ENERGY MANAGEMENT AROUND THE WORLD

MANAGEMENT FOR SUSTAINABLE ENERGY PROJECT

EVALUATION OF ENVIRO-SOCIAL IMPACT OF HIGH VOLTAGE TRANSMISSION SYSTEM: A CASE STUDY

SEPTEMBER 28, 2017

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2017 WEEC World Energy Engineering Congress 40 Years

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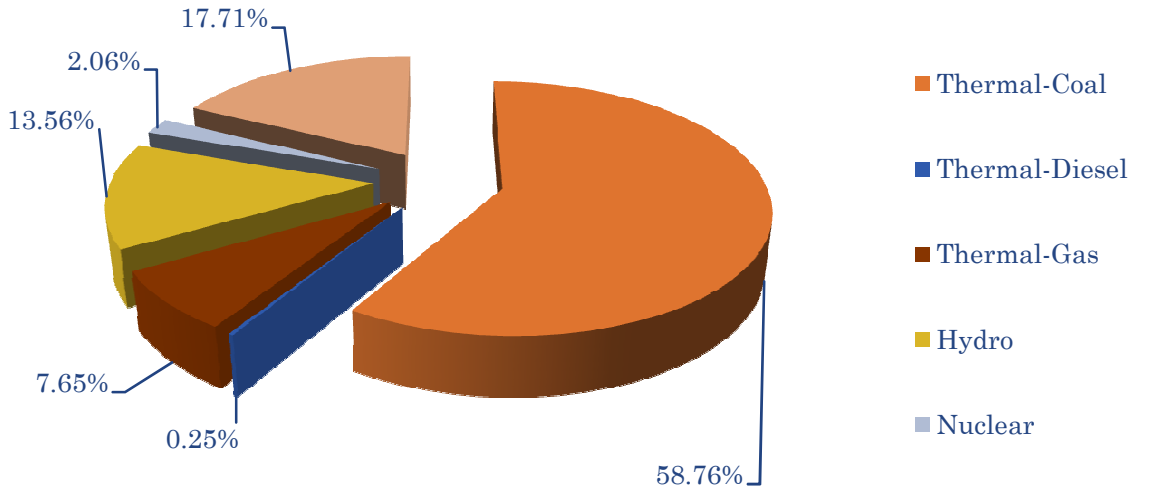
Prologue

Enviro-Social Impact Assessment (ESIA) is a process that determines the environmental and social impacts and risks of any developmental project in its area of influence.

It is the most useful tool for understanding and managing the enviro-social impacts of a project.

