Initial Environmental Examination (Draft)

September 2013

IND: Madhya Pradesh Power Transmission and Distribution System Improvement Project

Prepared by the Madhya Pradesh Power Transmission Corporation Ltd. (MP Transco), Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company (DISCOM-C), Madhya Pradesh Poorva Kshetra Vidyut Vitaran Company (DISCOM-E), and Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company (DISCOM-W) for the Asian Development Bank

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

CURRENCY EQUIVALENTS

(As of 1 August 2013)

Currency Unit – Indian Rupee (Rs)
Rs 1.00 = $0.02
$1.00 = Rs 50

ABBREVIATIONS

ADB	– Asian Development Bank
CEA	– Central Electricity Authority
CPCB	– Central Pollution Control Board, Government of India
DC or D/C	– Double Circuit
DPR	– Detailed Project Report
DISCOM	– Distribution Company
EA	– Executing Agency
EIA	– Environmental Impact Assessment
EMoP	– Environmental Monitoring Plan
EMP	– Environmental Management Plan
EHV	– Extra High Voltage
EPC	– Engineering, Procurement and Construction
GoMP	– Government of Madhya Pradesh
GoI	– Government of India
GRM	– Grievance Redress Mechanism
IA	– Implementing Agency
IEE	– Initial Environmental Examination
LILO	– Line in – Line out
MOEF	– Ministry of Environment and Forests, Government of India
MP	– Madhya Pradesh
MP Transco	– MP Power Transmission Corporation Limited
MPPCB	– MP State Pollution Control Board
MPSEB	– MP State Electricity Board
PMU	– Project Management Unit
ROW	– Right of Way
RP	– Resettlement Plan
TA	– Technical Assistance

WEIGHTS AND MEASURES

ha (hectare)	– 10,000 sq m
km (kilometer)	– 1,000 m
kV	– Kilovolt (1,000 volt)
kWh	– Kilowatt-hour
mG	- milliGauss
MVA	– Megavolt-Ampere
MW	– Mega Watt
^{o}C	- degree Celsius

EXECUTIVE SUMMARY

1.0 Introduction

1. To improve the quality and reliability of service in the power transmission and distribution system networks, the Government of Madhya Pradesh (GoMP) has taken initiatives to invest in the power sector with funding from development partners like the Asian Development Bank (ADB). The investments involve expansion, upgrading and reconfiguration of the existing power transmission and distribution networks. A transmission company and three distribution companies involved in the power transmission and distribution service in Madhya Pradesh (MP) as a result of restructuring the Madhya Pradesh State Electricity Board (MPSEB) in 2005.[1] The MPSEB was dissolved on 26 April 2012. The Madhya Pradesh Power Management Company Ltd. (MPPMCL, previously known as Madhya Pradesh Power Trading Company) is the holding company of the three distribution companies (DISCOMs).

2.0 Project Description

2. The Project has three components: (i) transmission system improvement; (ii) distribution system improvement; and (iii) capacity building for the executing agency staff. The executing agency (EA) for the project will be MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W.

3. The component on transmission system improvement will include augmentation of substation capacity and line lengths across all the voltage levels (132 kV, 220 kV, 400 kV). About 1,800 circuit-km of transmission line is proposed to be constructed under the project. A total of 32 substations, (12.5% of the current number of substations) comprising of two 400 kV, four 220 kV and 26 132 kV substations are proposed to be constructed. The total capacity addition under the project would be about 4,000 MVA which is 25% of the targeted substation capacity addition by transmission company during the period of FY 2013-2017. This would result in an increase in the transmission substation capacity from 37,000 MVA in 2013 to 41,000 MVA by 2020.

4. The distribution system improvement component will include the construction of new 33/11 kV substations, bifurcation of overloaded 33 kV feeders, additional/augmentation of power transformers, installation of distribution transformers and capacitor banks. Approximately 2,225 circuit-km of 33 kV lines and 900 circuit-km of 11 kV lines are proposed for construction. An additional 149 new 33/11 kV substations are proposed to be constructed and another 328 existing 33/11 kV substations to be upgraded.

5. The capacity building component will include supporting DISCOM-C's training center to provide training for the EA staff. The support to the training centre will involve funding for the construction of hostels, laboratory and associated facilities, provide consultants to develop curricula for various courses, train the trainers, and conduct first round of training. Training will include induction training for new staff, and training on new technology, project management,

[1] Madhya Pradesh Power Transmission Corporation Limited (MP Transco) and distribution companies: Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company (DISCOM-C), Madhya Pradesh Poorva Kshetra Vidyut Vitaran Company (DISCOM-E) and Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company (DISCOM-W)

procurement, monitoring and evaluation, financial management, and safeguards for existing staff. Ten trainers and 100 EA staff will be trained with the support of the project.

3.0 Environmental Requirements

6. The Safeguard Policy Statement 2009 (SPS 2009) of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects. Under the SPS 2009, the project is classified as B on environment requiring the preparation of an initial environmental examination (IEE). Following the requirements of SPS 2009, this draft IEE is prepared covering the components of the proposed project on power transmission and distribution system improvement.

7. The Ministry of Environment and Forests (MoEF), GoI, in its notification in September 2006, has exempted transmission projects from environmental clearances due to the non-polluting nature of its activities.[2] However, forest clearances under the Forest Conservation Act 1980 will be necessary in the event that transmission line passes through forest areas.

4.0 Anticipated Environmental Impacts and Mitigation Measures

8. The selection of the subprojects included in the power transmission and distribution system improvement was guided by 13 criteria and a 17-question checklist with an overall objective of avoiding potential significant adverse environmental impacts and land acquisition. Transmission line subprojects traverse mainly agricultural land planted to soybean rice, corn, vegetables and other cash crops. No subproject is located within the areas declared as forest by MoEF, cultural and archaeological sites considered of national importance, and the nine national parks and 25 wildlife sanctuaries in Madhya Pradesh.

9. The subprojects are not expected to cause significant adverse environmental impacts but may cause temporary impacts during construction such as increased noise and dust level that may cause inconvenience to local people, accumulation of scrap materials/debris, increased presence of workers at substation construction sites which can be readily mitigated by good construction engineering practices and proper planning. The distribution system improvement will include upgrading of 328 existing 33/11 kV substations which may involve dismantling of equipment. Scrap material that are still useful will be stored in the warehouse of the EAs in Bhopal, Indore, Itarsi and Jabalpur. An environmental management plan and environmental monitoring plan were prepared and shown in **Table E.1** and **Table E.2**, respectively. Part of the capacity building component of the Project is safeguards training for the EAs.

5.0 Information Disclosure, Consultation, and Participation

11. Initial consultations were done during the site visits held on July 23-26, 2013. Consultations with project stakeholders in varying degrees will continue throughout the life of the project. Concerns of local people were common and they include: (i) load shedding and lack of reliable and stable supply of power affecting their produce and livelihood, and (ii) timely compensation to farmers affected during construction of substations, erection of the transmission towers, and stringing of the conductors. Local people are aware of the proposed

[2] Notification in the Gazette of India, Extra-ordinary part II and section 3, subsection II, 14 September 2006).

project and are generally supportive due to expected long-term benefit of reliable and stable supply of power.

12. This draft IEE will be posted on the ADB website as required by SPS 2009 and Public Communications Policy 2011. A project factsheet or a frequently asked questions flyer in Hindi will be made available at the EAs field offices. Aside from this public disclosure requirement, the Right to Information Act 2005 of GoI also provides for additional obligation for the EAs to provide information about the project.

6.0 Implementation Arrangements

13. A Project Management Unit (PMU) will be set in each EA responsible for project management and safeguards compliance monitoring of contractor(s) during construction. The PMU will recruit an environmental staff (or a Consultant) prior to the award of the civil works contract who will be primarily responsible for ensuring that the EMP is properly implemented and will prepare the environmental monitoring reports for submission to ADB at least twice a year during construction, and annually during operation phase. PMU will inform EPC Contractor(s) of their responsibility to comply with the EMP and the requirements of ADB.

7.0 Grievance Redress Mechanism

14. A grievance redress mechanism will be established by the PMU in each EA to deal with complaint(s) from affected persons (APs) during implementation. APs can seek redress of their grievance at three levels: (i) the PMU at each EA, (ii) the grievance redress committee (GRC), and (iii) the appropriate courts of law. GRC is set up by the PMU in each EA as soon as the project commences and will function as such from construction to operation. The PMU in each EA will ensure the representation of women on the members of GRC which will consist of representatives from the local *Panchayat* Head, a District Revenue Commissioner, representative from the EPC Contractor(s) only during construction phase, designated staff of EA on safeguards, Manager/Director of EA, and a witness of the complainant/affected person.

8.0 Conclusions and Recommendations

15. The subprojects were selected following criteria and appropriate survey methods with the objectives of avoiding the potential significant adverse environmental impacts and land acquisition. Transmission line routes traverse primarily agricultural lands planted to soybean, rice, corn, vegetables and other cash crop. No subproject is located near or within environmentally-sensitive areas such as forest declared by MoEF, archeological and excavation sites of national importance, the nine national parks and 25 wildlife sanctuaries in Madhya Pradesh.

16. None of the subprojects are expected to cause significant adverse environmental impacts during construction and also during operation. However, vegetation and land clearing within the right of way and the substation sites will be required which can be easily mitigated by proper planning, consultation, and best practices in construction engineering. Mitigation measures are included in the environmental management plan and parameters for monitoring have been identified in the environmental monitoring plan.

17. Consultations with local people that may be potentially affected by the project show that their concerns are common as: (i) load shedding and lack of reliable and stable supply of power affecting their produce and livelihood, and (ii) timely compensation to farmers affected during construction of substations, erection of the transmission towers, and stringing of the conductors. Overall, local people are aware of the proposed project and are generally supportive due to expected long-term benefit of reliable and stable supply of power as well as employment opportunities resulting from the project. Consultations will continue throughout the life of the project. A grievance redress mechanism will be set up by the PMU in each EA to properly address complaints and issues that may arise from affected persons during implementation.

18. This draft IEE will be publicly disclosed at the ADB website as required by SPS 2009 and Public Communications Policy 2011. A project brief and/or factsheet will be prepared in Hindi and made available to the public at the PMU-field offices of each EA. A workshop/training on safeguards is included in the component on capacity building. The reliability and stability of power supply resulting from the project is expected to improve the quality of life and the pace of economic development in Madhya Pradesh.

Table E.1 Environmental Management Plan

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
Planning and Pre-Construction Stage					
Preparation of feasibility study and detailed project report (DPR) • Location of substation, transmission and distribution lines • Choice of equipment and technology	• Land and vegetation	• Loss of agricultural land and crops • Loss of habitat and vegetation clearing • Land acquisition • Increase in soil erosion and impact to soil productivity	• Use of 13 criteria for site selection which include environmental factors to minimize potential impacts • Use of 17-question checklist/questionnaire in evaluating substation sites which aim at avoidance of land acquisition and environmental impacts • Substations are all on government land (32 sites for MP Transco, 149 sites for the three DISCOMs) • No land acquisition required but transfers of ownership from the government to MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W • 1,800 km of transmission line; 2,225 km of 33 kV distribution line and 915 km of 11 kV distribution line will not traverse forest, sanctuary, or protected areas • Use of mineral oil such as Duralife Transformer Oil for transformers • Use of air insulated substations to avoid fugitive	Included in the Project Costs *Associated costs of land transfers from the Government will be borne by MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W	MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W, District Commissioner Office
	• People	• Physical displacement of people and structures • Economic loss to people • Disturbance and inconvenience to people due to traffic, increased noise and dust levels, vibration • Interference to existing utilities			
	• Water	• Interference to local drainage • Water quality impacts due to erosion and/or sedimentation			
	• Air	• Increase dust and noise levels, and vibration • Emissions from heavy equipment machinery and construction vehicles			

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			emissions of SF_6 (a potent GHG gas)		
Construction Stage					
Orientation for contractor and workers	• People	• Awareness of workers on the environmental requirements and their responsibility • Understanding of EPC Contractor(s) of their responsibility in implementing the EMP	• Conduct briefing of EPC Contractor(s) on EMP, records management, and reporting • Identify critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases such as HIV/AIDs	Included in the costs of EPC Contractor(s)	EPC Contractor(s), PMUs of MP Transco, DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
Prepare construction management workplan	• People	• Avoid effects of EPC Contractor(s) unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Community and safety plan	Included in the costs of EPC Contractor(s)	EPC Contractor(s), PMUs of MP Transco, DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
	• Land		• Spoils disposal plan		
	• Air		• Noise and dust control plan		
	• Water		• Drainage and storm water management plan		
	• Waste		• Materials management plan • Construction waste management plan		
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project • Dispute over transparency of hiring	• EPC Contractor(s) will be required to use local labour for manual work and eligible local workforce for clerical and office jobs	---	EPC Contractor(s), PMUs of MP Transco, DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
Presence of workers at construction sites	• People	• Increase in demand for services such as food, temporary housing, etc. • Create opportunities for small-scale business to provide services such as	• None required	---	---

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
		food, temporary housing, etc.			
• Site preparation, vegetation and land clearing for substations and transmission line right-of-way (ROW) • Construction of substations, installation of required equipment at substations, erection of transmission towers and stringing of conductors	• People	• Dismantling of structure(s) and equipment from existing 220 kV substations (nine sites) and 33/11 kV substations (328 sites)	• Construction management plan will be strictly implemented • Use of proper safety clothes/equipment in dismantling structure(s) and equipment • Debris/dismantled structures/equipment will be disposed of in designated landfill and/or controlled dumpsites • Usable scrap materials from dismantling will be stored in warehouses of MP Transco in Jabalpur, DISCOM-C in Bhopal, DISCOM-E in Jabalpur, and DISCOM-W in Indore for resale/auction	Included in the costs of EPC Contractor(s)	EPC Contractor(s), PMUs of MP Transco, DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
		• Potential safety risks to community	• Provide fence or barricade (as appropriate), sufficient lights, clear warning signs and danger signals, and take all precautions identified in the community and safety plan • Assign security personnel to prevent accidents, trespassing, and pilferage • EPC Contractor(s) to direct drivers to strictly follow road regulations		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
		• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points • Construction vehicles to strictly follow road regulations • Implement temporary pedestrian and traffic management plan		
		• Potential health and safety risks to workers	• Provide sanitary facilities and wash areas • Provide safe drinking water and garbage bins • Enforce good housekeeping at all times • Provide workers with hard hat, safety shoes and belts • Coordinate with nearest hospital for arrangements in case of accidents • Assign nurse or medical staff to make weekly rounds at substation sites • Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
	• Land and vegetation	• Erosion and localized flooding (e.g., 33/11 kV Nayagaon substation) • Loss of habitat and some mature trees of economic value such as teak (e.g., 132 kV Silwani substation)	• Compensation for temporary damages to crops/plants along the ROW and substations • Cut trees owned by the government will be sold and revenue turned over to Revenue Authority • Only minimal vegetation will be cleared since most of the substation sites are grassland/shrubland (e.g., Salamatpur, Belkheda, Teesgaon, Shayamgarh, Chhayan, Udaipura, Anandnagar, Intkhedi, Hoshangabad, Adampur, Kirnapur, Singhana, Nayagaon, Kisanganj, etc.) • Landscaping/replanting of trees at subs-stations will be done after completion of construction works • Erosion-control measures will be provided (as needed) • Implement spoils disposal plan and construction waste management plan		
	• Water	• Generation of sewage from construction workers • Localized flooding • Increase turbidity in surface water near construction sites	• Avoidance of waterways in site selection • Provide sanitary facilities to workers and safe drinking water • Construction works will done during summer in areas potential for erosion and		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			localized flooding • Implement drainage and stormwater management plan • Waterways were avoided in selecting subproject sites		
	• Air	• Heavy equipment and construction vehicles may increase vehicular emissions • Transport of construction materials to constructions sites may increase dust level • Earthmoving works, excavations, and opened land areas for substations and towers may increase dust levels • Increase in noise level and vibration from excavation and heavy equipment and construction vehicles	• Construction vehicles will be maintained to minimize vehicular emissions • Enclose construction sites temporarily to contain dust dispersion • Warehouse for construction materials onsite will be provided to reduce trips of material delivery • EPC Contractor(s) will be required to maintain construction vehicles and heavy equipment machineries regularly to reduce emissions • Opened land areas or sources of dust will be sprayed with water (as needed) • Transport of dust-generating materials will be covered • Observance of low speed by vehicles to reduce noise • Noise-generating works will be done between 7AM and 7PM done at daytime as required by MPPCB (February 2013) • Construction sites will be		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			covered with acoustic screens and machineries will be temporarily enclosed to control noise (MPPCB guidelines, February 2013) • Require EPC Contractor(s) to maintain and tune-up construction vehicles to reduce noise and no blowing of horns • Observe/comply with traffic management plan		
Operation and Maintenance Stage					
Use of mineral oil for transformers	• Land • Water	• Accidental spillage that would contaminate land and water	• Provision of oil-water separator • Provide for oil containment structure	Included in the O & M costs of Project	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	• People	• Occupational health risks to workers due to exposure	• Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free • Fire extinguishers readily available in storage areas for mineral oil		
Presence of substations, power transmission and distribution lines	• Land	• Depreciation of land property values adjacent to substations and power transmission towers	• Availability of stable and reliable power will trigger economic development in the area	---	---
	• People	• Hazards such as electrocution, lightning strike, etc. due to accidental failure of power transmission and distribution lines	• Provide security and inspection personnel to avoid pilferage and vandalism of equipment and lines • Appropriate grounding and	Included in the O & M costs of Project	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			deactivation of live power lines during maintenance work • Designed with protection system that shuts off during power overload or similar emergencies • Maintain and comply with electrical standards • Distribution lines entering and leaving the substations are insulated (or covered) to minimize impacts • Regular monitoring and maintenance to ensure safety and integrity of power lines and substations • Conduct information and education campaign to local people to enhance awareness on safety practices of living near substations		
		• Accident working in elevated position	• Implement safety plan to reduce risks • Provision of safety belts and other working gears for protection	Included in the O & M costs of Project	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
		• Potential exposure to electric and magnetic fields (EMF)	• EMF levels expected to be way below the limits set by International Commission on Non-Ionizing Radiation Protection(ICNRP) which is 4.17 kV/m for electric field and 833 mG for magnetic field	Included in the O & M costs of Project	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Spot measurements of EMF • Substations will be fenced and security staff assigned to prevent unauthorized public access • Information and education campaign will be conducted to local people to create awareness on safety practices		
		• Generation of employment	• More than 200 positions will be created during the operation	---	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	• Noise	• Disturbance to settlements near the substations	• Periodic maintenance of equipment such as transformers and capacitors to minimize noise generation • Provide enclosure of noise-generating equipment • Monitor ambient noise levels	Included in the O & M costs of Project	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W

Table E.2 Environmental Monitoring Plan

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction and Planning	Guaranteed noise level of equipment and machineries	Substation sites	Machinery and equipment specifications – compliance to ambient noise levels	Once	PMUs of MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W
	Soil quality	Substation sites and transmission towers	Sampling and chemical analysis	Once	PMUs of MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W
	Quality of transformer oil	Substations sites	Material Safety Data Sheet – compliance to IS:1866	Once	PMUs of MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W
	Loss of terrestrial and aquatic habitat	Substation sites	Ocular inspection, transect survey	Once	PMUs of MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W
	Proximity to water resources	Substation sites and towers	Ocular inspection, maps	Once	PMUs of MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W
	Routes of migratory birds	Substation and towers	Ocular survey/observation, secondary data	Quarterly to capture seasonal variations	PMUs of MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W
Construction	Local recruitment of workers and staff	Substations, transmission towers, stringing of conductors	Number of local workers and staff recruited	Monthly	PMUs of MP Transco, DISCOM-C, DISCOM-E, DISCOM-W; EPC Contractor(s)
	Orientation of Contractor(s) and workers on issues like HIV/AIDS, compliance to EMP, etc.	Substations, transmission towers, stringing of conductors	Number of participants	Once before construction, and as needed	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)
	Spraying of water to opened land areas before movement of construction vehicles	Substations and road easements affected by delivery of equipment and construction material;	Ocular inspection/spot checks	• Weekly at road easements (or as needed) • Every day	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
		transmission tower sites (if needed); stringing of conductors		at substation sites during dry season	
	Solid waste management	Substations, workers' camps, stringing of conductors, transmission towers	Ocular inspection/spot checks	Every week	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)
	Danger and warning signs for safety of workers and the public	Substations and road easements affected by delivery of equipment and construction material; transmission towers; stringing of conductors	Ocular inspection/spot checks	Once a month	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)
	Announcement to the public of works schedule	Substations; along the road easement affected by interconnections of distribution lines, transmission towers, and stringing of conductors	Work schedule log sheet	As needed	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)
	Erosion control measures such as silt traps	Substations, transmission towers	Ocular inspection	Once a month	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)
	Smoke belching construction vehicles	Substations, transmission towers, and stringing of conductors	Ocular inspection/spot checking	Weekly	EPC Contractor(s), Environmental Staff of MP Transco-PMU
	Dust and noise level	Substations; along the road easement affected by interconnections of distribution lines, transmission towers, and	Ocular inspection/spot checks	Twice a month	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
		stringing of conductors			
	Housekeeping	Substations, transmission towers, workers' camps	Ocular inspection/spot checks	Weekly	PMUs of MP Transco, DISCOM-C, DISVOM-E, DISCOM-W; EPC Contractor(s)
Operation	Failure of transmission towers and/or distribution lines	Along the alignment	Maintenance log sheet	Monthly	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	Occupational health, and safety	Substations, transmission lines	Number of accidents and/or injuries	Semi-annually	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	Tree planting, maintenance of green landscape	Substations	Ocular inspection	Quarterly	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	Housekeeping	Substations	Spot checks	Monthly	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	Collection of waste (i.e., oil, garbage, etc.)	Substations	O & M log sheet	Monthly	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	Bird collision/electrocution	Along the power transmission and disribution alignment	Spot checks/oservation	Monthly	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W
	Pilferage of cables	Along transmission and distribution lines	Ocular inspection; O&M log sheet (security operations)	Quarterly	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W

1.0 INTRODUCTION

1. To improve the quality and reliability of service in the power transmission and distribution system networks, the Government of Madhya Pradesh (GoMP) has taken initiatives to invest in the power sector with funding from development partners like the Asian Development Bank (ADB). The investments involve expansion, upgrading and reconfiguration of the existing power transmission and distribution networks. A transmission company and three distribution companies involved in the power transmission and distribution service in Madhya Pradesh (MP) as a result of restructuring the Madhya Pradesh State Electricity Board (MPSEB) in 2005.[3] The MPSEB was dissolved on 26 April 2012. The Madhya Pradesh Power Management Company Ltd. (MPPMCL, previously known as Madhya Pradesh Power Trading Company) is the holding company of the three distribution companies (DISCOMs).

1.1 Overview of the Project

2. The peak availability in the MP power sector was 9,692 megawatt (MW) while the estimated unrestricted peak demand was 10,308 MW resulting in an unmet demand of 616 MW in fiscal year (FY) 2012. Expansion of the distribution system with new power connections to households, increased consumption from existing customers, and the rapid economic growth of the state[4] are expected to rapidly increase the demand for electricity. Demand for electricity grew at about 13.42% per annum during FY 2010-2012 and is predicted to grow over 11% per annum between FY2013-2017. By 2017 transmission and distribution system should deliver about 7000 MW of additional power to the customers. An estimated 20% demand supply gap may result by FY 2017 if the transmission and distribution (T&D) capacity is not enhanced. Therefore, the proposed investments in T&D aim removing the existing bottlenecks and expansion of the T&D capacity to meet the growing demand.

3. Over the last 10 years, the transmission system has witnessed appreciable improvement with the Government and ADB's support and now its capacity is adequate to meet the current requirements. The transmission company has already been able to bring down the transmission losses from 7.93% in FY 2003 to 3.30% in FY 2013 while the system availability is 99.44% as against the target of 98%. Further reduction in transmission system losses to around 3% and maintaining the current standards of reliability would mean investment for the transmission system strengthening in the state. The transmission company has prepared a detailed investment plan based on the technical studies and which has been approved by the state electricity regulatory commission. According to the approved transmission plan, around $1,474 million is required for the 5 year period from FY 2013 to FY 2017. This includes construction of 10,667 circuit-km of transmission lines and additional capacity of 19,698 MVA for the extra-high voltage (EHV) substations. Of the total, MP Transco already invested $574 million and Japan International Cooperation Agency (JICA) provided a loan of $200 million. The proposed project undertakes about $350 million worth investments identified in the five year transmission development plan.

[3] Madhya Pradesh Power Transmission Corporation Limited (MP Transco) and distribution companies: Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company (DISCOM-C), Madhya Pradesh Poorva Kshetra Vidyut Vitaran Company (DISCOM-E) and Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company (DISCOM-W)

[4] MP economy is growing at a faster rate compared to Indian economy since 2009. MP economy is predicted to grow at 10% in 2013 which is the highest amongst Indian states.

4. The distribution system is still in growth phase and currently needs strengthening to meet the growing demand in the various regions. The state has set ambitious target of 24 hour power supply to households. In order to achieve this objective three major programs are in implementation: i) Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), program aimed at providing 1.8 million new household connections; (ii) The Restructured Accelerated Power Development Reforms Program (R-APDRP), to improve electricity distribution infrastructure in urban areas; and (iii) Feeder Separation Program to limit agricultural supply to 8 hours and to provide rural households with 24 hour power supply. On the supply side, the capacity additions are likely for both the state owned utilities and the Independent Power Producers (IPPs) which are proposed to come up in the state as a consequence of its successful IPP policy. The state will also have its share in the central sector generating stations. The capacity addition target is around 9,700 MW by FY 2018 to meet the growth in the future demand. Madhya Pradesh (MP) is predicted to have generation surplus from FY 2014 onwards.

5. The distribution companies have not been able to make profits mainly due to high technical and commercial losses. The cumulative state aggregate technical and commercial (AT&C) losses for the distribution system has come down from 39.52% in FY 2009 to currently 27.1% in FY 2013. By FY 2016, the targeted AT&C loss for the state would be around 17.3%. In order to achieve the FY 16 target of AT&C loss reduction as well as to cater to the growing demand, the three distribution companies in MP have identified investments in various projects worth $2,600 million during the period FY 2013 to FY 2017. The ongoing RGGVY, R-APDRP and Feeder Separation programs partially meet this requirement. The proposed project supports some selected distribution improvements included in Distribution Companys' (DISCOMs) five year plans.

1.1.1 Impact and Outcome

6. The impact of the project would be adequate and reliable power supply for sustainable growth of power sector of MP. The project outcome would be increased capacity and improved operational efficiency in electricity transmission and distribution system in MP.

1.1.2 Outputs

7. Project has three components: transmission system improvement; distribution system improvement; and capacity building for the distribution companies. The outputs for the transmission system improvement component include augmentation of substation capacity and line lengths across all the voltage levels (132 kV, 220 kV, 400 kV). For the 220 kV and 400 kV voltage levels, the focus is to upgrade the transformer capacity at the existing substations. For the 132 kV transmission network, the target is to create more substations to feed the distribution network while improving the overall quality and reliability of supply. About 1,800 circuit km of transmission line is proposed to be constructed under the project. A total of 32 substations, substationcomprising 2 400 kV, 4 220 kV and 26 132 kV substations are proposed to be constructed. The total capacity addition under the project would be about 4,000 MVA which is 25% of the targeted substation capacity addition by MP Transco during the period of FY 2013-2017. This would result in an increase in the transmission substation capacity from 37,000 MVA in 2013 to 41,000 MVA by 2020.

8. The outputs for the distribution system improvement component include the construction of new 33/11 kV substations, bifurcation of overloaded 33 kV feeders, addition/augmentation of power transformers, installation of distribution transformers and capacitor banks. Approximately 2,225 circuit-kilometers of 33 kV lines and 900 circuit kilometers of 11 kV lines are proposed to be constructed. A total of 149 new 33/11 kV substations are proposed to be constructed and another 328 33/11 kV substation to be upgraded.

9. The outputs for the capacity building component include supporting DISCOM-C's training center to provide training for the executing agency (EA) staff in MP. The project will support the construction of hostels, laboratory and associated facilities, provide consultants to develop curricula for various courses, train the trainers, and conduct a first round of training. Training will include induction training for new staff, and training on new technology, project management, procurement, monitoring and evaluation, financial management, and safeguards for existing staff. Ten trainers and 100 EA staff will be trained with the support of the project. **Appendix 1** presents the details of the subprojects.

1.1.3 Tentative Financing Plan and Implementation Arrangement

10. The tentative financing plan of the project is given in **Table 1.1**.

Table 1.1 Tentative Financing Plan

Source	**Amount** ($ million)	**Share of Total** (%)
Asian Development Bank Ordinary capital resources (loan)	350.00	70.0
Government	150.00	30.0
Total	**500.00**	**100.0**

Source: ADB estimates

11. MP Transco and the three DISCOMs will be the executing agencies (EA) and at the same time, implementing agencies. A project management unit (PMU) will be set up in each of the executing agency / implementing agency. The MP Department of Energy will provide the supervision and coordination of project activities implemented by the four companies. **Figure 1.1** shows the indicative implementation arrangement.

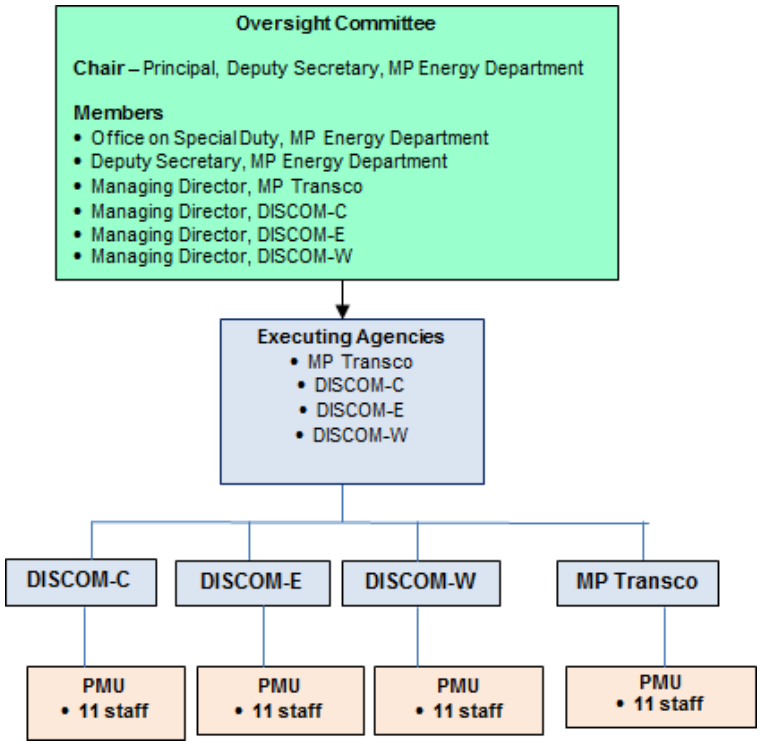

Figure 1.1 Indicative Project Implementation Arrangements

1.2 The Need for an Initial Environmental Examination

1.2.1 National Requirements

12. The Government of India (GoI) considers power transmission projects as environment-friendly compared to other power development projects since they do not generate and dispose of hazardous waste to land air and water, thus, they are not included within the realm of the Environment Protection Act 1986. In September 2006, the Ministry of Environment and Forests (MoEF) has issued a notification exempting power transmission projects from environmental clearances due to its non-polluting nature.[5] Therefore, no environmental clearances for the proposed project will be required from the MoEF or from the Madhya Pradesh State Pollution Control Board (MPPCB).

