



Environmental & Social Impact Assessment Report for 25 MW Solar PV Project at OG Kuppam Village, Chittoor District in the state of Andhra Pradesh

Prepared for:

**Waaneep Solar Private Limited
602, Western Edge-I,
Western Express Highway, Borivali (E),
Mumbai-400066, Maharashtra, India.**

Prepared by:

**M/s Gensol Consultants Pvt. Ltd,
A-2, 12th Floor Palladium,
Opposite to Vodafone House,
Corporate Road, Prahladnagar,
Ahmedabad-380015,
Gujarat.**

Table of Contents

EXECUTIVE SUMMARY.....	6
PROJECT AT A GLANCE	6
GRID CONNECTIVITY	6
LAND.....	6
CATEGORY OF THE PROJECT	7
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) SUMMARY	7
1. PROJECT DETAILS.....	8
1.1 PROJECT DEVELOPER	8
1.2 PROJECT DETAILS	8
1.3 SITE CONDITIONS	11
2. PROJECT JUSTIFICATION	14
2.1 INDIAN ENERGY SCENARIO.....	14
2.1.1 INDIAN RENEWABLE ENERGY SCENARIO	16
2.2 ANDHRA PRADESH ENERGY SCENARIO	19
2.3 ANDHRA PRADESH RENEWABLE ENERGY SCENARIO.....	20
2.4 ANDHRA PRADESH SOLAR POLICY	21
2.5 BENEFITS FROM THE PROJECT.....	22
3. ESIA STUDY	24
3.1 NEED FOR ESIA STUDY	24
3.2 OBJECTIVE OF THE ESIA STUDY	24
3.3 EIA METHODOLOGY	24
3.4 LEGAL POLICIES & ACTS.....	26
3.4 ENVIRONMENTAL & SOCIAL IMPACT & MANAGEMENT PLAN (ESMP)	27
3.5 STRUCTURE OF THE ESIA REPORT	28

4. LEGAL POLICIES & INSTITUTIONAL FRAMEWORK	31
4.1 INTRODUCTION.....	31
4.2 REGULATORY FRAMEWORK.....	31
4.3 DETAILED FRAMEWORK PROCESS OF ADB’S ENVIRONMENTAL AND SOCIAL ASSESSMENT	32
4.4 LEGISLATIVE FRAMEWORK	36
4.5 ENVIRONMENT, HEALTH & SAFETY (EHS) POLICY.....	43
5. EXISTING ENVIRONMENTAL AND SOCIAL CONDITION OF THE PROJECT LOCATION.....	45
5.1 ENVIRONMENTAL SOCIAL PARAMETERS OF THE SITE.....	45
5.2 LAND.....	46
5.3 WASTE WATER TREATMENT AND DISPOSAL SYSTEM	46
5.4 SOLAR RADIATION PROFILE OF THE SITE	47
5.5 SEISMIC ZONE PROFILE OF THE SITE.....	48
5.6 SOIL TYPE AT THE LOCATION	49
5.7 MINERAL MAP:	50
5.8 TOPOGRAPHY, SOIL CONDITIONS AND LAND USE.....	50
5.9 CLIMATIC CONDITIONS.....	51
5.10 DEMOGRAPHICS	53
6. ANALYSIS OF ALTERNATIVES	54
6.1 DO NOTHING SCENARIO.....	54
6.2 SITE ALTERNATIVE	54
6.3 PRODUCTION METHODOLOGY ALTERNATIVE.....	54
6.4 TECHNOLOGY ALTERNATIVE	55
7. ANTICIPATED ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATION MEASURES.....	56
7.1 INTRODUCTION.....	56

7.2 POTENTIAL IMPACT GENERATION ACTIVITIES	56
7.3 IMPACTS DURING PLANNING AND DESIGN PHASE	57
7.4 IMPACTS DURING CONSTRUCTION PHASE	57
7.5 IMPACT DURING OPERATION PHASE.....	65
7.6 IMPACTS DURING DECOMMISSIONING PHASE	68
7.7 SOCIAL IMPACTS	68
8. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN.....	70
8.1 INTRODUCTION.....	70
8.2 ENVIRONMENTAL & SOCIAL MANAGEMENT PROCESS	70
8.3 ENVIRONMENT & SOCIAL MANAGEMENT CELL.....	70
8.4 LABOUR DEPLOYMENT AND LABOUR CAMP MANAGEMENT PLAN.....	71
8.5 WASTE MANAGEMENT PLAN SCOPE & PURPOSE OF THE PLAN	73
8.6 SAFETY & EMERGENCY PLAN	74
8.7 SAFETY AWARENESS AMONG WORKERS/EMPLOYEES.....	74
8.8 SAFETY REVIEW CHECK LIST.....	75
8.9 FIRE FIGHTING ARRANGEMENT	75
8.10 IN-HOUSE SAFETY RULES AND PLAN	75
8.11 CLEAN DEVELOPMENT MECHANISM (CDM).....	79
9. GRIEVANCE REDRESSAL MECHANISM	81
9.1 COMMUNICATION WITH CONTRACTOR STAFF:.....	81
10. PUBLIC CONSULTATION, PARTICIPATION & DISCLOSURE	83
11. CONCLUSION & RECOMMENDATION	84

List of Figures

Figure 1: Proposed Project Location	10
Figure 2 : MMS structure erected at OG Kuppam project site.....	11
Figure 3: Internal Road access.....	11
Figure 4: Switchyard.....	12
Figure 5: Transmission line & towers	12
Figure 6: Leaders in Solar PV Employment.....	23
Figure 7: Steps involved in EIA process	25
Figure 8: EIA Methodology process.....	26
Figure 9: Solar radiation profile.....	47
Figure 10: Seismic zone profile.....	48
Figure 11: Soil Profile of the Site	49
Figure 12: Mineral deposits of the site	50
Figure 13: Temperature profile	51
Figure 14: Vegetation map of Andhra Pradesh	52
Figure 15: Demographic map of Andhra Pradesh	53
Figure 16 Rest room available at site	72
Figure 17 Drinking water facility at site.....	73
Figure 18 Scrap yard at the site.....	74
Figure 19 Emergency safety measures.....	76
Figure 20 Training to the workers	78
Figure 21 Firefighting equipment's and training.....	79

EXECUTIVE SUMMARY

M/s. Waaneep Solar Private Limited (referred as “developer” from here on) has planned to set up 25 MW Solar PV Project at OG Kuppam Village, Chittoor District in the State of Andhra Pradesh. M/s. Waaneep Solar Private Limited has appointed Gensol Consultants Private Limited (GCPL) as an independent third party to do Environmental and Social Impact Assessment (ESIA) study for this project.

Project at a Glance

Table 1: Project details

Proposed Capacity	25 MW
Proposed Location	Village: OG Kuppam District: Chittoor State : Andhra Pradesh
Proposed Site Coordinates	Latitude: 13.288907° N Longitude: 79.619042° E
Annual Global Horizontal Irradiation (GHI)	1907.40 kWh/m ² (Meteonorm) 1868.50 kWh/m ² (NASA)
Land available	~92 acres
Distance to Grid Substation	10 km

Grid Connectivity

The grid substation is located 10 km (by road) away from the project site. The generated power will be evacuated through 132 kV transmission line which will be connected to 132/33 kV Nagari Substation.

Land

The land area available at the OG Kuppam site is about 92 acres which would be used for setting up of proposed 25 MW Solar PV plant.

Category of the Project¹

As per the safeguard project Categories 'A', 'B', 'C', & 'F1' of Asian Development Bank (ADB), this proposed solar project is more closely aligned to 'Category C' due to limited adverse environmental impacts. The reason for limited adverse environmental impacts are described briefly in each chapter.

Environmental Impact Assessment (EIA) Summary

An environment analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The study infers that most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. From this perspective, the project is expected to have a small environmental footprint. Hence, the proposed project has limited adverse environmental and social impact which can be mitigated through the Environmental and Social Management Plan (ESMP) and shall be pollution free renewable source of power.



¹ <https://www.adb.org/site/safeguards/safeguard-categories>

1. PROJECT DETAILS

1.1 Project Developer

Waaneep Solar Private Limited²

Waaneep Solar Private Limited (WSPL) is a Special Purpose Vehicle promoted through Public-Private partnership between Waaree Energies Ltd. (WER) and North Eastern Electric Power Corporation Limited (NEEPCO). WER is the flagship company of Waaree group established in 1989, having the largest Solar PV module manufacturing capacity of 1.5 GW at its plant in Gujarat. The headquarters of the company is located in Mumbai. The group provides EPC services as well as project development, rooftop solutions, solar water pumps and also as an Independent Power Producer. Waaree has its presence in over 250+ locations across India and 68 countries worldwide. Along with these, the group has 100+ customers internationally and 1000+ customers in India. The company had delivered more than 500 MW EPC projects and 100 MW projects is under execution. Waaree group has been recognized as the Tier-1 module manufacturer and also awarded as the “Best Solar PV Module manufacturer & Solar Power Developer” by Government of India

1.2 Project Details

Proposed Capacity	25 MW
Proposed Location	Village : OG Kuppam District: Chittoor State : Andhra Pradesh
Proposed Site Coordinates	Latitude: 13.288907° N Longitude:79.619042° E
Connectivity	<u>Nearest National Highway:</u> Chennai-Anantapur Highway (4.5 km) <u>Nearest Railway station:</u> Nagari railway station (5 km) <u>Nearest Airport:</u> Tirupati Airport (40 km)
Nearest Major City	Chennai

² <http://www.waaneep.com/>

Annual Global Horizontal Irradiation (GHI)	1907.40 kWh/m ² (Meteonorm) 1868.50 kWh/m ² (NASA)
Climatic Data	Average Temperature : 28.1° C Average Wind Speed: 2.3 m/s
Land available	~92 acres
Distance from Reserve Forest	No Reserve forest nearby
Distance from Coastal region if any	Away from Coastal region (~80 km)
Type of Vegetation over land	Grass
Distance to Grid Substation (by road)	10 km
Grid Substation (GSS)	Nagari Substation
Grid Substation Authority	APTRANSCO
GSS Voltage level	132 kV

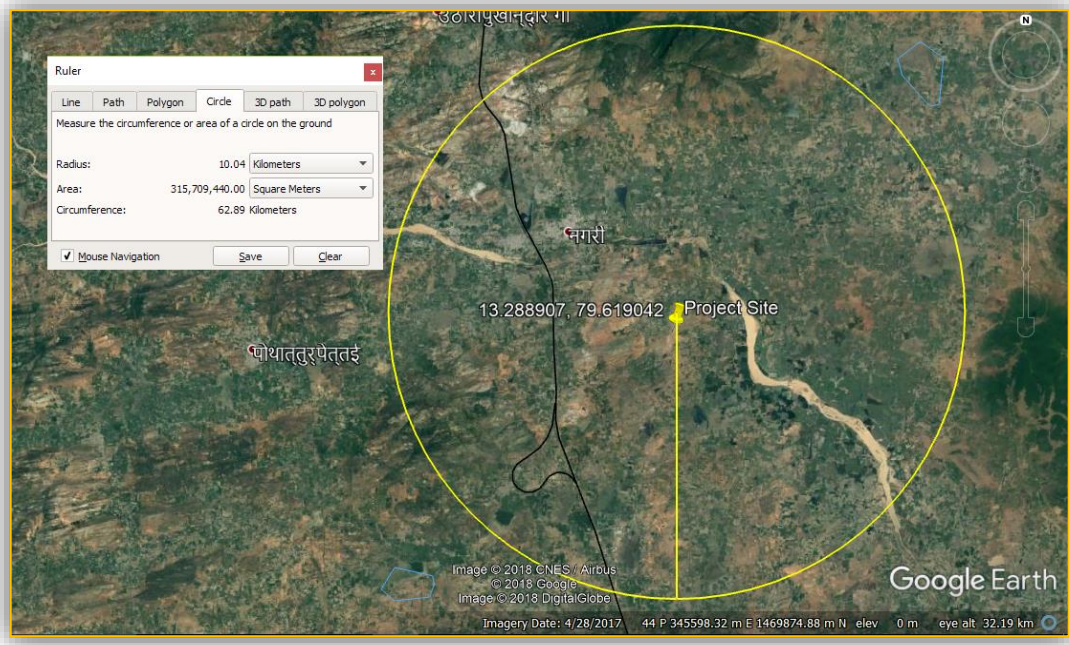


Figure 1: Proposed Project Location

1.3 Site Conditions



Figure 2 : MMS structure erected at OG Kuppam project site



Figure 3: Internal Road access



Figure 4: Switchyard

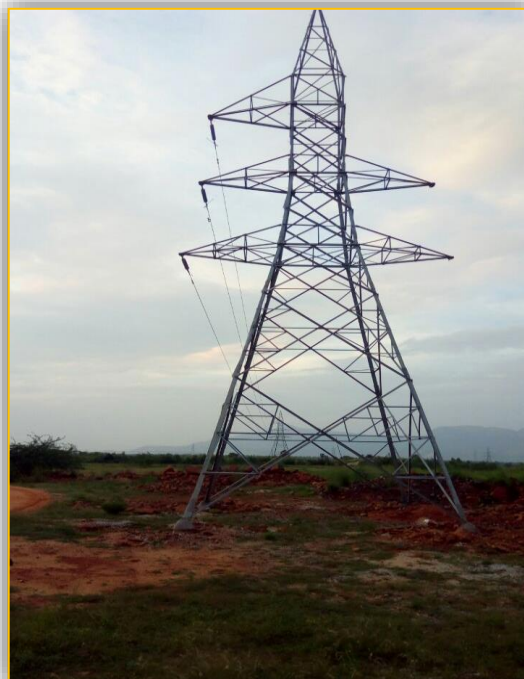


Figure 5: Transmission line & towers

Site Features

- The type of vegetation over the land is grazing.
- There is no water source available nearby the project site.
- There is no shading object located in the vicinity of site.
- The soil condition of the site is gravel, sandy (red & yellow soil).
- The site is located relatively close to good electrical infrastructure including the major substation from Nagari. Hence, in terms of connection, the site is therefore considered adequate.
- There is no coastal region and reserve forest nearby the project site.

2. PROJECT JUSTIFICATION

2.1 Indian Energy Scenario

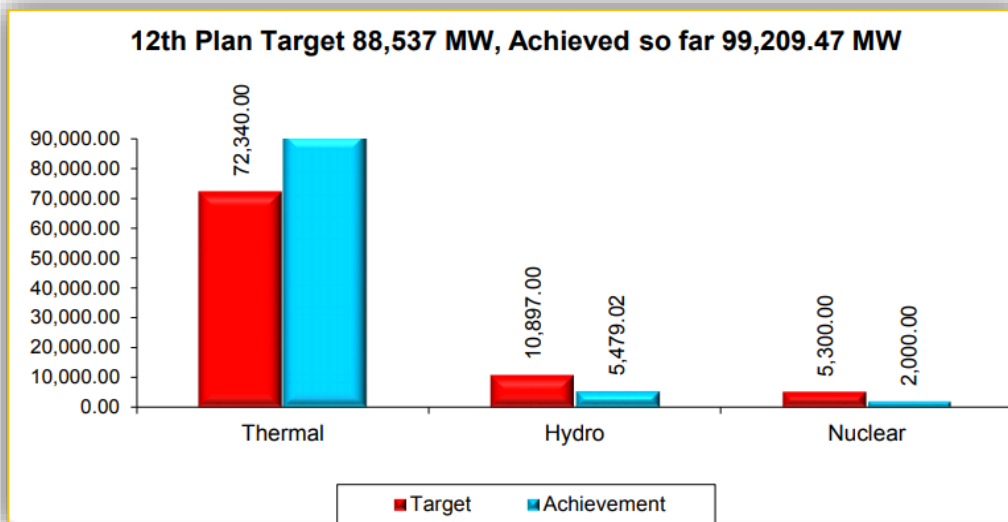
India, home to 18% of the world's population, consumes only about 6% of the World's Primary Energy³. India's energy consumption has almost doubled since 2000 and the potential for further rapid growth is gigantic. Policy-makers at National and State levels are intensifying their efforts to ensure that energy is a spur, rather than a hindrance, to India's advancement, looking to removing obstacles to investment in energy supply while also focusing on energy efficiency and pricing reform. Coal is the most important fuel in the energy mix, but India's recent climate pledge underlined the country's commitment to a growing role for low-carbon sources of energy, led by solar and wind power.