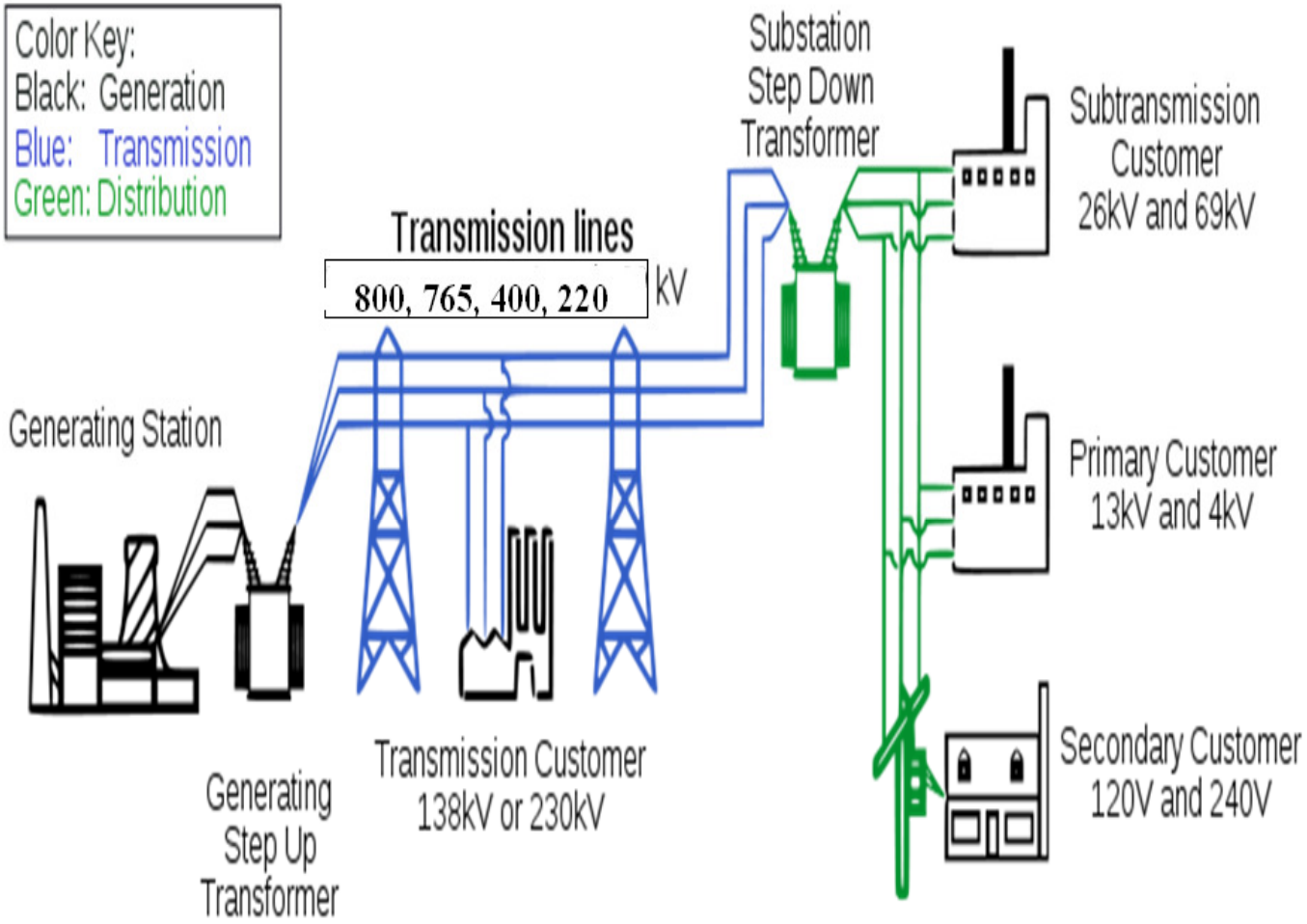
Energy Scenario of India



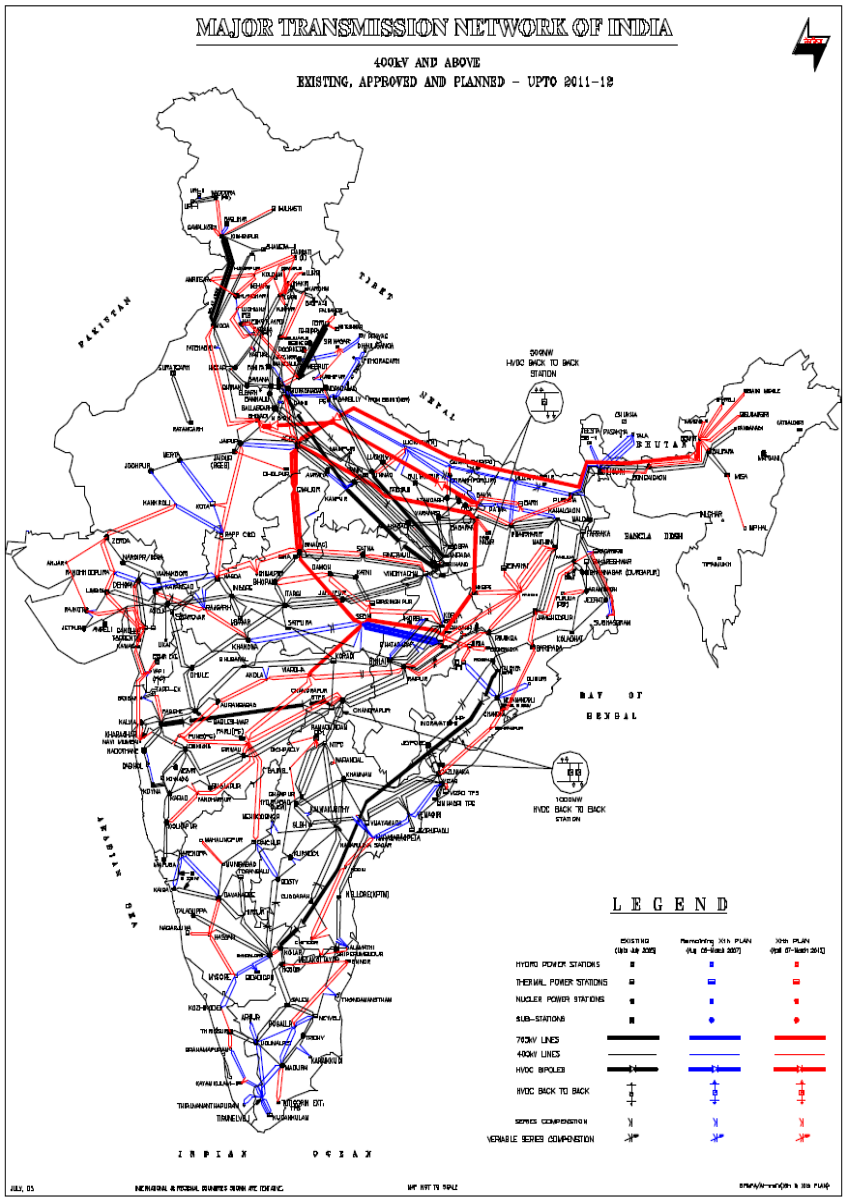
Total Installed Capacity: 329,226 MW

Source: CEA, September 2017

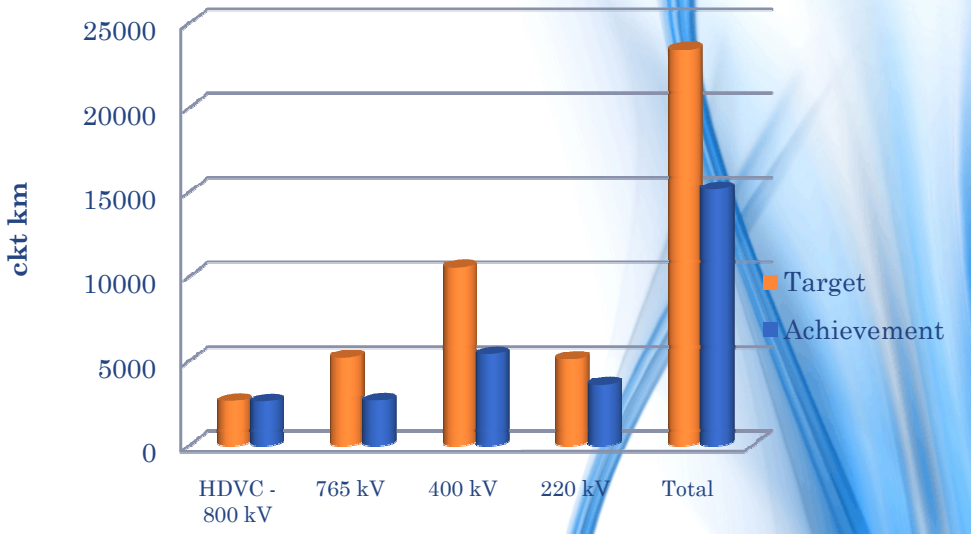
POWER TRANSMISSION SYSTEM



STATUS OF HIGH VOLTAGE TRANSMISSION NETWORK OF INDIA



High Voltage Transmission Network in India during 2016-17



Source: Ministry of Power, Government of India, September 2016

The development of High Voltage Transmission System (HVTS) usually exerts wide array of environmental and social impacts viz., displacement of local people affecting their livelihood, electro-magnetic radiation leading to serious health complications, migration of avi fauna as well as change in agricultural yield besides posing various other health and safety risks depending on existing landuse pattern of the project area.

Objectives of the Study

The present study was undertaken for proposed high voltage transmission system (765/400 kV) in an Indian sub-continent with the prime objectives of-

- To assess the existing enviro-social setting of project area;
- To evaluate the potential significant environment & social impacts and hazards;
- To facilitate formulation of mitigation measures to minimise potential environmental & social impacts;
- To formulate effective action plan for implementation and monitoring of ESMP.