13. However, under the Forest Conservation Act 1980, if power transmission projects will traverse or affect land classified as forest by GoI, forest clearance has to be obtained from the relevant authorities to prevent deforestation and degradation. The MP state government cannot de-classify any forest land or authorize its use to any non-forest purpose without the approval of the Central government. Given this stringent requirement, avoidance of land designated as forest by GoI has been included as one of the main criteria for site selection in power transmission and distribution projects.

[5] Notification in the Gazette of India, Extra-ordinary part II and section 3, subsection II, 14 September 2006

1.2.2 Requirements of Asian Development Bank

14. The Safeguard Policy Statement 2009 (SPS 2009) of ADB sets out the requirements for environmental safeguard that applies to all ADB-financed projects.[6] Under SPS 2009, projects that require financing from ADB are screened and categorized based on their potential environmental impacts. This project is classified by ADB as Category B on environment requiring the preparation of an initial environmental examination (IEE). Following the requirements of SPS 2009, this draft IEE is prepared covering the components of the proposed project on power transmission and distribution system improvement.

1.2.3 Objectives of the IEE

15. The objectives in undertaking an IEE are:

(i) to assess the environmental impacts – positive and negative associated with the proposed project;
(ii) to identify the corresponding mitigation and/or enhancement measures for the environmental impacts; and,
(iii) to ensure that all statutory requirements for the project such as applicable rules and regulations, clearances required (if any), etc. have been considered to ensure compliance.

1.2.4 Scope and Methodology

16. The scope of the IEE covers the general environmental profile of MP, an assessment of the potential environmental impacts on physical, ecological, economic, and social and cultural resources within the project's influence area during design and/or pre-construction, construction, and operation stages. An environmental management plan and an environmental monitoring plan are integral part of the IEE. The IEE followed a number of steps:

(i) Conduct field visits to collect primary or secondary data relevant to the project area to establish the baseline environmental condition;
(ii) Assess the potential impacts on environmental attributes due to the location, design, construction and operation of the Project through field investigations and data analysis;
(iii) Explore opportunities for environmental enhancement and identify measures;
(iv) Prepare an environment management plan (EMP) outlining the measures for mitigating the impacts identified including the institutional arrangements;
(v) Identify critical environmental parameters required to be monitored subsequent to the implementation of the Project and prepare an environmental monitoring plan;
(vi) Compare the environmental safeguard requirements of GoI, GoMP and ADB, and identify measures to bridge the gap, if any;

[6] Asian Development Bank Safeguard Policy Statement (SPS 2009), http://www.adb.org/documents/safeguard-policy-statement. (Accessed 25 July 2013)

(vii) Carry out consultation with affected stakeholders, local administrative bodies to identify perception of the Project, introduce project components and anticipated impacts; and,
(viii) Disclose the draft IEE at ADB website and prepare project brief and/or FAQs in local language to be made publicly available at the offices of MP Transco, DISCOM-C, DISCOM-E and DISCOM-W.

17. Field visits were done between July 22 to July 26, 2013 to conduct ocular inspection and to assess the existing condition of the physical and biological environment of selected subproject sites, consult with local people that may be potentially affected by the subprojects, coordinate with MP Transco, DISCOM-C, DISCOM-E, and DISCOM-W; and local authorities, and to conduct secondary data collection.

1.3 Structure of the Report

18. In line with SPS 2009, the IEE report has the following contents:

- *Executive Summary* This section briefly describes the critical facts, significant findings, and recommended actions.

- *Introduction (Section 1.0)* Describes the overview of the project, environmental requirements, objectives and scope of the study, approach and methodology.

- *Policy, Legal, and Administrative Framework (Section 2.0)* Discusses the national and local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the GoI is a party or signatory, and other requirements relevant to the proposed project such as no objection certificate, consent/permission from concerned departments and/or organizations, as applicable.

- *Description of the Existing Environment (Section 3.0)* Describes the relevant physical, biological, and socioeconomic conditions within Madhya Pradesh as the subprojects covered in the proposed project are spread all over the state

- *Project Description* Provides an overview of the proposed project; its objectives and major components including maps showing the project‘s location

- *Analysis of Alternatives* Examines the alternatives to proposed project sites to ensure avoidance of significant adverse environmental impacts

- *Anticipated Environmental Impacts and Mitigation Measures* Provides an assessment of the associated environmental impacts and corresponding mitigation measures. The environmental impacts and mitigation measures including the environmental monitoring are summarized in the environmental management plan and environmental monitoring plan.

- *Information Disclosure, Consultation, and Participation* Describes the process of engaging stakeholders and information disclosure. This section summarizes the comments and concerns of affected persons.

- *Grievance Redress Mechanism* This section describes the grievance redress framework and setting out the time frame and mechanisms for resolving potential complaints and/or issues from affected persons.

- *Environmental Management Plan* Describes the set of mitigation and management measures to be taken for each identified environmental impact during project design, construction and operation. This section also includes monitoring and reporting procedure as well as institutional implementation arrangements.

- *Conclusion and Recommendation*

19. **Section 4.0 and Section 5.0** present the environmental assessment of the power transmission and distribution system improvement, respectively. Section 4.0 covers MP Transco while Section 5.0 covers the three DISCOMs.

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 ADB Safeguard Policy Statement 2009

20. ADB requires the consideration of environmental issues in all aspects of its operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement 2009 (SPS 2009).[7] This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.

21. *Screening and Categorization*. The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impact are assigned to one of the following four categories:

(i) **Category A**. Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
(ii) **Category B**. Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
(iii) **Category C**. Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
(iv) **Category FI**. Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all Projects will result in insignificant impacts.

22. *Environmental Management Plan*. An EMP that addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project‘s impact and risks.

23. *Public Disclosure*. The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into Hindi for the project-affected people and other stakeholders. ADB will post the following safeguard documents on its website so affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation.

[7] ADB, Safeguard Policy Statement, June 2009, para.50, p.19.

2.2 Applicable National and State Legislation

24. The implementation of the project and subprojects will be governed by the GoI and GoMP[8] environmental acts, rules, regulations, and standards. These regulations impose restrictions on activities to minimize and/or mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the policy, legal and administrative framework across all hierarchy - national, state municipal and local.

25. Some of the applicable national and state acts/rules applicable to this project are as follows and details given in **Appendix 2**. Compliance with legislations (acts/rules) is mandatory at all stages of project implementation.

(i) The Hazardous Wastes (Management and Handling) Amendment Rules, 2003
(ii) Batteries (Management and Handling) Rules, 2001
(iii) Ozone Depleting Substances (Regulation and Control) Rules, 2000
(iv) The Environment (Protection) Act, 1986, amended 1991 and including Rules/Notification issued under this Act.
(v) The Biodiversity Act, 2002

2.3 National and State Environmental Assessment Requirements

27. As per GoI's Environment Impact Assessment (EIA) Notification 2006, power transmission (and distribution) projects **are not listed as environmental sensitive projects and hence no environmental clearance** is required from MP State Pollution Control Board (MPSPCB)[9] or the Ministry of Environment and Forests (MoEF)[10]. Clearance from MP Forest Department is required only in cases where subproject is constructed on forestland or requires cutting of forest trees. **Figure 2.1** shows the process of obtaining an environmental clearance in India.

[8] Madhya Pradesh Pollution Control Board. http://www.mppcb.nic.in/environment_legislation.htm. (Accessed 10 August 2013)
[9] Ibid 8.
[10] Notification in the Gazette of India, Extra-ordinary part II and section 3, subsection II, 14 September 2006)

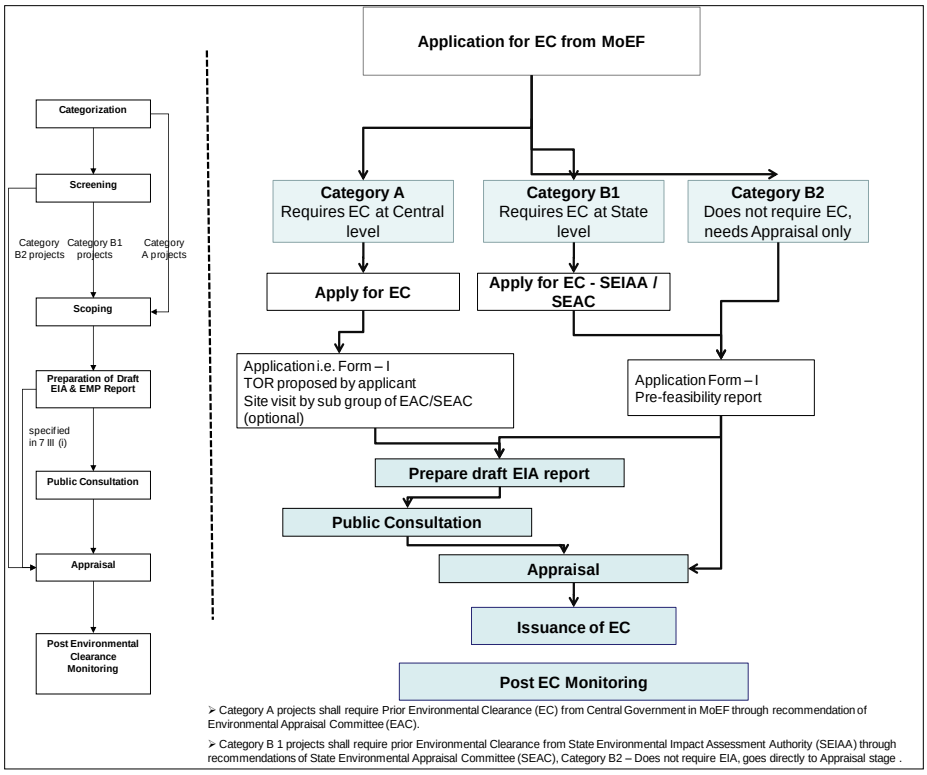

Figure 2.1 Environmental Clearance Process in India

28. The MoEF, GoI, vide its Notification Nos. S.O. 1533 dated September 14, 2006, reengineered the EIA process in India, also decentralized some powers, and made provision to constitute the State Level Environment Impact Assessment Authority (SEIAA) and the State Level Expert Appraisal Committee (SEAC) for performing functions under the said Notification.

29. In MP, the central Government constituted the State Level Environment Impact Assessment Authority (SEIAA) in the pursuance of the GoI notification on 1533(1) dated 14 September 2006. The SEIAA, MP bases its decision on the recommendations of the State Level Expert Appraisal Committee (SEAC) also constituted for MP as per the order.[11]

30. **Table 2.1** presents a comparison of the environmental requirements of ADB and GoI.

Table 2.1 Comparison of Environmental Requirements of ADB and GoI

Project Stage	ADB	GoI	Gaps
Screening and Categorization	• Uses sector-specific rapid environmental assessment checklist for screening • assigns categories based on potential impacts:	• EIA Notification (2006; 2009) set screening criteria to classify new and expansion projects based on potential environmental impacts as	• As per the Indian regulations, the environment impact assessment (EIA) is *mandatory* for eight types of

[11] Madhya Pradesh State Environment Impact Assessment Authority. http://mpseiaa.nic.in/mpseiaa_aboutus.html. (Accessed 6 August 2013)

Project Stage	ADB	GoI	Gaps
	• A - EIA required (irreversible, diverse or unprecedented adverse environmental impacts) • B - IEE required • C - no environmental assessment required but a review of environmental implications is required • FI - ESMS required	follows: Category A, B1 and/or B2. • The category determines the level of environmental assessment.	project activities including mining, power generation, primary processing, materials production and processing, specific manufacturing and services sectors, infrastructure and construction. Under each category, the threshold limits are specified when it is mandatory to conduct an EIA. • Power transmission (and distribution) projects are not listed as environmental sensitive projects.
Environmental Assessment	• Identify potential impacts on physical, biological, physical cultural resources, and socioeconomic aspects in the context of project's area of influence (i.e., primary project site and facilities, and associated facilities)	*Category A* - • Require Prior Environmental Clearance (EC) from Central Government in the MoEF through recommendation of Environmental Appraisal Committee (EAC). *Category B* – • Category B 1 projects require prior Environmental Clearance from State Environmental Impact Assessment Authority (SEIAA) through recommendations of State Environmental Appraisal Committee (SEAC), *Category B2* – • Does not require EIA, goes directly to Appraisal stage.	• Power transmission (and distribution) projects are not listed as environmental sensitive projects. • In such cases, however, to comply with the SPS (2009), an environmental assessment needs to be carried out.
Analysis of Alternatives	For projects with potential significant impacts (i.e., Category A) • Examine alternatives to the project's location, design, and technology • Document rationale for selecting the particular project location, design, and technology • Consider "no project" alternative	• Compares feasible alternatives to the proposed projects site, technology, design and operation including the "without project" situation in terms of their potential environmental impacts, the feasibility of mitigating these impacts, their capital and recurrent costs, their suitability under local conditions and abatement.	• Under the National Law, Transmission projects have the "right of way" • In such cases, however, to comply with the SPS (2009), and analysis of alternatives needs to be carried out.
Meaningful Consultation	• Starts early and continues during implementation • Undertaken in an atmosphere free of intimidation • Gender inclusive and responsive • Tailored to the needs of	• Public consultation required to be undertaken through public notice prior to the approval by the MoEF only for Category B1 and A projects. • Starts at a later stage in the project cycle	• There are no major gaps. However the public consultation starts at a later stage in the project cycle.

Project Stage	ADB	GoI	Gaps
	vulnerable groups • Allows for the incorporation of all relevant views of stakeholders		
Information Disclosure	ADB will post in its website the following: •Draft EIA report posted on ADB website at least 120 days prior to Board consideration •Draft EA/EARF prior to appraisal •Final or updated EIA/IEE upon receipt •Environmental monitoring report submitted by borrowers upon receipt	• Information disclosure required to be undertaken through public notice prior to the approval by the MoEF only for Category B1 and A projects.	• No major gaps
Grievance Redress Mechanism	• Establish a mechanism to receive and facilitate resolution of grievances or complaints	• Grievance redress mechanism is not mentioned in the regulations	• Major gap. • To comply with the SPS 2009, a mechanism for redressal will be set up.
Use of Environmental Standards	•Refers to Environmental Health and Safety Guidelines (EHS) 2007 •If national regulations differ, more stringent will be followed •If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification	• The Environment (Protection) Rules, 1986 • Various legislations addressing aspects such as air and water pollution, hazardous substance management, etc. • Occupational health and safety standards included in the Factories Act (India) and various India specific Labor Laws	• The limiting value of some pollutants specified in the Indian regulatory standards maybe different than those specified in EHS 2007 guidelines and hence some gaps in certain situations.
Monitoring and Reporting	•Prepare monitoring reports on the progress of EMP •Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects •Prepare and implement corrective action plan if non-compliance is identified •Requires submission of quarterly, semiannual, and annual reports to ADB for review	• Post environmental clearance (EC) monitoring is stipulated by the regulations, with half yearly compliance reports to be made available as public documents. • Latest report displayed on website of regulatory authority	• .No major gaps

2.4 Applicable International Environmental Agreements

31. International conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN)[12], Convention on Migratory Species (CMS)[13], Convention on

[12]The International Union for Conversation of Nature, IUCN provides a comprehensive analysis of the global conservation status, trends, and threats to species viz the IUCN Red List or Red Data List. The IUCN Red list establishes a baseline from which to monitor the change in status of species; provides a global context for the

Wetlands of International Importance (Ramsar Convention)[14], Convention on Biological Diversity (CBD)[15], and Stockholm Convention on Persistent Organic Pollutants (POPs)[16] are applicable for selection and screening of subprojects under restricted and /or sensitive areas. India is a party to these conventions as detailed in **Appendix 2**.

32. For the subprojects, (i) animals and plant species found in the subproject sites are not included in the IUCN Red List; (ii) will not alter bird migration; (iii) sites are not within or adjacent to wetlands, protected or forest areas; and (iv) does not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

33. Subprojects may be subject to Stockholm Convention on Persistent Organic Pollutants (POPs) as per Article 3 and Annex A of the Convention and shall subscribe to the provisions set forth under the Convention.

2.5 Other Applicable Laws and Policies

34. According to the Child Labor Act[17] adolescents between the ages of 14 to 18 years, if employed, shall not be engaged in hazardous working conditions. The national and state laws cover the occupational health and safety of employees working only in factories and mines. However, the Indian Constitution stipulates provisions to ensure that the health and well-being of all employees are protected and the state has the duty to ensure protection. The project will ensure compliance to applicable core labour standards of ADB-ILO during design and implementation.[18]

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establishment of conservation priorities at the local level; and on a continuous basis, monitor the status of a representative selection of species (as biodiversity indicators) that cover all the major ecosystems of the world. http://www.iucnredlist.org/about/red-list-overview. (Accessed 2 August 2013)

[13] The Convention on Migratory Species (CMS), also known as the Bonn Convention aims to conserve terrestrial, aquatic, and avian migratory species whilst recognizing that States must be the protectors of species that live within or pass through their corresponding national jurisdictions. Hence, the Parties to the Convention adhere to strictly protecting such species, conserving or restoring the places where they live. http://www.cms.int/about/intro.htm. (Accessed 2 August 2013)

[14] The Convention on Wetlands of International Importance, called the Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. According to the Ramsar list of Wetlands of International Importance, there are 25-26 designated wetlands in India that are threatened. http://south-asia.wetlands.org/OurWetlands/OverviewofallwetlandswithRamsarstatus/tabid/634/Default.aspx. (Accessed 1 August 2013)

[15] As per the Convention on Biological Diversity or CBD States have in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. India is a party to the Cartagena Protocol on Biosafety to CBD which aims to ensure the safe handling, transport and use of living modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account risks to human health. http://www.cbd.int/convention/. (Accessed 1 August 2013)

[16] The Stockholm Convention on Persistent Organic Pollutants (POPs). Mindful of the precautionary approach as set forth in Principle 15 of the Rio Declaration on Environment and Development, the Objective of POPs is to protect human health and the environment from persistent organic pollutants.http://chm.pops.int/Home/tabid/2121/mctl/ViewDetails/EventModID/871/EventID/407/xmid/6921/Default.aspx. (Accessed 2 August 2013)

[17] The Ministry of Labor and Employment, Notification October 2006.http://www.childlineindia.org.in/pdf/Amendment-2006-Child-Labour-Act.pdf. (Accessed 2 August 2013)

[18] Asian Development Bank and International Labor Organization. Core Labor Standards. October 2006

3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 Physical Resources

3.1.1 Topography, Geology, and Soils

35. The project and subprojects of MP Transco and all the three DISCOMS are located in various geographic locations across MP, which lies between latitude 21°6' and 26°54'N and longitude 740 and 82°47'E. MP covers a geographical area of 308,245 square km (km^2) or about 9.38% of the total area of India. MP is land-locked and surrounded by Uttar Pradesh, Chhattisgarh, Andhra Pradesh, Maharashtra, Gujarat and Rajasthan. MP is traversed by the Vindhya, Satpura and Maikal hill ranges running east-west. Most of MP has an elevation of between 305 to 610 meters above mean sea level. Low-lying areas are in the narrow Narmada valley in the central southern parts. In general, MP stretches across a geographically elevated position.[19] The area is part of peninsular plateau consisting of sedimentary and metamorphic rocks and is structurally part of the peninsular block.

36. MP has 5 crop zones, 11 agro climatic regions and 4 soil types, which add to its biodiversity and acts favorably for production of various agriculture and horticulture crops. The soil of the region is rich and fertile and of variety ranging from rich clayey to gravelly. The major groups of soils found in MP can be divided into 4 categories namely; alluvial, medium and deep black, shallow and medium black, mixed red and black.[20]

3.1.2 Meteorology and Climate

37. **Climate:**MP has a typically tropical climate varying from dry sub-humid to semi-arid, with three distinct seasons - winter, summer and monsoons.

38. **Rainfall:**Annual rainfall in the state varies from 600 mm to 1,600 mm while the average rainfall in MP is 1,200 mm. There is one distinct rainy season when MP receives rains through the southwest monsoon in the months of June to October. Production in almost 70% of the agriculture area remains highly dependent on rainfall.

39. **Temperature:** MP has a tropical climate. The lowest temperature during the cooler months of December and January is 10°C and in the summer months of May and June, the temperature reaches 29°C.[21] Most parts of MP in summer are hot and humid.

3.1.3 Air Quality and Noise

40. Air quality in MP is considered to be good except in few urban and industrial centers where air quality is poor due to industrial activities and transport sources. Ambient air quality measurements are conducted on a continuous basis by the Madhya Pradesh State Pollution

[19] The Department of Land Resources, GoI. http://dolr.nic.in/dolr/downloads/spsp/Madhya%20Pradesh_SPSP.pdf. (Accessed 2 August 2013)
[20] Ibid 19.
[21] India – WRIS (Water Resources Information System of India). http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Madhya_Pradesh#Climate. (Accessed 3 August 2013)

Control Board (MPPCB) in various cities in MP.[22] Ambient air quality measurements generally comply with Air Prevention and Control of Pollution Act 1981 (**Appendix 2**) and the National Ambient Air Quality Standards.[23]

41. As of February 2013, MPPCB has come up with new guidelines for curbing air and noise pollution associated with construction activities, with the implementation of the Indore Municipal Corporation. Under the new guidelines, all construction works will have to be carried out between 7 am and 7 pm, and construction sites should be covered with acoustic screens and enclosures to control noise. Aside from this, contractors will have to enclose noisy machineries in acoustic enclosures. The noise standards as given by the MoEF are:[24]

Table 3.1 Noise Standards, Ministry of Environment and Forests

Noise Standards			
Code		Day Time (6 am – 9 pm)	Night Time (9 pm – 9 am)
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone	50	40

3.1.4 Natural Hazards

42. **Seismicity:** The Bureau of Indian Statistics (IS-1893 Part 1, 2002) classified India into four seismic zones based on various scientific inputs including earthquake data from India Meteorological Department (IMD). The seismic zones in India are given below:

Seismic Zone	Intensity on Modified Mercalli Scale	% of total area
II (Low intensity zone)	VI (or less)	43%
III (Moderate intensity zone)	VII	27%
IV (Severe intensity zone)	VIII	18%
V (Very severe intensity zone)	IX (and above)	12%

43. According to IMD, MP falls with Zones II and III (i.e., low to moderate damage risk seismic zone). Historically, parts of MP have experienced seismic activity in the range of intensity 5 to 6 of the Modified Mercalli Intensity (MMI) scale. Based on historical records of earthquake events in India from 16 June 1819 to 18 September 2011, only one earthquake occurred in Madhya Pradesh on 22 May 1997 at intensity 6 based on MMI scale. IMD has an earthquake monitoring and a real time seismic monitoring for early warning of tsunamis.

[22] Madhya Pradesh State Pollution Control Board. Ambient air quality measurements (interactive). http://www.mppcb.nic.in/aaqm_data.htm. (Accessed 27 July 2013)
[23] The Central Pollution Control Board. http://cpcb.nic.in/National_Ambient_Air_Quality_Standards.php. (Accessed 3 August 2013)
[24] Ministry of Environment and Forests (MoEF). http://moef.gov.in/citizen/specinfo/noise.html. (Accessed 2 August 2013)

Figure 3.1 Seismic Zones of India

44. **Drought and Floods:** With its vast expanse, geographical features and varying climate conditions, different parts of MP have been perennially prone to drought conditions as well as floods. During 2007-2008, 39 out of 50 districts (165 *Tehsils* and one cluster) of MP have been declared as drought affected. Additionally, district in the western and northwestern parts of MP are considered to be susceptible to desertification. These regions also do not have a thick forest cover in comparison with the central and eastern parts of MP. The calamity events recorded from 1991-2007 are shown in **Table 3.2**

Table 3.2 Calamity Events in Madhya Pradesh (1991-2007)

Year	No. of Districts	Name of Districts	Type of Calamity
1991-92	23	Rewa, Sidhi, Satna, Shahdol, Jabalpur, Balaghat, Chhindwara, Mandla, Seoni, Rajgarh, Betul, Dhar, Jhabua, Khandwa, Sagar, Damoh, Panna, Tikamgarh, Chhatarpur, Gwalior, Guna, Data, Ratlam	Drought
1992-93	4	Mandla, Khandwa, Chhindwara, Balaghat	Drought
1994-95	4	Rajgarh, Tikamgarh, Balaghat, Khandwa	Drought
1995-96	8	Panna, Tikamgarh, Chhatarpur, Rajgarh, Ratlam, Khandwa, Jhabua, Chhindwara	Drought
1996-97	5	Balaghat, Jabalpur, Seoni	Drought
1997-98	35	Indore, Khargone, Khandwa, Ujjain, Dewas, Shajapur, Mandsaur, Ratlam, Gwalior, Shivpuri, Guna, Bhind, Rewa, Shahdol, Satna, Sagar, Damoh, Panna, Chhatarpur, Tikamarh, Bhopal, Betul, Raisen, Rajgarh, Sehore, Vidisha, Hoshangabad, Jabalpur, Balaghat, Chhindwara, Seoni, Mandla, Narsinghpur	Excessive Rains &Hail Storms
1998-99	23	Vidisha, Dhar, Neemuch, Ujjain, Bhopal, Ratlam, Betul, Shajapur, Sagar, Guna, Chhindwara, Damoh, Dindori, Dewas, Khandwa, Khargone, Indore, Mandsaur, Gwalior, Sehore, Mandla, Jabalpur, Rajgarh	Hail Storms
1999-2000	4	Dhar, Jhabua, Khargone, Badwani	Drought
	6	Hoshangabad, Harda, Raisen, Sehore, Narsinghpur, Dewas	Flood
2000-01	32	Ratlam, Rajgarh, Panna, Seoni, Jhabua, Ujjain, Khargone, Badwani, Balaghat, Khandwa, Dhar, Neemuch, Katni, Bhind, Mandsaur, Chhindwara, Mandla, Jabalpur, Damoh, Chhatarpur, Narsinghpur, Tikamgarh, Shahdol, Indore, Sheopur, Satna, Betul, Sidhi, Dindori	Drought
2001-02	6	Ujjain, Shajapur, Ratlam, Rajgarh, Seoni & Chhindwara	Drought
2002-03	33	Ratlam, Rajgarh, Panna, Seoni, Ujjain, Morena, Gwalior, Balaghat, Neemuch, Katni, Shivpuri, Guna, Datia, Bhind, Mandsaur, Chhindwara, Mandla, Jabalpur, Damoh, Chhatarpur, Tikamgarh, Shahdol, Shajapur, Barwani, Sheopur, Satna, Sidhi, Dindori, Raisen, Sagar, Rewa, Umaria and Vidisha	Drought
2004-05	21	Sheopur, Datia, Tikamgarh, Balaghat, Panna, Chhatarpur, Rewa, Shahdol, Sidhi, Chhindwara, Harda, Hoshangabad, Seoni, Betul, Dewas, Khargone, Barwani, Ratlam, Umaria, Sehore, Ujjain	Drought
2005-06	9	Tikamgarh, Ratlam, Mandsaur, Shajapur, Chhatarpur, Khargone, Rajgarh, Chhindwara, Panna	Drought
	3	Chhindwara (Chindwara)	Drought
		Shajapur (Agar), Panna (Gunnor & Pawai)	Drought
2006-07	9	Panna, Tikamgarh, Chhatarpur, Satna, Gwalior, Shivpuri, Rewa, Katni, Ratlam	Drought

3.1.5 Water Resources

45. **Surface Water:** There are 10 major rivers that originate from MP and most are interstate rivers. The rivers namely Chambal, Sindh, Betwa, Ken flow northward and meet with Yamuna River. Sone River drains directly into Ganga, Narmada, Tapti and Mahi Rivers which then flow westward and meet Arabian Sea while Wainganga and Pench Rivers meet Godavari River in

the south. Annual run-off from these rivers within MP is estimated at 81,719 hectometer (hm), out of which about 49, 743 hm can be harnessed for irrigation purpose.[25]

46. **Groundwater:** Groundwater use is common in MP with groundwater development at 48 %.[26] Due to varied topographical, rainfall and climatic conditions in MP, the availability of water is not uniform spatially or temporally. There is an increasing demand of water for human consumption, agriculture and industrial purposes, etc. In May 2001, a total of 790 water samples were collected from the National Hydrograph Network Stations in MP and analyzed by the Chemical Lab of NCR in Bhopal. Based on the results, groundwater quality in the northern region of MP is generally good but shows high salinity in Bind district and in localized areas in the districts of Shajapur, Sagar, Ratlam, Ujjain, Vidisha, Chhatarpur and Sheopur. Very high values (more than 3,000 m/cm) of electrical conductivity (EC) were found in few localized pockets in these areas while those ranging from 750 to 1,500 m/cm at 25^{o}C were found in the north and western parts of MP. Results of analysis showed that generally, ground water in MP is alkaline-earth bicarbonate type. **Figure 3.2** shows the groundwater quality map of MP.[27]

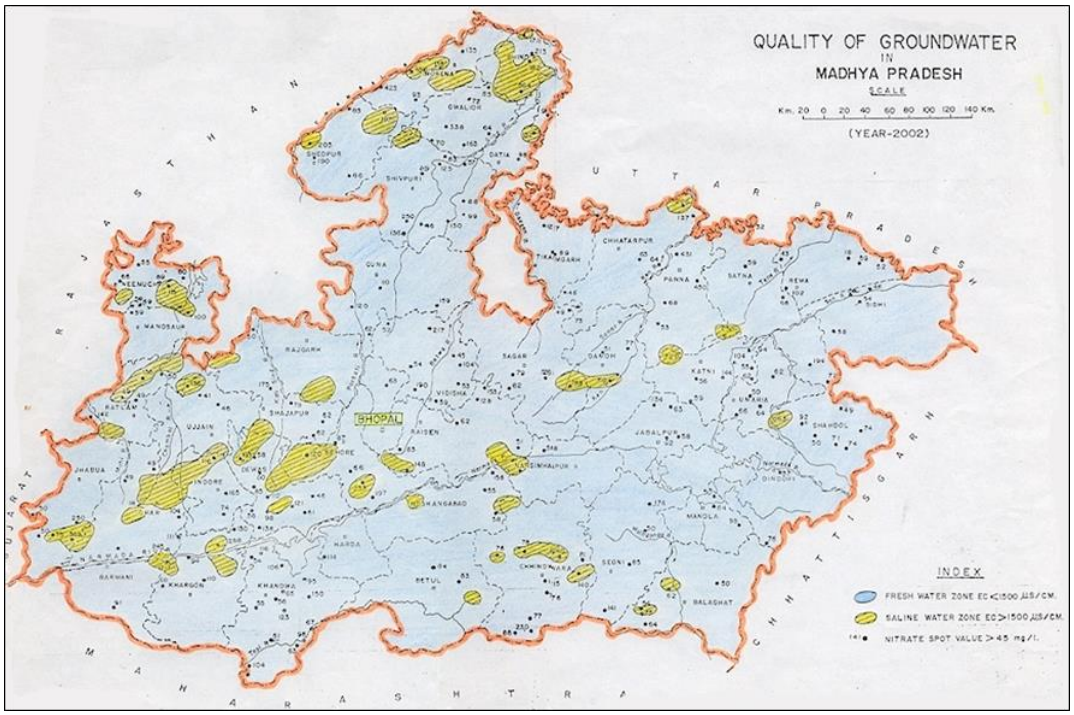


Figure 3.2 Groundwater Quality of MP

47. **Drainage:** The drainage system of the state is governed by six major river basins namely the Ganga basin (consisting of Yamuna, Tons and Sone sub-basins), Narmada basin, Godavari basin, Tapti basin, Mahi basin and Mahanadi[28] basin. Details of basins and sub-basins

[25] Ibid 19.
[26] http://www.cgwb.gov.in/gw_profiles/st_mp.html. (Accessed 2 August 2013)
[27] Central Ground Water Board, Geochemical Studies. http://cgwb.gov.in/ncr/GWQuality.htm. (Accessed 13 August 2013)
[28] The major portion of Mahanadi basin now lies in Chhattisgarh.

with respective drainage area in MP and corresponding water availability are provided in **Table 3.3.**

Table 3.3 Basin Wise Water Resources and Availability[29]

Name of Basin	Drainage Area (Sq.km)	Water Availability (hm)	Water Share of MP (hm)
1. Ganga Basin			
a. Yamuna sub-basin	1,42,250	27,267	23,642
b. Sone sub basin	28,880	7870*	3970*
c. Tons sub-basin	11,924	2,244	2244
2. Narmada Basin	85,149	34,542	22,511
3. Godavari/Waingaga sub Basin	23,388	5083*	2700*
4. Tapi Basin	9,800	2,401	1,646
5. Mahi Basin	6,700	1,952	338
6. Mahanadi	154	Not Defined	Negligible
Total	**3,08,245**	**81,719**	**57,051**

* On account of division of MP into MP and Chhattisgarh, 2001-2002, the water availability may have changed.

