. According to legal status, Reserved Forests (14373 sq km.) constitute 66.40%, Protected Forests (2886 sq km.) constitute 13.33% and Un-classed Forests (4388 sq km.) constitute 20.27% of the total forest area. Main Forest types occurring in the State are Tropical Moist Deciduous Forest, Tropical Dry Deciduous Forest, Northern Tropical Thorn Forest and Littoral & Swamp Forest. Based on interpretation of satellite data, total forest cover is 14,653 sq. km which is 7.48% of State's geographical area. In terms of forest canopy density classes, the State has 376 sq. km very dense forest, 5,220 sq. km moderately dense forest and 9,057 sq. km is open forest (**Fig 4.1**).

Figure 4.1: Forest Cover Map of Gujarat



Source: India State of Forest Report 2015

61. The recorded forest area of the district is 840 sq.km. which is 8.52% of the district's geographical area. Out of the total 840 sq.km forest cover, moderate dense forest constitutes 369 sq. km. and remaining are open forest. There is no major forest product, Minor forest products like, Tendu leaves, Mahuwa flowers, Bamboo, Neem seeds, Honey and Herbal medicines etc.

62. By adopting careful route selection technique, forest involvement along route of proposed transmission line has been completely avoided thereby minimizing ecological disturbance.

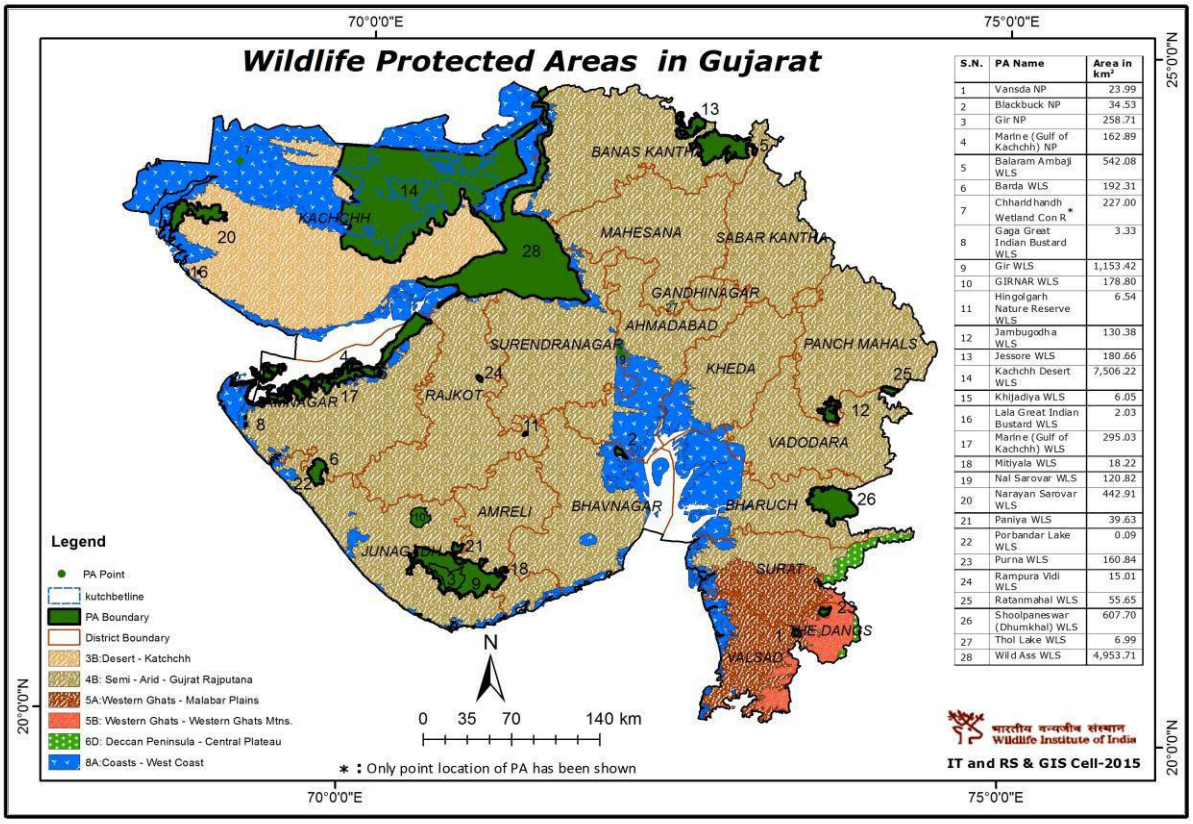
Protected Areas

63. Gujarat has 28 Protected Areas (PA) including 23 Wildlife Sanctuaries, 4 National Parks

and 1 conservation reserve covering an area of 17,099.93 sq.km which constitutes 8.61 % of geographical area of the state. Though, the geographical area of Gujarat is only 5.9% of the total area of India, it contributes 11.37% (17099.93 sq. km.) area to the total PA (148532 sq.km) of the country. Out of the total 17099.93 sq.km. of PA, only 4640.58 sq.km. 27.45% is forest land of various categories, whereas larger contribution is from non-forest ecosystems including mainly the saline deserts [124559.92 sq.km. i.e.73.71% of the total PA].

64. **Figure 4.2** shows the location of National Parks and the wildlife sanctuaries in Gujarat State.

Figure 4.2: Wildlife Protected Areas in Gujarat State



S.N.	PA Name	Area in km²
1	Vansda NP	23.99
2	Blackbuck NP	34.53
3	Gir NP	258.71
4	Marine (Gulf of Kachchh) NP	162.89
5	Balaram Ambaji WLS	542.08
6	Barda WLS	192.31
7	Chharidhandh Wetland Con R*	227.00
8	Gaga Great Indian Bustard WLS	3.33
9	Gir WLS	1,153.42
10	GIRNAR WLS	178.80
11	Hingolgarh Nature Reserve WLS	6.54
12	Jambugodha WLS	130.38
13	Jessore WLS	180.66
14	Kachchh Desert WLS	7,506.22
15	Khijadiya WLS	6.05
16	Lala Great Indian Bustard WLS	2.03
17	Marine (Gulf of Kachchh) WLS	295.03
18	Mitiyala WLS	18.22
19	Nal Sarovar WLS	120.82
20	Narayan Sarovar WLS	442.91
21	Paniya WLS	39.63
22	Porbandar Lake WLS	0.09
23	Purna WLS	160.84
24	Rampura Vidi WLS	15.01
25	Ratanmahal WLS	55.65
26	Shoolpaneswar (Dhumkhal) WLS	607.70
27	Thol Lake WLS	6.99
28	Wild Ass WLS	4,953.71

Source: ENVIS Centre on Wildlife & Protected Areas, Hosted by Wildlife Institute of India, Dehradun, Sponsored by Ministry of Environment, Forests & Climate Change, Govt of India

65. Some extremely rare wildlife dwells in Gujarat. The Asiatic Lion is found only in Gir. The Wild Ass in the Rann of Kutch, the rare Great Indian Bustard in the bird reserves, the world's only Four-horned Antelope and the Black Buck are some other valued species protected in Gujarat.

66. None of the proposed sub-projects are located inside or near or passing through the designated core and/or buffer zones of national parks, sanctuaries, biosphere reserves, and reserved forests.

Human and Economic Development

Demography

67. As per 2011 census, the population of Banaskantha district is 31,20,506, which constitutes 5.16% of Gujarat's population. Sex ratio of the district is 938 females for 1000 males. Average literacy of the district stands at 65.32%, while male and female literacy figures are 78.15% and 51.75% respectively. The district has a population density of around 290 persons per square kilometer.

Agriculture

68. Banaskantha contributes significantly to Agricultural production in the state. It is the largest producer of potatoes and one of the leading producers of Isabgul (*Psyllium husk*) in the country. Bajri, Maize, Tobacco, Castor oil and Jowar are the major crops of the district. Apart from Isabgul, other spices like Fennel, Fenugreek and Cumin are also produced in the district.

Industries

69. Agro & Food processing, Tourism, textile and mineral based industries (ceramics) form the major industrial base of the district. The district ranks 1st in the production of vegetable oil in the state. A significant number of Medium & Large Scale Industries (MSI & LSI) in Banaskantha district are engaged in the production of granite, marble blocks, cement and Food Processing. Some of the prominent names are Shreeji Granite, Tirupati Marbles Ltd, Shri Ram Cement, Gujarat Agro Industries, Royal proteins etc. There are seven small-scale industries (SSI) clusters in the state; 3 in Palanpur taluka, 2 in Vadgam taluka and one each in Danta and Deesa talukas. The textile clusters located in Palanpur and Vadgam talukas together consists of 397 units. The diamond processing cluster located in Palanpur and Deesa has 104 units, while 48 units are present in ceramic cluster present at Danta. See Table 4.6 below.

Table 4.6 Industrial Status of Banaskantha District

S.No.	Head	Unit	Particulars
1.	Registered Industrial Unit	Nos.	524
2.	Total Industrial Unit	Nos.	-
3.	Registered Medium and Large Unit	Nos.	15
4.	Estimated Avg. No. of Daily Worker Employed in Sma Scale Industries	No.	No data-
5.	Employment in Large and Medium Industries	No.	1200
6.	No. of Industrial Area		06
7.	Turnover of Small Scale Industries		NA
8.	Turnover of Medium and Large Scale Industries		NA

Source: Brief Industrial Profile of Banaskantha District, GoIndia, Ministry of Micro Small and Medium Enterprises, 2013

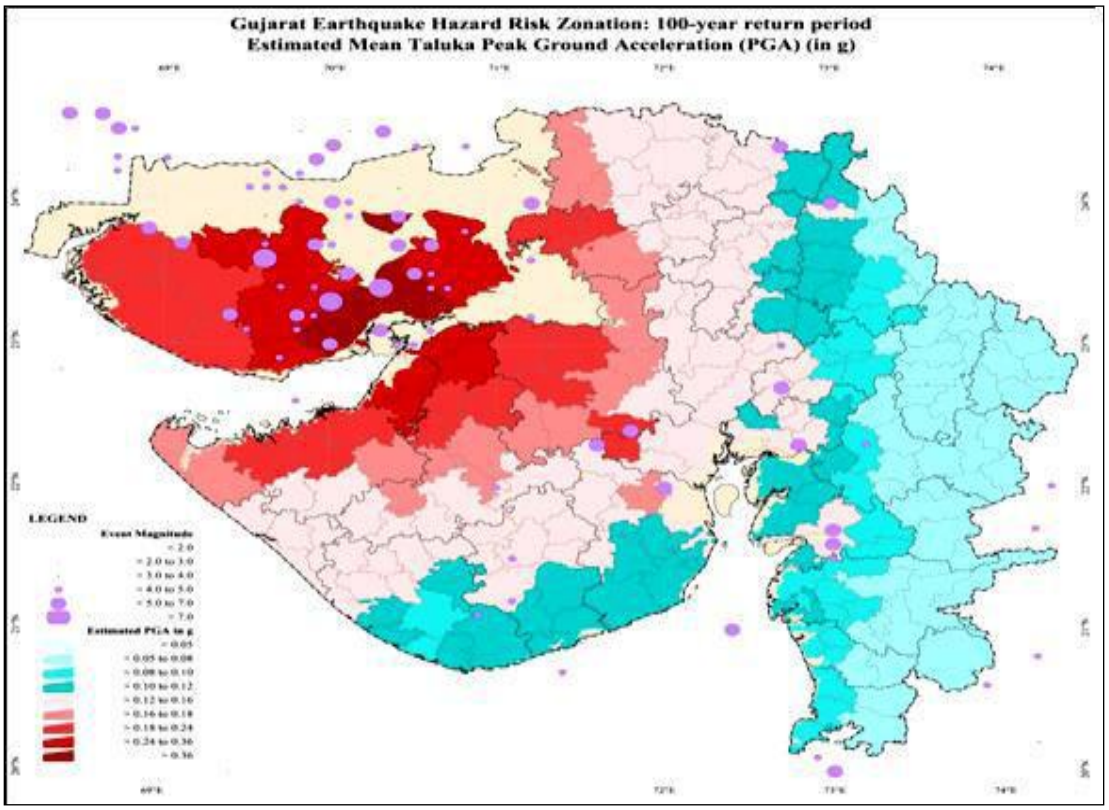
4.1.2 Seismology in Gujarat

70. As per Indian Seismic Zone Map, Gujarat region lies in three zones- Zone III, IV and V. Kachchh region (about 300 km x 300 km) lies in zone V where earthquakes of magnitude 8 can be expected. A belt of about 60-70 km width around this zone covering areas of North Saurashtra and areas bordering Eastern part of Kachchh lie in zone IV where intensity VIII can be expected mainly due to earthquakes in Kachchh and some local earthquakes along North

Kathiawar Fault in Northern Saurashtra. The rest of Gujarat lies in zone III where intensity VII earthquakes can be expected due to moderate local earthquakes or strong Kachchh earthquakes.

71. The estimated mean taluka earthquake peak ground acceleration (PGA) zonation for a 100-year return period is presented in the **Figure 4.3**. All of Kachchh, almost the entire coastline of northern Saurashtra that adjoins Kachchh and a small area in Patan district fall into the very sever intensity zone over a 100-year return period. The cities of Ahmedabad, Bharuch, Rajkot, and Bhavnagar fall into the severe intensity zone, while Bhuj and Jamnagar fall in the very severe intensity zone over this time frame.

Figure 4.3: Gujarat Earthquake Hazard Risk Zonation Map



Source: Gujarat State Disaster Management Plan, Volume 1, ***Gujarat State Disaster Management Authority 2016-17***

5.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Project's Area of Influence

72. The project's area of influence covers the project sites and the associated facilities. Direct impacts result from the components as follows:

- 400 kV D/c Radhanesda (GETCO) - Banaskantha line (PG) – **95.00 km**

73. 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…"

74. Within this context, the proposed 400 kV Radhanesda Pooling Substation of GETCO will be an associated facility.

75. **Figure 5.1** presents the project's area of influence.

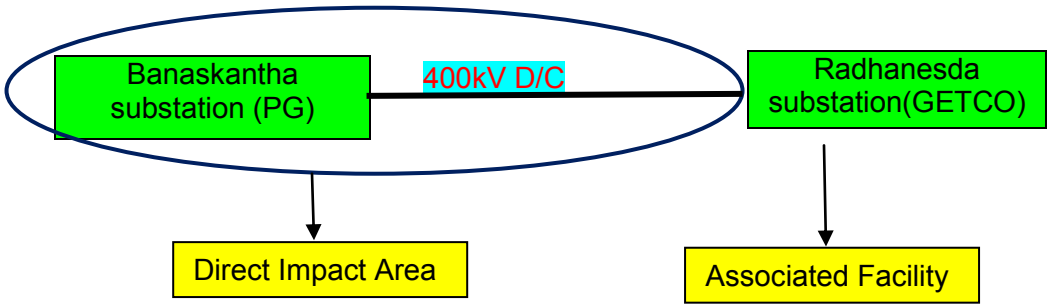


Figure 5.1 Project's area of influence

5.2 Impacts and mitigation measures due to location and design

76. 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:

77. Distance from various receptors such as schools, hospitals, community centers, houses, national highway, temples etc. is give in **Table 5.1** below:

Table 5.1: Approximate distance of subprojects from sensitive receptors*

Sl. No.	Name of Substation	Distance from houses, other facilities	Distance from project site to schools	Distance from project site to Temple etc.	Distance from project site to Community market	Distance from National Highway or major road or railways	Distance from Health Facilities	Previous Land Use/Area
		1	2	3	4	5	6	7
1	765/400/220 kV Banaskantha Substation (PG)	300 m	1000 m (Govt School)	Temple 1500 m	The proposed land is located at Mudetha village in Banaskantha district. *Co-ordinates: 24°8'27.18" N 71°59'46.49"E*	Location is just adjacent to Mudetha – Ariniwad Road which connect NH-14 at a distance of 1.4 km. No new approach road is required	1400 m	Barren Government land Size of land – 167 acre
2	Gantry Point of PG near 400/220 kV Radhanesda (GETCO) Substation	Border camp 700 m	None	None	Major Nearby Town Tharad – approx. 12 km	SH-63 at a distance of approx. 10 km	None	PG Gantry on barren Government land. substation land yet to be transferred to GETCO by State Govt.

**** Safe distances from the facilities shall be maintained as per CEA (Measures relating to safety and electric supply), Regulation, 2010.***

(i) Land value depreciation

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

(ii) Historical/cultural monuments/value

79. As per the policy of route selection, only that route alignment is finalized which avoids all the historical and cultural monuments. As per the preliminary assessment carried out during finalization of route alignment in consultation with State Revenue authorities and Archaeological Survey of India (ASI), no such monuments are coming in the proposed route alignments. Moreover, utmost care shall be taken during detailed survey to avoid such areas. However, during excavation, if any treasure, archaeological artifacts are found the same shall be intimated in writing to Collector/Archaeology department as per the provisions of Section - 4 of "Indian Treasure Trove Act, 1878 as amended in 1949". The Collector shall initiate further action for its safe custody or its shifting to Treasury/ Secure place. The construction activity may be suspended temporarily during this process.

(iii) Encroachment into precious ecological areas

80. All precautions have been taken to avoid routing of transmission line through forest and ecologically-sensitive areas such as national parks and sanctuaries. The route of the proposed transmission line have been finalized in consultation with the Forest Department to ensure that forest areas have been completely avoided.

81. As per preliminary survey/assessment, 95.00 km line route of proposed 400 kV D/c Radhanesda (GETCO) - Banaskantha (PG) line has been aligned in such a manner that it does not involve any forest area & any protected areas.

82. However, exact involvement of forest stretch shall be known only after detailed survey and finalization of route alignment. Under the Forest (Conservation) Act 1980, prior approval from the MoEF&CC 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.

(iv) Encroachment into other valuable lands

83. Impacts on agricultural land will be restricted during the construction phase and when large-scale maintenance measures are required during the O & M 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 sq.m. per average farm holding **(Figure 5.2)**

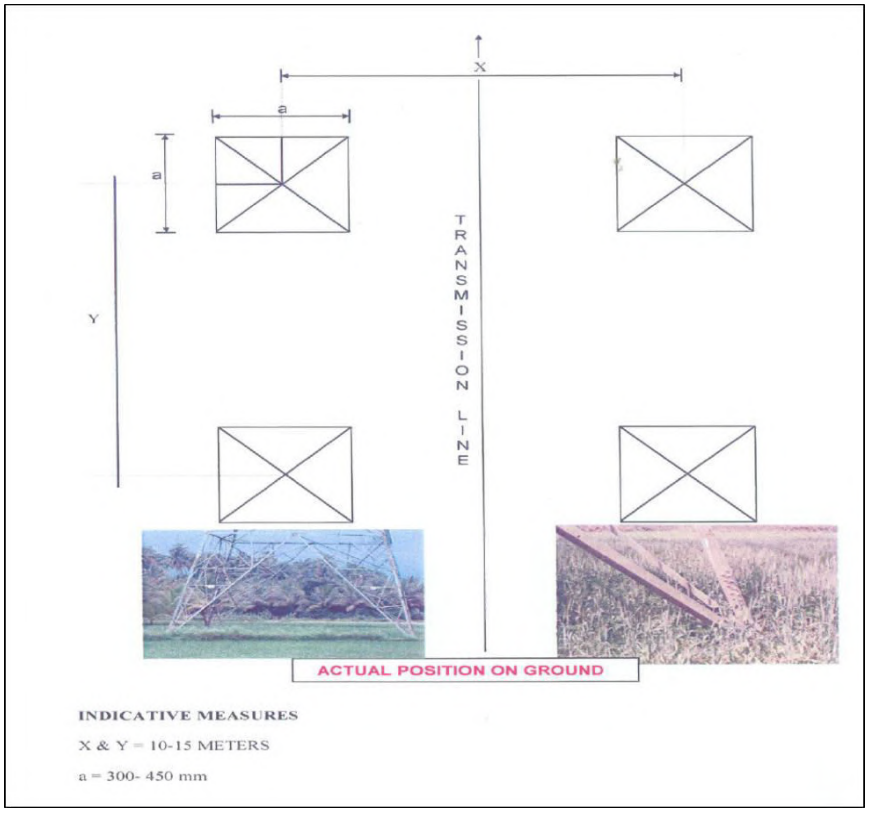


Figure 5.2 Typical plan of Transmission tower footings
Source: ESPP 2009, Appendix XVI

84. It is estimated that for 400 kV D/c Radhanesda (GETCO) - Banaskantha (PG) line (95.00 kms) a total of 257 towers will result in a total land loss of approx. 257 sq.m. or 0.0257 ha. of land which is negligible and will not adversely affect the land holding.

85. As per existing law, land for tower and right of way is not acquired and agricultural activities are allowed to continue after construction activity and POWERGRID pays compensation for all damages and will also pay compensation towards diminishing land value for area under tower base as well as ROW as per recent guidelines issued by MoP, GOI on 15th October 2015.

86. 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.

87. 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.

88. 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). It is estimated that a total of 5800 of trees is likely to be affected due to construction of said line[9] (refer **Table-5.2**). The major species of trees found in the subproject area are Neem (*Azadirachta indica*) Babool (*Acacia nilotica*) and other Thorny Bushes.

Table 5.2: Total Number of Trees

Details	Trees in Private Area (Numbers)	Trees in Govt Area (Numbers)	Total
400 kV D/c Radhanesda-Banaskantha line	5,600	200	5,800

89. Agricultural lands under private ownership will be identified, and in accordance with normal POWERGRID procedures compensation will be paid to the affected villagers. The procedure for providing trees/crops compensation[10] is described in **Annexure-1.**

90. Budgetary provision of **Rs 14.93 lakhs** is made in the project cost estimates to meet Environment Management and Monitoring Costs are provided in **Annexure- 2**.

(v) Interference with other utilities and traffic

91. 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

[9] Above trees are tentative and based upon preliminary survey of said line and shall be calculated exactly after detail/check survey.
[10] Discussed in detail in Compensation Plan for Temporary Damages (CPTD) Report

necessary, from the aviation authorities that are likely to be affected by the construction of the transmission lines.

92. Transmission lines affect nearby telecommunication circuits by causing electrical interference. A standing committee -- Power Telecom Co-ordination Committee (PTCC) 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.

93. 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 neighbouring 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.

94. Wherever transmission line crosses the railways, clearance is taken from that department. 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 near the airports, the towers beyond specified height are painted in alternate orange and white stripes for easy visibility and warning lights (aviation) are placed atop these towers.

95. The main approach road for accessing the construction sites are either through National Highways, i.e. NH-14 & NH-15 or through other State/Village roads bifurcating from these National Highways. The volume of traffic on these roads is found to be of low to medium intensity. Therefore, possibility of any steep rise in volume of traffic due to mobilization for said projects is not envisaged.

(vi) Interference with drainage pattern

96. As the transmission lines are constructed aerially and the blockage of ground surface is limited to area of tower footings, which is very small, there is little possibility of affecting drainage pattern. However, management measures as specified in EMP (refer clause - 5 & 12) like appropriate siting of towers shall be undertaken during detailed alignment survey and design to avoid any incidence of flooding hazards of loss of agricultural production due to interference with drainage patterns or irrigation channels.

97. In the infrequent instances where the natural flow/drainage is affected, flow will be trained and guided to safe zones. In the instant scheme, no tower will be placed in the river bed as there is no major river crossing in the proposed transmission line. Further, substations are located in plane terrain and hence no effect on drainage of the area is envisaged particularly with adequate arrangement of drainage built in all substation design.

(vii) Escape of polluting materials

98. The equipments installed on lines and substations are static in nature and do not generate any fumes or waste materials. However, detailed specification with respect to equipment design and substation sewage design has been included in tender document to avoid any incidence of land and water contamination. Apart from this, solid waste like packing materials, cables, aluminum conductor, sand, aggregate material, cements and steel generated

during construction is carefully handled and removed from site. To avoid contamination of ground water/land from leakage of transformer oil, an oil sump is constructed below each transformer to collect any oil during change over or leakage. Oil sump is a part of standard design criteria for transformer foundation.

(viii) Explosion/fire hazards

99. 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.

100. Fires due to flashover from lines can be a more serious problem in forest. However, adequate safety measures shall be taken to avoid such incidence and has been included in EMP (refer clause - 15, 23 & 52). Besides this forest authorities also incorporate measures like making fire lines to prevent spreading of fire in the affected forest area. Apart from this, state of art safety instruments are installed in the substations on both the ends so that line gets tripped within milliseconds in case of any fault.

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

101. The project components will not be making use of any natural resources occurring in the area during construction as well as maintenance phases. The construction materials such as tower members, cement etc. shall come from factories while the excavated soil shall be used for leveling and backfilling to restore the surface. During construction of line, very small quantity of water is required which is met from nearby existing source or through takers. Hence, it may be seen that the activities associated with implementation of subject project shall not cause any accelerated use of resources for short term gain.

(x) Endangering of species

102. No endangered species of flora and fauna are found to exist within the areas affected by the project components. The location of project with respect to nearest protected areas is shown as **Map 1a & 1b**. **Table-5.3** below provides details about distances of nearest National Parks/Wildlife Sanctuary (WLS) from project components:

Table 5.3: Distance from WLS and National Parks from subprojects

Sl.N.	Name of Protected Area	Minimum Distance from line/substation
1	Jessore Sloth Bear Sanctuary	Approx. 44.5 km from proposed Banaskantha substation/line (**Map-1a**).
2	Balaram Ambaji Sanctuary	Approx. 52 km from proposed Banaskantha substation/line (**Map-1b**).

(xi) Promoting undesirable rural to urban migration

103. The 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

104. 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. Schematic map depicting area of influence by 400 kV line is enclosed as **Map-2**.

105. If forest areas are encountered, clearing of vegetation along the RoW will be done under the supervision of the Forest Departments[11]. 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. For 400 kV line, three-meter wide strips under each conductor will be cleared and maintained as maintenance rows, but the remaining area 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

106. During construction limited quantity of excavated material will be generated from tower foundations and bay extension in substation. However, adequate measures shall be taken to store excavated materials properly for leveling and refilling after construction is over. In case of hill slopes and erosion prone soils, internationally accepted engineering practices including bio-engineering techniques, wherever, feasible shall be undertaken to prevent soil erosion. Hence, uncontrolled silt run off is not anticipated.

107. The proposed transmission line does not involve any river crossings. Normally as per practice, POWERGRID takes all possible efforts to avoid placing of tower in the river bed while crossing the river. In case, complete avoidance is not possible, due precaution to minimize impact on river ecology shall be undertaken. Apart from these measures, practices such as construction during lean period, dredging by using anti-turbidity technology, driver pre-cast pile technique etc. shall be used to reduce all possible impact on aquatic flora and fauna.

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

108. Most of the excavated materials from the foundation (more than 90%) are being used for leveling & re-filling and remaining materials are disposed properly as detailed out in EMP (refer clause - 25, 26 & 28). 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. In hill slopes and erosion prone soils, internationally accepted engineering practices including bio-engineering techniques, wherever, feasible shall be undertaken to prevent soil erosion, thereby, reducing the possibility of any erosion of

[11] IS: 5613, 1989, Bureau of Indian Standards, Code of Practice for Design, Installation and Maintenance of Overhead Power Lines.

exposed area due to construction activity.

(iv) Nuisance to public/ nearby properties

109. During the site selection, due care was taken to keep the transmission line and substation 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.

110. Impacts on air quality, noise level and vehicular emissions are not major issues with transmission project, their control and management measures have been mentioned in the EMP and protection of environment is a part of contract conditions **(Annexure-3)**.

(v) Interference with utilities, traffic and blockage of access way

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

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

113. POWERGRID will follow all applicable standards concerned with safety for transmission and erection of Substation. These include IS: 5613 – recommendation on safety procedures and practices in electrical work as per CEA (Measures relating to Safety and Electric Supply) Regulation, 2010 notified in the Gazette on 20th Sept. 2010 (**Annexure - 4**). Apart from this, safety precaution like barricading of work area and placement of visible signage shall be undertaken to avoid any unforeseen incident. Furthermore, speed restrictions are imposed on project vehicles in Project/Habitation areas. Moreover, the construction activities associated with Transmission Line projects are not so extensive and only limited excavation is involved in tower foundations. As such, the volume of traffic and movement of construction vehicles laden with construction materials is quite limited and don't pose any safety hazards for local population as well as increase in road accidents. The construction activities in substation area are always undertaken in enclosed/confined areas.

(vi) Inadequate resurfacing for erosion control

114. The proposed line will 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.

115. 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 in dry/non-monsoon period to prevent soil erosion. Since the proposed line is mostly passing through plain area, such problems are not anticipated.

(vii) Inadequate disposition of borrow areas

116. Transmission tower & line bays foundations involve excavations on small scale basis and the excavated soil is utilized for back-filling. Hence, acquisition/opening of borrow area is not needed.

(viii) Protection of worker's health and safety

117. All health and safety issues and its management aspects are integral part of project/contract specific safety plan (**Annexure- 5**) which is also part of contract condition. Various aspects such as work and safety regulations, workmen's compensation, insurance are adequately covered under the General Conditions of Contract (GCC), a part of bidding documents.

118. Project is executed as per the approved plan and is regularly monitored by dedicated Safety personnel. Moreover, for strict compliance of safety standard/plan a special provision as a deterrent has been added in the contract which provides for a heavy penalty of Rs.10 lakhs for each accidental death and Rs1.0 lakh/each for any injury and is deducted from the contractor's payment and paid to the deceased/affected family (refer **Annexure – 3)**

119. POWERGRID maintains safety as a top priority and has framed guidelines/checklist for workers' safety as its personnel are exposed to live EHV apparatus and transmission lines. These guidelines/checklists include work permits and safety precautions for work on the transmission lines and substations both during construction and operation (**Annexure - 6**) and are regularly monitored by site in-charge.

120. In addition, training will be conducted for 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 and remaining workforce of unskilled labourers will be comprised of mostly local people. As per policy/norms preference shall be given to the eligible local labor having required skills a specific clause has been incorporated in contract conditions (refer clause- 22.2.1 of GCC of Standard Bidding Document) for compliance of same by Contractor.

121. Workers are also covered by the statutory Workmen (Compensation) Act. Regular health checkup 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

122. The Operation and Maintenance (O&M) program in POWERGRID is normally implemented by substation personnel for both the transmission lines as well as 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. Thermo-vision scanning is done using thermo-vision camera which used to measure the temperature of distant objects without any direct contact. It provides thermal information of every point in the entire image. Thermovision cameras are used for online condition monitoring of equipment. Generally, hotspot is developed due to internal fault inside an instrument on account of excessive stress/ loose connections. The same can be detected through Thermovision Camera and corrective action can be taken. Thermovision camera is very useful in detecting loose connections of bolted joints of transmission/ distribution lines, Electrical panels etc.

123. 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 is 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

124. 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.

125. To contain the noise levels within the permissible limits in case of exceedances, 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.[12]

(iii) Escape of polluting materials

126. 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

127. 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.

128. Areas that will be traversed by the subject line are mostly dry agricultural and barren land. Since there are no protected areas, migration path of wildlife exist near the subproject

[12] R. E. Leonard and S. B. Parr, “Tree as a Sound Barrier,” Journal of Forestry, 1970.

project locations, possibility of any disturbance to wildlife is not anticipated. Another phenomenon reported in some places viz. Bird hit/electrocution by electric lines during landing and takeoff near the water bodies, fly path of birds is also not envisaged in the instant case due to routing of line away from such areas.

(v) Environmental aesthetics

129. Normal spacing between the towers is approx. 300-400 m. This spread is not expected to cause visual aesthetics of the localities particularly when it is ensured to route the lines as far away from the localities as possible. POWERGRID takes up plantation of trees to buffer the visual effect around its substations and to provide better living conditions.

130. 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.

(vi) Exposure to electromagnetic fields (EMF)

131. 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.”

132. 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).

133. The magnetic field below 400 kV overhead power transmission lines is estimated at a maximum value of 40 micro Tesla (μT). 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 μ T.

134. 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.

135. POWERGRID is following the approved international standards and design, which are absolutely safe. Based on the studies carried out by different countries on the safety of EHV lines in reference to EMF affect POWERGRID have also carried out such studies with the help of PTI, USA and CPRI, Bangalore on their design. The studies inferred that the POWERGRID design are safe and follow the required international standard (for details refer **Annexure- 7**).

136. Additionally, in order to, ascertain the actual value of EMF, studies by independent as well as in house agencies were carried out. From the studies, it is evident that values of EMF are well within the limits prescribed by ICNIRP for continuous exposure. Since, residential areas

are mostly avoided during routing of line, the chances of continuous exposure are remote. The values are presented in **Table- 5.2** below:

Table 5.4: EMF in POWERGRID lines

Sl. No.	Name of Line	Maximum Value		ICNIRP Limits		Name of the Agency (Date of Study)	Remarks
		Electric Field (kV/m)	Magnetic Field (μT)	Electric Field (kV/m)	Magnetic Field (μT)		
1	400 kV S/C	2.5	--	5	100	CPRI, Bangalore & Osmania University, Hyderabad (Aug'2000)	All readings at 1.8 meter height.
2	400 kV D/C	3.5	--	5	100		
3	400 kV Ballabhgarh-Maharanibagh	3.7	2.32	5	100	Corporate Technology Deptt.(CTD) PGCIL (Feb'2012)	
4	400 kV D/C Bhiwadi-Agra	4.8	2.84	5	100	CTD, PGCIL (Feb'2012)	
5	400kV Hyderabad-Ramagundam	3.2	5.04	5	100		

(vii) Hazardous Waste Disposal

137. Waste batteries and transformer oil will be disposed of through lead waste re-processors in accordance with the provisions of Central Pollution Control Board (CPCB) as per Batteries (Management and Handling) Rules, 2001 and Hazardous Waste (Management, Handling, Trans-boundary Movement) Rules, 2008 issued by MoEF&CC, Government of India. Procedure for disposal of used/ waste oil and used batteries is specified in the ESPP in Appendix X-XI and Appendix IX.

(viii) Sulphur Hexafluoride (SF_6) Leakage

138. SF_6 is a non-toxic greenhouse gas used as a dielectric medium in circuit breakers, switch gear, and other electrical equipment. As regard control of SF_6 leakage, it may be noted that the present standard of SF_6 gas leakage[13] from GIS substation & circuit breaker is 0.5% & 1% per year respectively.

139. Management of SF6 gas is given utmost importance considering its Global Warming Potential. Strict and well defined procedure has been put in place for storage, handling and refilling of SF6 gas cylinders. Every refill is documented and any unusual variation in gas volume is reported to concerned higher officials for review and rectification. Each and every leakage is promptly detected, addressed and documented.

[13] As per IEC Standard 62271-203

140. Considering the importance of SF6 management, it is also incorporated in EMP (refer clause - 45)

5.5 Potential Cumulative Impacts and Strategic Environmental Assessment

141. Environmental impacts of transmission projects are negligible and can be further minimized through careful route selection. Moreover in the instant project the proposed transmission line is associated with environmentally clean solar power as well as no other similar projects are being implemented in the project area, hence no potential cumulative impacts are envisaged. As regard Strategic Environmental Assessment (SEA), due to environmentally friendly renewable generation associated with this project no Govt. SEA has been carried out till date.

6.0 ANALYSIS OF ALTERNATIVES

142. 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 in this section.

143. 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

144. 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.

145. To achieve this, POWERGRID undertakes route selection for individual transmission lines in close consultation with representatives from the MoEF&CC 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.

146. 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 Alternatives Route Alignment of 400 kV D/c Radhanesda- Banaskantha line

147. 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 **(Map -3a-c)**. The comparative details of these alternatives are shown in the **Table 6.1** below:

Table 6.1 Comparative analysis of three alternatives route

S.N	Description	Alternative-I	Alternative-II	Alternative-III
BEE Line length- 85 km				
1.	**Route particulars**			
i.	Route Length (km)	95	100	101
ii.	Terrain			
	Hilly	Nil	Nil	Nil
	Plain	100%	100%	100%
2.	**Environmental impact**			
i.	Name of District(s) through which the line passes	Banaskantha	Banaskantha	Banaskantha
ii.	Town in alignment	No major towns in the alignment. some nearby town/village settlements are Radhanesda, Tadav, Dhima, Tharad Nesda, Mudhetha	No major towns in the alignment. some nearby towns/villages are Radhanesda, Vav Tharad, Dhima, Umedpura Mudhetha	No major towns in the alignment. some nearby towns/villages are Radhanesda, Prattapura, Idhata, Ratanpura, Nesda, Mudhetha
iii.	House within RoW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey
iv.	Forest involvement (km/ha.)	Nil	Nil	Nil
v.	Type of Forest (RF/PF)& whether part of Wildlife Area/ Elephant corridor/ Biodiversity Hotspots/ Biosphere Reserve/ Wetlands or any other environmentally sensitive area, if any	NA	NA	NA
vi.	Density of Forest	NA	NA	NA
vii.	Type of flora	Mainly Neem (*Azadirachta indica*) Babool (*Acacia nilotica*) and other Thorny Bushes	Mainly Neem (*Azadirachta indica*) Babool (*Acacia nilotica*) and other Thorny Bushes	Mainly Neem (*Azadirachta indica*) Babool (*Acacia nilotica*) and other Thorny Bushes
viii.	Type of fauna	Mostly domestic species like *C*ow (*Bos indicus*), Buffalo *(Bubalus bubalis)* Goat *(Capra hircus)*, Donkey (*Equus asinus), Camel (Camelus dromedaries) etc.*	Mostly domestic species like *C*ow (*Bos indicus*), Buffalo *(Bubalus bubalis)* Goat *(Capra hircus)*, Donkey (*Equus asinus), Came l(Camelus dromedaries) etc.*	Mostly domestic species like *C*ow (*Bos indicus*), Buffalo *(Bubalus bubalis)* Goat *(Capra hircus)*, Donkey (*Equus asinus), Camel (Camelus dromedaries) etc.*

S.N	Description	Alternative-I	Alternative-II	Alternative-III
ix.	Endangered species, if any	Nil	Nil	Nil
x.	Historical/cultural Monuments, if any	Nil	Nil	Nil
3.	**Compensation Cost:**			
i.	Crop (Non Forest)	475.00 lakhs (@ 5 lakhs/km)	500.00 lakhs (@ 5 lakhs/km)	505.00 lakhs (@ 5 lakhs/km)
ii.	Land for Tower Base & RoW Corridor	2594.18 (@ 15 lakhs/acre)	2730.71 (@ 15 lakhs/acre)	2758.02 (@ 15 lakhs/acre)
iii.	Forest (CA+NPV)	NA	NA	NA
4.	**Major Crossings:**			
i.	Highway(NH/SH)	2(NH) & 3(SH)	2(NH) & 3(SH)	2(NH) & 3(SH)
ii.	Power Line (Nos.)	5	5	5
iii.	Railway Line (Nos.)	1	1	1
iv.	River Crossing (Nos.)	Nil	Nil	Nil
v.	**Overall remarks**	Shorter in Line length, easy approachability and minimum tree felling and less RoW issues involved	Line length is more and also involves moderate RoW issues and more tree felling as compared to Alt-1	Longest in line and also involve moderate RoW problems as well as more tree feeling

Reasons for Selection of Final Route

148. From the above comparison of three (3) different alternatives, it is evident that Alternative- I is the not only shorter in length than Alternative- II & III but also involve less tree felling as it passes mostly through agricultural lands having low density tree cover area. Further, the route of Alternative-I has better accessibility as it is very close to existing roads and therefore lesser degree of RoW issues as well as construction and O&M problems that are anticipated as compared to other two alternatives. Based on above analysis, **Alternative - I** is considered as the most optimized route and recommended for detailed survey.

149. **Table 6.3** provides locational details for the substations.

Table 6.3: Locational Analysis for 400/220 kV Radhanesda (GETCO) and 765/400/220 kV Banaskantha (PG) substation

S. No	Description	Proposed 400/220 kV Radhanesda (GETCO) Pooling substation	765/400/220 kV Banaskantha (PG) substation
1	Land Details	Barren land identified for substation by State Govt. Land yet to be transferred to GETCO.	Barren Govt. Land already in possession with PG
1.1.a	Area of land	--	67.61 Hectares
1.b	Slope/Plain Land	Plain	Plain
1.c	Approximate Amount of land cutting required	None	None
2.	Owner Ship of land (Private/Forest/ Other Government Department/Other)	Government	Government
3.	Private land (in ha.)	NA	NA
	(i) Agriculture :- a) Irrigated b)Non – irrigated	NA	NA
	(ii) Non - Agriculture/ Private Wasteland / barren.	NA	NA
	(iii) House or Building: a) Residential b) Non – Residential	NA	NA
4.	Distance from Nearest (With name)		
4.a	River (Name/Distance)		
4.b	Highway	NA	NH-14 -1.4 km
4.c	Forest Area	NA	NA
4.d	Village / town	Radhanesda	Mudetha
4.e	Market/Area of Economic Activity	Radhanesda	Mudetha
5.	Road accessibility	Connected with Metal Road	Metal road connecting Arniwad village
6.	EHV Line Passing Near By (Distance)	NA	220 kV D/C passing at a distance of 200 meter
7.	HT line Passing Near By	NA	
8.	No. of Forest Trees :- a) Trees to be felled b) Trees to be lopped	NA	NA
9.	No. of private trees	NA	NA
	(i) Fruit Trees: a) Trees to be felled b) Trees to be lopped	NA	
	(ii) Non - Fruit Trees: a) Trees to be felled b) Trees to be lopped	NA	NA

S. No	Description	Proposed 400/220 kV Radhanesda (GETCO) Pooling substation	765/400/220 kV Banaskantha (PG) substation
10.	Distance from coastal area	NA	NA
11.	Distance from cultivated area	Semi desert area	Outside boundary
12.	Altitude of Substation	MSL- 7.92 m	MSL- 95.4 m
13.	Nearest distance from airport/national & international boundaries	International Boundary: Approx. 35 km	Ahmedabad Airport- approx. 130 km
14.	Distance from nearest religious or archaeological sites	NA	Temple at a distance of 1500 m at Mudetha

7.0 INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

150. Public consultation/information is an integral part of the POWERGRID project cycle. POWERGRID follows a well-defined procedure for conducting public consultation involving different techniques as laid down in its ESPP. There are 10 different techniques which are used either independently or in combination appropriately at different milestones of the project depending on field conditions (for details refer **Annexure -8**).