Regulatory & Legal Framework for ESIA

The applicable prime national enviro-social regulations include:

- The Environmental (Protection) Act, 1986;
- The Forest (Conservation) Act, 1980;
- The Wildlife (Conservation) Act, 1972;
- The Indian Telegraph Act, 1885;
- The Indian Electricity Act, 1910;
- The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

The prime international enviro-social policies and guidelines include:

- OP 4.01 Environmental Assessment,
- OP 4.04 Natural Habitats,
- World Bank Operational Directive (OD) 4.20 Indigenous Peoples,
- World Bank OD 4.30 Involuntary Resettlement,
- World Bank Operational Policy Note (OPN) 11.03 Cultural Property,
- IFC's Performance Standards on Social & Environmental Sustainability,
- IFC's Sustainability Framework, 2012,
- Equator Principles, June 2006.

Project Description

Transmission Line	765 kV 2xS/C lines (2 x 630 km)
	400 kV quad D/C line (30 km)
Substations	6000 MVA of 765/400 kV transformation capacity

Process of ESIA

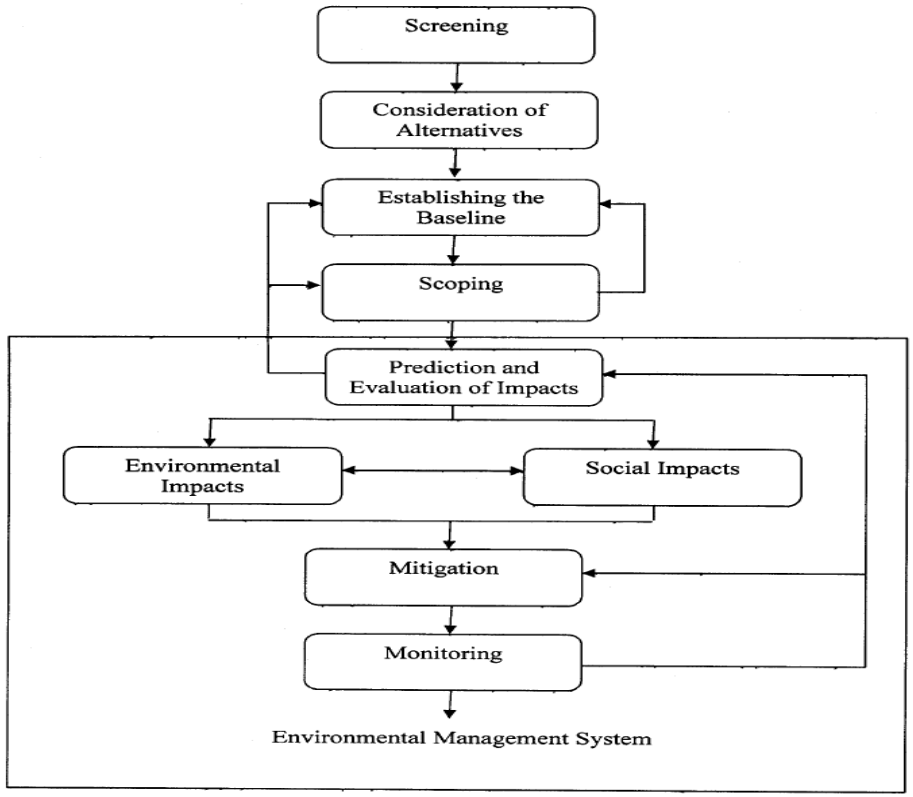
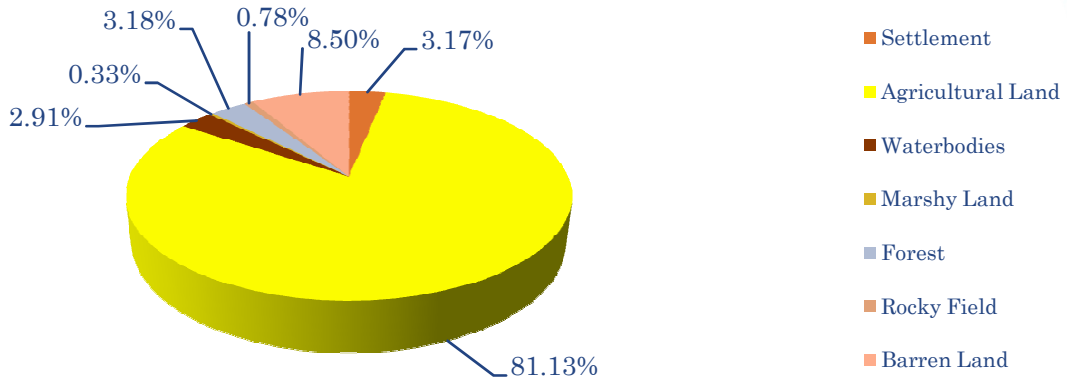