3.2 Biological Resources

3.2.1 Terrestrial Ecology

48. **Flora;** MP is very rich in terms of forest wealth compared to its neighbors, Uttar Pradesh, Chhattisgarh, Andhra Pradesh, Maharashtra, Gujarat and Rajasthan. MP is ranked fourth in the country in terms of forest wealth. According to India State of Forest Report (2011) published by the Forest Survey of India,[30] MP has a recorded forest area at 94,689 km^2, which is about 30% of its total geographic area. Out of this area, reserved forests constitute 65.36%, protected forests 32.84%, and un-classed forests 1.8%. **Figure 3.3** shows the map of forest cover in MP.

[29] Ibid 19.
[30] The Forest Survey of India, Ministry of Environment and Forests. http://www.fsi.org.in/sfr_2011.htm. (Accessed 3 August 2013)

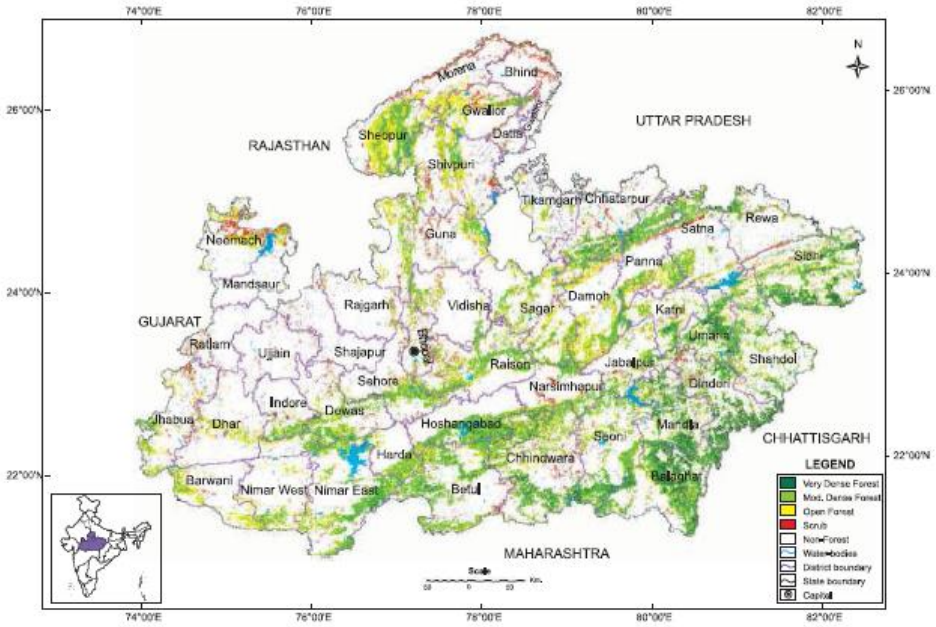


Figure 3.3 Map of Forest Cover in Madhya Pradesh

49. The common flora species are babul, neem, keekar, jaria, chhola, and reonjha, while the important non-wood forest products are Tendu leaves (*Diospyros melanoxylon*), Sal seed, (*Shorea robusta*), Harra (*Terminalia chebula*), Chironji (*Buchnania lanzan*), and flowers and seeds of Mahua (*Madhuca indica*). It is also famous for its bamboo resources.

50. **Fauna;** Most notable wildlife species reported are jackal, fox, monkey, wolf, squirrel, and reptiles. There are currently no threatened, protected, or endangered species in the project area as listed under the IUCN Red List. Moreover, the project does not transverse through Government-declared wildlife sanctuaries/national parks, or tiger reserves.

Migratory birds: According to Indian Bird Conservation Network, the following are threatened species in MP:[31]

- Oriental White-backed Vulture (*Gyps bengalensis)* - critically endangered
  This species has been reported breeding in many areas in MP such as Panna National Park (NP), Bandhavgarh NP, Kanha NP and Pench NP.
- Long-billed Vulture (*Gyps indicus*) - critically endangered
  In MP, this species may be seen in Bandhavgarh NP, and Kanha NP.
- Lesser Florican (*Sypheotides indica*) - endangered
  In MP, this species has been reported from the Karera Bustard, Ratlam, Sailana and Sardarpur Florican wildlife sanctuaries with some records from Kanha NP.
- Great Indian Bustard (*Ardeotis nigriceps*) - endangered
  In MP, it has been seen in Karera (Great Indian Bustard Sanctuary) between 25-30 birds

[31] Indian Bird Conservation Network. http://ibcn.in/wp-content/uploads/2011/12/28-657_690-Madhya-Pradesh.pdf. (Accessed 4 August 2013)

but now, there were no longer sightings of this bird. Other areas of sightings are in Ghatigaon Bustard Wildlife Sanctuary (WLS) and in some other patches of grassland where the bustard could be found.

- Sarus Crane (*Grus Antigone*) - vulnerable and also included in the IUCN Red List
  This species has a sparse distribution, and in MP it has been reported from the National Chambal WLS, Karera Bustard WLS, Madhav NP, Bandhavgarh NP, and Kanha NP.

Due to lack of scientific bird surveys in MP, a few sites are data-deficient and many potential sites might not have been included.

51. **Protected Areas:** According to the Forest Department of MP, there are nine national parks and 25 sanctuaries spread over an area of 10,862 km^2 which constitutes 11.40% of the total national forest area and 3.52% of the geographical area of MP.[32] **Figure 3.4** shows a location map of the national parks and sanctuaries.[33]

Table 3.4 National Park and Sanctuaries in Madhya Pradesh

No.	National Parks	Sanctuaries			
		No.	Name	No.	Name
1	Kanha	1	Bori	14	Khuno
2	Bandhavgarh	2	Bagdara	15	Pench
3	Panna	3	Phen	16	Ratapani
4	Pench	4	Ghatigaon	17	Sanjay Dubri
5	Satpura	5	Gandhisagar	18	Singhori
6	Sanjay	6	Karera	19	Son Ghariyal
7	Madhav	7	Ken Ghariyal	20	Sarfarpur
8	Vanvihar	8	Kheoni	21	Sallana
9	Fossil	9	Narsinghgarh	22	Ralamandal
		10	N. Chambal	23	Orchha
		11	Navrahedi	24	Gangau
		12	Pachmari	25	V. Durgawati
		13	Pan Patha		

Note: Please refer the number in Figure 3.4 for locations

[32] The Forest Department, Madhya Pradesh. http://mpforest.org/wildlife.html. (Accessed 3 August 2013)
[33] Ibid 32.

Figure 3.4 Map of National Parks and Sanctuaries in Madhya Pradesh

52. The GoI and the World Wildlife Fund (WWF) launched the "Project Tiger" in 1973 under which the Kanha National Park was one of the first nine protected areas selected. Currently, there are five Project Tiger areas in MP and these are Kanha, Panna, Bandhavgarh, Pench and Satpura.[34]

3.2.2 Aquatic Ecology

53. The aquatic ecology in MP in general terms, is in fair condition with extensive vegetation cover including riparian vegetation and seems to present a significant regulatory factor for high water quality and aquatic ecosystem integrity. Freshwater fish and decapods crustacean (crabs, freshwater shrimp or prawns) faunas are highly diverse in surface water.[35] There are no species listed under the IUCN Red List. However, listed among the identified impacts on aquatic biodiversity are deforestation, agriculture (including pesticides and irrigation), urban and industrial development, river regulation for water and hydropower production, mining, introduction of exotic species, dumping of solid wastes, and dredging and channelization.

3.3 Socioeconomic Profile

54. **Demography:** MP is the second largest State in the country in terms of area, with a population of 72.6 million. Out of the total population, 26% reside in urban areas and 74% in rural areas. MP is characterized by a variety of geographical, social and cultural variations. MP

[34] Ibid 32.

[35] Study of Aquatic Biodiversity and Water Resources of Rivers from Gujarat and Madhya Pradesh States, India. October 2012.

is home to the highest number of tribal population in India, spread out in remote and sparsely populated areas.

55. **Economy:** MP continues to be predominately agrarian with agricultural sector contributing about 26% to its gross state domestic product (GSDP) in 2007-2008.[36] The secondary sector comprising of mining, manufacturing, electricity, water supply and construction contributes about 26.93% to GSDP and the tertiary sector constituting railways and other transport, communication, banking and allied services, public services, tourism development across MP contributes 46.1%. It is the secondary and tertiary sectors which have seen substantial growth in MP while growth in the primary sector being almost static.

56. Major industries are cotton textiles, newsprint, pottery, cement, carpets, silk, rayon, jute, glass, steel, electrical engineering goods, electronics, telecommunications, petrochemicals, food processing, and automobiles. MP has also taken the lead in cement production and is famous for its traditional handicrafts and handlooms manufactured at Chanderi and Maheshwar.

57. **Water Supply and Sanitation:** MP ranks among the top states in accessibility and availability of safe drinking water supply. Nearly 90% of the total population has access to safe drinking water. Groundwater is primarily used for agricultural purposes in the project influence area. According to 2001 Census, majority of the people access drinking water near their premises (51%), around 25% have access within their premises, and 24% of households fetch their drinking water away from home. In terms of sanitation, MP is one of the five States (including Chhattisgarh, Jharkhand and Orissa) – largely rural that has less than 30% access to any sanitation source.

58. **Public Health:** Healthcare services network of MP comprises 50 district hospitals (13,400 beds), 333 community health centers, 1,155 primary health centers and 8,659 sub-centers. MP is one of the top two States that have high infant mortality rates with Panna standing at 93. MP is next only to Uttar Pradesh in high neonatal mortality rates (NNMR) standing at 44. NNMR is significantly high in rural areas than urban.[37] Despite improvements in the coverage of antenatal care, only 4 in 10 women in MP receive them.

59. **Land Use:** MP has 10 divisions and 50 districts. Nearly 44.33% of the land is utilized for agriculture with a few variations every year that largely depends upon the onset of monsoon and rainfall variability. MP has a total of 30.76 million hectares of land of which about 150.78 lakh hectares is the net sown area under agriculture. This represents 49% of the total geographical area. Forestland covers around 30% of the total geographical area with total cultivable area estimated at about 18.704 million ha.

[36] Draft Madhya Pradesh State Action Plan on Climate Change. April 2012. Government of Madhya Pradesh http://www.moef.nic.in/downloads/public-information/MP-SAPCC.pdf. (Accessed 3 August 2013)

[37] The Ministry of Home Affairs. Government of India. Annual Health Survey 2010–2011. http://www.censusindia.gov.in/vital_statistics/AHSBulletins/AHS_Baseline_Factsheets/M_P.pdf. (Accessed 3 August 2013)

Land Use	Area in '000 ha	Percentage
Total geographical area	30,825	
Reporting area for land utilization	30,757	100.00
Forests	8,696	28.27
Not available for land cultivation	3,401	11.06
Permanent pastures and other grazing lands	1,337	4.35
Land under misc. tree crops and groves	19	0.06
Culturable wasteland	1,160	3.77
Fallow lands other than current fallows	621	2.02
Current fallows	582	1.89
Net area sown	14,941	48.58

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2008-09.

60. **Employment and Income:** MP is largely agrarian state with 43% of the workers being cultivators and 29% agricultural laborers. Industrial growth centres have been established in MP which aims to attract industries towards economic development. As of January 2011, MP had 733 large and medium industrial units providing direct employment to about 1.75 lakh people. In terms of economic groups, the landless laborers, the marginal and small farmers, the forest produce collectors, the construction workers and the household based artisans are the ones who are engaged in the most economically insecure livelihoods.

61. **Governance:** MP has a three-tier *Panchayat Raj* system and Urban Local Bodies as the institutions of local self-governance. MP has 10 Commissioner Divisions, 50 Districts, 272 *Tehsils* and 313 Community Development Blocks, including 89 Tribal Development Blocks.

62. **Cultural and Archaeological Resources:** The following are the major cultural and archaeological resources (excavation sites) in MP that are ascertained as protected areas by the Archaeological Survey of India, and hence of national importance.[38]

- **Besnagar, Dt Vidisha, MP** Besnagar is identified with ancient Vidisa (Nagara) and is renowned in ancient literature as the capital of Akara and Dasawa and as a centre of cultural activities, with trade routes passing through it.
- **Sanchi Dt. Raisen, MP** With impressive Buddhist remains ranging in date from the 3rd century B.C. to the 12th century A.D., situated on a low hill-top, anciently known as Vedisa-giri (due to its proximity to Vidisa, Besnagar) Cetiya-giri. Kakanada-bota and Bota-sri-parvata. The main stupa, Stupa 1, the outstanding monument on the hill, is believed to have been built by Asoka in the 3rd century B.C., and one of his queens is said to have built a monastery here. Asoka set up one of his pillars near his stupa, surmounted it by a four-lioned capital and had his anti-schism edict in scribed on it.
- **Uijain, MP** Situated on the eastern bank of the Sipra and well-known as the capital of Avanti, one of the 16 mahajanapadas in die 6th century B.C. and as the seat of a viceroy (*kumara*) of the Mauryan empire during the rule of Asoka in the 3rd century B.C., as mentioned in his Dhauli separate Rock-edict I. It is hallowed traditionally by its association

[38] The Archaeological Survey of India, Government of India. http://asi.nic.in/asi_exca_imp_madhyapradesh.asp. (Accessed 4 August 2013)

with the jyotir-Linga of Mahakala and as one of seven holy cities of India, and remembered through later history and literature, especially the Meghaduta of Kalidasa.

63. **Climate change impacts:** MP is highly dependent of agriculture for livelihood and thus, vulnerable to climate change. According to the MP State Action Plan on Climate Change (draft report, April 2012),[39] some of the projected climate risks for MP are increase in maximum and minimum temperatures, changes in spatial and temporal distribution of monsoon, increase in frequency and intensity of rains, loss of rainy days, extended summers etc. Climate change will not only affect the natural resources but would also impact upon human health and availability of safe habitats in the future. These climate change risks may affect the envisioned sustainable development of MP.

4.0 POWER TRANSMISSION SYSTEM IMPROVEMENT

4.1 Project Description

64. Madhya Pradesh Power Transmission Corporation Limited (MP Transco) is the sole power transmission company in the second largest state of India with a network of power transmission system ranging from 400 kV, 220 kV and 132 kV spread all over MP. As of May 2013, the existing capacity of MP Transco is given below (**Table 4.1**):

Table 4.1 Existing Capacity of MP Transco

Voltage Level	Length of Transmission Line (circuit-km)	Extra-high Voltage Substation	
		Number	Capacity (MVA)
400 kV	2,448.13	7	5,460
220 kV	11,337.25	56	15,750
132 kV	13,988.07	193	16,881
66 kV	61	1	20

Source: Madhya Pradesh Power Transmission Co. Ltd. Project Report for Madhya Pradesh Transmission and Distribution System Improvement Project. July 2013

65. With the existing capacity, MP Transco has successfully supplied the maximum demand of 9,484 MW in 2012. However, the peak availability of the power sector in MP was 9,692 MW while the estimated unrestricted peak demand was 10,308 MW, resulting in an unmet demand of 616 MW in FY 2012. MP Transco is currently executing power transmission expansion and strengthening works expected to be completed by end of 2013 to evacuate power from the 1200 MW Shri Singanji (Malwa) Thermal Power Station and 500 MW Satpura Thermal Power Station Extension funded by Japan International Cooperation Agency (JICA) and the Power Finance Corporation Limited.

66. Aside from this, the GoMP has signed a Memorandum of Undertaking with several IPPs to develop power plants in Madhya Pradesh for the next five years. Thus, there will be substantial supply of power for the rural areas, residential and commercial users in the urban areas which would require enhancement of transmission capacity network.

[39] Ibid 36.

4.1.1 Objectives and Benefits

67. The subprojects included in transmission system improvement are consistent with the 12th Five-Year Plan of MP Transco approved by the State of Madhya Pradesh and the Madhya Pradesh Electricity Regulatory Commission (MPERC).

68. The main objective is to create an infrastructure to evacuate power generated from the implementation of the IPPs and to meet the steadily growing demand for power in the urban and rural areas. Part A subprojects will also allow the transmission and supply of additional power needed by the three distribution companies without overloading the existing 400 kV, 220 kV, and 132 kV transmission lines and extra-high voltage transformers.

69. With the identified subprojects, the MP Transco will be able to meet the various parameters defined in the Grid Code issued by MPERC, and will reduce the overloading of 220 kV, 132 kV and 33 kV system. The technology of the works associated with the subprojects is proven to be the best and no difficulty is anticipated during project implementation.

70. Overall, it is expected that the completion of the transmission system improvement will provide a continuous, more stable and reliable power transmission capacity networks that is likely to contribute to poverty alleviation through the use of available electricity for agricultural production, tourism, industrialization, business, education, commercial activities, health, and other employment-generation activities.

4.1.2 Location and Components

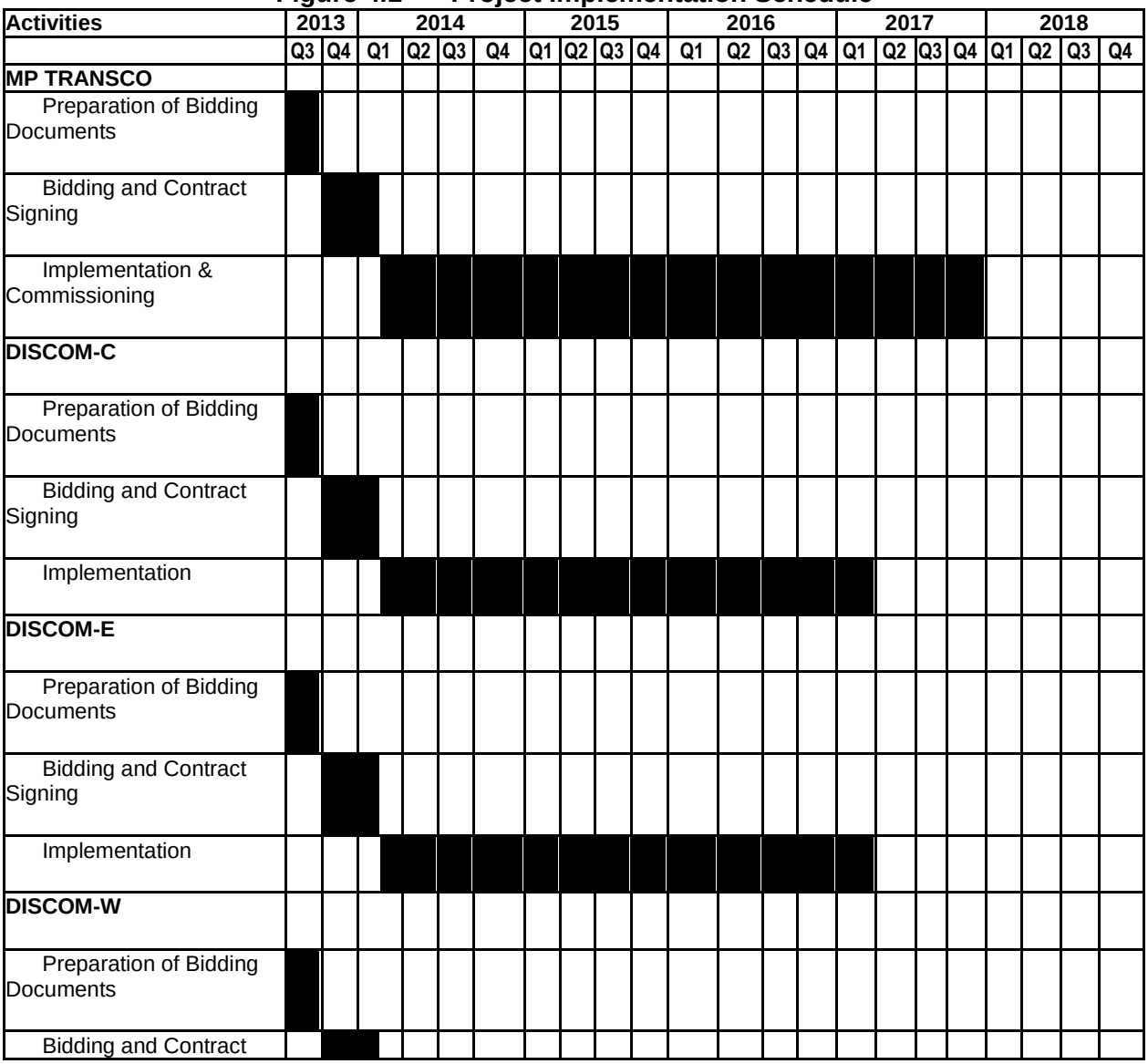
71. The outputs for the transmission system improvement component include augmentation of substation capacity and line lengths across all the voltage levels (132 kV, 220 kV, 400 kV). For the 220 kV and 400 kV voltage levels, the focus is to upgrade the transformer capacity at the existing substations. For the 132 kV transmission network, the target is to create more substations to feed the distribution network while improving the overall quality and reliability of supply.

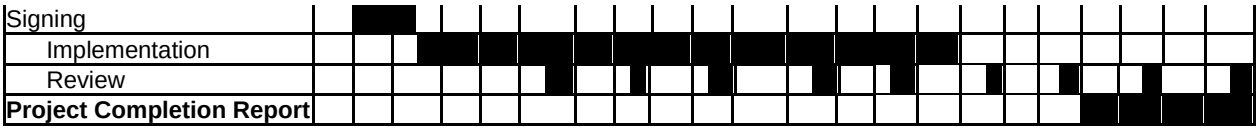
72. About 1,800 circuit-km of transmission line is proposed to be constructed under the project. A total of 32 substations (or 12.5% of the existing substations) comprising two 400 kV, four 220 kV and twenty six 132 kV substations are proposed to be constructed. **Table 4.1** presents the summary of the subprojects for MP Transco (see **Appendix 1** for details of subprojects.). The total capacity addition under the project would be about 4,000 Mega Volt Amperes (MVA) which is 25% of the targeted substation capacity addition by MP Transco during FY 2013-2017. This would result in an increase in the transmission substation capacity from 37,000 MVA in 2013 to 41,000 MVA by 2020. Transmission system improvement is expected to commence in February 2014 and completed in August 2014. **Figure 4.1** presents the project implementation schedule.

Table 4.1 Summary of Subprojects, MP Transco

Voltage	Transmission Line (km)	Substation Capacity (MVA)	Number of New Substation	Number of Additional Units for Upgrading
400 kV	15	1,458	2	2
220 kV	291	480	4	-
132 kV	1,069	1,318	26	---
Augmentation	0	800		5
Total	**1,375**	**4,056**	**32**	**7**

Figure 4.1 Project Implementation Schedule





73. All the 32 new substations will be air insulated substation (AIS) which uses atmospheric air as the phase to ground insulation for the switchgear of the substation. Main disadvantage of the AIS substation is the overall size making it attractive to locate in the rural areas and they are usually installed outdoor. Given the available space on Government land in MP and the cost of land transfer between Government agencies, using AIS will not be a constraint.

74. Land required for substations varies with capacity and in selecting a potential substation site; MP Transco considers future growth and expansion of substations. As a rule of thumb, MP Transco is guided by the following land requirements: (i) 36 ha for 440 kV substation, (ii) 9 ha for 220 kV substation, and (iii) 2.25 ha for 133 kV substation.

75. The conductors for the transmission line will be a mix of single ACSR double circuit and ACSR moose four (quad bundle) of aluminum alloy conductor material while the supporting towers will be lattice steel structures of two types – tension and suspension, double-circuit with bolted joints which is designed to carry the line conductors with necessary insulators, earth wire, fittings and fixtures under all loading conditions. Double circuit configuration allows for an increased long-term reliability and capacity of the transmission lines to evacuate power over long distances.

4.1.3 Implementation Activities

76. Broadly, the implementation of transmission system improvements includes detailed and check survey, excavation, tower site leveling, backfilling (if needed), construction of substations, tower erection and assembly, stringing of conductors and earthwire, pre-commissioning and commissioning. For the erection of transmission lines and construction of substation, the following GoI standards/codes shown in **Table 4.2** will be complied with by MP Transco:

Table 4.2 Relevant Construction Standards of the Government of India

GoI standards and/or codes	Title
IS:5613-1995 (Part-II)	Code of practice for design, installation and maintenance of overhead power lines. Section 1 - Designs. Section 2 - Installation and Maintenance
IS:269-1967	Ordinary rapid hardening and low heat Portland cement.
IS:456-2000	Code of practice for plain and reinforced concrete
IS:1786-1966	Cold twisted steel bars for concrete reinforcements

GoI standards and/or codes	Title
IS:4091-1967	Code of practice for design and construction of foundation for transmission line towers & poles
IS:3072-1975	Code of practice for the installation and maintenance of switchgear
IS: 3043-1987	Code of practice for earthing
IS: 1255-1983	Code of practice for the installation and maintenance of power cables • Cable sheaths and armour bonding to the earthing system
IS: 1866	Transformer insulation oil quality analysis • Circulation and filtering of oil, heating of oil, sampling and testing of oil • Inspection, storage, installation of transformers/reactors
IS: 7205-1974	Safety code for erection of structural steelworks

4.2 Analysis of Alternatives

77. During the planning stage and preliminary design, alternatives were considered in the selection of the substation site and transmission line routes to ensure that they are economically and financially feasible, at the same time, potential environmental impacts are minimized. The following selection criteria guided MP Transco:

(i) Availability of a suitable right of way (ROW) and access to site by overhead transmission and distribution circuits;
(ii) Location of existing transmission and distribution lines for potential interconnection;
(iii) Distance to all weather roads, accessibility of heavy equipment under all weather conditions and access roads to the site;
(iv) Site maintenance requirements, water supply and storage;
(v) Soil resistivity, drainage, and soil conditions;
(vi) Cost of earth removal, earth conditions and earth moving;
(vii) Atmospheric conditions and potential contamination from industry;
(viii) Available space for future expansion and current requirements;
(ix) Land ownership, avoidance of private land acquisition;
(x) Topographical features of the site, avoidance of flood plains, wetlands, forests and other environment-sensitive areas;
(xi) Consideration of public safety and concern, avoidance of schools, playgrounds, hospitals, and structures of worship;
(xii) Avoidance of waterways and existing utilities, railway, road crossings, etc.; and,
(xiii) Total costs including transmission and distribution lines with due consideration of environmental factors.

78. Following the criteria above, a questionnaire/checklist with 17 questions is used during site planning. Some considerations include the following:

- "Whether any *Nallah*, water tank, canal, etc. is within the proximity of the proposed land should be clearly mentioned. In case of the existence of the above, the extent of water spread during maximum flood level should be indicated."
- "In the detailed map, give the orientation of the EHT lines (existing or proposed) and the distance of lines from the proposed site."

79. Preliminary site assessments conducted by MP Transco are based on the interpretation of available relevant maps of the area (i.e., topographic maps, vegetation maps, land use, etc.) aided by existing satellite images, aerial photos, location of permanent wetlands, and other environmentally-sensitive areas, and walk-over survey. During field works or walkover surveys, locations of forests, railways, schools, waterways, utilities, road crossings, structures of worship, etc. are identified along the alignments under consideration (or a "bee-line"). Soil characterization and land use evaluation are also carried out during the walk-over survey or inventorization.