151. The location for public meeting is usually selected at every 50-100 km involving major villages/habitated area en-route of line. However, in other villages/parts, informal group meetings or other techniques are applied for consultation. The consultation and feedback process is a continuous one and implemented regularly at different milestone of project cycle. As per the Action Plan for Safeguards, POWERGRID has conducted stakeholder consultations that had some representation of women. Since public consultation is a continuous process, major emphasis on women representation shall be provided in subsequent consultations.

152. The process of consultation and information dissemination begins even before the start of work as POWERGRID informs the general public by publishing in 2 (Two) local newspapers in vernacular language on implementation of project indicating the route of final alignment with name of the town /villages its passing. During survey also POWERGRID site officials meet people and inform them about the routing of transmission lines. During construction, every individual, on whose land the transmission line is constructed and people affected by RoW, are consulted. Apart from this, Public consultation using different technique like Public Meeting, Small Group Meeting, Informal Meeting shall also be carried out during different activities of project cycle. During such consultation the public are informed about the project in general and in particular about the following:

- Complete project plan (i.e. its route and terminating point and substations, if any, in between);
- Design standards in relation to approved international standards;
- Health impacts in relation to EMF;
- Measures taken to avoid public utilities such as school, hospitals, etc.;
- Environmental and other impacts associated with transmission lines and POWERGRID approach to minimizing and solving them; and
- Trees and crop compensation process.

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

- ✓ Whether this line will improve the power supplies in our village and remove frequent interruption/outage;
- ✓ Whether these lines are safe for the nearby dwellers without any problems of electrocution while working in the fields;
- ✓ What is compensation policy for the standing crops damaged and compensation for the land occupied by the tower footings;
- ✓ What about employment for local people and procedure for same; and
- ✓ What is the width of RoW for cutting tree. How much compensation for the trees will be given and when.

154. In the instant scheme also, many group meetings were organized (informally and formally) in all villages where the interventions are likely to happen. Such consultation culminated in public meeting organized at different locations as provided in **Table- 7.1**. These meetings were attended by Village Panchayat members, Senior/respected person of village, interested villagers/general public and representatives from POWERGRID. To ensure maximum participation, prior intimation in local language was given and such notices were also displayed at prominent places/panchayat office etc. During the public consultation details of line and its importance were explained to the villagers by the officials of POWERGRID.

Table 7.1 Details of Public Consultations en-route of Transmission line

Transmission Line	Date of meeting	Name of Village	Taluka-District-Banaskantha	No. of villagers attended	Persons Attended
Radhanesda – Banaskantha 400 kV D/c line	**Informal Group Meeting**				
	20.07.2016	Paldi	Deesa	14	Village Panchayat representatives, farmers, teachers and others interested persons attended the meeting.
		Ratanpura	Deesa	12	
		Soila	Deesa	15	
	22.07.2016	Nesda-Nava	Deesa	20	
		Nesda-Juna	Deesa	11	
		Ramvas	Deesa	15	
	23.07.2016	Soni	Deodar	14	
		Navapura	Deodar	12	
		Manpur	Deodar	15	
		Shergarh	Deodar	19	
	Public Consultation Meeting				
	27.07.2016	Zalodha	Diodar	51	Village Sarpanch, Talati of the village and several senior dignitary of village & interested public participated in this program

155. The consultation was arranged in interactive manner in local language and queries like crop/land compensation, employment opportunities for village youths, health & safety, improvement of power scenario & infrastructure in region etc. were addressed. The initiative was appreciated by the villagers and they assured their cooperation for construction of the said lines. The process of such consultation shall continue during different stage of project implementation and even during O& M stage. Details of above public consultation meetings including minutes of meeting, list of participants, photographs and public queries & answers are enclosed as **Annexure - 9**.

156. POWERGRID will provide relevant environmental information, including information from the above documents in a timely manner, in an accessible place and in Hindi and English to affected people and other stakeholders.

8.0 GRIEVANCE REDRESS MECHANISM

157. Grievance redressal is 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. The contact person is the POWERGRID's head of project at the project site.

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

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

160. The complainant will also be allowed to submit its complaint to local project official who will pass it to GRC immediately but not more than 5 days of receiving such complaint. The first meeting of GRC will be organized within 15 days of its constitution/disclosure to formulate procedure and frequency of meeting. In case of any complaint, GRC meeting shall be convened within 15 days. If Project level GRC not able to take decision it may refer the complaint to corporate GRC for solution. GRC endeavor will be to pronounce its decision within 30-45 days of receiving grievances. In case complainant/appellant is not satisfied with the decision of project level GRC they can make an appeal to corporate GRC for review. The proposed mechanism does not impede access to the country's judicial or administrative remedies at any stage.

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

9.0 ENVIRONMENTAL MANAGEMENT PLAN

9.1 Institutional Mechanism for Mitigation and Monitoring Requirements

162. 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

163. 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&CC for expediting forest clearances and follow-ups with the Ministry of Power.
- Imparts training to POWERGRID’s Regional Head Quarters (RHQs) and site officials on environment and social issues and their management plan.

b) Regional Level

164. 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

165. 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 also head of Environmental and Social Management Team (ESMT) at site. Key functions of the ESMT are:

- Conduct surveys on environmental and social aspects to finalize the route for the power transmission projects;
- Conduct surveys & Interact with Revenue Authorities for land acquisition;
- Interact with the Forest Departments to make the forest proposal and follow it up for MoEF&CC clearance;
- Implementation of EMP;
- Monitoring of EMP & producing periodic reports on the same.

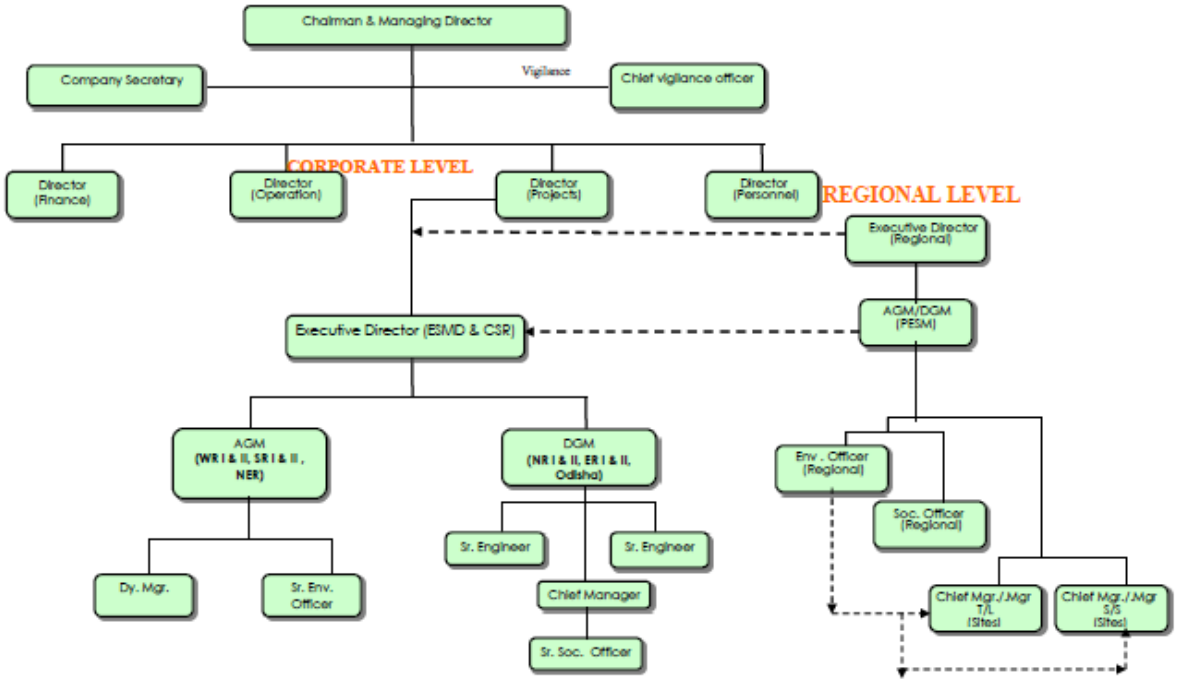


Figure 9.1 Organisational support structure for EMP implementation and monitoring

166. 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 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 is included in the contract document.

9.2 Environmental Monitoring and Management Plan

167. A comprehensive and a detailed 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 IEAR which shall be implemented during various stages of project.

168. The environment monitoring reports (EMR), which will report on the status of EMP implementation including necessary corrective actions, will be prepared by POWERGRID and disclose on its website semi-annually as per agreed format for previous loans and submitted to ADB for review. POWERGRID is well equipped to implement and monitor its environment and social management plans.

9.3 Institutional Mechanism for Reporting and Review

169. POWERGRID, through the PMU, will be responsible for internal monitoring of EMP implementation and the Action Plan for Safeguards, and will forward semi-annual progress reports of the ADB financed components to ADB (the GoI, if required). The reports will cover EMP implementation with attention to compliance and any needed corrective actions. On-going consultation remedial measures, if any, will be incorporated in the EMP.

170. Construction contractors will be responsible for the implementation of mitigation measures during the construction stage[14]. The IEAR, including its revisions and updates, if any will be made publicly available by POWERGRID on its website.

171. POWERGRID will (i) update IEAR (if needed) and EMPs before contracts are finalized and work begins; (ii) prepare environmental monitoring reports; (iii) officially disclose environmental safeguards documents on its website in a timely manner, and in Hindi and English to the affected persons; (iv) document instances where EMP requirements were met or not met, status of associated corrective actions agreed with contractor and POWERGRID site staff, feedback from consultations with local residents, and shortcomings identified in site visit reports by environmental specialists from POWERGRID or external consultants.

172. 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. In case there are unanticipated impacts noticed during the implementation, POWERGRID shall take necessary action to mitigate the impact and inform ADB of such occurrence.

173. The EMP implementation shall be sufficiently ensured by the environment specialists from POWERGRID.POWERGRID will engage environmental specialists based on assessment and requirements during construction for each project.

[14] As per POWERGRID policy, provisions of ESPP and EMP are included in contract/bidding documents and already explained in Clause no. 5.3 (viii)

Table 9.1 Environment Management Plan (EMP)

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
Pre-construction							
1	Location of line towers and line alignment and design	Exposure to safety related risks	Setback of dwellings to line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and alignment selection with respect to nearest dwellings	Setback distances to nearest houses – once	POWERGRID	Part of tower sitting survey and detailed alignment survey and design
2	Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	PCBs not used in substation transformers or other project facilities or equipment.	Transformer design	Exclusion of PCBs in transformers stated in tender specification – once	POWERGRID	Part of tender specifications for the equipment
			Processes, equipment and systems not to use chlorofluorocarbons (CFCs), including halon, and their use, if any, in existing processes and systems should be phased out and to be disposed of in a manner consistent with the requirements of the Govt.	Process, equipment and system design	Exclusion of CFCs stated in tender specification – once	POWERGRID	Part of tender specifications for the equipment
					Phase out schedule to be prepared in case still in use – once		Part of equipment and process design
3	Transmission line design	Exposure to electromagnetic interference	Line design to comply with the limits of electromagnetic interference from power lines	Electromagnetic field strength for proposed line design	Line design compliance with relevant standards – once	POWERGRID	Part of design parameters
4	Substation location and design**	Exposure to noise	Design of plant enclosures to comply with noise regulations.	Expected noise emissions based on substation design	Compliance with regulations - once	POWERGRID	Part of detailed siting survey and design
		Social inequities	Careful selection of site to avoid encroachment of socially, culturally and archaeological sensitive areas (i.e. sacred groves, graveyard, religious worship place, monuments etc.)	Selection of substation location (distance to sensitive area).	Consultation with local authorities -once	POWERGRID	Part of detailed siting survey and design

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

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Minimize the need by using RoW wherever possible	Tower location and line alignment selection	Consultation with local authorities and design engineers - once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
8	Line through identified Elephant corridor / Migratory bird	Damage to the Wildlife/ Birds and also to line	Study of earmarked elephant corridors to avoid such corridors, Adequate ground clearance, Fault clearing by Circuit Breaker, Barbed wire wrapping on towers, reduced spans etc., if applicable	Tower location and line alignment selection. Minimum/maximum ground clearance	Consultation with local forest authorities – once. Monitoring – quarterly basis	POWERGRID	Part of tower sitting and detailed alignment survey & design and Operation
			Avoidance of established/ identified migration path (Birds & Bats). Provision of flight diverter/ reflectors, bird guard, elevated perches, insulating jumper loops, obstructive perch deterrents, raptor hoods etc[15]., if applicable	Tower location and line alignment selection	Consultation with local forest authorities – once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
9	Line through forestland	Deforestation and loss of biodiversity edge effect	Avoid locating lines in forest land by careful site and alignment selection	Tower location and line alignment selection (distance to nearest protected or reserved forest)	Consultation with local authorities – once	POWERGRID	Part of tower siting survey and detailed alignment survey and design
			Minimise the need by using existing towers, tall towers and RoW, wherever possible		Consultation with local authorities and design engineers – once		
			Measures to avoid invasion of alien species	Intrusion of invasive species	Consultation with local forest authorities – once		
			Obtain statutory clearances from the Government	Statutory approvals from Government	Compliance with regulations – once for each subproject		

[15] *As per International/National best practices and in consultation with concerned forest/wildlife Authority.*

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
10	Lines through farmland	Loss of agricultural production/ change in cropping pattern	Use existing tower or footings wherever possible.	Tower location and line alignment selection.	Consultation with local authorities and design engineers – once	POWERGRID	Part of detailed alignment survey and design
			Avoid sitting new towers on farmland wherever feasible	Tower location and line alignment selection	Consultation with local authorities and design engineers – once		Part of detailed sitting and alignment survey /design
11	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
12	Interference with drainage patterns/ irrigation channels	Flooding hazards/ loss of agricultural production	Appropriate sitting of towers to avoid channel interference	Tower location and line alignment selection (distance to nearest flood zone)	Consultation with local authorities and design engineers – once	POWERGRID	Part of detailed alignment survey and design
13	Escape of polluting materials**	Environmental pollution	Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill clean up equipment.	Equipment specifications with respect to potential pollutants	Tender document to mention specifications – once	POWERGRID	Part of detailed equipment design /drawings
			Substations to include drainage and sewage disposal systems to avoid offsite land and water pollution.	Substation sewage design	Tender document to mention detailed specifications – once	POWERGRID	Part of detailed substation layout and design /drawings
14	Equipments submerged under flood	Contamination of receptors	Substations constructed above the high flood level(HFL) by raising the foundation pad	Substation design to account for HFL (elevation with respect to HFL elevation)	Base height as per flood design- once	POWERGRID	Part of detailed substation layout and design/drawings
15	Explosions /Fire	Hazards to life	Design of substations to include modern fire fighting equipment	Substation design compliance with fire prevention and control codes	Tender document to mention detailed specifications – once	POWERGRID	Part of detailed substation layout and design /drawings
			Provision of fire fighting equipment to be located close to transformers				

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
Construction							
16	Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection seeking to minimize ground disturbance.	Construction techniques and machinery	Construction techniques and machinery creating minimal ground disturbance- once at the start of each construction phase	POWERGRID (Contractor through contract provisions)	Construction period
17	Physical construction	Disturbed farming activity	Construction activities on cropping land timed to avoid disturbance of field crops (within one month of harvest wherever possible).	Timing of start of construction	Crop disturbance – Post harvest as soon as possible but before next crop – once per site	POWERGRID (Contractor through contract provisions)	Construction period
18	Mechanized construction	Noise, vibration and operator safety, efficient operation	Construction equipment to be well maintained.	Construction equipment – estimated noise emissions	Complaints received by local authorities – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
		Noise, vibration, equipment wear and tear	Turning off plant not in use.	Construction equipment – estimated noise emissions and operating schedules	Complaints received by local authorities – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
19	Construction of roads for accessibility	Increase in airborne dust particles	Existing roads and tracks used for construction and maintenance access to the line wherever possible.	Access roads, routes (length and width of new access roads to be constructed)	Use of established roads wherever possible – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
		Increased land requirement for temporary accessibility	New access ways restricted to a single carriageway width within the RoW.	Access width (meters)	Access restricted to single carriage –way width within RoW – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
20	Construction activities	Safety of local villagers	Coordination with local communities for construction schedules, Barricading the construction area and spreading awareness among locals	Periodic and regular reporting /supervision of safety arrangement	No. of incidents- once every week	POWERGRID (Contractor through contract provisions)	Construction period
		Local traffic obstruction	Coordination with local authority/ requisite permission for smooth flow of traffic	Traffic flow (Interruption of traffic)	Frequency (time span)- on daily basis	POWERGRID (Contractor through contract provisions)	Construction period
21	Temporary blockage of utilities	Overflows, reduced discharge	Measure in place to avoid dumping of fill materials in sensitive drainage area	Temporary fill placement (m^3)	Absence of fill in sensitive drainage areas – every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
22	Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m^2)	Clearance strictly limited to target vegetation – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
			No use of herbicides and pesticides				
23	Trimming /cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Species-specific tree retention as approved by statutory authorities (average and max. tree height at maturity, in meters)	Presence of target species in RoW following vegetation clearance – once per site	POWERGRID (Contractor through contract provisions)	Construction period
		Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities	Presence of target species in RoW following vegetation clearance - once per site	POWERGRID (Contractor through contract provisions)	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies.	Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m^2)	Use or intended use of vegetation as approved by the statutory authorities – once per site	POWERGRID (Contractor through contract provisions)	Construction period
24	Wood/ vegetation harvesting	Loss of vegetation and deforestation	Construction workers prohibited from harvesting wood in the project area during their employment, (apart from locally employed staff continuing current legal activities)	Illegal wood /vegetation harvesting (area in m^2, number of incidents reported)	Complaints by local people or other evidence of illegal harvesting – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
25	Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings/ substation foundation disposed of by placement along roadsides, or at nearby house blocks if requested by landowners	Soil disposal locations and volume (m^3)	Acceptable soil disposal sites – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
26	Substation construction**	Loss of soil	Loss of soil is not a major issue as excavated soil will be mostly reused for levelling and re-filling. However, in case of requirement of excess soil the same will be met from existing quarry or through deep excavation of existing pond or other nearby barren land with agreement of local communities	Borrow area sitting (area of site in m^2 and estimated volume in m^3)	Acceptable soil borrow areas that provide a benefit - every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
		Water pollution	Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season	Seasonal start and finish of major earthworks(P^H, BOD /COD, Suspended solids, others)	Timing of major disturbance activities –prior to start of construction activities	POWERGRID (Contractor through contract provisions))	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
27	Site clearance	Vegetation	Tree clearances for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed	Ground disturbance during vegetation clearance (area, m^2) Statutory approvals	Amount of ground disturbance – every 2 weeks Statutory approvals for tree clearances – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
28	Tower erection & Substation foundation- disposal of surplus earthwork / fill	Waste disposal	Excess fill from substation/tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner.	Location and amount (m^3)of fill disposal	Appropriate fill disposal locations – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
29	Storage of chemicals and materials	Contamination of receptors (land, water, air)	Fuel and other hazardous materials securely stored above high flood level.	Location of hazardous material storage; spill reports (type of material spilled, amount (kg or m^3) and action taken to control and clean up spill)	Fuel storage in appropriate locations and receptacles – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
30	Construction schedules	Noise nuisance to neighbouring properties	Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [dB(A)]	Daytime construction only – every 2 weeks	POWERGRID (Contractor through contract provisions)	Construction period
31	Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities – once each new facility	POWERGRID (Contractor through contract provisions)	Construction period
32	Influx of migratory workers	Conflict with local population to share local resources	Using local workers for appropriate asks	Avoidance/reduction of conflict through enhancement/ augmentation of resource requirements	Observation & supervision–on weekly basis	POWERGRID (Contractor through contract provisions)	Construction period

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
33	Lines through farmland	Loss of agricultural productivity	Use existing access roads wherever possible	Usage of existing utilities	Complaints received by local people /authorities - every 4 weeks	POWERGRID (Contractor through contract provisions)	Construction period
			Ensure existing irrigation facilities are maintained in working condition	Status of existing facilities			
			Protect /preserve topsoil and reinstate after construction completed	Status of facilities (earthwork in m^3)			
			Repair /reinstate damaged bunds etc after construction completed	Status of facilities (earthwork in m^3)			
		Loss of income.	Land owners/ farmers compensated for any temporary loss of productive land as per existing regulation.	Process of Crop/ tree compensation in consultation with forest dept. (for timber yielding tree) and Horticulture Dept. (for fruit bearing tree)	Consultation with affected land owner prior to implementation and during execution.	POWERGRID	During construction
34	Uncontrolled erosion/silt runoff	Soil loss, downstream siltation	Need for access tracks minimised, use of existing roads.	Design basis and construction procedures (suspended solids in receiving waters; area re-vegetated in m^2; amount of bunds constructed [length in meter, area in m^2, or volume in m^3])	Incorporating good design and construction management practices – once for each site	POWERGRID (Contractor through contract provisions)	Construction period
			Limit site clearing to work areas				
			Regeneration of vegetation to stabilise works areas on completion (where applicable)				
			Avoidance of excavation in wet season				
			Water courses protected from siltation through use of bunds and sediment ponds				
35	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	POWERGRID (Contractor through contract provisions)	Construction period

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

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

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
43	Equipment submerged under flood	Contamination of receptors (land, water)	Equipment installed above the high flood level (HFL) by raising the foundation pad.	Substation design to account for HFL ("as-built" diagrams)	Base height as per flood design – once	POWERGRID	During operations
44	Oil spillage	Contamination of land/nearby water bodies	Substation transformers located within secure and impervious sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substation bunding (Oil sump) ("as-built" diagrams)	Bunding (Oil sump) capacity and permeability - once	POWERGRID	During operations
45	SF_6 management	Emission of most potent GHG causing climate change	Reduction of SF6 emission through awareness, replacement of old seals, proper handling & storage by controlled inventory and use, enhance recovery and applying new technologies to reduce leakage	Leakage and gas density/level	Continuous monitoring	POWERGRID	During Operations
46	Inadequate provision of staff/workers health and safety during operations	Injury and sickness of staff /workers	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (lost work days due to illness and injuries)	Preparedness level for using these technologies in crisis – once each year	POWERGRID	Design and operation
			Safety awareness raising for staff.	Training/awareness programs and mock drills	Number of programs and percent of staff /workers covered – once each year		
			Preparation of fire emergency action plan and training given to staff on implementing emergency action plan				
			Provide adequate sanitation and water supply facilities	Provision of facilities	Complaints received from staff /workers every 2 weeks		
47	Electric Shock Hazards	Injury/ mortality to staff and public	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (no. of injury incidents, lost work days)	Preparedness level for using these technology in crisis- once a month	POWERGRID	Design and Operation

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Security fences around substations	Maintenance of fences	Report on maintenance – every 2 weeks		
			Barriers to prevent climbing on/ dismantling of 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		
48	Operations and maintenance staff skills less than acceptable	Unnecessary environmental losses of various types	Adequate training in O&M to all relevant staff of substations & line maintenance crews.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	POWERGRID	Operation
			Preparation and training in the use of O&M manuals and standard operating practices				
49	Inadequate periodic environmental monitoring.	Diminished ecological and social values.	Staff to receive training in environmental monitoring of project 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
50	Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems using chlorofluorocarbons (CFCs) , including halon, should be phased out and to be disposed of in a manner consistent with the requirements of the Govt.	Process, equipment and system design	Phase out schedule to be prepared in case still in use – once in a quarter	POWERGRID	Operation
51	Transmission line maintenance	Exposure to electromagnetic interference	Transmission line design to comply with the limits of electromagnetic interference from overhead power lines	Required ground clearance (meters)	Ground clearance - once	POWERGRID	Operation
52	Uncontrolled growth of vegetation	Fire hazard due to growth of tree/shrub /bamboo along	Periodic pruning of vegetation to maintain requisite electrical clearance.	Requisite clearance (meters)	Assessment in consultation with forest authorities - once a year(pre-	POWERGRID	Operation

Clause No.	Project activity / stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
		RoW	No use of herbicides/ pesticides		monsoon/post-monsoon		
53	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

***** These measures will not be applicable in the instant case since no new substation is covered under the present scope of works.***

10.0 CONCLUSION

174. None of the project components is in environmentally-sensitive areas. Careful route selection has resulted in total avoidance of forest areas and protected areas. No impact on wildlife is envisaged as there is no forest/ protected area is involved along the route of the lines.

175. 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. Overall, the environmental impacts associated with project are mainly limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.

176. Best available technology and best management practices are built-in to the project design. The project shall not have environmentally significant impacts, and is classified as environment category "B" as per the ADB safeguard category.[16] As noted in the IEAR document, all project components will be implemented and monitored in line with the Environmental and Social Policy & Procedures of POWERGRID and the Action Plan for Safeguards prepared for the use of CSS.

[16] ESPP refers to the ADB's safeguard category system.

ANNEXURE – 1

TREE / CROP COMPENSATION PROCEDURE

TREE AND CROP COMPENSATION PROCEDURES

In exercise of the powers vested with Power Grid Corporation of India Limited (POWERGRID) under Indian telegraph Act'1885, part 3, section 10 to 19 conferred under section 164 of the Electricity Act 2003 through Gazette by India, extra ordinary dated 24th Dec. 2003, has the authority to place and maintain transmission lines under over along or across and posts in or upon, any immoveable property. As per the provisions of Indian Telegraph Act1885 Part III Section 10 (b) which prohibits acquisition of any rights other than that of use only, land for tower and right of way is not acquired and agricultural activities are allowed to continue. However, as per clause 10 (d) of same act stipulates that the user agency shall pay full compensation to all interested for any damages sustained during the execution of said work. Accordingly, POWERGRID pays compensation to land owners towards damages if any to trees or crop during implementation of transmission project as well as during Operation and maintenance phase. The procedure followed for such compensation is as follows:

POWERGRID follows the principle of avoidance, minimization and mitigation in the construction of line in agricultural field having crop due to inherent flexibility in phasing the construction activity and tries to defer construction in cropped area to facilitate crop harvesting. However, if it is unavoidable and is likely to affect project schedule, compensation is given at market rate for standing crops. All efforts are also taken to minimize the crop damage to the extent possible in such cases. As regards trees coming in the Right of Way (RoW) following procedure is adopted for enumeration:

i) All the trees which are coming within the clearance belt of ROW on either side of the center line are identified and marked/numbered from one AP to the other and documented.
ii) Type, Girth (Measured 1 m. above ground level), approximate height o the tree is also noted for each tree
iii) Trees belonging o Govt., Forest, Highways and other local bodies may be separately noted down or timely follow up with the concerned authorities for inspection and removal.
iv) Cashew, Guava, Lemon and other hybrid trees which are not of tall growing nature are not marked for cutting since these trees can be crossed using standard tower extensions if required.

A notice under Indian Telegraph Act is served to the land owners informing that the proposed transmission line is being routed through the property of the individual concerned. The notice shall contain the particulars of the land, ownership details and the details of the trees/crops inevitability likely to be damaged during the course of the construction of the proposed transmission line and acknowledgement received from land owner. A copy of said notice is further issued to the Revenue Officer, who has been authorized by the State Govt. for the purpose of assessment/valuation and disbursement of compensation to the affected parties.

The revenue officer shall further issue a notice of intimation to the concerned land owner and inspect the site to verify the documents related to the proof of ownership and a detailed Mahazar is prepared for the identified trees and crops inevitability damaged during the course of the construction. For assessing the true value of timber yielding trees help of forest officials is taken and for fruit bearing trees help of Horticulture department is taken.

The Mahazar shall contain the land owner details type of tree/crop, its present age, variety, yielding pattern etc. and the same is prepared at site in the presence of the land owner. These Mahazars are further compiled and a random verification is conducted by the concerned District Collector OR his authorized representative in order to ascertain the assessment carried out by the revenue office is genuine and correct. After this process the District collector issues a tree cutting permit to Power Grid Corporation to enable removal / damage to the standing tree/crop identified in the line corridor.

Once the tree/crop is removed / damaged, POWERGRID shall issue a tree cutting/crop damaged notice to the land owner with a copy to the Revenue Officer to process the compensation payment. Based on the above the compensation payment is generated by means of a computerized programme developed by the National Informatics Center exclusively for this purpose. The detailed Valuation statement thus generated using this programme is verified at various levels and approval of payment of compensation is accorded by the concerned District Collectors.

On approval of compensation, the revenue officer shall further intimate the amount payable to the different land owners and POWERGRID arranges the payment by way of

Demand Draft to the affected parties. The payment is further disbursed at the local village office after due verification of the documents in presence of other witnesses.

Procedure exclusively followed in Kerala State:

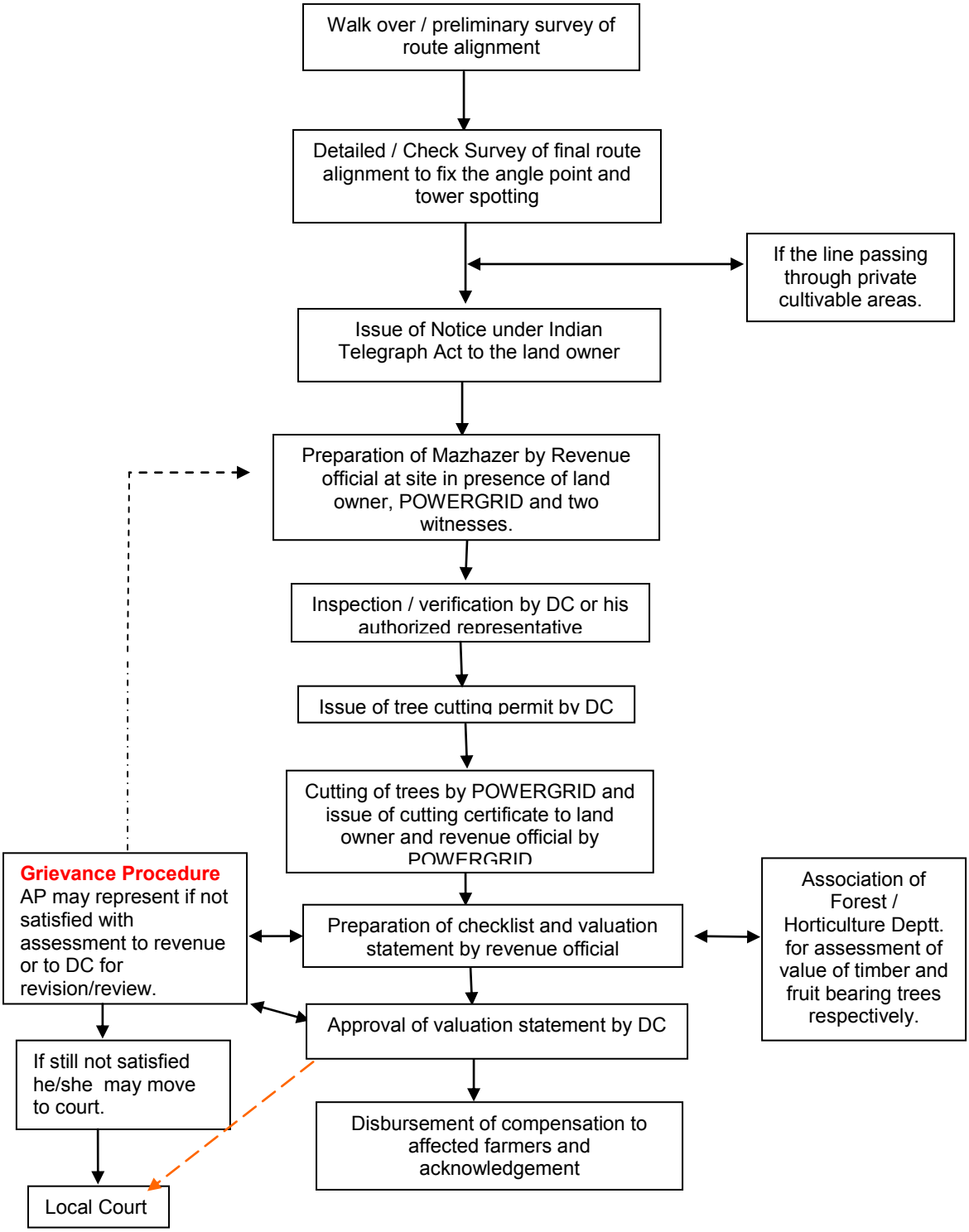
Due to typical demography of Kerala state and presence of several orchards of Coconut and Rubber, State government in consultation with Kerala State Electricity Board (KSEB) have devised a formula for arriving the compensation which is as follows:

Compensation = yield X constant factor X average market value X future age.

The constant factor is to arrive the net return component for the particular variety of tree in line with the annuity ratio slab prescribed for the balance life of the tree. A sample calculation sheet using the said formula to arrive at compensation towards trees / crop is enclosed for ready reference.

Another measure adopted in Kerala to expedite assessment and disbursement by POWERGRID is to appoint an Special Revenue Officer and associated staff on deputation from State Government exclusively for the project under execution. This has helped in timely assessment and distribution of compensation amount to affected farmer. Moreover, it has further contributed in simplifying the process as affected farmer need not to visit revenue official again and again and his case is processed at site quickly.

TREE / CROP COMPENSATION PROCESS



ANNEXURE – 2

ESTIMATED BUDGET

Budget Estimate for Environment Management and Monitoring Plan

400 kV D/c Radhanesda (GETCO) to Banaskantha (PG) Transmission line
Total line length: 95.00 Kms.

A.	Mitigation Measures/Compensation	Forest Area (ha)	Rs. (in lakhs)
a	Forest Compensation	Nil	0
b	EMP Mitigation*		15.00
	Sub Total A		**Rs. 15.00**
B.	**Implementation Monitoring & Audit**		
a.	Man-power involved for EMP implementation & Monitoring in entire route of Transmission lines (Rs.10,000/-x 95.00 Kms.)		9.50
b.	Independent Audit (LS)** if needed		5.00
	Sub Total B		**Rs. 14.50**
C.	**Contingent cost 3% (A)+(B)**		**Rs. 0.88**
	Total Cost (A+B+C)		**Rs. 30.38 Lakhs**

* Most of the EMP related cost included in Contractor scope and is part of overall bidding cost. However, provision for Rs. 15.00 lakhs has been made to meet future contingency, if any

**Generally not required for Environment Category B projects under ADB SPS 2009.

Note : Compensation cost of Rs. 475.00 lakhs towards tree/crop/ other damages and land compensation cost of Rs 2594.18 for tower base & RoW corridor have been excluded from above budget estimate as same shall be part of CPTD report prepared separately for this project

ANNEXURE – 3

ESPP & EMP AS PART OF CONTRACT DOCUMENT

not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the government.

p) Factories Act 1948: The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

GC 22.4.1 Addition of New Clause GC 22.4.1

Protection of Environment

The Contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as consequence of his methods of operation.

During continuance of the Contract, the Contractor and his Sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made thereunder, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

Salient features of some of the major laws that are applicable are given below:

The Water (Prevention and Control of Pollution) Act, 1974, This provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

The Air (Prevention and Control of Pollution) Act, 1981, This provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

The Environment (Protection) Act, 1986, This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property.

The Public Liability Insurance Act, 1991, This provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under Environment (Protection) Act; 1986, and exceeding such quantity as may be specified by notification by the Central Government

GC 22.4.2 **Addition of New Sub Clause 22.4.2**

(i) The Contractor shall (a) establish an operational system of managing environmental impacts, (b) carry out all the monitoring and mitigation measures set forth in the environment management plan attached to the Particular Conditions as Appendix-I, and (c) allocate the budget required to ensure that such measures are carried out. The Contractor shall submit to the Employer (quarterly) semi-annual) reports on the carrying out of such measures.

(ii) The Contractor shall adequately record the conditions of roads, agricultural land and other infrastructure prior to transport of material and construction commencement, and shall fully reinstate pathways, other local infrastructure and agricultural land to atleast their pre-project condition upon construction completion.

(iii) The Contractor shall undertake detailed survey of the affected persons during transmission line alignment finalization under the Project, where applicable, and

(iv) The Contractor shall conduct health and safety programme for workers employed under the Contract and shall include Information on the risk of sexually transmitted diseases, including HIV/AIDS in such programs.

GC 22.4.3 **Addition of New Sub Clause 22.4.3 including its Sub-Clauses**

Safety Precautions

GCC 22.4.3.1 The Contractor shall observe all applicable regulations regarding safety on the Site.

Unless otherwise agreed, the Contractor shall, from the commencement of work on Site until taking over, provide:

a) fencing, lighting, guarding and watching of the Works wherever required, and

b) temporary roadways, footways, guards and fences which may be necessary for the accommodation and protection of Employer / his representatives and occupiers of adjacent property, the public and others.

GCC 22.4.3.2 The Contractor shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to POWERGRID or to others, working at the Site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required both by the relevant legislations and the Engineer, as he may deem necessary.

GCC 22.4.3.3 The Contractor will notify well in advance to the Engineer of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. The Engineer shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contractor shall strictly adhere to and comply with such instructions. The Engineer shall have the right at his sole discretion to inspect any such container or such construction plant/equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by the Owner and the Owner shall not entertain any claim of the Contractor

towards additional safety provisions/conditions to be provided for/constructed as per the Engineer's instructions.

Further, any such decision of the Engineer shall not, in any way, absolve the Contractor of his responsibilities and in case, use of such a container or entry thereof into the Site area is forbidden by the Engineer, the Contractor shall use alternative methods with the approval of the Engineer without any cost implication to POWERGRID or extension of work schedule.

GCC 22.4.3.4 Where it is necessary to provide and/or store petroleum products or petroleum mixtures and explosives, the Contractor shall be responsible for carrying-out such provision and/or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosives Act, 1948 and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of the Engineer. In case, any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the Contractor shall be responsible for obtaining the same.

GCC 22.4.3.5 All equipment used in construction and erection by Contractor shall meet Indian/International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipment shall be strictly operated and maintained by the Contractor in accordance with manufacturer's Operation Manual and safety instructions and as per Guidelines/rules of POWERGRID in this regard.

GCC 22.4.3.6 Periodical examinations and all tests for all lifting/hoisting equipment & tackles shall be carried-out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity Act 1910 and associated Laws/Rules in force from time to time. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by the Engineer or by the person authorised by him.

GCC 22.4.3.7 The Contractor shall be fully responsible for the safe storage of his and his Sub-Contractor's radioactive sources in accordance with BARC/DAE Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in connection with use, storage and handling of

such material will be taken by the Contractor.

GCC 22.4.3.8 The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by the Engineer who will also have right to examine these safety equipment to determine their suitability, reliability, acceptability and adaptability.

GCC 22.4.3.9 Where explosives are to be used, the same shall be used under the direct control and supervision of an expert, experienced, qualified and competent person strictly in accordance with the Code of Practice/Rules framed under Indian Explosives Act pertaining to handling, storage and use of explosives.

GCC 22.4.3.10 The Contractor shall provide safe working conditions to all workmen and employees at the Site including safe means of access; railings, stairs, ladders, scaffoldings etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection, good and standard quality of material only shall be used by the Contractor.

GCC 22.4.3.11 The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Owner or other Contractors under any circumstances, whatsoever, unless expressly permitted in writing by POWERGRID to handle such fuses, wiring or electrical equipment

GCC 22.4.3.12 Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contractor or Owner, he shall:

a. Satisfy the Engineer that the appliance is in good working condition;

b. Inform the Engineer of the maximum current rating, voltage and phases of the appliances;

c. Obtain permission of the Engineer detailing the sockets to which the appliances may be connected.

GCC 22.4.3.13 The Engineer will not grant permission to connect until he is satisfied that;

a. The appliance is in good condition and is fitted with suitable plug;

b. The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

GCC 22.4.3.14 No electric cable in use by the Contractor/Owner will be disturbed without prior permission. No weight of any description will be imposed on any cable and no ladder or similar equipment will rest against or attached to it.

GCC 22.4.3.15 No repair work shall be carried out on any live equipment. The equipment must be declared safe by the Engineer and a permit to work shall be issued by the Engineer before any repair work is carried out by the Contractor. While working on electric lines/equipment, whether live or dead; suitable type and sufficient quantity of tools will have to he provided by the Contractor to electricians/workmen/officers.

GCC 22.4.3.16 The Contractors shall employ necessary number of qualified, full time electricians/electrical supervisors to maintain his temporary electrical installation.

GCC 22.4.3.17 The Contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ at least one full time officer exclusively as safety officer to supervise safety aspects of the equipment and workmen, who will coordinate with the Project Safety Officer. In case of work being carried out through Sub-Contractors, the Sub-Contractor's workmen/employees will also be considered as the Contractor's employees/workmen for the above purpose.