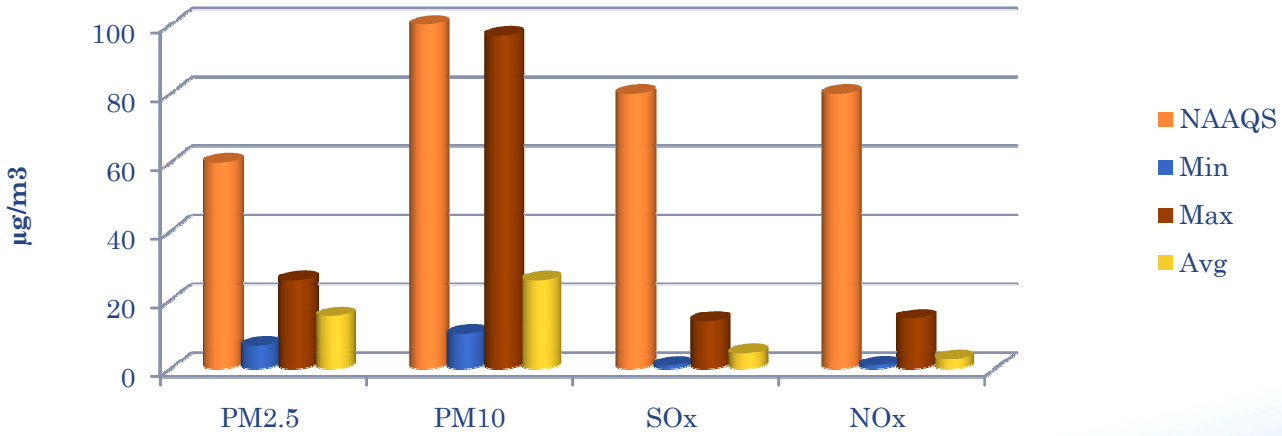
FIGURE 1: PROCESS OF ESIA

Baseline Environmental Status

Landuse Pattern within High Voltage Transmission Line CoI



Status of Ambient Air Quality within CoI



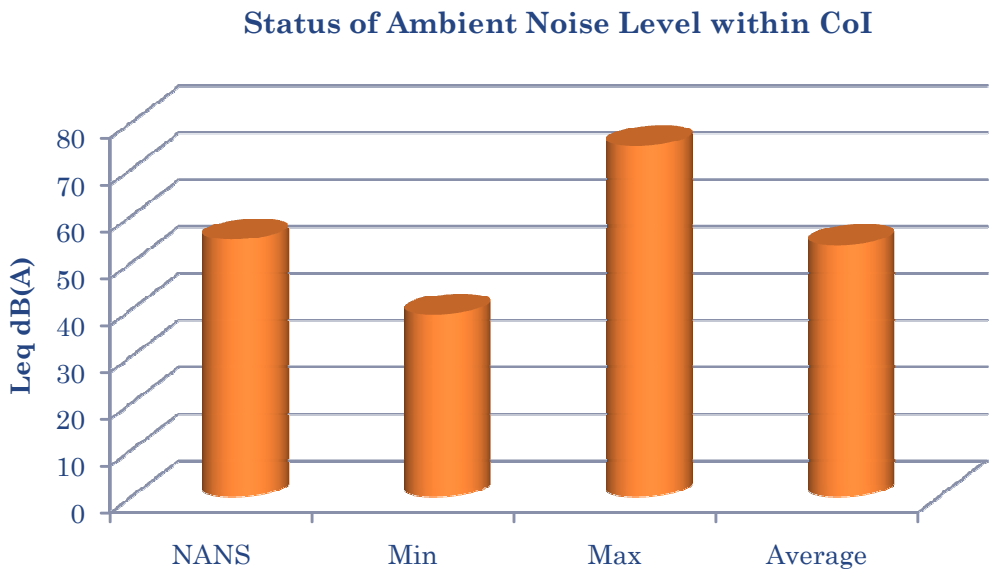


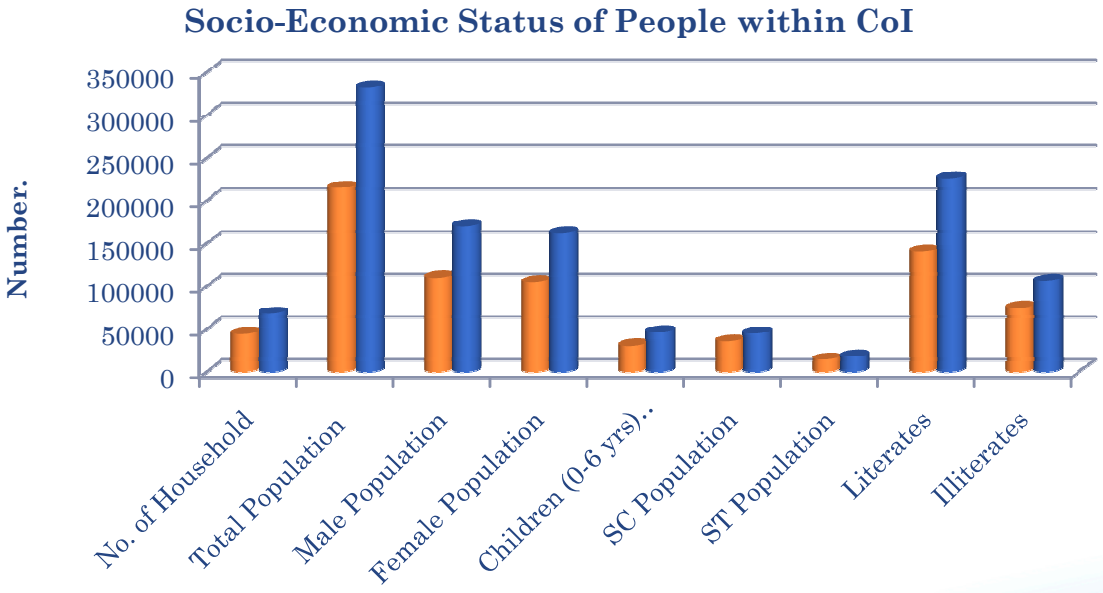
LANDUSE PATTERN WITHIN CoI



AMBIENT AIR QUALITY MONITORING WITHIN CoI

Baseline Environmental Status





Evaluation of Enviro-Social Impacts

- The environmental and social impacts have been identified through field surveys, onsite monitoring and consultation with the local communities as well as other stakeholders including project authorities.

- The criterions that have been used to evaluate the impacts on various environmental and social aspects includes their context, duration, type and intensity.

Construction Phase Impacts

Parameter	Potential Impact
Soil Quality	Soil structure and soil quality may change as a result of excavation or compaction.
Waste Disposal	Construction debris may contaminate wells, canals etc. in proximity of the activity.
Aesthetics and Visual Impact	The visual impacts and change of landscape due to construction activity will be for a short period of 15-30 days.

Parameter	Potential Impact
Surface Water &Hydrogeology	Only 6.4 m^3 of water required for casting of foundations for each tower, which will be sourced from nearby water bodies through tankers therefore its impact would be insignificant.
Ecology - Flora & Fauna	The possible impacts due to construction of the transmission line are disturbance to fauna or flora species in the project area due to movement of vehicles, dust, noise as well as clearance of trees for laying of the transmission line.
Traffic and Transport	The traffic movement during the construction phase is likely to be occasional and very low resulting in negligible impacts from the traffic.
Atmospheric Emissions	As the construction of transmission line involves limited groundwork, the potential for dust generation is low and short lived.
Noise Pollution	There is potential for change in noise level in proximity of the towers due to construction related activities.
Archaeological, Historic & Cultural Effects	Based on the route profile developed during the detailed survey, it is observed that transmission line will not pass near or over any site of archaeological and or historical importance.