80. From the outputs of preliminary assessment, the alignment that will be selected for further evaluation is determined. Based on preliminary assessment, some alignments are reduced as in the example below:

(i) Beragargh 220 kV - Inthkedi 132 kV Double circuit double string (DCDS) transmission line: Initially proposed to be 50 km and later revised to 18 km
(ii) LILO of one circuit of Bhopal - Hoshangabad 220 kV D/C line at Adampur 220 kV S/S (D/C)
   - Option (a): Will pass through Anandnagar – this route will be within the catchment of the Hathaikeda Dam, a rainfed reservoir ('water dam') located in Anandnagar (Bhopal district) and under the jurisdiction of the MP Department of Irrigation requiring require their clearance. This option will result to a reduced length of 5 km.
   - Option (b): Will pass through Khujuri Kalan – if clearance from MP Department of Irrigation for Option (a) is not obtained, then this option will be 15 km.

81. **Table 4.3** provides a comparison of the general situation in case of "with project" and "without project" scenario.

Table 4.3 "With Project" and "Without Project" Scenario

No.	Parameter	With Project Scenario	Without Project Scenario

No.	Parameter	With Project Scenario	Without Project Scenario
1	Electricity	Major effect, improved voltage, less fluctuation, increased availability	Unstable power supply, energy not served to users
	Environment		
2	Effect on protected, sensitive, or forest areas	No effect, avoids protected, sensitive or forest areas	No effect
3	Effect on endangered species	No effect, avoids protected, sensitive or forest areas	No effect
4	Tree cutting	Minor effect, no forest will be involved but shall comply with environmental safeguards provision of ADB, GoI national laws and regulations	No effect
5	Air emissions	Major effect; improvement due to reduced usage of diesel generators currently employed for water abstraction from surface/ground water sources for agricultural purposes	May increase use of diesel generators for agricultural purposes
9	Water supply	Improved water accessibility for agricultural purposes	No improvement in access to water for agricultural purposes
	Social		
10	Disturbances of people/communities	During construction phase, short and temporary impact	No issue
11	Effect of business	Construction activities may employ local people generating economic and livelihood opportunities.	Opportunity cost
12	Status of living	Improved access to electricity will reduce domestic load for women such as for cooking purposes, education, etc.	No change
	Economic		
13	Economic development	Greater rate of economic development expected	Slow development

4.3 Anticipated Environmental Impacts and Mitigation Measures

82. The Ministry of Environment and Forests (MoEF) of GoI, in its notification in September 2006, has exempted transmission projects from environmental clearances due to the non-polluting nature of its activities.[40] However, forest clearance under the Forest Conservation Act 1980 will be necessary in the event the transmission line passes through forest areas.

83. One of the factors considered in selecting the best and optimum transmission line route is avoidance of potential significant environmental impacts. In power transmission projects, potential environmental impacts are confined in the right of way (ROW) for while substations, they are site specific.

[40] Notification in the Gazette of India, Extra-ordinary part II and section 3, subsection II, 14 September 2006).

84. Appropriate survey methods and good engineering practice have been used to select the best alignment but residual impacts associated with the project cannot be entirely avoided resulting from varying topographical locations that will be traversed by the transmission line. An environmental management plan (EMP) and an environmental monitoring plan (EMoP) will help ensure that these residual impacts are mitigated and/or enhanced.

4.3.1 Pre-construction and Design Phase

4.3.1.1 Location of substations and transmission line routes

85. As discussed in Sect. 4.2 (Analysis of Alternatives), 13 criteria for site selection and a 17-question checklist/questionnaire guide the selection of transmission line route and substations, among others, to avoid significant adverse environmental impacts.

86. There are nine national parks and 25 wildlife sanctuaries in MP. Based on these criteria and checklist, forest, cultural and archaeological sites, sanctuary, protected, and other ecologically-sensitive areas such as Ratapani Wildlife Sanctuary in Sehore and Raisen districts, Bandhavgarh National Park, Bhoj Wetland (known as the "Upper Lake", a Ramsar site) were avoided.

87. Aside from the criteria and checklist used by MP Transco, the walkover survey/transect, which involves setting up of temporary tracks, helps determine the type and number of trees and plants that may be affected (if any), type of structures and settlements within the ROW, and natural physical features and public utilities that may be traversed by the transmission line. Walkover surveys may cause short and temporary disturbance to local people within the ROW.

88. Some of the subprojects selected will not require erection of additional towers as they mainly involve stringing of 3rd conductor for 220 kV (Bina to Mungaoli) and some second circuit for 132 kV transmission line (i.e., Gairatganj-Vidisha, Bairagarh-Shyampur, Tikamgarh-Budhera, etc.).

4.3.1.2 Choice of equipment and technology

89. All the substations will be air insulated and not gas insulated. Air insulated substation (AIS) uses atmospheric air as the phase to ground insulation for the switchgear of the substation while gas insulated substation (GIS) uses sulfur hexafluouride (SF_6) gas. SF_6 has a dielectric strength higher than air and the phase to phase spacing is reduced resulting to a more compact substation that is particularly advantageous in an urban environment where space is expensive. However, SF_6 is a potent greenhouse gas (GHG) with a global warming potential of 23,900 times compared to CO_2. One of the disadvantages of the AIS substation is the overall size making it more attractive to locate in the rural areas and they are usually installed outdoor. Given the available government land in MP, the use of AIS will not be a major constraint.

4.3.1.3 Land acquisition for the substations

90. All the MP Transco substation sites are on government land so there is no need for land acquisition from private owners. Substation sites that were initially evaluated as technically suitable but located on private lands that would entail land acquisition, physical and economic displacement of local people were not considered.

4.3.2 Construction Phase

91. During this phase, some activities include clearing of ROW, setting up of temporary access tracks, setting up of materials storage areas along the route and substation work sites, transport of material and equipment to the site, excavation for substations and towers foundation, cementing/concreting of tower foundation, erection of the towers, and conductor stringing. MP Transco-PMU will ensure that the contract of the Engineering, Construction and Procurement (EPC) Contractor(s) will include the obligation to compensate for any temporary damage, loss or inconvenience as result of the project during the construction phase.

4.3.2.1 Prepare construction management plan

92. The construction management plan (CMP) will help in avoiding the unplanned activities of EPC Contractor(s) and will guide the smooth implementation of earth-moving works, civil and electrical works. The CMP will cover temporary pedestrian and traffic management, community and safety, spoils or muck disposal, noise and dust control, drainage and stormwater management, material management, and waste management. The CMP will also include designate sites/areas for monitoring such as workers facilities, work areas, and materials warehouse/storage.

4.3.2.2 Hiring of project staff and workers

93. The implementation of several subprojects will be opportunities for local employment. While this is beneficial, it may also be a cause of conflict due to migration of workers and dispute over transparency of hiring particularly if migrant workers are recruited over local people. The EPC Contractor(s) will be required to use local labour for manual work and eligible local workforce for technical and administrative jobs. MP Transco-PMU will monitor the compliance to priority of local hiring.

4.3.2.3 Orientation for EPC contractor(s) and workers

94. MP Transco-PMU will conduct briefing and/or orientation for EPC Contractor(s) on the environmental management plan (EMP), grievance redress mechanism, consultation, and reporting. This will provide an understanding of their responsibility in implementing and compliance to the EMP as well as agreement on critical areas that needs monitoring. The briefing will also include strict compliance against child labour, bonded or forced labour, and awareness about socially transmitted disease such as HIV/AIDS to prevent potential incidence. Aside from relevant national and state labour regulations, ADB's core labour standards will provide guidance for compliance. EPC Contractor(s) will provide training/drills on emergency preparedness and exercises before start of work will be encouraged to maintain health and fitness.

4.3.2.4 Presence of workers at construction sites

95. The presence of workers and staff at the 32 new substation construction sites may increase demand for services such as housing, food, etc. This localized demand may be an opportunity for local people to have temporary small-scale business in providing services such as food, temporary lodging, etc. This will be a beneficial impact to local economy.

4.3.2.5 Site preparation and construction of substations and transmission towers

- *Impacts on land and vegetation*

96. Clearing of land and vegetation, excavation and earthmoving will be done and some mature trees (e.g., teak) of economic value (i.e., firewood, timber, furniture, etc.) will be cleared such as in 132 kV Silwani substation. Cut trees owned by the Government will be sold and revenue turned over to Revenue Authority.

97. Vegetation clearing may cause some loss of habitat. Most of the substation sites are on grassland/shrubland such as in Salamatpur, Belkheda, Teesgaon, Shayamgarh, Anandnagar, Hoshangabad, Kirnapur, Adampur, etc. (see **Figure 4.2**) and transmission line routes will traverse mainly agricultural land. No protected area, sanctuary or forest will be affected. Construction works will not be scheduled during harvest time to minimize damage to cash crops. The destruction and/or loss of habitat due to clearing of ROW and to stringing of conductors will naturally regenerate in about 2-3 years. Agricultural activities within the ROW will be allowed after construction but with restrictions to height of vegetation.

Figure 4.2 Vegetation in Substation sites

98. The line in-line out (LILO) of 400 kV Seoni-Bhilai single circuit at Bhalaghat/Kirnapur double circuit will be in Balaghat District where Kanha and Pench National Parks including the Pen Sanctuary are located. As well, the LILO of 400 kV Nagda-Rajgarh line is in Badnawar District where Sardarpur Sanctuary is located. These protected areas will not be traversed or anywhere near the LILO.

99. Earthmoving works in substation sites may cause potential erosion and localized flooding. Adequate erosion control measures will be provided in areas located in sloping terrain (or as needed) and spoils disposal plan will be strictly implemented to prevent localized flooding. For transmission towers, earthworks will be isolated to tower sites only. Tower foundations involve small-scale excavations and the excavated topsoil will be used for backfilling. For substations, wherever necessary, downhill slopes will be provided with revetments, retaining walls or sow soil binding grass around the sites to contain soil erosion. Landscaping/replanting/revegetation will be done as soon as earthworks are completed to stabilize the soil.

100. For transmission towers, only the exact amount of construction materials (i.e., sand, gravel, concrete, etc.) will be brought on-site to avoid stockpiling that may cause localized

flooding during the monsoon season and to minimize any inconvenience to local people. At substation sites, adequate storage for materials needed for construction works will be provided.

101. During the erection of transmission towers, a four- legged steel lattice type will be used. Following the Forest Conservation Act 1980 and the Indian Standard (IS) 5613-1993, the ROW for the 400 kV transmission line is 52 m from the centreline, 35 m for 220 kV transmission line, and 27 m for 132 kV transmission line.

102. The two subprojects that will involve 400 kV transmission line will require about 38 towers while the five subprojects on 220 kV transmission line would need an approx. 530 towers. The 29 subprojects on 132 kV transmission line will need about 2,720 towers. Therefore, the estimated total number of towers for transmission system improvement will be about 3,288 towers. Eight subprojects do not require towers as these will only involve stringing of conductors. Of the total 36 subprojects on transmission line, about 3,890.5 ha will be affected by the ROW and about 0.2661 ha (or 2,661 m^2) will be lost to tower footings. **Table 4.4** gives a summary of the land affected by the ROW and tower footings.

Table 4.4 Summary of land affected by ROW and tower footings

Voltage	Transmission line (km)	Right of Way (m)	Area affected by right of way (ha)	Area permanently affected by base of transmission towers (ha)	Total (ha)
400 kV	15	52	78	0.0031	78.0031
220 kV	175	35	612.5	0.043	612.543
132 kV	1,185	27	3,200	0.22	3,200.22

103. Crops and trees along the ROW that may be affected or damaged during the erection of towers and stringing of conductors will be compensated based on entitlements following the national laws and SPS 2009. Payments to affected farmers cover at least three phases (i.e., if there are crops during each phase): (i) preparing the foundation for towers, (ii) erection of towers, and (iii) stringing of conductors.

104. Based on the Schedule of Rates (2012-2013) of MP Transco for transmission line, the crop/tree compensation for clearing of ROW in non-forest areas will be Rs50,000 per location for construction of double circuit/single string (DCSS) and double circuit/double string (DCDS) such as in Pithampur (400 kV)-Depalpur (220 kV) DCSS line, Beragarh (220 kV)-Intkhedi (132 kV) DCDS line, Malanpur (220 kV)-Gohad (132 kV) DCDS line, etc. For second circuiting of DCSS, the rate will be Rs80,000 per km as in Betul (220 kV)-Gudgaon (132 kV) DCSS line, Vidisha (220 kV)-Salamatpur (132 kV) DCSS line, etc.

105. Agricultural activities within the ROW will be allowed after construction but with restrictions to the height of vegetation: (i) 5.5 m for the 400 kV, (ii) 4.6 m for the 220 kV, and (iii) 4 m for the 132 kV. Thus, plants and crops that are less than 3 m tall like wheat, soybean, corn, rice, etc. will remain along the buffer area of the ROW.

106. There will be no access road construction for erection of towers and stringing of conductors but access tracks will be created to reach the location of the towers. The access tracks created for bringing in the tower components will remain tracks and would just be wide enough to accommodate the machinery needed to erect the towers and to maintain them. Materials required for the erection of towers will be carried manually to minimize disturbance. In some substation sites such as Intkhedi and Adampur, existing approach roads may require upgrading and/or rehabilitation to facilitate construction. This will benefit not only MP Transco operations but local people as well who will use the roads.

- *Impacts on people*

107. There will be seven existing substations that will be upgraded such as in Mandideep, Betul, Kotar, Chhatarpur, etc., which may require dismantling of structures and equipment and/or installation of new transmission transformers (about 160 MVA). Workers assigned to dismantling works will be provided with proper safety clothes and protection gear/equipment to avoid accidents. Debris and scrap materials from dismantling activities will be transported to MP Transco's warehouses located in Jabalpur, where there are dedicated storage yards, for resale and auction to authorized dealers. Similarly, servicing and/used transformer oil (if any) will be disposed of/sold to Government-registered recyclers only as set forth by the Hazardous Waste Management and Handling Rules 2008. MP has a common treatment, storage and disposal facility located in Pitampur, Dhar District. EPC Contractor(s) will be required to observe and implement the construction waste management plan. MP Transco-PMU will monitor compliance.

108. The erection of towers and poles as well as stringing of conductors may potentially interfere with road crossings that may pose safety risks to the public and construction workers. To minimize the risks, adequate danger and clearly visible warning signs will be posted at designated sites while scaffoldings will be placed over road crossing points. EPC Contractor(s) will be required to instruct drivers of construction vehicles to strictly follow road regulations and to implement the temporary pedestrian and traffic management plan. Security personnel will be assigned to prevent trespassing and accidents at the substation sites.

109. Local hiring will be given priority so workers can come home after work every day. However, if required, EPC Contractor(s) will provide construction camps with sanitary facilities, wash areas, safe drinking water, garbage bins, and designated security personnel. Designated staff will be provided with communication device to facilitate communication particularly during emergency.

110. Site engineers will find the location of the nearest hospital and will make arrangements in case of accidents in the worksites. First aid treatment will be set up within the construction sites and field offices. Workers will be provided with hard hats, safety shoes, and safety belts while designated staff will be provided with communication devices. A health personnel (or a nurse) will be assigned by EPC Contractor(s) to visit the construction sites once a week to broadly check the sanitary conditions of the construction sites and overall health condition of workers to minimize outbreak of diseases. Good housekeeping will be enforced at all times and will be monitored by MP Transco-PMU. The Contractor(s) will comply with relevant safety measures required by law and best engineering practices.

- *Impacts on air quality, noise and vibration*

111. The use of heavy equipment and construction vehicles may increase vehicular emissions. Vehicular emissions, land clearing, earthmoving works and transport of construction materials may increase levels of suspended particulate matter affecting air quality. Opened and exposed land areas at the substation sites and transmission towers will be sprayed with water to suppressed dust level particularly during the summer season. Construction sites for substations will be temporarily enclosed to contain dust dispersion. EPC Contractor(s) will be required to maintain construction vehicles regularly to minimize the contribution of vehicular emissions to poor air quality. Warehouse for construction materials will be provided onsite to reduce the trips of material delivery while construction vehicles transporting materials that generate dusts will be covered.

112. Aside from vehicular emissions, the use of heavy equipment, construction vehicles and civil works may increase the noise levels while excavation works at the substation sites may induce vibration. Increase in noise levels and potential vibration may inconvenience local people living at and around these sites. As required by MPPCB guidelines (February 2013), noise-generating activities will be scheduled between 7AM and 7PM while noise-generating machineries and construction areas will be covered with acoustic screens and/or temporary enclosures. Drivers will be required to observe low speed wherever necessary and no blowing of horns. EPC Contractor(s) will ensure that the traffic management plan as well as air quality and noise control plans are implemented. MP Transco-PMU will monitor compliance.

- *Impacts on water quality*

113. Presence of workers at construction sites will generate sewage that may affect water quality while earth moving works may cause localized flooding during monsoon season and in other low-lying areas. EPC Contractor(s) will provide workers with sanitary facilities and safe drinking water. The site selection of subprojects avoided waterways to minimize the costs of mitigating the associated environmental impacts. To avoid localized flooding, construction works will be scheduled during summer in areas potential to flooding and during the monsoon season, drainage and stormwater management plan will be implemented by EPC Contractor(s). MP Transco-PMU will monitor compliance to these measures.

4.3.3 Operation Phase

4.3.3.1 Presence of transmission towers and substations

- *Impacts on land and vegetation*

114. The presence of substations and transmission towers may lower the real estate property values near or adjacent to these facilities. However, the availability of a stable and reliable power supply will attract and promote local economic development and thus, may actually enhance property values.

115. There will be restrictions on height of plants/crops that will be allowed within the ROW to keep its integrity. This is to ensure that the required vertical spacing between the conductors

and the vegetation is maintained for safety reasons. Height restrictions on vegetation will be: (i) 5.5 m for the 400 kV, (ii) 4.6 m for the 220 kV, and (iii) 4 m for the 132 kV. A budget for planting medicinal plants along the ROW is allocated at Rs457,200 per hectare.

116. A service road for vehicles will be set up under the transmission line but will be used only to maintain the towers and the conductors. The services road will not be maintained and will remain access tracks to discourage encroachment and unauthorized public access.

117. While no subproject is located near or adjacent to the 9 national parks and 25 wildlife sanctuaries, birds and other wildlife may be attracted to the presence of substations and transmission towers particularly migratory birds. Transmission lines are designed to have ground wire spacing and lightning arresters as safety features to generally protect the public (and birds). Spot checks/ocular inspection of wildlife crossing and bird electrocution (if any) will be included as part of maintenance work along the transmission line. Maintenance workers will be trained to create awareness on this monitoring.

- *Impacts on noise*

118. Substations may cause disturbance to settlements adjacent to it due to noise generated by its operation. To minimize the impact, noise-generating equipment will be enclosed (if needed) and periodic maintenance of equipment such as transformers will be conducted.

- *Impacts on people*

119. The presence of transmission line and substation may pose potential hazards such as electrocution, lightning strike, etc. due to accidental failure of power transmission. To ensure safety, transmission towers are equipped with danger boards, barbed wire, and galvanized groundwire for earthing purposes. MP Transco provides a budget for anticlimbing device for transmission towers at Rs 8,040 per location.

120. Aside from these measures, security and inspection personnel will be deployed to avoid vandalism of equipment and pilferage of cables which may cause accident and/or electrocution. Transmission systems are designed with protection system that shuts off during power overload or similar emergencies. Indian and international electrical standards will be complied with by MP Transco at all times. There will be regular monitoring and maintenance to ensure safety and integrity of power lines and substations.

121. After more than 20 years of global research, concerns on the potential risks of cancer from exposure to electric and magnetic field (EMF) from overhead transmission lines and substations continue. In the Philippines, the Bureau of Health Devices and Technology of the Department of Health measured on 19 April 2004 the strength of electric and magnetic field generated by a 138 kV double circuit transmission line and from transformers in the substations as follows:[41]

Type of Exposure	138 kV Transmission Line	International

[41]National Transmission Corporation, Negros-Panay Overhead Transmission Line and Substation Expansion Project, IEE Checklist of Cebu-Negros-Panay Interconnection Updating Project, Annex 8, September 2004.

	Centerline	Conductors	Commission on Non-Ionizing Radiation Protection (ICNRP) limit of exposure for the general public
Electric field, kV per meter	1.76	1.503	4.17
Magnetic field, milliGauss (mG)	0.813	0.823	833
	Substations		
	150 MVA transformer	**50 MVA transformer**	
Electric field, kV per meter	1.891	0.148	4.17
Magnetic field, mG	15.75	4.71	833

122. The National Grid Corporation of the Philippines measured the electric and magnetic field for their 230 kV Sucat-Araneta-Balintawak transmission line as 0.04 kV/m and 3.15 mG, respectively.[42] They also measured the 500 kV Tayabas-San Manuel-San Jose transmission line as 1.15 kV/m (electric field) and 6.04 mG. These results suggest that the EMF which may be generated by the 36 subprojects of MP Transco are not expected to exceed the limits set by the International Commission on Non-Ionizing Radiation Protection (ICNRP) which is 4.17 kV/m for electric field and 833 mG for magnetic field. Therefore, the substations and power transmission lines are not expected to pose health risks to the public. The substations will be fenced and security staff will be assigned to prevent unauthorized public access. Appropriate warning signs will be posted at designated areas. MP Transco will conduct information and education campaign to local people to enhance awareness on living safely near the substations (see **Table 4.5**). Spot measurements of EMF will be conducted to have a baseline data.

123. Working on elevated position during maintenance of power transmission lines may also pose occupational and safety risks to workers. To minimize risks of accidents, maintenance workers/linemen will be provided with safety clothing and other working gears for protection, provide training on safety and emergency preparedness, and implement a safety plan.

124. The operation of the 36 subprojects will create employment to local people. It is estimated that more than 200 positions will be created as a result of the project. Aside from employment, there will be a stable and reliable supply of power, and improved delivery of service.

4.3.3.2 Use of mineral oil for transformers

- *Impacts on land and water*

[42]National Grid Corporation of the Philippines. Electric and Magnetic Fields (EMF) Frequently Asked Question. Manila.

125. The use of transformers may cause potential accidental spillage that may contaminate land and water. The substations will have an oil-water separator and will have oil-containment structure/basin at the workshop areas.

- *Impacts on people*

126. Use and handling of mineral oil for transformers may pose occupational and health risks to workers due to exposure. Delivery and acceptance of mineral oil will be accompanied by material safety data sheets and/or be certified that it is polychlorinated biphenyl-free. Fire extinguishers will be posted at designated locations in the storage areas for mineral oil. Workers will be provided with training on emergency preparedness.

4.4 Information Disclosure, Consultation, and Participation

127. Initial consultations were done during the site visits on July 23-26, 2013 for transmission system improvement and a total of 48 persons were consulted (see **Figure 4.3**). Consultations were held at the 132 kV substation sites in Udaipura and Silwani. Concerns of local people were common and they include: (i) load shedding and lack of reliable and stable supply of power affecting their produce and livelihood, and (ii) timely compensation to farmers affected during construction of substations, erection of the transmission towers, and stringing of conductors.

Figure 4.3 Consultations at Silwani Substation

128. Local people are aware of the proposed project and are generally supportive due to expected benefits. Consultations with project stakeholders in varying degrees will continue throughout the life of the project. The proposed consultation plan during implementation is given in **Table 4.5**.

129. The draft IEE will be posted to the website of ADB as required by SPS 2009 and Public Communications Policy 2011. A project factsheet or a frequently asked questions flyer in Hindi will be made available to the public at the MP Transco-PMU field office. The flyer will include among others, the information on grievance redress mechanism. Aside from these public disclosure requirements, the Right to Information Act 2005 of GoI also provides for additional obligation to MP Transco to provide information about the project.

Table 4.5 Public Consultation Plan During Implementation

Project Activity	Approach for Consultation	Schedule
Detailed survey (i.e., walk-over and contractor)	Informal meetings at different spot along the transmission line route (approx. 20-30 km)	Pre-construction stage
Construction works	• Project brief and/or frequently asked questions (FAQs) in Hindi to be made publicly available in the MP Transco-PMU field office • Village or local informal meetings as needed	Construction Stage
Operation & Maintenance	• Flyers or information leaflets particularly on safety issues such as electric and magnetic field, maintenance of ROW, pilferage or theft of power cable, etc. • Press releases as and when needed • Response to public inquiries	Operation Stage

4.5 Grievance Redress Mechanism

130. **Current Scenario** MP Transco conducts "vigilance" through its cell which covers civil and electrical works only. There is no separate cell to address public grievance or complaint on environmental issues. Generally, public grievance is associated with land acquisition issues. In such a case, affected person(s) contacts the Revenue Department who will lodge the grievance on behalf of the affected person(s) to the Superintendent Engineer (SE) of MP Transco. The SE under Engineering & Construction Department reviews the complaint and resolves the issue.

131. To ensure that public grievance and/or complaint on environmental (and social) issues are addressed during the implementation of the transmission system improvement project, the PMU of MP Transco will establish a grievance redress mechanism (GRM).

132. **Goals** The GRM shall provide an accessible platform for receiving and facilitating resolution of affected person's grievances related to the project/ subproject. According to SPS 2009, the GRM will address concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to the affected persons at no costs and without retribution. GRM is normally incorporated in the compensation process due to land acquisition and temporary damages to crops and lands during construction but will also cover issues that may be raised on environmental issues such as increased level of dust and noise causing inconvenience to local people, traffic, or other relevant issues.

133. **Composition** The GRM will have a grievance redress committee (GRC) set up by MP Transco-PMU as soon as the project commence and will continue to function from construction to operation phase. The GRC will consist of representatives from the local *Panchayat* Head, a District Revenue Commissioner, representative from the EPC Contractor(s) only during

construction phase, designated staff of MP Transco-PMU on safeguards, Manager/Director of MP Transco-PMU, and a witness of the complainant/affected person. MP Transco-PMU will ensure that there is representation of women in the GRC.

134. **Responsibilities** The GRC is expected to: (i) resolve issues on land acquisition (if any), compensation to temporary damages to crops and plants, and other use of land such as borrow areas for transmission towers and substations; (ii) convene twice a month to review complaints lodged (if any), (iii) record the grievances and resolve the issues within a month (30 days) from the date the grievance was filed, (iv) report to the complainant(s) the status of grievance resolution and the decisions made.

135. **Procedures** Minor grievances on compensation or environmental issue during construction will be resolved onsite through the EPC Contractor(s) Project Site Engineer. As a formal process of grievance resolution, the procedure is given below and described in **Figure 4.3**.

(i) Affected persons (APs) will be informed in writing by MP Transco-PMU (or designated representative) of the damages and entitlements for compensation. If the APs are satisfied, compensation can be claimed from MP Transco-PMU through the EPC Contractor(s). If the APs are not satisfied, they can request for clarification from MP Transco-PMU. If the APs are not convinced with the outcome, they can file the grievance to the GRC with the help of MP Transco-PMU who will provide the written documentation.

(ii) The GRC will conduct a hearing of the grievance in the presence of the APs and will provide a decision within 15 days from the receipt of the complaint. Minutes of the meeting will be approved by MP Transco-PMU and provided to the APs including the decision made by the GRC. If the APs are satisfied with the GRC decision, they can claim the compensation from MP Transco-PMU and/or EPC Contractor(s).

(iii) If the issue(s) remains unresolved, the case will be referred by the GRC to the appropriate Court of Law for settlement.

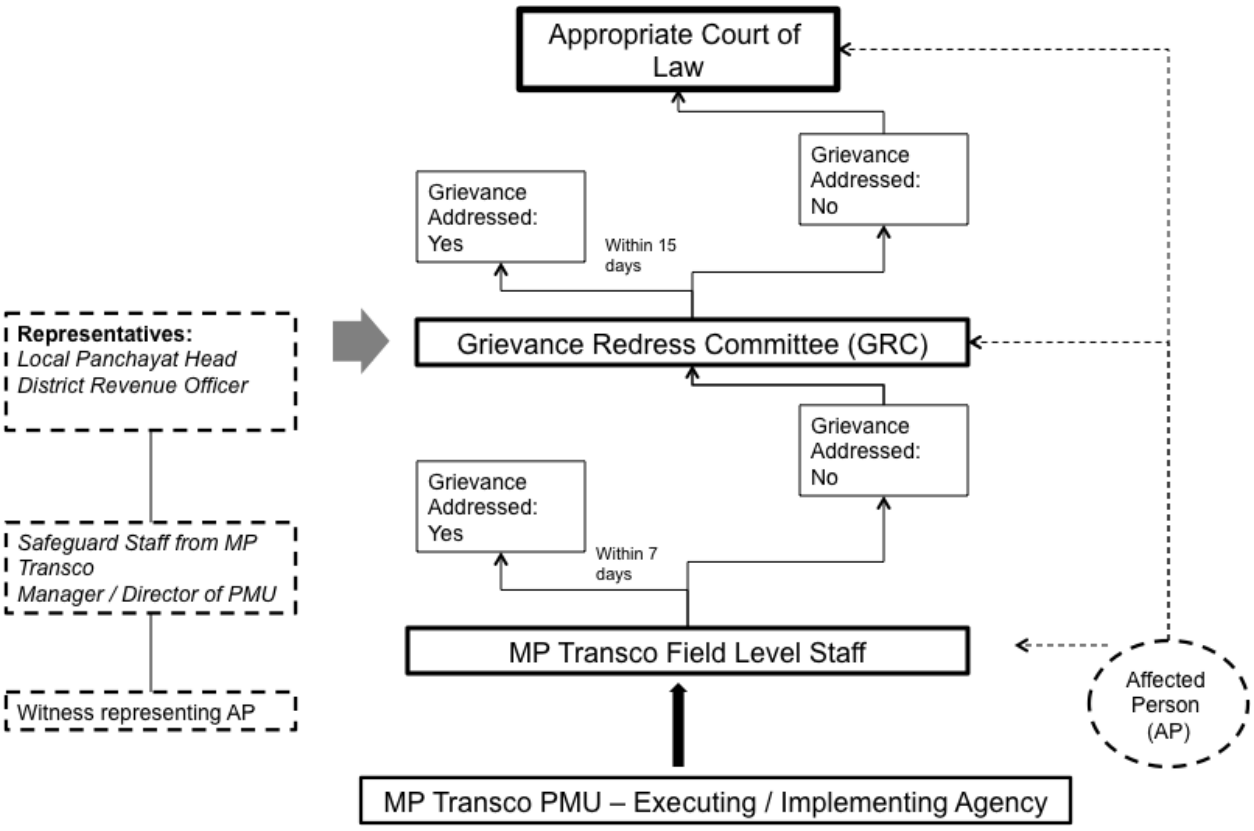


Figure 4.3 Process of Grievance Redress Mechanism at MP Transco

136. **Area of Jurisdiction** GRC shall be set up at the *Panchayat* level where subprojects are proposed.