The name and address of such Safety Officers of the Contractor will be promptly informed in writing to Engineer with a copy to Safety Officer-In charge before he starts work or immediately after any change of the incumbent is made during currency of the Contract.

GCC 22.4.3.18 In case any accident occurs during the construction/ erection or other associated activities undertaken by the Contractor thereby causing any minor or major or fatal

injury to his employees due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the Engineer in prescribed form and also to all the authorities envisaged under the applicable laws.

GCC 22.4.3.19 The Engineer shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipment. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary, appeal against the order of stoppage of work to the Engineer within 3 days of such stoppage of work and decision of the Engineer in this respect shall be conclusive and binding on the Contractor.

GCC 22.4.3.20 The Contractor shall not be entitled for any damages/compensation for stoppage of work due to safety reasons as provided in para GCC 22.4.3.19 above and the period of such stoppage of work will not be taken as an extension of time for completion of work and will not be the ground for waiver of levy of liquidated damages.

GCC 22.4.3.21 It is mandatory for the Contractor to observe during the execution of the works, requirements of Safety Rules which would generally include but not limited to following:

Safety Rules

a) Each employee shall be provided with initial indoctrination regarding safety by the Contractor, so as to enable him to conduct his work in a safe manner.

b) No employee shall be given a new assignment of work unfamiliar to him without proper introduction as to the hazards incident thereto, both to himself and his fellow employees.

c) Under no circumstances shall an employee hurry or take unnecessary chance when working under hazardous conditions.

d) Employees must not leave naked fires unattended. Smoking shall not be permitted around fire prone areas and adequate fire fighting equipment shall be provided at crucial location.

e) Employees under the influence of any intoxicating beverage, even to the slightest degree shall not be permitted to remain at work.

f) There shall be a suitable arrangement at every work site for rendering prompt and sufficient first aid to the injured.

g) The staircases and passageways shall be adequately lighted.

h) The employees when working around moving machinery, must not be permitted to wear loose garments. Safety shoes are recommended when working in shops or places where materials or tools are likely to fall. Only experienced workers shall be permitted to go behind guard rails or to clean around energized or moving equipment.

i) The employees must use the standard protection equipment intended for each job. Each piece of equipment shall be inspected before and after it is used.

j) Requirements of ventilation in underwater working to licensed and experienced divers, use of gum boots for working in slushy or in inundated conditions are essential requirements to be fulfilled.

k) In case of rock excavation, blasting shall invariably be done through licensed blasters and other precautions during blasting and storage/transport of charge material shall be observed strictly.

GCC 22.4.3.22 The Contractor shall follow and comply with all POWERGRID Safety Rules, relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any demur, protest or contest or reservations. In case of any discrepancy between statutory requirement and POWERGRID Safety Rules

referred above, the latter shall be binding on the Contractor unless the statutory provisions are more stringent.

GCC22.4.3.23 If the Contractor fails in providing safe working environment as per POWERGRID Safety Rules or continues the work even after being instructed to stop work by the Engineer as provided in para GCC 22.4.3.19 above, the Contractor shall promptly pay to POWERGRID, on demand by the Owner, compensation at the rate of Rs.5, 000/- per day of part thereof till the instructions are complied with and so certified by the Engineer. However, in case of accident taking place causing injury to any individual, the provisions contained in para GCC 22.4.3.24 shall also apply in addition to compensation mentioned in this para.

GCC 22.4.3.24 If the Contractor does not take adequate safety precautions and/or fails to comply with the Safety Rules as prescribed by POWERGRID or under the applicable law for the safety of the equipment and plant or for the safety of personnel or the Contractor does not prevent hazardous conditions which cause injury to his own employees or employees of other Contractors or POWERGRID employees or any other person who are at Site or adjacent thereto, then the Contractor shall be responsible for payment of a sum as indicated below to be deposited with POWERGRID, which will be passed on by POWERGRID to such person or next to kith and kin of the deceased:

a.	Fatal injury or accident causing death	Rs. 1,000,000/- per person
b.	Major injuries or accident causing 25% or more permanent disablement	Rs. 100,000/- per person

Permanent disablement shall have same meaning as indicated in Workmen's Compensation Act. The amount to be deposited with POWERGRID and passed on to the person mentioned above shall be in addition to the compensation payable under the relevant provisions of the Workmen's Compensation Act and rules framed there under or any other applicable laws as applicable from

time to time. In case the Contractor does not deposit the above mentioned amount with POWERGRID, such amount shall be recovered by POWERGRID from any monies due or becoming due to the Contractor under the contract or any other on-going contract.

GCC22.4.3.25 If the Contractor observes all the Safety Rules and Codes, Statutory Laws and Rules during the currency of Contract awarded by the Owner and no accident occurs then POWERGRID may consider the performance of the Contractor and award suitable 'ACCIDENT FREE SAFETY MERITORIOUS AWARD' as per scheme as may be announced separately from time to time.

GC 22.6 **Emergency Work (GC Clause 22.6)**

Replace the words "Otherwise" with "In case such work is not in the scope of the Contractor", in the second last line of second paragraph of GC clause 22.6.

GC 23.3 **Supplementing sub-clause GC 23.3**

For notification of testing, four weeks shall be deemed as reasonable advance notice.

GC 23.7 **Test and Inspection (GC Clause 23.7)**

Replace the words "GC Sub-Clause 6.1" with "GC Sub-Clause 46.1", in the last line of GC clause 23.7.

GC 24.4 **Replacing Sub-Clause GC 24.4**

As soon as all works in respect of Precommissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready for Commissioning, the Contractor shall commence Commissioning as per procedures stipulated in Technical Specification, and as soon as Commissioning is satisfactorily completed, the Contractor shall so notify the Project Manager in writing.

GC 24.5 **Replacing Sub-Clause GC 24.5**

The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GC Sub-Clause 24.4, notify the Contractor in writing of any defects and/or deficiencies.

If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GC Sub-Clause 24.4. If the Project Manager is satisfied that the Facilities or that part thereof have passed Precommissioning, the Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice/ seven (7) days after receipt of the Contractor's repeated notice, advise the Contractor to proceed with the Commissioning of the Facilities or that part thereof. If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

GC 24.6 **Replacing Sub-Clause GC 24.6**

If the Project Manager fails to advise the Contractor to proceed with the Commissioning of the Facilities or the relevant part thereof or inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GC Sub-Clause 24.4 or within seven (7) days after receipt of the Contractor's repeated notice under GC Sub-Clause 24.5, then the Facilities or that part thereof shall be deemed to have passed Precommissioning, as of the date of the Contractor's notice or repeated notice, as the case may be

Existing Sub-clause GC24.7 stands amended and renumbered as GC 24.9 and following Sub-Clauses stand added as new Sub-Clauses GC 24.7, 24.7.1, 24.7.2, 24.7.3, 24.7.4, 24.7.5, 24.7.5.1 & 24.7.6

GC 24.7 **GC 24.7 Commissioning**

GC 24.7.1 Commissioning of the Facilities (or specific part thereof where specific parts are specified in the GC 1.1) shall be commenced by the Contractor immediately after being advised by the Project manager, pursuant to GC sub-clause 24.5 or immediately after the deemed Completion except for Commissioning Precommissioning (including deemed Precommissioning) under GC sub-clause 24.6.

GC 24.7.2 The Employer shall, to the extent specified in Appendix-6 (scope of works and supply by the Employer), deploy the operating and maintenance personnel and supply raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other materials required for Commissioning.

GC 24.7.3 On passing of the Precommissioning and charging of the Facilities at rated voltage, Commissioning would be attained.

2.11.6 Wet locations shall be kept completely dewatered, both during and 24 hours after placing the concrete, without disturbance of the concrete.

2.11.7 If the concrete surface is found to be defective after the form work has been removed, the damage shall be repaired with a rich cement sand mortar to the satisfaction of the Employer before the foundation is back filled.

2.12 Backfilling and Removal of Stub Templates

2.12.1 After opening of formwork and removal of shoring, timbering, etc. backfilling shall be started after repairs, if any, to the foundation concrete. Backfilling shall normally be done with the excavated soil, unless it is a clay type or it consists of large boulders/stones, in which case the boulders shall be broken to a maximum size of 80-mm. At locations where borrowed earth is required for backfilling, Contractor shall bear the cost irrespective of lead & lift.

2.12.2 The backfilling materials shall be clean and free from organic or other foreign materials. A clay type soil with a grain size distribution of 50% or more passing the no. 200 sieve as well as a black cotton soil are unacceptable for backfilling. The earth shall be deposited in maximum 200mm layers, levelled, wetted if necessary and compacted properly before another layer is deposited. The moisture content for compaction shall be based on the Proctor compaction test results given in the Geo-technical Report, Clause 3.0 of section III. The density of the compacted backfill material may further be verified to the satisfaction of the Employer based on the sand-cone method described in the ASTM D1556-82 standard.

2.12.3 The backfilling and grading shall be carried to an elevation of about 75mm above the finished ground level to drain out water. After backfilling 50mm high, earthen embankment (band) will be made along the sides of excavated pits and sufficient water will be poured in the backfilling earth for at least 24 hours. After the pits have been backfilled to full depth the stub template may be removed.

2.13 Curing

The concrete shall be cured by maintaining the concrete wet for a period of at least 10 days after placing. Once the concrete has set for 24 hours the pit may be backfilled with selected moistened soil and well consolidated in layers not exceeding 200mm thickness and thereafter both the backfill earth and exposed chimney shall be kept wet for the remainder of the prescribed 10 days. The exposed concrete chimney shall also be kept wet by wrapping empty gunny bags around it and wetting the bags continuously during the critical 10 days period.

2.14 Benching

When the line passes through hilly/undulated terrain, leveling the ground may be required for casting of tower footings. All such activities shall be termed benching and shall include cutting of excess earth and removing the same to a suitable point of disposal as required by Employer. Benching shall be resorted to only after approval from Employer. Volume of the earth to be cut shall be measured before cutting and approved by Employer for payment purposes. Further, to minimize benching, unequal leg extensions shall be considered and provided if found economical. If the levels of the pit centres be in sharp contrast with the level of tower centre, suitable leg extensions may be deployed as required. The proposal shall be submitted by the Contractor with detailed justification to the Employer.

2.15 **Protection of Tower and Tower Footing**

2.15.1 Tower spotting shall endeavor to minimise the quantity of revetment required.

2.15.2 The work shall include all necessary stone revetments, concreting and earth filling above ground level, the clearing from site of all surplus excavated soil, special measures for protection of foundation close to or in nalas, river bank / bed, undulated terrain, protection of up hill / down hill slopes required for protection of tower etc., including suitable revetment or galvanised wire netting and meshing packed with boulders. The top cover of stone revetment shall be sealed with M-15 concrete (1:2:4 mix). Contractor shall recommend protection at such locations wherever required. Details of protection of tower/tower footing are given in drawing enclosed with these specifications for reference purpose only.

2.15.3 Tower footings shall generally be backfilled using soil excavated at site unless deemed unsuitable for backfilling. In the latter case, backfilling shall be done with borrowed earth of suitable quality irrespective of leads and lift. The unit rate for backfilling quoted in BPS shall include the required lead and consolidation and leveling of earth after backfilling.

2.15.4 The provisional quantities for protection work of foundations are furnished in price schedule of Bid Proposal Sheet(BPS). The unit rates shall also be applicable for adjusting with the actual quantities of protection works done. These unit rates shall hold good for protection work carried out on down hills or up hills slopes applicable for the tower locations.

2.15.5 The unit rates for random rubble masonry revetment quoted in price schedule shall also include excavation & (1:5) random masonry and unit rate for top sealing with M-15 concrete. For payment purposes the volume of random rubble masonry revetment shall be measured from bottom to top sealing coat and paid at the quoted rates indicated in price schedule.

No extra rates shall be paid for allied work such as excavation, for revetment packed stone at head of weep holes etc. However, no deduction

1.9.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols, i.e. fragile, handle with care, use no hook etc. wherever applicable.

1.9.5 Each package shall be legibly marked by the Contractor at his expenses showing the details such as description and quantity of contents, the name of the consignee and address, the gross and net weights of the package, the name of the Contractor etc.

2.0 Employer 's Environment and Social Policy and its Implementation

2.1 Development and growth of mankind through Industrialization and unwarranted use of natural resources has inflicted considerable impact on Environment and Society. As a result, Environmental and Social issues have emerged as the focal point of global debate.

Employer's activities by their inherent nature and flexibility have negligible impacts on environmental and social attributes. In order to address these issues and to match the rising expectations of a cleaner, safer and healthier environment, Employer has evolved its Environmental and Social Policy and Procedures (ESPP). The key principles of Employer Environmental and Social Policy are :

i) Avoidance of environmentally and socially sensitive areas while planning project activities.

ii) Minimisation of impacts when project activities occur in environmentally and socially sensitive areas.

iii) Mitigation of any unavoidable adverse impacts arising out of its projects.

2.2 Basic issues to be kept in mind while carrying out construction activities are to

i) Avoid socially sensitive areas with regard to human habitations and areas of cultural significance

ii) Secure the interest of people affected by Employer's projects

iii) Involve local people affected by transmission line projects as per requirement and suitability

iv) Consult affected people in decisions having implication to them if considered necessary

v) Apply, efficient and safe technology/practices

vi) Keep abreast of all potential dangers to people's health, occupational safety and safety of environment and the respective mitigatory measures.

vii) Establish preventive mechanisms to guarantee safety.

viii) Mitigation measures in case of accidents.

ix) Avoid unwarranted cutting of trees in forest area.

2.3 While constructing the lines through forest stretches the contractor will provide alternate fuel to its employee e.g. working labours/supervisors etc in order to avoid cutting of forest woods.

2.4 Contractor will ensure safety to the wild life, during working/camping near to the National park.

2.5 Contractor during construction of lines in agricultural fields will ensure minimum damages to the crops, trees, bunds, irrigation etc. If the same is un-avoidable, the decision of Engineer- in-charge shall be final.

2.6 The waste/excess material/debris should be removed from the construction site including agricultural field, forest stretches, river etc. immediately after construction work.

2.7 The Contractor will ensure least disturbance to the hill slope and natural drainage so as to avoid soil erosion. Natural drainage in plain area if disturbed to be trained to the satisfaction of Engineer- in-charge.

2.8 As far as possible existing path/kutchha road/approach shall be used for the construction.

2.9 The Contractor will ensure supply of stone chips/sand from authorised/approved quarry areas.

2.10 Proper documentation of above, if any.

ANNEXURE – 4

CEA Gazette Notification for Electrical Safety

CENTRAL ELECTRICITY AUTHORITY

NOTIFICATION

New Delhi, the 20th September, 2010

No. CEI/1/59/CEA/EI.—In exercise of the powers conferred by section 177 of the Electricity Act, 2003 (36 of 2003), the Central Electricity Authority hereby makes the following regulations for Measures relating to Safety and Electric Supply, namely:-

Chapter I

1. **Short title and Commencement.-** (1) These regulations may be called the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010.

(2) They shall come into force on the date of their final publication in the Official Gazette.

2. **Definitions.-** (1) In these regulations, unless the context otherwise requires,

(a) "Act" means the Electricity Act,2003;

(b) "accessible" means within physical reach without the use of any appliance or special effort;

(c) "ampere" means a unit of electric current and is a constant current which, flowing in two parallel straight conductors of infinite length of negligible cross section and placed at a distance of one meter apart in a vacuum will produce a force of $2x10^{-7}$ Newton per meter length between the conductors;

(d) "apparatus "means electrical apparatus and includes all machines, fittings, accessories and appliances in which conductors are used;

(e) "bare" means not covered with insulating materials;

(f) "cable" means a length of insulated single conductor(solid or stranded) or of two or more such conductors each provided with its own insulation, which are laid up together. Such insulated conductor or conductors may or may not be provided with an overall mechanical protective covering;

(g) "circuit" means an arrangement of conductor or conductors for the purpose of conveying electricity and forming a system or a branch of a system;

(h) "circuit breaker" means a device, capable of making and breaking the circuit under all conditions, and unless otherwise specified, so designed as to break the current automatically under abnormal conditions;

(i) "concentric cable" means a composite cable comprising an inner conductor which is insulated and one or more outer conductors which are

insulated from one another and are disposed over the insulation of, and more or less around, the inner conductor;

(j) "conductor" means any wire, cable, bar, tube, rail or plate used for conducting electricity and so arranged as to be electrically connected to a system;

(k) "conduit" means rigid or flexible metallic tubing or mechanically strong and fire resisting non-metallic tubing into which a cable or cables may be drawn for the purpose of affording it or them mechanical protection;

(l) "connected load" means the sum of the ratings of the electricity consuming apparatus connected to a consumer's installation;

(m) "covered with insulating material" means adequately covered with insulating material of such quality and thickness as to prevent danger;

(n) "cut out" means any appliance for automatically interrupting the transmission of electricity through the conductor when the current rises above a pre-determined amount, and shall also include fusible cut-out;

(o) "danger" means danger to health or danger to life or any part of body from shock, burn or other injury to persons, or property, or from fire or explosion, attendant upon the generation, transmission, transformation, conversion, distribution or use of electricity;

(p) "dead" means at or about earth potential and disconnected from any live system. It is used only with reference to current carrying parts when these parts are not live.

(q) "designated person" means a person designated under regulation 3;

(r) "earthed" or "connected with earth" means connected with the general mass of earth in such manner as to ensure at all times an immediate discharge of electricity without danger;

(s) "earthing system" means an electrical system in which all the conductors and appliances are earthed;

(t) "enclosed sub-station" means any premises or enclosure or part thereof, being large enough to admit the entrance of a person after the apparatus therein is in position, containing apparatus for transforming or converting electricity to or from a voltage at or exceeding 650 V (other than transforming or converting solely for the operation of switch gear or instruments) with or without any other apparatus for switching, controlling or otherwise regulating the electricity, and includes the apparatus therein;

(u) "enclosed switch-station" means any premises or enclosure or part thereof, being large enough to admit the entrance of a person after the apparatus therein is in position, containing apparatus for switching, controlling or otherwise regulating electricity at or exceeding 650 V but not for transforming or converting electricity(other than for transforming or converting solely for the operation of switchgear or instruments)and includes the apparatus therein,

(v) "flameproof enclosure" means an enclosure for electrical machinery or apparatus that will withstand, when the covers, or other access doors are properly secured, an internal explosion of the inflammable gas or vapour which may enter or originate inside the enclosure, without suffering damage and without communicating the internal flammation (or explosion) to the external inflammable gas or vapour in which it is designed to be used, through any joints or other structural openings in the enclosure;

(w) "flexible cable" means a cable consisting of one or more cores each formed of a group of wires, the diameter and the physical properties of the wires and insulating material being such as to afford flexibility.

(x) "guarded" means covered, shielded, fenced or otherwise protected by means of suitable casings, barrier, rails or metal screens to remove the possibility of dangerous contact or approach by persons or objects to a point of danger;

(y) "hand-held portable apparatus" means an apparatus which is so designed as to be capable of being held in the hands and moved while connected to a supply of electricity;

(z) "High Voltage Direct Current (HVDC)" means Direct Current (DC) voltage above 100000 Volts used for transmission of power.

(za) "inspector of mines" means an Inspector appointed under the Mines Act,1952 (35 of 1952);

(zb) "installation" means any composite electrical unit used for the purpose of generating, transforming, transmitting, converting, distributing or utilizing electricity;

(zc) "intrinsically safe" as applied to apparatus or associated circuits shall denote that any sparking that may occur in normal working is incapable of causing explosion of inflammable gas or vapour;

(zd) "increased safety type 'e' " means a method of protection by which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of occurrence of arcs and sparks in apparatus which does not produce arcs or sparks in normal service;

(ze) "lightning arrestor" means a device which has the property of diverting to earth any electrical surge of excessively high amplitude applied to its terminals and is capable of interrupting flow current if present and restoring itself thereafter to its original operating conditions;

(zf) "linked switch" means a switch with all the poles mechanically linked so as to operate simultaneously;

(zg) "live" means electrically charged;

(zh) "metallic covering" means mechanically strong metal covering surrounding one or more conductors;

(zi) "meter" means a device suitable for measuring, indicating and recording consumption of electricity or any other quantity related with electrical system and shall include, wherever applicable, other equipment such as Current Transformer (CT), Voltage Transformer (VT) or Capacitor Voltage Transformer (CVT) with necessary wiring and accessories;

(zj) "mine" has the same meaning as defined in the Mines Act, 1952 (35 of 1952);

(zk) "neutral conductor" means that conductor of a multi-wire system, the voltage of which is normally intermediate between the voltages of the other conductors of the system and shall also include return wire of the single phase system;

(zl) "occupier" means the owner or person in occupation of the premises where electricity is used or proposed to be used;

(zm) "ohm" means a unit of electrical resistance and is the electrical resistance between two points of a conductor when a constant potential difference of one volt, applied to these points produces a current of one ampere in the conductor, provided no electromotive force is generated in the conductor;

(zn) "open sparking" means sparking which owing to the lack of adequate provisions for preventing the ignition of inflammable gas external to the apparatus would ignite such inflammable gas;

(zo) "overhead line" means any electric supply line which is placed above ground and in the open air but excluding live rails of a traction system;
(zp) "owner" means the company or body corporate or association or body of individuals, whether incorporated or not or artificial juridical person which owns or operates or maintains Electric Plants and Lines;
(zq) "owner", "agent" and "manager" of a mine have the same meanings as are assigned to them in the Mines Act,1952(35 of 1952);
(zr) "poles" means the phase terminals of a Switch.
(zs) "portable apparatus" means an apparatus which is so designed as to be capable of being moved while in operation;
(zt) "portable hand lamp" means a portable light-fitting provided with suitable handle, guard and flexible cord connected to a plug;
(zu) "Schedule" means a schedule to these regulations.
(zw) "section" means a Section of the Act;
(zv) "span" means the horizontal distance between two adjacent supporting points of an overhead conductor;
(zw) "street box" means a totally enclosed structure, either above or below ground containing apparatus for transforming, switching, controlling or otherwise regulating electricity;
(zx) "supplier" means any generating company or licensee from whose system electricity flows into the system of another generating company or licensee or consumer;
(zy) "switch" means a manually operated device for opening and closing or for changing the connection of a circuit;
(zz) "switchboard" means an assembly including the switchgear for the control of electrical circuits, electric connections and the supporting frame;
(zza) "switchgear" shall denote switches, circuit breakers, cut-outs and other apparatus used for the operation, regulation and control of circuits;
(zzb) "system" means an electrical system in which all the conductors and apparatus are electrically connected to a common source of electric supply;
(zzc) "transportable apparatus" means apparatus which is operated in a fixed position but which is so designed as to be capable of being moved readily from one place to another;
(zzd) "volt" means a unit of potential difference of electro-motive force and is the difference of electric potential which exists between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is one watt;
(zze) "voltage" means the difference of electric potential measured in Volts between any two conductors or between any part of either conductor and the earth as measured by a voltmeter meeting Indian Standards;
(zzf) "watt" is a unit of active power and "MW" means megawatt and is equal to 10^6 watts.

(2) Words and expressions used and not defined in these regulations but defined in the Act shall have the meanings respectively assigned to them in the Act.

Chapter II

3. **Designating person(s) to operate and carry out the work on electrical lines and apparatus.-** (1) A supplier or a consumer, or the owner, agent or manager of a mine, or the agent of any company operating in an oil-field or the owner of a drilled well in an oil field or a contractor who has entered into a contract with a supplier or a consumer to carry out duties incidental to the generation, transformation, transmission, conversion, distribution or use of electricity shall designate persons for the purpose to operate and carry out the work on electrical lines and apparatus.

(2) The supplier or consumer, or the owner, agent or manager of a mine, or the agent of any company operating in an oil-field or the owner of a drilled well in an oil field or a contractor referred to on sub-regulation (1) shall maintain a register wherein the names of the designated persons and the purpose for which they are engaged, shall be entered.

(3) No person shall be designated under sub-regulation (1) unless,-

(i) he possesses a certificate of competency or electrical work permit, issued by the Appropriate Government.

(ii) his name is entered in the register referred to in sub-relgulation (2).

4. **Inspection of designated officers and other safety measures.-** (1) The register maintained under sub-regulation (2) of regulation 3 shall be produced before the Electrical Inspector when required by him.

(2) If on inspection, the Electrical Inspector finds that the designated person does not fulfill the required qualification, he shall recommend the removal of the name of such persons from the register.

5. **Electrical Safety Officer.-** (1) All suppliers of electricity including generating companies, transmission companies and distribution companies shall designate an Electrical Safety Officer for ensuring observance of safety measures specified under these regulations in their organisation for construction, operation and maintenance of power stations, sub-stations, transmission and distribution lines.

(2) The Electrical Safety Officer shall be an Electrical Engineering degree holder with at least ten years of experience in operation and maintenance of electricity plants or an Electrical Engineering Diploma holder with at least fifteen years of experience in operation and maintenance of electric plant.

(3) The Electrical Safety Officer designated under sub-regulation (1), shall ensure periodic inspection of such installations, get them tested and keep a record thereof and such records shall be made available to the Electrical Inspector if and when required.

(4) For every factory registered under Factory Act, 1948, where more than 250 kW of electrical load is connected, the management of the factory shall designate a person having qualification specified in sub-regulation (2), for ensuring the

observance of the safety provisions laid under the Act and the regulations made thereunder, who shall periodically inspect such installation, get them tested and keep a record thereof and such records shall be made available to the Electrical Inspector if and when required.

6. **Safety measures for operation and maintenance of electric plants.-** (1) Engineers and supervisors appointed to operate or undertake maintenance of any part or whole of a thermal power generating station and a hydro power plant together with the associated sub-station shall hold diploma in Engineering from a recognized institute, or a degree in Engineering from a university.

(2) The Technicians to assist engineers or supervisors shall possess a certificate in appropriate trade, preferably with a two years course from a Industrial Training Institute recognized by the Central Government or the State Government.

(3) Engineers, supervisors and Technicians engaged for operation and maintenance of electric plants should have successfully undergone the type of training as specified in Schedule-I.

Provided that the existing employees shall have to undergo the training mentioned in sub-regulation (3) within three years from the date of coming into force of these regulations.

(4) The owner of every thermal power generating station and hydro power plant together with their associated sub-station shall arrange for training of personnel engaged in the operation and maintenance of his generating station along with associated sub-station in his own institute or any other institute recognized by the Central Government or the State Government.

Provided that separate training shall be given to the persons engaged in operation and maintenance of thermal power stations and hydro power stations including associated sub-stations.

7. **Safety measures for operation and maintenance of transmission, distribution systems.-** (1) Engineers or supervisors engaged in operation and maintenance of transmission and distribution systems shall hold diploma in electrical, mechanical, electronics and instrumentation Engineering from a recognized institute or university.

(2) The Technicians to assist engineers or supervisors shall possess a certificate in appropriate trade, preferably with a two years course from a Industrial Training Institute recognized by the Central Government or State Government.

(3) Engineers, supervisors and Technicians engaged for operation and maintenance of transmission and distribution systems electric plants should have successfully undergone the type of training as specified in Schedule-II.

Provided that the existing employees shall have to undergo the training mentioned in sub-regulation (3) within three years from the date of coming into force of these regulations.

(4) Owner of every transmission or distribution system shall arrange for training of their personnel engaged in the operation and maintenance of transmission and distribution system in his own institute or any other institute recognized by the Central Government or State Government.

8. **Keeping of records and inspection thereof.-** (1) The generating company or licensee shall maintain records of the maps, plans and sections relating to supply or transmission of electricity and submit the same to the Electrical Inspector for inspection as and when required by him.

(2) The Electrical Inspector shall supply a copy of the report of inspection referred to in sub-regulation (1), to the generating company or licensee, as the case may be.

9. **Deposit of maps.** – When a license has been granted, two sets of maps showing, as regards such licensee, the particulars specified in application for license shall be signed and dated to correspond with the date of notification of the grant of the license by an officer designated by the Appropriate Commission in this behalf, one set of such maps shall be retained by the said officer and the other one shall be furnished to the licensee.

10. **Deposit of printed copies.-** (1) Every person who is granted a license, shall, within thirty days of the grant thereof, have copies of the license and maps, showing the area of supply as specified in the license to Exhibit I same for public inspection at all reasonable times at his head office, his local offices, if any, and at the office of every local authority within the area of supply.

(2) Every such licensee shall, within the aforesaid period of thirty days, supply free of charge one copy of the license along with the relevant maps to every local authority within the area of supply and shall also make necessary arrangement for the sale of printed copies of the license and maps to all persons applying for the same, at a price to be notified by the Appropriate Government from time to time.

11. **Plan for area of supply to be made and kept open for inspection.-** (1) The licensee shall, after commencing to supply electricity, forthwith cause a plan, to be made in electronic form, of the area of supply, and shall cause to be marked thereon the alignment and in the case of underground works, the approximate depth below the surface of all the existing electric supply lines, street distributing boxes and other works, and shall once in every year cause that plan to be duly corrected so as to show the electric supply lines, street distributing boxes and other works for the time being in position and shall also, if so required by an Electrical Inspector, cause to be made sections showing the approximate level of all his existing underground works other than service lines.

(2) Every plan shall be drawn to such horizontal and vertical scale as the Appropriate Commission may require.

Provided that no scale shall be required unless maps of the locality on that scale are for the time being available to the public.

(3) Every plan and section so made or corrected, or a copy thereof, marked with the date when it was made or corrected, shall be kept by the licensee at his

principal office or place of business within the area of supply, and shall at all reasonable times be open to the inspection of all applicants, and copies thereof shall be supplied.

Provided that existing and old plans and sections and underground distribution network shall be converted to electronic form within three years from the date of commencement of these regulations.

(4) Global Positioning System (GPS) mapping or mapping through any other latest technology, of existing and old plans and sections shall be completed within five years from the date of commencement of these regulations and new plans and sections shall be compatible to the Global Positioning System mapping or mapping through any other latest technology.

(5) The licensee shall, if required by an Electrical Inspector, and, where the licensee is not a local authority, by the local authority, if any, concerned, supply free of charge to such Electrical Inspector or local authority a duplicate copy of every such plan or section or a part of the same duly corrected.

(6) The copies of plans and sections under this regulation shall be supplied by the licensee to every applicant on the payment of such fee as the Appropriate Commission may, by regulation, specify.

Chapter III

General safety requirements

12. **General safety requirements pertaining to construction, installation, protection, operation and maintenance of electric supply lines and apparatus.-** (1) All electric supply lines and apparatus shall be of sufficient rating for power, insulation and estimated fault current and of sufficient mechanical strength, for the duty cycle which they may be required to perform under the environmental conditions of installation, and shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of human beings, animals and property.

(2) Save as otherwise provided in these regulations, the relevant code of practice of the Bureau of Indian Standards or National Electrical Code, if any, may be followed to carry out the purposes of this regulation and in the event of any inconsistency, the provisions of these regulaions shall prevail.

(3) The material and apparatus used shall conform to the relevant specifications of the Bureau of Indian Standards or International Elelctro-Technical Commission where such specifications have already been laid down.

(4) All electrical equipment shall be installed above the Mean Sea Level (MSL) as declared by local Municiple Authorities and where such equipment is to be installed in the basement, consumer shall ensure that the design of the basement

should be such that there is no seapage or leakage or logging of water in the basement.

13. **Service lines and apparatus on consumer's premises.-** (1) The supplier shall ensure that all electric supply lines, wires, fittings and apparatus belonging to him or under his control, which are on a consumer's premises, are in a safe-condition and in all respects fit for supplying electricity and the supplier shall take precautions to avoid danger arising on such premises from such supply lines, wires, fittings and apparatus.

(2) Service lines placed by the supplier on the premises of a consumer which are underground or which are accessible shall be so insulated and protected by the supplier as to be secured under all ordinary conditions against electrical, mechanical, chemical or other injury to the insulation.

(3) The consumer shall, as far as circumstances permit, take precautions for the safe custody of the equipment on his premises belonging to the supplier.

(4) The consumer shall also ensure that the installation under his control is maintained in a safe condition.

14. **Switchgear on consumer's premises.-** (1) The supplier shall provide a suitable switchgear in each conductor of every service line other than an earthed or earthed neutral conductor or the earthed external conductor of a concentric cable within a consumer's premises, in an accessible position and such switchgear shall be contained within an adequately enclosed fireproof receptacle:

Provided that where more than one consumer is supplied through a common service line, each such consumer shall be provided with an independent switchgear at the point of rigid junction to the common service.

(2) Every electric supply line other than the earthed or earthed neutral conductor of any system or the earthed external conductor of a concentric cable shall be protected by a suitable switchgear by its owner.

15. **Identification of earthed and earthed neutral conductors and position of switches and switchgear therein.-** Where the conductors include an earthed conductor of a two-wire system or an earthed neutral conductor of a multi-wire system or a conductor which is to be connected thereto, the following conditions shall be complied with:-

(i) an indication of a permanent nature shall be provided by the owner of the earthed or earthed neutral conductor, or the conductor which is to be connected thereto, to enable such conductor to be distinguished from any live conductor and such indication shall be provided-

(a) where the earthed or earthed neutral conductor is the property of the supplier, at or near the point of commencement of supply;

(b) where a conductor forming part of a consumer's system is to be connected to the supplier's earthed or earthed neutral conductor, at the point where such connection is to be made;

(c) in all other cases, at a point corresponding to the point of commencement of supply or at such other points as may be approved by an Electrical Inspector.

(ii) no cut-out, link or switch other than a linked switch arranged to operate simultaneously on the earthed or earthed neutral conductor and live conductors shall be inserted or remain inserted in any earthed or earthed neutral conductor of a two wire-system or in any earthed or earthed neutral conductor of a multi-wire system or in any conductor connected thereto.

Provided that the above requirement shall not apply in case of-

(a) a link for testing purposes, or

(b) a switch for use in controlling a generator or transformer.

16. Earthed terminal on consumer's premises.- (1) The supplier shall provide and maintain on the consumer's premises for the consumer's use, a suitable earthed terminal in an accessible position at or near the point of commencement of supply.

Provided that in the case of installation of voltage exceeding 250 V the consumer shall, in addition to the aforementioned earthing arrangement, provide his own earthing system with an independent electrode.

Provided further that the supplier may not provide any earthed terminal in the case of installations already connected to his system on or before the date to be specified by the State Government in this behalf if he is satisfied that the consumer's earthing arrangement is efficient.

(2) The consumer shall take all reasonable precautions to prevent mechanical damage to the earthed terminal and its lead belonging to the supplier.

(3) The supplier may recover from the consumer the cost of installation on the basis of schedule of charges published by him in advance and where such schedule of charges is not published, the procedure laid down, in regulation 63 shall apply.

Explanation.- For the purposes of sub-regulation (1), the expression "point of commencement of supply of electricity" shall mean the point at the incoming terminal of the switchgear installed by the consumer.

17. Accessibility of bare conductors.- Where bare conductors are used in a building, the owner of such conductors shall,-

(a) ensure that they are inaccessible;

(b) provide in readily accessible position switches for rendering them dead whenever necessary; and

(c) take such other safety measures as are specified in the relevant Indian Standards.

18. **Danger Notices**.- The owner of every installation of voltage exceeding 250 V shall affix permanently in a conspicious position a danger notice in Hindi or English and the local language of the District, with a sign of skull and bones of a design as per IS -2551 on-

(a) every motor, generator, transformer and other electrical plant and equipment together with apparatus used for controlling or regulating the same;

(b) all supports of overhead lines of voltage exceeding 650 V which can be easily climbed upon without the aid of ladder or special appliances;

(c) luminous tube sign requiring supply, X-ray and similar high frequency installations of voltage exceeding 650 V but not exceeding 33 kV:

Provided that where it is not possible to affix such notices on any generator, motor, transformer or other apparatus, they shall be affixed as near as possible thereto, or the word 'danger' and the voltage of the apparatus concerned shall be permanently painted on it:

Provided further that where the generator, motor, transformer or other apparatus is within an enclosure one notice affixed to the said enclosure shall be sufficient for the purposes of this regulation.

Explanation- For the purpose of clause (b) rails, tubular poles, wooden supports, reinforced cement concrete poles without steps, I-sections and channels, shall be deemed as supports which cannot be easily climbed upon

19. **Handling of electric supply lines and apparatus.-** (1) Before any conductor or apparatus is handled, adequate precautions shall be taken, by earthing or other suitable means, to discharge electrically such conductor or apparatus, and any adjacent conductor or apparatus if there is danger therefrom, and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon.

(2) Every person who is working on an electric supply line or apparatus or both shall be provided with tools and devices such as gloves, rubber shoes, safety belts, ladders, earthing devices, helmets, line testers, hand lines and the like for protecting him from mechanical and electrical injury and such tools and devices shall always be maintained in sound and efficient working condition.

(3) No person shall work on any live electric supply line or apparatus and no person shall assist such person on such work, unless he is designated in that behalf, and takes the safety precautions given in Schedule-III.

(4) Every telecommunication line on supports carrying a line of voltage exceeding 650 V but not exceeding 33 kV shall, for the purpose of working thereon, be deemed to be a line of voltage exceeding 650 V.

(5) All non-current carrying metal parts of switchgear and control panels shall be properly earthed and insulating floors or mat conforming to IS-15652: 2006, of appropriate voltage level shall be provided in front of the panels for the safety of operating personnel.

(6) All panels shall be painted with the description of its identification at front and at the rear.

20. **Supply to vehicles and cranes.-** Every person owning a vehicle, travelling crane, or the like to which electricity is supplied from an external source shall ensure that it is efficiently controlled by a suitable switch enabling all voltage to be cut off in one operation and, where such vehicle, travelling crane or the like runs on metal rails, the owner shall ensure that the rails are electrically continuous and earthed.

21. **Cables for portable or transportable apparatus.-** (1) Flexible cables shall not be used for portable or transportable motors, generators, transformers, rectifiers, electric drills, electric sprayers, welding sets or any other portable or transportable apparatus unless they are heavily insulated and adequately protected from mechanical injury.

(2) Where the protection is by means of metallic covering, the covering shall be in metallic connection with the frame of any such apparatus and earthed.

(3) The cables shall be three core type and four core type for portable and transportable apparatus working on single phase and three phase supply respectively and the wire meant to be used for ground connection shall be easily identifiable.

22. **Cables protected by bituminous materials.-** (1) Where the supplier or the owner has brought into use an electric supply line, other than an overhead line, which is not completely enclosed in a continuous metallic covering connected with earth and is insulated or protected *in situ* by composition or material of a bituminous character,-

(i) any pipe, conduit, or the like into which such electric supply line may have been drawn or placed shall, unless other arrangements are approved by the Electrical Inspector in any particular case, be effectively sealed at its point of entry into any street box so as to prevent any flow of gas to or from the street box, and;

(ii) such electric supply line shall be periodically inspected and tested where accessible, and the result of each such inspection and test shall be duly recorded by the supplier or the owner.

(2) The supplier or the owner after the coming into force of these regulations, shall not bring into use any further electric supply line as aforesaid which is insulated or

protected *in situ* by any composition or material known to be liable to produce noxious or explosive gases on excessive heating.

23. **Street boxes.**- (1) Street boxes shall not contain gas pipes, and precautions shall be taken to prevent, as far as reasonably possible, any influx of water or gas.

(2) Where electric supply lines forming part of different systems pass through the same street box, they shall be readily distinguishable from one another and all electric supply lines of voltage exceeding 650 V at or in street boxes shall be adequately supported and protected so as to prevent risk of damage to or danger from adjacent electric supply lines.

(3) All street boxes shall be regularly inspected for the purpose of detecting the presence of gas and if any influx or accumulation is discovered, the owner shall give immediate notice to any authority or company who have gas mains in the neighbourhood of the street box and in cases where a street box is large enough to admit the entrance of a person after the electric supply lines or apparatus therein have been placed in position, ample provision shall be made-

(i) to ensure that any gas which may by accident have obtained access to the box shall escape before a person is allowed to enter; and

(ii) for the prevention of danger from sparking.

(4) The owners of all street boxes or pillars containing circuits or apparatus shall ensure that their covers and doors are kept closed and locked and are so provided that they can be opened only by means of a key or a special appliance.

24. **Distinction of different circuits.**- The owner of every generating station, sub-station, junction-box or pillar in which there are any circuits or apparatus, whether intended for operation at different voltages or at the same voltage, shall ensure by means of indication of a permanent nature that the respective circuits are readily distinguishable from one another.

25. **Distinction of the installations having more than one feed.**- The owner of every installation including sub-station, double pole structure, four pole structure or any other structure having more than one feed, shall ensure by means of indication of a permanent nature, that the installation is readily distinguishable from other installations

26. **Accidental charging.**- (1) The owners of all circuits and apparatus shall so arrange them that there shall be no danger of any part thereof becoming accidentally charged to any voltage beyond the limits of voltage for which they are intended.

(2) Where alternating current and direct current circuits are installed on the same box or support, they shall be so arranged and protected that they shall not come into contact with each other when live.

27. **Provisions applicable to protective equipment.**- (1) Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires, in addition to fire extinguishers suitable for dealing with fires, shall be conspicuously marked

and kept in all generating stations, enclosed sub-stations and switching-stations in convenient location.

(2) The fire extinguishers shall be tested for satisfactory operation as per relevant Indian Standard at least once a year and record of such tests shall be maintained.

(3) First-aid boxes or cupboards conspicuously marked and equipped with such contents as the State Government may specify, shall be provided and maintained in every generating station, enclosed sub-station, enclosed switching station and in vehicles used for maintenance of lines so as to be readily accessible during all working hours and all such boxes and cupboards shall, except in the case of unattended sub-stations and switching stations, be kept in charge of responsible persons who are trained in first-aid treatment and one of such persons shall be available during working hours.