Parameter	Potential Impact
Social Impacts:	
Partial Loss of Productivity of Land	It is likely that the ploughing activity in the land under and around the pylon tower base would be restricted, thereby affecting the overall agricultural productivity of that portion of the land.
Temporary Losses during Construction of the Towers	Standing crops may get damaged and farmer may not able to cultivate the land since construction activities may continue for a short to medium term duration depending the pace of work, clearances etc.
Impact on public properties and common resources	The RoW of the transmission line has been selected avoiding impact on common properties such as schools, religious places, cemeteries, water bodies, access roads etc.
Expectations/ Opportunities	Expectations of community remain high with regard to creation of job opportunities during the construction phase of the project.
Impact on Community and their Cultural Aspects	Consultations with the community revealed concerns and problems regarding the behavioral, lifestyle and nature of work force and the effects of their interactions with the host community
Impact on Public Amenities and Utilities	The proposed alignment of 765 kV transmission line is not intersecting any village settlement and also not passing through any urban establishment in the entire stretch.

Operation Phase Impacts

Parameter	Potential Impact
Soils Quality	Spillage of Aluminum oxide paint during operation and maintenance of the transmission line towers may impact soil quality.
Waste Disposal	No significant waste is anticipated to be generated during operation of the transmission line.
Aesthetics and Visual Impact	There will be no additional visual impact due to operation of transmission line as this will only involve transmission of electricity through the established network.
Surface Water & Hydrogeology	No impact on the surface water and hydrogeology of the area are anticipated from the operation of the transmission line.
Ecology - Flora and Fauna	The impact to flora from the operation of the transmission line will be the routine clearance of vegetation undertaken for maintaining adequate clearances along the route length. The bird collision incidences are normally species specific and vary on spatio-temporal scales. However, the possibilities of such collision are low as the avifauna in the area would be habituated to presence of transmission line as most part of the proposed route run parallel to existing transmission lines.

Parameter	Potential Impact
Soils Quality	Spillage of Aluminum oxide paint during operation and maintenance of the transmission line towers may impact soil quality.
Waste Disposal	No significant waste is anticipated to be generated during operation of the transmission line.
Aesthetics and Visual Impact	There will be no additional visual impact due to operation of transmission line as this will only involve transmission of electricity through the established network.
Traffic and Transport	Considering occasional and short lived movement of the traffic for monitoring and maintenance work, impacts related to the traffic during construction will be negligible.
Atmospheric Emissions	The operation of the transmission line will not contribute to any atmospheric emissions directly and hence the predicted impacts are negligible.
Noise Pollution	Noise pollution from energised overhead lines produced by 'Corona Discharge' may be significant.
Archaeological, Historic and Cultural Effects	No impacts are predicted from the operation of the transmission system on any site of archaeological, cultural or historic importance.
Potential Hazards	There is a possibility of lines or towers falling to the ground during the operational phase which may lead in electrocution.

Parameter	Potential Impact
Electromagnetic Fields	People living in the vicinity of transmission line are potentially prone to exposure to EMF. In India it is stipulated that electric field intensity should not exceed 4.16 kV/m and magnetic field intensity should not exceed 100μT in public areas.

HEALTH EFFECT DUE TO EXPOSURE OF ELECTRIC AND MAGNETIC FIELDS

Surface Current Density(mA/m^2)	Health Effect
<1	Absence of any established effects.
1 To 10	Minor biological effects.
10 To 100	Well established effects(a) Visual effect.(b) Possible nervous system effect
100 To 1000	Changes in central nervous System
>1000	Ventricular Fibrillation (Heart Condition Health hazards)

Environment & Social Management Plan

ESMP provides a delivery mechanism to address potential adverse impacts, to instruct contractors and to introduce good practice to be adopted for project activities during construction and operation phases of the project.

Construction Phase Mitigation Measures

Parameter	Mitigation Measure
Soil Quality	The construction activities shall be planned in non-monsoon months to minimize run-off. Loose soil should be kept covered till the time of backfill .
Waste Disposal	Construction debris generated at the site will be removed from the site immediately after the completion of construction activities and the site will be leveled as original.
Aesthetics & Visual Impact	The route would be finalized to avoid habitation and forest areas to the extent possible.