Economic growth and increasing prosperity, coupled with factors such as growing rate of urbanization, rising per capita energy consumption and widening access to energy in the country, are likely to push energy demand further in the country. The country has been rapidly adding capacity over the last few years, with total installed capacity growing to 344 GW as on March 2018.⁴ The Planning Commission of India has set a power capacity addition target of 88,537 MW in the 12th Plan, in which 99,209.47 MW (about 12% increased achievement than the target) has been achieved upto March 2017. In particular for the year 2017-2018, the capacity addition target was 13,171 MW while 3,740 MW has been achieved as on February 2018.⁵

³ https://www.iea.org/publications/freepublications/publication/IndiaEnergyOutlook_WEO2015.pdf

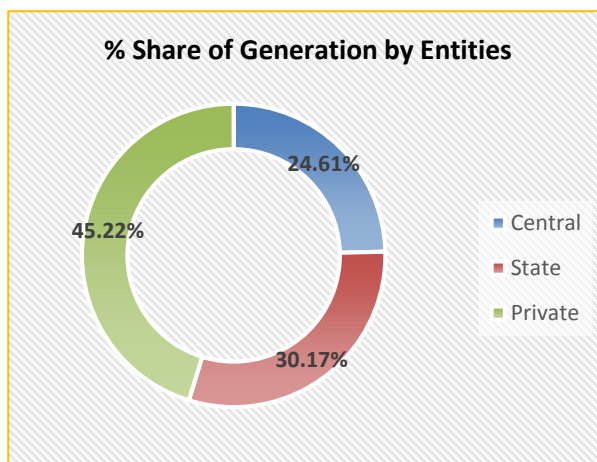
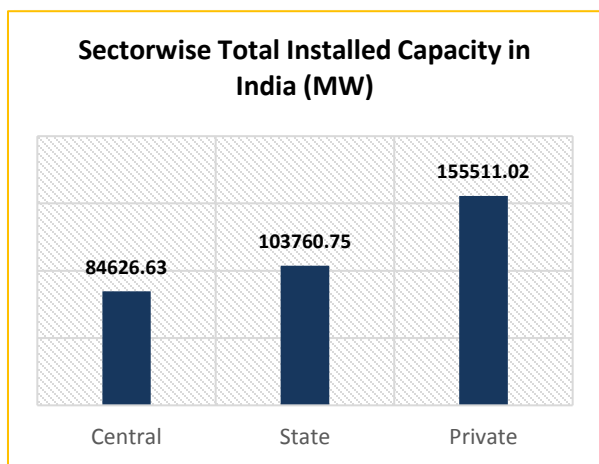
⁴ http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-06.pdf

⁵ http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-05.pdf



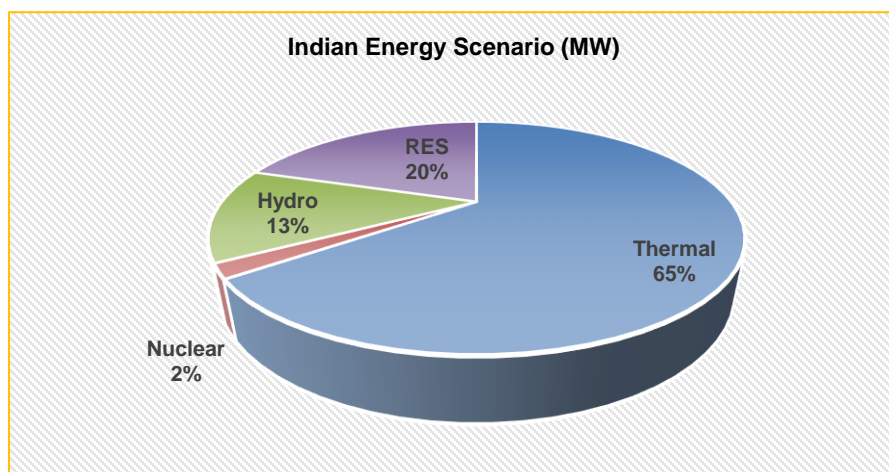
Graph 1: 12th Plan Capacity Target and Achievement

As on June 2018, out of the total installed capacity of 343.89 GW, the Central Sector accounts for 24.61%, while the State and Private Sectors occupy 30.17% and 45.22% share of capacity, respectively.⁶



Graph 2: Share of Generation by Entities in India

⁶ http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-05.pdf



Graph 3: Indian Energy Scenario (as on May 2018)⁷

India's demand growth of 165%, nearly three times the overall non-OCED growth of 61%, also outpaces each of the BRIC countries: China (+41%), Brazil (+60%), and Russia (+6%). India's share of global demand rises to 11% in 2040 from 5% in 2016, accounting for the second largest share of the BRIC countries. The share of coal in the energy mix falls from 57% in 2016 to 50% by 2040, while the share of renewable rises from 2% to 13%.⁸

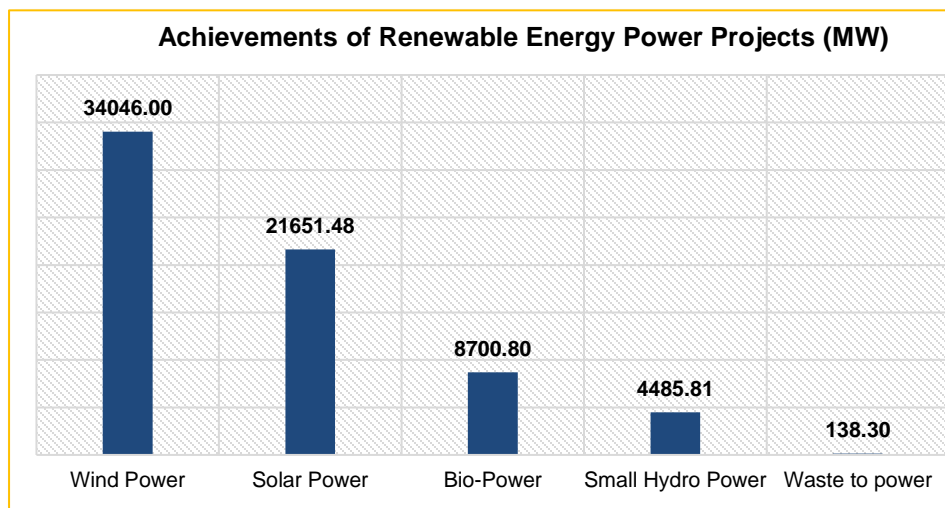
2.1.1 Indian Renewable Energy Scenario

India is on the path of rapid economic growth along with speedy overall development. India will require an assured supply of 3 to 4 times more energy than the total energy consumed today to meet the energy requirement for such a fast growing economy, simultaneously it has to face the global threat of climate change and different environment related problems. Renewable energy is a clean and sustainable source of energy derived from nature and it has potential to provide solutions to the venerable energy problems being faced by the developing countries like India. To overcome energy shortage in India the renewable energy sources like wind energy, solar energy, geothermal energy, ocean energy, biomass energy and fuel cell technology can be used. Power Generation from Renewable Sources (which includes Hydro power, Biomass Power, Waste to Energy, Solar and Wind) is on the rise in India, with the share in the country's total energy mix rising from 7.8% in 2008 to 20% in 2018. The installed renewable energy capacity is 69.02

⁷ http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-05.pdf

⁸ <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/energy-outlook/bp-energy-outlook-2018-country-insight-india.pdf>

GW as of March 2018. As per latest records of MNRE, Wind Power is the leading renewable energy source with 34.04 GW (49.31%) installed capacity followed by Solar Power with 21.65 GW (31.36 %) installed capacity.⁹



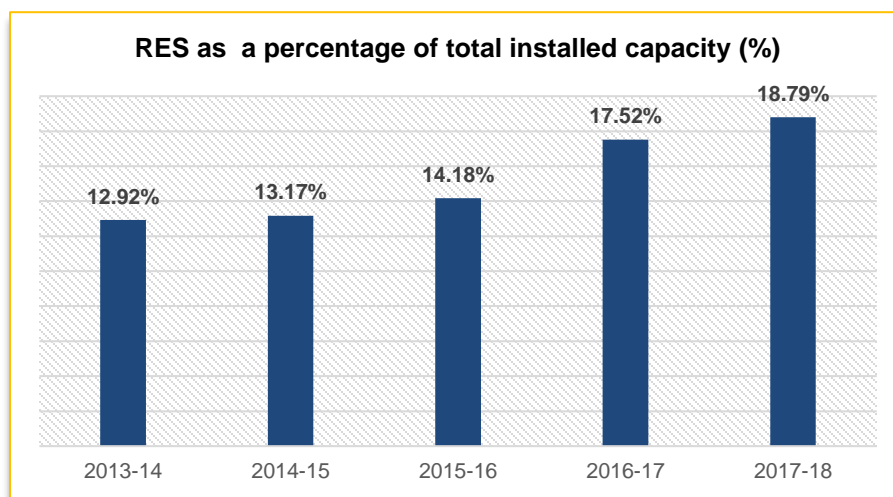
Graph 4: Total Installation of RES (in MW)

It has been estimated that renewables will comprise 49% of India's power generation by 2040. Over the last few years there has been an increase in percentage contribution of renewable energy to total installed capacity. In 2013-14 the contribution was 12.92% which has increased to 18.79% by January 2018. India aims to achieve a total of 175 GW of installed renewable energy capacity by 2022. India has moved from the second position in 2017 to fourth position in 2018 in the Renewable Energy Country Attractiveness Index (RECAI) as on May 2018¹⁰.



⁹ http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-05.pdf

¹⁰ <https://www.ey.com/gl/en/newsroom/news-releases/news-us-overtakes-india-on-renewable-energy-country-attractiveness-index-despite-rising-protectionism>



Graph 5: Year Wise Installation of RES¹¹

JNNSM

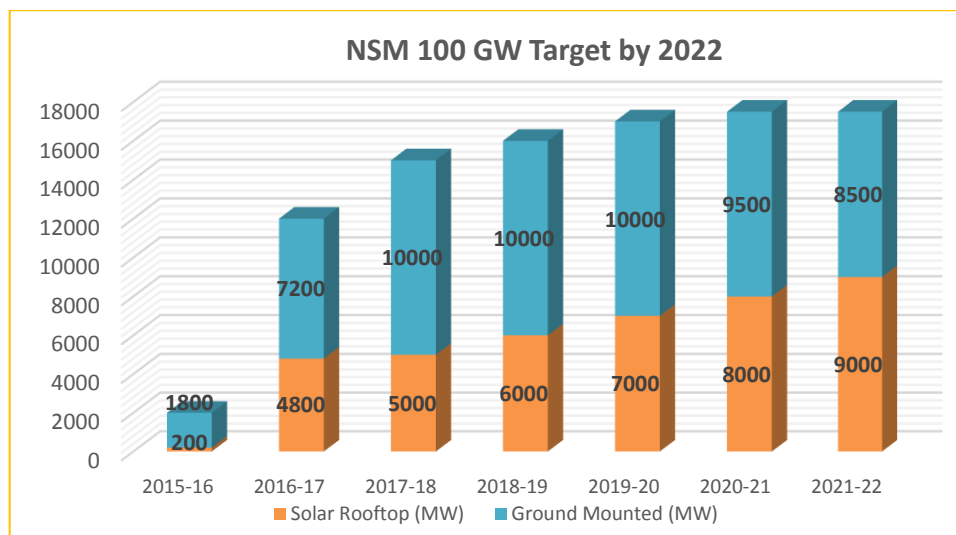
The Jawaharlal Nehru National Solar Mission (JNNSM) is a major initiative of the Government of India with active participation from States to promote ecologically sustainable growth while addressing India's energy security challenge. It will also constitute a major contribution by India to the global effort to meet the challenges of climate change. The objective of the Mission is to establish India as a global leader in solar energy, by creating the policy conditions for its large scale diffusion across the country as quickly as possible.

The Mission has set a target, amongst others, for deployment of grid connected solar power capacity of 100 GW by 2022 and is planned to be implemented in three phases with phase-1 by 2013, phase-2 by 2017 and phase 3 by 2022. The total estimated solar power potential in India is 748.9 GWp.¹²



¹¹ <http://www.irena.org/solar>

¹² <https://mnre.gov.in/file-manager/UserFiles/Statewise-Solar-Potential-NISE.pdf>



Graph 6: NSM Target by 2022

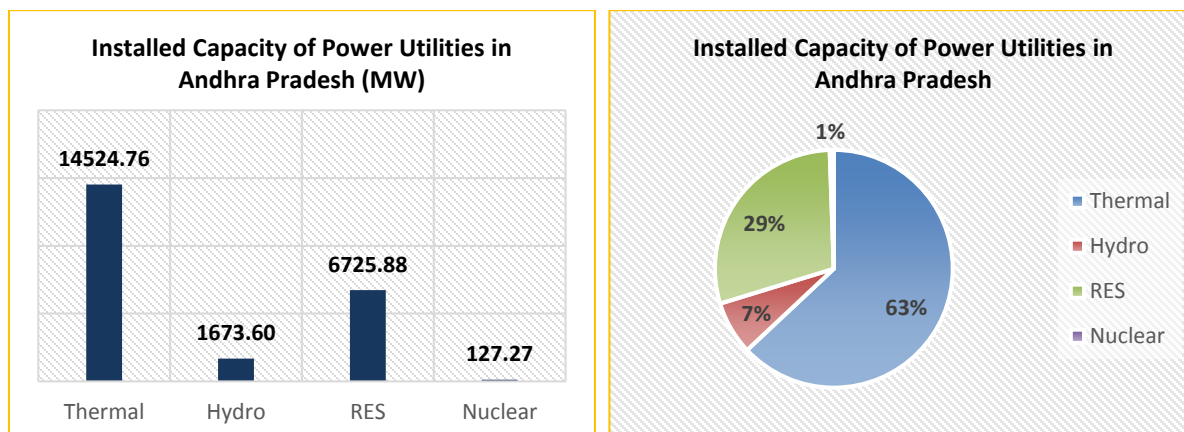
The Government has up-scaled the target of renewable energy capacity to 175 GW by the year 2022 which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro-power MNRE had laid down a plan of action to achieve the target of 100¹³ GW by 2022.

2.2 Andhra Pradesh Energy Scenario

The state of Andhra Pradesh is located in the southern part of India and forms a major constituent of the southern grid. Major electricity generation happens through the thermal and hydro power plants and these power plants are being operated by Andhra Pradesh Power Generation Company (APGENCO). Andhra Pradesh has a total installed power generation capacity of 23052 MW from all the sources. Out of it, 14524.76 MW is from thermal, 1673.6 MW from hydro, 6725.8 MW is from Renewable energy sources and 127.27 MW is from Nuclear (as on May 2018)¹⁴.

¹³ <http://mnre.gov.in/file-manager/grid-solar/100000MW-Grid-Connected-Solar-Power-Projects-by-2021-22.pdf>

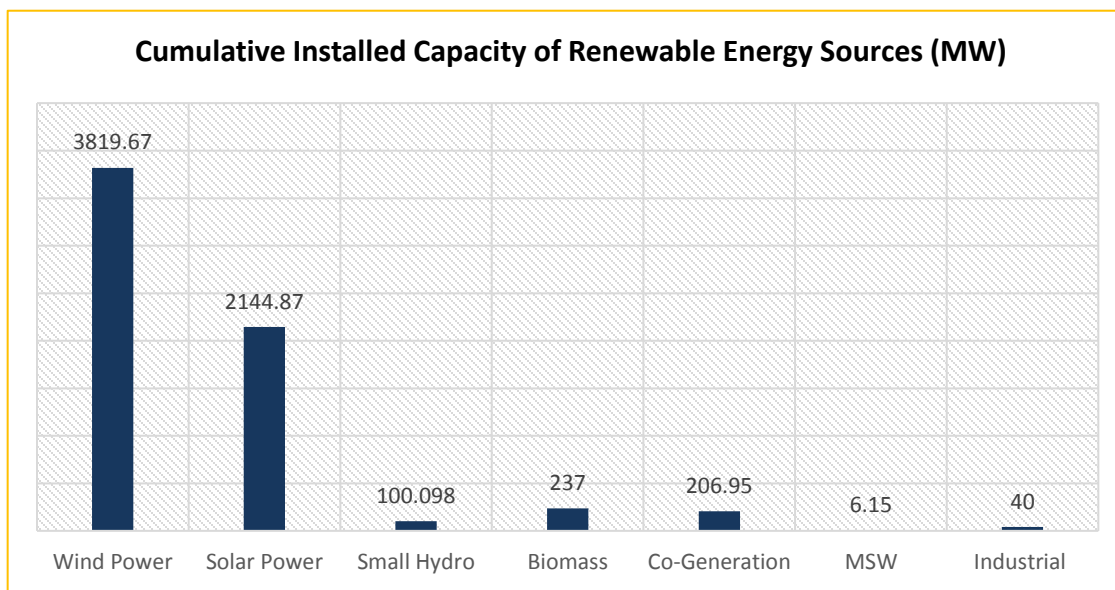
¹⁴ http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-05.pdf



Graph 7: Installed capacity of Power utilities in Andhra Pradesh (MW)

2.3 Andhra Pradesh Renewable Energy Scenario

Andhra Pradesh has emerged as one of the leading states for renewable energy in recent years and now ranks as second state for solar installations, with a cumulative capacity of 2144.87MW. The government of Andhra Pradesh has set target to achieve 18 GW renewable energy power capacities by the year 2021-22, out of which 10 GW is of solar and 8 GW is of wind power capacity. Andhra Pradesh has a total installed renewable energy power generation of 6554.45 MW¹⁵. The following graph shows the capacity of RE sources:



Graph 8: Cumulative installed capacity of Renewable Energy Sources

¹⁵ <http://www.irena.org/solar>

2.4 Andhra Pradesh Solar Policy

2.4.1 Introduction

India is blessed with abundant sunshine and solar power is expected to play a critical role in meeting the energy needs of the country in the long run. Solar power projects can be setup in a much shorter timeframe when compared to conventional power projects and the cost of solar power has become more economical today.

The State government is keen to tap the immense solar potential and promote this clean source of energy to meet the rising energy requirements of the State. Availability of about 300 sunny days in a year with solar insolation of more than 5 kWh/m²/day.

Policy: Andhra Pradesh Solar Policy, 2015

Objective:

To target a minimum total solar power capacity addition of 5,000 MW in the next five years in the State with a view to meet the growing demand for power in an environmentally sustainable manner.