(4) Two or more gas masks shall be provided conspicuously and installed and maintained at accessible places in every generating station with capacity of 5 MW and above and enclosed sub-station with transformation capacity of 5 MVA and above for use in the event of fire or smoke:

Provided that where more than one generator with capacity of 5 MW and above is installed in a power station, each generator shall be provided with at least two separate gas masks in an accessible and conspicuous place:

Provided further that adequate number of gas masks shall be provided by the owner at every generating station and enlosed sub-station with capacity less than 5 MW and 5 MVA respectively.

28. **Display of instructions for resuscitation of persons suffering from electric shock.-** (1) Instructions, in English or Hindi and the local language of the District and where Hindi is the local language, in English and Hindi for the resuscitation of persons suffering from electric shock, shall be affixed by the owner in a conspicuous place in every generating station, enclosed sub-station, enclosed switching station, mines and in every factory as defined in clause (m) of section 2 of the Factory Act,1948 (63 of 1948) in which electricity is used and in such other premises where electricity is used as the Electrical Inspector may, by notice in writing served on the owner, direct.

(2) The owner of every generating station, enclosed sub-station, enclosed switching station and every factory or other premises to which these regulations apply, shall ensure that all designated persons employed by him are acquainted with and are competent to apply the instructions referred to in sub-regulation (1).

(3) In every manned generating station, sub-station or switching station of voltage exceeding 650 V, an artificial respirator shall be provided and kept in good working condition.

29. **Precautions to be adopted by consumers, owners, occupiers, electrical contractors, electrical workmen and suppliers.-** (1) No electrical installation work, including additions, alterations, repairs and adjustments to existing installations, except such replacement of lamps, fans, fuses, switches, domestic

appliances of voltage not exceeding 250V and fittings as in no way alters its capacity or character, shall be carried out upon the premises of or on behalf of any consumer, supplier, owner or occupier for the purpose of supply to such consumer, supplier, owner or occupier except by an electrical contractor licensed in this behalf by the State Government and under the direct supervision of a person holding a certificate of competency and by a person holding a permit issued or recognised by the State Government.

Provided that in the case of works executed for or on behalf of the Central Government and in the case of installations in mines, oil fields and railways, the Central Government and in other cases the State Government, may, by notification in the Official Gazette, exempt on such conditions as it may impose, any such work described therein either generally or in the case of any specified class of consumers, suppliers, owners or occupiers.

(2) No electrical installation work which has been carried out in contravention of sub-regulation (1) shall either be energised or connected to the works of any supplier.

30. **Periodical inspection and testing of installations.**- (1) Where an installation is already connected to the supply system of the supplier or trader, every such installation shall be periodically inspected and tested at intervals not exceeding five years either by the Electrical Inspector or by the supplier as may be directed by the State Government in this behalf or in the case of installations belonging to, or under the control of the Central Government, and in the case of installation in mines, oilfields and railways, by the Central Government.

(2) The periodical inspection and testing of installations of voltage above 650 V belonging to the supplier, shall also be carried out at intervals not exceeding five years by the Electrical Inspector;

(3) Where the supplier is directed by the Central or the State Government, as the case may be, to inspect and test the installation, he shall report on the condition of the installation to the consumer concerned in the Forms I, II and III as specified in Schedule-IV and shall submit a copy of such report to the Electrical Inspector;

(4) The Electrical Inspector may, on receipt of such report, accept the report submitted by the supplier or record variations as the circumstances of each case may require and may recommend that the defects may be ractified as per report;

(5) In the event of the failure of the owner of any installation to rectify the defects in his installation pointed out by the Electrical Inspector in his report and within the time indicated therein, such installation shall be liable to be disconnected under the directions of the Electrical Inspector after serving the owner of such installation with a notice for not less than forty eight hours.

Provided that the installation shall not be disconnected in case an appeal is made under sub-rule (1) of rule (8) of "Qualifications, Powers and Functions of Chief Electrical Inspector and Electrical Inspectors issued by Central Government vide GSR 481 (E) dated 17.08.2006 and the appellate authority has stayed the orders of disconnection.

Chapter VI

Safety provisions for electrical installations and apparatus of voltage exceeding 650 volts

43. **Approval by Electrical Inspector.** – (1) Voltage above which electrical installations will be required to be inspected by the Electrical Inspector before commencement of supply or recommencement after shutdown for six months and above shall be as per the notification to be issued by the Appropriate Government, under clause (x) of sub-section (2) of section 176 and sub-section (1) of section 162 of the Act.

(2) Before making an application to the Electrical Inspector for permission to commence or recommence supply after an installation has been disconnected for six months and above at voltage exceeding 650 V to any person, the supplier shall ensure that electric supply lines or apparatus of voltage exceeding 650 V belonging to him are placed in position, properly joined and duly completed and examined and the supply of electricity shall not be commenced by the supplier for installations of voltage needing inspection under these regulations unless the provisions of regulations 12 to 29, 33 to 35, 44 to 51 and 55 to 77 have been complied with and the approval in writing of the Electrical Inspector has been obtained by him:

Provided that the supplier may energise the aforesaid electric supply lines or apparatus for the purpose of tests specified in regulation 46.

(3) The owner of any installation of voltage exceeding 650 V shall, before making application to the Electrical Inspector for approval of his installation or additions thereto, test every circuit of voltage exceeding 650 V or additions thereto, other than an overhead line, and satisfy himself that they withstand the application of the testing voltage set out in sub-regulation (1) of regulation 46 and shall duly record the results of such tests and forward them to the Electrical Inspector:

Provided that an Electrical Inspector may direct such owner to carry out such tests as he deems necessary or accept the manufacturer's certified tests in respect of any particular apparatus in place of the tests required by this regulation

(4) The owner of any installation of voltage exceeding 650 V who makes any addition or alteration to his installation shall not connect to the supply his apparatus or electric supply lines, comprising the said alterations or additions unless and until such alteration or addition has been approved in writing by the Electrical Inspector.

44. **Use of electricity at voltage exceeding 650 Volts.** - (1) The Electrical Inspector shall not authorise the supplier to commence supply or where the supply has been discontinued for a period of six months and above, to recommence the supply at voltage exceeding 650 V to any consumer unless-

(i) all conductors and apparatus situated on the premises of the consumer are so placed as to be inaccessible except to a designated person

and all operations in connection with the said conductors and apparatus are carried out by a designated person;

(ii) the consumer has provided and agrees to maintain a separate building or a locked weather proof and fire proof enclosure of agreed design and location, to which the supplier at all times shall have access for the purpose of housing his apparatus and metering equipment, or where the provision for a separate building or enclosure is impracticable, the consumer has segregated the aforesaid apparatus of the supplier from any other part of his own apparatus:

Provided that such segregation shall be by the provision of fire proof walls, if the Electrical Inspector considers it to be necessary:

Provided further that in the case of an outdoor installation the consumer shall suitably segregate the aforesaid apparatus belonging to the supplier from his own;

(iii) all pole type sub-stations are constructed and maintained in accordance with regulation 50.

(2) The owner shall observe the following conditions, where electricity at voltage exceeding 650 V is supplied, converted, transformed or used,-

(i) he shall maintain safety clearances for electrical apparatus as per Bureau of Indian Standard specification so that sufficient space is available for easy operation and maintenance without any hazard to the operating and maintenance personnel working near the equipment and for ensuring adequate ventilation;

(ii) he shall not allow any encroachment below such installation:

Provided that where the Electrical Inspector comes across any such encroachment, he shall direct the owner to remove such encroachments;

(iii) the minimum safety working clearances specified in Schedule-VII shall be maintained for the bare conductors or live parts of any apparatus in outdoor sub-stations excluding overhead lines of installations of voltage exceeding 650 V;

(iv) he shall ensure that the windings of motors or other apparatus within reach from any position in which a person may require to be, are suitably protected so as to prevent danger;

(v) he shall ensure that where a transformer or transformers are used, suitable provision shall be made, either by connecting with earth, a point of the circuit at the lower voltage or otherwise, to guard against danger by reason of the said circuit becoming accidentally charged above its normal voltage by leakage from or contact with the circuit at the higher voltage;

(vi) a sub-station or a switching station with apparatus having more than 2000 litres of oil shall not be located in the basement where proper oil draining arrangement cannot be provided;

(vii) where a sub-station or a switching station with apparatus having more than 2000 litres of oil is installed, whether indoor or outdoors, he shall take the following measures, namely:-

(a) the baffle walls of four hours fire rating shall be provided between the apparatus,-

(i) where there is a single phase transformer banks in the switch-yards of generating stations and sub-stations;

(ii) on the consumer premises;

(iii) where adequate clearance between the units is not available.

(b) provisions shall be made for suitable oil soakpit and where use of more than 9000 litres of oil in any one oil tank, receptacle or chamber is involved, provision shall be made for the draining away or removal of any oil which may leak or escape from the tank, receptacle or chamber containing the same, and special precautions shall be taken to prevent the spread of any fire resulting from the ignition of the oil from any cause and adequate provision shall be made for extinguishing any fire which may occur;

(c) spare oil shall not be stored in the vicinity of any oil filled equipment in any such sub-station or switching station;

(d) all the transformers and switchgears shall be maintained in accordance with the maintenance schedules prepared in accordance with the relevant codes of practice of Bureau of Indian Standards;

(e) dry type of transformers only shall be used for installations inside the residential and commercial buildings;

(viii) without prejudice to the above measures, he shall take adequate fire protection arrangement for quenching the fire in the apparatus;

(ix) he shall ensure that the transformers of 10 MVA and above rating or in case of oil filled transformers with oil capacity of more than 2000 liters are provided with fire fighting system as per IS - 3034: 1993 or with Nitrogen Injection Fire Protection system;

(x) where it is necessary to locate the sub-station, or switching station in the basement, he shall take the following measures, namely:-

(a) the room shall necessarily be in the first basement at the periphery of the basement;

(b) the entrances to the room shall be provided with fire resisting doors of 2 hour fire rating and the door shall always be kept closed and a notice of this effect shall be affixed on outer side of the door;

(c) a curb (sill) of a suitable height shall be provided at the entrance in order to prevent the flow of oil from a ruptured transformer into other parts of the basement;

(d) direct access to the transformer room shall be provided from outside and the surrounding walls shall be lined with fire bricks;

(e) the cables to primary side and secondary side shall have sealing at all floors and wall opening of atleast two hours rating;

(f) fire Retardent Low Smoke (FRLS) cable of two hours rating shall be used.

(xi) he shall ensure that oil filled transformers installed indoors in other than residential or commercial buildings are placed at the ground floor or not below the first basement;

(xii) he shall ensure that cable trenches inside the sub-stations and switching stations containing cables are filled with sand, pebbles or similar non-inflammable materials or completely covered with non-inflammable slabs;

(xiii) he shall ensure that unless the conditions are such that all the conductors and apparatus may be made dead at the same time for the purpose of cleaning or for other work, the said conductors and apparatus shall be so arranged that these may be made dead in sections, and that work on any such section may be carried on by a designated person without danger;

(xiv) only persons designated under sub-regulation (1) of regulation 3, shall carry out the work on live lines and apparatus.

(3) All apparatus shall be protected against lightning and apparatus exceeding 220 kV shall also be protected against switching over voltages.

(4) The equipment used for protection and switching shall be adequately co-ordinated with the protected apparatus to ensure safe operation and to maintain the stability of the inter-connected units of the power system.

(5) The minimum clearances specified in Schedule-VIII shall be maintained for bare conductors or live parts of any apparatus in outdoor sub-stations, excluding overhead lines of High Voltage Direct Current installations.

(6) There shall not be tapping of another transmission line from the main line for 66 kV and above class of lines.

45. Inter-locks and protection for use of electricity at voltage exceeding 650 Volts.- (1) The owner shall ensure the following, namley:-

(i) isolators and the controlling circuit breakers shall be inter-locked so that the isolators cannot be operated unless the corresponding breaker is in open position;

(ii) isolators and the corresponding earthing switches shall be inter-locked so that no earthing switch can be closed unless and until the corresponding isolator is in open position;

(iii) where two or more supplies are not intended to be operated in parallel, the respective circuit breakers or linked switches controlling the supplies shall be inter-locked to prevent possibility of any inadvertent paralleling or feedback;

(iv) when two or more transformers are operated in parallel, the system shall be so arranged as to trip the secondary breaker of a transformer in case the primary breaker of that transformer trips;

(v) all gates or doors which give access to live parts of an installation shall be inter-locked in such a way that these cannot be opened unless the live parts are made dead and proper discharging and earthing of these parts should be ensured before any person comes in close proximity of such parts;

(vi) where two or more generators operate in parallel and neutral switching is adopted, inter-lock shall be provided to ensure that generator breaker cannot be closed unless one of the neutrals is connected to the earthing system.

(2) The following protection shall be provided in all systems and circuits to automatically disconnect the supply under abnormal conditions, namly:-

(i) over current protection to disconnect the supply automatically if the rated current of the equipment, cable or supply line is exceeded for a time which the equipment, cable or supply line is not designed to withstand;

(ii) earth fault or earth leakage protection to disconnect the supply automatically if the earth fault current exceeds the limit of current for keeping the contact potential within the reasonable values;

(iii) gas pressure type and winding and oil temperature protection to give alarm and tripping shall be provided on all transformers of ratings 1000 KVA and above;

(iv) transformers of capacity 10 MVA and above shall be protected against incipient faults by differential protection;

(v) all generators with rating of 100 KVA and above shall be protected against earth fault or leakage;

(vi) all generators of rating 1000 KVA and above shall be protected against faults within the generator winding using restricted earth fault protection or differential protection or by both;

(vii) high speed bus bar differential protection along with local breaker back up protection shall be commissioned and shall always be available at all 132 kV and above voltage sub-stations and switching stations and generating stations connected with the grid:

Provided that in respect of existing 132 kV sub-stations and switching stations having more than one incoming feeders, the high speed bus bar differential protection along with local breaker back up protection, shall be commissioned and shall always be available;

(viii) every generating station and sub-station connected to the grid at 220 kV and above shall be provided with disturbance recording and event logging facilities and all such equipment shall be provided with time synchronization facility for global common time reference but wherever numerical relays with provision of recording fault data are installed, disturbance recorder and event logger may not be installed;

(ix) distance protection and carrier communication protection shall be provided for all lines connecting to 400/220 kV substation.

46. **Testing, Operation and Maintenance.-** (1) Before approval is accorded by the Electrical Inspector under regulation 43 the manufacturer's test certificates shall, if required, be produced for all the routine tests as required under the relevant Indian Standards.

(2) No new apparatus, cable or supply line of voltage exceeding 650 Volts shall be commissioned unless such apparatus, cable or supply line are subjected to site tests as per relevant code of practice of the Bureau of Indian Standards.

(3) No apparatus, cable or supply line of voltage exceeding 650 V which has been kept disconnected, for a period of six months or more, from the system for alterations or repair, shall be connected to the system until such apparatus, cable or supply line are subjected to the relevant tests as per code of practice of Bureau of Indian Standards.

(4) Notwithstanding the provisions of this regulation, the Electrical Inspector may require certain tests to be carried out before or after charging the installations.

(5) All apparatus, cables and supply lines shall be maintained in healthy conditions and tests shall be carried out periodically as per the relevant code of practice of the Bureau of Indian Standards.

(6) Records of all tests, trippings, maintenance works and repairs of all equipments cables and supply lines shall be duly kept in such a way that these records can be compared with earlier ones.

(7) It shall be the responsibility of the owner of all installations of voltage exceeding 650 V to maintain and operate the installations in a condition free from danger and as recommended by the manufacturer or by the relevant codes of practice of the Bureau of Indian Standards.

(8) Failures of transformers and reactors of 20 MVA or MVAR and higher capacity shall be reported by the consumer and the suppliers of electricity, within forty eight hours of the occurrence of the failure, to the Central Electricity Authority and the reasons for failure and measures to be taken to avoid recurrence of failure shall be sent to the Central Electricity Authority within one month of the occurrence in the format given in Schedule-IX.

47. **Precautions to be taken against excess leakage in case of metal sheathed electric supply lines.-** The following precautions shall be taken in case of electric supply lines other than overhead lines, for use at voltage exceeding 650 V; namely:-

(i) the conductors of the cable except the cable with thermoplastic insulation without any metallic screen or armour shall be enclosed in metal sheathing which shall be electrically continuous and connected with earth, and the conductivity of the metal sheathing shall be maintained and reasonable precautions taken where necessary to avoid corrosion of the sheathing;

(ii) the resistance of the earth connection with metallic sheath shall be kept low enough to permit the controlling circuit breaker or cut-out to operate in the event of any failure of insulation between the metallic sheath and the conductor.

Explanation- For the purpose of this regulation;

(a) in the case of thermoplastic insulated and sheathed cables with metallic armour the metallic wire or tape armour, shall be considered as metal sheathing.

(b) where an electric supply line as aforesaid has concentric cables and the external conductor is insulated from an outer metal sheathing and connected with earth, the external conductor may be regarded as the metal sheathing for the purposes of this regulation provided that the foregoing provisions as to conductivity are complied with.

48. **Connection with earth for apparatus exceeding 650V.-** (1) All non-current carrying metal parts associated with an installation of voltage exceeding 650 V shall be effectively earthed to a grounding system or mat which shall,-

(i) limit the touch and step potential to tolerable values;

(ii) limit the ground potential rise to tolerable values so as to prevent danger due to transfer of potential through ground, earth wires, cable sheath, fences, pipe lines, etc.;

(iii) maintain the resistance of the earth connection to such a value as to make operation of the protective device effective;

(2) In the case of star connected system with earthed neutrals or delta connected system with earthed artificial neutral point,-

(i) the neutral point of every generator and transformer shall be earthed by connecting it to the earthing system not by less than two separate and distinct connections:

Provided that the neutral point of a generator may be connected to the earthing system through an impedance to limit the fault current to the earth:

Provided further that in the case of multi-machine systems neutral switching may be resorted to, for limiting the injurious effect of harmonic current circulation in the system;

(ii) the generator or transformer neutral shall be earthed through a suitable impedance where an appreciable harmonic current flowing in the neutral connection causes interference, with communication circuits;

(iii) in case of the delta connected system the neutral point shall be obtained by the insertion of a grounding transformer and current limiting resistance or impedance wherever considered necessary at the commencement of such a system.

(3) In case of generating stations, sub-stations and industrial installations of voltage exceeding 33 kV, the system neutral earthing and protective frame earthing may be, if system design so warrants, integrated into common earthing grid provided the resistance to earth of combined mat does not cause the step and touch potential to exceed its permissible values.

(4) Single phase systems of voltage exceeding 650 V shall be effectively earthed.

(5) In the case of a system comprising electric supply lines having concentric cables, the external conductor shall be connected with earth.

(6) Where a supplier proposes to connect with earth an existing system for use at voltage exceeding 650 V which has not hitherto been so connected with earth, he shall give not less than fourteen days notice in writing together with particulars of the proposed connection with earth to the telegraph-authority established under the Indian Telegraph Act, 1885 (13 of 1885).

(7) Where the earthing lead and earth connection are used only in connection with earthing guards erected under overhead lines of voltage exceeding 650 V where they cross a telecommunication line or a railway line, and where such lines are equipped with earth leakage, the earth resistance shall not exceed twenty five

ohms and the project authorities shall obtain No Objection Certificate (NOC) from Railway Authorities and Power and Telecommunication Co-ordination Committee before energisation of the facilities.

(8) Every earthing system belonging to either the supplier or the consumer shall be tested for its resistance to earth on a dry day during dry season not less than once a year and records of such tests shall be maintained and produced, if so required, before the Electrical Inspector.

49. **General conditions as to transformation and control of electricity.-** (1) Where electricity of voltage exceeding 650 V is transformed, converted, regulated or otherwise controlled in sub-stations or switching stations including outdoor sub-stations and outdoor switching stations to be transformed or in street boxes constructed underground, the following provisions shall be observed, namely:-

(i) sub-stations and switching stations shall preferably be erected above ground, but where necessarily constructed underground due provisions for ventilation and drainage shall be made and any space housing switchgear shall not be used for storage of any materials especially inflammable and combustible materials or refuse;

(ii) outdoor sub-stations except pole type sub-stations and outdoor switching stations shall, unless the apparatus is completely enclosed in a metal covering connected with earth, the said apparatus also being connected with the system by armoured cables, be efficiently protected by fencing not less than 1.8 metres in height or other means so as to prevent access to the electric supply lines and apparatus therein by an undesignated person and the fencing of such area shall be earthed efficiently;

(iii) underground street boxes, other than sub-stations, which contain transformers shall not contain switches or other apparatus, and switches, cut-outs or other apparatus required for controlling or other purposes shall be fixed in separate receptacle above ground wherever practicable.

(2) Where electricity is transformed, suitable connection shall be made by connecting with earth a point of the system at the lower voltage and also to guard against danger by reason of the said system becoming accidentally charged above its normal voltage by leakage from a contact with the system at the higher voltage.

50. **Pole type sub-stations.-** Where platform type construction is used for a pole type sub-station and sufficient space for a person to stand on the platform is provided, a substantial hand rail shall be built around the said platform and if the hand rail is of metal, it shall be connected with earth:

Provided that in the case of pole type sub-station on wooden supports and wooden platform the metal hand-rail shall not be connected with earth.

51. **Condensers.-** Suitable arrangement shall be made for immediate and automatic or manual discharge of every static condenser on disconnection of supply.

52. Supply to luminous tube sign installations of voltage exceeding 650 Volts but not exceeding 33 kV.- (1) Any person who proposes to use or who is using electricity for the purpose of operating a luminous tube sign installation, or who proposes to transform or is transforming electricity to a voltage exceeding 650 V but not exceeding 33 kV for any such purpose shall comply with the following conditions, namely:-.

(i) all live parts of the installation, including all apparatus and live conductors in the secondary circuit, but excluding the tubes except in the neighbourhood of their terminals, shall be inaccessible to undesignated persons and such parts shall be effectively screened;

(ii) irrespective of the method of obtaining the voltage of the circuit which feeds the luminous discharge tube sign, no part of any conductor of such circuit shall be in metallic connection, except in respect of its connection with earth, with any conductor of the supply system or with the primary winding of the transformer;

(iii) all live parts of an exterior installation shall be so disposed as to protect them against the effects of the weather and such installation shall be so arranged and separated from the surroundings as to limit, as far as possible, the spreading of fire;

(iv) the secondary circuit shall be permanently earthed at the transformer and the core of every transformer shall be earthed;

(v) where the conductors of the primary circuit are not in metallic connection with the supply conductors, one phase of such primary circuit shall be permanently earthed at the motor generator or convertor, or at the transformer and an earth leakage circuit breaker of sufficient rating shall be provided on the side of voltage not exceeding 250 V to detect the leakage in such luminous tube sign installations;

(vi) a sub-circuit which forms the primary circuit of a fixed luminous discharge tube sign installation shall be reserved solely for such purpose;

(vii) a separate primary final sub-circuit shall be provided for each transformer or each group of transformers having an aggregate input not exceeding 1,000 volt-amperes, of a fixed luminous discharge tube sign installation;

(viii) an interior installation shall be provided with suitable adjacent means for disconnecting all phases of the supply except the "neutral" in a 3-phase, 4-wire circuit;

(ix) for installations on the exterior of a building a suitable emergency fire-proof linked switch to operate on all phases except the neutral in a 3-phase, 4-wire circuit shall be provided and fixed in a conspicuous position at not more than 1.70 metres above the ground;

(x) a special "caution" notice shall be affixed in a conspicuous place on the door of every enclosure of voltage exceeding 650 V but not exceeding 33 kV to the effect that the supply must be cut off before the enclosure is opened;

(xi) where static condensers are used, they shall be installed on the load side of the fuses and the primary side of the transformers where the voltage does not exceed 250 V;

(xii) where static condensers are used on primary side, provision shall be made for automatic or manual discharging of the condensers when the supply is cut off;

(xiii) before using the static condensers or any interrupting device on the voltage exceeding 650 V, the executing agencies shall test and ensure that automatic discharging device is functional thereon.

(2) The owner or user of any luminous tube sign or similar installation of voltage exceeding 650 V but not exceeding 33 kV shall not bring the same into use without giving to the Electrical Inspector not less than fourteen days notice in writing of his intention so to do.

53. **Supply to electrode boilers of voltage exceeding 650 Volt but not exceeding 33 kV.**- (1) Where a system having a point connected with earth is used for supply of electricity to an electrode boiler of voltage exceeding 650 V which is also connected with earth, the owner or user of electrode boiler shall comply with the following conditions, namely:-

(i) the metal work of the electrode boiler shall be efficiently connected to the metal sheathing and metallic armouring, if any, of the electric supply line of voltage exceeding 650 V but not exceeding 33 kV whereby electricity is suppied to the electrode boiler;

(ii) the supply of electricity at voltage exceeding 650 V to the electrode boiler shall be controlled by a suitable circuit-breaker so set as to operate in the event of the phase currents becoming unbalanced to the extent of ten per cent of the rated current consumption of the electrode boiler under normal conditions of operation:

Provided that if in any case a higher setting is essential to ensure stability of operation of the electrode boiler, the setting may be increased so as not to exceed fifteen per cent of the rated current consumption of the electrode boiler under normal conditions of operation;

(iii) an inverse time element device may be used in conjuction with the aforesaid circuit breaker to prevent the operation thereof unnecessarily on the occurrence of unbalanced phase currents of momentary or short duration;

(iv) the supplier or owner shall serve a notice in writing on the telegraph-authority at least seven days prior to the date on which such supply of electricity is to be afforded specifying the location of every point, including

the earth connection of the electrode boiler, at which the system is connected with earth.

(2) The owner or user of any electrode boiler of voltage exceeding 650 V shall not bring the same into use without giving the Electrical Inspector not less than fourteen days notice in writing of his intention so to do.

54. **Supply to X-ray and high frequency installations.**- (1) Any person, who proposes to use or who is using electricity for the purpose of operating an X-ray or similar high-frequency installation, other than portable units or shock-proof self contained and stationary units shall comply the following conditions, namely:-

(i) mechanical barriers shall be provided to prevent too close an approach to any parts of the X-ray apparatus of voltage exceeding 650 V but not exceeding 33 kV, except the X-ray tube and its leads, unless such parts of voltage exceeding 650 V but not exceeding 33 kV have been rendered shock proof by being shielded by earthed metal or adequate insulating material;

(ii) where generators operating at 300 kV peak or more are used, such generators shall be installed in rooms separate from those containing the other equipment and any step-up transformer employed shall be so installed and protected as to prevent danger;

(iii) a suitable switch shall be provided to control the circuit supplying a generator, and shall be so arranged as to be open except while the door of the room housing the generator is locked from the outside;

(iv) X-ray tubes used in therapy shall be mounted in an earthed metal enclosure;

(v) every X-ray machine shall be provided with a milliammeter or other suitable measuring instrument, readily visible from the control position and connected, if practicable, in the earthed lead, but guarded if connected in the lead of voltage exceeding 650 V but not exceeding 33 kV:

Provided that earth leakage circuit breaker of sufficient rating shall be provided on the side wherein voltage does not exceed 250 V to detect the leakage in such X-ray installations.

Explanation:- For the purpose of this regulation "shock proof", as applied to X-ray and high-frequency equipment, shall mean that such equipment is guarded with earthed metal so that no person may come into contact with any live part.

(2) (i) in the case of nonshock proof equipment, overhead conductors of voltage exceeding 650 V but not exceeding 33 kV, unless suitably guarded against personal contact, shall be adequately spaced and high voltage leads on tilting tables and fluroscopes shall be adequately insulated or so surrounded by barriers as to prevent inadvertent contact;

(ii) the circuit of voltage not exceeding 250 V of the step up transformer shall contain a manually operated control device having overload protection, in addition to the over current device for circuit protection, and these devices shall have no exposed live parts and for diagnostic work there shall be an additional switch in the said circuit, which shall be of one of the following types:-

(a) a switch with a spring or other mechanism that will open automatically except while held close by the operator, or;

(b) a time switch which will open automatically after a definite period of time for which it has been set;

(iii) if more than one piece of apparatus be operated from the same source of voltage exceeding 650 V, each shall be provided with a switch of voltage exceeding 650 V to give independent control;

(iv) low frequency current-carrying parts of a machine of the quenched-gap or open gap type shall be so insulated or guarded that they cannot be touched during operation but the high frequency circuit-proper which delivers high-frequency current normally for the therapeutic purposes shall be exempt from such insulation;

(v) all X-ray generators having capacitors shall have suitable means for discharging the capacitors manually;

(vi) except in the case of self-contained units, all 200 kV peak or higher X-ray generators shall have a sphere gap installed in the system of voltage exceeding 650 V but not exceeding 33 kV adjusted so that it will break down on over voltage surges.

(3) (i) all non-current carrying metal parts of tube stands, fluroscopes and other apparatus shall be properly earthed and insulating floors, mats or platforms shall be provided for operators in proximity to parts of voltage exceeding 650V unless such parts have been rendered shock proof;

(ii) where short wave therapy machines are used, the treatment tables and examining chairs shall be wholly non-metallic.

(4) The owner of any X-ray installation or similar high frequency apparatus shall not bring the same into use without giving to the Electrical Inspector not less than fourteen days notice in writing of his intention to do so:

Provided that the aforesaid notice shall not be necessary in the case of shock-proof portable X-ray and high-frequency equipment which have been inspected before the commencement of their use and periodically thereafter.

Chapter VII

Safety requirements for overhead lines, underground cables and generating stations

55. Material and strength.- (1) All conductors of overhead lines other than those specified in regulation 68 shall have a breaking strength of not less than 350 kg.

(2) Where the voltage does not exceed 250 V and the span is of less than fifteen metres and is drawn through the owner's or consumer's premises, a conductor having an actual breaking strength of not less than 150 kg may be used.

56. Joints.- (1) No conductor of an overhead line shall have more than one joint in a span and joints between conductors of overhead lines shall be mechanically and electrically secure under the conditions of operation.

(2) The ultimate strength and the electrical conductivity of the joint shall be as per relevant Indian Standards.

57. Maximum stresses and factors of safety.- (1) The load and permissible stresses on the structural members, conductors and ground wire of self supporting steel lattice towers for overhead transmission lines shall be in accordance with the specifications laid down, from time to time, by the Bureau of Indian Standards.

(2) Overhead lines not covered in sub-regulation (1) shall have the following minimum factors of safety, namely:-

(i)	for metal supports	-	1.5
(ii)	for mechanically processed concrete supports	-	2.0
(iii)	for hand-moulded concrete supports	-	2.5
(iv)	for wood supports	-	3.0

(3) The minimum factors of safety shall be based on such load as may cause failure of the support to perform its function, assuming that the foundation and other components of the structure are intact.

(4) The load shall be equivalent to the yield point stress or the modulus of rupture, as the case may be, for supports subject to bending and vertical loads and the crippling load for supports used as strut.

(5) The strength of the supports of the overhead lines in the direction of the line shall not be less than one-fourth of the strength required in the direction transverse to the line.

(6) The minimum factor of safety for stay-wires, guard-wires or bearer-wires shall be 2.5 based on the ultimate tensile strength of the wire.

(7) The minimum factor of safety for conductors shall be two, based on their ultimate tensile strength, in addition, the conductor's tension at 32^0 C, without external load, shall not exceed the following percentages of the ultimate tensile strength of the conductor:- .

(i)	Initial unloaded tension	.....	35 per cent
(ii)	Final unloaded tension	.....	25 per cent

Provided that for the conductors having a cross section of a generally triangular shape, such as conductors composed of 3-wires, the final unloaded tension at 32^0 C shall not exceed thirty per cent of the ultimate tensile strength of such conductor.

(8) For the purpose of calculating the factors of safety in sub-regulation (2), the following conditions shall be observed, namely:-

(i) the maximum wind pressure shall be as specified in the relevant Indian Standards;

(ii) for cylindrical structures the effective area shall be taken as full projected area exposed to wind pressure; and

(iii) the maximum and minimum temperatures shall be such as specified in the relevant Indian Standards.

(9) Notwithstanding anything contained in sub-regulation (2) to (8) in localities where overhead lines are liable to accumulations of ice or snow, the load and permissible stresses on the structural members, conductors and ground wire of self supporting steel lattice towers for overhead transmission lines shall be in accordance with the specifications laid down, from time to time, by the Bureau of Indian Standards or as specified by Appropriate Government, by order in writing.

58. **Clearance above ground of the lowest conductor of overhead lines.-** (1) No conductor of an overhead line, including service lines, erected across a street shall at any part thereof be at a height of less than-

(i)	for lines of voltage not exceeding 650 Volts	-	5.8 metres
(ii)	for lines of voltage exceeding 650 Volts but not exceeding 33 kV	-	6.1 metres

(2) No conductor of an overhead line, including service lines, erected along any street shall at any part thereof be at a height less than-

(i)	for lines of voltage not exceeding 650 Volts	-	5.5 metres
(ii)	for lines of voltage exceeding 650 Volts but not exceeding 33 kV	-	5.8 metres

(3) No conductor of an overhead line including service lines, erected elsewhere than along or across any street shall be at a height less than -

(i)	for lines of voltage upto and including 11,000 Volts,if bare	-	4.6 metres
(ii)	for lines of voltage upto and including 11,000 Volts, if insulated	-	4.0 metres
(iii)	for lines of voltage exceeding 11,000 Volts but not exceeding 33 kV	-	5.2 metres

(4) For lines of voltage exceeding 33 kV the clearance above ground shall not be less than 5.2 metres plus 0.3 metre for every 33,000 Volts or part thereof by which the voltage of the line exceeds 33,000 Volts;

Provided that the minimum clearance along or across any street shall not be less than 6.1 metres.

(5) For High Voltage Direct Current (HVDC) lines, the clearance above ground shall not be less than:-

Sl.No.	DC Voltage(kV)	Ground Clearance (mtrs.)
1.	100 kV	6.1
2.	200 kV	7.3
3.	300 kV	8.5
4.	400 kV	9.4
5.	500 kV	10.6
6.	600 kV	11.8
7.	800 kV	13.9

(6) Ground clearances shall be as specified in schedule-X.

59. **Clearance between conductors and trolley wires.-** (1) No conductor of an overhead line crossing a tramway or trolley bus route using trolley wires shall have less than the following clearances above any trolley wire-

(i) lines of voltage not exceeding 650 Volts - 1.2 metres

Provided that where an insulated conductor suspended from a bearer wire crosses over a trolley wire the minimum clearance for such insulated conductor shall be 0.6 metre.

(ii) lines of voltage exceeding 650 Volts up to and including 11,000 Volts - 1.8 metres

(iii) lines of voltage exceeding 11,000 Volts but not exceeding33,000 Volts - 2.5 metres

(iv) lines of voltage exceeding 33 kV - 3.0 metres

(2) In any case of a crossing specified in sub-regulation (1), whoever lays his line later in time, shall provide the clearance between his own line and the line which will be crossed in accordance with the provisions of the said sub-regulation:

Provided that if the later entrant is the owner of the lower line and is not able to provide adequate clearance, he shall bear the cost for modification of the upper line so as to comply with this sub-regulation.

60. **Clearance from buildings of lines of voltage and service lines not exceeding 650 Volts.-** (1) An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.

(2) Where an overhead line of voltage not exceeding 650 V passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed, namely:-

(i) for any flat roof, open balcony, varandah roof and lean-to-roof-

(a) when the line passes above the building a vertical clearance of 2.5 metres from the highest point, and

(b) when the line passes adjacent to the building a horizontal clearance of 1.2 metres from the nearest point, and

(ii) for pitched roof-

(a) when the line passes above the building a vertical clearance of 2.5 metres immediately under the line, and

(b) when the line passes adjacent to the building a horizontal clearance of 1.2 metres.

(3) Any conductor so situated as to have a clearance less than that specified above shall be adequately insulated and shall be attached at suitable intervals to a bare earthed bearer wire having a breaking strength of not less than 350 kg.

(4) The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

(5) Vertical and horizontal clearances shall be as specified in schedule-X.

Explanation:- For the purpose of this regulation, the expression "building" shall be deemed to include any structure, whether permanent or temporary.

61. **Clearances from buildings of lines of voltage exceeding 650 V.-** (1) An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.

(2) Where an overhead line of voltage exceeding 650 V passes above or adjacent to any building or part of a building it shall have on the basis of maximum sag a vertical clearance above the highest part of the building immediately under such line, of not less than-

(i) for lines of voltages exceeding 650 Volts upto and including 33,000 Volts	- 3.7 metres
(ii)for lines of voltages exceeding 33 kV	- 3.7 metres plus 0.30 metre for every additional 33,000 Volts or part thereof.

(3) The horizontal clearance between the nearest conductor and any part of such building shall, on the basis of maximum deflection due to wind pressure, be not less than-

(i)	for lines of voltages exceeding 650 V upto and including 11,000 Volts	- 1.2 metres
(ii)	for lines of voltages exceeding 11,000 V and up to and including 33,000 V	- 2.0 metres
(iii)	for lines of voltages exceeding 33 kV	- 2.0 metres plus 0.3 metre fore every additional 33kV or part thereof.

(4) For High Voltage Direct Current (HVDC) systems, vertical clearance and horizontal clearance, on the basis of maximum deflection due to wind pressure, from buildings shall be maintained as below:

Sl.No	DC Voltage (kV)	Vertical Clearance (mtrs.)	Horizontal Clearance (mtrs.)
1.	100 kV	4.6	2.9
2.	200 kV	5.8	4.1
3.	300 kV	7.0	5.3
4.	400 kV	7.9	6.2
5.	500 kV	9.1	7.4
6.	600 kV	10.3	8.6
7.	800 kV	12.4	10.7

(5) Vertical and horizontal clearances shall be as specified in schedule-X.

Explanation:- For the purpose of this regulation the expresssion "building" shall be deemed to include any structure, whether permanent or temporary.

62. **Conductors at different voltages on same supports.-** Where conductors forming parts of systems at different voltages are erected on the same supports, the owner shall make adequate provision to guard against danger to linemen and others, from the lower voltage system being charged above its normal working voltage, by leakage from or contact with the higher voltage system and the methods of construction and the applicable minimum clearances between the conductors of the two systems shall be as specified in regulation 69 for lines crossing each other.

63. Erection or alteration of buildings, structures, flood banks and elevation of roads.- (1) If at any time subsequent to the erection of an overhead line, whether covered with insulating material or not, any person proposes to erect a new building or structure or flood bank or to raise any road level or to carry out any other type of work whether permanent or temporary or to make in or upon any building, or structure or flood bank or road, any permanent or temporary addition or alteration, he and the contractor whom he employs to carry out the erection, addition or alteration, shall, give intimation in writing of his intention to do so, to the supplier or owner and to the Electrical Inspector and shall furnish therewith a scale drawing showing the proposed building, structure, flood bank, road or any addition or alteration and scaffolding thereof required during the construction.

(2) On receipt of such intimation, the supplier or owner shall examine,-

(i) whether the line under reference was laid in acordance with the provisions of these regulations and any other law;

(ii) whether it is technically feasible;

(iii) whether it meets the requirement of Right of Way (ROW);

(iv) whether such person was liable to pay the cost of alteration of the overhead line and if so, send a notice without undue delay, to such person together with an estimate of the cost of the expenditure likely to be incurred to so alter the overhead line and require him to deposit, within thirty days of the receipt of the notice, with the supplier or owner, the amount of the estimated cost.

(3) If such person disputes the cost of alteration of the overhead line estimated by the supplier or owner or even the responsibility to pay such cost, the dispute may be referred to the Electrical Inspector whose decision thereof shall be final.

(4) The Electrical Inspector shall estimate the cost of alteration of overhead line on the following basis, namely:-

(i) the cost of material used on the alteration after crediting the depreciated cost of the material which shall be available from the existing line;

(ii) the wages of labour employed in affecting the alteration;

(iii) supervision charges to the extent of fifteen per cent of the wages mentioned in sub clause (ii); and charges incurred by the supplier or owner in complying with the provisions of section 67 of the Act, in respect of such alterations.

(5) Any addition or alteration to the building or structure shall be allowed only after the deposite of such estimated cost to the supplier or owner.

(6) No work upon such building, structure, flood bank, road and addition or alteration thereto shall be commenced or continued until the Electrical Inspector

has certified that the provisions of regulation 58, 60 and 61 should not be contravened either during or after the aforesaid construction:

Provided that the Electrical Inspector may, if he is satisfied that the overhead line has been so guarded as to secure the protection of persons or property from injury, certify that the work may be executed prior to the alteration of the overhead line or in the case of temporary addition or alteration, without alteration of the overhead line.

(7) The supplier or owner shall, on receipt of such deposit, alter the overhead line in such a way that it does not contravene the provisions regulation 58, 60 and 61 either during or after such construction within two months from the date of such deposit or within such longer period as the Electrical Inspector may allow.

64. **Transporting and storing of material near overhead lines.**- (1) No rods, pipes or similar materials shall be taken below, or in the vicinity of, any bare overhead conductors or lines if these contravene the provisions of regulations 60 and 61 unless such materials are transported under the direct supervision of a person designated in this behalf by the owner of such overhead conductors or lines.

(2) No rods, pipes or other similar materials shall be brought within the flash over distance of bare live conductors or lines.

(3) No material or earth work or agricultural produce shall be dumped or stored, no trees grown below or in the vicinity of, bare overhead conductors, or lines to contravene the provision of regulations 60 and 61.

(4) No flammable material shall be stored under the electric supply line.