Parameter	Mitigation Measure
Surface Water & Hydrogeology	At the river crossing the horizontal clearance (the distance between the towers) will be greater than the maximum river width at high flood levels and the vertical clearances will be according to the statutory requirements.
Ecology - Flora & Fauna	Felling of trees will be avoided unless it is absolutely necessary. Routes having trees supporting significant number of birds or mammals will be avoided wherever possible.
Traffic & Transport	Vehicles used for construction activities will move along the existing roads as far as possible.
Atmospheric Emissions	To reduce the emission sprinkling of water on dust generating areas would be undertaken along with restricting the speed limits of vehicles during movement on unpaved roads and covering of vehicles carrying loose soil/construction material.
Noise Pollution	Construction activities will be undertaken sequentially so that no area is prone to long duration of noise impacts. Most of the work shall be done manually instead of cranes and other heavy equipment, which will reduce the noise pollution.
Social Impacts	Compensation for loss of productivity of land due to use of land for laying the transmission line shall be worked out based on the crop existing in the land and crop rates of that month .
Impact on Community and their Cultural Aspects	The labour force will be instructed about the conduct and manners to be maintained while working along the transmission line. All required PPEs will be used by the workers at site and their use will be supervised. Safety harness will be ensured for workers while erection of tower .

Operation Phase Mitigation Measures

Parameter	Mitigation Measure
Soils Quality	Low frequency of painting as well as involving experienced personnel with mitigations like prior spread of sheets underneath the tower structure while painting shall reduce the adverse impacts.
Ecology - Flora & Fauna	Routine clearance of vegetation will be restricted along the transmission line. Visibility enhancement objects such as marker balls, bird deterrents, or diverters will be installed to avoid avian collision.
Noise Pollution	Conductors designed and constructed to minimise corona effects will be chosen for transmission.
Archaeological, Historic &Cultural Effects	Risks to general public will be reduced by public awareness and an appropriate warning sign on all faces of the tower.
Electromagnetic Fields	To minimize exposure to the public, installation of transmission line or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices), will be avoided.

EXPOSURE LIMITS TO ELECTRIC AND MAGNETIC FIELDS

Frequency	Electric Field (V/m)	Magnetic Field (μT)
General Public:		
50 Hz	5000	100
60 Hz	4150	83
Occupational Exposure:		
50 Hz	10,000	500
60 Hz	8300	415

Source: International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Risk Assessment & Disaster Management Plan

The objective of the Transmission Line Disaster Management Plan (TL-DMP) is to ensure safety of life, protection of environment, protection of infrastructure and restoration of electricity transmission.

- Construction of transmission line involves safety issues such as a slip-trip hazard, fall hazards during towers erection, occupational hazards and road accidents due to vehicle movement in hilly terrain.
- Operation of the project involves potential risk of electrocution and physical hazards due to any contact with transmission line or snapping of lines or structure failure of towers resulting in fall of tower structure on to the ground.
- The various stakeholders will be trained about the mandatory precaution and safety practices prior to commencement of construction activities, including use of PPEs, Safety harness.
- Risks to general public during operation will be reduced by public awareness and education along with physical measures such as attaching appropriate warning signboards on all faces of each tower.

Summary & Conclusions

- Enviro-social impacts are envisaged in high voltage overhead transmission lines (HVOHL) during construction as well as operation phase.
- HVOHL impact the environment in six ways: Landscape, Biodiversity, land use, Proximity effect, Indirect emissions and Resource depletion.
- Impacts by magnetic or electric fields can be minimised through maximisation of effect distances.
- When laying high voltage transmission line, utilize best available technology to keep warming at a low level.
- The greatest chance to avoid impacts exists in an early corridor improvement.
- Thus the importance of a strategic enviro-social assessment and cost-benefit evaluation to integrate these environmental impact during primary planning phases is crucial to avoid decisions that may be biased towards less environment friendly solutions.
- The present study reveals the typical model for assessing the potential enviro-social impact and effective management plan of high voltage transmission system based on a case study undertaken in an Indian sub-continent.

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THANK YOU