2.4.2 Solar Power Projects

Sale of Power to AP Discom:

The government will promote setting up of Solar Power Projects for sale of power to AP Discoms. It is envisaged that the Discoms would procure around 2,000 MW of solar power capacity in a phased manner within the next five (5) years.

Captive/ Third Party Sale:

The government will encourage solar power producers to set up Solar Power Projects for captive use within the State or third party sale within and outside the State of Andhra Pradesh

Solar Parks

The Govt. of AP will develop Solar Parks with capacity additions of around 2500 MW in next five year to promote Solar Power Projects development in clusters of 500-1000 hectares.

2.4.3 Incentives

- Transmission and distribution charges for wheeling of power for captive/ Third party sale exempted.

- Distribution losses exempted only for Solar Power Projects injecting at 33kV or below irrespective of voltage level.
- Cross subsidy exempted for the period of 5 years from the date of commissioning.
- Electricity duty exempted for all Solar Power Projects.
- No NOC/Consent required from pollution control board.

2.4.4 Banking

Banking of 100% of energy shall be permitted for all Captive and Open Access/ Scheduled Consumers during all 12 months of the year. Banking charges shall be adjusted in kind @ 2% of the energy delivered at the point of drawl. The banking year shall be from April to March.

Drawls from banked energy shall not be permitted during five (5) month period from 1st April to 30th June and 1st February to 31st March of each financial year. In addition, drawls of banked energy during the Time of the Day (TOD) applicable during the peak hours, as specified in the respective Retail Supply Tariff Order, shall also not be permitted throughout the year.

2.4.5 Open Access

Intra-state Open Access clearance for the whole tenure of the project or 25 years whichever is earlier will be granted as per the APERC Regulations amended from time to time. In absence of any response or intimation from the Nodal Agency to the generator within 21 days, then such application shall be considered to be deemed open access.

2.4.6 Grid Connectivity and Evacuation Facility

The Eligible Developer shall bear the entire cost of construction of power evacuation facilities from the project upto the interconnection point and/or upto AP Transco / Discom(s) substation.

Solar Power Exempted for paying any supervision charges to AP Transco.

2.5 Benefits from the Project

Given the fact that this project is a renewable energy project, it leads to sustainable development through efficient utilization of naturally available sunlight. It is expected to add clean and green energy to the Indian grid, which is dominated by thermal technologies using polluting carbon-based fuels. 1 MW of Solar PV plant

can produce approximately 4 MWh of energy per day¹⁶. Hence, 25MW of Solar PV plant can produce 36500 MWh of energy per year. As per the “CO₂ Baseline Database for the Indian Power Sector” release by Central Electricity Authority¹⁷, the Grid Emission Factor for calculating the reduction in CO₂ equivalent was found to be 0.92 Ton of CO₂ per MWh of energy generated. Thus, 25 MW of Solar PV plant can reduce 33,580 tons of CO₂ equivalent per year. The PV technology does not produce any noise, toxic-gas emissions, reduces CO₂ emission, or greenhouse gases.

Alongside, the project will lead to local area development through creation of jobs for the local population and also increasing general visibility of the area for commercial activities. Globally, the solar PV installation increased from 73GW to 94GW as of 2017. China, India, the United States and Japan were the most important markets stands next to Turkey, Germany, Australia and the Republic of Korea. Employment opportunities got increased by 8.7% to approach 3.37 million jobs in 2017.

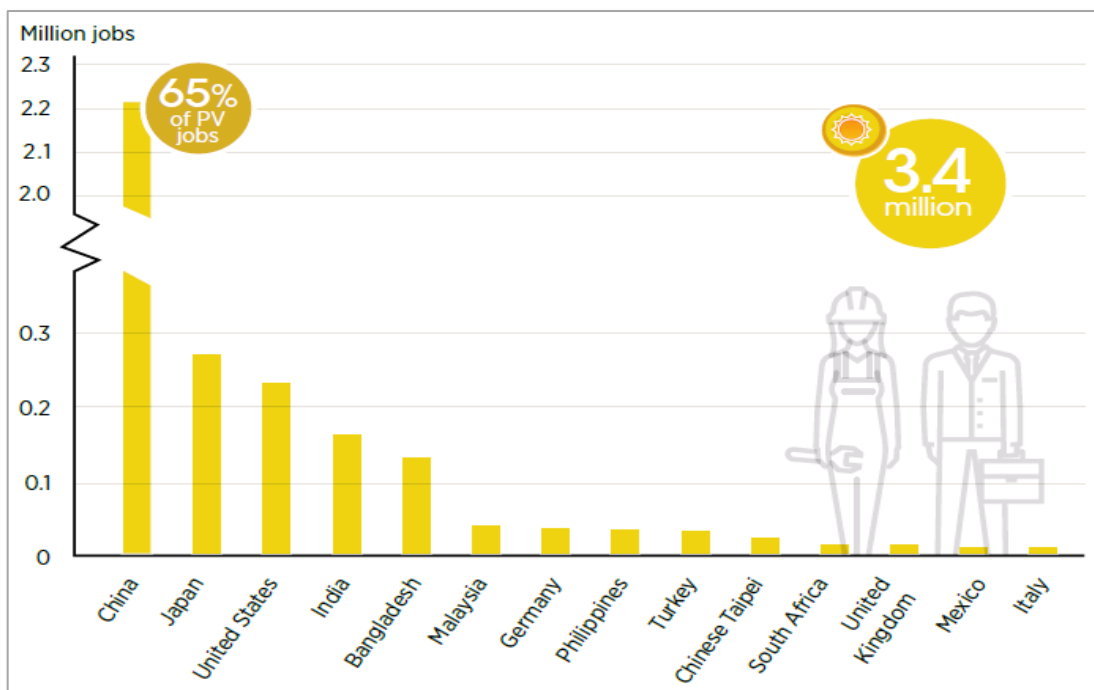


Figure 6: Leaders in Solar PV Employment¹⁸

¹⁶ http://www.eai.in/ref/ae/sol/rooftop/power_output

¹⁷ http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

¹⁸ https://irena.org//media/Files/IRENA/Agency/Publication/2018/May/IRENA_RE_Jobs_Annual_Review_2018.pdf

3. ESIA STUDY

3.1 Need for ESIA Study

The ESIA study is required for the following purposes:

- Environmental impact on the community
- Location of the project
- Substantial impact on the ecosystem of the locality
- Whether the project results in the diminution of the aesthetic, recreational, scientific, historic, cultural or other environmental quality of the locality
- Effects on any endangered species of flora and fauna or their habitat
- Scale of the project
- Extent of the degradation of the quality of environment
- Whether the project will result in an increase in demand for natural resources in the locality
- Cumulative impact of the project together with other activities or projects, on the environment

3.2 Objective of the ESIA Study

The objective of Environmental and Social Impact Assessment (ESIA) is to prepare a document based on anticipated Environmental Impact due to setting up this Photo voltaic based Solar Power Project and to applicable local and national regulations.

3.3 EIA Methodology

3.3.1 Steps involved in EIA process

Environmental Impact Assessment can be defined as the “*systematic process of identifying future consequences of a current or a proposed action*”. It provides information for decision making on the environmental consequences of proposed actions and it also promotes sustainable development through the identification of appropriate enhancement and mitigation measures. The steps involved in the EIA process were shown below:

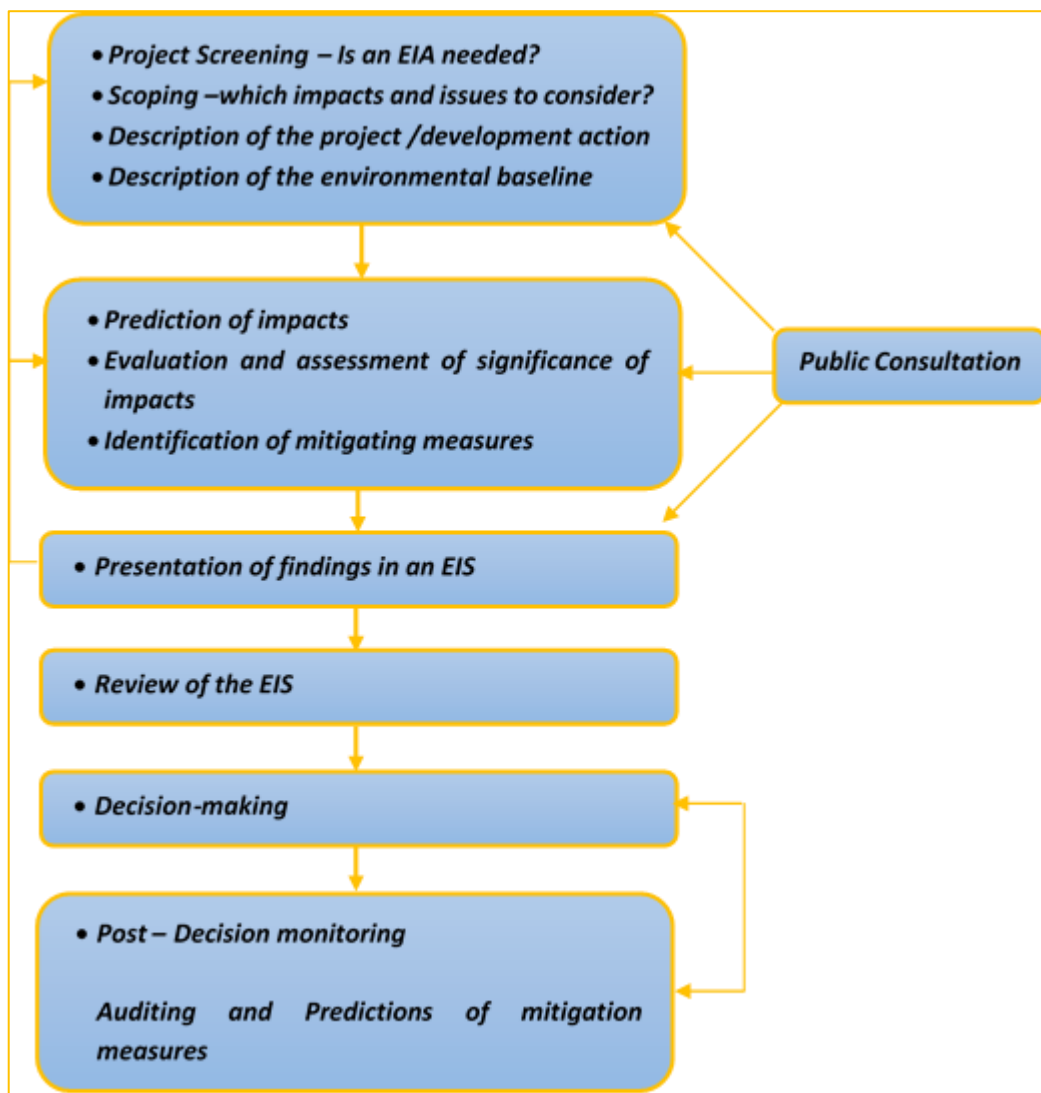


Figure 7: Steps involved in EIA process

3.3.2 EIA Methodology

EIA plays a major role in all stages of the project. It results in environmental safeguards which are sufficient to mitigate serious adverse effects and avoid irreversible loss of resource and ecosystem functions. The following figure illustrates the process of EIA cycle:

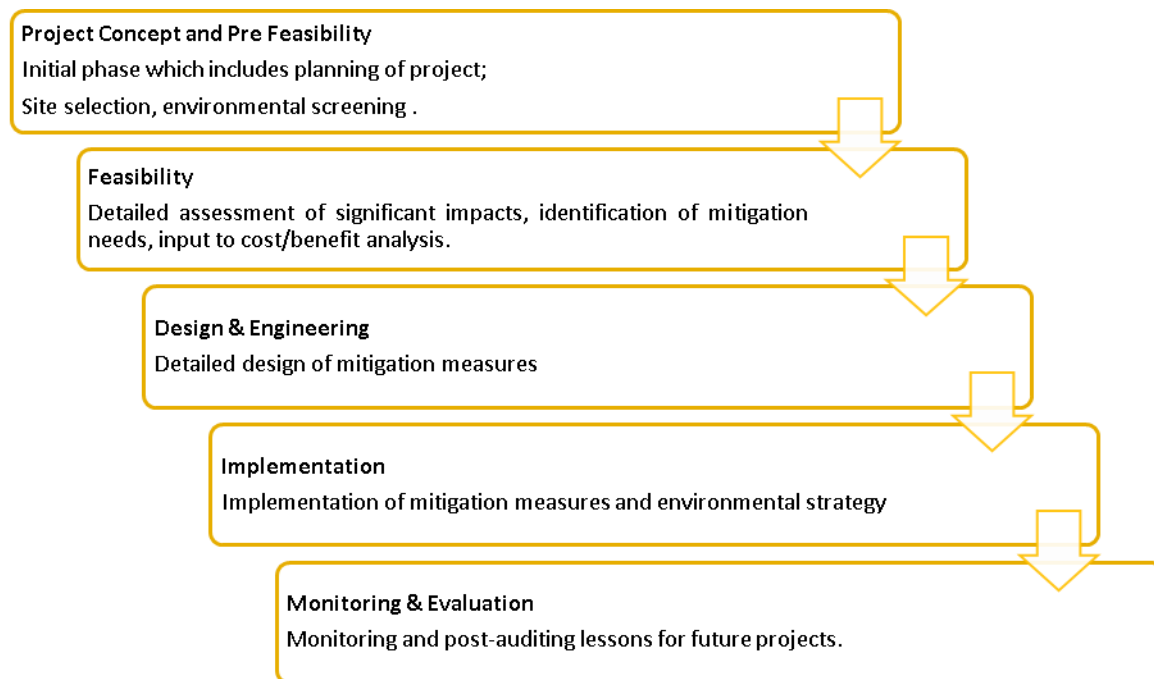


Figure 8: EIA Methodology process¹⁹

3.4 Legal Policies & Acts

The Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification²⁰, 2006 and hence, no environmental clearance is required. Hence, it does not require preparation of Environmental Impact Assessment Report and pursuing environmental clearance from Central Government or State Level Environmental Impact Assessment Authority.

The environmental regulations, legislations and policy guidelines and control for the proposed project are governed by various Government agencies. The principal environmental regulatory agency in India is Ministry of Environment and Forest (MoEF), Delhi. The important legislations governing the proposed

¹⁹ <https://www.epd.gov.hk/epd/SEA/eng/interactive/p20610.html>

²⁰ <http://envfor.nic.in/sites/default/files/OM-SolarPV.pdf>

project are given below:

The key environmental legislations pertaining to the proposed operations include²¹:

- The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment Protection Act, 1986, Rules there under (with amendments);
- Land Acquisition Act
- Batteries (Management and Handling) Rules, 2001
- Indian Labour Laws
- National Environmental Appellate Authority Act 1997
- Wildlife Protection Act 1980
- National Policy on Resettlement and Rehabilitation of Project Affected families 2007
- Electricity Act 2003

Besides this, the project shall meet the National Ambient Air Quality Standards (NAAQS), Ambient Noise Standards and Effluent Discharge Standards set by CPCB.

3.4 Environmental & Social Impact & Management Plan (ESMP)

The ESMP has been designed within the framework of requirement under ADB's Environmental and Social Safeguard (2009) on environmental and socio-economic aspects for construction and operation phases of the proposed project. The mitigation measures to be adopted for the implementation of the proposed project include the following:

- Environmental Management Plan
- Rainwater Harvesting
- Clean Development Mechanism
- Occupational Health and Safety
- Labour Working Conditions
- Construction Labour Management
- Environmental Action and Monitoring Plan

²¹ [http://spa.ac.in/writereaddata/Day3\(NGT\).pdf](http://spa.ac.in/writereaddata/Day3(NGT).pdf)

- Community Development Plan
- Public Consultation and Information Disclosure Plan
- Grievance Redressal Mechanism
- Disaster Management Plan
- Resettlement Plan

3.5 Structure of the ESIA Report

The report consists of the following chapters and the contents of the chapters are briefly described in this section.

Legal Policies and Institutional Framework: This chapter presents applicable legal provisions and regulations, IFC Performance Standards, National environmental and social (including labor) laws and policies as well as the relevant national and international standards and guidelines.

Project Description: This chapter provides information related to various feature of the proposed power plant including power generation process, transmission lines, access roads, utilities, water and power requirement and other proposed infrastructure facilities.

Baseline Status: This chapter brings out findings based on secondary data on physical, biological and socio economic environments, to present the baseline environmental condition of the study area. It includes the information regarding micro-meteorology, water environment, air environment, soil environment, land use, demographics and ecological environment and the socio- economic baseline settings of the study area.

Analysis of Alternatives: Alternatives considered for the proposed project are evaluated by comparing the feasibility, recurrent costs, suitability and discussed with particular emphasis on environmental considerations.

Anticipated Environmental and Social Impacts and Mitigation Measures: This chapter provides details of the environmental and social impact assessment of the project during construction, operational and decommissioning phases. It expresses the impacts of the proposed project on the various components of environment. Mitigation measures are suggested along with the impact prediction. This

section presents a brief outline of impact and respective management plan to address socio-economic conditions.

Environmental & Social Management Plan: This chapter deals with the Environmental and Social management plan incorporating recommendations to implementation of the suggested mitigation measures to minimize adverse environmental and social impacts during construction, operation and decommissioning phases. The chapter includes management program, organization structure, training, community engagement, monitoring and reporting elements. The chapter also includes Environment Social Action Plan and Corporate Social Responsibility Plan.