(5) No fire shall be allowed above underground cables.

(6) Firing of any material below electric lines shall be prohibited.

65. **General clearances.**- (1) For the purpose of computing the vertical clearance of an overhead line, the maximum sag of any conductor shall be calculated on the basis of the maximum sag in still air and the maximum temperature as specified under regulations 57 and computing any horizontal clearance of an overhead line the maximum deflection of any conductor shall be calculated on the basis of the wind pressure specified under regulations 57.

(2) No blasting for any purpose shall be done within 300 metres from the boundary of a sub-station or from the electric supply lines of voltage exceeding 650 V or tower structure thereof without the written permission of the owner of such sub-station or electric supply lines or tower structures and in case of mining lease hold area, without the written permission of the Inspector of Mines.

(3) No cutting of soil within ten meters from the tower structure of 132 kV and above voltage level shall be permitted without the written permission of the owner of tower structure.

(4) No person shall construct brick kiln or other polluting units near the installations or transmission lines of 220 kV and above within a distance of 500 metres.

66. **Routes proximity to aerodromes.**- Overhead lines shall not be erected in the vicinity of aerodromes unless the Airport Authorities have approved in writing the route of the proposed lines as per relevant Indian Standards.

67. **Maximum interval between supports.**- All conductors shall be attached to supports at intervals not exceeding the safe limits based on the ultimate tensile strength of the conductor and the factor of safety specified under regulations 57.

Provided that in the case of overhead lines carrying conductors of voltage not exceeding 650 V when erected in, over, along or across any street, the interval shall not, without the consent in writing of the Electrical Inspector, exceed 65 metres.

68. **Conditions to apply where telecommunication lines and power lines are carried on same supports.**- (1) Every overhead telecommunication line erected on supports carrying a power line shall consist of conductors each having a breaking strength of not less than 270 kg.

(2) Every telephone used on a telecommunication line erected on supports carrying a power line shall be suitably guarded against lightning and shall be protected by cut-outs.

(3) Where a telecommunication line is erected on supports carrying a power line of voltage exceeding 650 V, arrangement shall be made to safeguard any person against injury resulting from contact, leakage or induction between such power and telecommunication lines.

69. **Lines crossing or approaching each other and lines crossing street and road.**- Where an overhead line crosses or is in proximity to any telecommunication line, the owner of either the overhead line or the telecommunication line, whoever lays his line later, shall arrange to provide for protective devices or guarding arrangement and shall observe the following provisions, namely:-

(i) when it is intended to erect a telecommunication line or an overhead line which will cross or be in proximity to an overhead line or a telecommunication line, as the case may be, the person proposing to erect such line shall give one month's notice of his intention so to do along with the relevant details of protection and drawings to the owner of the existing line;

(ii) guarding shall be provided where lines of voltage not exceeding 33 kV cross a road or street;

(iii) where an overhead line crosses or is in proximity to another overhead line, guarding arrangements shall be provided so to guard against the possibility of their coming into contact with each other;

(iv) where an overhead line crosses another overhead line, clearances shall be as under:-

(Minimum clearances in metres between lines crossing each other)

Sl. No	Nominal System Voltage	11-66 kV	110-132 kV	220 kV	400 kV	800 kV
1.	Low and Medium	2.44	3.05	4.58	5.49	7.94
2.	11-66 kV	2.44	3.05	4.58	5.49	7.94
3.	110-132 kV	3.05	3.05	4.58	5.49	7.94
4.	220 kV	4.58	4.58	4.58	5.49	7.94
5.	400 kV	5.49	5.49	5.49	5.49	7.94
6.	800 kV	7.94	7.94	7.94	7.94	7.94

Provided that no guardings are required when line of voltage exceeding 33 kV crosses over another line of 250 V and above voltage or a road or a tram subject to the condition that adequate clearances are provided between the lowest conductor of the line of voltage exceeding 33 kV and the top most conductor of the overhead line crossing underneath the line of voltage exceeding 33 kV and the clearances as stipulated in regulation 58 from the topmost surface of the road maintained;

(v) where an overhead direct current (DC) line crosses another overhead line, clearances shall be as under:-

(Minimum clearances in metres between AC and DC lines crossing each other)

Sl. No.	Sysytem Voltage AC/DC	100 kV DC	200 kV DC	300 kV DC	400 kV DC	500 kV DC	600 kV DC
1.	Low and Medium AC	3.05	4.71	5.32	6.04	6.79	7.54
2.	11-66 kV AC	3.05	4.71	5.32	6.04	6.79	7.54
3.	110-132 kV AC	3.05	4.71	5.32	6.04	6.79	7.54
4.	220 kV AC	4.58	4.71	5.32	6.04	6.79	7.54
5.	200 kV DC	4.71	4.71	5.32	6.04	6.79	7.54

6.	300 kV AC	5.32	5.32	5.32	6.04	6.79	7.54
7.	400 kV AC	5.49	5.49	5.49	6.04	6.79	7.54
8.	400 kV DC	6.04	6.04	6.04	6.04	6.79	7.54
9.	500 kV DC	6.79	6.79	6.79	6.79	6.79	7.54
10.	600 kV DC	7.54	7.54	7.54	7.54	7.54	7.54
11.	800 kV DC	7.94	7.94	7.94	7.94	7.94	7.94

(vi) a person erecting or proposing to erect a line which may cross or be in proximity with an existing line, shall provide arrangements on his own line or require the owner of the other overhead line to provide guarding arrangements as referred to in clause (iii) and (iv);

(vii) in all cases referred to in this regulation the expenses of providing the guarding arrangements or protective devices shall be borne by the person whose line was last erected;

(viii) where two lines cross, the crossing shall be made as nearly at right angles as the nature of the case admits and as near the support of the line as practicable, and the support of the lower line shall not be erected below the upper line;

(ix) the guarding arrangements shall ordinarily be carried out by the owner of the supports on which it is made and he shall be responsible for its efficient maintenace.

70. **Guarding.**- (1) Where guarding is required under these regulations the following shall be observed , namely:-

(i) every guard-wire shall be connected with earth at each point at which its electrical continuity is broken;

(ii) every guard-wire shall have an actual breaking strength of not less than 635 kg and if made of iron or steel , shall be galvanised;

(iii) every guard-wire or cross-connected systems of guard-wires shall have sufficient current-carrying capacity to ensure them rendering dead, without risk of fusing of the guard-wire or wires, till the contact of any live wire has been removed.

(2) In the case of a line crossing over a trolley-wire the guarding shall be subjected to the following conditions, namely:-.

(i) where there is only one trolley-wire, two guard-wires shall be erected as in DIAGRAM-A;

(ii) where there are two trolley –wires and the distance between them does not exceed 40 cms, two guard-wires shall be erected as in DIAGRAM-B;

(iii) where there are two trolley wires and the distance between them exceeds 40 cms but does not exceed 1.2 metres, three guard-wires shall be erected as in DIAGRAM-C;

(iv) where there are two trolley-wires and the distance between them exceeds 1.2 metres, each trolley-wire shall be separately guarded as in DIAGRAM-D;

(v) the rise of trolley boom shall be so limited that when the trolley leaves the trolley-wire, it shall not foul the guard-wires; and

(vi) where a telegraph-line is liable to fall or be blown down upon an arm, stay-wire or span-wire and so slide-down upon a trolley-wire, guard hooks shall be provided to prevent such sliding.

DIAGRAM-A

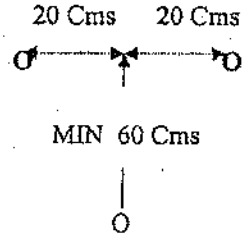


DIAGRAM-B

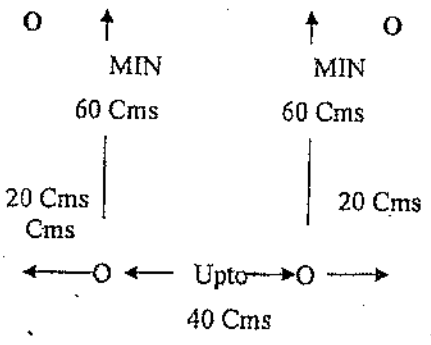


DIAGRAM-C

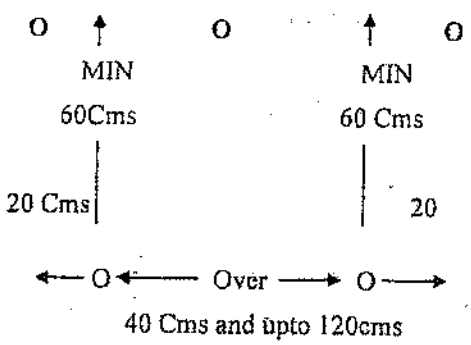
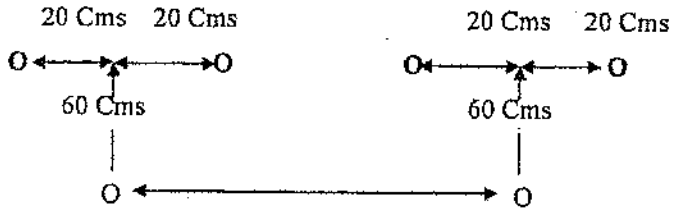


DIAGRAM-D



OVER 120cms.

71. **Service lines from overhead lines.-** No service-line or tapping shall be taken off an overhead line except at a point of support:

Provided that the number of tappings per conductor shall not be more than four in case of connections at voltage not exceeding 650 V.

72. **Earthing.-** (1) All metal supports and all reinforced and prestressed cement concrete supports of overhead lines and metallic fittings attached thereto, shall be either permanently and efficiently earthed by providing a continuous earth wire and securely fastening to each pole and connecting with earth ordinarily at three points in every km. with the spacing between the points being as nearly equidistant as possible or each support and the metallic fitting attached thereto shall be efficiently earthed.

(2) Metallic bearer wire used for supporting insulated wire of overhead service lines of voltage not exceeding 650 V shall be efficiently earthed or insulated.

(3) Each stay-wire shall be similarly earthed unless insulator has been placed in it at a height not less than 3.0 metres from the ground.

73. **Safety and protective devices.-** (1) Every overhead line which is not being suspended from a dead bearer wire, not being covered with insulating material and not being a trolley-wire, is erected over any part of a street or other public place

or in any factory or mine or on any consumer's premises shall be protected with earth gaurding for rendering the line electrically harmless in case it breaks.

(2) An Electrical Inspector may, by notice in writing, require the owner of any such overhead line, wherever it may be erected, to protect it in the manner specified in sub-regulation (1).

(3) The owner of every overhead line of voltage exceeding 650 V shall make adequate arrangements as per relevant Indian Standards to prevent undesignated persons from ascending any of the supports of such overhead lines which can be easily climbed upon without the help of a ladder or special appliances.

Explanation.- For the purpose of this relgulation, rails, reinforced cement concrete poles and pre-stressed cement concrete poles without steps, tubular poles, wooden supports without steps, I-sections and channels' shall be deemed as supports which cannot be easily climbed upon.

74. **Protection against lightning.**- (1) The owner of every overhead line, sub-station or generating station which is exposed to lightning shall adopt efficient means for diverting to earth any electrical surges due to lightning which may result into injuries.

(2) The earthing lead for any lightning arrestor shall not pass through any iron or steel pipe, but shall be taken as directly as possible from the lightning arrestor without touching any metal part to a separate vertical ground electrode or junction of the earth mat already provided for the sub-station of voltage exceeding 650 V subject to the avoidance of bends wherever practicable.

75. **Unused overhead lines.**- Where an overhead line ceases to be used as an electric supply line:

(i) the owner shall maintain it in a safe mechanical condition in accordance with regulation 57 or remove it.

(ii) the Electrical Inspector shall, by a notice in writing served on the owner, require him to maintain it in a safe mechanical condition or to remove it within thirty days of the receipt of the notice.

76. **Laying of cables.**- (1) No underground power cable of voltage exceeding 33 kV shall be laid without a minimum underground depth of 1.2 meters.

(2) No underground telecommunication cable shall be laid without a minimum separation distance of 0.6 meters to the underground power cable of voltage exceeding 33 kV.

77. **Protection against electromagnetic interference.**- The owner of every overhead power line of voltage level 11 kV or higher shall submit proposal for obtaining Power Telecommunication Co-ordination Committee clearance to ensure safety of the personnel and telecom equipment.

Schedule-II

Safety measures for operation and maintenance of transmission and distribution system

[See sub-regulation (3) of regulation (7)]

Part I

(1). Duration and content of training shall be as specified below:

(i) Engineers and supervisors – The time allocation and various components of the training course for engineers and supervisors who would be engaged on operation and maintenance of transmission system shall be as given in Part II of this Schedule.

(ii) Technicians – The time allocation and various components of the training course for technicians who would assist the engineers and supervisors in operation and maintenance of transmission system shall be as given in Part III of this Schedule.

(iii) Engineers, Supervisors and Technicians – The time allocation and various components of the training course for engineers, supervisors and Technicians in operation and maintenance of sub-transmission and distribution system shall be as given in Part IV, V and VI of this Scedule.

(iv) Refresher course - The duration and contents of the refresher courses shall be determined jointly by the owner of the said system and training institute.

(v) Visits to factories- As part of practical training the trainees may be taken to factories manufacturing equipments used in transmission and distribution installations.

(vi) Performance of the trainee(s) – The training institutes shall group the syllabus in modules for organising the training. The pass percentage in each module for theory and for project work shall be 50% whereas for on job training and for viva voce it shall be 75%. The sponsor(s) of the trainees may consider the institution of incentives and awards for excellent performance during the training and also for suitable action for sub-standard performance.

(2). Creation of the Institute:

(i) The existing training institutes established for training of personnel engaged in operation and maintenance of generating stations and substations associated with generating stations can create additional facilities for training in transmission and distribution systems.

(ii) Guidelines for such institutes specified under Schedule-I (Item 2) under the heading "Facilities for Creation of training institute" shall also be applicable for institutes which would impart training in transmission and distribution systems.

(3). Assessment forms for engineers and supervisors and for Technicians to assist the engineers and supervisors are given at Part XXVII of Schedule I .

Part II

SYLLABUS FOR ENGINEERS AND SUPERVISORS FOR OPERATION AND MAINTENANCE OF TRANSMISSION SYSTEM

Item No.	Particulars	Number of Hours
1	2	3
I.	General Introduction: (i) World Power Scenario (ii) Growth of Power Industry in India (iii) Generation Scenario in India (iv) Transmission and Distribution Scenario in India (v) Role of Private Power Participants in India (vi) Organisation/Power Sector set up (vii) Introduction to Indian Standard specifications for Electrical wiring (viii) Energy Conversation	6
II.	Power Generation: (i) Types of generation: conventional and non-conventional; Thermal Power Plant: components/ equipments and their brief details and uses, features and characteristics of boiler, turbine, generator, excitation, etc. Brief operational aspects, captive power plants (ii) Hydro Power Plant: components/ equipments and their brief details; features and characteristics of turbine generator, excitation, etc. Brief operational aspects (iii) Gas Power Plant: concept of open cycle and combined cycle; components, characteristics of gas turbines, brief operational aspects, captive power plants (iv) Nuclear Power Plant: salient features (v) Non-Conventional Energy : various sources, working principle; electricity generation (vi) Co-generation, optimal mix of different types of generation, base load and peak load operation	18
III.	Power Transmission: (1) HVAC and HVDC Transmission System (i) Brief history of EHV transmission system in India (ii) Tower types A, B, C, D and special towers (iii) Conductors/Earthwire and their accessories, types, configuration, transposition, selection criteria (iv) Insulators and hardware fittings: types, strength, details (v) Right of way, CEA (Measures relating to Safety and Electric Supply) Regulations, 2010 and Acts, statutory clearances from other agencies, compensation, etc. (vi) Surveying, route alignment, profiling, tower spotting (vii) Benching and soil classification, soil investigation and soil resistivity measurement. (viii) Tower design and testing, quality checks	30

(ix) Tower erection hardware and accessories, fitting procedures, stringing, clearances, commissioning

(x) Operation and Maintenance of Transmission Line : line patrolling, routine checks, filling log books, T & P, thermovision scanning, fault failure analysis, hot line maintenance, case studies

(xi) Development of HVDC technology, economics, comparison with HVAC systems, principles of HVDC conversion, HVDC lines, HVDC sub-stations - converters, reactive power considerations, HVDC system, operation and control, maintenance, AC and DC harmonics and filtering, protection system, insulation, coordination, emergencies and case studies.

(xii) FACTS (Flexible AC Transmission System)

(2) Sub - Stations (765kV/400 kV/220kV/132kV) 75

(i) Types : generation sub-station, grid sub-station, mobile sub-station, gas insulated sub-station, HVDC sub-station, indoor/outdoor, etc., general comparison

(ii) General arrangement and layout of switchyard, switching schemes, single line diagram

(iii) Power Transformers and Reactors

(a) Types : major components, constructional details, functions

(b) Design and selection, specification and rating

(c) Bushings, On Load Tap Changers (OLTC), Buchholz relay, conservator, breather, thermo syphon filter, indicators, etc.

(d) Cooling arrangements - methods of cooling, pumps, fans, radiators, etc.

(e) Transformer tests

(f) Introduction to relevant Indian Standards

(iv) Switchgears and Introduction to relevant Indian Standard

(a) Circuit Breaker: types (MOCB, ABCB, VCB, SF_6), constructional details, layout arrangement, connection to bus, design, selection parameters, ratings/ specifications, interlocks and introduction to relevant Indian Standard

(b) Isolator: types (Vertical, Horizontal, Pantography Breaks, constructional details, Earth switch, interlocks, design/selection, ratings/specifications

(c) Bus bar types, construction, supports, insulators, connectors, jumpers, safety clearances, design/selection, ratings/specifications

(d) CT/CVT/Lightning Arrestor/Lightning Mast: Types, constructional details, use, location, selection/design, ratings/specifications

(e) Power Line Carrier Communication (PLCC): principle, purpose, types of coupling and choice of components, use and operation of PLCC system, modules of PLCC panels, ratings/specifications

(f) Meters, Indicators, and Recorders: types and functional description of all types of meters, indicators and recorders-Voltmeter, Ammeter, Frequency Meter, Wattmeter, Energy meter, Event logger (EL), Disturbance Recorder (DR), Fault Locator (FL), indicators and knowledge of relevant Indian Standard

(g) Relays: types, functions, constructional details, selection, ratings/ specifications, testing and setting of relays and knowledge of relevant Indian Standard

(h) Protection System Philosophy: types, design, protection schemes, tripping schemes, protection of transformers/reactors, motors, feeders, generator bus, etc.

(v) Grounding: types of grounding, earth testing and treatment, earth mat design, step potential, touch potentials, transfer potentials, neutral grounding factor.

(vi) Auxiliary facilities

(a) DG set

(b) Fire fighting system - types of fire, extinguisher, Emulsifier system, deluge system, fire fighting system for transformer/reactor, oil storage system, control room, office building, etc.

(c) Station Battery System

(d) LT supply

(e) Air Conditioning System

(f) Compressed Air System (service air system, instrument air system)

(vii) Control Room: layout, arrangement of equipments/panels, false ceiling and flooring, fire safety measures, Air-conditioning, Uninterrupted Power Supply (UPS), computer and its peripherals, lighting /emergency lighting

(viii) Cables: types, control cables, power cables, layout, trench/gallery arrangement, cable ratings, selection, and cable termination and jointing.

(ix) Compensating devices: shunt reactor/capacitor, series reactor/ capacitor, static var compensators (SVC)

(x) Sub-station operation: operational aspects of all equipments/systems, salient features and parameters, limiting values, control room operation, local/remote operation, operational guidelines/procedures, and synchronisation, grid operation, communication with RLDC/ SLDC, etc., permit to work, line clear procedure, maintenance of log books, records , tripping reports, shift procedures, monitoring, duties /responsibilities of sub-station staff, interlocks and sequential operation, operational problems, operation under emergency, case studies.

(xi) Sub-station Maintenance:

(a) Need, philosophy, types- routine, preventive, planned, predictive, break-down, emergency maintenance, comparisons, life expectancy curves

(bathtub curves), tools and tackles, testing instruments, safety devices, sampling equipments, test kits, visual checks, condition monitoring techniques, on-line maintenance, daily/weekly/ monthly/quarterly/half yearly/annual maintenance of different equipments, planning the maintenance activities, preparation of maintenance estimates, budgeting for control, maintenance records, history

(b) spare parts management

(c) Transformer and Reactor Maintenance-factors affecting the life of transformer/reactor, types of faults that can occur, reasons for breakdown, visual checks/ inspection/ preliminary testing of various components- oil sampling and testing, oil filtration, Dissolved Gas Analysis (DGA), maintenance Schedule, fault rectification, need for major overhaul and methods

(d) Switchgear and Protection Maintenance : maintenance of CB, isolator, earthswitch, support insulators, CT/CVT, LA. Lightning Mast (LM), meters/ recorders, PLCC, protective relay maintenance, protection system maintenance

(e) Maintenance of auxiliaries and other systems- battery and charging system, DG set, air conditioning plant, compressed air system, fire fighting system, switchyard – lighting, control room, earth resistance testing, cables, compensating devices.

(xii) Erection and commissioning of sub-station, Project Evaluation and Review Technique (PERT), Critical Path Method (CPM), charts, project monitoring, erection, pre-commissioning checks/tests, commissioning, synchronisation.

(xiii) Civil works – surveying, site selection, soil investigation, general layout and architectural drawing, switchyard foundation, cable trench design, oil pit, control room building, DG set building, Fire fighting system and AC system- design, design and construction of roads, drains, water supply pipe lines, fencing/compound wall.

3. Load Dispatch and Communication 18

(i) Load Dispatch Centres- functions, SLDC/RLDC, NLDC, pre-dispatch, during-dispatch, post dispatch functions

(ii) Supervisory Control and Data Acquisition (SCADA) System, RTU, front end computers, main computers, visual display units, mimic boards

(iii) Energy Management System- functions

(iv) Load forecasting, generation scheduling, load management, load shedding

(v) Hydro - thermal scheduling

(vi) Voltage/frequency control

(vii) Reactive Power Management

(viii) Grid Management - problems/solutions
(ix) Operational co-operation, import/export of energy, role of tariff in system operation
(x) Maintenance, on-line maintenance
(xi) Grid disturbances- case studies
(xii) Software tools

Communication System: types- PLCC, microwave, leased lines, fibre optics, satellite, V-SAT Communication, comparison, characteristics, modules, planning criteria, selection criteria , RTUs, modems, baud rate, communication protocols, data exchange, system noise and interference, integrated communication system, O&M of communication system, protocol details, telemetry, tele-control and tele-protection.

IV. Commercial Aspects And Contracts 24

(1) Commercial Aspects

(i) Introduction to commercial aspects of power system/distribution system
(ii) Tariff Structure, types, components, methods of working out, revenue realization
(iii) Energy accounting, Availability Based Tariff (ABT), inter-utility tariff, commercial disputes and solutions
(iv) Inventory planning and control, bill of materials, purchase procedures, standardization and codification of stores
(v) Resource mobilisation through bonds/ debentures/shares.
(vi) Cost Engineering, costing and control, estimation, estimates for providing service (LT/HT) connections, street lighting.
(vii) Electricity Rules and Regulations, Enactment
(viii) Budget types, budgeting procedure, appropriation, budget control.
(ix) Accounting, auditing.

(2) Contracts 12

(i) Contract basics, terminology
(ii) Qualification- requirement, pre-qualification, bids, evaluation
(iii) Notice Inviting Tender (NIT), Notice Inviting Quotation
(iv) Preparation of bid documents, tendering/ bidding
(v) Bid opening, bid evaluation, award of contract, monitoring of contract.
(vi) Contractual obligations/liquidation, guarantee /warranty
(vii) Vendor - qualification, development
(viii) Contractual problems and solutions
(ix) Revised cost estimation, justification for cost/time over-run, substitute items
(x) Handing/taking over procedures, closing of contract
(xi) Legal issues of contracts, arbitration

V. Management: 12

(i) Principles of management, leadership, effective

	communication, motivation, decision making, strategic management (ii) Management Information System (iii) Project Management (iv) Finance Management (v) Construction Management (vi) Materials Management (vii) Total Quality Management	
VI.	System Planning and New Technologies: (1) System Planning (i) Introduction to power system planning requirements and methods (ii) Load forecasting and techniques (iii) Load flow studies for planning (iv) Preparation of feasibility report (FR), Detailed Project Report (DPR) (v) Approval/clearance of projects	6
	(2) New Technologies: (i) Latest development in transmission system design, material, component, system, tariff, operation, maintenance (ii) Latest developments in distribution system design, components, meters, system, tariff, operation, maintenance (iii) Latest developments in power system, communication, application of computers to power system.	6
	Total	207 Hours ≡ 7 Weeks
VII.	On Job Training: (1) System Operation (On job) (A) Sub-Station (Generating/Grid/Distribution) (i) Layout, equipment familiarisation (ii) Details, functioning, specification and different parameters of switchyard, control room, auxiliary system equipments (iii) Shift handing/taking over, logging of parameters, routine checks on equipments/ systems (iv) Operational aspects of equipments /systems, synchronization, grid operation, charging procedure (v) Line/feeder connections, protection schemes, loading aspects, etc. (vi) Salient features and operational aspects of HVDC sub-station.	3 Weeks
	(B) Load Dispatch and Communication (i) Load Dispatch Centre (NLDC/RLDC/SLDC): set up, functioning (ii) Supervisory Control and Data Acquisition (SCADA) and Energy Management System (EMS) functioning (iii) Load forecasting	

(iv) Generation scheduling
(v) Voltage and frequency control activities
(vi) Communication system operation
(vii) System Software
(viii) Shift operation

(2) System Maintenance (On job) **3 Weeks**

(A) Sub-Station Maintenance
(i) Visual checks, routine, preventive, planned, break-down maintenance of equipments/system
(ii) Transformer, reactor, switchgear, relays, protection system and auxiliary facilities.
(iii) Maintenance schedules
(iv) Referring log books/history records for maintenance.
(v) Testing Lab facilities, testing and commissioning.
(vi) Procedure for permit to work/line clear.
(vii) Safety devices and practices.

(B) T&D Line/Cable Maintenance
(i) Line patrolling, thermovision scanning, hot spots, hardware replacement procedure, T&P.
(ii) Emergency Restoration System (ERS)
(iii) Hot Line Maintenance.
(iv) Industrial visits and evaluation

Part III

SYLLABUS FOR TECHNICIANS TO ASSIST ENGINEERS AND SUPERVISORS IN OPERATION AND MAINTENANCE OF TRANSMISSION SYSTEM

Item No.	Particulars	Number of Hours
1	2	3
I	General introduction: (i) Functions of State Electricity Board/Utility (ii) Introduction to Electricity Act, 2003, and CEA (Measures relating to Safety and Electric Supply) Regulations, 2010.	6
II	Substation and Equipments: (i) Substations (a) Sub-stations, selection of site, clearances and control room (b) Sub-stations 33 kV to 765 kV (c) Selection of voltage level for sub-station and layouts (ii) Equipments: (a) Control/relay panels and meters (b) Switch gear, breakers (c) Isolators (d) Cables-types, construction and jointing (e) Power capacitors (f) Lightning arrestors (g) CT, PT and carrier communication.	12

III	Transformers (Power and Distribution) (i) Types of transformers and parallel operations (ii) Cooling and drying out of transformers (iii) Testing of transformers (iv) Maintenance of transformers (v) Protection of transformers (vi) Failures of transformers	12
IV	Circuit Breakers, Isolators and Relays (i) Principle and construction (ii) Types of circuit breakers (iii) Maintenance of circuit breakers (iv) Relays - various types and functions (v) Maintenance of isolators	12
V	Storage Batteries: Need, Functions, commissioning and maintenance	6
VI	Earthing: Sub-station earthing, equipment earthing and Consumer earthing and procedure for improving quality of earth resistance	3
VII	Safety and fire fighting (1) Safety (i) Basic principle of safety, importance of safety rules and their observation (ii) List of safety equipment, their use and maintenance thereof (iii) Permit procedure (iv) Self permit, permit on phone and procedures to be observed (v) Electric shock and safety. (vi) Causes of accident, precautions to be taken to avoid accidents while working. (2) Fire fighting: (i) Principle and causes of fire, class of fires, ie., A, B, C. Precautions to be taken to avoid fire (ii) Fire fighting equipments, their type and use, their periodical maintenance	6
VIII	Transmission and Distribution (Line-Construction and Maintenance) (1) Construction (i) Survey of HT, LT Lines and service lines and cables, crossing such as road, railway, river, etc. (ii) Selection of materials and poles for lines and handling of materials (iii) Pole erection, size of pit, concreting, pole alignment, etc.	18

(iv) Types of stays, their marking, grouting, stay insulator binding, etc.
(v) Types of conductors and their parameters such as current carrying capacity, etc., cables-types and joints.
(vi) Type of guarding and clearances, anticlimbing devices, danger board, etc.
(vii) Erection of transformer DP structure
(viii) Patrolling, line meggering and commissioning of power lines

(2) Line Maintenance
(i) Fuse grading necessity and its benefits
(ii) Patrolling, tree cutting and safe clearances
(iii) Guarding of lines, clearances and maintenance, attending to breakdowns.
(iv) Importance and maintenance of air-break switch, dropout fuse set, dist. box etc.
(v) Pre-monsoon maintenance - necessity and procedure thereof
(vi) Balancing of load using tong tester

(3) Service Connection, theft of energy
(i) Types of service connections (overhead, underground, High Tension/ Low Tension, Single phase, Three phase)
(ii) Point of supply, testing of Consumers' wiring and earthing terminals
(iii) Materials required for service connection, fuse grading, underground cable connections (feeder pillar, mini pillar, junction box.)
(iv) Theft of energy, preventive measures, unauthorized extensions
(v) Consumer relations and dealing with Consumer problems

IX	Duties of staff Duties of staff, assisting supervisory an operating staff and maintenance of records	6
X	Human Resource Development (i) Personal development and motivation (ii) Communication skill and its importance (iii) Attitudinal training	9
	Total	90 Hours ≅ **3 Weeks**
XI	On Job Training, industrial visits and evaluation:	**3 Weeks**

(1) Study Visits - after introduction
(i) 1st visit : 11 kV and 33 kV sub-station
(ii) 2nd visit : 66 kV and 132 kV sub-station
(iii) 3rd visit : 220 kV and 400 kV sub-station

(2) Study and practicals

(i) Measurement of current, voltage, power, energy, frequency and power factor
(ii) Testing and connection of relays
(iii) Study of Buchholz relays
(iv) Measurement of earth resistivity
(v) Meggering of installation and equipments
(vi) Study and maintenance of breathers
(vii) Study of "on load tap changer" for transformer
(viii) Study of line construction materials and hardware
(ix) Demonstration of conductor jointing
(x) Demonstration of cable jointing.
(xi) Study of various type of power fuses, control fuses, kitkat and horn gaps.
(xii) Use of safety equipments and practicals followed for permit on works
(xiii) First aid and fire fighting drills

Part IV

SYLLABUS FOR ENGINEERS ENGAGED IN THE OPERATION AND MAINTENANCE OF SUB-TRANSMISSION AND DISTRIBUTION SYSTEM

Item No.	Particulars	Number of Hours
1	2	3
I	Overview of Power Sector Scenario: (i) Growth of Power Industry in India (ii) Organisation/ Power Sector set-up in India (iii) Electricity Distribution in India (iv) Private Participation in Distribution (v) Distribution Reforms in India.	3
II	Regulatory Environment – Rules and Regulations: (i) Electricity Act,2003 – Provisions relating to electricity distribution (ii) Role of Regulatory Commissions (iii) CEA(Measures relating to Safety and Electric Supply) Regulations, 2010 – Relating to electricity distribution. (iv) Energy Conservation Act	3
III	Distribution planning and optimization: (i) Philosophy of distribution planning. (ii) Acquaintance with software for distribution planning and optimisation. (iii) Operation of software. (iv) Data entry formats and report generation. (v) Case study.	30
IV	Sub-transmission and Distribution Lines: (i) Supports-towers/ poles: (a) Types and selection criteria (b) Surveying and erection	15

(ii) Line conductor/ cables:
(a) Classification
(b) Selection criteria
(c) Conductor stringing, jointing/ binding, sagging and tensioning, clipping and jumpering
(d) Earthing arrangements

(iii) Cable – types, selection, cable trenches, cable routing and laying, cable jointing and junction box

(iv) Earth wire/ neutral wire, guarding, etc.

(v) Selection and fixing of control devices, viz. Gang Operating Switches, fuses, isolators and earthing switches, lightning arrestors, and distribution box, etc.

(vi) Installation of service lines.

(vii) Street Lighting – design and layout methods.

(viii) Statutory clearances, viz. Environment and forest, local bodies, railway and telegraph crossings, river crossings, clearances under CEA (Measures relating to Safety and Electric Supply) Regulations, 2010, Acts.

(ix) Line/ cable maintenance including hot line maintenance – line patrolling, inspection, periodicity, work permit, line clear and authorisation, erection of temporary earth and restoration of supply, maintenance T&P and safety devices, thermo vision scanning, hot spots, etc.

V Electric Sub-Stations (33 kV and below): 15

(i) Type, site selection , layout and civil Engineering requirements.

(ii) Bus bar arrangement, sub-station equipment, viz. transformers, circuit breakers, etc.

(iii) Auxiliary systems, viz. DG set, battery system and fire fighting system, etc.

(iv) Control panel, meters, indicators and recorders and relays, etc.

(v) Erection, testing and commissioning of equipments/systems

(vi) Earthing of sub-stations equipments and soil testing

(vii) Transformer oil and its testing

(viii) Operation and maintenance of all equipments, protective relays and auxiliaries.

VI Metering Requirements: 6

(i) Type of metering, viz. DT metering, feeder metering and Consumer metering.

(ii) Regulations on installation of meters and technical standards

(iii) Meter types, their settings and operation, testing and sealing.

(iv) Selection of meter and metering equipment

(v) Familiarity with hardware (CMRI) and software for meter data download, analysis and detection of meter tampering

(vi) Role of advanced metering system in controlling commercial losses

VII	Concept of Losses and Loss Reduction Measures: (i) Concept of AT& C losses (ii) Segregation of losses. (iii) Technical loss reduction measures. (iv) Reactive power management. (v) Detection of thefts, tampering, unauthorized loads (vi) Anti-theft measures and case studies (vii) Commercial loss reduction measures. (viii) Penalties under the Act for theft and misuse of power. (ix) Energy audit and accounting. (x) Demand side management.	9
VIII	Reliability Issues, Quality of Power Supply, Customer Awareness and Satisfaction: (i) Reliability and quality of power supply and reliability indices. (ii) Causes and cures for breakdowns, tripping and voltage and frequency fluctuation. (iii) Creating customer awareness (iv) Prompt attendance to faults. (v) Overview of the Electricity Supply Codes of Regulatory Commissions.	6
IX	IT Intervention: (i) Familiarisation with distribution software packages and latest software tools and use thereof for billing and revenue realisation, GIS mapping and Consumer indexing, inventory control, keeping track of equipments failure rate, quick fault location, attendance, staff salary, energy accountability and MIS etc. (ii) SCADA – RTU, communication and distribution automation. (iii) Customer care and call centres.	12
X	Rural Electrification: (i) Outsourcing of distribution activities, appointment of franchisees and self load management by villagers and Gram Panchayats (ii) Maintenance of complaint centres and fault removal, etc., by village Panchayats etc. (iii) Separation of rural and urban supply system (iv) Fixation of responsibility for energy receipt and supply balance. (v) Rajiv Gandhi Grameen Vidyutikaran Yojana. (vi) Distributed generation.	9
XI	Project Management: Contracts: (i) Contract basics and terminology (ii) Qualification – requirement, pre-qualification (iii) Bids – Technical and Commercial	9

	(iv) Vendors – qualification, development	
	(v) Notice Inviting Tenders(NIT)/ Notice Inviting Quotations(NIQ)	
	(vi) Preparation of Bid Documents, tendering/ bidding	
	(vii) Bid opening and evaluation, Award of contracts, monitoring of contracts	
	(viii) Contractual obligations/ liquidation, guarantee/ warranty	
	(ix) Contractual problems and solutions	
	(x) Revision of cost estimates, justification of cost/ time overrun and substitute items	
	(xi) Handling/taking over procedures, closing of contracts	
	(xii) Legal issues of contracts and arbitration	
	(xiii) CVC Guidelines.	
XII	Disaster Management:	3
	(i) Institutional set-up for disaster Management	
	(ii) Impact of different types of disasters	
	(iii)Trigger mechanism and warning system	
	(iv)Check list and preparedness to address disasters.	
	(v) First aid techniques.	
XIII	Electrical Safety Aspects:	9
	(i) Basic principles of safety, importance of safety rules and their observance.	
	(ii) List of safety equipment, their use and maintenance thereof.	
	(iii) Permit procedure - self permit, permit on phone and procedures to be observed.	
	(iv) Electric shock, safety and procedure for recovery/ resuscitation.	
	(v) Causes of accidents, safe working procedures to avoid accidents.	
	(vi) Principle and causes of fire, and precautions to be taken to avoid fires.	
XIV	Field Visits and on-job training:	66
	(i) Familiarisation with layout of sub-stations and equipments	
	(ii) Operational aspects of equipments/ systems and synchronization	
	(iii) Line/ feeder connections, protection schemes, loading aspects, balancing of loads	
	(iv) Planning shift operations.	
	(v) Maintenance schedules	
	(vi) Procedures for permit to work/ line clear	
	(vii) Testing lab facilities, testing and commissioning	
	(viii) Maintenance of Log Books/ history records and adherence to the timely recording.	
	(ix) Familiarisation with IT tools.	
	Total	195 Hours ≅ 6 ½ Weeks

Part V

SYLLABUS FOR SUPERVISORS ENGAGED IN THE OPERATION AND MAINTENANCE OF SUB-TRANSMISSION AND DISTRIBUTION SYSTEM

Item No.	Particulars	Number of Hours
1	2	3
I	Overview of Power Sector Scenario (i) Growth of Power Industry in India. (ii) Organisation/ Power Sector set-up in India. (iii) Electricity Distribution in India (iv) Private Participation in Distribution. (v) Distribution Reforms in India.	3
II	Distribution Planning and Optimisation: (i) Philosophy of distribution planning. (ii) Acquaintance with software for distribution planning and optimisation. (iii) Operation of software. (iv) Data entry formats and report generation. (v) Case study.	6
III	Sub-transmission and Distribution Lines: (i) Supports-towers/ poles (a) Types and selection criteria (b) Surveying and erection (ii) Line Conductor/ Cables – (a) Classification (b) Selection criteria (c) Conductor stringing, jointing/ binding, sagging and tensioning, clipping and jumpering (d) Earthing arrangements (iii) Cables – types, selection, cable trenches, cable routing and laying, cable jointing and junction box (iv) Earth wire/ neutral wire, guarding, etc. (v) Selection and fixing of control devices, viz. Gang Operating switches, fuses, isolators and earthing switches, lightning arrestors, and distribution box, etc. (vi) Installation of service lines. (vii) Street Lighting – design and layout methods. (viii) Statutory clearances, viz. environment and forest, local bodies, railway and telegraph crossings, river crossings, clearances under Safety and Electric Supply Regulations/Acts. (ix) Line/ cable maintenance including hot line maintenance – line patrolling, inspection, periodicity, work permit, line clear and authorisation, erection of temporary earth and restoration of supply, maintenance T&P and safety devices, Thermo vision scanning, hot spots, etc.	9

IV	Electric Sub-Stations (33 kV and below): (i) Type, site selection , layout and civil Engineering requirements. (ii) Bus bar arrangement, sub-station equipment, viz. transformers, circuit breakers, etc. (iii) Auxiliary systems, viz. DG set, battery system and fire fighting system, etc. (iv) Control panel, meters, indicators and recorders and relays, etc. (v) Erection, testing and commissioning of equipments/systems (vi) Earthing of sub-stations equipments and soil testing (vii) Transformer oil and its testing (viii) Operation and maintenance of all equipments, protective relays and auxiliaries.	9
V	Metering Requirements: (i) Type of metering, viz. DT metering, feeder metering and Consumer metering. (ii) Regulations on installation of meters and technical standards (iii) Meter types, their settings and operation, testing and sealing.	3
VI	Concept of Losses and Loss Reduction Measures: (i) Concept of AT&C losses (ii) Segregation of losses. (iii) Technical loss reduction measures. (iv) Reactive power management. (v) Detection of thefts, tampering, unauthorized loads (vi) Anti-theft measures and case studies (vii) Commercial loss reduction measures. (viii) Penalties under the Act for theft and misuse of power. (ix) Energy audit and accounting. (x) Demand side management.	6
VII	Reliability Issues, Quality of Power Supply, Customer Awareness and Satisfaction: (i) Reliability quality of power supply and reliability indices. (ii) Causes and cures for breakdowns, tripping and voltage and frequency fluctuation. (iii) Creating customer awareness (iv) Prompt attendance to faults. (v) Overview of the Electricity Supply codes of Regulatory Commissions.	3
VIII	IT Intervention: (i) Familiarisation with distribution software packages and latest software tools and use thereof for billing and	6

revenue realisation, GIS mapping and Consumer indexing, Inventory control, keeping track of equipments failure rate, quick fault location, attendance, staff salary, Energy accountability and MIS, etc.

(ii) SCADA – RTU, communication and distribution automation.

(iii) Customer care and call centres.