137. **Record-keeping** Records shall be kept by the PMU of all grievances received including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, and final outcome. Documentation of the grievances filed and resolved will be summarized and included in the semi-annual monitoring reports submitted to ADB during construction stage and annually during operation stage.

138. **Disclosure of Information** MP Transco-PMU will inform the APs on grievance redress procedure, who to contact and when, where and how to file a grievance, time likely to be taken for redressal of minor and major grievances, etc. Grievances received and responses provided will be documented and provided to the APs during the process. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the field offices of MP Transco-PMU and offices of the concerned local *Panchayat* and District Revenue Office.

139. **Review of the Process** MP Transco-PMU will periodically review the implementation of the GRM and record information on the effectiveness of the mechanism, especially on the project‘s ability to prevent and address grievances.

140. **Cost of Implementation** Costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by MP Transco. The cost of implementation will be taken from the administration cost included in the total cost of the resettlement plan (RP) for the project. If the administration cost is not adequate, the budget will be taken from the contingency cost of the RP.

4.6 Environmental Management Plan

4.6.1 Mitigation

141. The environmental management plan (EMP) presents a summary of the environmental impacts associated with subprojects for power transmission system improvement including the mitigation measures (**Table 4.6**). The EMP will be updated before the start of civil works, and as needed, to accommodate any change in the condition of the site or alignment of the transmission line after the contractor survey, performance of EPC Contractor(s), and feedback from local people or other stakeholders.

4.6.2 Monitoring

142. During the construction stage, environmental monitoring will be a daily or weekly process to ensure that non-compliance to the EMP by the EPC Contractor(s) if any, will be avoided and/or immediately addressed. The results of monitoring will be submitted to ADB twice a year during construction and annually during operation as required by SPS 2009.

143. Monitoring and maintenance of the power transmission system during operation ensure the integrity and safety of the structures and components, thus, minimizing safety risks to the public and damage to properties. **Table 4.7** gives a summary of the environmental monitoring plan.

4.6.3 Implementation Arrangements

144. Currently, MP Transco has a PMU responsible for procurement, feasibility assessments, and bid planning. PMU staff are aware of safeguards issues and compliance but there is no staff designated to deal with these concerns.

145. During the implementation, MP Transco will have a PMU which will be responsible for project management and general supervision. Overall implementation of the EMP will be carried out under the supervision of the Head, MP Transco-PMU. An environmental staff (or a Consultant), who will be primarily responsible for ensuring that the EMP is properly implemented, will be recruited for the project prior to award of the civil works contract. He/she will coordinate and interact with MP Transco-PMU on compliance to ADB requirements, relevant government agencies and local authorities on permits (as needed), update and finalize the draft IEE, and will prepare environmental monitoring reports for submission to ADB at least twice a year during construction and annually during operation.

146. EPC Contractor(s) will be informed of their responsibility to comply with the EMP and the requirements of ADB. There are specific responsibilities for EMP compliance during

construction phase that will rest with the EPC Contractor(s) who will be monitored by the environment staff of the project.

Table 4.6 Environmental Management Plan

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
Planning and Pre-Construction Stage					
Preparation of feasibility study and detailed project report (DPR) • Location of substation, transmission and distribution lines • Choice of equipment and technology	• Land and vegetation	• Loss of agricultural land and crops • Loss of habitat and vegetation clearing • Land acquisition • Increase in soil erosion and impact to soil productivity	• Use of 13 criteria for site selection which include environmental factors to minimize potential impacts • Use of 17-question checklist/questionnaire in evaluating substation sites which aim at avoidance of land acquisition and environmental impacts • Substations are all on government land (32 sites for MP Transco) • No land acquisition required but transfers of ownership from the government to MP Transco • 1,800 km of transmission line will not traverse forest, sanctuary, or protected areas • Use of mineral oil such as Duralife Transformer Oil for transformers • Use of air insulated substations to avoid fugitive emissions of SF_6 (a potent GHG gas)	Included in the Project Costs *Associated costs of land transfers from the Government will be borne by MP Transco	MP Transco, District Commissioner Office
	• People	• Physical displacement of people and structures • Economic loss to people • Disturbance and inconvenience to people due to traffic, increased noise and dust levels, vibration • Interference to existing utilities			
	• Water	• Interference to local drainage • Water quality impacts due to erosion and/or sedimentation			
	• Air	• Increase dust and noise levels, and vibration • Emissions from heavy equipment machinery and construction vehicles			
Construction Stage					
Orientation for contractor and	• People	• Awareness of workers on the environmental requirements and their	• Conduct briefing of EPC Contractor(s) on EMP,	Included in the costs of EPC	EPC Contractor(s), MP Transco-PMU

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
workers		responsibility • Understanding of EPC Contractor(s) of their responsibility in implementing the EMP	records management, and reporting • Identify critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases such as HIV/AIDs • Conduct training/drills on emergency preparedness • Encourage workers to conduct exercises every day prior to start of work to keep fit	Contractor(s)	Environmental staff/consultant in PMU
Prepare construction management workplan	• People	• Avoid effects of EPC Contractor(s) unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Community and safety plan	Included in the costs of EPC Contractor(s)	EPC Contractor(s), MP Transco-PMU Environmental staff/consultant in PMU
	• Land		• Spoils disposal plan		
	• Air		• Noise and dust control plan		
	• Water		• Drainage and stormwater management plan		
	• Waste		• Materials management plan • Construction waste management plan		
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project • Dispute over transparency of hiring	• EPC Contractor(s) will be required to use local labour for manual work and eligible local workforce for clerical and office jobs	---	EPC Contractor(s), MP Transco-PMU Environmental staff/consultant in PMU
Presence of workers at construction sites	• People	• Increase in demand for services such as food, temporary housing, etc. • Create opportunities for small-scale business to provide services such as food, temporary housing, etc.	• None required	---	---

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
• Site preparation, vegetation and land clearing for substations and transmission line right-of-way (ROW) • Construction of substations, installation of required equipment at substations, erection of transmission towers and stringing of conductors	• People	• Dismantling of structure(s) and equipment from existing 220 kV substations (nine sites) • Dismantled equipment may be suspected or potentially-PCB contaminated	• Construction management plan will be strictly implemented • Use of proper safety clothes/equipment in dismantling structure(s) and equipment •	Included in the costs of EPC Contractor(s)	EPC Contractor(s), MP Transco-PMU Environmental staff/consultant in PMU
		• Potential safety risks to community	• Provide fence or barricade (as appropriate), sufficient lights, clear warning signs and danger signals, and take all precautions identified in the community and safety plan • Assign security personnel to prevent accidents, trespassing, and pilferage • EPC Contractor(s) to direct drivers to strictly follow road regulations		
		• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points • Construction vehicles to strictly follow road regulations • Implement temporary pedestrian and traffic management plan		
		• Potential health and safety risks to workers	• Provide sanitary facilities and wash areas • Provide safe drinking water and garbage bins		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Enforce good housekeeping at all times • Provide workers with hard hat, safety shoes and belts • Coordinate with nearest hospital for arrangements in case of accidents • Assign nurse or medical staff to make weekly rounds at substation sites • Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers		
	• Land and vegetation	• Erosion and localized flooding • Loss of habitat and some mature trees of economic value such as teak (e.g., 132 kV Silwani substation)	• Only minimal vegetation will be cleared since most of the substation sites are grassland/shrubland (e.g., Salamatpur, Belkheda, Teesgaon, Shayamgarh, Chhayan, Udaipura, Anandnagar, Intkhedi, Hoshangabad, Adampur, Kirnapur, Singhana, Kisanganj, etc.) • Landscaping/replanting of trees at subs-stations will be done after completion of construction works		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Compensation for temporary damages to crops/plants along the ROW and substations • Cut trees owned by the government will be sold and revenue turned over to Revenue Authority • Debris/dismantled structures/equipment will be disposed of in designated landfill and/or controlled dumpsites • Usable scrap materials from dismantling will be stored in warehouses of MP Transco in Jabalpur and Bhopal for resale/auction • Erosion-control measures will be provided (as needed) • Implement spoils disposal plan and construction waste management plan		
	• Water	• Generation of sewage from construction workers • Localized flooding • Increase turbidity in surface water near construction sites	• Avoidance of waterways in site selection • Provide sanitary facilities to workers and safe drinking water • Construction works will done during summer in areas potential for erosion and localized flooding • Implement drainage and stormwater management plan • Waterways were avoided in		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			selecting subproject sites		
	• Air	• Heavy equipment and construction vehicles may increase vehicular emissions • Transport of construction materials to constructions sites may increase dust level • Earthmoving works, excavations, and opened land areas for substations and towers may increase dust levels • Increase in noise level and vibration from excavation and heavy equipment and construction vehicles	• Construction vehicles will be maintained to minimize vehicular emissions • Enclose construction sites temporarily to contain dust dispersion • Warehouse for construction materials onsite will be provided to reduce trips of material delivery • EPC Contractor(s) will be required to maintain construction vehicles and heavy equipment machineries regularly to reduce emissions • Opened land areas or sources of dust will be sprayed with water (as needed) • Transport of dust-generating materials will be covered • Observance of low speed by vehicles to reduce noise • Noise-generating works will be done between 7AM and 7PM done at daytime as required by MPPCB (February 2013) • Construction sites will be covered with acoustic screens and machineries will be temporarily enclosed to control noise (MPPCB guidelines, February 2013)		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Require EPC Contractor(s) to maintain and tune-up construction vehicles to reduce noise and no blowing of horns • Observe/comply with traffic management plan		
Operation and Maintenance Stage					
Use of mineral oil for transformers	• Land • Water	• Accidental spillage that would contaminate land and water	• Provision of oil-water separator • Provide for oil containment structure	Included in the O & M costs of Project	MP Transco
	• People	• Occupational health risks to workers due to exposure	• Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free • Fire extinguishers readily available in storage areas for mineral oil		
Presence of substations, power transmission and distribution lines	• Land and vegetation	• Depreciation of land property values adjacent to substations and power transmission towers • Restrictions on height of plants/crops that will be allowed within the ROW to keep its integrity. • Lopping of trees and/or pruning along the ROW to maintain height restrictions.	• Availability of stable and reliable power will trigger economic development in the area • Restriction of height to ensure the required vertical spacing between the conductors and the vegetation is maintained for safety reasons. Height restrictions on vegetation will be: (i) 5.5 m for the 400 kV, (ii) 4.6 m for the 220 kV, and (iii) 4 m for the 132 kV. A budget for planting medicinal	---	---

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			plants along the ROW is allocated at Rs457,200 per hectare. • Pruning or lopping of trees ensure the integrity the transmission line and safety		
	• People	• Hazards such as electrocution, lightning strike, etc. due to accidental failure of power transmission and distribution lines	• Provide security and inspection personnel to avoid pilferage and vandalism of equipment and lines • Appropriate grounding and deactivation of live power lines during maintenance work • Designed with protection system that shuts off during power overload or similar emergencies • Maintain and comply with electrical standards • Regular monitoring and maintenance to ensure safety and integrity of power lines and substations • Conduct information and education campaign to local people to enhance awareness on safety practices of living near substations	Included in the O & M costs of Project	MP Transco
		• Accident working in elevated position	• Implement safety plan to reduce risks • Provision of safety belts and other working gears for protection	Included in the O & M costs of Project	MP Transco, DISCOM-C, DISCOM-E and DISCOM-W

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Conduct training to maintenance workers on safety		
		• Potential exposure to electric and magnetic fields (EMF)	• EMF levels expected to be way below the limits set by International Commission on Non-Ionizing Radiation Protection(ICNRP) which is 4.17 kV/m for electric field and 833 mG for magnetic field • Spot measurements of EMF to have baseline data • Substations will be fenced and security staff assigned to prevent unauthorized public access • Information and education campaign will be conducted to local people to create awareness on safety practices	Included in the O & M costs of Project	MP Transco
		• Generation of employment	• More than 200 positions will be created during the operation	---	MP Transco
	• Noise	• Disturbance to settlements near the substations	• Periodic maintenance of equipment such as transformers and capacitors to minimize noise generation • Provide enclosure of noise-generating equipment • Monitor ambient noise levels	Included in the O & M costs of Project	MP Transco

Table 4.7 Environmental Monitoring Plan

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction and Planning	Guaranteed noise level of equipment and machineries	Substation sites	Machinery and equipment specifications – compliance to ambient noise levels	Once	MP Transco-PMU
	Soil quality	Substation sites and transmission towers	Sampling and chemical analysis	Once	MP Transco-PMU
	Quality of transformer oil	Substations sites	Material Safety Data Sheet – compliance to IS:1866	Once	MP Transco-PMU
	Loss of terrestrial and aquatic habitat	Substation sites	Ocular inspection, transect survey	Once	MP Transco-PMU
	Proximity to water resources	Substation sites and towers	Ocular inspection, maps	Once	MP Transco-PMU
	Routes of migratory birds	Substation and towers	Ocular survey/observation, secondary data	Quarterly to capture seasonal variations	MP Transco-PMU
Construction	Local recruitment of workers and staff	Substations, transmission towers, stringing of conductors	Number of local workers and staff recruited	Monthly	MP Transco-PMU, EPC Contractor(s)
	Orientation of Contractor(s) and workers on issues like HIV/AIDS, compliance to EMP, etc.	Substations, transmission towers, stringing of conductors	Number of participants	Once before construction, and as needed	MP Transco-PMU, EPC Contractor(s)
	Spraying of water to opened land areas and before movement of construction vehicles	Substations and road easements affected by delivery of equipment and construction material; transmission tower sites (if needed); stringing of conductors	Ocular inspection/spot checks	• Weekly at road easements (or as needed) • Every day at substation sites during dry season	MP Transco-PMU, EPC Contractor(s)
	Solid waste management	Substations, workers' camps, stringing of conductors, transmission towers	Ocular inspection/spot checks	Every week	MP Transco-PMU, EPC Contractor(s)
	Danger and warning signs for safety of	Substations and road easements	Ocular inspection/spot	Once a month	MP Transco-PMU, EPC

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
	workers and the public	affected by delivery of equipment and construction material; transmission towers; stringing of conductors	checks		Contractor(s)
	Announcement to the public of works schedule	Substations; along the road easement affected by interconnections of distribution lines, transmission towers, and stringing of conductors	Work schedule log sheet	As needed	MP Transco-PMU, EPC Contractor(s)
	Erosion control measures such as silt traps	Substations, transmission towers	Ocular inspection	Once a month	MP Transco-PMU, EPC Contractor(s)
	Smoke belching construction vehicles	Substations, transmission towers, and stringing of conductors	Ocular inspection/spot checking	Weekly	MP Transco-PMU, EPC Contractor(s)
	Dust and noise level	Substations; along the road easement affected by interconnections of distribution lines, transmission towers, and stringing of conductors	Ocular inspection/spot checks	Twice a month	MP Transco-PMU, EPC Contractor(s)
	Housekeeping	Substations, transmission towers, workers' camps	Ocular inspection/spot checks	Weekly	MP Transco-PMU, EPC Contractor(s)
Operation	Failure of transmission towers and/or distribution lines	Along the alignment	Maintenance log sheet	Monthly	MP Transco
	Occupational health, and safety	Substations, transmission lines	Number of accidents and/or injuries	Semi-annually	MP Transco
	Tree planting, maintenance of green landscape	Substations	Ocular inspection	Quarterly	MP Transco
	Housekeeping	Substations	Spot checks	Monthly	MP Transco
	Collection of waste (i.e., oil, garbage,	Substations	O & M log sheet	Monthly	MP Transco

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
	etc.)				
	Bird collision/electrocution	Along the alignment	Spot checks/observation	Monthly	MP Transco
	Pilferage of cables	Along transmission and distribution lines	Ocular inspection; O&M log sheet (security operations)	Quarterly	MP Transco

4.7 Conclusion and Recommendation

147. Aside from best engineering practice and survey approaches in selecting the transmission lines, 13 criteria were considered and a checklist/questionnaire with 17 questions were included to minimize environmental impacts. For substations, one of the primary considerations in selecting the sites is avoidance of land acquisition.

148. All the subprojects for transmission system improvement are not located anywhere near the 9 national parks and 25 wildlife sanctuaries or the cultural/archeological excavation sites. The impacts that are associated during construction stage such as increased noise and dust level are temporary and of short duration. Approach roads in some substation sites such as in Adampur and Intkhedi will require upgrading to facilitate construction but this will also benefit local residents using the roads. Relevant Indian construction standards on the design, installation and maintenance of substations and transmission lines such as IS:5613 (1995) Part II, IS:4091-1967 and IS:3072 (1975) will be complied with. Mitigation measures and monitoring to minimize environmental impacts have been incorporated in the environmental management plan and monitoring plan. Environmental monitoring report will be submitted by MP Transco to ADB semi-annually during construction and annually during operation. An environmental staff/consultant will be recruited by MP Transco to provide technical support to MP Transco-PMU in addressing relevant environment issues and in complying the requirements of ADB. To ensure sustainability, a workshop/training on safeguards compliance will be part of capacity building provided by the project.

149. MP Transco conducts “vigilance” through its cell which covers civil and electrical works only and do not include grievance on environmental issues. To address this limitation, a grievance redress mechanism will be implemented as soon as the project commence. As part of this mechanism, a grievance redress committee will be created and MP Transco-PMU will ensure the representation of women in the members. The grievance redress committee will function throughout the life of the project.

150. Consultations of local people were done as part of preliminary surveys and environmental assessment in July 2013. There were concerns on the transparency and valuation of compensation to temporary damages for crops and plants during construction. Overall, local people are supportive of the project due to the expected long-term benefit of a reliable and stable power supply. Consultations will continue in varying degrees during construction and operation. Local people will be informed of the grievance redress mechanism through a flyer/project brief that will be made available in Hindi at the field office of MP Transco-PMU. The

draft IEE will be posted in the website of ADB as provided for by SPS 2009 and Public Communications Policy 2011. All the relevant permits required by GoI will be obtained by MP Transco prior to construction works.

5.0 POWER DISTRIBUTION SYSTEM IMPROVEMENT

5.1 Introduction

151. The power distribution system of MP operates at 33kV, 11kV and 0.4kV capacities and is owned and operated by three distribution companies (DISCOMs).[43] The DISCOMs were incorporated by GoMP on 31 May 2002 under the Companies Act 1956 with Gazette Notification on 31 May 2005. The DISCOMs began functioning independently on 1 June 2005. The distribution system is still in growth phase and currently needs strengthening to meet the growing demand in the various regions.

5.1.1 Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited (DISCOM-C)

152. DISCOM-C is responsible for operating the distribution and retail supply of electricity in the four commissionaires of MP namely Bhopal, Hoshangabad, Gwalior and Chambal. DISCOM-C is connected to the MP Transco transmission network through the 33 kV and 11 kV system but there are few interconnection points with the other DISCOMs.

153. There are about 2.7 million customers served by DISCOM-C spread over an area of 96,069 square km (km^2). Of these customers, about 75% are residential covering the urban and rural areas consuming an estimated 20% of energy, and 15% agricultural users consuming 43.8% of total energy.

5.1.2 Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Limited (DISCOM-E)

154. DISCOM-E operates the distribution system within Jabalpur, Sagar and Rewa. At present, it has about 3.2 million customers covering an area of 135,162 km^2. About 78% of their customers are residential both in the rural and urban areas with 32% energy consumption. Users in the agricultural sector represent about 13% but consume an estimated 24% of the total energy.

5.1.3 Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Limited (DISCOM-W)

155. DISCOM-W is responsible for operation and maintenance of the distribution system in the commissionaires of Indore and Ujjain. They currently serve about 3.75 million customers within an area of 77,021 km^2 in the rural and urban areas.

[43] Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company (DISCOM-C); Madhya Pradesh Poorva Kshetra Vidyut Vitaran Company (DISCOM-E); and Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company (DISCOM-W).

5.2 Project Description

156. Expansion of the distribution system is pivotal to meet the requirements of new power connections to households and increased consumption from existing customers driven by a rapid economic growth of the state.[44] Demand for electricity grew at 13.67% per annum during FY 2010-2012 and is predicted to grow over 11% per annum during FY 2013-2017. By 2017 transmission and distribution system should deliver about 7,000 MW of additional power to the customers.

157. On the supply side, the capacity additions are likely for both the state-owned utilities and the Independent Power Producers (IPPs) that have established in MP as a consequence of its successful IPP policy. MP will also have its share in the central sector generating stations. The capacity addition target is around 9,700 MW by FY 2018 to meet the growth in the future demand. MP is predicted to have generation surplus from FY 2014 onwards. The proposed project supports some selected distribution improvements included in DISCOMs' five year plans.

5.2.1 Components

158. The components of the distribution system improvement include the construction of new 33/11 kV substations, bifurcation of overloaded 33 kV feeders, additional/augmentation of power transformers, and installation of distribution transformers and capacitor banks.

159. About 2,225 circuit-km of 33 kV lines and 710 circuit-km of 11 kV lines are proposed to be constructed. A total of 149 new 33/11 kV sub stations are proposed to be constructed and another 328 existing 33/11 kV substations are to be upgraded. **Table 5.1**, **Table 5.2**, and **Table 5.3** present a summary of subprojects for DISCOM-C, DISCOM-E, and DISCOM-W, respectively.

Table 5.1 Summary of Subprojects, DISCOM-C

Description	Unit	P1-1	PI-2	PI-Total	PII-1	PII-2	PII-Total	Grand Total
Distribution line								
33 kV line on Panther DCSS	km	23	10	33	-	-	-	**33**
33 kV line on H Beam	km	98	90	188	-	-	-	**188**
33 kV line on PCC Pole	km	194	156	350	-	-	-	**350**
11 kV line on H BEAM	km	55	40	95	-	-	-	**95**
11 kV line on PCC Pole	km	180	107	287	-	-	-	**287**
33 kV Bays	Number	2	2	4	-	-	-	**4**
Addition of new substations								
33/11 kV substation with 5 MVA capacity	Number	49	30	79	-	-	-	**79**
Installation of capacitor banks in existing 33/11 kV substations								

[44] MP economy is growing at a faster rate compared to Indian economy since 2009. MP economy is predicted to grow at 10% in 2013 which is the highest amongst Indian states.

Capacitor Banks	Number	-	-	-	136	195	331	**331**

Note: PI-1 (Package I-Lot 1), PI-2 (Package I-Lot 2), PII-1 (Package II-Lot 1), PII-2 (Package II-Lot 2) based on procurement

Table 5.2 Summary of Subprojects, DISCOM-E

Description	Units	PI- 1	PII- 1	PII- 2	PII- 3	Total
Augmentation of capacity						
From 3.15 to 5 MVA	Number	103	-	-	-	**103**
from 5 MVA to 8 MVA	Number	45	-	-	-	**45**
Additional distribution transformers						
5 MVA	Number	12	-	-	-	**12**
8 MVA	Number	0	-	-	-	**0**
Addition of new substations						
33/11 kV substations	Number	-	16	3	11	**30**
Capacity	MVA	-	74.45	15	53.15	**142.6**
Distribution lines						
33 kV line double circuit single string on H Beam 13-m long	km	-	192	51	120	**363**
33 kV line on Pre-stressed Cement Concrete (PCC) Pole with dog conductor	km	-	502	106	470	**1,078**
11 kV line on PCC pole with rabbit conductor for interconnection	km	-	99	19	75	**193**

Note: PI-1 (Package I-Lot 1), PII-1 (Package II-Lot 1), PII-2 (Package II-Lot 2), and PII-3 (Package II-Lot 3) based on procurement

Table 5.3 Summary of Subprojects, DISCOM-W

Description	Unit	P I - 1	P I - 2	PI - Total	P II - 1	P II - 2	PII - Total	Total
Augmentation of Capacity								
From 3.15 MVA to 5 MVA	-	51	49	100	-	-	-	**100**
From 5 MVA to 8 MVA	Number	11	-	11	-	-	-	**11**
Additional 5 MVA	Number	27	30	57	-	-	-	**57**
Transformer capacity addition	MVA	262.35	240.65	503	-	-	-	**503**
Addition of new substations								
33/11 kV substations	Number	22	18	40	-	-	-	**40**
Capacity	MVA	110	90	200	-	-	-	**200**
Addition of distribution lines								
11 kV distribution line	km	186.75	153.5	340.25	-	-	-	**340.25**
33 kV distribution line	km	123.5	89.9	213.4	-	-	-	**213.4**
Additional feeders and distribution transformers								
33 kV	Number	29	28	57	-	-	-	**57**
Distribution transformer capacity	MVA	-	-	-	41.4	80.7	122.1	**122.1**

Note: PI-1 (Package I-Lot 1), PI-2 (Package I-Lot 2), PII-1 (Package II-Lot 1), PII-2 (Package II-Lot 2) based on procurement

5.2.2 Implementation Activities

160. Broadly, the implementation of transmission system improvements includes detailed and check survey, excavation, tower site leveling, backfilling (if needed), construction of substations, tower erection and assembly, stringing of conductors and earthwire, pre-commissioning and

commissioning. For the erection of transmission lines and construction of substation, the following GoI standards/codes shown in **Table 4.2** will be complied with by the DISCOMs:

Table 4.2 Relevant Construction Standards of the Government of India

GoI standards and/or codes	Title
IS:5613-1995 (Part-II)	Code of practice for design, installation and maintenance of overhead power lines. Section 1 - Designs. Section 2 - Installation and Maintenance
IS:269-1967	Ordinary rapid hardening and low heat Portland cement.
IS:456-2000	Code of practice for plain and reinforced concrete
IS:1786-1966	Cold twisted steel bars for concrete reinforcements
IS:4091-1967	Code of practice for design and construction of foundation for transmission line towers & poles
IS:3072-1975	Code of practice for the installation and maintenance of switchgear
IS: 3043-1987	Code of practice for earthing
IS: 1255-1983	Code of practice for the installation and maintenance of power cables • Cable sheaths and armour bonding to the earthing system
IS: 1866	Transformer insulation oil quality analysis • Circulation and filtering of oil, heating of oil, sampling and testing of oil • Inspection, storage, installation of transformers/reactors
IS: 7205-1974	Safety code for erection of structural steelworks

5.3 Analysis of Alternatives

161. During the planning stage and preliminary design, alternatives were considered in the selection of the substation sites and distribution line routes to ensure that they are economically and financially feasible, at the same time, potential environmental impacts are minimized. Similar to MP Transco, the following selection criteria guided the three DISCOMs (DISCOM-C, DISCOM-E, DISCOM-W):

(i) Availability of a suitable right of way (ROW) and access to site by overhead distribution circuits;
(ii) Location of existing distribution lines for potential interconnection;
(iii) Distance to all weather roads, accessibility of heavy equipment under all weather conditions and access roads to the site;
(iv) Site maintenance requirements, water supply and storage;
(v) Soil resistivity, drainage, and soil conditions;
(vi) Cost of earth removal, earth conditions and earth moving;
(vii) Atmospheric conditions and potential contamination from industry;
(viii) Available space for future expansion and current requirements;
(ix) Land ownership, avoidance of private land acquisition;

(x) Topographical features of the site, avoidance of flood plains, wetlands, forests and other environment-sensitive areas;
(xi) Consideration of public safety and concern, avoidance of schools, playgrounds, hospitals, and structures of worship;
(xii) Avoidance of waterways and existing utilities, railway, road crossings, etc.; and,
(xiii) Total costs including transmission and distribution lines with due consideration of environmental factors.

162. A questionnaire/checklist with 17 questions following the criteria above is used during site planning. Preliminary site assessments conducted by the DISCOMs are based on the interpretation of available relevant maps of the area (i.e., topographic maps, vegetation maps, land use, etc.) aided by existing satellite images, aerial photos, location of permanent wetlands, and other environmentally-sensitive areas, and walk-over survey.

163. From the outputs of preliminary evaluation, some proposed sites were dropped from further study due to close proximity to forest areas. For example, in DISCOM-C:

Substation sites (33/11 kV) such as Bagaspur, Chargoan, Danjipura, and Chakrampura were dropped to avoid potentially significant adverse environmental impacts due to location.

164. **Table 5.4** presents a comparison of the general situation in case of "with project" and "without project" scenario.

Table 5.4 "With Project" and "Without Project" Scenario

No.	Parameter	With Project Scenario	Without Project Scenario
1	Electricity	Major effect, improved voltage, less fluctuation, increased availability	No effect
	Environment		
2	Effect on protected, sensitive, or forest areas	No effect, avoids protected, sensitive or forest areas	No effect
3	Effect on endanger species	No effect, avoids protected, sensitive or forest areas	No effect
4	Tree cutting	Minor effect, shall comply with the environmental safeguards provision of the ADB, GoI national laws and regulations	No effect
5	Air emissions	Major effect; improvement because of reduced usage of diesel generators currently employed for water abstraction from surface / ground water sources for employing on agricultural lands	No effect
9	Water supply	Improved water accessibility for agriculture purposes	No effect
	Social		
10	Disturbances of people / communities	During construction phase, temporary impact	No issue
11	Effect of business	Construction activities may employ local populace generating economic and livelihood generation opportunities. .	No issue
12	Status of living	Improve; access to electricity will reduce domestic load for women such as for cooking purposes, etc.	No change
	Economic		
13	Economic development	Greater rate of economic development expected	Slow development

5.4 Anticipated Environmental Impacts and Mitigation Measures

165. The Ministry of Environment and Forests (MoEF) of GoI, in its notification in September 2006, has exempted transmission projects from environmental clearances due to the non-polluting nature of its activities.[45] However, forest clearance under the Forest Conservation Act 1980 will be necessary in the event the transmission line passes through forest areas.

166. One of the factors considered in selecting the best and optimum substation site and associated distribution line route is avoidance of potential significant environmental impacts. In power transmission projects, potential environmental impacts are confined in the right of way (ROW) while for substations, they are site specific.

167. Appropriate survey methods and good engineering practice have been used to select the best alignment but residual impacts associated with the project cannot be entirely avoided resulting from varying topographical locations that will be traversed by interconnecting distribution lines. An environmental management plan (EMP) and an environmental monitoring plan (EMoP) will help ensure that these residual impacts are mitigated and/or enhanced.

5.4.1 Pre-construction and Design Phase

5.4.1.1 Location of substations and transmission line routes

168. As discussed in Sect. 5.2 (Analysis of Alternatives), 13 criteria for site selection and a 17-question checklist/questionnaire guide the selection of distribution line routes and substations, among others, to avoid significant adverse environmental impacts. Distribution lines generally follow the road easement. There will be a total of 2,225 circuit-km (ct-km) for 33 kV lines and 710 ct-km for 11 kV lines for the DISCOMs.