Grievance Redressal Mechanism: This chapter addresses the Grievance Redressal Mechanism (GRM) which provides an effective approach for complaints and resolution of issues made by the affected community in reliable way.

Public Consultation, Participation and Disclosure: This chapter addresses the requirement of Public Consultation ADB's Integrated Safeguards System Policy.

Conclusions & Recommendations: This chapter consolidates the conclusions and recommendations of the ESIA Study carried out for the Solar PV Report.

The following figure represents the structure of the ESIA report:



4. LEGAL POLICIES & INSTITUTIONAL FRAMEWORK

4.1 Introduction

The emerging environmental scenario calls for attention on conservation and judicious use of natural resources. There is a need to integrate the environmental consequences of the development activities and for planning suitable measures in order to ensure sustainable development of a region. The environmental considerations in any developmental process have become necessary for achieving sustainable development. To achieve such goals the basic principles to be adopted are:

- To enhance the quality of environment in and around the project area by adopting proper measures for conservation of natural resources
- Prevention of adverse environmental and social impact to the maximum possible extent
- To mitigate the possible adverse environmental and socio-economic impact on the project-affected areas.

The proposed Project is covered under several environmental legislations. This report has been prepared with reference to the ADB's Safeguards Policy Statement²² (SPS) – safeguards requirements on environment and other legislations applicable to the proposed project.

4.2 Regulatory Framework

Ministry of Environment and Forests (MoEF) is the nodal agency for drafting the new environmental legislations and giving the Environmental Clearance (EC) to the Greenfield and Brownfield projects.

The process of Environmental Impact Assessment was made mandatory in 1994 under provisions of Environmental Protection Act, 1986. Under the current EIA notification, its subsequent amendments, procedure has been laid down for projects or activities that require prior environmental clearance from the concerned regulatory authority.

The notification categorizes the projects as Category "A" and Category "B" based on the spatial extent of potential impacts on human health and natural and manmade resources. Application seeking prior environmental clearance in all cases is required to be made in the prescribed forms along with conceptual

²² <https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>

plan before commencing any construction activity or preparation of land at the site by applicant.

All projects or activities included as Category 'A' in the Schedule should require prior environmental clearance from the Central Government in the Ministry of Environment and Forests (MoEF). All projects or activities included as Category 'B' in the Schedule will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA).

As per requirement of environment clearance under EIA "Solar Projects" are not covered by the notification and hence no environmental clearance is required²³. The Solar Power PV Projects does not require preparation of Environmental Impact Assessment Report and pursuing Environmental Clearance from Central Government or State Level Environmental Impact Assessment Authority.

4.3 Detailed Framework Process of ADB's Environmental and Social Assessment

4.3.1 ADB's Safeguard Policy Statement (2009)

As described in the Safeguard Policy Statement (SPS) (2009), safeguard policies are generally understood to be operational policies that seek to avoid, minimize or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. ADB's safeguard policy framework consists of three operational policies on the environment, Indigenous Peoples and involuntary resettlement. All three safeguard policies involve a structured process of impact assessment, planning and mitigation to address adverse effects of projects throughout the project cycle.

SR1 on Environment requires that environment must be considered at all stages of the project cycle from project identification through implementation. The environmental assessment requirements depend on the environment category (either A, B, C or FI). A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse and often reversible through mitigation. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. A proposed project is classified as category FI if it involves investment of ADB funds through a financial intermediary.

²³ <http://envfor.nic.in/sites/default/files/OM-SolarPV.pdf>

SR 2 on Involuntary Resettlement requires that all impacts (physical and economic displacement) brought about by land acquisition be mitigated properly following the principle of replacement value. The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. SR 2 discusses the objectives, scope of application, and underscores the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents, exploring negotiated land acquisition, disclosing information and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.

SR 3 on Indigenous Peoples require that the Indigenous people are identified and if present, they should benefit from the development projects and the project should avoid or mitigate potentially adverse effects on indigenous people caused by the Project. In India, this applies to scheduled tribes (ST). As per the survey of the solar power plant site and vicinity, the proposed solar PV project does not affect ST families.

4.3.2 ADB's Gender and Development Policy (1998)

ADB Policy on **Gender and Development** (GAD) requires Projects to consider gender issues in all aspects of ADB operations, accompanied by efforts to encourage women's participation in the decision-making process in development activities. In this Project, the GAD policy will be taken into consideration during preparation and implementation of the Community Development/CSR Program, Community Liaison, and actions relevant to mitigating impacts of involuntary resettlement.

4.3.3 ADB's Social Protection Strategy (2001)

The Social Protection Strategy requires that Projects comply with applicable labor laws, and take the following measures to comply with the core labor standards for the ADB financed portion of the Project:

- a) Carry out its activities consistent with the intent of ensuring legally permissible equal opportunity fair treatment and non-discrimination in relation to recruitment and hiring, compensation, working conditions and terms of employment for its workers;
- b) Not restrict its workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of

employment;

- c) Engage contractors and other providers of goods and services
 - i. who do not employ child labor or forced labor
 - ii. who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of (a) ensuring legally permissible equal opportunity and fair treatment and non-discrimination for their workers, and (b) not restricting their workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment and whose subcontracts contain provisions which are consistent with paragraphs (i) and (ii).

4.3.4 The International Finance Corporation (IFC) Performance Standards²⁴

The IFC Performance Standards apply to private sector projects and provide project participants with instruments to structure, design, construct and manage the operations of projects in an environmentally and socially acceptable manner, while providing measures to avoid or mitigate adverse environmental and social impacts resulting from the projects. These Performance Standards are intended to focus on outcomes rather than process, thereby stressing the implementation of sound environmental and social management systems that achieve desired outcomes, including the mitigation of adverse impacts.

The following Performance Standards are applicable to the proposed Solar Photovoltaic Power Project:

- Social & Environmental Assessment and Management Systems
- Labor and Working Conditions
- Community Health and Safety
- Land Acquisition and Involuntary Resettlement

²⁴https://www.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES

Social & Environmental Assessment and Management Systems

Objectives:

- Identify and assess environmental and social impacts in the project's area of influence.
- Avoid, minimize, mitigate or compensate for adverse impacts
- Ensure that affected communities are engaged on issues that may affect them
- Promote improved environmental and social performance through effective management systems

Labour and Working Conditions

Objectives:

- Establish, maintain and improve the worker-management relationship
- Promote fair treatment and equal opportunity for workers, in compliance with national laws
- Protect workforce by addressing child labour and forced labour
- Promote safe working conditions and protect / promote the health of workers

Community Health & Safety

Objectives:

- Avoid or minimize the risks to, and impacts on, the health and safety of the local community over the project life cycle, from both routine and non-routine circumstances.
- Ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.

Land Acquisition and Involuntary Resettlement

Objectives:

- Avoid or minimize involuntary resettlement whenever feasible by exploring alternative project designs.

- Mitigate adverse social and economic impacts by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and informed participation of those affected.
- Improve or at least restore livelihoods and living standards of displaced persons.
- Improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.

4.4 Legislative Framework

The environmental regulations, legislations and policy guidelines and control for the proposed project are governed by various Government agencies. The principal environmental regulatory agency in India is Ministry of Environment and Forest (MoEF), Delhi. The important legislations governing the proposed Project is given below:

The key legislations pertaining to the proposed operations include:

- The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment Protection Act, 1986, Rules there under
- Land Acquisition Act, 1894
- Batteries (Management and Handling) Rules, 2001
- Workmen's Compensation Act, 1923
- National Environmental Appellate Authority Act 1997
- Wildlife Protection Act 1980
- Indian Electricity Rules, 1956 there under
- National Resettlement & Rehabilitation Policy, 2007
- Right of Way and compensation under Electricity Act 2003
- Minimum Wages Act, 1948
- Child Labor (Prohibition and Regulation) Act, 1986
- The Labors Act, 1988
- The Factories Act, 1948
- Contract Labor (Regulation and Abolition) Act, 1970
- The Building and other Construction Workers Act, 1996

These key instruments and all subsequent and relevant amendments to them are discussed in detail below.

4.4.1 The Water (Prevention and Control of Pollution) Act, 1974

This Act introduced the State Pollution Control Boards (SPCB) to grant Consent for Establishment (CFE) and Consent for Operation (CFO) to the industries. The establishment or operation of any industry cannot be undertaken without the prior consent of the SPCB. While granting the consent, SPCB can stipulate conditions pertaining to the effluents arising from the process. The consent to operate is granted for a specific period (usually one year) after which the conditions attached are reviewed by the SPCB before renewal.

4.4.2 The Air (Prevention and Control of Pollution) Act, 1981

This Act is very similar in scope to the Water Act, 1974. The Act stipulates the establishment of State Boards for the Prevention and Control of Air Pollution. In States where a water pollution board had already been established under the earlier Water Act, the two boards were combined to form SPCBs.

4.4.3 Environment Protection (EP) Act and Rules, 1986

EP Act was enacted to provide for the protection and improvement of environment and for matters connected there with. A decision was taken by India to protect and improve the human environment at the United Nations Conference on Human Environment held at Stockholm in June 1972. It is considered necessary to prevent the hazards to human beings, other living creatures, plants and property.

This Act is an umbrella Act and gave birth to many sub acts and rules. The EP Act call for procedural requirements for:

- Obtaining Environmental Clearance
- Submission of Environmental Statement.

This act was enacted with the objective of providing for the protection and improvement of the environment. It empowers the Central Government to establish authorities [under section 3(3)] charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. Under this Act, the Central Government is empowered to take measures necessary to protect and improve the quality of the environment by setting standards for emissions and discharges; regulating the location of industries; management of hazardous wastes, and protection of public health and welfare. From time to time the Central Government issues notifications under the EPA for the protection of ecologically-sensitive areas or

issues guidelines for matters under the EPA.

The important environmental legislations applicable to the proposed project are given in table:

Table 2: Key Environment Legislation

Name	Scope and Objectives	Key Areas	Operational Agencies/
Water (Prevention and Control of Pollution) Act, 1974	To provide for the prevention and control of water pollution and enhancing quality of water	Control of Sewage and industrial effluent discharges	Central and State Pollution Control Boards
Air (Prevention and Control of Pollution) Act 1981	To provide for the prevention and control of air pollution	Controls emission and air pollutants	Central and State Pollution Control Boards
Environment Protection Act, 1986 Environment Protection Rules, 1989	To provide for the protection and improvement of environment	An umbrella Legislation; supplements pollution laws	Central Government, nodal agencies MoEF, can delegate powers to department of environment
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 1981	To provide for the protection and improvement of the forests	A legislation to protect forests and forest products	Central Government, nodal agencies MoEF, can delegate powers to Department of Forest
Noise Pollution (Prevention & Control) Rules 2000	To control and take measures for abatement of noise and ensure that the level does not cross specified standards	Noise in urban area and around industrial sites	Central Government, nodal agencies MoEF, State governments

Hazardous Wastes (Management And Handling) Rules,1989, 2001	To the adequate handling of hazardous materials or wastes	Hazardous waste generated from the industrial activity	Central Government, Nodal Agencies MoEF, CPCB
Public Liability Insurance Act, 1991	To provide for public liability- insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto	To provide public liability insurance during risk material handling	Central Government, Nodal Agencies MoEF, State Govt.

4.4.4 Land Acquisition Act

The Land Acquisition Act (LA Act) of 1894, provides for the acquisition of land for public purposes and companies in national interest and for determining the amount of compensation to be made on account of such acquisition.

The Land Acquisition Act of 1894 is summarized below:

- Land identified for the purpose of a project is placed under Section 4 of the LAA. This constitutes notification. Objections must be made within 50 days to the Collector (highest administrative officer) of the concerned District. The LAA requires 30 days for objections
- The land is then placed under Section 6 of the LAA. This is a declaration that the Government intends to acquire the land. The Collector is directed to take steps for the acquisition, and the land is placed under Section 9. Interested parties are then invited to state their interest in the land and the price. Under Section 11, the Collector should make an award within two years of the date of publication of the declarations. Otherwise, the

acquisition proceedings should lapse

- In case of disagreement on the price awarded, within six weeks of the award the parties can request the Collector to refer the matter to the Courts to make a final ruling on the amount of compensation
- Once the land has been placed under Section 4, no further sales or transfers are allowed. However, since the time lag between Sections 4 and the others following it is about three years, land transfers are not uncommon
- Compensation for land and improvements (such as houses, wells, trees, etc.) is paid in cash by the project authorities to the State government, which in turn compensates landowners. In the case of acquisition for coal projects, the coal companies make direct payments to landowners
- The price to be paid for the acquisition of agricultural land is based on sale prices recorded in the District registrar's office averaged over the three years preceding notification under Section 4. The compensation is paid after the area is acquired, actual payment by the State taking about two or three years. An additional 30 percent is added to the award as well as an escalation of 12 percent per year from the date of notification to the final placement under Section 9. For delayed payments, after placement under Section 9, an additional 9 percent per annum is paid for the first year and 15 percent for subsequent years.

4.4.5 Batteries (Management and Handling) Rules, 2001

The MOEF has issued final Batteries (M&H) Rules, 2001 to control the hazards associated with the backyard smelting and unauthorized reprocessing of lead acid batteries. Manufacturers/ Assemblers/ Re-conditioners/ Importers/ Recyclers/ Auctioneers/ Users/ bulk Consumers are required to submit half yearly returns to the SPCB who have been designated as the Prescribed Authority. The forms have been designed in such a manner as to enable easy verification of responsibilities fixed for every one under the rules. The bulk consumer-means a consumer such as the Departments of Central Government like Railway Defence, Telecom, Posts and Telegraph, the Departments of State Government, the Undertakings, Boards and other agencies or companies who purchase hundred or more than hundred batteries per annum.

The project does not envisage any storage of power and hence it is not applicable.

4.4.6 Indian Labour Laws

All the workmen of the company are required to be governed by the relevant Indian Labour laws, which are stated below:

Workmen's Compensation Act, 1923

The Workmen's Compensation Act, 1923 is one of the important social security legislations. It aims at providing financial protection to workmen and their dependents in case of accidental injury by means of payment of compensation by the employers.

Main Provisions and Scope of the Act

Under the Act, the State Governments are empowered to appoint Commissioners for Workmen's Compensation for (i) settlement of disputed claims, (ii) disposal of cases of injuries involving death, and (iii) revision of periodical payments. Sub-section (3) of Section 2 of the Act, empowers the State Governments to extend the scope of the Act to any class of persons whose occupations are considered hazardous after giving three months' notice to be published in the Official Gazette. Similarly, under Section 3(3) of the Act, the State Governments are also empowered to add any other disease to the list mentioned in Parts A and B of Schedule – II and the Central Government in case of employment specified in Part C of Schedule III of the Act.

4.4.7 National Environment Appellate Authority Act 1997

The National Environment Appellate Authority (NEAA) was set up by the Ministry of Environment and Forests to address cases in which environment clearances are required in certain restricted areas. An Act to provide for the establishment of a National Environment Appellate Authority to hear appeals with respect to restriction of areas in which any industries, operations or processes or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards under the Environment (Protection) Act, 1986 and for matters connected therewith or incidental thereto.

4.4.8 Wild Life (Protection) Act 1972

The Government of India enacted Wild Life (Protection) Act 1972 with the objective of effectively protecting the wild life of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The punishment and penalty for offences under the Act are more stringent. The objective is

to provide protection to the listed endangered flora and fauna and ecologically important protected areas.

4.4.9 National Re-habitation and Resettlement Policy 2007

The objectives of the policy are as follows:-

- a. To minimize displacement and to identify non-displacing or least displacing alternatives;
- b. To plan the R&R of PAFs including special needs of Tribals and vulnerable sections;
- c. To provide better standard of living to PAFs; and
- d. To facilitate harmonious relationship between the Requiring Body and PAFs through mutual cooperation.

4.4.10 Electricity Act 2003

The Act consolidates the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies constitution of Central Electricity Authority, Regulatory Commissions and establishment of Appellate Tribunal and for matters connected therewith or incidental thereto. Related section relevant to the implementation of the Project and in particular the transmission requirement for Right of Way, below:

- a. Section 68 (1) - sanction of the Ministry of Power (MOP) is a mandatory requirement for taking up any new transmission project.
- b. Section 164 –under this section NEEVMPL has all powers that the telegraph authority possesses and can erect and construct towers without actually acquiring the land.

4.4.11 Firefighting

The Fire Protection Research Foundation (FPRF) identifies hazards affecting fire prevention services with solar panel use. Firefighters must distinguish between the types of solar power used to work efficiently in the event of a fire. Without knowledge the type of panel used, firefighters' safety may be at risk. Hazards apparent in both types include flame spread, slipping and structural collapse due to added weight.

Firefighters and other emergency-response teams require special training to work safely around solar-energy technology. The fire-related hazards of photovoltaic conversion for emergency responders are burns, electric shock, inhalation of toxic smoke, battery leakage and explosion and roof-related injuries.

- A PV system includes an electric shock hazard.
- Fires that involve solar power systems can be one of three basic types depending on the point of ignition
 - (1) an external exposure fire to a building equipped with a solar power system;
 - (2) a fire originating within a structure from other than the solar power system; or
 - (3) a fire originating in the solar power system as the point of ignition.

4.5 Environment, Health & Safety (EHS) Policy

Well-established Corporate Occupational Health and Safety measures will be applied and strictly implemented, and all national labor laws and applicable International Labour Organization conventions on workplace conditions will be followed. Regulations related to occupational Health and Safety management will be issued and strictly enforced. All personnel will receive training in Occupational Health and Safety practices. Safety drills will be carried out periodically. Safety manuals or handbooks will be prepared as required.