(iv) Enterprise resource planning-
(a) Maintenance Management
(b) Asset Management
(c) Training Management
(d) Financial Accounting
(e) Material Management
(f) Outage Management
(g) Time Management

IX Rural Electrification: 3

(i) Outsourcing of distribution activities, appointment of franchisees and self load management by villagers and Gram Panchayats.

(ii) Maintenance of complaint centres and fault removal, etc., by Village Panchayats, etc.

(iii) Separation of rural and urban supply system

(iv) Fixation of responsibility for energy receipt and supply balance.

(v) Rajiv Gandhi Grameen Vidyutikaran Yojana.

(vi) Distributed generation.

X Project Management: Contracts: 3

(i) Contract basics and terminology

(ii) Qualification – requirement, pre-qualification

(iii) Bids – technical and commercial

(iv) Vendors – qualification, development

(v) Notice Inviting Tenders(NIT)/ Notice Inviting Quotations(NIQ)

(vi) Preparation of bid documents, tendering/ bidding

(vii) Bid opening and evaluation, award of contracts, monitoring of contracts

(viii) Contractual obligations/ liquidation, guarantee/ warranty

(ix) Contractual problems and solutions

(x) Revision of cost estimates, justification of cost/ time overrun and substitute items

(xi) Handling/taking over procedures, closing of contracts

(xii) Legal issues of contracts and arbitration

(xiii) CVC Guidelines.

XI Disaster Management: 3

(i) Institutional set-up for disaster management

(ii) Impact of different types of disasters

(iii) Trigger mechanism and warning system
(iv) Check list and preparedness to address disasters.
(v) First aid techniques.

XII	Electrical Safety Aspects: (i) Basic principles of safety, importance of safety rules and their observance. (ii) List of safety equipment, their use and maintenance thereof. (iii) Permit procedure- self permit, permit on phone and procedures to be observed. (iv) Electric shock, safety and procedure for recovery/ resuscitation. (v) Causes of accidents, safe working procedures to avoid accidents. (vi) Principle and causes of fire, and precautions to be taken to avoid fires.	6
XIII	Field Visits and On-Job Training: (i) Familiarisation with layout of sub-stations and equipments (ii) Operational aspects of equipments/ systems and synchronization (iii) Line/ feeder connections, protection schemes, loading aspects, balancing of loads (iv) Planning shift operations. (v) Maintenance schedules (vi) Procedures for permit to work/ line clear (vii) Testing lab facilities, testing and commissioning. (viii) Maintenance of Log Books/ history records and adherence to the timely recording. (ix) Familiarization with IT tools.	60
	Total	120 Hours ≅ 4 Weeks

Part VI

SYLLABUS FOR TECHNICIANS ENGAGED IN THE OPERATION AND MAINTENANCE OF SUB-TRANSMISSION AND DISTRIBUTION SYSTEM

Item No.	Particulars	Number of Hours
1	2	3
I	Overview of Power Sector Scenario: (i) Growth of Power Industry in India. (ii) Organisation/ Power Sector set-up in India. (iii) Electricity Distribution in India (iv) Private Participation in Distribution. (v) Distribution Reforms in India.	3
II	Sub-transmission and Distribution Lines: (i) Survey for lines at voltage upto 250 V, lines at voltage above 650 Volts but less than 33kV and for service lines and cables and crossings such as road, railway, river and other power and telecom lines. (ii) Selection of line materials and towers/ poles and safe handling of the same. (iii) Erection of towers/ poles – size of pit, concreting and pole/tower alignment, etc. (iv) Line Conductors – types, selection criteria, conductor stringing, jointing/ binding, sagging and tensioning, clipping and jumpering and earthing arrangements. (v) Types of stays, its marking, grouting, stay insulator, binding, etc. (vi) Cable – types, selection, cable trenches, cable routing and laying, cable jointing and junction box, etc. (vii) Types of guarding and clearances, earth wire/ neutral wire, anti-climbing devices and danger boards and their erection. (viii) Selection and fixing of control devices, viz. Gang Operating Switches, fuses, Isolators and earthing switches, lightning arrestors, and distribution box, etc. (ix) Installation of service lines. (x) Street lighting – layout methods. (xi) Line meggering and commissioning of distribution lines. (xii) Line patrolling, inspection, periodicity, work permit, line clear and authorisation, tree cutting and safe clearances, erection of temporary earth, attending to breakdowns and restoration of supply. (xiii) Maintenance T&P and safety devices, Thermo vision scanning, hot spots, etc. (xiv) Hot line maintenance.	9
III	Electric Sub-Stations (33 kV and below): (i) Type, site selection, layout and civil Engineering requirements.	9

(ii) Bus bar arrangement, sub-station equipment, viz. transformers, circuit breakers, isolator, lightning arrestors, CTs, PTs and power capacitors, etc.,
(iii) Types of transformers, their erection and parallel operation, testing, maintenance, protection and failure.
(iv) Auxiliary systems, viz. DG set, battery system and fire fighting system, etc. – need, functions, commissioning and maintenance.
(v) Control panels, meters, indicators, recorders and relays, etc. – operation, maintenance and recording readings, etc.
(vi) Control and power cables – types, laying of and jointing.
(vii) Installation , operation and maintenance of all equipments.
(viii) Cooling and drying out of transformers, transformer oil and its testing.
(ix) Erection of DP structure for transformer.
(x) High Voltage Distribution System (HVDS) – erection and connecting the Consumers.
(xi) Sub-station earthing, equipment earthing and Consumer's earthing, and use of Megger and procedure and materials for improving quality of earth resistance.
(xii) Fire fighting equipment, their type, use and periodical maintenance, indicators and recorders and relays, etc.

IV Metering Requirements: 3
(i) Type of metering, viz. DT metering, feeder metering and Consumer metering.
(ii) Regulations on installation of meters and technical standards
(iii) Meter types, their settings and operation, testing and sealing.
(iv) Computerised billing.

V Concept of Losses and Loss Reduction Measures: 3
(i) Concept of AT&C losses.
(ii) Detection of thefts, tampering, unauthorized loads.
(iii) Anti-theft measures and case studies.

VI Reliability issues, Quality of Power Supply, Customer Awareness and Satisfaction: 3
(i) Introduction to reliability and quality of power supply.
(ii) Causes and cures for breakdowns, tripping and voltage and frequency fluctuation.
(iii) Prompt attention to faults and customer care.

VII Electrical Safety Aspects: 12
(i) Basic principles of safety, importance of safety rules and their observance.

	(ii) List of safety equipment, their use and maintenance thereof.	
	(iii) Permit procedure- self permit, permit on phone and procedures to be observed.	
	(iv) Electric shock, safety and procedure for recovery/ resuscitation.	
	(v) Causes of accidents, safe working procedures to avoid accidents.	
	(vi) Principle and causes of fire, and precautions to be taken to avoid fires.	
VIII	Rural Electrification:	3
	(i) Separation of rural and urban supply systems.	
	(ii) Rajiv Gandhi Grameen Vidyutikaran Yojana.	
IX	Disaster Management:	3
	(i) Impact of different types of disasters.	
	(ii) Check list and preparedness to address disasters.	
	(iii) First aid techniques.	
X	Field Visits and On Job Training:	60
	(i) Familiarisation with layout of sub-stations and equipments.	
	(ii) Operational aspects of equipments/ systems and synchronization.	
	(iii) Line/ feeder connections, protection schemes, loading aspects, balancing of loads.	
	(iv) Adherence to shift system.	
	(v) Maintenance schedules.	
	(vi) Procedures for permit to work/ line clear.	
	(vii) Testing lab facilities, testing and commissioning.	
	(viii) Safety aspects and safety drill.	
	(ix) Hot line maintenance.	
	(x) Maintenance of Log Books/ history records and adherence to the timely recording.	
	(xi) Familiarisation with Tools and Plants (T&P).	
	(xii) Familiarisation with IT tools.	
	Total	108 Hours ≅ 4 Weeks

Schedule-III

Handling of electric supply lines and apparatus

[See sub-regulation (3) of regulation (19)]

Precautions to be observed

(1) Hotline Maintenance trained personnel only are designated to do work on line.

(2) Work permit will be taken from the terminal substations at each end of the line.

(3) Work shall be performed with proper planning and prior understanding and clarity.

(4) Favourable climatic condition for hotline operations is sunny weather. If the weather forecasts rain or thunderstorms work will not begin.
(5) Organisation of work shall be discussed among the members and responsibility of each team member fixed.
(6) Before going to the work site all equipment and tools shall be inspected and checked for correct operation.
(7) Auto re-closure shall be in 'OFF' position for the line at both ends.
(8) The work procedure shall be discussed with the team member at the tower location and the responsibility of each member shall be properly defined.
(9) The land in close vicinity to the tower shall be cleared to provide a site area for the required tools.
(10) All cleaned hot sticks, strain carrier and other assemblies shall be kept on the hotline tool rack to avoid ground contact.
(11) Wear helmet, safety shoes and safety belt shall compulsorily be used.
(12) All hot sticks and ladders shall be cleaned and checked for integrity by the hot sticks Tester.
(13) All linemen in the hotline team shall be equipped with personal protective equipment during the work.
(14) No live-line team members on the tower and conductor shall wear any metallic chain, wristwatch or ring to avoid any circulating current.
(15) The team linemen will wear conductive socks, boots, helmets and hand gloves. The 'hot-end' lineman shall wear complete bare hand suit.
(16) Tarpaulin sheet should be laid on the work area.
(17) A light vehicle shall be kept nearby during entire work period.

<u>Tools normally required for hot line maintenance operation</u> :

The following tools conforming to relevant Indian Standard or equivalent specifications shall be used in on-line working.

(1) Wire tongs
(2) Wire tongs saddle
(3) Tie sticks
(4) Strain link sticks
(5) Roller link sticks
(6) Suspension link sticks
(7) Auxiliary arms
(8) Strain carrier
(9) Gin poles
(10) Cum-a-along clamp
(11) Safety equipment like conductor guards, X-arm guards, insulator covers, hand gloves etc.
(12) Hot sticks

Schedule-VII

Minimum safety working clearances where electricity at voltage exceeding 650 V is supplied, converted, transformed or used

[See sub-regulation (2)(iii) of regulation (44)]

Highest System Voltage (kV)	Safety Working Clearance (Metres)
12	2.6
36	2.8
72.5	3.1
145	3.7
245	4.3
420	6.4
800	10.3

(1) The above values are valid for altitude not exceeding 1000 m. A correction factor of 1.25 per cent per 100 m is to be applied for increasing the clearance for altitude more than 1000 m and upto 3000 m;

(2) The above safety working clearances are based on an insulation height of 2.44 m which is the height of lowest point on the insulator, where it meets the earthed metal, from the ground;

(3) "Safety Working Clearance" is the minimum clearance to be maintained in air between the live part of the equipment on one hand and earth or another piece of equipment or conductor on which it is necessary to carry out the work, on the other;

(4) The "Highest System Voltage" is defined as the highest rms phase to phase voltage which occurs under normal operating conditions at any time and at any point of the system. It excludes voltage transients (such as those due to system switching) and temporary voltage variations due to abnormal system conditions (such as those due to fault conditions or the sudden disconnection of large loads).

Schedule-VIII

Minimum safety clearances to be maintained for bare conductors or live parts of any apparatus in out-door sub-stations, excluding overhead lines of HVDC installations

[See sub-regulation (5) of regulation (44)]

S.No.	DC Voltage (kV)	Pole to Earth Clearance (Metres)	Ground Clearance (Metres)
1.	100 kV	1.17	4.55
2.	200 kV	1.80	5.65
3.	300 kV	2.45	6.75
4.	400 kV.	3.04	8.00
5.	500 kV	3.65	9.00
6.	600 kV	3.98	10.1
7.	800 kV	5.3	11.2

(1) The above ground clearances are not applicable to equipment that are housed within fence or a building and where access is prevented under energised condition through a suitable safety interlocking scheme;

(2) The above pole to earth clearances are for conductor-structure electrode configuration using gap factor k equal to 1.35.

(3) It is recognised that within a substation many different types of electrode configurations shall be there with different values of k, therefore, the above clearance shall be modified based upon the values of gap factor for a particular electrode configuration subjected to the minimum ground clearance.

(4) Clearance shall be provided for electrical apparatus so that sufficient space is available for easy operation and maintenance without any hazard to the operating and maintenance personnel working near the equipment and for ensuring adequate ventilation.

Schedule-IX

Form for reporting failure of Transformers or Reactors of rating 20 MVA/MVAR and above

[See sub-regulation (8) of regulation (46)]

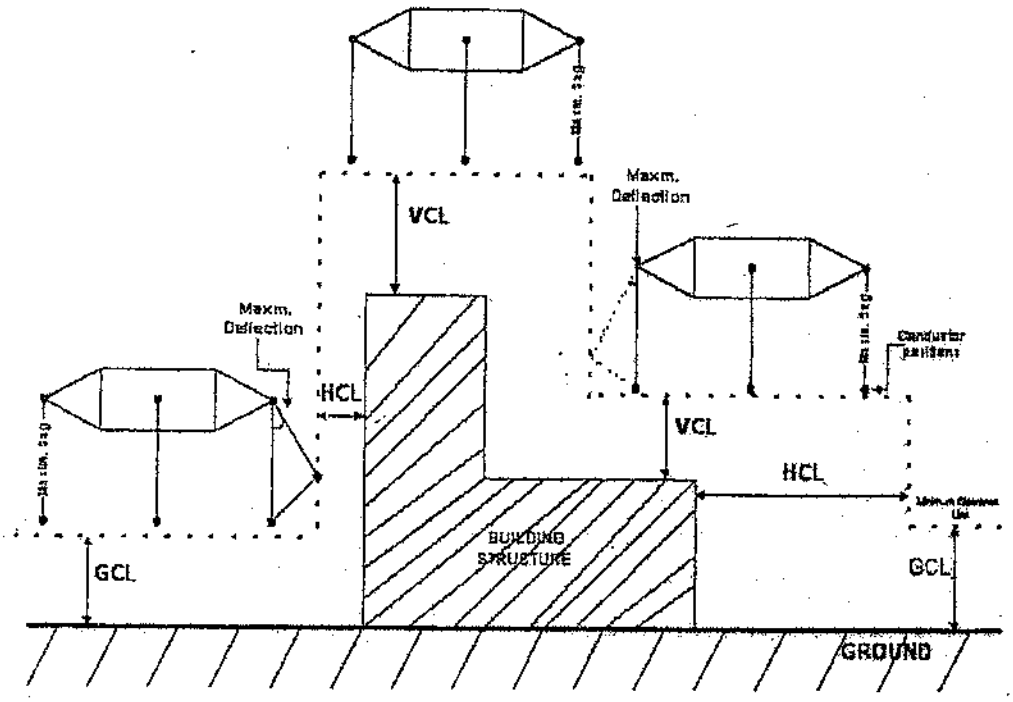
(1) Type of Equipment (Transformer or Reactor)
(2) Capacity (MVA/MVAR)
(3) Location (Address)
(4) Owner and address of owner
(5) Date of failure
(6) Year of manufacture
(7) Date of Installation
(8) Make
(9) Reasons for failure
(10) Measures being taken to avoid recurrence of failure

Date :

(Signature and name of Manager/Executive Engineer of the installation)

Schedule-X

Ground, Vertical and Horizontal clearances
[See sub-regulation (6) of regulation 58, sub-regulation (5) of regulation (60) and sub-regulation (5) of regulation 61]



GCL: Clearances as per Regulation 59
VCL: Clearances as per Regulation 60 & 61
HCL: Clearances as per Regulation 60 & 61

ANNEXURE – 5

SAFETY PLAN

SAFETY PLAN

13. FORM OF SAFETY PLAN TO BE SUBMITTED BY THE CONTRACTOR WITHIN SIXTY DAYS OF AWARD OF CONTRACT

[TO BE EXECUTED ON A NON JUDICIAL STAMP PAPER WORTH RS. TWENTY ONLY]

SAFETY PLAN

THIS SAFETY PLAN is made this ……..... day of ……..... 20..... by ……..…… a Company registered under the Companies Act, 1956/Partnership firm/proprietary concern having its Registered Office at …….....[*to be modified suitably for JV Contractor*] (hereinafter called as 'Contractor' which expression shall include its successors and permitted assigns) for approval of .....*(insert name of the Employer)*....., a company incorporated under the Companies Act, 1956 having its Registered Office at .....*(insert registered address of the Employer)*..... for its Contract for …….....
.....*(insert package name, project name alongwith Specification number of the Contract)*.....

WHEREAS .....*(abbreviated name of the Employer)*..... has awarded to the Contractor the aforesaid Contract vide its Notification of Award/Contract No. ……..……..... dated ...……..and Amendment No. ..... (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which the Contractor is required to submit 'Safety Plan' along with certain documents to the Engineer In-Charge/Project Manager of the Employer within Sixty (60) days of Notification of Award for its approval.

NOW THEREFORE, the Contractor undertakes to execute the Contract as per the safety plan as follows:

1. THAT the Contractor shall execute the works as per provisions of Bidding Documents including those in regard to Safety Precautions / provisions as per statutory requirements.

2. THAT the Contractor shall execute the works in a well planned manner from the commencement of Contract as per agreed mile stones of work completion schedule so that planning and execution of construction works goes smoothly and consistently through out the contract duration without handling pressure in last quarter of the financial year/last months of the Contract and the shall be finalized in association with EMPLOYER Engineer In-charge/Project Manager from time to time as required.

3. THAT the Contractor has prepared the safe work procedure for each activity i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. to be executed at site, which is enclosed at **Annexure – 1A (SP)** for acceptance and approval of Engineer In-charge/Project Manager. The Contractor shall ensure that on approval of the same from Engineer In-charge/Project Manager , the approved copies will be circulated to Employer's personnel at site [Supervisor(s)/Executive(s)] and Contractor's personnel at site [Gang leader, supervisor(s) etc.] in their local language / language understood by gang.

THAT the Contractor has prepared minimum manpower deployment plan, activity wise as stated above, which is enclosed at **Annexure – 1B (SP)** for approval of Engineer In-charge/Project Manager.

4. THAT the Contractor shall ensure while executing works that they will deploy minimum 25% of their own experienced work force who are on the permanent roll of the company and balance 75% can be a suitable mixed with the hired gangs / local workers / casual workers if required. The above balance 75% work force should be provided with at least 10 days training by the construction agencies at sites and shall be issued with a certificate. No worker shall be engaged without a valid certificate. Hired gang workers shall also follow safe working procedures and safety norms as is being followed by company's workmen. It should also be ensured by the contractor that certified fitters who are climbing towers / doing stringing operations can be easily identifiable with a system like issue of Badge / Identification cards (ID cards) etc. Colour identification batches should be worn by the workers. Contractor has to ensure that inexperience workers / unskilled workers should not be deployed for skilled job.

5. THAT the Contractor's Gang leader / Supervisor / Senior most member available at every construction site shall brief to each worker daily before start of work about safety requirement and warn about imminent dangers and precautions to be taken against the imminent dangers (Daily Safety Drill). This is to be ensured without fail by Contractor and maintain record of each gang about daily safety instructions issued to workers and put up to EMPLOYER site In-charge for his review and record.

6. THAT the Contractor shall ensure that working Gangs at site should not be left at the discretion of their Gang Leaders who are generally hired and having little knowledge about safety. Gang leader should be experienced and well versed with the safe working procedures applicable for transmission line/ Sub Station works. In case gang is having Gang leader not on permanent roll of the company then additional Supervisor from company's own roll having thorough knowledge about the works would be deployed so as to percolate safety instructions up to the grass root level in healthy spirits. Contractor has to ensure close supervision while executing critical locations of transmission lines / sub stations and ensures that all safety instructions are in place and are being followed.

7. THAT the Contractor shall maintain in healthy and working condition all kind of Equipments / Machineries / Lifting tools / Lifting tackles / Lifting gears / All kind of Ropes including wire ropes / Polypropylene ropes etc. used for Lifting purpose during execution of the project and get them periodically examined and load tested for safe working load in accordance with relevant provisions and requirement of Building & other construction workers Regulation of Employment and Conditions of Services Act and Central Rule 1998, Factories Act 1948, Indian Electricity Act 2003 before start of the project. A register of such examinations and tests shall be properly maintained by the contractor and will be promptly produced as and when desired by the Engineer In-charge/Project Manager or by the person authorised by him. The Contractor has to ensure to give special attention on the formation / condition of eye splices of wire rope slings as per requirement of IS 2762 Specification for wire rope slings and sling legs.

   THAT the Contractor has prepared a list of all Lifting machines, lifting Tools / Lifting Tackles / Lifting Gears etc. / All types of ropes and Slings which are subject to safe working load is enclosed at **Annexure – 2 (SP)** for review and approval of Engineer In-charge/Project Manager.

8. THAT the Contractor has to procure sufficient quantity of Personal Protective Equipment (PPE)conforming to Indian / International standards and provide these equipment to every workman at site as per need and to the satisfaction of Engineer-in-charge/Project Manager of EMPLOYER. The Contractor's Site Supervisor/ Project Manager has to ensure that all workmen must use Personal Protective Equipment at site. The Contractor shall also ensure that Industrial Safety helmets are being used by all workmen at site irrespective of their working (at height or on ground). The Contractor shall further ensure use of safety shoes by all ground level workers and canvas shoes for all workers working at height, Rubber Gum Boots for workers working in rainy season and concreting job, Use of Twin Lanyard Full body Safety Harness with attachment of light weight such as aluminium alloy etc. and having features of automatic locking arrangement of snap hook, by all workers working at height for more than three meters and also for horizontal movement on tower shall be ensured by contractor. The Contractor shall not use ordinary half body safety harness at site. The Contractor has to ensure use of Retractable type fall arrestors by workers for ascending / descending on suspension insulator string and other similar works etc., Use of Mobile fall arrestor for ascending / descending from tower by all workers. The contractor has to provide cotton / leather hand gloves as per requirement, Electrical Resistance Hand gloves for operating electrical installations / switches, Face shield for protecting eyes while doing welding works and Dust masks to workers as per requirement. The Contractor will have to take action against the workers not using Personal Protective Equipment at site and those workers shall be asked to rest for that day and also their Salary be deducted for that day. EMPLOYER may issue warning letter to Project Manager of contractor in violation of above norms.

   THAT the Contractor shall prepare a detailed list of PPEs, activity wise, to commensurate with manpower deployed, which is enclosed at **Annexure – 3 (SP)** for review and approval of Engineer In-charge/Project Manager. It shall also be ensured that the sample of these equipment shall be got approved from EMPLOYER supervisory staff before being distributed to workers. The contractor shall submit relevant test certificates as per IS / International Standard as applicable to PPEs used during execution of work. All the PPE's to be distributed to the workers shall be checked by EMPLOYER supervisory staff before its usage.

   The Contractor also agrees for addition / modification to the list of PPE, if any, as advised by Engineer In-Charge/Project Manager.

9. THAT the Contractor shall procure, if required sufficient quantity of Earthing Equipment / Earthing Devices complying with requirements of relevant IEC standards (Generally IECs standards for Earthing Equipments / Earthing Devices are – 855, 1230, 1235 etc.) and to the satisfaction of Engineer In-Charge/ Project Manager and contractor to ensures to maintained them in healthy condition.

   THAT the Contractor has prepared / worked out minimum number of healthy Earthing Equipments with Earthing lead confirming to relevant IS / European standards per gang wise during stringing activity/as per requirement, which is enclosed herewith at **Annexure – 4 (SP)** for review and acceptance of Engineer In-Charge/ Project Manager prior to execution of work.

10. THAT the Contractor shall provide communication facilities i.e. Walky – Talkie / Mobile Phone, Display of Flags / whistles for easy communication among workers during Tower erection / stringing activity, as per requirement.

11. THAT the Contractor undertakes to deploy qualified safety personnel responsible for safety as per requirements of Employer/Statutory Authorities.

    THAT the Contractor employing more than 250 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ at least one full time officer exclusively as qualified safety officer having diploma in safety to supervise safety aspects of the equipment and workmen who will coordinate with Engineer In-charge /Project Manager/Safety Coordinator of the Employer. In case of work being carried out through sub contractors the sub – contractor's workmen / employees will also be considered as the contractor's employees / workmen for the above purpose. If the number of workers are less than 250 then one qualified safety officer is to be deployed for each contract. He will report directly to his head of organization and not the Project Manager of contractor He shall also not be assigned any other work except assigning the work of safety. The curriculum vitae of such person shall be got cleared from EMPLOYER Project Manager / Construction staff.

    The name and address of such safety officers of contractor will be promptly informed in writing to Engineer In-charge with a copy to safety officer - In-charge before start of work or immediately after any change of the incumbent is made during the currency of the contract. The list is enclosed at **Annexure – 5A (SP)**.

    THAT the Contractor has also prepared a list including details of Explosive Operator (if required), Safety officer / Safety supervisor / nominated person for safety for each erection / stringing gang, list of personnel trained in First Aid Techniques as well as copy of organisation structure of the Contractor in regard to safety. The list is enclosed at **Annexure – 5B (SP)**.

12. The Project Manager shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipment. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary, appeal against the order of stoppage of work to the Project Manager within 3 days of such stoppage of work and decision of the Project Manager in this respect shall be conclusive and binding on the Contractor.

13. THAT, if, any Employer's Engineer/ supervisor at site observes that the Contractor is failing to provide safe working environment at site as per agreed Safety Plan / EMPLOYER Safety Rule/ Safety Instructions / Statutory safety requirement and creates hazardous conditions at site and there is possibility of an accident to workmen or workmen of the other contractor or public or the work is being carried out in an un safe manner or he continues to work even after being instructed to stop the work by Engineer / Supervisor at site / RHQ / Corp. Centre, the Contractor shall be bound to pay a penalty of Rs. 10,000/ - per incident per day till the instructions are complied and as certified by Engineer / Supervisor of Employer at site. The work will remain suspended and no activity will take place without compliance and obtaining clearance / certification of the Site Engineer / Supervisor of the Employer to start the work.

14. THAT, if the investigation committee of Employer observes any accident or the Engineer In-charge/Project Manager of the Employer based on the report of the Engineer/Supervisor of the Employer at site observes any failure on the Contractor's part to comply with safety requirement / safety rules/ safety standards/ safety instruction as prescribed by the Employer or as prescribed under the applicable law for the safety of the equipment, plant and personnel and the Contractor does not take adequate steps to prevent hazardous conditions which may cause injury to its own Contractor's employees or employee of any other Contractors or Employer or any other person at site or adjacent thereto, or public involvement because of the Contractor's negligence of safety norms, the Contractor shall be liable to pay a compensation of Rs. 10,00,000/- (Rupees Ten Lakh only) per person affected causing death and Rs. 1,00,000/- (Rupees One Lakh only) per person for serious injuries / 25% or more permanent disability to the Employer for further disbursement to the deceased family/ Injured persons. The permanent disability has the same meaning as indicated in Workmen's Compensation Act 1923. The above stipulations is in addition to all other compensation payable to sufferer as per workmen compensation Act / Rules

    THAT as per the Employer's instructions, the Contractor agrees that this amount shall be deducted from their running bill(s) immediately after the accident, That the Contractor understands that this amount shall be over and above the compensation amount liable to be paid as per the Workmen's Compensation Act /other statutory requirement/ provisions of the Bidding Documents.

15. THAT the Contractor shall submit Near-Miss-Accident report along with action plan for avoidance such incidence /accidents to Engineer – In-charge/ Project Manager. Contractor shall also submit Monthly Safety Activities report to Engineer – In-charge/ Project Manager and copy of the Monthly Safety Activities report also to be sent to Safety In-charge at RHQ of the Employer for his review record and instructions.

16. THAT the Contractor is submitting a copy of Safety Policy/ Safety Documents of its Company which is enclosed at **Annexure – 6 (SP)** and ensure that the safety Policy and safety documents are implemented in healthy spirit.

17. THAT the Contractor shall make available of First Aid Box [Contents of which shall be as per Building & other construction workers (Regulation of Employment and Conditions of Services Act and Central Rule 1998 / EMPLOYER Guidelines)] to the satisfaction of Engineer In-Charge/ Project Manager with each gang at site and not at camp and ensures that trained persons in First Aid Techniques with each gang before execution of work.

18. THAT the Contractor shall submit an 'Emergency Preparedness Plan' for different incidences i.e. Fall from height, Electrocution, Sun Stroke, Collapse of pit, Collapse of Tower, Snake bite, Fire in camp / Store, Flood, Storm, Earthquake, Militancy etc. while carrying out different activities under execution i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. which is enclosed at **Annexure – 7 (SP)** for approval of the Engineer In-Charge/ Project Manager before start of work.

19. THAT the Contractor shall organise Safety Training Programs on Safety, Health and Environment and for safe execution of different activities of works i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal

of materials at site / store etc. for their own employees including sub contractor workers on regular basis.

The Contractor, therefore, submits copy of the module of training program, enclosed at **Annexure – 9 (SP)**, to Engineer In-charge/Project Manager for its acceptance and approval and records maintained.

20. THAT the Contractor shall conduct safety audit, as per Safety Audit Check Lists enclosed at **Annexure – 8 (SP)**, by his Safety Officer(s) every month during construction of Transmission Lines / Sub Stations / any other work and copy of the safety audit report will be forwarded to the Employer's Engineer In-charge / Site In-charge/Project Manager for his comments and feedback. During safety audit, healthiness of all Personal Protective Equipments (PPEs) shall be checked individually by safety officer of contractor and issue a certificate of its healthiness or rejection of faulty PPEs and contractor has to ensure that all faulty PPEs and all faulty lifting tools and tackles should be destroyed in the presence of EMPLOYER construction staff. Contractor has to ensure that each gang be safety audited at least once in two months. During safety audit by the contractor, Safety officer's feedback from EMPLOYER concerned shall be taken and recorded. The Employer's site officials shall also conduct safety audit at their own from time to time when construction activities are under progress. Apart from above, the Employer may also conduct surveillance safety audits. The Employer may take action against the person / persons as deemed fit under various statutory acts/provisions under the Contract for any violation of safety norms / safety standards.

21. THAT the Contractor shall develop and display Safety Posters of construction activity at site and also at camp where workers are generally residing.

22. THAT the Contractor shall ensure to provide potable and safe drinking water for workers at site / at camp.

23. THAT the Contractor shall do health check up of all workers from competent agencies and reports will be submitted to Engineer In-Charge within fifteen (15) days of health check up of workers as per statutory requirement.

24. THAT the Contractor shall submit information along with documentary evidences in regard to compliance to various statutory requirements as applicable which are enclosed at **Annexure – 10A (SP)**.

    The Contractor shall also submit details of Insurance Policies taken by the Contractor for insurance coverage against accident for all employees are enclosed at **Annexure – 10B (SP)**.

25. THAT a check-list in respect of aforesaid enclosures along with the Contractor's remarks, wherever required, is attached as **Annexure – Check List** herewith.

THE CONTRACTOR shall incorporate modifications/changes in this 'Safety Plan' necessitated on the basis of review/comments of the Engineer In-Charge/Project Manager within fourteen (14) days of receipt of review/comments and on final approval of the Engineer In-Charge/Project Manager of this 'Safety Plan', the Contractor shall execute the works under the Contract as per approved 'Safety Plan'. Further, the Contractor has also noted that the first progressive payment

towards Services Contract shall be made on submission of 'Safety Plan' along with all requisite documents and approval of the same by the Engineer In-Charge/Project Manager.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

For and on behalf of

M/s.....…….....

WITNESS

1. Signature..... Signature.....

   Name..... Name.....

2. Signature..... Authorised representative

   Name..... (Common Seal)

   Address..... (In case of Company)

Note:
All the annexure referred to in this "Safety Plan" are required to be enclosed by the contractor as per the attached "Check List "

1. Safety Plan is to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute such contract documents etc., (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a Photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to this Safety Plan.

2. For all safety monitoring/ documentation, Engineer In-charge / Regional In-charge of safety at RHQ will be the nodal Officers for communication.

CHECK LIST FOR SEFETY PLAN

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
1.	**Annexure – 1A (SP)** Safe work procedure for each activity i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc. to be executed at site.	Yes/No	
2.	**Annexure – 1B (SP)** Manpower deployment plan, activity wise foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc.	Yes/No	
3.	**Annexure – 2 (SP)** List of Lifting Machines i.e. Crane, Hoist, Triffor, Chain Pulley Blocks etc. and Lifting Tools and Tackles i.e. D shackle, Pulleys, come along clamps, wire rope slings etc. and all types of ropes i.e. Wire ropes, Poly propylene Rope etc. used for lifting purposes along with test certificates.	Yes/No	
4.	**Annexure – 3 (SP)** List of Personal Protective Equipment (PPE), activity wise including the following along with test certificate of each as applicable: 1. Industrial Safety Helmet to all workmen at site. (EN 397 / IS 2925) with chin strap and back stay arrangement. 2. Safety shoes without steel toe to all ground level workers and canvas shoes for workers working on tower. 3. Rubber Gum Boot to workers working in rainy season / concreting job. 4. Twin lanyard Full Body Safety harness with shock absorber and leg strap arrangement for all workers working at height for more than three meters. Safety Harness should be with attachments of light weight such as of aluminium alloy etc. and having a feature of automatic locking arrangement of snap hook	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	and comply with EN 361 / IS 3521 standards. 5. Mobile fall arrestors for safety of workers during their ascending / descending from tower / on tower. EN 353 -2 (Guided type fall arresters on a flexible anchorage line.) 6. Retractable type fall arrestor (EN360: 2002) for ascending / descending on suspension insulator string etc. 7. Providing of good quality cotton hand gloves / leather hand gloves for workers engaged in handling of tower parts or as per requirement at site. 8. Electrical Resistance hand gloves to workers for handling electrical equipment / Electrical connections. IS : 4770 9. Dust masks to workers handling cement as per requirement. 10. Face shield for welder and Grinders. IS : 1179 / IS : 2553 11. Other PPEs, if any, as per requirement etc.		
5.	**Annexure – 4 (SP)** List of Earthing Equipment / Earthing devices with Earthing lead conforming to IECs for earthing equipments are – (855, 1230, 1235 etc.) gang wise for stringing activity/as per requirement.	Yes/No	
6.	**Annexure – 5A (SP)** List of Qualified Safety Officer(s) along with their contact details.	Yes/No	
7.	**Annexure – 5B (SP)** Details of Explosive Operator (if required), Safety officer / Safety supervisor for every erection / stinging gang, any other person nominated for safety, list of personnel trained in First Aid as well as brief information about safety set up by the Contractor alongwith copy of organisation of the Contractor in regard to safety	Yes/No	
8.	**Annexure – 6 (SP)** Copy of Safety Policy/ Safety Document of the Contractor's company	Yes/No	
9.	**Annexure – 7 (SP)** 'Emergency Preparedness Plan' for different incidences i.e. Fall from height, Electrocution, Sun	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	Stroke, Collapse of pit, Collapse of Tower, Snake bite, Fire in camp / Store, Flood, Storm, Earthquake, Militancy etc. while carrying out different activities under execution i.e. foundation works including civil works, erection, stringing (as applicable), testing & commissioning, disposal of materials at site / store etc.		
10.	**Annexure – 8 (SP)** Safety Audit Check Lists (Formats to be enclosed)	Yes/No	
11.	**Annexure – 9 (SP)** Copy of the module of Safety Training Programs on Safety, Health and Environment, safe execution of different activities of works for Contractor's own employees on regular basis and sub contractor employees.	Yes/No	
12.	**Annexure – 10A (SP)** Information along with documentary evidences in regard to the Contractor's compliance to various statutory requirements including the following:		
(i)	Electricity Act 2003 _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(ii)	Factories Act 1948 _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(iii)	Building & other construction workers (Regulation of Employment and Conditions of Services Act and Central Act 1996) and Welfare Cess Act 1996 with Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(iv)	Workmen Compensation Act 1923 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(v)	Public Insurance Liabilities Act 1991 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
(vi)	Indian Explosive Act 1948 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(vii)	Indian Petroleum Act 1934 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(viii)	License under the contract Labour (Regulation & Abolition) Act 1970 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(ix)	Indian Electricity Rule 1956 and amendments if any, from time to time. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(x)	The Environment (Protection) Act 1986 and Rules. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(xi)	Child Labour (Prohibition & Regulation) Act 1986. _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(xii)	National Building Code of India 2005 (NBC 2005). _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(xiii)	Indian standards for construction of Low/ Medium/ High/ Extra High Voltage Transmission Line _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
(iv)	Any other statutory requirement(s) [*please specify*] _____ [*Name of Documentary evidence in support of compliance*]	Yes/No	
13.	**Annexure – 10B (SP)** Details of Insurance Policies alongwith		

S. N.	Details of Enclosure	Status of Submission of information/ documents	Remarks
	documentary evidences taken by the Contractor for the insurance coverage against accident for all employees as below:		
(i)	Under Workmen Compensation Act 1923 and Rules. _____ [*Name of Documentary evidence in support of insurance taken*]	Yes/No	
(ii)	Public Insurance Liabilities Act 1991 _____ [*Name of Documentary evidence in support of insurance taken*]	Yes/No	
(iii)	Any Other Insurance Policies _____ [*Name of Documentary evidence in support of insurance taken*]	Yes/No	

EMPLOYER

ANNEXURE – 6

HEALTH & SAFETY CHECKLISTS

HEALTH AND SAFETY CHECKLIST

Safety Related Check List during Construction of Transmission Lines

Region : ..... Name of DHQ/GHQ: ..... Date of Safety Audit:.....

Name of Tr. Line: .....……

Loc. No: .....……Voltage Level: .....

Name of Contractor: .....……

Name of Sub Contractor: .....……

A. DURING TOWER FOUNDATION :

SN	Description of Activity	Feed back	Remarks
I) EXCAVATION :			
1.	Dumping of Excavated soil. (Minimum 1.5 Mts. or half the depth of the pit which ever is more)	Yes / No.	
2.	Whether angle of repose of soil as per design in the foundation is maintained or not.	Yes / No.	
3.	De watering arrangement is available (If necessary)	Yes / No.	
4.	Working area has been protected properly to avoid against fall of passerby or animal in the excavated pit.	Yes / No.	
5	Shoring & Shuttering to protect the loose rock / soil against fall exists.	Yes / No.	
6	Arrangement of illumination at construction site is available. (if required)	Yes / No.	
7	Check proper/adequate arrangement is made for extension of electric supply. (Proper size of cable, Use of fuse, No loose connection for De-watering Pumps/ Illumination / Electric compressors etc. if applicable).	Yes / No.	
8	Check for damage / Uneven settlement of foundation.	Yes / No.	
9	Ensure Life saver arrangements have been made during construction of well foundation in river bed. (Where necessary)	Yes / No.	
10	Check that the adequate arrangement is made for the storage of blasting material at safe place. (if required)	Yes / No.	
11	Check that the blasting materials is handled with due care at site. (If required)	Yes / No.	
12	Check that during blasting operation, Labour / Workmen / Passerby are at safe places and arrangement is made to inform public by caution markings (Red Flag) / Public Notices.	Yes / No.	
13	Check that the Blaster is holding the proper license issued by the appropriate authority. as per the Indian Explosive Act.	Yes / No.	
14	Check that the length of the fuse wire used during blasting operation is adequate.	Yes / No.	
15	Ensure Laying of temporary cable used for operation of Machines		

SN	Description of Activity	Feed back	Remarks
	used during construction should not cause any danger for electrocution of workmen.	Yes / No.	
16	Check that PPEs i.e. Safety helmets, Safety Shoes, is used by blaster and their gang members during blasting.	Yes / No.	
17	Ensure that Shuttering and timbering has been made as detailed in I:S: 3764.	Yes / No.	
18	Ensure that before undertaking excavation, the soil has been tested and in case of availability of any explosive / dangerous gas, necessary arrangement must be made to remove / dilute such gases.	Yes / No.	
19	The positions of underground installations such as sewers, water pipes and electrical cables have been verified and in case of their existence, they must be isolated.	Yes / No.	
20	Arrangement shall be made to prevent external vibrations due to rail / road traffic (If required).	Yes / No.	
21	Safety is ensured during the construction of Tr. Lines for buildings, structures etc. which are coming in the vicinity of the excavated area from collapse. (If required)	Yes / No.	
22	Check that sufficient strong ladder of suitable length is available for ingress / outgress of persons in the pit	Yes / No.	
23	Lone worker should not be allowed to work in the excavated area beyond shoulder level.	Yes / No.	
24	Check for any possibility of seepage of water from nearby pond / river should be estimated and taken care of.	Yes / No.	
25	After excavation the work has been completed speedily and back filling done at the earliest.	Yes / No.	
II) CASTING OF FOUNDATION / CONCRETING :			
1	Check construction materials are stacked at safe place and also does not cause any danger. (Away from pit by 1.5 Mtrs. Or half the depth of pit, which ever is more.)	Yes / No.	
2	Check arrangement of illumination at Construction Site. (If required).	Yes / No.	
3	Ensure life saver arrangements have been made during construction of Well foundation in River Bed.	Yes / No.	
4	Check that the Concreting Mixer machine is placed at a safe place. (Not very near to pit.)	Yes / No.	
5	Check proper / adequate arrangement is made for extension of electric supply. (Proper size of cable, Use of fuse, No loose connection for De watering Pumps / Illumination / Electric compressors etc. if applicable).	Yes / No.	
6	Check that laying of temporary cables used during construction activities should not cause any danger for electrocution to workmen.	Yes / No.	
7	Inspection of excavations shall be made by a Competent Person every day. In case, possible cave in or slide is apparent, all working in the excavation shall be seized until the necessary precautions have been taken to safeguard the possible cave in or slide.	Yes / No.	
8	Jacks and vertical supports shall be positioned in such a manner that		

SN	Description of Activity	Feed back	Remarks
	the vertical loads are distributed equally and do not exceed the capacity of the jacks and the jacks are placed away from pit edge etc.	Yes / No.	
9	Proper Jacking arrangement is made to take the entire load of template.	Yes / No.	
10	In case of long template in stub setting, more jacks have been provided and check that the Jacks are placed on levelled and hard surface to avoid the unbalancing and fallen.	Yes / No.	
11	Wire mesh rolls shall be secured in order to prevent dangerous recoiling action.	Yes / No.	
12	Lone worker should not be allowed to work in the excavated area.	Yes / No.	
13	Check that sufficient strong ladder of suitable length is available for ingress / outgress of persons in the pit	Yes / No.	