169. There are nine national parks and 25 wildlife sanctuaries in MP. Based on these criteria and checklist, forest, cultural and archaeological sites, sanctuary, protected, and other ecologically-sensitive areas such as Ratapani Wildlife Sanctuary in Sehore and Raisen districts, Bandhavgarh National Park, Bhoj Wetland (known as the “Upper Lake”, a Ramsar site) were avoided.

170. Aside from the criteria and checklist used by the DISCOMs in selecting the subprojects, the walkover survey/transect, which involves setting up of temporary tracks, helps determine the type of vegetation, type of structures and settlements within the road easements, and natural physical features and public utilities that may be traversed by the interconnecting distribution line. Walkover surveys may cause short and temporary disturbance to local people within the ROW.

5.4.1.2 Choice of equipment and technology

[45] Notification in the Gazette of India, Extra-ordinary part II and section 3, subsection II, 14 September 2006).

171. All the 149 new 33/11 kV substations will be air insulated and not gas insulated. Air insulated substation (AIS) uses atmospheric air as the phase to ground insulation for the switchgear of the substation while gas insulated substation (GIS) uses sulfur hexafluouride (SF_6) gas. SF_6 has a dielectric strength higher than air and the phase to phase spacing is reduced resulting to a more compact substation that is particularly advantageous in an urban environment where space is expensive. However, SF_6 is a potent greenhouse gas (GHG) with a global warming potential of 23,900 times compared to CO_2. One of the disadvantages of the AIS substation is the overall size making it more attractive to locate in the rural areas and they are usually installed outdoor. Given the available government land in MP, the use of AIS will not be a major constraint.

5.4.1.3 Land acquisition for the substations

172. The substation sites of the DISCOMs are on government land so there is no need for land acquisition from private owners. Substation sites that were initially evaluated as technically suitable but located on private lands that would entail land acquisition, physical and economic displacement of local people were not considered.

5.4.2 Construction Phase

173. During this phase, some activities may include clearing of ROW, setting up of temporary access tracks, setting up of materials storage areas along the route and substation work sites, transport of material and equipment to the site, excavation for substations, installation of poles and conductor stringing. Each PMU of DISCOMs will ensure that the contract of the Engineering, Construction and Procurement (EPC) Contractor(s) will include the obligation to compensate for any temporary damage, loss or inconvenience as result of the project during the construction phase.

5.4.2.1 Prepare construction management plan

174. The construction management plan (CMP) will help in avoiding the unplanned activities of EPC Contractor(s) and will guide the smooth implementation of earth-moving works, civil and electrical works. The CMP will cover temporary pedestrian and traffic management, community and safety, spoils or muck disposal, noise and dust control, drainage and stormwater management, material management, and waste management. The CMP will also include designate sites/areas for monitoring such as workers facilities, work areas, and materials warehouse/storage.

5.4.2.2 Hiring of project staff and workers

175. The implementation of 149 new substations and 328 existing substations for upgrading will be opportunities for local employment. While this is beneficial, it may also be a cause of conflict due to migration of workers and dispute over transparency of hiring particularly if migrant workers are recruited over local people. The EPC Contractor(s) will be required to use local labour for manual work and eligible local workforce for technical and administrative jobs. DISCOMs-PMUs will monitor the compliance to priority of local hiring.

5.4.2.3 Orientation for EPC contractor(s) and workers

176. Each of the PMU of DISCOMs will conduct briefing and/or orientation for EPC Contractor(s) on the environmental management plan (EMP), grievance redress mechanism, consultation, and reporting. This will provide an understanding of their responsibility in implementing and compliance to the EMP as well as agreement on critical areas that needs monitoring. The briefing will also include strict compliance against child labour, bonded or forced labour, and awareness about socially transmitted disease such as HIV/AIDS to prevent potential incidence. Aside from relevant national and state labour regulations, ADB's core labour standards will provide guidance for compliance. EPC Contractor(s) will provide training/drills on emergency preparedness and exercises before start of work will be encouraged to maintain health and fitness.

5.4.2.4 Presence of workers at construction sites

177. The presence of workers and staff at the 149 new 33/11 kV substation construction sites and 328 existing substations for upgrading may increase demand for services such as housing, food, etc. This localized demand may be an opportunity for local people to have temporary small-scale business in providing services such as food, temporary lodging, etc. This will be a beneficial impact to local economy.

5.4.2.5 Site preparation and construction of substations

- *Impacts on land and vegetation*

178. Vegetation clearing may cause some loss of habitat. Most of the substation sites are on grassland/shrubland such as in Nayagaon, Samnapur and Tikhawan. No protected area, sanctuary or forest will be affected. Construction works will not be scheduled during harvest time to minimize damage to cash crops. The destruction and/or loss of habitat due to clearing and to stringing of conductors will naturally regenerate in about 2-3 years.

179. Earthmoving works in substation sites may cause potential erosion and localized flooding such as in Nayagaon with elevation lower than the street level. Adequate erosion control measures will be provided in areas located in sloping terrain (or as needed) and spoils disposal plan will be strictly implemented to prevent localized flooding.

180. Site preparation for 33/11 kV poles will be minimal earthworks compared to towers. Preparation for poles involves small-scale excavations and the excavated topsoil will be used for backfilling. For substations, wherever necessary, downhill slopes will be provided with revetments, retaining walls or sow soil binding grass around the sites to contain soil erosion. Landscaping/replanting/revegetation will be done as soon as earthworks are completed to stabilize the soil.

181. For distribution poles, only the exact amount of construction materials (i.e., sand, gravel, concrete, etc.) will be brought on-site to avoid stockpiling that may cause localized flooding during the monsoon season and to minimize any inconvenience to local people. At substation sites, adequate storage for materials needed for construction works will be provided.

182. Crops that may be affected or damaged during the installation of distribution poles and stringing of conductors will be compensated based on entitlements following the national laws and SPS 2009. Existing approach roads such as in Tikhawan and Nayagaon may require upgrading and/or rehabilitation to facilitate construction. This will benefit not only DISCOMs operations but local people as well who will use the roads.

- *Impacts on people*

183. There will be 328 existing substations that will be upgraded which may require dismantling of structures and equipment and/or installation of new transmission transformers. Workers assigned to dismantling works will be provided with proper safety clothes and protection gear/equipment to avoid accidents. Debris and scrap materials from dismantling activities will be transported to DISCOMs warehouses located in Bhopal, Indore and Jabalpur, where there are dedicated storage yards, for resale and auction to authorized dealers. Similarly, servicing and/used transformer oil (if any) will be disposed of/sold to Government-registered recyclers only as set forth by the Hazardous Waste Management and Handling Rules 2008. MP has a common treatment, storage and disposal facility located in Pitampur, Dhar District. EPC Contractor(s) will be required to observe and implement the construction waste management plan. PMUs of DISCOMs will monitor compliance.

184. The installation of distribution poles as well as stringing of conductors may potentially interfere with road crossings that may pose safety risks to the public and construction workers. To minimize the risks, adequate danger and clearly visible warning signs will be posted at designated sites while scaffoldings will be placed over road crossing points. EPC Contractor(s) will be required to instruct drivers of construction vehicles to strictly follow road regulations and to implement the temporary pedestrian and traffic management plan. Appropriate permits from the local authority will be obtained prior construction works. Security personnel will be assigned to prevent trespassing and accidents at the substation sites.

185. Local hiring will be given priority so workers can come home after work every day. However, if required, EPC Contractor(s) will provide construction camps with sanitary facilities, wash areas, safe drinking water, garbage bins, and designated security personnel. Designated staff will be provided with communication device to facilitate communication particularly during emergency.

186. EPC Contractor(s) will find the location of the nearest hospital and will make arrangements in case of accidents in the worksites. First aid treatment will be set up within the construction sites and field offices. Workers will be provided with hard hats, safety shoes, and safety belts while designated staff will be provided with communication devices. A health personnel (or a nurse) will be assigned by EPC Contractor(s) to visit the construction sites once a week to broadly check the sanitary conditions of the construction sites and overall health condition of workers to minimize outbreak of diseases. Good housekeeping will be enforced at all times and will be monitored by PMUs of DISCOMs. The Contractor(s) will comply with relevant safety measures required by law and best engineering practices.

- *Impacts on air quality, noise and vibration*

187. The use of heavy equipment and construction vehicles may increase vehicular emissions at and around the substation sites. Vehicular emissions, land clearing, earthmoving works and transport of construction materials may increase levels of suspended particulate matter affecting air quality. Opened and exposed land areas at the substation sites and distribution poles will be sprayed with water to suppress dust level particularly during the summer season. Construction sites for substations will be temporarily enclosed to contain dust dispersion. EPC Contractor(s) will be required to maintain construction vehicles regularly to minimize the contribution of vehicular emissions to poor air quality. Warehouse for construction materials will be provided onsite to reduce the trips of material delivery while construction vehicles transporting materials that generate dusts will be covered.

188. Aside from vehicular emissions, the use of heavy equipment, construction vehicles and civil works may increase the noise levels while excavation works at the substation sites may induce vibration. Increase in noise levels and potential vibration may inconvenience local people living at and around these sites. As required by MPPCB guidelines (February 2013), noise-generating activities will be scheduled between 7AM and 7PM while noise-generating machineries and construction areas will be covered with acoustic screens and/or temporary enclosures. Drivers will be required to observe low speed wherever necessary and no blowing of horns. EPC Contractor(s) will ensure that the traffic management plan as well as air quality and noise control plans are implemented. PMUs of DISCOMs will monitor compliance.

- *Impacts on water quality*

189. Presence of workers at construction sites will generate sewage that may affect water quality while earth moving works may cause localized flooding during monsoon season and in other low-lying areas. EPC Contractor(s) will provide workers with sanitary facilities and safe drinking water. The site selection of subprojects avoided waterways to minimize the costs of mitigating the associated environmental impacts. To avoid localized flooding, construction works will be scheduled during summer in areas potential to flooding and during the monsoon season, drainage and stormwater management plan will be implemented by EPC Contractor(s). PMUs of the DISCOMs will monitor compliance to these measures.

5.4.3 Operation Phase

5.4.3.1 Presence of distribution poles and substations

- *Impacts on land and vegetation*

190. The presence of substations and distribution poles may lower the real estate property values near or adjacent to these facilities. However, the availability of a stable and reliable power supply will attract and promote local economic development and thus, may actually enhance property values.

191. While no subproject is located near or adjacent to the 9 national parks and 25 wildlife sanctuaries, birds and other wildlife may be attracted to the presence of substations and distribution poles particularly migratory birds. Distribution lines are designed to have ground wire spacing and lightning arresters as safety features to generally protect the public (and birds). Spot checks/ocular inspection of wildlife crossing and bird electrocution (if any) will be

included as part of maintenance work along the distribution lines. Maintenance workers will be trained to create awareness on this monitoring.

- *Impacts on noise*

192. Substations may cause disturbance to settlements adjacent to it due to noise generated by its operation. To minimize the impact, noise-generating equipment will be enclosed (if needed) and periodic maintenance of equipment such as transformers will be conducted.

- *Impacts on people*

193. The presence of distribution lines, poles and substation may pose potential hazards such as electrocution, lightning strike, etc. due to accidental failure of power distribution transmission. To ensure safety, distribution line poles are equipped with galvanized groundwire for earthing purposes.

194. Aside from these measures, security and inspection personnel will be deployed to avoid vandalism of equipment and pilferage of cables which may cause accident and/or electrocution. Distribution line systems are designed with protection system that shuts off during power overload or similar emergencies. Indian and international electrical standards will be complied with by DISCOMs at all times. There will be regular monitoring and maintenance to ensure safety and integrity of power lines and substations.

195. After more than 20 years of global research, concerns on the potential risks of cancer from exposure to electric and magnetic field (EMF) from overhead transmission lines and substations continue. In the Philippines, the Bureau of Health Devices and Technology of the Department of Health measured on 19 April 2004 the strength of electric and magnetic field generated by a 138 kV double circuit transmission line and from transformers in the substations as follows:[46]

Type of exposure	Centreline on 132 kV line	Conductors of 132 kV line	Limit of exposure for the general public, stilupated by International Commission on Non-ionizing Radiation Protection (ICNRP)
Magnetic field, milliGauss (mG)	0.813	0.823	833
	150 MVA transformer	**50 MVA transformer**	
Electric field, kV per meter	1.891	0.148	4.17
Magnetic field, mG	15.75	4.71	833

196. The results shown above suggest that the EMF that may come from the 33/11 kV substation and distribution lines will not be expected to exceed the limits set by the International Commission on Non-Ionizing Radiation Protection (ICNRP) which is 4.17 kV/m for electric field and 833 mG for magnetic field. Therefore, the substations and power transmission lines are not

[46]National Transmission Corporation, Negros-Panay Overhead Transmission Line and Substation Expansion Project, IEE Checklist of Cebu-Negros-Panay Interconnection Updating Project, Annex 8, September 2004.

expected to pose health risks to the public. The substations will be fenced and security staff will be assigned to prevent unauthorized public access. Appropriate warning signs will be posted at designated areas. DISCOMs will conduct information and education campaign to local people to enhance awareness on living safely near the substations (see **Table 4.5**).

197. Working on elevated position during maintenance of distribution lines may also pose occupational and safety risks to workers. To minimize risks of accidents, maintenance workers/linemen will be provided with safety clothing and other working gears for protection, provide training on safety and emergency preparedness, and implement a safety plan.

198. The operation of the 149 new 33/11 kV substations will create employment to local people. Aside from employment, there will be a stable and reliable supply of power, and improved delivery of service.

5.4.3.2 Use of mineral oil for transformers

- *Impacts on land and water*

199. The use of transformers may cause potential accidental spillage that may contaminate land and water. The substations will have an oil-water separator and will have oil-containment structure/basin at the workshop areas.

- *Impacts on people*

200. Use and handling of mineral oil for transformers may pose occupational and health risks to workers due to exposure. Delivery and acceptance of mineral oil will be accompanied by material safety data sheets and/or be certified that it is polychlorinated biphenyl-free. Fire extinguishers will be posted at designated locations in the storage areas for mineral oil. Workers will be provided with training on emergency preparedness.

5.5 Information Disclosure, Consultation, and Participation

201. Initial consultations were done during the site visits on July 23-26, 2013 and a total of 48 persons were consulted. Consultations were held at the 33/11 kV substation sites in Tikhawan, Samnapur, and Nayagaon (Maheshwari). Concerns of local people were common and they include: (i) load shedding and lack of reliable and stable supply of power affecting their produce and livelihood, and (ii) timely compensation to farmers affected during construction of substations, erection of the transmission towers, and stringing of the conductors.

202. Local people are aware of the proposed project and are generally supportive due to expected benefits. Consultations with project stakeholders in varying degrees will continue throughout the life of the project. The proposed consultation plan during implementation is given in **Table 5.5**.

203. This draft IEE will be posted to the websites of ADB as required by SPS 2009 and Public Communications Policy 2011. A project factsheet or a frequently asked questions flyer in Hindi will be made available at the field office of the PMUs of DISCOM-C, DISCOM-E, and DISCOM-

W. Aside from this public disclosure requirement, the Right to Information Act 2005 of GoI requires the DISCOMs to provide information to the public about the project.

Table 5.5 Public Consultation Plan During Implementation

Project Activity	Approach for Consultation	Schedule
Detailed survey (i.e., walk-over and contractor)	Informal meetings at different spot along the transmission line route (approx. 20-30 km)	Pre-construction stage
Construction works	• Project brief and/or frequently asked questions (FAQs) in Hindi to be made publicly available in DISCOMs PMU field offices • Village or local informal meetings as needed	Construction Stage
Operation & Maintenance	• Flyers or information leaflets particularly on safety issues such as electric and magnetic field, maintenance of ROW, pilferage or theft of power cable, etc. • Press releases as and when needed • Response to public inquiries	Operation Stage

5.6 Grievance Redress Mechanism

204. **Current Scenario:** The DISCOMs have their own process of handling complaints/grievance from their customers about the quality of delivery service. DISCOM-C has a grievance redressal forum online[47] and they also operate a Vigilance Cell for issues pertaining to high electricity bills, fallen lines, theft, or disrupted electricity, etc. The Vigilance Cell does not include a system or process for receiving complaints or grievances that may be attributed to social or environmental issues. As well, DISCOM–E and DISCOM-W have an online complaint logging system and a Vigilance Cell for the same issues which do not include safeguards issues on project implementation. In case the issue is related to land, the Revenue Department of MP will be in charge of filing the complaint on behalf of the affected person(s) and submit the complaint to the Operations & Maintenance of the DISCOM. To address the limitation, the PMUs of the DISCOMs will establish a grievance redress mechanism (GRM) to handle complaints and/or grievances on safeguards issues associated with the implementation of the subprojects of DISCOMs.

205. **Goals:** GRM shall provide an accessible platform for receiving and facilitating resolution of affected person's grievances related to the project/ subproject. According to SPS 2009, the GRM will address concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to the affected

[47] http://www.mpcz.co.in/portal/Bhopal_home.portal?_nfpb=true&_pageLabel=custCentre_Grievance_bpl

persons at no costs and without retribution. GRM is normally incorporated in the compensation process due to land acquisition and temporary damages to crops and lands during construction but will also cover issues that may be raised on environmental issues such as increased level of dust and noise causing inconvenience to local people, traffic, or other relevant issues.

206. **Composition:** The GRM will have a grievance redress committee (GRC) set up by each PMU in DISCOM-C, DISCOM-E, and DISCOM-W as soon as the project commence and will continue to function from construction to operation phase. The GRC will consist of representatives from the local *Panchayat* Head, a District Revenue Commissioner, representative from the EPC Contractor(s) only during construction phase, designated staff on safeguards in the PMU of each DISCOM, Manager/Director of each PMU in DISCOMs, and a witness of the complainant/affected person. PMU in each of the three DISCOMs will ensure the representation of women in the GRC.

207. **Responsibilities:** The GRC is expected to: (i) resolve issues on land acquisition (if any), compensation to temporary damages to crops and plants, and other use of land such as borrow areas for transmission towers and substations; (ii) convene twice a month to review complaints lodged (if any), (iii) record the grievances and resolve the issues within a month (30 days) from the date the grievance was filed, (iv) report to the complainant(s) the status of grievance resolution and the decisions made.

208. **Procedures:** Minor grievances on compensation or environmental issue during construction will be resolved onsite through the EPC Contractor(s) Project Site Engineer. As a formal process of grievance resolution, the procedure is given below and described in **Figure 5.1**.

(i) Affected persons (APs) will be informed in writing by DISCOM-PMU (or designated representative) of the damages and entitlements for compensation. If the APs are satisfied, compensation can be claimed from DISCOM-PMU through the EPC Contractor(s). If the APs are not satisfied, they can request for clarification from DISCOM-PMU. If the APs are not convinced with the outcome, they can file the grievance to the GRC with the help of the DISCOM-PMU who will provide the written documentation.
(ii) The GRC will conduct a hearing of the grievance in the presence of the APs and will provide a decision within 15 days from the receipt of the complaint. Minutes of the meeting will be approved by the DISCOM-PMU and provided to the APs including the decision made by the GRC. If the APs are satisfied with the GRC decision, they can claim the compensation from the DISCOM-PMU and/or EPC Contractor(s).
(iii) If the issue(s) remains unresolved, the case will be referred by the GRC to the appropriate Court of Law for settlement.

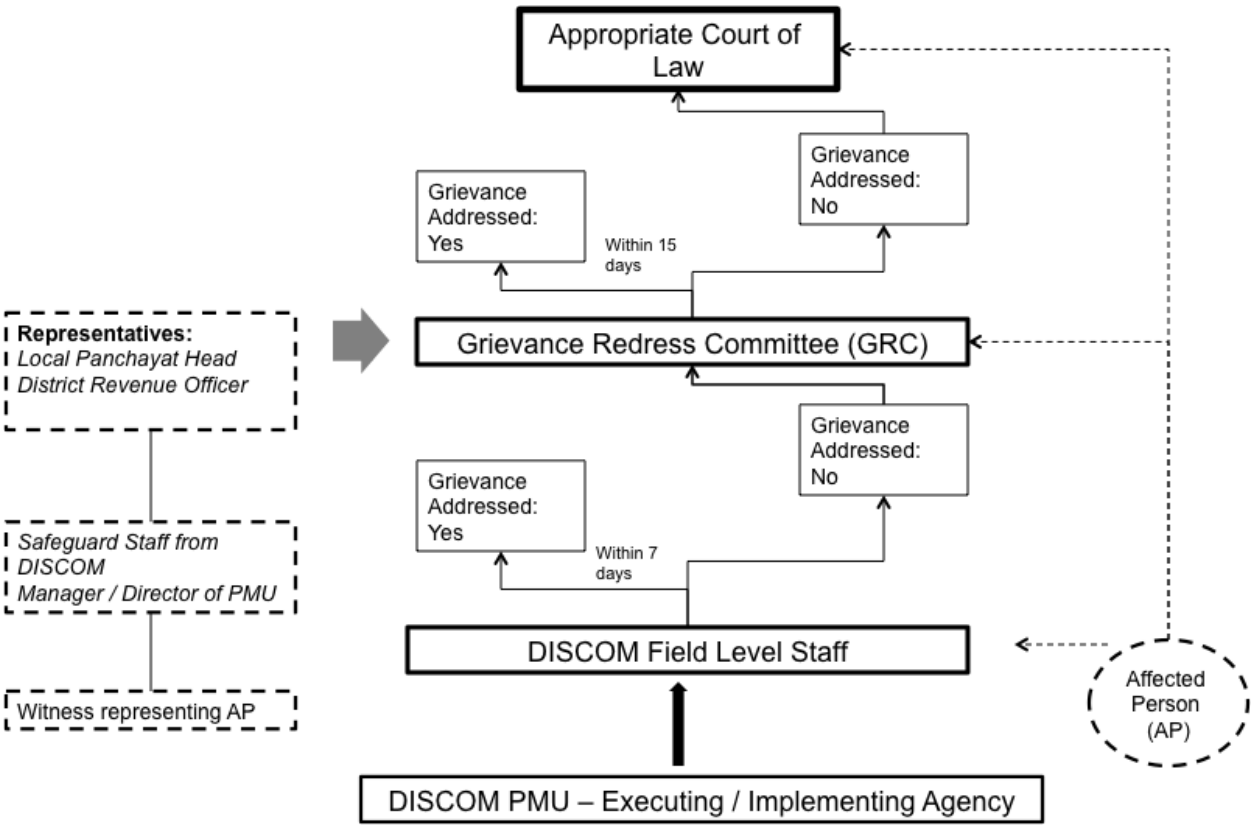


Figure 5.1 Process for Grievance Redress Mechanism in the DISCOM

209. **Area of Jurisdiction:** GRC shall be set up at the *Panchayat* level where subprojects are proposed.

210. **Record-keeping:** Records shall be kept by the DISCOM-PMU of all grievances received including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, and final outcome. Documentation of the grievances filed and resolved will be summarized and included in the semi-annual monitoring reports submitted to ADB during construction stage and annually during operation stage.

211. **Disclosure of Information:** DISCOM-PMU will inform the APs on grievance redress procedure, who to contact and when, where and how to file a grievance, time likely to be taken for redressal of minor and major grievances, etc. Grievances received and responses provided will be documented and provided to the APs during the process. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the field offices of DISCOM-PMU and offices of the concerned local *Panchayat* and District Revenue Office (if required).

212. **Review of the Process:** Each DISCOM-PMU will periodically review the implementation of the GRM and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances.

213. **Cost of Implementation:** Costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by DISCOM-PMU. The cost of implementation will be taken from the administration cost included in the total cost of the resettlement plan (RP) for the project. If the administration cost is not adequate, the budget will be taken from the contingency cost of the RP.

5.7 Environmental Management Plan

5.7.1 Mitigation

214. The mitigation measures for the corresponding environmental impacts identified are presented in **Table 5.6.** The environmental management plan (EMP) will be updated before the start of civil works, and as needed, to cover any change in the condition of the site or alignment of the transmission line after the contractor/check survey, performance of EPC Contractor(s), and feedback from local people or other stakeholders (if any).

5.7.2 Monitoring

215. During the construction stage, environmental monitoring will be a daily or weekly process to ensure that non-compliance to the EMP by the EPC Contractor(s) if any will be avoided and/or immediately addressed.

216. Monitoring and maintenance of the power transmission system during operation ensure the integrity and safety of the structures and components, thus, minimizing safety risks to the public and damage to properties. **Table 5.7** gives a summary of the environmental monitoring plan.

5.7.3 Implementation Arrangements

217. Project Management and general supervision of project implementation will be done by DISCOM-PMU. The overall implementation of the EMP will be carried out under the supervision of the Head, DISCOM-PMU. An environmental staff (or a Consultant), who will be primarily responsible for ensuring that the EMP is properly implemented, will be recruited for the project prior to award of the civil works contract. He/she will coordinate and interact with the DISCOM-PMU on compliance to ADB requirements, relevant government agencies and local authorities on clearances (as needed), update and finalize the draft IEE, and will prepare environmental monitoring reports for submission to ADB at least twice a year during construction and annually during operation phase.

218. EPC Contractor(s) will be informed of their responsibility to comply with the EMP and the requirements of ADB. There are specific responsibilities for EMP compliance during construction phase that will rest with the Contractor who will be monitored by the environmental staff of the project.

Table 5.6 Environmental Management Plan

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
Planning and Pre-Construction Stage					
Preparation of feasibility study and detailed project report (DPR) • Location of substation, transmission and distribution lines • Choice of equipment and technology	• Land and vegetation	• Loss of agricultural land and crops • Loss of habitat and vegetation clearing • Land acquisition • Increase in soil erosion and impact to soil productivity	• Use of 13 criteria for site selection which include environmental factors to minimize potential impacts • Use of 17-question checklist/questionnaire in evaluating substation sites which aim at avoidance of land acquisition and environmental impacts • Substations are all on government land (149 sites for the three DISCOMs) • No land acquisition required but transfers of ownership from the government to DISCOM-C, DISCOM-E, and DISCOM-W • 2,225 km of 33 kV distribution line and 710 km of 11 kV distribution line will not traverse forest, sanctuary, or protected areas • Use of mineral oil such as Duralife Transformer Oil for transformers • Use of air insulated substations to avoid fugitive emissions of SF_6 (a potent GHG gas)	Included in the Project Costs *Associated costs of land transfers from the Government will be borne by DISCOM-C, DISCOM-E, and DISCOM-W	DISCOM-C, DISCOM-E, and DISCOM-W, District Commissioner Office
	• People	• Physical displacement of people and structures • Economic loss to people • Disturbance and inconvenience to people due to traffic, increased noise and dust levels, vibration • Interference to existing utilities			
	• Water	• Interference to local drainage • Water quality impacts due to erosion and/or sedimentation			
	• Air	• Increase dust and noise levels, and vibration • Emissions from heavy equipment machinery and construction vehicles			

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
Construction Stage					
Orientation for contractor and workers	• People	• Awareness of workers on the environmental requirements and their responsibility • Understanding of EPC Contractor(s) of their responsibility in implementing the EMP	• Conduct briefing of EPC Contractor(s) on EMP, records management, and reporting • Identify critical areas to be monitored and the required mitigation measures • Create awareness of sexually-transmitted diseases such as HIV/AIDs	Included in the costs of EPC Contractor(s)	EPC Contractor(s), PMUs of DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
Prepare construction management workplan	• People • Land • Air • Water • Waste	• Avoid effects of EPC Contractor(s) unplanned activities • Smooth work implementation	• Temporary pedestrian and traffic management plan • Community and safety plan • Spoils disposal plan • Noise and dust control plan • Drainage and stormwater management plan • Materials management plan • Construction waste management plan	Included in the costs of EPC Contractor(s)	EPC Contractor(s), PMUs of DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
Hiring of project staff and workers	• People	• Conflict due to potential workers' migration • Lack of local support to the project • Dispute over transparency of hiring	• EPC Contractor(s) will be required to use local labour for manual work and eligible local workforce for clerical and office jobs	---	EPC Contractor(s), PMUs of DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
Presence of workers at construction sites	• People	• Increase in demand for services such as food, temporary housing, etc. • Create opportunities for small-scale business to provide services such as food, temporary housing, etc.	• None required	---	---

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
• Site preparation, vegetation and land clearing for substations and transmission line right-of-way (ROW) • Construction of substations, installation of required equipment at substations, erection of transmission towers and stringing of conductors	• People	• Dismantling of some structure(s) and equipment from existing 33/11 kV substations (328 sites for the DISCOMs) • Dismantled equipment may be suspected or potentially-PCB contaminated	• Construction management plan will be strictly implemented • Use of proper safety clothes/equipment in dismantling structure(s) and equipment • Compensation for temporary damages to crops/plants along the ROW and substations • Cut trees owned by the government will be sold and revenue turned over to Revenue Authority	Included in the costs of EPC Contractor(s)	EPC Contractor(s), PMUs of DISCOM-C, DISCOM-E and DISCOM-W Environmental staff/consultant in PMU
		• Potential safety risks to community	• Provide fence or barricade (as appropriate), sufficient lights, clear warning signs and danger signals, and take all precautions identified in the community and safety plan • Assign security personnel to prevent accidents, trespassing, and pilferage • EPC Contractor(s) to direct drivers to strictly follow road regulations		
		• Interference with road crossings	• Danger and clearly visible warning signs will be posted at designated sites • Scaffoldings will be placed over road crossing points • Construction vehicles to strictly follow road regulations		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Implement temporary pedestrian and traffic management plan		
		• Potential health and safety risks to workers	• Provide sanitary facilities and wash areas • Provide safe drinking water and garbage bins • Enforce good housekeeping at all times • Provide workers with hard hat, safety shoes and belts • Coordinate with nearest hospital for arrangements in case of accidents • Assign nurse or medical staff to make weekly rounds at substation sites • Set up first aid treatment within construction sites and field office • Observance and compliance with relevant safety measures required by law and best engineering practices • Provide communication devices to designated workers		
	• Land and vegetation	• Erosion and localized flooding (e.g., 33/11 kV Nayagaon substation) • Loss of habitat and some shrubs	• Only minimal vegetation will be cleared since most of the substation sites are grassland/shrubland (e.g., Samnapur, Nayagaon, etc.) • Landscaping/replanting of trees at subs-stations will be		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			done after completion of construction works • Debris/dismantled structures/equipment will be disposed of in designated landfill and/or controlled dumpsites • Usable scrap materials from dismantling will be stored in warehouses of DISCOM-C in Bhopal, DISCOM-E in Jabalpur and DISCOM-W in Indore for resale/auction • Erosion-control measures will be provided (as needed) • Implement spoils disposal plan and construction waste management plan		
	• Water	• Generation of sewage from construction workers • Localized flooding • Increase turbidity in surface water near construction sites	• Avoidance of waterways in site selection • Provide sanitary facilities to workers and safe drinking water • Construction works will done during summer in areas potential for erosion and localized flooding • Implement drainage and stormwater management plan • Waterways were avoided in selecting subproject sites		
	• Air	• Heavy equipment and construction vehicles may increase vehicular emissions • Transport of construction materials to	• Construction vehicles will be maintained to minimize vehicular emissions • Enclose construction sites		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
		constructions sites may increase dust level • Earthmoving works, excavations, and opened land areas for substations and towers may increase dust levels • Increase in noise level and vibration from excavation and heavy equipment and construction vehicles	temporarily to contain dust dispersion • Warehouse for construction materials onsite will be provided to reduce trips of material delivery • EPC Contractor(s) will be required to maintain construction vehicles and heavy equipment machineries regularly to reduce emissions • Opened land areas or sources of dust will be sprayed with water (as needed) • Transport of dust-generating materials will be covered • Observance of low speed by vehicles to reduce noise • Noise-generating works will be done between 7AM and 7PM done at daytime as required by MPPCB (February 2013) • Construction sites will be covered with acoustic screens and machineries will be temporarily enclosed to control noise (MPPCB guidelines, February 2013) • Require EPC Contractor(s) to maintain and tune-up construction vehicles to reduce noise and no blowing of horns		