The safety manual to be used during the construction period and Environment Management

System ISO 14001:2004 and occupational Health & Safety management system OHSAS 18001:2007 certification for the site should be obtained.

The company believes that good Health, Safety and Environmental performance is an integral part of efficient and profitable business management and these matters rank equally in importance with other management responsibilities and that success in these areas depends in the involvement and commitment of everyone in the organization.

As a consequence to the Company's overall commitment to preserve Health, Safety, and a Sound

Environment the company has a responsibility to:

- Provide and maintain healthy and safe working conditions, equipment and systems of work for all employees.
- Ensure the protection of the health and safety of people who may be affected by its

constructions.

- Prevent, or if that is not practicable, minimize and make safe releases to air, water and land of substances which could adversely affect human health or the environment.
- Reduce waste and source by careful use of materials, energy and other resources and maximize recycling opportunities.
- Set targets for improving health and safety at work and environmental protection, carry out regular assessments and report annually on performance.
- Ensure that each of its locations adopts policies and commitments which also describe the local organization and arrangements for putting them into practice.

The Company regards Health, Safety and Environmental matters as mainstream management responsibilities.

- Executive and the line managers at all levels within the company are directly responsible through the normal management structure for Health, Safety and Environmental matters in the operations under their control.
- All employees have a responsibility to take reasonable care of themselves and others while at work and to participate positively in the task of preserving workplace health and safety and a sound environment.

5. EXISTING ENVIRONMENTAL AND SOCIAL CONDITION OF THE PROJECT LOCATION

5.1 Environmental Social Parameters of the Site

Environmental/ Social Parameters	Description	Remarks
ESIA required?	Not required	No livelihood will be disturbed. In addition, since solar power projects are non-polluting in nature and do not involve disposal of solid waste, effluents and hazardous substances on land, air and water, such projects are exempted from environmental clearance as per the EIA notification.
Are there neighbors subject to be against the project?	No	Community members are highly interested in using the site for a solar PV plant. There are no houses in direct view of the site.
Are there any protected species or is it part of a protected area?	No	There are no endangered species in the project area.
Any resettlements required?	No	There are no habitation/settlements within the site, thus no resettlement issues prevails.
Is anyone subject to loss of livelihood (particular women)?	No	The land remains fallow throughout the year except during the rainy season when it is used for grazing. Thus, the proposed project does not involve loss of livelihood.
Is the site subject to ancestral rights?	No	All the families in the community have been sensitized about the proposed project on the land and are anxiously awaiting its implementation.
Does the site provide food to the local community?	No	No farming activities currently in place.
Site preparation needed? (backfill, removal of stones, felling of trees).	Yes	Consideration should be given to the existing site contours. Site levelling works (backfill, removal of stones, felling of trees) will be required.

Is tree-felling subject to any compensation?	No	Cutting down of the few trees in the site will not raise any alarm.
Has the site particular religious significance?	No	No significant area or building of cultural heritage is present near the project site; hence no impact is envisaged
Are there day tracks or seasonal tracks (for animal herds) on the site?	No	No animal droppings were observed by the local people.

5.2 Land

The land available for installation is about 92 acres which can accommodate about **25 MW of solar PV capacity**.

5.3 Waste Water Treatment and Disposal System

The project developer will use sprinkler system for cleaning of PV modules. This will enabling the system to produce more energy. The system also eliminates the need for elevated handling and cleaning risks. Since the water is used for PV module cleaning purpose, the drain water collected after cleaning the solar modules shall be passed through a sump with a baffle wall to arrest the suspended solids if any. Water runoff / discharge from the panels is likely to be absorbed into the arid ground below the panels, and no drainage canal is required. **The discharge water does not include any chemical or hazardous material and hence no treatment is required.**

5.4 Solar Radiation Profile of the Site

The proposed site has average solar insolation of nearly 5.2-5.6 kWh/m². **Hence, more energy generation can be captured from the Solar PV plant located in OG Kuppam, Andhra Pradesh.**

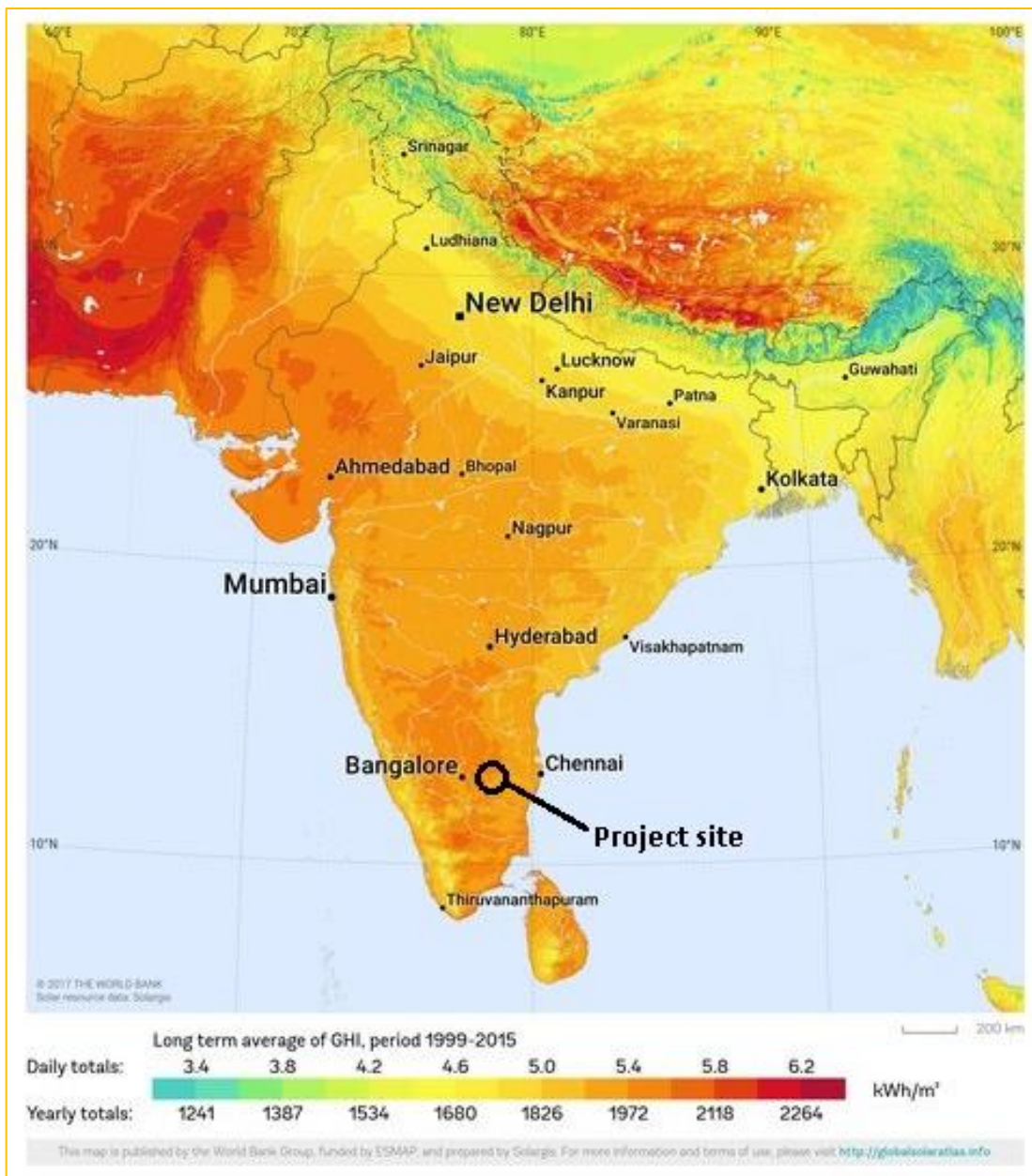


Figure 9: Solar radiation profile²⁵

²⁵ <https://solargis.com/maps-and-gis-data/download/india>

5.5 Seismic Zone Profile of the Site

The project site lies in the low hazard zone which is less prone to earthquakes. *Hence, the selected location will be more stable for housing the solar PV plant.*

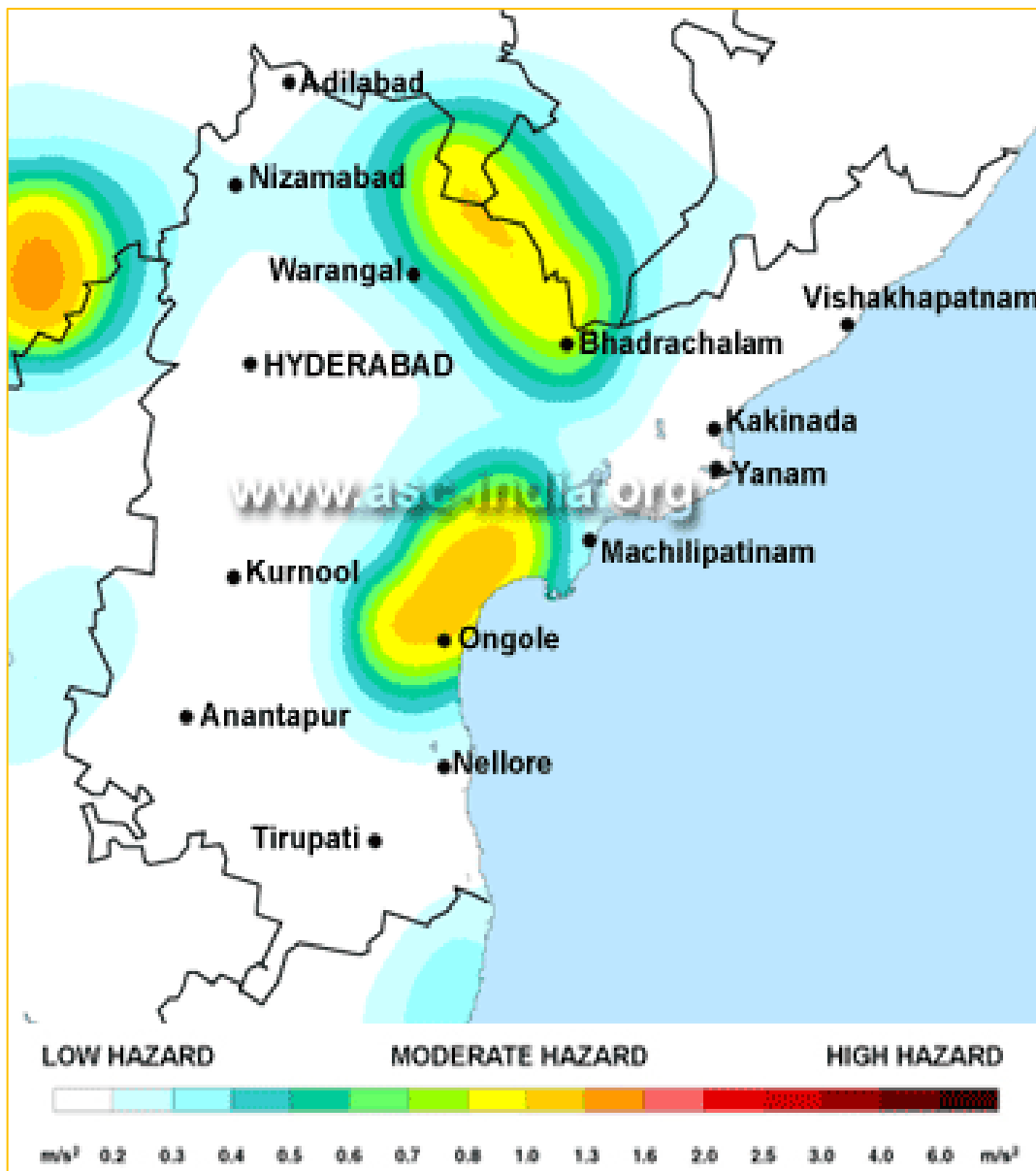


Figure 10: Seismic zone profile²⁶

²⁶ <http://asc-india.org/maps/hazard/haz-andhra-pradesh.htm>

5.6 Soil Type at the Location

The project site is rich in Red and Yellow soil which are not rich in nitrogen, organic nutrients and have poor water absorbing capacity. *Hence, the site is not suitable for cultivation purposes. Also the selected land at OG Kuppam village has sandy terrain. Hence, the land can be utilised effectively for the development of this project.*

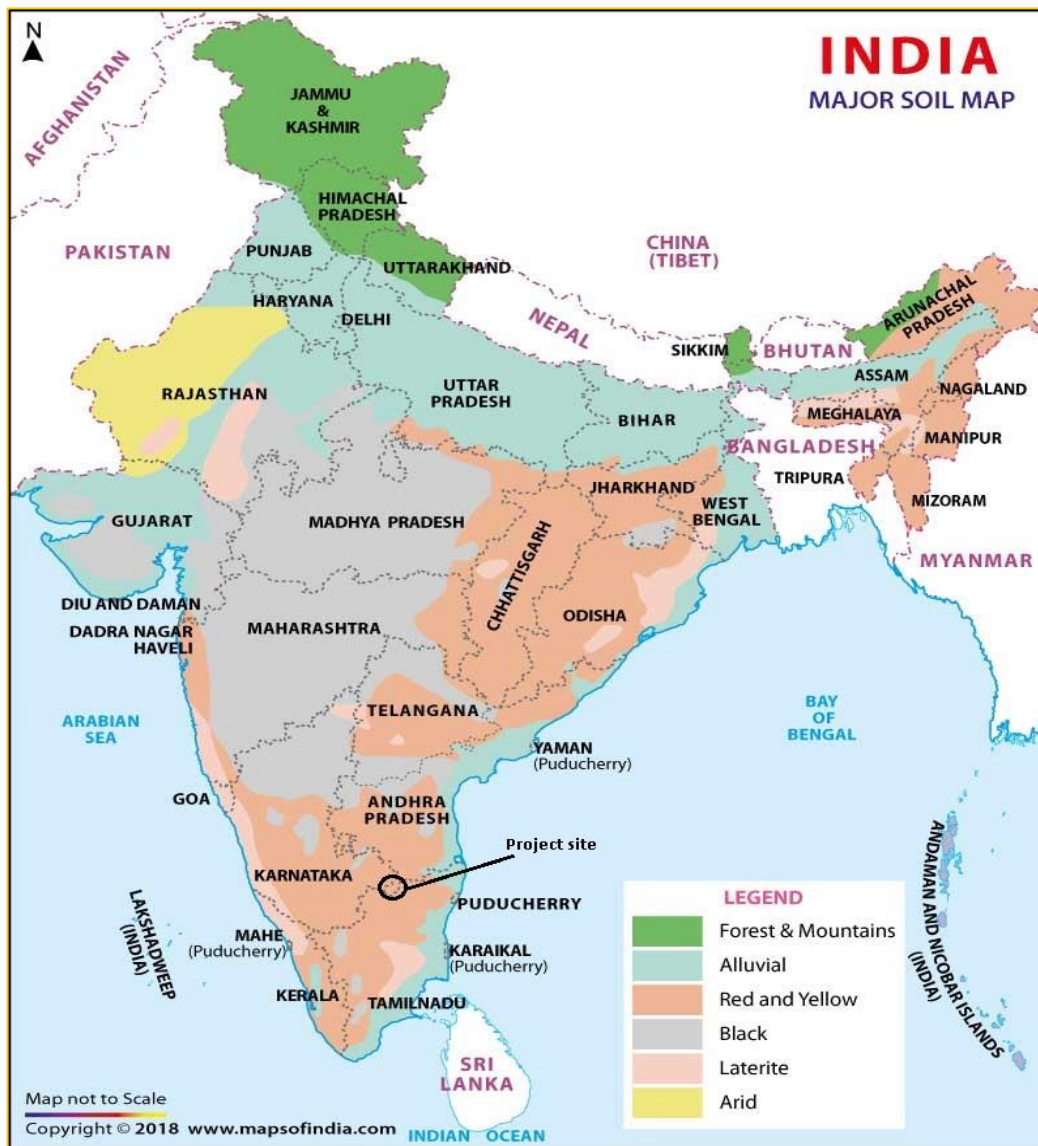


Figure 11: Soil Profile of the Site²⁷

²⁷ <https://www.mapsofindia.com/maps/schoolchildrens/major-soil-types-map.html>

5.7 Mineral Map:

There is no mineral deposit occurred in the project site. Thus, **implementing the solar power plant would not affect any mining activities. Therefore, the site is well suited for housing the solar plant.**

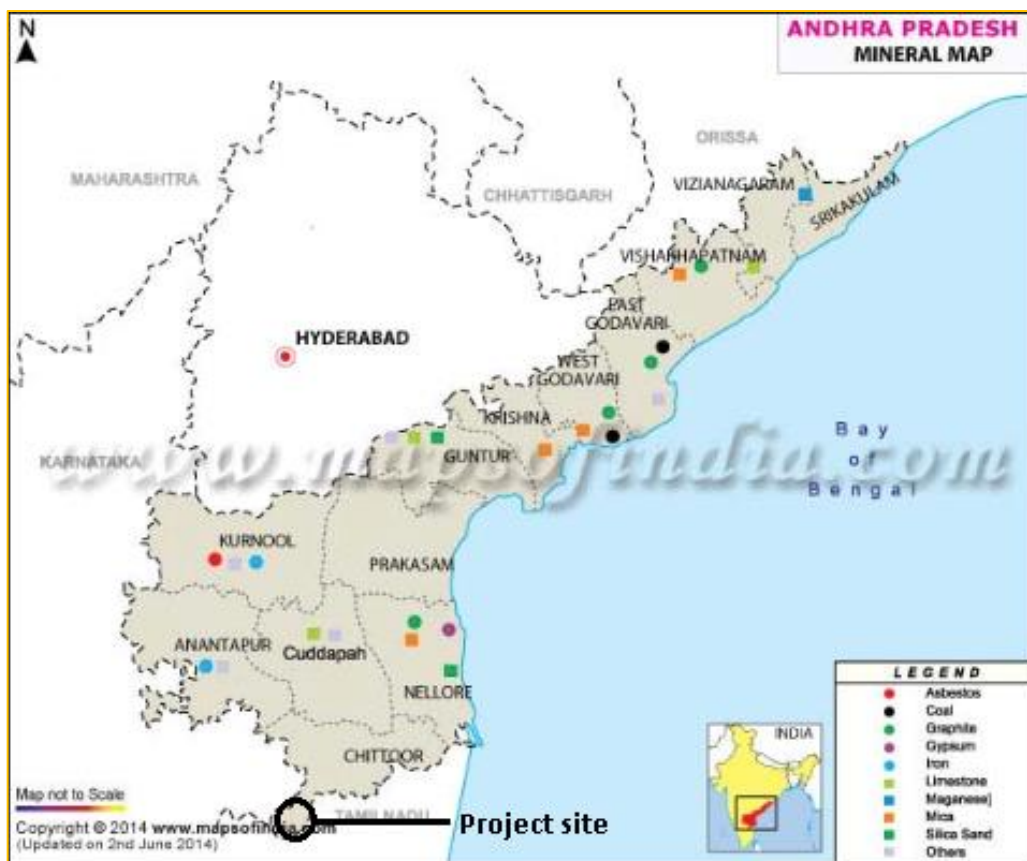


Figure 12: Mineral deposits of the site²⁸

5.8 Topography, Soil Conditions and Land use

The proposed site has flat topography with nil shadings. **The identified site was used for seasonal livestock grazing. The soil type of the site was sandy and gravel, reddish yellow soil. There were no sign of soil erosion.**

²⁸https://www.mapsofindia.com/print_image.php?id=https://www.mapsofindia.com/maps/andhrapradesh/andhrapradesh-minerals-map.jpg&spid=undefined

5.9 Climatic Conditions

5.9.1 Temperature profile

The average annual temperature of the site is about 25-30 degrees which denotes a good number for solar energy yield.