B. TOWER ERECTION :

SN	Description of Activity	Feed back	Remarks
1	Check proper communication facility is available at site during Tower erection. (If required)	Yes / No.	
2.	Check damages or uneven settlement of foundation.	Yes / No.	
3.	Ensure the derrick used before tower erection has been checked for adequate strength/ size. Ensure for copy of test certificate for all the lifting machines and tackles.	Yes / No.	
4.	Ensure that the pulleys used before tower erection has been checked for adequate strength / proper size (diameter). Also in case of open type pulleys proper locking arrangements like providing of Safety Pin is made. Ensure for copy of test certificate for all the lifting machines and tackles.	Yes / No.	
5.	Ensure that the ropes used before tower erection has been checked for adequate strength / physical condition (Free from break of strands and knots etc.	Yes / No.	
6.	Check that the lifting tools and tackles i.e. Winch Machine, Chain Pulley Block, Trifor, D - Shackle etc. are in healthy condition and has been tested periodically. (Attach copy of test certificate).	Yes / No.	
7.	Ensure that permission has been obtained from Aviation Authority for erection of special towers. (Where necessary).	Yes / No.	
8.	Ensure that permission has been obtained form Aviation Authority for erection of towers which comes in the vicinity of flying zone. (Where necessary)	Yes / No.	
9.	Check that the safety measures has been taken before undertaking for the Road / Rail / River Xing jobs involving like wise stretches.	Yes / No.	
10.	For rail or road crossing check whether written working plan is available at site with specific reference to safety e.g. local earthing, skilled & experience manpower, proper T&P, strength and height of scaffolding to maintain the required clearance etc.	Yes / No.	
11.	Ensure that all the members and proper size of Nuts and Bolts of lower section are fitted properly before erection of the upper section of tower is taken up.	Yes / No.	
12.	Check that the anti climbing devices are provided in the tower after		

SN	Description of Activity	Feed back	Remarks
	erection job.	Yes / No.	
13.	Check that the danger plates have been provided.	Yes / No.	
14.	Check that only erection team members are allowed to stand near the tower while erection is in process and should wear the safety helmet / Safety Shoes.	Yes / No.	
15.	Working area of the tower has been demarcated during erection.	Yes / No.	
16	Check that proper guying arrangement has been made. And also to see that proper size of the crow bars has been used which has been fixed at hard surface in case of sandy soil or loose soil.	Yes / No.	
17	Check that proper arrangement is made while lifting the tower members and fixing them at height i.e. Proper size and strength of the hook used for lifting the tower members.	Yes / No.	
18	Check sufficient numbers of guys are made while lifting the assembled cross arm and also avoiding use of single sheeve pulleys while lifting the assembled cross arm / heavy load.	Yes / No.	

C. CONDUCTOR STRINGING:

SN	Description of Activity	Feed back	Remarks
1.	All drivers and plant operators are holding the valid driving license.	Yes / No.	
2.	Check that the permit has been obtained from the Competent Authority for stringing of conductor while crossing through Road / Rail / River / Venerable areas etc. (Where necessary)	Yes / No.	
3.	Check that required painting has been made on tower falling in the vicinity of aviation zones. (Where necessary.)	Yes / No.	
4.	Check that all safety measures have been taken during stringing of conductor crossing the EHV / HV / LT lines (Earthing of existing lines etc.)	Yes / No.	
5.	Ensure that proper size of Nuts and Bolts is rigidly tightened and punching / tacking / tack welding is done in towers before undertaking stringing job.	Yes / No.	
6.	Ensure that proper scaffolding arrangements made during stringing of conductor (While Road Xing / Power Line Xing etc.	Yes / No.	
7.	Ensure that all members are fitted in tower before undertaking conductor stringing work.	Yes / No.	
8.	Check that the back filling of the foundation has been done as per specification.	Yes / No.	
9.	Ensure that the discharge rod is electrically tested before use.	Yes / No.	
10.	Stringing Machine / Tension pullor Machine are properly earthed.	Yes / No.	
11.	Check the brake arrangement of the TSE Machines is working.	Yes / No.	
12.	Ensure that the pulleys used before conductor stringing has been checked for adequate strength / proper size (diameter), also in case of open type pulleys proper locking arrangements like providing of Safety Pin is made Ensure for copy of test certificate for all the lifting machines and tackles.	Yes / No.	
13.	Ensure the ropes used before conductor stringing has been checked for adequate strength / physical condition (Free from break of strands and knots etc.	Yes / No.	
14.	Check that the lifting tools and tackles i.e. Winch Machine, Chain		

SN	Description of Activity	Feed back	Remarks
	Pulley Block, Trifor, D - Shackle etc. are in healthy condition and has been tested periodically. (Attach copy of test certificate).	Yes / No.	
15.	Check for the brake arrangement of the Drum reel of conductor during laying / paying out of conductor.	Yes / No.	
16.	Check that proper communication facility is available at site during of stringing of conductor (If required)	Yes / No.	
17.	Whether the tower has been permanently earthed.	Yes / No.	
18.	Check that Sag Board is provided at two locations.	Yes / No.	
19.	Check that the Sag Board arrangement is made by the experienced / trained persons.	Yes / No.	
20.	Check approved Sag tension chart is available and followed at site.	Yes / No.	
21.	While clamping of conductor / EW to be done, check for earthing.	Yes / No.	
22.	Ensure sending signal to puller to stop when last layer of conductor / EW being pulled.	Yes / No.	
23.	Check tension applied on the dynamo meter dial and check values with approved data.	Yes / No.	
24.	Before stringing starts check that the villagers do not come underneath the job of the concerned section.	Yes / No.	
25.	Only nylon or polypropylene ropes should be used during conductor stringing in vicinity of live overhead lines.	Yes / No.	
26.	Ensure that PTW has been taken from the concerned authority.	Yes / No.	
27.	Ensure that Winch, Pulleys etc. are properly earthed.	Yes / No.	
28.	For LT lines, whether special persons are posted at each point of isolation till return of permit (PTW).	Yes / No.	
29.	Whether the network of LT lines has been thoroughly checked and precautions taken Against inadvertent charging.	Yes / No.	
30.	Check that proper arrangement is made / available for development and use of a Portable Earthing and Short – Circuiting Devices which can be engaged and disengaged to and from the LT lines, keeping away from the LT lines, until all operations on the same are completed and all men and materials are removed from LT lines.	Yes / No.	
31.	Check the provision and proper positioning for the guying and back staying (Where necessary).	Yes / No.	
32.	Check demarcation of feeder is done for D/c Line.	Yes / No.	
33.	Ensure that all the insulator strings are thoroughly checked for availability and proper fixing of cotter / split pins before hoisting the same.	Yes / No.	

General Points common for all activities during Excavation, Casting of Foundation

A. ERECTION OF TOWER AND STRINGING OF CONDUCTOR :

SN	Description of Activity	Feed back	Remarks
1.	Check whether the contractor had procured required quantity of PPEs considering maximum numbers of erection gangs deployed at one time.	Yes / No.	
2.	Supervisors/ Workmen have been provided with required healthy PPEs, like Safety helmet / Safety Belts / Safety Shoes / Gum Boot etc. as applicable.	Yes / No.	
3.	Availability of First Aid Box with required medicines at site.	Yes / No.	
4.	Instruction register is available at site.	Yes / No.	
5.	Ensure that Supervisor / Gang Leader always issues instruction to the Workmen before start of work.	Yes / No.	
6.	Ensure that supervisory staff from Power Grid is available at site during construction.	Yes / No.	
7.	All driver and plant operators are holding valid driving license.	Yes / No.	
8.	Check the vehicle for rescue is available at site.	Yes / No.	
9.	Ensure engaged labour are aware of the job.	Yes / No.	
10.	Check that the unskilled labourers are not engaged in skilled job.	Yes / No.	
11.	Ensure that supervisor / workmen engaged in the field are aware of First Aid Techniques (Such as in case of Electric Shock, Fall from the height, Snake bite and the person rescued from buried under the debris etc.	Yes / No.	
12.	Check for nearby Hospital / Doctor in case of emergencies arises.	Yes / No.	
13.	While transporting heavy consignment of conductor / EW drums from central store to site by the use of Cranes, Truck, and Tractor. The safety aspect for construction and failure of brake system of moving machinery is to be checked.	Yes / No.	
14.	At least one dry powder type of portable fire extinguisher shall be provided especially where explosive or blasting agents are used for excavation.	Yes / No.	
15.	Check the competence (Qualification / Experience) of supervisor / gang leader of contractor.	Yes / No.	

REMARKS IF ANY:

Signature Name : Designation : Representative of Contractor	Signature Name : Designation: Power Grid Rep. from Site.	Signature Name : Designation: Power Grid Rep. from RHQ.

Safety Related Check List during Construction of Substation

Region: .....…. Name of DHQ / GHQ: ..... Date of Safety Audit:.....

Name of Sub Stn. / Switching Stn.: .....……

Name of Contractor: .....…….

Contractor License / Registration No.:…….....Validity.....…….....

Name of Sub Contractor : .....……

A. SUB STATION CIVIL WORKS :

SN	Description of Activity	Feed back	Remarks
I): SAFETY DURING EXCAVATION :			
1.	Check Sub station area has been protected by constructing boundary wall all around the sub station to avoid entry of passerby / unauthorized person or animal in the sub station.	Yes / No.	
2.	De watering arrangement is available (If necessary)	Yes / No.	
3.	Check proper / adequate arrangement is made for extension of electric supply. (Proper size of cable, Use of fuse, No loose connection and no naked wire connection to Pumps / Illumination / Electric compressors etc. if applicable).	Yes / No.	
4.	Check arrangement of illumination at construction site is available.	Yes / No.	
5.	Check dumping of Excavated soil (Minimum 1.5 Mts. Or half the depth of the pit which ever is more from the edge of the pit.)	Yes / No.	
6.	Check Shoring & Shuttering to protect the loose rock / soil against fall. (if required).	Yes / No.	
7.	Check lone worker is not be allowed to work in the excavated area.	Yes / No.	
8.	Ensure Laying of temporary cables used for operation of Machines used during construction should not cause any danger for electrocution of persons / animals.	Yes / No.	
9.	Ensure that before undertaking excavation, the soil has been tested and in case of availability of any explosive / dangerous gas, necessary arrangement must be made to remove / dilute such gases.	Yes / No.	
10.	The positions of underground installations such as sewers, water pipes and electrical cables has been verified and in case of their existence, they must be isolated before further excavation works to ensure Human Safety.	Yes / No.	
11.	Check that the scaffolds are not overloaded in any case. Scaffolds are to be erected and supported properly.	Yes / No.	
12.	Stability of the soil of the excavated pit for safe working is to be checked and certified by a competent person daily before start of work. A register at site is maintained where competent person can certify accordingly. No manhole should remain uncovered during night & off days.	Yes / No.	
13.	Check the provision of sufficient strong ladder of suitable length is available near the working place during excavation.	Yes / No.	

SN	Description of Activity	Feed back	Remarks
14.	Check if any permission is required from local statutory body before excavation.	Yes / No.	
15.	Check for No undercutting / toe cutting in soil.	Yes / No.	
16.	Check after excavation the work should be speedily completed without delay and back filling done at the earliest.	Yes / No.	
17.	Check for any possibility of seepage of water from nearby pond / river has been estimated and taken care of.	Yes / No	
18.	Check to avoid slide / collaps of side walls of excavated pit, the excavation is to be done in trapezoidal cross – section.	Yes / No.	
II): SAFETY PRECAUTION DURING STORAGE, HANDLING AND USE OF BLASTING MATERIAL:			
1	Check that the adequate arrangement is made for the storage of blasting material at safe place. (Temporary Magazine is to be installed observing all norms) as per Indian Explosive Act.	Yes / No.	
2.	Check that the blasting materials is handled by licensed blaster with due care at site. (If applicable)	Yes / No.	
3.	Check smoking is prohibited in the vehicle carrying explosives.	Yes / No.	
4.	Check that the Blaster is holding proper license issued by the appropriate authority. As per Indian Explosive Act.	Yes / No.	
5.	Check that the length of the fuse wire used during blasting operation is adequate.	Yes / No.	
6.	Check while transportation, no unauthorized person is allowed in vehicle carrying explosives.	Yes / No.	
7.	Check that the loading and unloading of explosives is being done carefully.	Yes / No.	
8.	Check explosives and detonators or blasting caps is not being transported in the same vehicle.	Yes / No.	
9.	Check while transportation the detonators and explosives are not carried loose or mixed with other materials.	Yes / No.	
10	Check surplus explosives shall not be stacked near working area during loading / unloading.	Yes / No.	
11.	Check explosives shall not be held in hands when lightening the fuse.	Yes / No.	
12.	Check that blasting in the open has been carried out during the fixed hours every day or on fixed days in the week so that the public at large should know about this.	Yes / No.	
13.	Check that arrangement has been made to display sufficient warnings / sign board to enable the people to get out of the blasting area to get off the danger zone	Yes / No.	
14.	Check that the danger zone has been suitably cordoned off.	Yes / No.	
15.	Check during blasting operations begin / after the firing of explosives shall follow the loud siren.	Yes / No.	
16.	Check that during blasting operation, Labour / Workmen / Passerby are at safe places and arrangement is made to inform public by caution markings (Red Flag) / Public Notices etc.	Yes / No.	
17.	Check that PPEs i.e. Safety helmets, Safety Shoes, is used by blaster and their gang members during blasting and also the persons supervising the blasting operations.	Yes / No.	

SN	Description of Activity	Feed back	Remarks
18.	For covered blasting ensure placement of cover plates of proper thickness and sufficient numbers of sand filled bags.	Yes / No.	
19.	Ensure that permission for blasting has been obtained from the appropriate authority.	Yes / No.	
III) SAFETY DURING CASTING OF FOUNDATION / CONCRETING :			
1.	Check construction materials are stacked at safe place and also does not cause any danger. (Away from pit) i.e. 1.5 Mtrs. or half the depth of the pit which ever is more.)	Yes / No.	
2.	Check proper arrangement of illumination at Construction Site of Sub station is available.	Yes / No.	
3.	Check that the Concreting Mixer/ Vibrator machines etc are placed at a safe place (Not very near to any pit at least 1.5 Mtr. from the edge of the pit) to avoid transfer of vibrations and should be operated by skilled persons.	Yes / No.	
4.	Check proper / adequate arrangement is made for extension of electric supply. (Proper size of cable, Use of fuse, No loose connection for De watering Pumps / Illumination / Electric compressors etc. if applicable).	Yes / No.	
5.	Check for laying of temporary cables used during construction activities should not cause any danger for electrocution to persons / animals.	Yes / No.	
6.	All bracing, struts and shuttering in excavations shall be adequately secured so as to prevent their accidental displacement.	Yes / No.	
7.	Ensure Shuttering and timbering has been made as detailed in I:S: 3764 for protecting the loose rock / soil against fall.	Yes / No.	
8.	Check for proper placing of Hydraulic jacks with stability and constant watch of these instruments (which are continuously loaded) to avoid any danger of displacement causing sever accident.	Yes / No.	

B. SAFETY DURING STRUCTURE, EQUIPMENT ERECTION & CABLE LAYING ETC. :

SN	Description of Activity	Feedback	Remarks
1.	Check Back filling done prior to erection activity.	Yes / No.	
2.	Check the derrick used before structure erection has been checked for adequate strength / size and no joints are permitted.	Yes / No.	Test certificate is required apart from visual inspection.
3.	Check that the pulleys used before structure erection / Equipment Erection has been checked for adequate strength / proper size (diameter), also in case of open type pulleys proper locking arrangements like providing of Safety Pin is made Safe working load should be punched.	Yes / No.	Test certificate is required apart from visual inspection.
4.	Check the ropes used before structure erection / Equipment Erection has been checked for adequate strength / physical condition (free from break of strands and knots etc.	Yes / No.	Test certificate is required apart from visual inspection.

SN	Description of Activity	Feedback	Remarks
5.	Check that the lifting tools and tackles are in healthy condition and has been tested periodically.	Yes / No.	Test certificate is required apart from visual inspection.
6.	Check permission has been obtained from Aviation Authority for erection of Lightning Mast which comes in the vicinity of flying zone. (Where necessary)	Yes / No.	
7.	Check that all Nuts and Bolts are fitted in the structure before undertaking the job of other section of the structure and are tightened.	Yes / No.	
8.	Check area has been cordoned off to prevent injuries to unauthorized persons from hitting against structural component or falling in the excavated pits.	Yes / No.	
9.	Check that danger plates are available on all the equipment & structures in the switchyard.	Yes / No.	
10.	Check demarcation of feeder is done for Double Circuit Line.	Yes / No.	
11.	Check only erection team members are allowed to stand near the structure / Equipment while erection is in process and should wear the safety helmet / Safety Shoes.	Yes / No.	
12.	Check proper guying arrangement has been made while lifting structure / Equipment, if necessary.	Yes / No.	
13.	Check that proper arrangement is made while lifting the structure members and fixing them at height i.e. Proper size and strength of the hook used for lifting the structure members.	Yes / No.	
14.	Check sufficient numbers of guys are made while lifting the assembled structure / heavy loads and also avoiding use of single sheeve pulleys while lifting the assembled structure / heavy load.	Yes / No.	
15.	Check arrangement has been made for equipment identification.	Yes / No.	
16.	Check that required painting made on tower falling in the vicinity of aviation zones. (Where necessary.)	Yes / No.	
17	Check no live wires nearby. Take shut down if necessary.	Yes / No.	
18.	Check the structure has been permanently earthed.	Yes / No.	
19.	Check crane are preferably be used for erection of pipe structure in the sub station building works (if required.)	Yes / No.	
20.	Check all safety procedures for erection work like use of safety helmets, Safety belts, use of guy wires, lowering / lifting of tools by rope etc. are strictly adhered to during structure erection works is in progress in the switchyard.	Yes / No.	
21.	Check that correct size of spanner (Box or ring type) as well as DE spanners is being used.	Yes / No.	
22.	Check working area of the structure has been demarcated during erection.	Yes / No.	
23.	Check heavy structures are lifted with crane with proper safety.	Yes / No.	

SN	Description of Activity	Feedback	Remarks
24.	Only polypropylene ropes are to be used to tie the aluminium tube / Bus bar since this is soft material and will not damage aluminium tube / Bus bar during erection.	Yes / No.	
25.	Ensure that R clips in insulator caps are fixed properly to avoid disconnection of insulator discs.	Yes / No.	
26.	Ensure that all the necessary security pins (split pins) are fixed.	Yes / No.	
27.	Check all nuts of jumper fittings are properly tightened and live metal clearance have been maintained as per POWERGRID specification.	Yes / No.	
28.	In case of tension fitting dead end joint dimensions before & after the compression are checked and recorded.	Yes / No.	
29.	No damaged component of any hardware fitting should be used on works.	Yes / No.	
30.	Length of jumpers has been measured properly to give it a parabolic shape. No sharp bend should exist.	Yes / No.	
31.	Check surge counter erection facilitates proper reading and that earthing is done with minimum bends.	Yes / No.	
32.	Check Surge monitor has been earthed by connecting it to main earth mat with (G I Flat 75 x 12 mm) and earth pit separately as per drawing.	Yes / No.	
33.	Check the alignment of earth switch with isolator, earth switch of isolator is put into operation and the contacts are cleaned. After completion of pre commissioning checks and formats are dully filled and signed.	Yes / No.	
34.	Ensure that the rubber beedings are kept in good condition.	Yes / No.	
35.	Check CT has been placed on the support structure very carefully and all nuts have been tightened. Earthing is done as per drawing.	Yes / No.	
36.	Ensure the lattice structure of CT has been earthed at two points.	Yes / No.	
37.	Check the marshalling box in the switchyard has proper illumination arrangement.	Yes / No.	
38.	Check the capacitor unit is short circuited & earthed, until erection and commissioning works are being done on CVT. (The capacitor get charged by the electrical fields in the vicinity and they keep these charges for a long time, which can be dangerous to human life. Hence the shorting of capacitor unit is necessary). It should be removed before tests / use.	Yes / No.	
39.	Check Fuses in the marshaling box are OK.	Yes / No.	
40.	Check proper earthing of CVT tank has been done.	Yes / No.	
41.	Check all housing accessories, mounting stools including bolts / Nuts for fixing Line Trap and insulators are of non magnetic material.	Yes / No.	
42.	Check H.F. point of CVTs on which the coupling device is not mounted has been earthed.	Yes / No.	

SN	Description of Activity	Feedback	Remarks
43.	Check the remaining CVTs have been earthed thro' coupling device.	Yes / No.	
44.	Cable drums after visual inspection should be stored preferably in the covered area. Cable ends should be clamped.	Yes / No.	
45.	Ensure each cable and conduit run should be tagged with cable identity numbering as per the approved that appear in the cable and conduit schedule.	Yes / No.	
46.	The tag should be of aluminium plate with ID number punched on it and securely attached to the cable conduit by not less than two turns. Cable tags should of rectangular shape for power cables and of circular shape for control cables.	Yes / No.	
47.	Check underground cable markers should project 150 mm above ground and spaced at an interval of 30 Mts. They shall be located on both sides of road and drain crossing and also at every change in direction.	Yes / No.	
48.	Check cable tags should be provided inside the switchgear, motor control centres, control and relay panels etc. wherever required for cable identification, where a number of cables enter together through a gland plate.	Yes / No.	
49.	The cable (power and control) between LT stations, Control room, DG set building and fire fighting pump house should be laid in the buried cable trenches. In addition to the above, for lighting purpose also, buried cable trench can be used in outdoor area.(as per Technical specification of specific contract)	Yes / No.	
50.	Cable route and joint markers and RCC warning covers should be provided wherever required. The voltage grade of cables should be engraved on the marker.	Yes / No.	
51.	Tray Identification Number on each run of trays at an interval of 10 Mtrs should be painted.	Yes / No.	
52.	In case the outer sheath of a cable is damaged during handling / installation, the same should be repaired to the satisfaction of the site. In case any other part of a cable is damaged, the same should be replaced by a healthy cable. Power cables should be at the top most layers. The armor of control cable is to be earthed.	Yes / No.	
53.	All cable termination should be appropriately tightened to ensure secure and reliable connections. All the exposed parts of cable lugs should be covered with tape, sleeve or paint.	Yes / No.	
54.	Power and control cables are laid on separate cable trays	Yes / No.	
55.	Co-axial cable is laid separately from power cable.	Yes / No.	
56.	All cable trays, racks and metallic ducts have been grounded by connecting each to earth / mat. (As per Scheme)	Yes / No.	
57.	Check sections of cable trays have been bridged by copper jumpers/ G I to retain continuity of earthing. (As per Scheme)	Yes / No.	
58.	Check earthing of panel is done by the erection contractor for connecting it with switchyard earth mat. (As per Scheme)	Yes / No.	

SN	Description of Activity	Feedback	Remarks
59.	Auxiliary bus wiring for AC and DC supplies, Voltage Transformer circuits, annunciation circuits and other common services is provided near the top of the panels running through out the entire length of the panels.	Yes / No.	
60.	All internal wiring to be connected to external equipment is terminated on terminal blocks, preferably vertically mounted on the side of each panel.	Yes / No.	
61.	Check whether Mimic Diagram is available preferably made of anodized aluminium or plastic of approved fast colour material and screwed on to the panel that can be easily cleaned.	Yes / No.	
62.	Check the panels all equipment mounted on front and rear side as well as equipment mounted inside are provided with individual name plates with equipment designated engraved.	Yes / No.	
63.	Check on top of each panel on front as well as rear side, large and bold name plates are provided for circuit / feeder designation.	Yes / No.	
64.	Check all front mounted equipments are provided at the rear with individual name plates engraved with tag numbers corresponding to panel internal wiring to facilitate easy tracing of the wiring.	Yes / No.	
65.	Check the name plates mounted directly by the side of the respective equipments should not be hidden by equipment wiring.	Yes / No.	
66.	Check availability of 240V single phase 50 HZ, AC socket with switch suitable to accept 5 Amps and !5 Amps pin round standard plug, is provided in the interior of each cubicle with ON-OFF switch for connection of hand lamps.	Yes / No.	
67.	Check that panels are provided with a fluorescent lighting fixture rated with 240 Volts single phase, 50 Hz supply for the interior illumination of the panel during maintenance. The fittings are complete with switch fuse unit and switching of the lighting is controlled by the respective panel door switch. Adequate lighting with fuse unit is also provided for the corridor in control panels.	Yes / No.	
68.	Check control panels are provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub circuits are separately with switch fuse units.	Yes / No.	
69.	Check panels are provided with a space heater rated for 240 V, single phase, 50 Hz, AC supply for the internal heating of the panel to prevent condensation of moisture.	Yes / No.	
70.	Check all panels are equipped with an earth bus securely fixed	Yes / No.	
71.	Check when several panels are mounted adjoining each other, the earth bus is made continuous with necessary connectors and clamps for this purpose.	Yes / No.	
72.	Check provision is made for extending the earth bus bars to adjoining panels on either side.	Yes / No.	

SN	Description of Activity	Feedback	Remarks
73.	Check provision is made on each bus bar of the end panels for connecting earthing grid.	Yes / No.	
74.	Check all metallic cases of relays, instruments and panel mounted equipment including gland plates are connected to the earth bus by copper wires of specified size.	Yes / No.	
75.	Check the colour code of the earthing wire is green.	Yes / No.	
76.	Check that earthing made with equipment is with Nuts and Bolts i.e. For such connection lugs should be pressed and tightened to the terminals through Nuts and Bolts.	Yes / No.	
77.	Check that no equipment is mounted on the panel doors.	Yes / No.	
78.	Check each switch should bear clear inscription identifying its function.	Yes / No.	
79.	Check those who have sufficient knowledge of steel structural job have been employed in steel structural works only.	Yes / No.	
80.	Check necessary instruction has been communicated by supervisor before start of the day's works to workmen under his control.	Yes / No.	
81.	Storing of equipments is to be made properly to avoid any accident during handling.	Yes / No.	
82.	Check all Nuts and bolts are properly raised or lowered preferably using closed loop pulleys and gully bags / hand bags tied at the end for carrying nuts and bolts.	Yes / No.	
83.	Check that Fire resistant sheets are used before entrance of control cable in control room.	Yes / No.	
84.	Check air compressor tubing properly tightened.	Yes / No.	
85.	Check all carrying connectors / clamps properly tightened.	Yes / No.	

C. CONDUCTOR LAYOUT DURING CONSTRUCTION STAGE :

SN	Description of Activity	Feed back	Remarks
1.	Check all members are fixed in structure and ensure proper size of Nuts and Bolts are rigidly tightened and punching / tacking / tack welding is done in towers / structures before undertaking conductor laying job.	Yes / No.	
2.	Ensure proper scaffolding arrangements made during laying of conductor (While Power Line crossing etc).	Yes / No.	
3.	Ensure that all members are fitted in structure before undertaking conductor laying work.	Yes / No.	
4.	Ensure that the discharge rod is electrically tested before use.	Yes / No.	
5.	Ensure whether the structure is properly earthed.	Yes / No.	
6.	Only nylon or polypropylene ropes should be used during conductor laying in vicinity of live overhead lines.	Yes / No.	
7.	Ensure that PTW has been taken from the concerned authority when extension of existing sub station is under execution.	Yes / No.	
8.	Ensure that Winch, Pulleys etc. are properly earthed.	Yes / No.	

SN	Description of Activity	Feed back	Remarks
9.	For LT lines, check whether special persons are posted at each point of isolation till return of permit (PTW) if positioning of person is not possible then it is to be seen that all the point of isolation has been kept in the locked position till the work is in progress.	Yes / No.	
10.	Whether the network of LT lines has been thoroughly checked and precautions taken against inadvertent charging.	Yes / No.	
11.	Check that proper arrangement is made / available for grounding LT lines coming across during conductor laying. (This can be done by way of portable earthing and short circuiting devices which cab be engaged to and disengaged from LT lines, keeping away from the LT lines until all operations on the same are completed and all man and materials are removed from the LT lines).	Yes / No.	
12.	Check the provision and proper positioning for the guying and back staying (Where necessary).	Yes / No.	
13.	Check working of hydraulic crimping machine.	Yes / No.	
14.	Check before and after crimping, dimensional changes in clamps and are in accordance with the drawings and specifications.	Yes / No.	

D SWITCHYARD EARTHING DURING CONSTRUCTION STAGE:

SN	Description of Activity	Feed back	Remarks
1.	Check that while earthing conductor crossing the road is laid 300 mm below the road or at greater depth depending upon the site conditions.	Yes / No.	
2.	Check that while laying the Earthing conductor in outside area is buried at least 600 mm below the furnished ground level.	Yes / No.	
3.	Check that the earthing pads have been provided for the apparatus / equipments at accessible position.	Yes / No.	
4.	Check all steel columns, metallic stairs are connected to nearby earthing grid conductor by two earthing leads.	Yes / No.	
5.	Check of earthing of lightening fixtures, receptacles switches, junction boxes lighting conduits has been done by a separate earthing conductor.	Yes / No.	
6.	Check that the railway tracks within switchyard area has been earthed at a spacing of 30 Mts. / specified distance and also at both ends.	Yes / No.	
7.	Check cable trays has been connected to earthing flat of 50X6 mm / specified sized earthing flat at intervals specified in approved drawing.	Yes / No.	
8.	Check that this earthed flat is earthed at about 30 Mts. distance.	Yes / No.	
9.	All accessories in transformer and reactor like radiators tank, cooling banks etc are connected to the earthing grid at minimum two points.	Yes / No.	
10.	Check metallic conduits are not used as earth continuity conductor.	Yes / No.	
11.	Check flexible earthing connectors should be provided for the moving parts.	Yes / No.	

SN	Description of Activity	Feed back	Remarks
12.	Check sheath and armor of single core power cable is earthed at switchgear end and equipment side.	Yes / No.	
13.	Check contact surface of earthing pads for jointing free from scale, paint, enamel, grease, rust or dust.	Yes / No.	
14.	Check that light poles, junction boxes on the poles, cable and cable boxes / glands, lockout switches etc. are connected to the earthing conductor running along with the supply cable which intern is connected to the earthing grid conductor at a minimum two points.	Yes / No.	
15.	Check earthing conductor which is generally buried 2000 mm outside the switchyard fence. All the gates and every alternate post of the fence are to be connected to earthing grid.	Yes / No.	
16.	Check megger used for measuring soil resistivity is calibrated with desired accuracy.	Yes / No.	
17.	The earth resistivity has been measured in dry weather condition.	Yes / No.	
18.	Check the earthing of Transformers and Shunt reactor, earth pits are constructed as per relevant standard / approved drawing.	Yes / No.	
19.	Check that the measured value of combined earth resistance should be less than 1 Ohm.	Yes / No.	
20.	Check that for earth electrode and individual earth pits, this value should not be more than one Ohm.	Yes / No.	
21.	Check all non current carrying metal parts shall be effectively earthed by two separate and distinct earth connections (Indian Electricity Rule 61,67)	Yes / No.	
22.	Check that all pylon supports in the Fire Fighting HVSW system has been earthed to the earthmat.	Yes / No.	

E: GENERAL POINTS COMMON FOR ALL ACTIVITIES DURING EXCAVATION, CASTING OF FOUNDATION

Erection of structures, laying of Conductor, storage and transportation of material:

SN	Description of Activity	Feed back	Remarks
1.	Check Supervisors / Workmen have been provided with required healthy PPEs. Like (Safety helmet / Safety Belts / Safety Shoes / Gum Boot etc. as applicable)	Yes / No.	
2.	Check availability of First Aid Box with required medicines at site.	Yes / No.	
3.	Check Site Instruction register is available at site.	Yes / No.	
4.	Ensure Supervisor / Gang Leader always issues instruction to the Workmen including contractor labour before start of work.	Yes / No.	
5.	Ensure supervisory staff from Power Grid is available at site during construction.	Yes / No.	
6.	Check all driver and plant operators are holding valid driving license.	Yes / No.	
7.	Check the vehicle for rescue is available at site.	Yes / No.	
8.	Ensure engaged labour are aware of the job.	Yes / No	
9.	Ensure supervisor / workmen engaged in the field are aware of First Aid Techniques (Such as in case of Electric Shock, Fall from the	Yes / No.	

SN	Description of Activity	Feed back	Remarks
	height, Snake bite and the person rescued from buried under the debris, rescue of person from drowning etc.		
10.	Check for availability and to keep a record of nearby Hospital / Doctor in case of emergencies arises.	Yes / No.	
11.	While transporting heavy consignment of conductor / EW drums from central store to site by the use of Cranes, Truck, Tractor. The safety aspect for construction and failure of brake system of moving machinery is to be checked.	Yes / No.	
12.	At least one dry powder type of portable fire extinguisher shall be provided especially where explosive or blasting agents are used for excavation. (If applicable)	Yes / No.	
13.	Check the competence (Qualification / experience) of supervisor / gang leader of contractor.	Yes / No.	
14.	Wire mesh rolls shall be secured in order to prevent dangerous recoiling action.	Yes / No.	
15.	Proper unloading arrangement has been made at site (Preferably with crane) to unload the material.	Yes / No.	
16.	After unloading the material visual inspection of the materials has been carried out along with the erection contractor to check that the material has not been damaged or not (Galvanizing is proper or not) As per approved Field Quality Plan etc.	Yes / No.	
17.	While transporting the heavy laden equipment like transformer / Reactor by road from Rly Stn to Sub station check whether for all safety precaution taken. Like safe lifting capacity of crane, safe load on culvert / Bridge / Nala / Drain etc.and working plan is available at site with specific reference to safety e.g. local earthing, skilled & experience manpower, proper T&P, strength and LT wires / HT wires interrupting the height of equipment and the required clearance maintained etc. Permission to be obtained from concerned authority if required. "Impact recorder on the equipment like Reactor / Transformer must be installed during transportation"	Yes / No.	
18.	Check that the adequate and safe means of access and aggress has been provided for all work places as far as reasonably practicable and is being used by the workers.	Yes / No.	
19.	Check proper illumination is provided at the work places and their approaches including passage ways.	Yes / No.	
20.	Check that the lamps have been protected by suitable guards where necessary to prevent danger, in case the lamp breaks.	Yes / No.	
21.	Check loose materials which are not required for use shall not be placed or left so as dangerously to obstruct work places or passage ways.	Yes / No.	
22.	Check all projected nails has been removed or bent over to prevent injury.	Yes / No.	
23.	Check scrap, waste and rubbish has not been allowed to accommodate on the site or the scrap materials has been stored at the isolated place.	Yes / No.	
24.	Check that the worker while working at height scaffold materials, waste materials and tools are not being thrown by them to cause injury to any person.	Yes / No.	

SN	Description of Activity	Feed back	Remarks
25.	Check whether contractor has procured required quantity of PPE considering maximum number of erection gangs deployed at one time. Check the quantity of PPEs.	Yes / No.	
26.	Check that the PPEs required by the workmen are being utilized by them always.	Yes / No.	
27.	Check the worker is under constant surveillance by the other person while working at height.	Yes / No.	
28.	Check construction site has been barricaded for unauthorized persons / animals.	Yes / No.	
29.	Check that lifting appliances and machines and vehicles used on the construction site is of sound material and good quality and is free from patent defects and is strong enough to with safely the load and stresses to which they will be subjected.	Yes / No.	
30.	Check structures and equipment is being used only for the purpose for which they were intended.	Yes / No.	
31.	Check equipment has been operated by the competent person.	Yes / No.	
32.	Check portable ladders shall not exceed 9 Mts. in length, other wise may cause danger while climbing of person and back legs shall be equally braced.	Yes / No.	
33.	Check unskilled labour are not utilized for skilled jobs and only experience persons are deployed for erection.	Yes / No.	
34.	Check a well planed and documented procedure for the entire Construction works of Sub station shall be prepared by contractor and get approved from Power Grid for distribution to Contractors' field staff and Power Grid for follow up.	Yes / No.	
35.	Check no metallic measuring tapes are being used during expansion of charged bays.	Yes / No.	
36.	Check metal ladders are not being used in the vicinity of exposed live electrical equipment.	Yes / No.	
37.	Check one bore well is available for water supply in case Municipal Construction supply is not available	Yes / No.	
38.	Check charged area of a yard should be properly fenced off.	Yes / No.	
39.	Check ladders / lengthy articles / lengthy equipments etc. should always be carried in horizontal position.	Yes / No.	
40.	Check insurance by contractor for the labour to provide adequate coverage for any accident etc.	Yes / No.	

REMARKS IF ANY:

Signature Name : Designation: Power Grid Rep.	Signature Name : Designation: Rep. from Contractor	Signature Name : Designation : Rep. from

ANNEXURE – 7

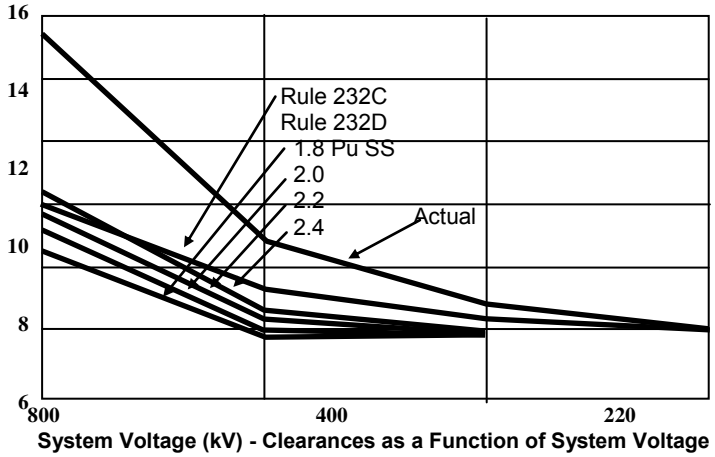
REPORT OF PTI ON EMF

ELECTRO-MAGNETIC FIELD

Power Technologies, Inc. has been requested to review POWERGRID's 132 KV, 220 KV, 400 KV and 800 KV lines with respect to conductor to ground, phase to phase and circuit to circuit clearances and their appropriateness in light of present practice.

Based on a review of POWERGRID's designs, we find that the phase to phase and circuit to circuit clearances are consistent with practices used for line clearances throughout the world. The values used by POWERGRID are generally in the middle range of that used throughout the world and are expected to provide satisfactory performance.

The conductor to ground clearances are within typical limits and meet or exceed the requirements of the National Electrical Safety Code, American National Standard Institute, C2, as shown on Figure.



Analysis of POWERGRID Transmission Line Clearances

The analysis was based on the following data as supplied by POWERGRID.

800 KV S/C LINE

Configuration - Horizontal
Conductor Bundle - Quad CSR Bursitis (35.1 mm id)
Max. conductor sag - 14.56 m
Phase to phase spacing - approx. 15 m.
Ground clearance - 12.4 m (as per IE rules):15 m (maintained to limit max. electric field to 10 KV/m)
Right of way - 85 m

400 KV S/C LINE

Configuration - Horizontal
Conductor Bundle - Twin ACSR Moose (31.77 mm dia)
Maximum conductor sag - 12.87 m
Phase to phase spacing - 10 to 12 m
Ground clearance - 8.84 m (as per IE rules)
Right of way - 52 m

400 KV D/C LINE

Configuration - Vertical
Conductor Bundle - Twin ACSR Moose (31.77 mm dia)
Maximum conductor sag - 12.87 m
Phase to phase spacing - 8 to 9 m
Ckt. to ckt. spacing - 12 to 14 m
Ground clearance - 8.84 m (as per IE rules)
Right of way - 52 m

220 KV D/C LINE

Configuration - Vertical
Maximum conductor sag - approximately 9.8 m
Phase to phase spacing - 5 to 5.5 m
Ckt. to ckt. spacing - approximately 10
Ground clearance - 7.015 m (as per IE rules)
Right of way - 35 m

132 KV D/C LINE

Configuration - Vertical
Conductor - ACSR Panther (21 mm dia)
Maximum conductor sag - approximately 6.6 m
Phase to phase spacing - approximately 4 m
Ckt. to ckt. spacing - approximately 7 m
Ground clearance - 6.1 m (as per IE rules)
Right of way - 27 m

ANNEXURE – 8

PROCEDURE OF PUBLIC CONSULTATION

POWERGRID'S PUBLIC CONSULTATION PROCESS

Public consultation forms an integral part of POWERGRID's project cycle, and will be carried out in Regional/local language for wider/better understanding. The process of consultation and its documentation shall be as follows:

TRANSMISSION LINES

1. When planning a transmission line, public consultation is used as an integral tool for screening, assessment and finalisation of route alignment. During initial screening and walkover survey, POWERGRID's staffs meet the public in the route of proposed transmission line. Observations and problems arising from these discussions are given due consideration while finalising the route.