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			• Observe/comply with traffic management plan		
Operation and Maintenance Stage					
Use of mineral oil for transformers	• Land • Water	• Accidental spillage that would contaminate land and water	• Provision of oil-water separator • Provide for oil containment structure	Included in the O & M costs of Project	DISCOM-C, DISCOM-E and DISCOM-W
	• People	• Occupational health risks to workers due to exposure	• Acceptance of mineral oil should be accompanied with Material Data Safety Sheets and/or be certified that it is PCB-free • Fire extinguishers readily available in storage areas for mineral oil		
Presence of substations and distribution lines	• Land	• Depreciation of land property values adjacent to substations and power distribution lines	• Availability of stable and reliable power will trigger economic development in the area	---	---
	• People	• Hazards such as electrocution, lightning strike, etc. due to accidental failure of power distribution lines	• Provide security and inspection personnel to avoid pilferage and vandalism of equipment and lines • Appropriate grounding and deactivation of live distribution lines during maintenance work • Designed with protection system that shuts off during power overload or similar emergencies • Maintain and comply with electrical standards • Distribution lines entering	Included in the O & M costs of Project	DISCOM-C, DISCOM-E and DISCOM-W

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
			and leaving the substations are insulated (or covered) to minimize impacts • Regular monitoring and maintenance to ensure safety and integrity of power lines and substations • Conduct information and education campaign to local people to enhance awareness on safety practices of living near substations		
		• Accident working in elevated position	• Implement safety plan to reduce risks • Provision of safety belts and other working gears for protection	Included in the O & M costs of Project	DISCOM-C, DISCOM-E and DISCOM-W
		• Potential exposure to electric and magnetic fields (EMF)	• EMF levels expected to be way below the limits set by International Commission on Non-Ionizing Radiation Protection(ICNRP) which is 4.17 kV/m for electric field and 833 mG for magnetic field • Spot measurements of EMF • Substations will be fenced and security staff assigned to prevent unauthorized public access • Information and education campaign will be conducted to local people to create awareness on safety practices	Included in the O & M costs of Project	DISCOM-C, DISCOM-E and DISCOM-W

Project Activity	Environmental Component Likely to be Affected	Description of Potential Environmental Impact	Mitigation/Enhancement Measures	Estimated Cost	Responsible Unit
		• Generation of employment	• More than 200 positions will be created during the operation	---	DISCOM-C, DISCOM-E and DISCOM-W
	• Noise	• Disturbance to settlements near the substations	• Periodic maintenance of equipment such as transformers and capacitors to minimize noise generation • Provide enclosure of noise-generating equipment • Monitor ambient noise levels	Included in the O & M costs of Project	DISCOM-C, DISCOM-E and DISCOM-W

Table 5.7 Environmental Monitoring Plan

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
Pre-Construction and Planning	Guaranteed noise level of equipment and machineries	Substation sites	Machinery and equipment specifications – compliance to ambient noise levels	Once	PMUs of DISCOM-C, DISCOM-E and DISCOM-W
	Soil quality	Substation sites and distribution poles	Sampling and chemical analysis	Once	PMUs of DISCOM-C, DISCOM-E and DISCOM-W
	Quality of transformer oil	Substations sites	Material Safety Data Sheet – compliance to IS:1866	Once	PMUs of DISCOM-C, DISCOM-E and DISCOM-W
	Loss of terrestrial and aquatic habitat	Substation sites	Ocular inspection, transect survey	Once	PMUs of DISCOM-C, DISCOM-E and DISCOM-W
	Proximity to water resources	Substation sites and distribution poles	Ocular inspection, maps	Once	PMUs of DISCOM-C, DISCOM-E and DISCOM-W
	Routes of migratory birds	Substation sites and distribution poles	Ocular survey/observation, secondary data	Quarterly to capture seasonal variations	PMUs of DISCOM-C, DISCOM-E and DISCOM-W
Construction	Local recruitment of workers and staff	Substations, distribution poles, stringing of conductors	Number of local workers and staff recruited	Monthly	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Orientation of Contractor(s) and workers on issues like HIV/AIDS, compliance to EMP, etc.	Substations, transmission towers, stringing of conductors	Number of participants	Once before construction, and as needed	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Spraying of water to opened land areas and before movement of construction vehicles	Substations and road easements affected by delivery of equipment and construction material; distribution poles (if needed); stringing of conductors	Ocular inspection/spot checks	• Weekly at road easements (or as needed) • Every day at substation sites during dry season	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Solid waste management	Substations, workers' camps,	Ocular inspection/spot	Every week	PMUs of DISCOM-C,

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
		stringing of conductors, distribution poles	checks		DISCOM-E and DISCOM-W EPC Contractor(s)
	Danger and warning signs for safety of workers and the public	Substations and road easements affected by delivery of equipment and construction material; distribution poles; stringing of conductors	Ocular inspection/spot checks	Once a month	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Announcement to the public of works schedule	Substations; along the road easement affected by interconnections of distribution lines, distribution poles, and stringing of conductors	Work schedule log sheet	As needed	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Erosion control measures such as silt traps	Substations, distribution poles	Ocular inspection	Once a month	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Smoke belching construction vehicles	Substations, distribution poles, stringing of conductors	Ocular inspection/spot checking	Weekly	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Dust and noise level	Substations; along the road easement affected by interconnections of distribution lines, distribution poles, and stringing of conductors	Ocular inspection/spot checks	Twice a month	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)
	Housekeeping	Substations, distribution poles, workers' camps	Ocular inspection/spot checks	Weekly	PMUs of DISCOM-C, DISCOM-E and DISCOM-W EPC Contractor(s)

Project Stage	Parameter/Indicator	Location	Method of Measurement	Frequency	Responsibility (Implementation and Supervision)
Operation	Failure of distribution lines	Along the alignment	Maintenance log sheet	Monthly	DISCOM-C, DISCOM-E, and DISCOM-W
	Occupational health, and safety	Substations, distribution linew	Number of accidents and/or injuries	Semi-annually	DISCOM-C, DISCOM-E, and DISCOM-W
	Tree planting, maintenance of green landscape	Substations	Ocular inspection	Quarterly	DISCOM-C, DISCOM-E, and DISCOM-W
	Housekeeping	Substations	Spot checks	Monthly	DISCOM-C, DISCOM-E, and DISCOM-W
	Collection of waste (i.e., oil, garbage, etc.)	Substations	O & M log sheet	Monthly	DISCOM-C, DISCOM-E, and DISCOM-W
	Pilferage of cables	Along distribution lines	Ocular inspection; O&M log sheet (security operations)	Quarterly	DISCOM-C, DISCOM-E, and DISCOM-W

5.8 Conclusion and Recommendation

219. One of the primary considerations in selecting the sites for the new 33/11 kV substation (149 sites) is avoidance of land acquisition and potential adverse environmental impacts. All the sites are not located within or near areas that are declared protected by GoI such as the nine national parks and 25 sanctuaries or the cultural/archeological excavation sites of national importance. The upgrading and/or augmentation of the existing 33/11 kV substations (328 sites) will mainly involve additional distribution transformers and capacitor banks. Transformers do not involve polychlorinated biphenyls (PCBs). Appendix 5 of ADB's SPS 2009 includes the use of PCBs in the prohibited investment activities list. The 33 kV (2,225 circuit-km) and 11 kV (710 circuit km) distribution lines will follow the road easements and will not incur major disturbance during the installation of poles and stringing of conductors.

220. The subprojects included by the DISCOMs are not expected to cause significant adverse environmental impacts during construction and operation. Impacts associated with construction phase can be easily mitigated by proper planning and best practices in construction engineering. Appropriate construction standards issued by GoI for the design, installation and maintenance of substations and distribution lines such as IS:5613 (1995) Part II, IS:4091-1967 and IS:3072 (1975) will be complied. Measures and monitoring to minimize environmental impacts have been incorporated in the environmental management plan and monitoring plan.

221. While the DISCOMs have their existing Vigilance Cell to deal with theft, power failure, fallen line, and other associated issues on delivery of service, they do not include environmental and social issues on project implementation. To address this limitation, a grievance redress mechanism will be set up by the PMUs of the DISCOMs as soon as the project commence. The PMUs will ensure the representation of women in the grievance redress committee which will function from project construction to operation.

222. Consultations of local people were done as part of preliminary surveys and environmental assessment in July 2013. While there were some concerns about transparency and proper compensation for temporary damages to crops and plants during construction and maintenance of distribution lines, the local people were supportive of the project given the long-term expected benefits. Consultation will continue throughout the life of the project and local people will be informed of the grievance redress mechanism.

223. The DISCOMs will obtain the relevant permits from GoMP prior to civil works. The draft IEE will be publicly disclosed as required by ADB's SPS 2009 and Public Communications Policy 2011. The project will have long-term beneficial impacts due to improved stability and reliability of power distribution systems in Madhya Pradesh.

Appendix 1

Details of Subprojects

Part A - Power Transmission System Improvement

No.	Name of Subproject	Transmission Line (km)	New Substation Works Substation Name, Capacity and Associated Feeder Bays
A. 400 kV Works			
1	LILO of 400 kV Seoni to Bhilai Single Circuit (S/C) line at Balaghat/Kirnapur Double Circuit (D/C)	5	Balaghat/Kirnapur 400/132 kV (2x100+40 MVA) + 400 kV FB(2)+132 kV FB(4)
2	LILO of both ckts of 400 kV Nagda - Rajgarh line at Badnawar (2xD/C)	10	Badnawar 400/220 kV (2x315 MVA) + 400 kV FB(4)+220 kV FB(4) + 125 MVAR bus reactor
3	400/220kV Addnal Transformer at Bhopal 400kV S/S		1x315 MVA
4	400/220kV Addnal Transformer at Chhegaon 400kV S/S		1x315 MVA
5	400kV Bus Reactor at Nagda 400kV S/S		1x125 MVAR
B. 220 kV works			
1	LILO of one circuit of Ashta 400 - Dewas 220kV D/C line at Chapda 220kV S/s (D/C)	35	Upgradation of Chapda 132 kV S/S to 220 kV (1x160 MVA) + 220 kV FB(2)
2	Pithampur (400kV) - Depalpur (220kV) DCSS line	35	Upgradation of Depalpur 132 kV S/S to 220 kV (1x160 MVA) + 220 kV FB(1)
3	LILO of 1 circuit of Bhopal - Hoshangabad 220kV D/C line at Adampur 220kV S/S (D/C)	5	Adampur 220/33 kV 2x50 MVA + 220 kV FB(2)
4	LILO of Badnagar - Raltam 220kV D/C line at Badnawar 400kV S/S (2xD/C)	20	
5	Julwaniya (400kV)-Kukshi (220kV) line (D/C)	80	Kukshi 220/132 kV 160 MVA + 220 kV FB(2) + 132 kV FB(1)
C. 132 kV works			
1	Talakpura - Bistan 132kV DCSS Line	35	Bistan 132/33 kV 40 MVA + 132 kV FB(1)
2	Dewas (220kV) - Agrod)(132kV DCSS Line	30	Agrod 132/33 kV 40 MVA + 132 kV FB(1)
3	Badnagar220 - Chhayan 132kV DCSS Line	35	Chhayan 132/33 kV 40 MVA + 132 kV FB(1)
4	Second Circuit of Kukshi - Alirajpur 132kV line	42	
5	LILO of 132kV Badod-Garoth line at Shyamgarh (D/C)	25	Shyamgarh 132/33 kV 40 MVA + 132 kV FB(2)
6	Dhar220 - Teesgaon 132kV DCSS Line	20	Teesgaon 132/33 kV 40 MVA + 132 kV FB(1)
7	Chhegaon220 - Pandhana 132KV DCDS line	30	Pandhana 132/33 kV 63 MVA + 132 kV FB(2)
8	LILO Manawar - Kukshi DCSS line at Singhana (D/C)	20	Singhana 132/33 kV 40 MVA + 132 kV FB(2)
9	Julwania400 - Talakpura 132KV DCSS line	30	Talakpura 132/33 kV 40 MVA + 132 kV FB(1)
10	LILO of Ratlam - Meghnagar 132KV S/c line at Petlawad DCDS (D/C)	20	
1	Mehgaon220 - Pratappura 132kV DCSS Line	30	Pratappura 132/33 kV 40 MVA + 132 kV FB(1)
2	Dabra - Chinaur 132kV DCSS Line	35	Chinaur 132/33 kV 40 MVA + 132

No.	Name of Subproject	Transmission Line (km)	New Substation Works
			Substation Name, Capacity and Associated Feeder Bays
			kV FB(1)
3	Sabalgarh220 - Kelaras 132kV DCSS Line	25	Kelaras 132/33 kV 63 MVA + 132 kV FB(1)
4	LILO of Mungaoli Traction Feeder to Mungaoli (D/C)	10	Mungaoli 132/33 kV 63 MVA + 132 kV FB(2)
5	Stringing of 3rd conductor from Bina220 to Mungaoli (35km)	35	
6	Malanpur220 - Gohad 132kV DCDS Line	22	Gohad 132/33kV 63MVA + 132kV FB(2)
7	Shujalpur-Narsinggarh 220kV DCSS line (Initially charged on 132kV)	58	Narsinghgarh 132/33kV 40MVA + 132kV FB(1)
8	Vidisha220 - Salamatpur 132KV DCSS line	25	Salamatpur 132/33kV 40MVA + 132kV FB(1)
9	Beragarh220 - Intkhedi 132KV DCDS line	15	Intkhedi 132/33kV 63MVA + 132kV FB(2)
10	Udaipura - Silvani 132KV DCSS line	25	Silwani 132/33kV 40MVA + 132kV FB(1)
11	Ashoknagar220 - Kothiya 132kV DCSS line	35	Kothiya 132/33kV 40MVA + 132kV FB(1)
12	Second circuit of Gairatganj - Vidisha220 132kV line	56	
13	Second circuit of Betul220 - Gudgaon 132kV line	57	
14	Second circuit of Bairagarh - Shyampur	20	
15	Chichli220 - Udaipura 132KV DCDS line (220kV line charged at 132kV)	58	Udaipura 132/33kV 40MVA + 132kV FB(2)
16	Datiya220 - Bhander 132kV DCSS Line	35	Bhander 132/33kV 63MVA + 132kV FB(1)
1	Budhera - Bada Malehra 132kV DCSS Line	40	Bada Malehra 132/33kV 40MVA + 132kV FB(1)
2	2nd ckt of Tikamgarh-Budhera 132kV DCSS Line	45	
3	LILO of 132kV Balaghat-Seoni/Katangi line at Waraseoni 132kV S/s (2xD/C)	20	Waraseoni 132/33kV 40MVA + 132kV FB(2)
4	Narsinghpur220-Devnagar 132kV DCSS Line	30	Deonagar 132/33kV 40MVA + 132kV FB(1)
5	Karakbel - Belkheda 132KV DCSS line	20	Belkheda 132/33kV 40MVA + 132kV FB(1)
6	Khurai - Khimlasa 132KV DCSS line	20	Khimlasa 132/33kV 40MVA + 132kV FB(1)
7	Narsinghpur220KV - Karakbel 132KV DCDS line	50	Karakbel 132/33kV 40MVA + 132kV FB(2)
8	LILO of both ckt of 132kV Balaghat-Bhanegaon Line at Balaghat/Kirnapur 4000kV S/s (2xD/C)	18	
9	Second circuit of 132KV Tap Line from Balaghat - Katangi	40	
10	Second circuit of Chhatarpur - Khajuraho 132kV line	34	
11	Panagar 220 - Patan 132kV DCSS line.	40	
D. Augmentation/Addition			
1	Betul 220 (2nd)		220/132kV Transformer
2	Kotar 220 (2nd)		220/132kV Transformer
3	Sidhi 220 (2nd)		220/132kV Transformer
4	Chhatarpur (2nd)		220/132kV Transformer
5	Mandideep 220 (2nd)		220/132kV Transformer

Part B - Power Distribution System Improvement

A. DISCOM-Central

A.1 New 33/11 kV Substations

No.	Name of Circle	Name of Division	Name of Proposed S/S	33 kV Distribution Line (km)	11 kV Distribution Line (km)
1	Bhopal Circle		Amravad	1	9
2			Anghora	5	14
3			Nayagaon (Maheshwari)	3	10
4		Raisen	Begamganj	3	5
5			Sunwaha	20	9
6		Bhopal	Kalakhedi ki Badi	5	7
7			Bagsi	4	2
8	Sehore Circle	Sehore	Chandbad Jagir	10	3
9		Sehore	Khandwa	7	5
10		Astha	Samrdha	5	4
11		Astha	Dabri	1	2
12	Vidisha Circle	Basoda	Dabar Gaon	10	12
13		Basoda	Pipaliyaghat	12	7
14		Basoda	Kakaruwa	6	5
15		Basoda	Sunkher	5	5
16		Vidisha	Tilakhedi	3	5
17		Vidisha	Dangarwada	5	8
18	Rajgarh Circle	Rajgrh/Biaora	Khilichipur	1	4
19		Rajgrh/Biaora	Biaora	0	5
20		Rajgrh/Biaora	Goriyakheda	0	4
21		Rajgarh/N Garh	Bawadikheda	0	3
22		Rajgarh/N Garh	Dhabla	4	1
23		Rajgarh/N Garh	Bamnyakhedi	0	3
24		Rajgrh/Biaora	Dhamanda	9	3
25		Rajgrh/Biaora	Hasrod	6	2
26		Rajgrh/Rajgarh	Bangpura	0	3
27	Hoshangabad Circle	H,bad	Khapariya	12	5
28		Itarsi	Choukipura	1	5
29		Pipariya	Nandwara	3	5
30			Chargaon	8	5
31		Harda	Temlawadi	9	5
32			Aedabeda	3	5
33	Betul Circle	Betul/Betul (N)	Rampur	2	3
34		Betul/Betul (S)	Bharkawadi	2	2
35		Betul/ Multai	Tiwarkhedi	15	7
36		Betul/Betul (N)	Hardu	7	8
37		Betul/Betul (N)	Ratanpur	10	3
38		Betul/Betul (N)	Pthakheda	1	7
39		Betul/Betul (N)	Likhadi	8	7
40		Betul/Betul (S)	Goregaon	5	6
41	City Circle Bhopal	Bhopal West	Amrita Kutiram	8	3
42		Bhopal West	Jhatkheda	8	2
43		Bhopal South	MVM College	3	3
44		Bhopal North	Sabji Mandi	2	3
45		Bhopal North	CTO (Dev Lok)	4	2
46		Bhopal East	BMHRC	30	5
47		Bhopal North	Chola Dusherrra Maidan	1	1
48		Bhopal East	Maholi	1	2

No.	Name of Circle	Name of Division	Name of Proposed S/S	33 kV Distribution Line (km)	11 kV Distribution Line (km)
49		Bhopal East	Kokta	1	2
50	Morena Circle	Sabalgarh	Dhamkan	6	5
51		Sabalgarh	Gureema	12	5
52		Sabalgarh	Bawdipura	2	5
53		Ambah	Vijaygarha	8	5
54		Ambah	Sihoniya	15	5
55		Ambah	Rajodha	1	5
56		Morena 2	GarhiKheda	2	5
57	Shivpuri Circle	Shivpuri 2	Kheru Hotel	1	6
58		Pichhore	Bachron	1	6
59	Bhind Circle	Mehgaon	Konhar	2	6
60		Bhind	Rampura	6	6
61		Mehgaon	Kanathar	2	6
62	Sheopur Circle	Sheopur south	Sheopur 2	2	5
63		Sheopur South	Charond	4	5
64		Sheopur North	Gohta	8	6
65		Sheopur South	Radep	7	4
66		Sheopur North	Shyampur	6	6
67	Gwalior O&M Circle	Dabra	Karhi	4	5
68		Gwalior	Khurari	2	3
69		Gwalior	Sirsod	8	6
70		Gwalior	Rangavan	7	3
71		Gwalior	Badera	1	3
72	Guna Circle	Guna	Ghatawada	8	6
73		Guna	Manpur	9	4
74		Guna	Pathi	13	7
75		Guna	Kherikhata	2	4
76		Ashoknagar	Barkheda Nai	9	5

A.2 33 kV Interconnection/Bifurcation

No.	Name of Circle	Proposed 33 kV Interconnection	33 kV Interconnection (km)
1	City Circle Bhopal	Ananad Nagar Bypass to Kopta	2
2		Switching S/s to Minal	1
3		Chambal -I to Sahpura	5
4		Shahpura to E-8	5
5		Amravat to SaketNagar	6
6		Habibganj to Danapani	6
7	O&M Circle Rajgarh	Jeerapur to Kodkiya	14
8		Sarangpur to Sarangpur	6
9	O&M Circle Bhind	Sewda to Mau	18
10		Sarawa to Gohad	15
11	O&M Circle Sheopur	Pali Road to Dhan mill	3
12	O&M Circle Gwalior	Bela ka Tiraha to Nayagon	12
Total			**48**

A.3 Installation of Capacitor Bank in existing 33/11 kV substations

No.	Particulars	Number of Capacitor Banks
1	City Bhopal	25
2	O&M Bhopal	15
3	Sehore	15
4	Vidisha	20
5	Rajgarha	20
6	Hoshangabad	26
7	Betul	15
8	City Gwalior	8
9	O&M Gwalior	40
10	Morena	31
11	Bhind	30
12	Shivpuri	30
13	Sheopur	26
14	Guna	30

B. DISCOM-East

B.1. Power Evacuation from EHV Substation of MPPTCL

No.	Name of circle	Name of proposed EHV	Name of 4 new feeders	Estimated length for power evacuation (km) including 4x33 kV bays at 33/11 kV Substations
1	Jabalpur (CC)	Gora-bazar (220 kV)	1. Gora-bazar 2. Katanga 3. Chitapahad 4. Piparia	25
2	NSP	Paloha Bada	1. Paloha-Town 2. Banskheda 3. Saikheda 4. Bhama	25
3	Jabalpur(O&M)	Katangi	1. Katangi-Town 2. Boriya 3. Kaymori 4. Pola	25
4	Narsinghpur	Karapgaon/Kareli	1. Kareli-Town 2. Bansadehi 3. Karapgaon 4. Aamgaon	25
5	Chhindwara	Badkuhi/Umreth	1. Badkuhi/Umreth-Town 2. Gajandoh 3. Khirsadoh 4. Kanhargaon	25
6	Jabalpur(O&M)	Belkheda	1. Belkheda-Town 2. Karaiyah 3. Meregaon 4.	25
7	Narsinghpur	Themi/Karakbel	1. Themi/Karakbel-Town 2. Jhamar	25

No.	Name of circle	Name of proposed EHV	Name of 4 new feeders	Estimated length for power evacuation (km) including 4x33 kV bays at 33/11 kV Substations
			3. Tindani 4. Mushran Pipariya-Mugali	
8	Jabalpur(O&M)	Panagar (220 kV)	1. Panagar -Town 2. Kusner 3. Baroda 4. Bisendi	25
9	Jabalpur(City)	Jabalpur-2	1. Ukhari 2. Lamti 3. Rameshawaram 4.Sanjivani nagar	25
10	Narsinghpur	Deonagar	1. Panagar -Town 2. Kusner 3. Baroda 4. Bisendi	25
11	Chhindwara	Saori	1. Saori -Town 2. Palakhed 3. Lawaghoghari 4. Mujawar	25
12	Seoni	220 KV Balaghat/Kirnapur	1. Kirnapur -Town 2. Rajegaon 3. Saleteka 4.	25
13	Seoni	Waraseoni	1. Waraseoni -Town 2. Rampayali 3. Dongermali 4. Khairlanji	25
14	Damoh	Patera	1. Patera-Town 2. Kumhari 3. Kudai 4. Baghwarkala (Panna)	25
15	Tikamagarh	Budhera	1. Budhera-Town 2. Badagaon 3 .Khodera-Patori 4. Nainwari	25
16	Sagar	Khimlasa	1. Khimlasa-Town 2. Bhangarh 3. Malthon 4. Talapar	25
17	Chhatarpur	Bada Malhara	1. Bada Malhara-Town 2. Darugawa 3. Bhagwa 4. Ghuwara	25
18	Rewa	Semariya(Rewa)	1. Semariya-Town 2. Bhusaul 3.Shahpur 4.Tighara	25
19	Rewa	Aitraila	1. Aitraila-Town 2. Rambagh 3. Jawa 4. Panwarkala	25
20	Satna	Satna-2	1. Bada Malhara-Town 2. Darugawa	25

No.	Name of circle	Name of proposed EHV	Name of 4 new feeders	Estimated length for power evacuation (km) including 4x33 kV bays at 33/11 kV Substations
			3.Bhagwa 4.Ghuwara	
21	Sidhi	Rampur-Naikin	1. Rampur-Naikin-Town 2. Dhanha 3. Bahgwar 4. Kuthila	25
22	Rewa	Sirmour	1. Sirmour-Town 2. Umari 3. Phooldewas 4. Patehara	25
23	Sidhi	Madwas	1. Madwas-Town 2. Majholi 3. Kusumi-Pondi 4. Kamchad-Gadaigaon	25

B.2 Bifurcation of Overloaded 33 kV Feeders

No.	Name of Circle/District	Name of EHV Substation	Name of 33 kV feeder	Length of feeder (km)	Additional Circuit Required	
					33 kV line (km)	Name of Section
1	Jabalpur (O&M)	132 kV Patan	Ronsra	18	10	132 kV Patan to Ronsara S/s
2	Jabalpur (O&M)	132 kV Kisrondh	Belkheda-1	55	30	132 kV Kishrodh to Belkheda
3	Jabalpur (O&M)	220 kV Nayagaon	J-6	55	15	220 kV Nayagaon to Manegaon
4	Jabalpur (O&M)	132 kV Marhotal	Marhotal	35	5	132 kV Marhotal to Marhotal
5	Jabalpur (O&M)	220 kV Nayagaon	J-7	52	15	220 kV Nayagaon to Shaw-Vllace/Sahajpur tapping
6	Jabalpur (O&M)	132 kV Maneri	J-5	40	17	132 kV Maneri to Pipariya onwards tapping
7	Narsinghpur	132 kV Narsinghpur	Themi-2	65	15	33/11 kV Murdai to Badhaiyakheda S/s
8	Katni	Katni	Bilhari	54	15	220 kV Katni to Deogaon S/s
9	Katni	132 kV Sleemnabad	Umariyapan	42	20	132 kV Sleemnabad to Upan
10	Katni	220 kV Katni	Katni	50	15	220 kV Katni to Chako S/s
11	Chhindwada	132 kV Chourai	Panjra	45	22	132 kV Chourai to Panjra S/s
12	Chhindwada	220 kV Chhindwada	Saori-old	54	25	220 kV Chhindwada to Bhutai
13	Tikamgarh	Tikamgarh	Nayakheda	47	24	New 132 kV Digoda to Gour S/s
14	Rewa	Rewa	Bankuiya	49	16	From 33/11 kV Amriti S/s to

No.	Name of Circle/District	Name of EHV Substation	Name of 33 kV feeder	Length of feeder (km)	Additional Circuit Required	
					33 kV line (km)	Name of Section
						Chhijwar S/s
15	Rewa	Rewa	Manikwar	36	22	Raipur to Khaira
16	Rewa	Katra	Chakghat	54	15	33/11 kV Raipur Sunori S/s to 132 kV Katra S/s
17	Rewa	132 kV Mauganj	Mauganj	60	20	From 33/11 kV Bahera dabar S/s to Sitapur S/s
18	Satna	220KV Sitpura	Unchehra	40	25	132 kV S/s Nagod to 33/11 kV Vasudha S/s
19	Satna	Kotar	Dagdiha	31	14	132 kV Kotar to Jaitwara tapping
20	Satna	Rampur	Krishangarh	50	15	132 kV Rampur to Silpari
21	Satna	Amarpatan	Amarpatan	20	25	132 kV Amarpatan to 33/11 kV Ahirgaon S/s
22	Satna	220KV Kotar	Birsinghpur	51	23	132 KV Majhgawa to Karigohi S/s
23	Sidhi	Sidhi	Patpara	36	12	132 kV Sidhi to Patpara S/s
24	Sidhi	132 kV Rajmilan	REC	125	23	132 kV Rajmilan to Khanuakhas
25	Sidhi	220 kV Sidhi	Sinhawal	110	17	33/11 kV Bahri S/s to Amiliya S/s
26	Shahdol	Shadol	Jaisinghnagar	60	35	132 kV Shadol to Gohparu S/s
27	Shahdol	Umariya	Manpur	60	50	132 kV Beohari to Manpur S/s
28	Shahdol	Beohari	Beohari	90	8	132 kV Beohari to Beohari S/s
29	Shahdol	Umariya	Umariya-T	55	5	132 kV Umariya to Umariya S/s

B.3 New 33 kV Substations

No.	Name of Circle	Proposed location of new substation	Substation Capacity (MVA)	
			1 X 3.15	5
1	Seoni	Lakhanwada		1
2	Seoni	Madhai	1	
3	Seoni	Jam		1
4	Seoni	Changotola	1	
5	Seoni	Dongargaon	1	
6	Narsinghpur	Umariya		1
7	Narsinghpur	Raipur		1
8	Seoni	Chargaon		1
9	Chhindwara	Hirwadi		1
10	Chhindwara	Belkheda/ Signa		1
11	Narsinghpur	Sunehti		1
12	Jabalpur (O&M)	Belkhadu		1
13	Chhindwara	Mankhedi		1