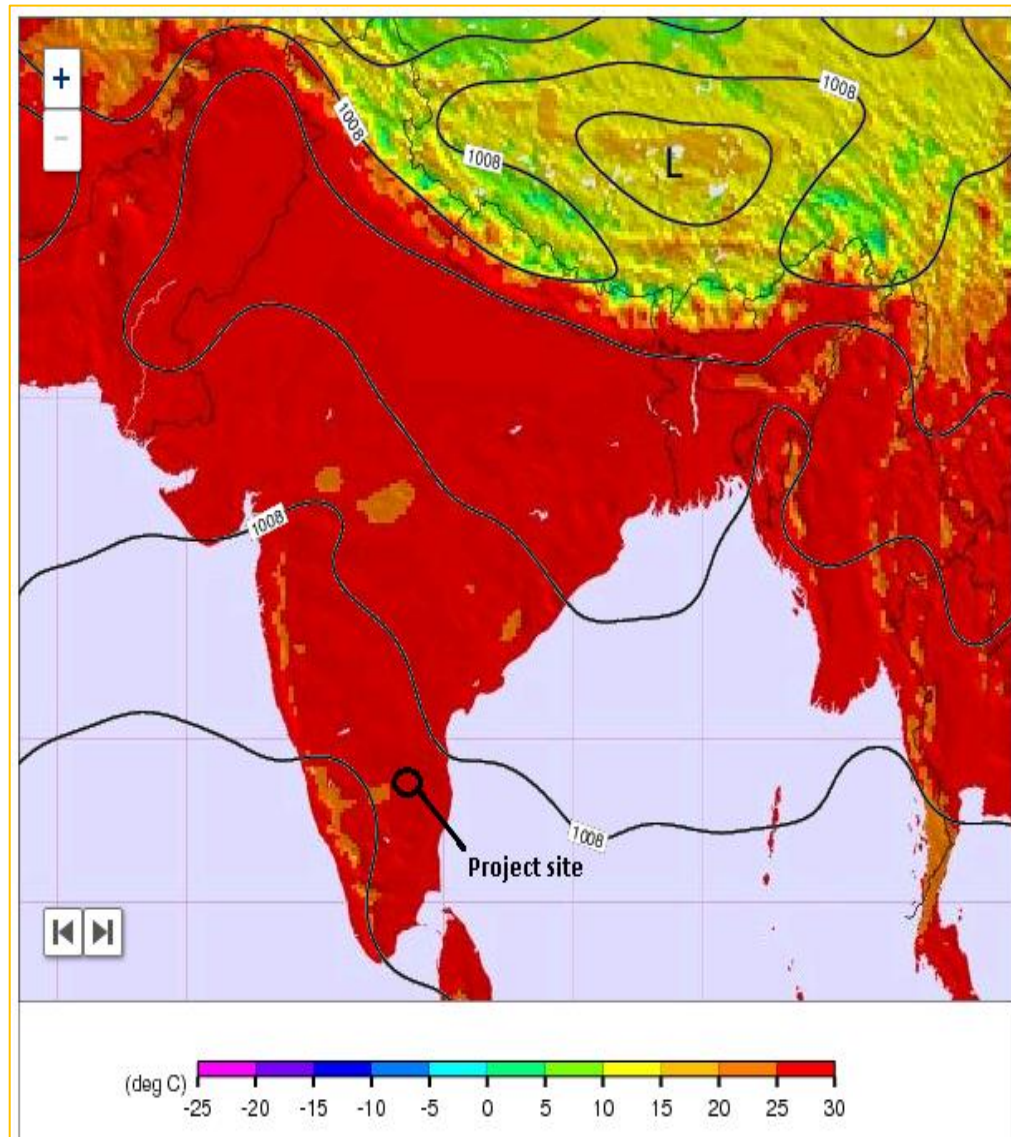


Figure 13: Temperature profile²⁹

²⁹ <https://www.weather-forecast.com/maps/India?symbols=none&type=lapse>

5.9.2 Vegetation

The proposed site has no shrubs and trees and there is no reserved forest nearby the selected site. The nearby area is covered by grassland which is being used for livestock grazing.

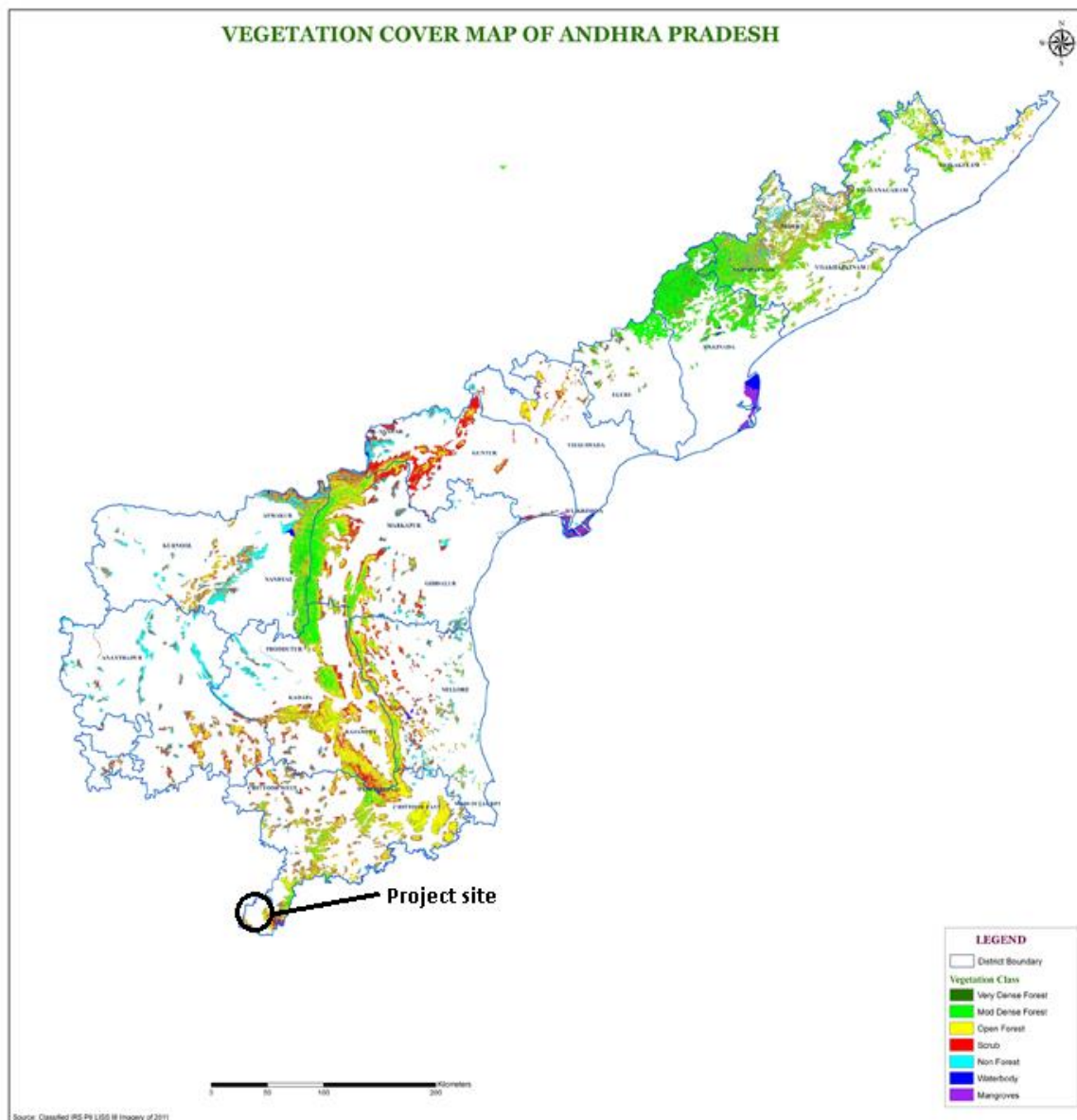


Figure 14: Vegetation map of Andhra Pradesh³⁰

³⁰ <http://www.forests.ap.gov.in/abkp/About.htm>

5.10 Demographics

The proposed location nearby the site has an average population growth of 25-30%. However, no live hood is dwelling in the project site location. **Hence, no resettlement or migration is required.**

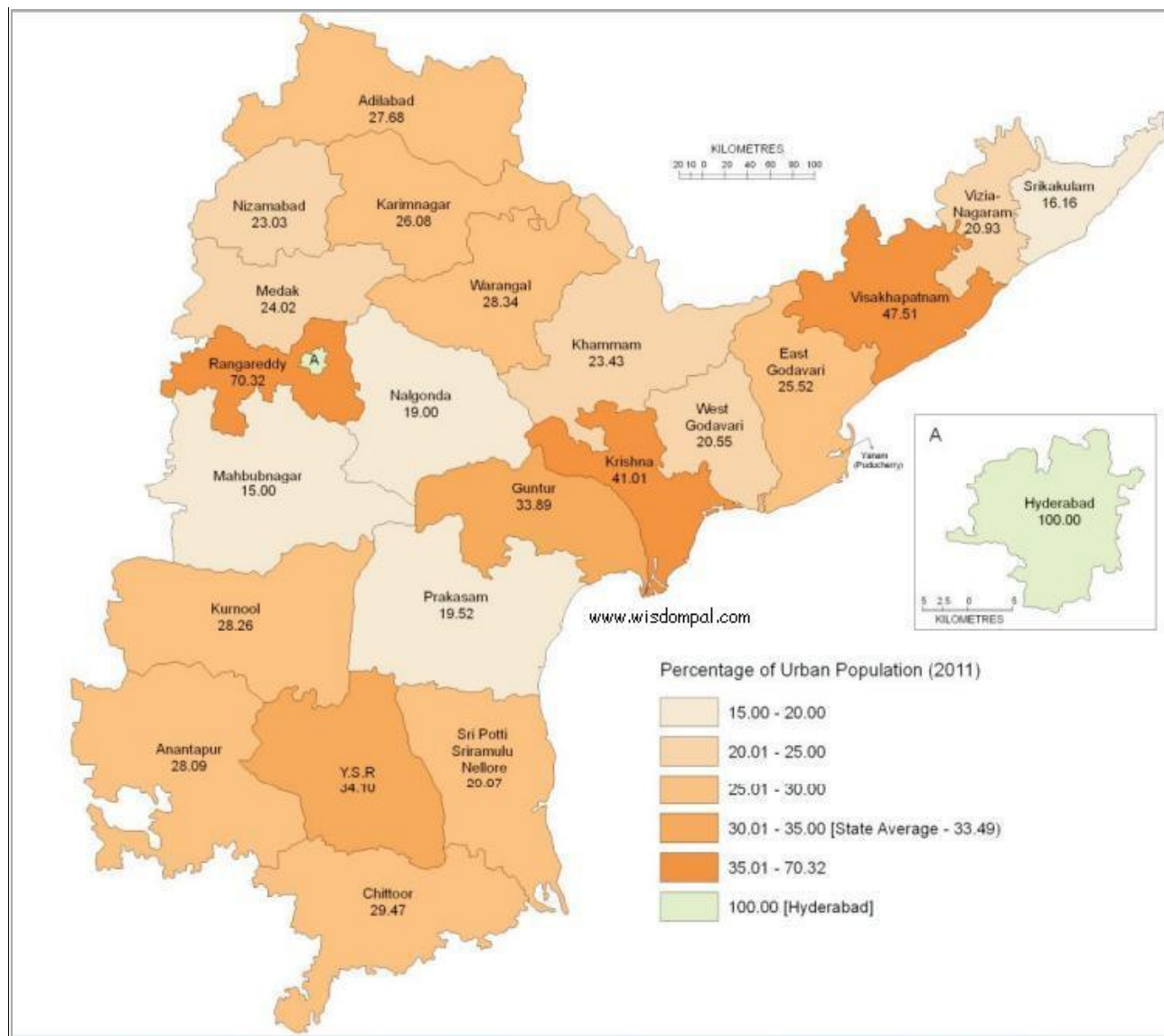


Figure 15: Demographic map of Andhra Pradesh³¹

³¹ <http://www.osmanian.com/andhra-pradesh-ap-census-2001-2011/>

6. ANALYSIS OF ALTERNATIVES

Setting up of a solar power project involves selection of environmentally and techno-economically suitable site, land characteristics, meteorology, infrastructure, grid availability, water availability, rail and road connectivity, accessibility and shading aspects etc.

6.1 Do Nothing Scenario

A significant capacity deficit exists with regards to power supply in India, and the use of the electricity distribution network of the area is severely constrained by insufficient transport capacity and frequent outages. The “Do Nothing” scenario would not alleviate the current limitations of low power generating capacity, high transmission and distribution losses, poor revenue collection and limited access. The limitations to power supply development could adversely affect the economic development of India. The opportunity to develop future generations of solutions that enhance efficiency and profitability, contribute to economic diversification, accelerate human development and other growth drivers (such as international competitiveness, labour and employment, governance and public sector reform) would be lost. *Therefore the “do-nothing” scenario is not a viable option.*

6.2 Site Alternative

For the site variant, the choice of the proposed site can be justified by:

Technically and financially

- Closeness of the site to good electrical infrastructure
- Significant amount of sunshine
- Availability of land for solar PV installation

Socially and Institutionally

- Social acceptability of the project by the local people of Kuppam location
- Bridging of regional disparities in the production of solar PV energy
- The project site being free from any occupation like agriculture
- The soil quality, which is major constraint for agricultural purpose

6.3 Production Methodology Alternative

- Reduction of GHG emissions at national level
- Low operating costs

- Lower rate of production of hazardous wastes
- Contribution to diversification of production sources

6.4 Technology Alternative

Crystalline Silicon module technology continues to dominate and forms about 86% of the market share. It is the current industry leader and the most commonly used PV technology. There are two types of crystalline silicon cells that are used in the industry: mono-crystalline and multi-crystalline. The mono-crystalline Si is produced by growing high purity, single crystal Si rods and slicing them into thin wafers. The multi-crystalline Si is made by sawing a cast block of silicon first into bars and then wafers. Crystalline Si PV modules score over thin film counterparts, since the former are less prone to breakage and have a lower degradation over their life. Major trend in PV industry is towards multi-crystalline technology, due to its lower cost of production and improved efficiencies. *Hence, it would be better to use poly-crystalline panels for better value of money.*

The other renewable technologies such as Biomass or Wind energy are not feasible option to generate the power at site due to the following reasons:-

- Unavailability of biomass at site having high calorific value;
- The average wind speed available at site is 2.3 m/sec which is not enough to rotate the wind turbine.

Thus, Solar PV plant is the best available renewable energy source available at site to generate the clean power.

7. ANTICIPATED ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATION MEASURES

7.1 Introduction

The proposed project may have impact on the environment during planning, construction & operation phases. During the construction phase, the impacts may be regarded as temporary or short-term, while long term impacts may be observed during the operation stage. The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of Solar PV power. It will certainly meet the ever increasing demand of power and to bridge the gap between demand and supply of power.