2. During the survey for tower spotting, POWERGRID's site officials meet the public i.e. people coming in the route of the line. This enables POWERGRID to gauge public opinion. At the time of construction, every individual on whose land a tower is to be erected is met with. People coming in the way of the ROW are consulted and their views and suggestions are incorporated thus allowing for public participation.

3. During construction POWERGRID pays the compensation for any damages to each land owner and obtains their final acknowledgement.

4. During maintenance, POWERGRID consults the individual landowners, obtains their approval and pays compensation for any damage to property.

SUBSTATIONS

1. POWERGRID identifies location of the substation and notifies the area under LA Act.

2. Public consultation is a part of LA Act. Under Section 4 of LA Act, a notification is published in the official Gazette and in two local daily newspapers (at least one of which is in the local regional language) about the details of the project. Any objections related to the land to be acquired are made to the collector in writing. Under section 5a, the District Collector hears the public objections by calling a public meeting, if so desired. DC sends report along with recommendations along with details of proceedings to the state government. DC issues notice under section 6 only after he receives the state government's approval.

3. Under Section 6 of LA Act, the DC issues a notice informing the public about the land to be acquired and invites their claims. All effective people informed individually. Compensation is paid to public according to local norms.

4. Besides publication consultation as an integral part of the LA Act, POWERGRID is committed to assessment of all probable impacts associated with land acquisition through its social assessment and management process which includes a socio-economic survey of the proposed substation sites. The socio-economic survey will assess both adverse and positive impacts of the project on aspects such as the natural resource base, developmental potential of the area, economy of the affected area, social

structure, norms and traditions. The socio-economic survey will include a complete household census recording members, property with legal rights and resources which are in possession or in use. Appropriate methods such as participatory rural appraisal and questionnaires will be used where necessary.

5. POWERGRID assess the social impacts of its land acquisition based on the socio-economic survey and designs its compensation packages in consultation with the people. POWERGRID organises meetings with the PAPs to evolve the RAP.

In order to further streamline the above process and to facilitate documentation of the same, and to discuss 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 minimising and solving them; and
- land acquisition details, proposed R&R measures and compensation packages in line with POWERGRID's policy

POWERGRID uses one or more of the following techniques at various stages. These include:

(1) ***Public meetings:*** POWERGRID will hold public meetings during its EAMP process at appropriate locations along the length of the transmission line. Public meetings will include one to one meetings with land owners during transmission tower spotting. Larger group meetings will be organised at strategic distances along the length of the transmission line. These will consist of all or at least most of the people to be directly affected by the concerned project and their local Gram Panchayat leaders.

(2) ***Informal small group meetings:*** Informal small group meetings will be conducted during walkover survey to find out local environmental and social issues along the proposed transmission line route. These meetings will be conducted by ESMT staff at appropriate intervals.

(3) ***Information brochures and Pamphlets:*** POWERGRID will make available information and project specific details to the public through Information brochures and Pamphlets. These brochures and pamphlets will contain information on: the overall project plan; design and construction standards; prudent deviations from design standards from transmission towers near schools, hospitals, human habitation; potential impacts and generic mitigation measures; resettlement and rehabilitation; and, compensation.

(4) ***Operating field offices:*** Information regarding the proposed transmission line can be accessed by the public from operating field offices. Information will be provided through brochures and pamphlets and any further queries will be responded by POWERGRID's staff.

(5) ***Local planning visits and site visits:*** POWERGRID staff will visit field sites. During this time informal contacts will be established with the local people. Reactions of the public to the project will be informally gauged.

(6) ***Response to public Enquires:*** ESMC/ESMT will respond to public enquiries by post or through notices in local news papers.

(7) ***Press release inviting comments:*** POWERGRID will publish details of proposed transmission routes in two local newspapers. Public will be invited to comment in writing or by meeting concerned POWERGRID officials within a specified period. POWERGRID will then incorporate relevant objections and suggestions.

(8) ***Project coordination committees:*** POWERGRID will set up grievance redressal committees to address the complaints and objections that PAP's may have regarding the project, its impacts or mitigation measures.

(9) ***Ombudsman or representative:*** For building a consensus on the project its impacts and mitigation measures, the PAPs will be encouraged to elect or appoint a trusted ombudsman or representative.

(10) ***Public Displays:*** POWERGRID will show their model projects to public/small representative groups.

DOCUMENTATION

The proceedings of the above consultation shall be documented. Details recorded will include date of the meeting, venue, number and possibly the names of the people attended, issues discussed and the outcome of the meeting.

The manager at DHQ will apply combinations of the appropriate techniques at various activities of a project depending upon the field conditions as shown below:

Milestones	Process	Techniques
1. Environmental & social screening & scoping for TLs	▪ Screen &scope Tls from an environmental and social perspective - spot verification	Informal small group meetings, local planning visits and site visits
2. Environmental & social screening & scoping for SS	▪ Screen &scope SS from an environmental and social perspective - spot verification	Informal small group meetings, Local planning visits and site visits
3. EAMP	▪ Tls & SS - undertake environmental review and formulate appropriate management measures	Public meetings, Press release inviting comments
4. SAMP	▪ Tls - negotiate compensation packages with revenue authorities and PAPs - finalise and document compensation and other management measures ▪ SS - finalise SS site - notify area under LAA - undertake detailed LA census	Informal small group meetings, local planning visits and site visits, Response to public enquiries Public meetings, Ombudsment or representative, Public

Milestones	Process	Techniques
	- final negotiations and documentation of agreements	display
5. Execution of Environmental management works	▪ Execute environmental management works - appropriate clearance for Transmission line ROW, etc. - compensatory afforestation	Information brochures and pamphlets, Operating field offices, Response to public enquiries
6. Execution of Social management works	▪ Tls - pay compensation as agreed and documented in SAMP and execute other measures ▪ SS - deposit compensation and take possession of land - execute R&R measures as prescribed in the SAMP	Information brochures and pamphlets, Operating field offices, Response to public enquiries Information brochures and pamphlets, Operating field offices, Response to public enquiries
7. Environmental and Social monitoring	▪ Monitor EAMP measures - maintenance of ROW - progress on compensatory afforestation ▪ Monitor SAMP measures - appropriate compensation and other measures during maintenance of towers and lines - progress on R&R measure	Information brochures and pamphlets, Operating field offices, Response to public enquiries Informal small group meetings

ANNEXURE – 9

DETAILS OF PUBLIC CONSULTATION

Public Consultation Program Report

As per the Environment and Social Policy and Procedure (ESPP), a public consultation meeting was organized for upcoming **400kV D/C Radhanesda- Banaskantha Transmission line** associated with transmission system for Ultra Mega Solar Power Plant (700MW) at Banaskantha, Gujarat**.** The public consultancy program was conducted at Zalodha Village, Diodar Taluka, Banaskantha District on 27/07/2016 to apprise the villagers about this prestigious project.

Zalodha has a common panchayat office for Manpur, Navapura villages, which are in the route of aforesaid transmission line. The program was organized at Village Panchayat Zalodha and prior information was given to the villagers through verbal communication & notice through Panchayat office. The Program was overwhelmingly received by Village public and Big gathering of Village people attended the program.

Zalodha, Manpar & Navapura Village Sarpanch,, Talati of the village and several senior Village dignitaries participated in this program & raised several queries regarding this project and were briefly explained with Project Information by POWERGRID Officials.

Major queries regarding compensation of crop and job opportunity for youth of village were discussed during meeting. Like;

- Q: Benefits to Village People

  A: Various People get directly/indirectly benefit from this projects. As per Govt. Laws, POWERGRID under its CSR program, would to propose to Head Office regarding Ambulance or any other work as proposed by Village Panchayat in consultation with the administration subject to guidelines of Govt. under CSR policy and financial limitations.
  Also, village people may get temporary employment in the work based on skill/ qualification as per requirement through contractor

- Q: Provision for Crop compensation

  A: POWERGRID is the Govt. under taking unit, there is a provision to pay crop compensation against damaged crop during construction work as per guidelines given by Government of India.

- Q: Jobs for Village Youth

  A: As POWERGRID being a Govt. of India Undertaking, all recruitments would be done through Proper Notification followed by Written Test and Interview. So,

No POWERGRID staff can promise Govt. Job in this Company. But, POWERGRID employed Contractor's may employ local skilled youth.

Finally, the program was concluded cordially after addressing/discussing of several issues of Village Public.

27/04/2016

डी. के. शर्मा / D. K. Sharma
मुख्य प्रबंधक / Chief Manager
पावरग्रिड / POWERGRID
बनासकांठा / BANASKANTHA

Public Consultation Program for upcoming 400kV Radhanesda Banaskantha Transmission line, "under Ultra Mega Solar Transmission System."


पावर ग्रिड कारपोरेशन आफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
"अल्ट्रा मेगा सोलार ट्रान्समिशन सीस्टम"
परामर्श कार्यक्रम


पावर ग्रिड कार्पोरेशन ऑफ इंडिया लिमिटेड
अल्ट्रा मेगा सोलार ट्रान्समिशन सीस्टम
जन परामर्श कार्यक्रम


जन परामर्श कार्यक्रम

LIST OF PERSONS ATTENDED PUBLIC CONSULTANCY PROGRAM FOR 400 KV D/C RADHANESDA BANASKANTHA TL

SR. NO	NAME OF PARTICIPANTS	SIGNATURE
1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
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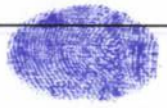
5	[illegible]	
6	[illegible]	B. C. Dubhi
7	[illegible]	[illegible]
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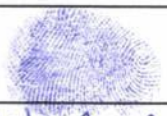
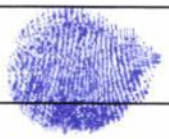
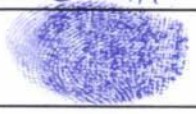
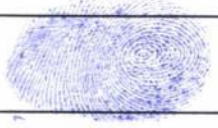
10	[illegible]	
11	[illegible]	[illegible]
12	[illegible]	S. T. P.
13	[illegible]	[illegible]
14	[illegible]	K. S. Dubhi
15	[illegible]	
16	[illegible]	J. K. [illegible]
17	[illegible]	[illegible]
18	[illegible]	

19	[illegible]	C.J. Patel
20	[illegible]	[illegible]
21	[illegible]	M.P Patel
22	[illegible]	P.J.V
23	[illegible]	[illegible]
24	[illegible]	
25	[illegible]	[illegible]
26	[illegible]	
27	[illegible]	R.S. Patel
28	[illegible]	P.V Mobi
29	[illegible]	
30	[illegible]	P.G Patel
31	[illegible]	P.P. Patel
32	[illegible]	[illegible]
33	[illegible]	[illegible]
34	[illegible]	K.P Patel
35	[illegible]	B.B. Patel
36	[illegible]	Rekha Chaudhari
37	[illegible]	
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43	[illegible]	[illegible]
44	[illegible]	
45	[illegible]	Shivabhai
46	[illegible]	[illegible]
47	[illegible]	
48	[illegible]	
49	[illegible]	
50	[illegible]	
51	[illegible]	[illegible]
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58		

Details of Informal Group meetings held along the route of **Radhanesda– Banaskantha 400 kV D/C Transmission line** associated with transmission system for Ultra Mega Solar Power Plant (700MW) at Banaskantha, Gujarat.

Transmission Line	**Date of meeting**	**No. of villagers who attended**	**Name of Village**	**Taluka-** District- Banaskantha	**Remarks**
Radhanesda – Banaskantha 400 kV D/c line	20.07.2016	14	Paldi	Deesa	Village Panchayat representatives, farmers, teachers and others attended the meeting. Compensation for Crops/trees, utilization of road paths were main concerns which were clarified during meeting. **(Annex some photos of such discussion also)**
	20.07.2016	12	Ratanpura	Deesa	
	20.07.2016	15	Soila	Deesa	

POWERGRID's Officials explaining the villagers of **Paldi Village** about the route of the Transmission Line and Compensation particulars paid during construction stage.

Details of Informal Group meetings held along the route of **Radhanesda– Banaskantha 400 kV D/C Transmission line** associated with transmission system for Ultra Mega Solar Power Plant (700MW) at Banaskantha, Gujarat.

Transmission Line	**Date of meeting**	**No. of villagers who attended**	**Name of Village**	**Taluka** District- Banaskantha	**Remarks**
Radhanesda(New) – Banaskantha(New) 400 kV D/c line	22.07.2016	20	Nesda-Nava	Deesa	Village Panchayat representatives, farmers, teachers and others attended the meeting. Compensation for Crops/trees, utilization of road paths were main concerns which were clarified during meeting.
	22.07.2016	11	Nesda-Juna	Deesa	
	22.07.2016	15	Ramvas	Deesa	

POWERGRID's Officials explaining the villagers of **Nesda Nava Village** about the route of the Transmission Line and Compensation particulars paid during construction

Details of Informal Group meetings held along the route of **Radhanesda– Banaskantha 400 kV D/C Transmission line** associated with transmission system for Ultra Mega Solar Power Plant (700MW) at Banaskantha, Gujarat.

Transmission Line	**Date of meeting**	**No. of villagers who attended**	**Name of Village**	**Taluka** District-Banaskantha	**Remarks**
Radhanesda(New) – Banaskantha(New) 400 kV D/c line	23.07.2016	14	Soni	Deodar	Village Panchayat representatives, farmers, teachers and others attended the meeting. Compensation for Crops/trees, utilization of road paths were main concerns which were clarified during meeting.
	23.07.2016	12	Navapura	Deodar	
	23.07.2016	15	Manpur	Deodar	
	23.07.2016	19	Shergarh	Deodar	

POWERGRID's Officials explaining the villagers of **Soni Village** about the route of the Transmission Line and Compensation particulars paid during construction stage.

ANNEXURE – 10

ACTION PLAN FOR SAFEGUARDS

ACTION PLAN FOR SAFEGUARDS

1. Based on the above Equivalence and Acceptability Assessments, ADB and POWERGRID agreed to implement the following Action Plan for bringing POWERGRID project implementation into full equivalence with SPS policy principles and attaining fully effective implementation of the ESPP and other components of its environmental and social management system.

2. POWERGRID has been updating its ESPP periodically to reflect changes in legal, policy and international best practices. POWERGRID agreed to update the ESPP as needed whenever there are policy and legislative changes related to environment and social safeguards. To ensure equivalence with the SPS, ADB proposes that covenants be included in the loan agreement for all ADB-financed projects to undertake the following equivalence and acceptability actions.

A. Equivalence Actions

3. As described above, ADB and POWERGRID agreed to incorporate the following requirements:

1. Environment

Action Plan
a) Assess potential cumulative impacts of power transmission projects and include in the environmental assessment process, where appropriate.
b) Provide data for any Government strategic environmental assessments that are relevant to POWERGRID business and operations.
c) Include cost estimates for project-specific environmental management measures into the Environmental Assessment Management Plan (EAMP) [1] (nee. Environment Management Plan(EMP), refer ESPP Appendix- XXX-A).
d) Disclose revisions and updates of the Initial Environmental Assessment Report if any, on the POWERGRID website, and provide relevant environmental information to affected people and other stakeholders, in a timely manner and in a form and language understandable to the affected people.

2. Involuntary Resettlement

Action Plan
a) Monitor each of the three methods of obtaining land (voluntary donation, negotiated purchase, involuntary acquisition). For negotiated purchase the monitoring is to include an assessment of the transparency of the process, confirmation that the agreed price was paid and confirmation by the seller that they were satisfied with the process. For involuntary acquisition the existing monitoring requirements are maintained.
b) Disclose annual monitoring reports for individual projects in a timely manner and in Hindi and English to the affected people.

3. Indigenous Peoples

Action Plan
a. Design (i) socio-economic benefit and, (ii) capacity development for Indigenous Peoples so that they are culturally appropriate, and gender and intergenerationally inclusive.

[1] Environment Assessment Management Plan (EAMP)" & "Environment Management Plan (EMP)" are synonyms and hence EAMP should be read as "EMP" in this document.

Action Plan
b. Disclose (i) draft and final Tribal People Development Plan; and (ii) monitoring reports in a timely manner and in a form of language understandable to the affected Indigenous Peoples.
c. Obtain consent from Indigenous Peoples in the case of commercial development of natural resources within tribal lands.

B. Acceptability Actions

4. ADB and POWERGRID agreed to implement the following practices in all projects supported by ADB under POWERGRID's ESPP in lieu of ADB safeguards.

1. Environment

Action Plan
a) Assign environmental specialist(s) (staff or consultants) to each project for project implementation and monitoring during construction.
b) Undertake stakeholder consultations with representation of women.
c) Document disclosure and availability of project information in a timely manner and in a form and languages understandable to affected people.
d) Document where EAMP requirements were not met and status of associated corrective actions in site visit reports by environmental specialists.

2. Involuntary Resettlement

Action Plan
a) Develop procedures on monitoring livelihood impacts of land acquisition.
b) Use recording and tracking systems in the Grievance Redress Mechanism.
c) Conduct meaningful consultation[2] with affected people.
d) Disclose monitoring reports, in a timely manner and in Hindi and English to the affected people.

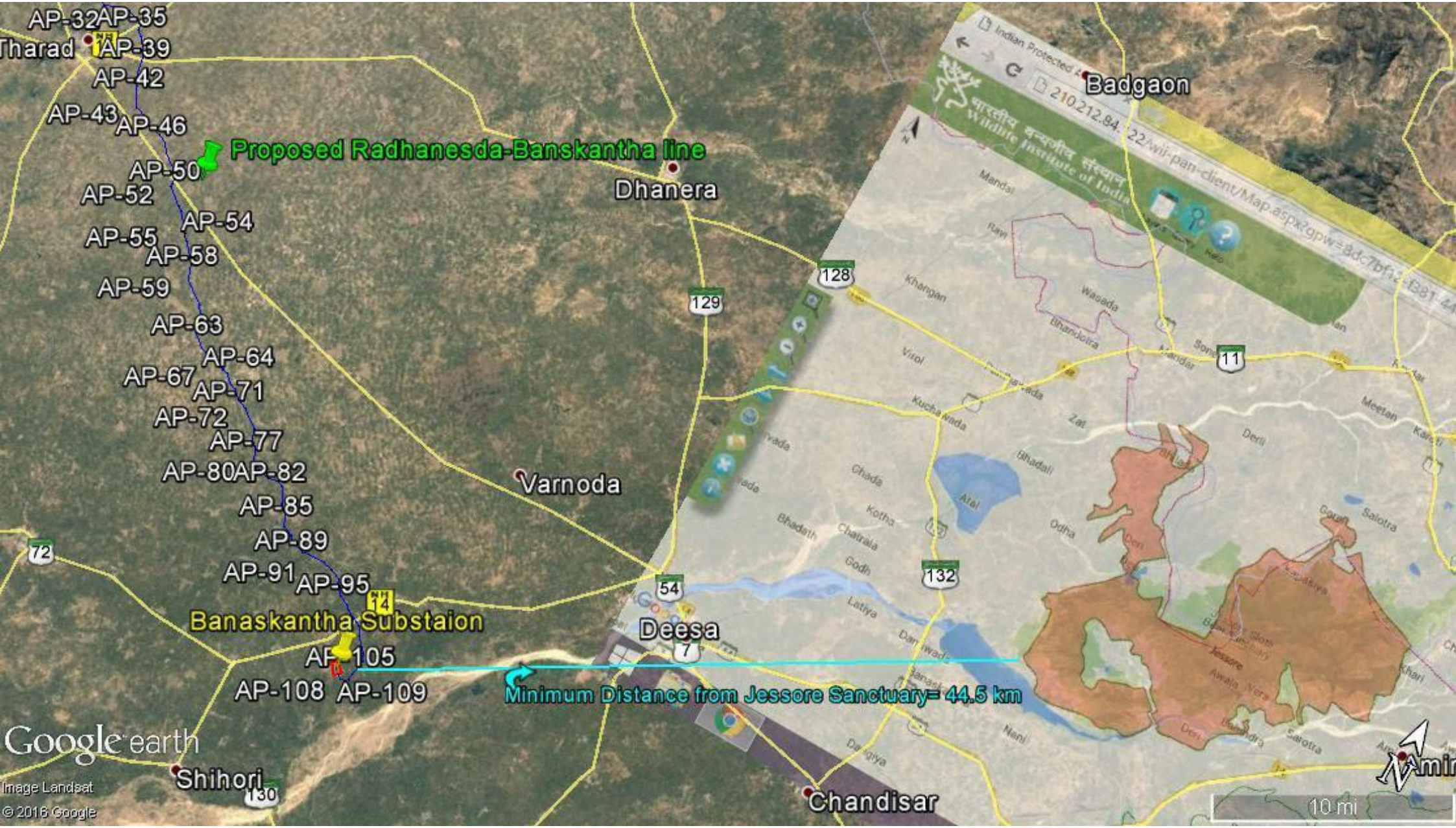
3. Indigenous Peoples

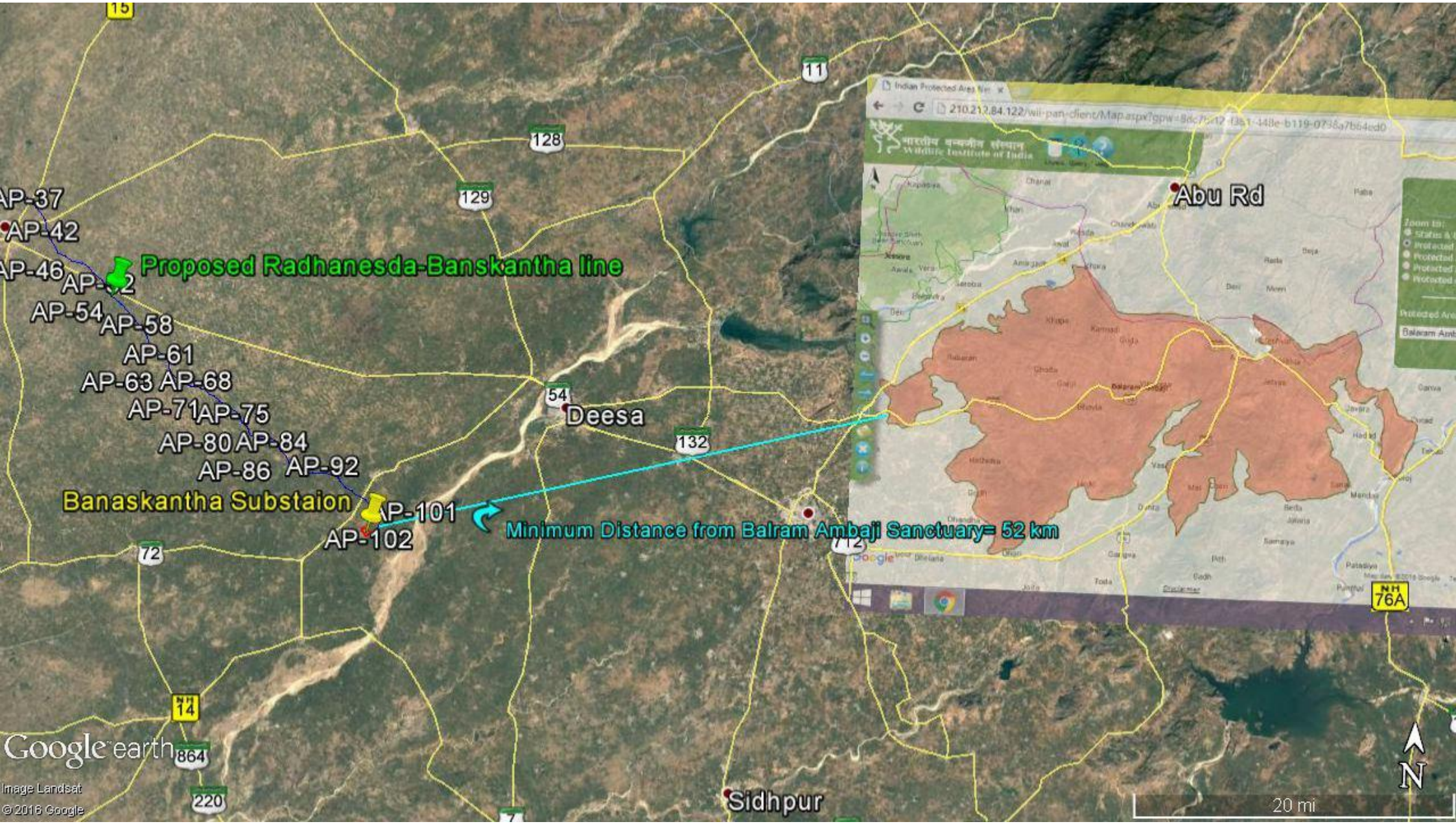
Action Plan
Provisions for acceptability actions with respect to safeguards of Indigenous Peoples are not applicable at this stage. While ESPP requires that a project affecting Indigenous Peoples prepare and implement a TPDP, there are currently no POWERGRID projects triggering Indigenous Peoples safeguards under implementation that are mature enough to assess.

[2] Meaningful consultation defines as a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

MAP – 1a & 1b

DISTANCE FROM PROTECTED AREAS

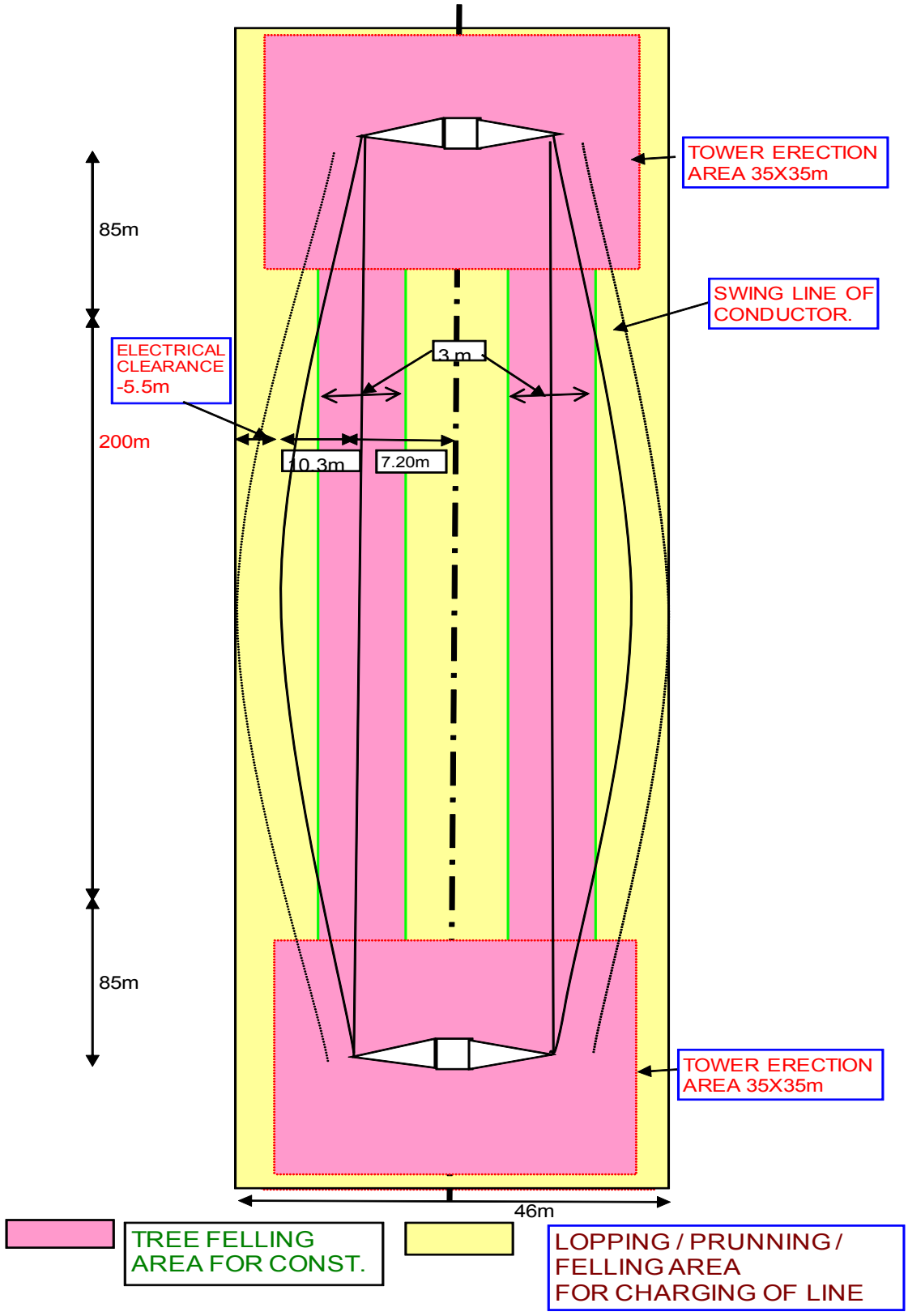

AP-32
AP-35
Tharad
AP-39
AP-42
AP-43
AP-46
Proposed Radhanesda-Banskantha line
AP-50
AP-52
AP-54
AP-55
AP-58
AP-59
AP-63
AP-64
AP-67
AP-71
AP-72
AP-77
AP-80
AP-82
AP-85
AP-89
AP-91
AP-95
Banaskantha Substaion
AP-105
AP-108
AP-109
Dhanera
Varnoda
Deesa
Shihori
Chandisar
Badgaon
Minimum Distance from Jessore Sanctuary= 44.5 km
Google earth
Image Landsat
© 2016 Google
10 mi


AP-37
AP-42
AP-46
Proposed Radhanesda-Banskantha line
AP-54
AP-58
AP-61
AP-63
AP-68
AP-71
AP-75
AP-80
AP-84
AP-86
AP-92
Banaskantha Substaion
AP-101
AP-102
Deesa
Minimum Distance from Balram Ambaji Sanctuary= 52 km
Abu Rd
Sidhpur
Google earth
Image Landsat
© 2016 Google
20 mi
N

Map – 2

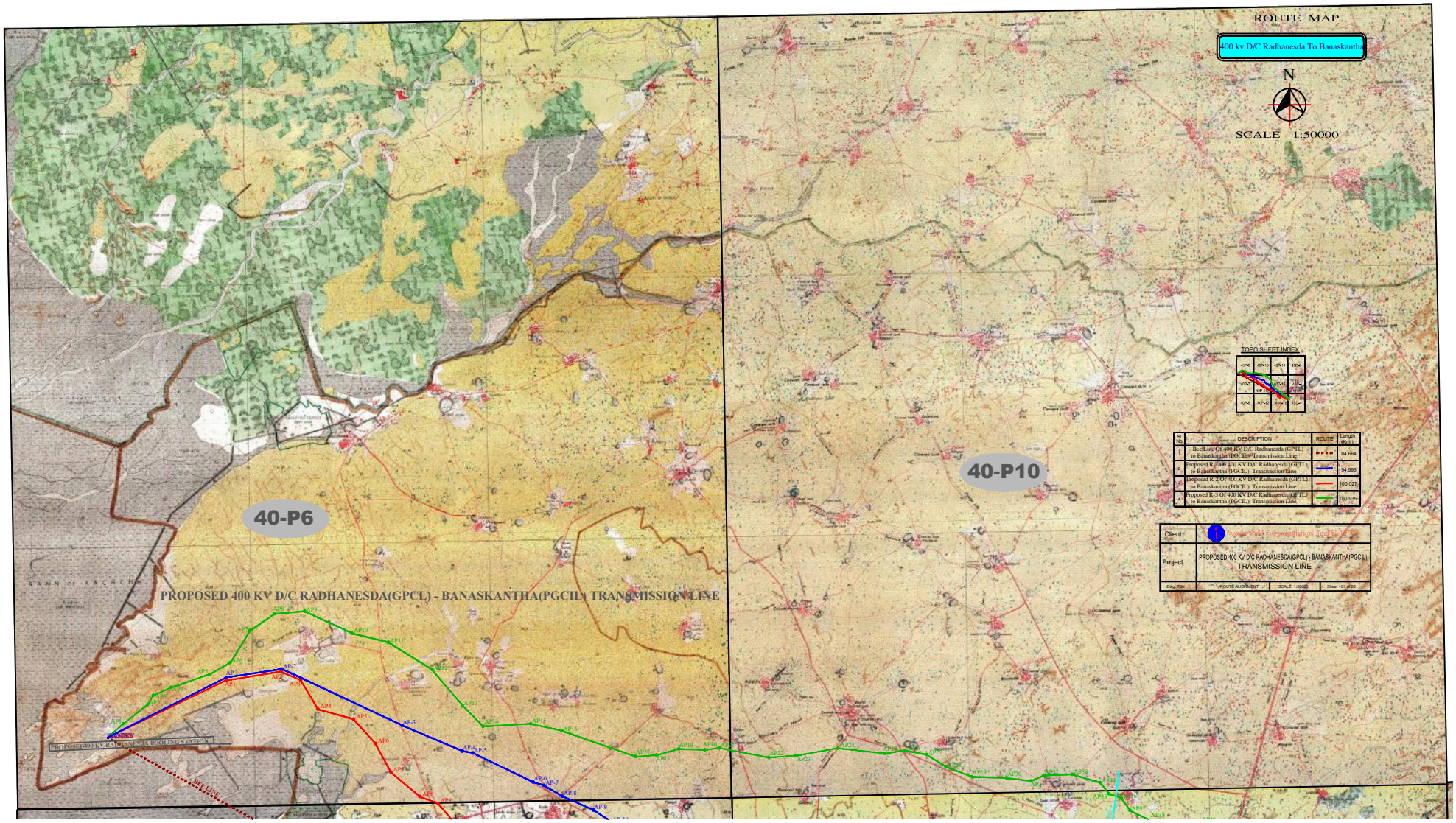
SCHEMATIC DIAGRAM INDICATING AREA OF INFLUENCE/IMPACT OF 400KV TRANSMISSION LINE

AREA OF INFLUENCE FOR 400KV TRANS. LINE

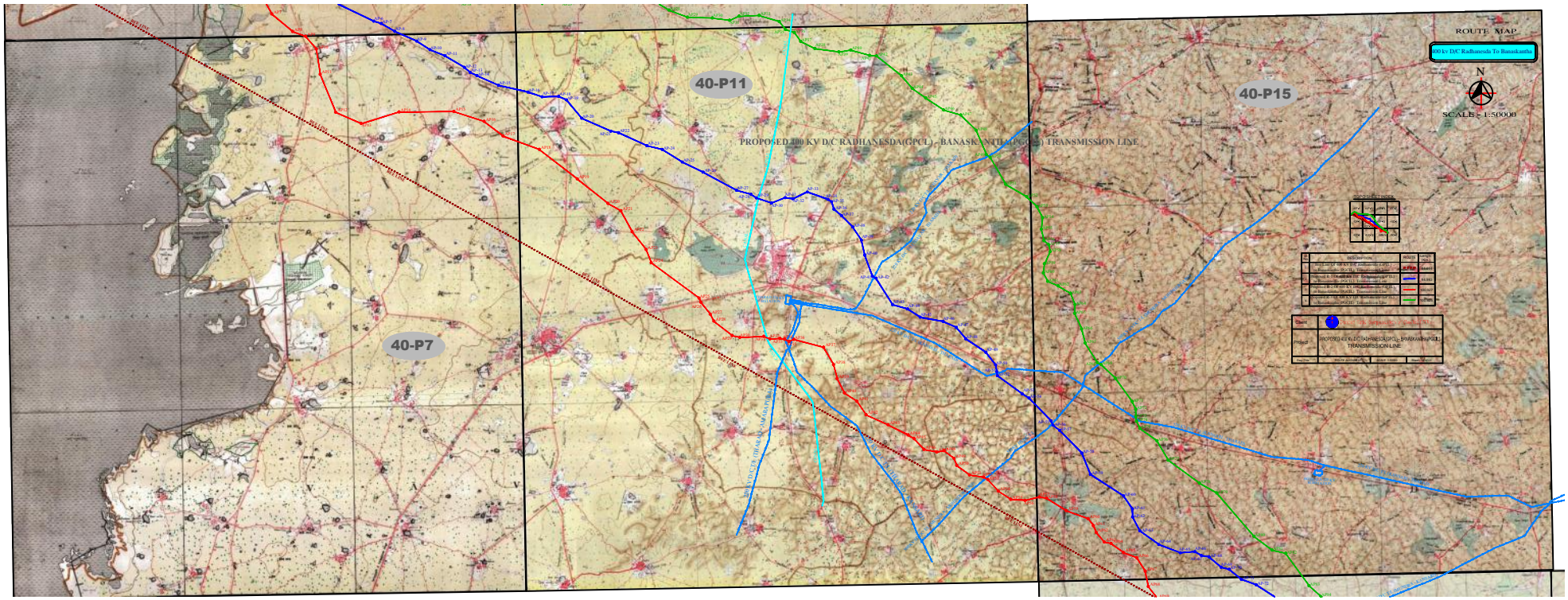


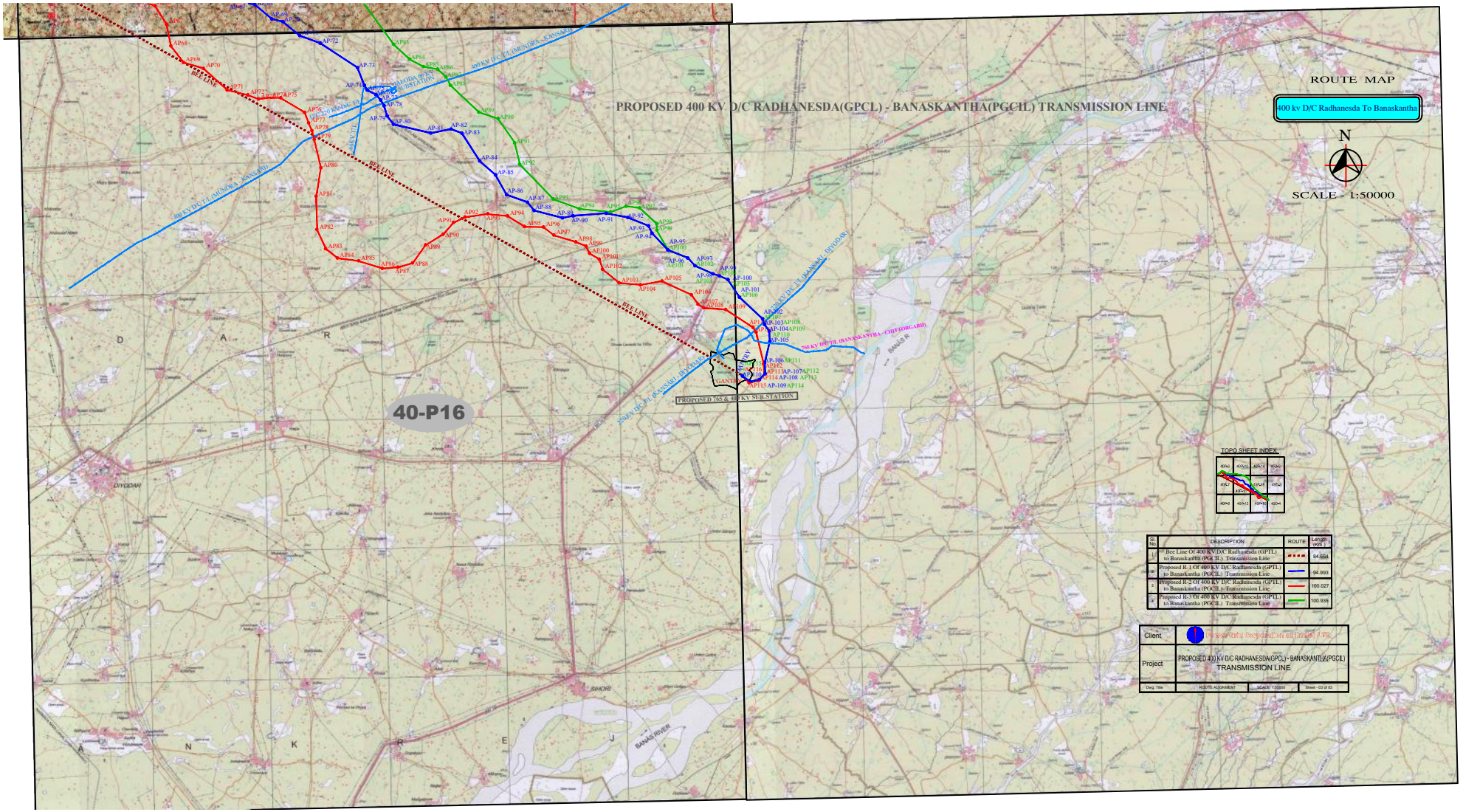
MAP – 3a-c

ALTERNATIVES ROUTE ALIGNMENT OF RADHANESDA (GETCO)- BANASKANTHA (PG) 400KV D/C LINE



Sr. No.	DESCRIPTION	ROUTE	Length (Kms.)
1	Bay Line Of 400 KV D/C Radhanesda (GPTL) to Banaskanatha (PGCIL) Transmission Line.		94.664
2	Proposed R-1 Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line.		94.992
3	Proposed R-2 Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line.		100.027
4	Proposed R-3 Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line.		100.935


ROUTE MAP
400 kv D/C Radhanesda To Banaskantha
N
SCALE - 1:50000
40-P7
40-P11
40-P15
PROPOSED 400 KV D/C RADHANESDA(GPCL) - BANASKANTHA(PGCIL) TRANSMISSION LINE



Sl. No.	DESCRIPTION	ROUTE	Length (KM.)
1	Bee Line Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line		84.594
2	Proposed R-1 Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line		94.993
3	Proposed R-2 Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line		100.027
4	Proposed R-3 Of 400 KV D/C Radhanesda (GPTL) to Banaskantha (PGCIL) Transmission Line		100.935