No.	Name of Circle	Proposed location of new substation	Substation Capacity (MVA)	
			1 X 3.15	5
14	Chhindwara	Binjhawada		1
15	Chhindwara	Bijuri		1
16	Narsinghpur	Singhpur-Chichli		1
17	Sagar	Ramnagar		1
18	Chhatarpur	Sunwani kala		1
19	Chhatarpur	Hardua Khamaria		1
20	Rewa	Itahakala		1
21	Rewa	Akauri		1
22	Satna	Mukundpur		1
23	Satna	Shyamnagar		1
24	Satna	Bharjuna		1
25	Shahdol	Pipratola	1	
26	Shahdol	Balhod		1
27	Satna	Jigna		1
28	Shahdol	Amarpur		1
29	Satna	Pondi		1
30	Rewa	Bakchera/ Pahadiya		1

B.4 Additional or augmentation of power transformers

No.	Name of Circle	Name of existing over loaded 33/11 kV Substation	Capacity (MVA)	Proposed Works							11 kV line
				Installation of Additional Transformer with two additional bay			Augmentation of transformer with two additional bay				
				1.6	5 (old)	5 (new)	1.6-3.15	1.6-5	3.15-5	5-8	
1	Jabalpur (O&M)	Ranjhi Manegaon	5		1						5
		Pipariya	5		1						5
		Ranjhi Manegaon	5		1						5
		Sukari	3.15		1						5
		Bargi	2 x3.15						1		0
		Sahajpur	3.15		1						5
		Nunsar	5		1						5
		Boriya	2X5							1	
		Sarond	2X3.15						1		
		Katangi	1x 5,1x3.15						1		
		Barela	2X5							1	
		Ponda	2X5							1	
		Bhidki	5		1						5
		Funwani	2X3.15						1		0
2	Katni	Niwar	2 x 3.15						1		0
		Vilayatkala	3.15			1					5
		Kymore	5		1						5
		Vijayraghavgarh	2x5							1	
		Kanti	3.15						1		
		Teori	2x3.15						1		
		Barhi	2x5							1	
		Dasharman	3.15						1		
		Dhimarkheda	3.15						1		
		Kuwa	3.15			1					5
		Karitalai	3.15		1						5
		Singodi	3.15			1					5
		Rithi	3.15			1					5
3	Chhindwara	Saori	2x 5,1x3.15							1	

No.	Name of Circle	Name of existing over loaded 33/11 kV Substation	Capacity (MVA)	Proposed Works							11 kV line
				Installation of Additional Transformer with two additional bay			Augmentation of transformer with two additional bay				
				1.6	5 (old)	5 (new)	1.6-3.15	1.6-5	3.15-5	5-8	
		Kalamgaon	3.15		1						5
		Imalikheda	5		1						5
		Umaranala	2x5							1	
		Sarora	3.15		1						5
		Barkuhi	2x5							1	
		Nandanwadi	2x3.15						1		
		Lodhikheda	5		1						5
		Hiwarkhedi	2x3.15						2		
		Chui	2x3.15						2		
		Titrai	5		1						5
4	Narsinghpur	Banwari	2X3.15						1		0
		Banskheda	3.15		1						5
		Sihora	2X5							1	0
		Bohani	5		1						5
		Atthaisa	2X5							1	
		Chichli	2X5							1	
		Nandner	2X5							1	
		Tendukheda(Raj)	2X3.15						2		
		Dobhi	2X5							1	
		Basadehi	2X5							1	
		Piparpani	3.15		1						5
		Barman	1x 5,1x3.15						1		
		Paloha(Suwatala)	2X3.15						2		
		Bandhi	5		1						5
		Themi	2X5							1	
		Dhamna	2X5							1	
		Kareli	2X5							1	
		Gotegaon	3X5							1	
		Joba	5		1						5
		Khamtara	5		1						5
		Gundrai (Old)	5		1						5
		Barehta	3.15		1						5
		Dudwara	3.15		1						5
		Devnagar	1x 1.6,1x3.15						1		
		Dangidhana	2X5							1	
		Niwari	5		1						5
		Amgaon	2X5							1	
		Ramkhariya	5		1						5
5	Seoni	Khamariya	1x3.15		1						5
		Bonkatta	3.15		1						5
		Waraseoni	2x5							1	
		Katangi	5		1						5
		Kanhiwada	5			1					5
		Kirnapur	1x5,1x3.15						1		
		Ghansor	1x3.15,1x1.6						1		
		Lakhnadon	1x3.15,1x1.6						1		
		Kishanpur	1x3.15,1x1.6						1		
		Mungwani	1x3.15,1x1.6						1		
		Bandol	2x3.15						2		
		Sunwara	3.15						1		
		Ugali	3.15						1		
		Khairapalari	5		1						5
6	Chhatarpur	Amanganj	2x5							1	0
		Pawai	2x5							1	0
		EHV Panna S/s	2x5							2	0
		Mohendra	3.15						1		

No.	Name of Circle	Name of existing over loaded 33/11 kV Substation	Capacity (MVA)	Proposed Works							11 kV line
				Installation of Additional Transformer with two additional bay			Augmentation of transformer with two additional bay				
				1.6	5 (old)	5 (new)	1.6-3.15	1.6-5	3.15-5	5-8	
		Simariya	2x5							1	
		Saleha	2x3.15		1						5
		Dharampur	3.15		1						5
		Ajaygarh	2x5							1	
		Sarbai	3.15		1						5
		Buxwaha	3.15		1						5
		Khairakala	5		1						5
		Kishangarh	3.15						1		
		Hatwaha	5		1						5
		Bada-Malhara	2x5							1	
		Loundi	2x5							1	
		Rajnagar	5		1						5
		Lugasi	3.15						1		
		Khajuraho	2x3.15						1		
		Harpalpur	2x5							1	
7	Tikamgarh	Neemkhera	1x3.15,1x1.6						1		0
		Baldeogarh	2x3.15						1		
		Patouri	3.15						1		
		Khargapur	2x5							1	
		Deri	3.15						1		
		Barana	3.15						1		
		Sarkanpur	3.15						1		
		Mohangarh	2x5							1	
		Veerpura	1x3.15,1x1.6						1		
		Simra	3.15						1		
		Sinoniya	3.15						1		
		Chakarpur	3.15						1		
		Beejor	3.15						1		
		Gora	3.15						1		
		Teharka	1x3.15,1x1.6						1		
8	Damoh	Taradehi	2x3.15						1		0
		Jhalon	3.15						1		0
		Killai Naka	2x5							1	0
		Jabalpur Naka	2x5							1	0
		Seeta Bawri	1x8		1						5
9	Sagar	Masurhai	5		1						5
		Rahatgarh	1x3.15,1x1.6						1		
		Meerkheri	2x3.15						1		
		Parasari Kalan	3.15			1					5
		Padarai Bansa	3.15			1					5
		Bandri	3.15			1					5
		Shahgarh	2x3.15						1		
		Rajwas	5			1					5
		Koha	5			1					5
		Bina	1x5,1x8							1	
		Jaitpur Kopra	3.15			1					5
		Chandpur	5			1					5
		Sahajpur	3.15						1		
		Chulha	3.15						1		
10	Rewa	Manikwar	2x5							1	0
		Panwar	1x3.15,1x1.6						1		
		Aitraila	1x3.15,1x1.6						1		
		Jawa	2x5							1	
		Tighara	2x3.15						2		
		Godhar-T	5		1						5
		Godhar-R	3.15						1		

No.	Name of Circle	Name of existing over loaded 33/11 kV Substation	Capacity (MVA)	Proposed Works							11 kV line
				Installation of Additional Transformer with two additional bay			Augmentation of transformer with two additional bay				
				1.6	5 (old)	5 (new)	1.6-3.15	1.6-5	3.15-5	5-8	
		Baikunthpur	2x5							1	
		Mangawan	2x5							1	
		Deotalab	2x5							1	
		Dhera	3.15		1						5
		Naigarhi	1x5,1x3.15						1		
		Chakghat	2x3.15						1		
		Raipur-Sunori	3.15		1						5
		Khatkhari	3.15		1						5
		Mauganj	2x5							1	
11	Satna	Kotar	2 x 5							1	
		Tikuri	1x5,1x3.15						1		
		Amma	2x3.15						2		
		Bara	3.15						1		
		Krishangarh	2x3.15						1		
		Majhiganwa	3.15						1		
		Sohawal	3.15		1						5
		Bagaha	3.15						1		
		Pondi	3.15						1		
		Madhogarh	3.15						1		
		Ghunwara	3.15						1		
		Singhpur	2x5							1	
		Badera	1x 5,1x3.15						1		
12	Shadol	Jaisingh Nagar	3.15		1						5
		Beohari	2x3.15						1		
		Bharewa	2x5							1	
		Pole Factory,Umariya	5		1						5
13	Sidhi	Churhat	2x5							1	
		Chilharikala	3.15						1		
		Navjiwan Bihar	3.15						1		
		Dudhmaniya	3.15						1		
		Semariya	3.15						1		
		Mada	3.15						1		
		Chhandana	3.15						1		0
		Baghwar	2x3.15						1		0

C. DISCOM-West

C.1 New 33/11 kV Substations

No.	Name of Circle	Substation	Description			
			5 MVA	11 kV line		
				PCC	H-Beam	DC-H Beam
1	Indore CC	South Div. Office	1		2	
2		IG Office Indore	1			0.2
3		Amar Tekri North Divison	1		1	
	Total Indore City		3	0	3	0.2
4	Indore OM	Avlai	1	3		
5		Kisanganj	1	3		
6		Chhota Bangarda	1	4		
7		Khalkhala	1	3		
	Total Indore		4	13	0	0

No.	Name of Circle	Substation	Description			
			5 MVA	11 kV line		
				PCC	H-Beam	DC-H Beam
8	Khandwa	Nawali	1	3		
9		Bilankheda	1	2		
	Total Khandwa		3	8	0	0
10	Burhanpur	Talawadi	1	5		
11		Collector office Town	1		5	
	Total Bpur circle		2	5	5	0
12	Khargone	Mohammadpur	1	3		
13		Hirapur	1	4		
14		Chitawad	1	2		
15		Durgapur	1	3		
	Total Khargone circle		4	12	0	0
16	Barwani	Rakhi Bujurg	1	3		
	Total Barwani circle		1	3	0	0
17	Dhar	Kabarwa	1	5		
18		Meghapura	1	6		
19		Kawada	1	8		
20		Phoolgawadi	1	4		
	Total Dhar Circle		6	26	2	0
21	Jhabua	Badi Khattali	1	3		
22		Pitol	1	2		
	Total Jhabua		2	5	0	0
	Total Indore Region		25	72	10	0.2
23	Ujjian	Ruee	1	1		
24		Banjari	1	3		
25		Pingleshwer	1	4		
26		Palduna	1	1		
	Total Ujjian circle		5	12	0	0
27	Dewas	Ponasa	1	8		
28		Gada Gaon Nimasa	1	8		
29		Neori Phata	1	9		
	Total Dewas circle		6	38	0	0
30	Shajapur	Siroliya	1	2		
31		Tajpur ukala	1	3		
32		Dharola	1	3		
	Total Shajapur circle		3	8	0	0
33	Ratlam	Piplodi	1	4		
34		Mamatkheda	1	5		
	Total Ratlam circle		4	16	0	0
35	Mandsaur	Jamalpura	1	3		
36		Kothdabahadur	1	3		
37		Garoda	1	2		
	Total Mandsaur circle		3	8	0	0
38	Neemuch	Khankhedi	1	1.5		
39		Barkheda	1	1.5		
40		Jaliner	1	2		
	Total Neeemuch circle		4	7	0	0
	Total Ujjian Region		25	89	0	0
	West Zone		50	161	10	0.2

C.2 Augmentation and additional distribution transformer capacity

No.	Name of Circle	33/11 kV Substation	Work			11 kV Line required for interconnection of feeder				
			3.15 MVA to 5 MVA	5 MVA to 8 MVA	Addl 5 MVA	11 kV line on Rabbit conductor using PCC Pole (km)	11 kV Line on Rabbit conductor using 11m H-Beam support (km)	11 kV Guarding	11 kV DP Structure using PCC Pole/H-Beam	11 kV DP Structure using 11m H-Beam support
1	Indore CC	Vijaynagar		1			0.5	1		1
2		MPSRTC		1			2.5			
3		LIG		1			0.05			
4		Sector-F			1		1			
5		Hamilton Rd.		1						
6		Rajmohalla		1						
7		Fotikoti		1						
8		Sanchar Nagar		1						
9		Goyalnagar			1					
10		Tejpur			1					
11		Satyasai		1						
12		Tokoganj		1						
13		Manoramaganj		1						
14		Railway Reservation		1						
	Total Indore CC		0	11	3	0	4.05	1	0	1
1	Indore OM	Bhagwaniya	1							
2		Panda	1							
3		Nahar kheda			1					
4		Ruddrakhya			1	4		2	5	
5		Limbodapar			1	2		2	2	
6		Boriyaborsi			1	4		2	2	
7		Nawdapanth			1	4		2	2	
8		Chhota Betma			1	7		5	7	
9		Sivni	1			5		5	6	
10		Alwasa	1							
11		Jamli	1							
12		Kalmer	1							
13		Agra	1			3		3		5
	Total Indore-OM		7	0	6	29	0	21	24	5
1	Khandwa	Dongargaon	1			2.5		2	3	
2		Sulgaon			1	1.5		2	2	
3		Zumarlkhali			1	2		3	4	
4		Satwada			1	2		2	3	
5		Rangaon	1			1		2	2	
	Total Khandwa circle		2	0	3	9	0	11	14	0
1	Burhanpur	Nimbola	1			2		4	5	
2		Khamni	1			6.5		10	8	
3		Shahpur	1							
4		Gondri	1			3.5		10	6	
5		OPH City			1		3	15	8	
	Total Burhanpur circle		4	0	1	12	3	39	27	0
1		Premnagar			1	4		5	6	
2		Orangpura	1							
3		Jamli	1			3		2	5	
4		Nandgaon			1					
5		Talakpura			1					
6		Lonara	1							
7		Mogargaon	1			3.5		4	4	
8		Bhagwanpura			1					
9		Oon			1					

No.	Name of Circle	33/11 kV Substation	Work			11 kV Line required for interconnection of feeder				
			3.15 MVA to 5 MVA	5 MVA to 8 MVA	Addl 5 MVA	11 kV line on Rabbit conductor using PCC Pole (km)	11 kV Line on Rabbit conductor using 11m H-Beam support (km)	11 kV Guarding	11 kV DP Structure using PCC Pole/H-Beam	11 kV DP Structure using 11m H-Beam support
10		Bhikangaon	1			2		4	4	
11		Anjangaon	1							
12		Ahirkheda	1			4		4	4	
13		Nagziri	1			4		4	4	
14		Khodi	1							
15		Belsar	1							
16		Bagod	1		1					
17		Ghangla	1							
18		Malgaon	1			2		3	3	
19		Bediya	1							
20		Kanapur	1							
21		Badud	1							
22		Kasrawad	1			2		7	5	
23		Sayta	1							
24		Makadkheda	1							
25		Balakwada	1							
26		Maltar	1							
27		Nimrani	1			5		11	13	
28		Mehatwada	1							
	Total Khargone		23	0	6	29.5	0	49	48	0
1	Barwani	Barwani Ind.	1							
2		Kalyanpura	1							
3		Borlai	1							
4		Surana	1							
5		Talwada Deb	1							
6		Dabad	1							
7		Ghatwa	1							
8		Jamti			1	9			6	
9		Palsood			1					
	Total Barwani circle		7	0	2	15	0	0	6	0
1	Dhar	Gulati	1							
2		Kalwani	1							
3		Mirjapur			1	5		8	10	
4		Kalibawdi			1	4		8	7	
5		Bilda			1	5		8	10	
6		Teesgaon	1							
7		Chhayan	1							
8		Rajod			1	1		2	2	
9		Talanpur			1	1		2	2	
10		Bola			1	1		2	2	
	Total Dhar		4	0	6	17		30	33	0
1	Jhabua	Walpur	1							
2		Jobat	1							
3		Bhabra	1							
4		Ambua	1							
	Total Jhabua		4	0	0	0	0	0	0	0
	Total Indore Region		47	11	21	94.5	7.05	121	119	6
1	Ujjain	Dhablagori			1	2		2	2	
2		Chintaman	1							
3		Jaithal	1							
4		Asadi			1	4		2	2	
5		Khamli	1							
6		Kharpa	1							
7		Sarola	1							
8		Kanasiya	1							

No.	Name of Circle	33/11 kV Substation	Work			11 kV Line required for interconnection of feeder				
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9		Nanded	1							
10		Makdone			1	3.5		5	5	
11		Runkheda			1	3.5		2	2	
12		Chandesra			1					
13		Narwar			1					
14		Piploda			1					
15		Raghopipliya			1	0.5		1	1	
16		Chitarkhedi	1							
17		Indokh	1							
18		Nagziri			1	4		4	4	
19		Palsoda	1		0	3		6	5	
20		Kothadi	1		0	3		4	5	
21		Ghinoda			1					
22		Batlawdi	1							
23		Hatai palki			1					
24		Buranabad	1			5		14	12	
25		Chirola			1					
26		Narsinghgarh	1							
27		Rupeta	1			4		5	5	
28		Runija	1							
29		Sijawata			1			0	0	
30		Akyalimba			1	3		3	4	
31		Zarda			1	3		6	5	
32		Ghonsla	1							
33		Banjari	1							
	Total Ujjain		18	0	15	38.5	0	54	52	0
1	Dewas	Tonkkhurd	1			2		3	4	
2		Kalma	1			3		4	6	
3		Choubarajagir	1			3		4	5	
4		Nanukheda	1			3		4	6	
5		Kamlapur	1			5		6	8	
6		Dokakuui	1			4		3	7	
7		Bijwad	1			4		4	6	
8		Kantaphod	1			4		4	6	
9		Pipalkota	1			3		2	5	
10		Pipliya Sadak	1			3		4	6	
11		Olamba			1	6		3	6	
	Total Dewas circle		10	0	1	40	0	41	65	0
1	Shajapur	Moyakheda	1							
2		Piplonkala	1							
3		Dehriya soyat	1							
4		Shyampur			1					
5		Bhayana			1					
6		Dadiyakhedi			1					
7		Bakayan			1					
	Total Shajapur circle		3	0	4	0	0	0	0	0
1	Ratlam	Simlawda	1							
2		Mundri	1			2		2	4	
3		Dharad	1							
4		Hatpipliya	1							
5		Asawta	1			6		12	8	
6		Sailana	1							
7		Kamed	1							
8		Rajapura	1							
9		Kalukheda	1							

No.	Name of Circle	33/11 kV Substation	Work			11 kV Line required for interconnection of feeder				
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	Total Ratlam circle		9	0	0	8	0	14	12	0
1		Rishyanand	1							
2		Afjalpur	1							
3		Amalawd	1							
4		Melkheda	1							
5		Garoth	1							
6		Bilod			1					
7		Mundri			1	3		3	6	
8		Pipliya Visniya			1					
9		Bhaguniya			1					
10		Babulda			1					
11		B.Istmurar			1					
12		Khajuri Panth			1					
13		Dhalmoo			1					
14		Rawti			1					
15		Dhalpat			1					
	Total Mandsaur		5	0	10	3	0	3	6	0
1	Neemuch	Dudhtalai	1							
2		Jaat	1							
3		Rampura	1							
4		Ratangarh	1							
	Total Neemuch		4	0	0	0	0	0	0	0
	Total Ujjain Region		49	0	30	89.5	0	112	135	0
	WEST ZONE		96	11	51	184	7.05	233	254	6

Appendix 2- List of Acts, Rules and Notifications as Applicable to the Project

No.	Act/Rule/Notification	Brief	Last Amd.	Trigger	Weblink for updates	Sec. Head
1	The Environment Protection Act, 1986 The Environment Protection Rules, 1986	It provides for the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property	2009	All projects/activities/ that being developed, implemented, established, operational and/or being funded, that would discharge or emit any environmental pollutant should take cognizance of this Act/Rule and ensure compliance to the prescribed emission standards	http://moef.nic.in/modules/rules-and-regulations/environment-protction/	Environment
2	Notification on Special Areas/ Restricted Activities	Notification deals with environmental issues in specific notified zones/areas in different regions and imposition of restrictions/prohibitions on certain industries or activities		All projects/activities being conceptualized, developed, implemented, operational and/or funded should verify the existence/ proximity of any notified area in and around the project site and is found should take cognizance of the provisions of the applicable Special Area Notification	http://moef.nic.in/modules/rules-and-regulations/environment-protction/	Environment
3	Environmental Impact Assessment Notification, 2006	The Notification imposes restrictions and prohibitions on new projects or activities and also on the expansion or modernization of existing projects or activities based on their potential environmental impacts.	2009	All projects/activities being conceptualized, developed, implemented or funded should take cognizance of the Schedule of Activities requiring Environmental Clearance under this Notification and if applicable, required clearances from MoEF / State Environmental Impact Assessment Authority should be taken	http://moef.nic.in/modules/rules-and-regulations/environment-protction/	Environment
4	The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008	It provides for regulation and control of indiscriminate disposal of Hazardous waste; and its sound management to reduce risks to environmental and human health	2010	All activities being implemented, operational and/or funded that deal with generation/ handling/storage/processing of hazardous waste should take cognizance of the provisions/schedules of these Rules and obtain authorization from the prescribed Authority/State Pollution Control Board/ Committee	http://www.moef.nic.in/legis/hsm.htm	Environment
5	The Noise Pollution (Regulation and Control) Rules, 2000	It provides for regulations to control ambient noise levels in public places from sources such as industries/construction works/community events, etc.	2010	All projects/activities/ being constructed, operational and/or funded that deal with sound emitting equipments while operational or during construction should take cognizance of the provisions/standards of these Rules and ensure compliance	http://moef.nic.in/modules/rules-and-regulations/environment-protction/	Environment
6	The Ozone Depleting	It provides for regulatory measures	2000	All activities being implemented, operational	http://moef.nic.in/mo	Enviro

No.	Act/Rule/Notification	Brief	Last Amd.	Trigger	Weblink for updates	Sec. Head
	Substances (Regulation & Control) Rules, 2000	so as to ensure progressive phasing out of domestic production and imports of ozone depleting substances		and/or funded that involve the use/ processing/ imports/ exports of Ozone depleting substances should take cognizance and comply with the provisions/schedules of these Rules	dules/rules-and-regulations/environment-protction/	nment
7	The Batteries (Management & Handling) Rules, 2001	It provides for regulations towards proper management & handling of Lead Acid Batteries so as to avoid, mitigate, minimize adverse impact on environment and human health	2001	All activities being implemented/ operational and/or funded that involve the manufacture, handling, purchase and use of batteries should take cognizance of the provisions and comply with the provisions of these Rules	http://www.moef.nic.in/legis/hsm.htm	Environment
8	Forest (Conservation) Act, 1980 Forest (Conservation) Rules, 2003	It provides for regulation to help conserve the country's forests. It restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government.	2004	All projects/activities being conceptualized, developed, implemented or funded within forest areas or depend on use of forest should take cognizance and comply with the provisions of these rules and obtain required clearances from the Forest Department	http://moef.nic.in/modules/rules-and-regulations/forest-conservation/	Environment
9	Wildlife (Protection) Act, 1972	It provides for regulations to effectively protect the wild life with a view to ensuring the ecological and environmental security of the country.	2010	All projects/activities being conceptualized, developed, implemented and/or funded within wildlife sanctuaries or national parks should take cognizance and comply with the provisions of these rules and obtain required clearances from the National Board for Wildlife /Chief Wildlife Warden	http://moef.nic.in/modules/rules-and-regulations/wildlife/	Environment
10	Wildlife Protection Strategy, 2002	The strategy document suggests measures and actions required for management of wildlife and protected areas.	`	All projects/activities being conceptualized, developed, implemented or funded within 10 km of wildlife sanctuaries or national parks should take note of the measures suggested in this Strategy document	http://envfor.nic.in/divisions/wild.html	Environment
11	Wetlands (Conservation & Management) Rules, 2010	To provide for protection and management of wetlands in India and regulate the activities within wetlands	2010	All projects/activities being conceptualized, developed, implemented and/or funded in and around wetlands should take cognizance of the provisions of this Notification and obtain required clearances from Central Wetlands Regulatory Authority/ Designated Local State Agency/ Forest Department	http://moef.nic.in/modules/public-information/home-archive/	Environment
12	Central Ground Water Authority, Notification,	It provides for regulation and control of ground water development and	2010	All projects being developed, implemented or funded that are dependent on Ground water as	http://www.cgwb.gov.in/gw_regulation.ht	Environment

No.	Act/Rule/Notification	Brief	Last Amd.	Trigger	Weblink for updates	Sec. Head
	1997	management.		a source of water, should take cognizance of the provisions of this Notification/Guidelines and require to obtain permission from the Central Ground Water Board/Regional Office/Prescribed Authority	ml	
13	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	It regulates the employment and conditions of service of building and other construction workers and provides for their safety, health and welfare	1996	All projects/activities being implemented and/or funded where cost of construction is more than Rs. 10 lakhs should take cognizance of the provisions of this Act, register establishments and provide for the construction workers in accordance with this Act	http://labour.nic.in/clc/welcome.html#leg	**Health & Safety**
14	Building and Other Construction Workers Welfare Cess Act, 1996 and Rules, 1998	An Act to provide for the levy and collection of a cess on the cost of construction incurred by employers.	1998	All projects/activities being implemented and/or funded where cost of construction is more than Rs. 10 lakhs should take cognizance and comply with the provisions of this Act and pay cess accordingly		**Health & Safety**
15	Workmen Compensation Act, 1923	It provides for payment of compensation by employers to their employees for injury by accident i.e. personal injury or occupational disease	2009	All projects/activities that are operational and/or funded that employ workmen for activities that are hazardous and have health and safety risks should take cognizance of this Act and ensure due compensation to employees in case of any injury	http://labour.nic.in/ss/Notification.html	**Health & Safety**
16	The Child Labour (Prohibition & Regulation) Act, 1986	It prohibits employment of children in certain specified hazardous occupations and processes and regulates the working conditions in others.	1986	All project/activities that are being implemented, operational and/or funded should refrain from employment of children. In case employed should take cognizance and comply with the provisions of this Act.	http://labour.nic.in/cwl/ChildLabour.htm	**Health & Safety**
17	Indian Electricity Rules, 1956	It provides for regulating the supply, transmission, generation, and use of electricity which includes precautionary measures to be adopted in construction, installation and maintenance of transmission, distribution, generation and use of electricity.	2000	All projects/ activities establishments being developed, implemented, operational and/or funded that deal with generation, transformation, transmission, conversion, distribution or use of energy should take cognizance and comply with the provisions of these Rules and obtain required authorization	http://powermin.nic.in/acts_notification/electricity_act2003/preliminary.htm	**Health & Safety**
18	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of	It recognizes and provides for forests rights and occupation in forest land by forest dwelling Scheduled Tribes	2007	All projects/activities being conceptualized, developed, implemented, operational and/or funded that are within or in close proximity to	http://tribal.nic.in/index1.asp?linkid=360&langid=1	**Social**

No.	Act/Rule/Notification	Brief	Last Amd.	Trigger	Weblink for updates	Sec. Head
	Forest Rights) Act, 2006 and Rules, 2007	and other traditional forest dwellers who are integral to the sustainability of the forest ecosystem.		forest areas should take cognizance of the provisions of this Act/Rules and verify and provide for the rights of the Tribal population		
19	Land Acquisition Act, 1894	It provides for facilitation in land acquisition for public purposes in cases where land to acquired has private claims	1985	All projects/activities being conceptualized, developed, implemented and/or funded that deal with public purposes or would lead to developmental benefits, for which land is to be acquired, should take cognizance and comply with the provisions of this Act	http://dolr.nic.in/dolr/actandrule.asp	**Social**
20	National Resettlement and Rehabilitation Policy, 2007	It provides for regulations to ensure a humane, participatory and transparent process of resettlement and rehabilitation due to land acquisition for industrialization, infrastructural facilities and urbanization needs	2007	All projects/activities being conceptualized, developed, implemented and/or funded that deal with involuntary displacement due to land acquisition should take cognizance of this policy and provide for fair compensation to the affected parties	http://dolr.nic.in/dolr/actandrule.asp	**Social**
21	The Biodiversity Act, 2002	In order to help in realizing the objectives of CBD, India has enacted an umbrella legislation called the biological Diversity Act 2002(No.18 of 2003) aimed at conservation of biological resources and associated knowledge as well as facilitating access to them in a sustainable manner and through a just process.	2002	It recognizes the sovereign rights of States to use their own Biological Resources.	http://www.envfor.nic.in/divisions/csurv/nba_act.htm	**Environment**

Appendix 3 - India and International Environmental Agreements

1. India is member of almost all major Multilateral Environmental Agreements (MEAs), under four clusters, namely the following:
   i. Nature conservation;
   ii. Hazardous material;
   iii. Atmospheric emissions; and
   iv. Marine environment.
2. There are over 500 active agreements/MOUs etc. to which India is signatory.
3. There are 20 major multilateral global MEAs, to which India is a signatory. These are listed below:

i. Nature conservation

- Ramsar Convention on Wetlands
- CITES (Convention on International Trade in Endangered Species of
- Fauna and Flora)
- TRAFFIC (The Wildlife Trade Monitoring Network)
- CMS (Convention on the Conservation of Migratory Species)
- CAWT (Coalition Against Wildlife Trafficking)
- CBD (Convention on Biological Diversity)
- ITTC (International Tropical Timber Organisation)
- UNFF (United Nations Forum on Forests)
- IUCN (International Union for Conservation of Nature and Natural
- Resources)
- GTF (Global Tiger Forum)

ii. Hazardous material

- Cartagena Protocol on Biosafety
- SAICM (Strategic Approach to International Chemicals Management)
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Basel Convention on the Control of Trans-boundary Movement of
- Hazardous Waste and Their Disposal
- Rotterdam Convention on Prior Informed Consent (PIC) for certain
- Hazardous Chemicals and Pesticides in International Trade

iii. Atmospheric emissions

- UNFCCC (United Nations Framework Convention on Climate Change)
- Kyoto Protocol
- UNCCD (United Nations Convention to Combat Desertification)
- Montreal Protocol (on Ozone Depleting Substances)

iv. Marine environment

- IWC (International Whaling Commission)

Source: MoEF, India