7.2 Potential Impact Generation Activities

The construction and operation phase of the proposed project comprises various activities each of which may have an impact on environmental parameters. The impacts of the project are envisaged during the design and planning, during pre-construction phase, construction phase. During the construction phase, the following activities may have impacts on environment:

- Site preparation
- Minor excavation and leveling
- Hauling of earth materials and wastes
- Cutting and drilling
- Erection of concrete and steel structures
- Road construction
- Painting and finishing
- Clean up operations
- Landscaping and afforestation

Moreover, construction work will involve cutting of trenches, excavation, concreting etc. All these activities attribute to dust pollution. The super-structural work will involve steel work, concrete work, masonry work etc. and will involve operation of large construction equipment like cranes, concrete mixers, hoists, welding sets etc. There may be emission of dust and gases as well as noise pollution from these activities. Mechanical erection work involves extensive use of mechanical equipment for storage, transportation, erection and on-site fabrication work. These activities may generate some air

contaminants and noise pollution. The electrical activities are less polluting in general.

7.3 Impacts during Planning and Design Phase

The potential adverse environment impacts associated with transmission lines shall be avoided or minimized through careful route selection. The alignment must be sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and vegetation areas should be avoided.

7.4 Impacts during Construction Phase

The environmental impact during construction phase is localized and of short term magnitude. Impact is primarily related to the civil works and some intensive impact due to erection of the equipment. The details of the activities and probable impact are brought out in table below:

Table 3: Identification of Activities & Probable Impacts (Construction Phase)

Construction Activities	Environment Attribute	Probable Impacts
Land Acquisition	Land	No significant impact on land-use is expected.
	Socio-economics	No impact due to rehabilitation & resettlement issues is expected.
Site clearing and Leveling (cutting, stripping, excavation, earth movement, compaction)	Air	<ul style="list-style-type: none"> ▪ Fugitive dust emissions ▪ Air emissions from construction equipment and machinery
	Water	Run-off from construction area
	Land	Loss of top soil
	Ecology	Minimal loss of vegetation / habitat as the site is has barren land with almost no vegetation
Transportation and Storage of Construction Material/ Equipment	Air	<ul style="list-style-type: none"> ▪ Air emissions from vehicles ▪ Fugitive dust emissions due to traffic movement
	Water	Run-off from storage areas
	Public Utilities	Increased flow of traffic

Civil Construction Activities	Air	<ul style="list-style-type: none"> ▪ Air emissions from construction machinery ▪ Fugitive dust emissions
	Water	Run-off from construction areas
Mech. and Elec. Erection Activities	Air	Air emissions from machines / activities
Influx of Labour and construction of temporary houses	Socio-economics	<ul style="list-style-type: none"> ▪ Employment opportunities shall increase ▪ Stress on infrastructure
	Land	Change in land use pattern of the area
	Water	Sanitary effluents from labour colonies

7.4.1 Impact on Land use

The mobilization of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labor camps for human resource to avoid environmental impact and public inconvenience. These locations shall comply with the local laws and regulations and need approval from authorities to utilize these facilities (access roads, telecommunication, and pipe borne water supply). The selection of temporary lands shall be made in such a way that it is at least 500 m away from highly populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas. The removal of trees and green cover vegetation will be minimized during preparation of access road and other facilities.

The construction activities attract a sizeable population and the influx of population is likely to be associated with construction of temporary hutments for construction work force, having an effect on land use pattern of the areas surrounding the project. However, this impact is envisaged to be insignificant due to following reasons.

- Temporary labour colonies shall be situated in the areas already acquired for the project.
- It will be only a temporary change (restricted to construction period). After construction phase, the areas acquired by labour colonies shall be reverted back similar to pre- construction stage.

Further, the developer shall also be in the process to improve the infrastructure of the area such as roads, schools, hospitals, etc. The project would add to the economic development of the area through

allied business, which will be set-up along with the plant.

7.4.2 Impact on Soil Cover

As the construction activities for the main plant units of project would be confined in the wasteland, the impact on soil will be minimal and confined. Only cutting and filling is required during construction. The construction activities result in loss of vegetation cover (grass and shrubs) and topsoil in the plant area. No adverse impact on soil in the surrounding area is anticipated. *However, in order to minimize such impacts, appropriate soil erosion control measures such as plantation activities would be undertaken by the developer to appease the chances of soil erosion. Completion of excavation and foundation work in limited time schedule would also reduce / minimize the chances of soil erosion.*

7.4.3 Impact of Solid Waste

Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, rejected components and materials, packing and shipping materials (pallets, crates, Styrofoam, plastics, etc.) and human waste. During the construction there will be generation of garbage, for which designated practices of solid waste disposal shall be followed as mentioned:

- A waste inventory of various waste generated should be prepared and periodically updated.
- The excavated material generated shall be reused for site filling and leveling operation to the maximum extent possible.
- The scrap metal waste generated from erection of structures and related construction activities should be collected and stored separately in a stack yard and sold to local recyclers.
- Food waste and recyclables viz. paper, plastic, glass etc. should be properly segregated and stored in designated waste bins/containers. The recyclables shall be periodically sold to local recyclers while food waste shall be disposed through waste handling agency.
- Hazardous waste viz. waste oil etc. should be collected and stored in paved and bounded area and subsequently sold to authorized recyclers. Necessary manifest for the same shall be maintained.

7.4.4 Air Impact

As the proposed project is solar PV project, the impact during construction is expected to be minimal as a greenfield project plant. Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly during excavation, back filling and hauling operations along with transportation activities. However, a high boundary wall will prevent the dust generated due to construction activities going outside the project area.

The main source of gaseous emission during the construction phase is movement of equipment and vehicles at site. Equipment deployed during the construction phase is also likely to result in marginal increase in the levels of SO₂, NO_x and particulate matter. *The impact is reversible, marginal and temporary in nature till the construction phase.*

7.4.5 Noise Impact

The major noise generating sources during the construction phase are vehicular traffic, construction equipment like dozer, scrapers, concrete mixers, cranes, generators, pumps, compressors, rock drills, pneumatic tools, vibrators etc. The operation of this equipment will generate noise ranging between 75 – 90 dB (A). To minimize the impact on nearby communities, construction schedules have to be optimized and vehicular traffic shall be routed away from the nearest settlement. Also the noise level should be substantially lower near the plant boundary due to attenuation caused over the distance. *Overall, the impact of generated noise on the environment during construction period is insignificant, reversible and localized in nature.*

7.4.6 Impact on Water Environment

The construction personnel would be housed in temporary settlements. These settlements would discharge considerable amount of domestic wastewater. Stagnant pools of water would increase breeding of mosquitoes and generally create insanitary conditions. Contractor should provide soak pit with a depth of 2 m to dispose liquid water so that such water will not form stagnant pools nor aggravate soil erosion. The main pollutants are organic components and microorganisms with the potential to cause contamination of water quality. To address potential impacts on water quality, disinfected latrines (e.g., through regular liming) shall be used as main component of the sanitation system.

Construction processes include fabrication of concrete and related water usage. Wastewater from construction activities would mostly contain suspended impurities. The waste water shall be arrested

before discharge, to prevent solids buildup in the existing drains. Thus, the construction site wastewater would be led to sedimentation basins, allowing a hydraulic retention time of 1.5 to 2 hours, where excess suspended solids would be settled out and relatively clear supernatant would be discharged to the plant drain. *Generally, surface run-off water is not there in dry months during construction.*

7.4.7 Ecological Impact

The impact of the construction activities would be primarily confined to the project site. The entire land is barren land with some shrubs and trees. *Thus, the site development works would not lead to any significant loss of important species or ecosystems.*

7.4.8 Impacts due to Transmission Lines during Construction Phase

The project activities during construction phase will involve clearing of trees along the route alignment wherever required, excavation for installation of towers, erection of towers, civil works related to transmission line and line stringing. During the operation phase, most of the construction phase impacts will get stabilized and the impacts will be restricted only to the operation and maintenance of the project. *The impacts of the project activities on various environmental attributes are discussed in subsequent sections.*

Impact on Climate

The transmission line area has to be constructed in barren uncultivated lands. Although, there will be few removals of trees, there will be no impact on the climatic conditions during the construction and operation phases of the transmission lines.

Impact on Air Quality

During the construction phase, the activity would involve excavation for the tower erection, movement of vehicles carrying the construction materials along the haul road (through un-built roads, which are not maintained). All these activities would give rise to emission of dust particles thereby affecting air quality marginally at the site. The impact will be temporary in nature and therefore is assessed as of low significance. Covering of stockpiles and sprinkling of water during excavation will reduce the dust emission to a greater extent. The construction of transmission line and the substation will not have any negative impact on the air quality of the region during the operation phase.

Impact on Noise Levels

During the construction phase, the major sources of noise pollution are movement of vehicles carrying the construction material and equipment to the site. The major work of the construction is expected to be carried out during the day time. As such, noise emissions will be minor and the noise produced during the construction period will have negligible impact on residents.

Impact on Surface Water Quality

There are no major surface water bodies in the area. Hence, the construction and operation phase of transmission lines will not have any major impact on the surface and ground water quality in the area.

Impact on Water Resources

Water needed during construction phase of the project would be minimal and limited to sanitary water. This would have negligible impact on water resources. Operation of the transmission lines would not require any water.

Impact on Ground Water Quality

In transmission line construction activity, no chemical substance or oil is used and hence there is no impact on ground water quality.

Impact on Ecological Resources

Since transmission line will be routed away from the inhabited areas, there will be no displacement of people or animals. It will not cause any disturbance to the life of people, local animals and birds' movement. In transmission there is no dynamic equipment and moving machinery which causes noise pollution, water and air pollution. There is no national wildlife park, bird sanctuary, wetland in the route alignment of the proposed transmission line. It is not expected that any flora and fauna that are rare, endangered, endemic or threatened will be affected. Migratory paths of small mammals and reptiles may be affected due to construction activities. However noise, vibration and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner. The impacts related to above activities are temporary and can be mitigated through following measures:

- Strict attention on worker force regarding disturbance to surrounding habitats, flora and fauna including hunting of animals
- Selection of approved locations for material storage yards and labour camps away from the environmental sensitive areas

- Avoid dumping of construction waste (cement particles, rock, rubbles and waste water) and sanitary waste to the surrounding water bodies.

Impact on Terrestrial Ecology

The removal of herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimized through adoption of mitigation measures like paving and surface treatment and water sprinkling.

Removal of Trees

As per the preliminary survey hardly any trees shall be removed during the line construction. The initial construction works along the alignment involving cutting, filling, and leveling may cause loss of vegetation. Appropriate compensation will be governed by the resettlement framework.

Effect on Local Road Network

Transformers, tower material, substation equipment, iron bars, concrete materials, piling equipment, will be transported through the provincial and local road network to the project site. This may impact local traffic temporarily. Appropriate maintenance of all road sections, which will be utilized for the construction related activities shall be carried.

Disposal of Debris

As a result of construction related activities, spoil and debris will be generated during the construction stage. Proper disposal of the debris shall be ensured to minimize the impact on the surrounding ecology, public health and scenic beauty.

Impact on Human Environment

Project activities could impact the health and safety of the work force and of the general public, in particular, in terms of risk of accidents and exposure to electromagnetic fields along the alignment. The accidents may be caused due to electro-cutting, lightening, fires and explosions. Necessary training regarding safety aspects to the personnel working at the line should be provided by the contractor. Personal protective equipment like safety gloves, helmet, harness, goggles and mufflers should be provided during construction period and during the maintenance work. First aid facilities must be made available with the labor gangs.

Socio-Economics

Construction of transmission line will generate local employment, as number of unskilled labors will be required at the time of construction activities. Local employment during this period will increase socio-economic standards.

Cultural sites

There are no archaeological, historical or cultural important sites along the route alignment, hence no impact on these sites is envisaged. In the case of discovery of archaeological features during excavation/construction works, a chance find procedure to notify relevant authorities should be put in place by the developer.

Solid Waste Disposal

The solid waste generation during tower erection site includes metal scraps and wooden packing material. Waste should be minimized and recycled wherever possible. Final waste should be collected and disposed of in compliance with applicable regulations and rules.

Liquid Waste Disposal

There will be no oil or chemical waste generated during the construction of transmission line, hence no mitigation is required.

Sanitary Waste Disposal at Construction Sites and Labour Camps

The labour camps at the site of tower erection will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Those places where most labor will be staying will be near hamlets which shall use the community services for solid waste, water and sanitation. Adequate drinking water facilities, sanitary facilities and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. There shall be proper solid waste disposal procedure to enhance sanitation of workers who stay in camps. Septic tank shall be used for sanitation purpose. Unacceptable solid waste disposal practices such as open dumping of solid waste and poor sanitation facilities will lead to pollution of surrounding environment, contamination of water bodies and increase adverse impact to the aquatic, terrestrial lives and general public inhabited in the area. Thus following measures are needed to protect and enhance the quality of environment during the construction stage:

- A better way to overcome garbage disposal as mentioned above by reducing or avoiding the

need to construct labour camps, thus the selection of the majority of skilled and unskilled workers from the project area of influence will be a proper measure in this regard. Contractor shall provide adequate facilities, soak pits to manage liquid waste.

- Provision of the solid waste disposal, sanitation and sewage facilities at all site of the construction/labour camps to avoid or minimize health hazards and environmental pollution.
- Contractor should handle and manage waste generated from the construction/labour camps without contamination to natural environment and enhance the quality of environment.
- Adequate supply of water should be provided to the urinals, toilets and wash rooms of the workers' accommodation.
- Contractor shall provide garbage bins to all workers' accommodation and construction sites, for dumping wastes regularly in a hygienic manner in the area.

7.5 Impact during Operation Phase

Various activities of operation and maintenance phase and their probable impacts on various sectors of environment are presented in the table below.

Table 4: Identification of Activities and Probable Impacts (O&M)

O&M Activities	Sector	Probable Impacts
Transportation	Air	<ul style="list-style-type: none"> • Air emissions from vehicles • Fugitive dust emissions due to traffic movement
	Public Utilities	Increased flow of traffic
	Water	Effluents from Oil Storage Areas
Burning of Fuel	Air	No Stack emissions from solar Project
Water Treatment for various uses	Water	Generation of wastewater due to PV module cleaning
Equipment Cooling	Water/ Ecology	Discharge of hot water containing chemicals
Operation of Transformers and Switchyard	Water	Generation of effluents containing oil

Impact on Land use

The site, after completion of its development, would consist of built structures, landscaped to give a pleasing outlook. Following the construction phase, the temporarily modified land use pattern, such as construction of temporary tents to accommodate some construction personnel will be totally removed during the operation stage. Land released from the construction activities would be put to economic and aesthetic use to hasten recovery from adverse impacts.

Impact on Soil Cover

Most impacts of Solar PV project on soil are restricted to the construction phase, which will get stabilized during operation phase. The soil conditions of the project site would be allowed to stabilize during this period after the impacts of the construction phase. The topsoil in non-built up areas would be restored and such portions of the site would be replanted with appropriate plant species to stabilize soil. The species shall be suitable for local climate and available. During operation of a project, no appreciable adverse changes in the soils are anticipated.

Air Impact

Plant operation would not significantly affect the air quality, as solar project is green field project & there are no gaseous emissions during operation phase from the proposed project.

Noise Impact

Work Zone Noise Levels

Protective instruments in the form of ear mufflers/ear plugs will be provided to the operators and workers working near the high noise generating machinery. In addition, reduction in noise levels in the high noise machinery areas will be achieved by adoption of suitable preventive measures such as adding sound barriers, use of enclosures with suitable absorption material, etc.

Impact on Water Environment

Impact on Ground Water

No ground water due to plant operation will be drawn during operation phase for any purpose. So lowering of groundwater table will not be an issue. In addition, rainwater harvesting shall be implemented at proposed plant to conserve storm water and help in recharge of ground water.

Impact on Surface Water

There shall be minimal discharge of wastewater from cleaning of Solar PV modules. The wastewater emanating from cleaning operations shall be recycled for plantation and greenbelt development around the plant. The rest of the wastewater shall be deposited in rain water harvesting pond.

Impacts of Transmission Lines during Operation Phase

Electric Shock

This may lead to death or injury to the workers and public in the area. This shall be minimized or avoided by:

- Security fences around substation
- Establishment of warning signs
- Careful design using appropriate technologies to minimize hazards.

Noise Generation

Nuisance to the community around the substation site can occur during the project operation stage. Provision of appropriate noise barriers at substations shall be made in this regard.

Maintenance of Transmission Line and Substation

Possible exposure to electromagnetic interference could occur during these activities. Design of transmission line shall comply with the limits of electromagnetic interference from overhead power lines.

Oil Spillage

Contamination of water on land/nearby water bodies by the transformer oil can occur during operation due to leakage or accident. Substation transformers are normally located within secure and impervious areas with a storage capacity of 100% spare oil. Also proper drainage facilities should be constructed during the construction stage to avoid overflow or contamination with natural flow paths especially during the rainy season.

Sulphur Hexa fluoride (SF₆) Leakage

SF₆ is a non-toxic greenhouse gas used as a dielectric in circuit breakers, switch gear, and other electrical equipment. Very high grade sealing system and erection methodology is required to keep the loss of SF₆ within 0.01% every year. SF₆ gas handling system for evacuation and storage is always

used for the maintenance of the circuit breaker. SF₆ gas leakage is one of the checks in every shift of the operation. Stock SF₆ records shall be maintained in each substation. This shall allow tracking of any release of SF₆ gas to the atmosphere.

7.6 Impacts during Decommissioning Phase

Dismantling operation however will have impact on environment due to noise and dust arising out of it. During de-installation, a specific strategy shall be adopted in order to handle each type of item to keep the impact during the actual activity low. The decommissioning of the power house which is a part of the local social fabric for many years will certainly create vacuum in the lives of the people directly and indirectly connected with it. The impact due to decommissioning on power, social and environmental scenario will be guided by applicable laws and guidelines. These will be addressed appropriately.

7.7 Social Impacts

7.7.1 Traffic Congestion

No overburden on the local transportation system is envisaged due to the proposed project.

7.7.2 Labour Influence

Construction Phase

During construction activities, there will be a sizeable influx of population and labour colony being constructed with basic amenities for the laborers working on the project. The peak labour population shall be 500 but on an average, there shall be 150 laborers for 6 months. This will have an effect on social fabrics of the areas surrounding the project. However, this impact is envisaged to be insignificant due to the following reasons:

- Temporary labour colonies shall be situated in the areas already acquired for the project.
- It will be only a temporary change restricted to construction period. After construction phase, the areas acquired by labour colonies shall be reverted back similar to pre- construction stage

Most of the construction labor will be on contractual basis. Separate labour camps shall be made within the plant premises for the construction laborers. Therefore, conflict of migrating labor with locals, will not take place during the construction phase. Regarding monitoring of diseases corresponding to labor influx, regular health status monitoring of laborers and its surrounding

population should be carried out with the mobile health care facilities.

7.7.3 Change in Socio-economic Condition

Employment

The project will generate employment opportunities for the local population. Even indirect job opportunities will be created outside the project boundary. Many people will find employment in service sector and marketing of day-to-day needs viz. Poultry and other agricultural products. The project will improve the basic infrastructure and the people of nearby villages can also use these amenities.

Development of Infrastructure

The job opportunities in non-agricultural sector are likely to increase. The installation of the power plant is expected to further increase the prospects by bringing in direct and indirect employment opportunities. As the project and consequent activities are expected to generate additional employment and income opportunities for the local population, market expansion supported by infrastructural development will foster economic growth in the area. Flow of reliable and adequate power from the proposed plant will not only enhance growth in the region, but will also bring about a change in energy consumption pattern by switching over from other sources of energy. This will ease off burden on the existing biomass.

8. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

8.1 Introduction

Environmental & Social Management Plan (ESMP) is an implementation plan to mitigate and offset the potential adverse environmental & social impacts of the project and enhance the positive impacts. The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of solar PV power.

8.2 Environmental & Social Management Process

The mitigation measures to be adopted for the implementation of the proposed project include the following:

- Environmental Management Plan
- Rainwater Harvesting
- Clean Development Mechanism
- Occupational Health and Safety
- Labour Working Conditions
- In house Safety plan
- Environmental Action and Monitoring Plan
- Public Consultation and Information Disclosure Plan
- Grievance Redressal Mechanism

8.3 Environment & Social Management Cell

The project developer has to established an Environment & Social Management Cell (ESMC) at corporate and site level for day-to- day implementation of the project. The developer is responsible for undertaking the transmission project in accordance with the EPA-SL's norms and conditions. The ESMC is responsible for coordinating and implementing all environmental and social activities. During project implementation, the ESMC will be responsible for reflecting the occurrence of new and significant impacts resulting from project activities and integrating sound mitigation measures into the EMP. The ESMC will include a safeguard specialist and supporting staff, together forming the Environmental and Social Unit, to look at right of way, environmental, social and safety issues.

The safeguards specialist will give guidance to the Project Manager and his staff to adopt the environmental good practice while implementing the project. The duties of the Environmental and Social

Unit of the ESMC at corporate level are to:

- Monitor the implementation of mitigation measures during construction and operation phase of the project.
- Prepare suitable environmental management reports at various sites.
- Advise and coordinating field unit's activity towards effective environment management.
- Prepare environment health and safety manual for the operation of transmission lines/substations.
- Advise during project planning/design cells on environmental and social issues while route selection of the alignment at the planning/design stage to avoid negative environmental impact.
- Provide training and awareness raising on environmental and social issues related to power transmission projects to the project/contract staff.

The duties of the Environmental and Social Unit at site level are to:

- Implement the environment policy guidelines and environmental good practices at the sites.
- Advise and coordinate the contractor's activity towards effective environment management.
- Implement environment and safety manual.
- Carry out environmental and social survey in conjunction with project planning cell.
- Make the contractor staff aware of environmental and social issues so that EMP could be managed effectively.

8.4 Labour Deployment and Labour Camp Management Plan

The developer shall draw a Labour Deployment & Welfare Management Plan for the proposed solar PV project. The EPC Contractor and the sub-contractor shall ensure the compliance of the labour welfare arrangement plan:

- **Accommodation for labour** – Provision of military tents for accommodating outstation labors
- **Separate accommodation for women labour**- Separate provision of military tents for accommodating women labors
- **Prevention from Insects/Snakes** – Carbolic acid bottles shall be buried under the

- ground surrounding the perimeter of the labour accommodation area to prevent them from the risk of snakes/insects
- **Sanitation for labour** – Portable toilets should be provided for labour. Waste water should be disposed in septic tanks/ soak pits.
 - **Sanitation for women labour**- Separate toilets should be provided for women labour.
 - **Water arrangements** – Treated water should be made available at site for drinking purpose.
 - **Health arrangements** - Tying up with local doctor for any exigencies at site. Also the doctor shall make occasional visits to the site for health check-up of labour
 - Strict adherence to the labour laws applicable in the area of work shall be ensured at the site.



Figure 16 Rest room available at site



Figure 17 Drinking water facility at site

8.5 Waste Management Plan Scope & Purpose of the Plan

The Waste Management Plan (WMP) identifies the wastes that are likely to be generated during the construction and operation of the proposed plant and documents cradle to grave waste management practices to be employed for their collection, storage, treatment and/or disposal. WMP is intended to serve as a guideline for the project proponent & the contractor to manage wastes effectively during construction and operation phase. The contractor should prepare their own WMP in compliance with this WMP and implement the same during the construction phase. The developer should implement the WMP throughout the operational phase. The developer must ensure proper handling, storage and disposal of wastes generated.



Figure 18 Scrap yard at the site

8.6 Safety & Emergency Plan

Safety of both men and material during construction and operation stages are of concern to industries. Keeping in view the safety requirements during construction, operation and maintenance phases, a safety policy should be formulated for the present solar PV project. Separate safety rules should be prepared for each type of occupation / processes involved in the project in consultation with manufacturer/supplier of equipment and materials and regular safety inspection should be ensured by a competent person of all buildings, equipments, work places and operations.

8.7 Safety Awareness among Workers/Employees

Training programs in safety and accident prevention should be organized at all levels of employees with a view to familiarize them with the general safety rules, safety procedures in various operational activities and to update their knowledge in safety and accident prevention, industrial hygiene and emergency equipment. These training programs should be conducted periodically in a planned manner to refresh their knowledge.

8.7.1 First Aid Training

First aid training programs should also be conducted for all employees with the help of qualified medical and para-medical staff. The programme should include basic first-aid techniques and should be repeated periodically to refresh knowledge.

8.7.2 Accident Reporting

Whenever accidents or dangerous events occur such incidents should be reported immediately and necessary action should be taken as per laws.

8.8 Safety Review Check List

A checklist is one of the very useful tools for hazard identification. A checklist should be prepared and used as a final check that nothing has been neglected. The following checklists shall be maintained at the site for period inspection of the equipments/activities:

- Erection safety check list.
- Safety while working at height checklist
- Checklist for housekeeping
- General safety inspection checklist
- Checklist for scaffolding
- Crane inspection checklist
- Vehicle & earth moving equipment inspection checklist
- Electrical safety inspection checklist
- Electrical safety inspection report

8.9 Fire Fighting Arrangement

Plant should be well equipped with fire protection systems and it should have a fully-fledged fire station.

8.10 In-house Safety Rules and Plan

8.10.1 Safe Access Control

- Brief Safety Induction to new entry workers.
- Issue of personal protective equipment's to all workers by concerned contractor.
- Issue of Gate Pass / safety induction card.

8.10.2 House Keeping

- Work areas shall be maintained in a neat and orderly manner.
- Trash, unused scraps, spills, etc. must be cleaned up as soon as possible.
- All work sites must be kept clean, orderly and in good condition.

8.10.3 Emergency Evacuation Plan

An emergency situation can happen at any time. Being prepared is more than just knowing emergency routes or contacting the relevant services. In case of a fire or any other emergency, everyone in the site should be familiar with the site evacuation plan. Aisles (passageways), emergency exits and controls must be kept free of materials at all times.



Figure 19 Emergency safety measures

8.10.4 Clothing and other apparel

Clothing suitable for the job shall be worn. Long pants and shirts or coveralls should be worn at all times during the work. Ragged or loose clothing and jewelry are not to be worn when operating equipment. Wearing of loose clothes is not allowed near rotating parts/equipments.

8.10.5 Storage, Use & Labelling of chemicals, solvents and paints

- All chemicals, solvents and paints are to be stored in accordance with standard/industrial practice in a well-ventilated locker.
- All chemicals, solvents and paints must be kept in containers, which are clearly labeled as to the respective contents.
- Contractor's personnel must be instructed in the safe use of the chemicals in accordance with an appropriate written Hazard Communication Program.
- Low flash point solvents shall not be used for any washing or cleaning.
- The use of gasoline for anything other than the intended purpose is not permitted at the work site.

8.10.6 Personal Protective Equipments (PPEs)

The wearing of appropriate personal protective equipment should be used at the worksite as well as any location where hazards exist in the work place.

- Head protection (safety helmet)
- Eye and face protection (safety goggle & face shield)
- Foot protection (safety shoe / gum boot)
- Hand protection (hand gloves)
- Fall protection & full body harness with double lanyards.
- Hearing protection in high noise area
- Protection from dust inhalation (Dust mask)

Proper training for the use and care of such personal protective equipment must be given to all workers at site. The developer must ensure the availability of sufficient quantity of PPEs to all the contract workers and staff.

8.10.7 Overhead work/Work at height

- Fall arrester or life line shall be used as applicable for the working at height activity.
- Full body safety harnesses and lifelines shall be used by all workers when working above 1.8 m from zero level where it is impractical then to provide adequate work platforms as specified in the safety manual.
- Signs reading “Danger – Work Overhead” shall be conspicuously posted.
- No person should be allowed to pass under a suspended load.



Figure 20 Training to the workers

8.10.8 Safety during Excavation & Trenching

- All trenches 4 feet or more in depth shall at all times be provided with at least one ladder for each.
- Standard safe practices for blasting and deep excavation shall be ensured.
- Warning signs and barricades shall be installed around excavated areas and in the night hours the area shall be kept illuminated to warn pedestrian and vehicular traffic.
- Lone worker shall not be allowed to work in any excavated area.

8.10.9 Fire protection & Firefighting training

- The developer shall provide appropriate fire protection equipment's at work site like portable fire extinguishers and fire buckets at site.
- Smoking is not permitted at site.
- Any work that has the potential to produce a spark or open flame (e.g. welding, cutting, grinding, and electrical) in the areas where flammable vapors or combustible materials may exist is strictly prohibited without work permit being taken.
- All the workers must be trained to operate the firefighting equipment's.



Figure 21 Firefighting equipment's and training

8.10.10 Electrical Safety

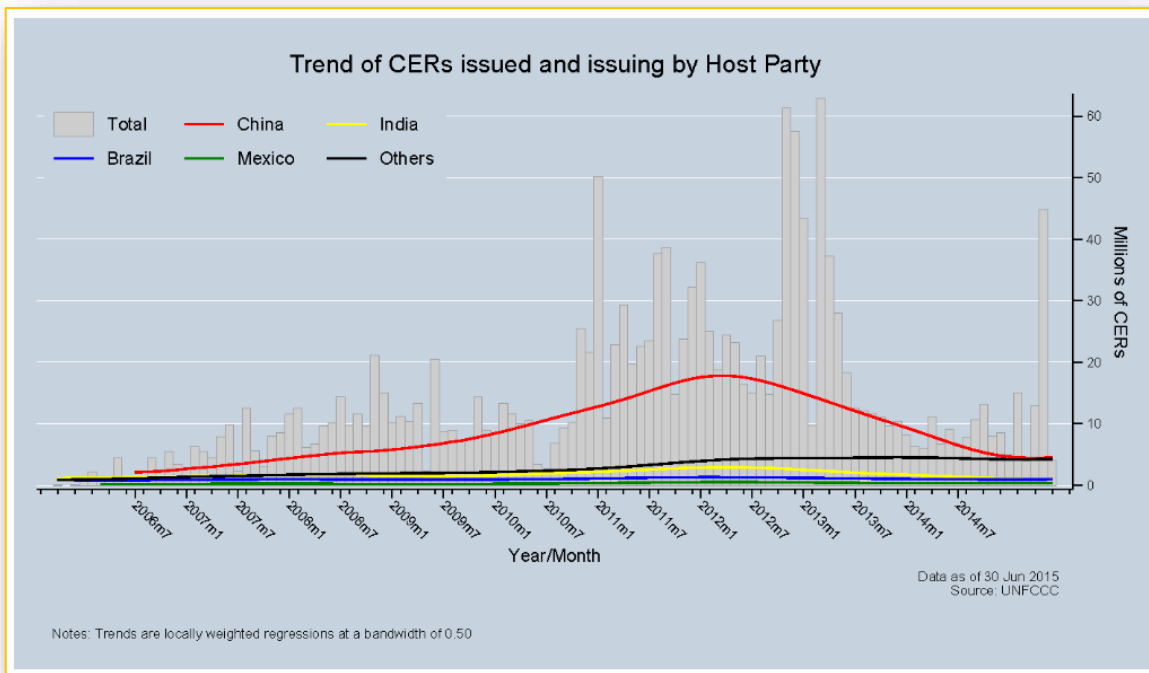
- All electrical connections to be routed through Earth Leakage Circuit Breaker (ELCB)/Residual Current Circuit breaker (RCCB).
- Personnel working around electrical equipment shall take precautions to ensure that the equipment is de-energized while work is being conducted on or around such equipment.
- Precautions should be taken to ensure that all equipment used is properly grounded and that accidental contact with ungrounded electrical sources is prevented.
- The developer shall ensure that a licensed person is deputed to work on electrical systems and connections.

8.11 Clean Development Mechanism (CDM)

For every 1 Ton of CO₂ emission reduction one credit has been rewarded, and in CDM this credit is claimed as Certified Emission Reduction (CER).

However, COP21, also known as the 2015 Paris Climate Conference, the UN Framework Convention on Climate Change (UNFCCC) has determined that Clean Development Mechanism (CDM). As of 30 June 2015, 7,645 CDM project activities were registered, of which 2,587 have already issued about 1.6 billion of CERs,

China hosted more than 49% of total projects between 2004 and 2015, followed by India with 20.6% and Brazil with 4.4%³².



CDM displays clear signs of weakness. After a first period characterized by relative price stability, a drastic augment in the number of projects between 2012 and 2013 increased the overall offer of Certified Emission Reduction (CER) credits. This sudden oversupply of CERs resulted in substantially dropping their market price. Low prices discouraged further investments in emission reduction projects.

Hence, the CDM benefits are no more feasible in the Indian Market.

³²<http://climateobserver.org/cop21-and-the-clean-development-mechanism-deciding-the-future-of-international-carbon-credits/>

9. GRIEVANCE REDRESSAL MECHANISM

Environmental and social grievances should be handled in accordance to the project grievance redress mechanism. Open and transparent dialogue should be maintained with project affected persons as and when needed. The Grievance Redress Mechanism (GRM) for the project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. This mechanism shall remain active throughout the life cycle of the project.

The project shall provide a grievance mechanism where employees may raise reasonable work place concerns. The mechanism should involve appropriate level of management involvement and address concerns promptly, using a transparent process that provides feedback to those concerns without any retribution. The developer should initiate the following activities under GRM:

- Inform the affected people about GRM and its functions,
- Determine how peoples representatives in the GRM shall be selected, set the procedures and mechanisms adopted for making the complaints
- Support the complainants in communicating their grievance and attending the GRM meetings
- Implement compliance with a GRMs' decision, its monitoring and communication to the people.

A Grievance Redressal Committee (GRC) shall be formed to ensure that the affected people's grievances on both environmental and social concerns are adequately addressed and thus facilitate timely project implementation.

9.1 Communication with Contractor Staff:

During the construction phase there would be an influx of people into the project area. As these people would have cultural differences with the resident population there are potential that a conflicts may arise because of issues related to the environment, safety and privacy issues of the women in the surrounding villages, spread of various communicable diseases, nuisance caused by workers due to improper sanitation facilities, etc.

A communication should be made to all contractor staff with the 'Dos' and 'Don'ts' and requesting proper behavioral actions and discipline amenable with the local customs and traditions during their association with the project.

As a part of the GRM, the developer should perform the following actions.

- Continuously collect and analyze complaint/grievance related data
- Disseminate the information into its organizational set up
- Review and upgrade exiting plans if required

In addition, this procedure will help to improve the project social performance. This is because the number and nature of received complaints including punctuality, nature and effectiveness of grievance redressal are indicators of the manner in which the project is implemented and the behavior of employees and contractors.

10. PUBLIC CONSULTATION, PARTICIPATION & DISCLOSURE

The need for public consultation and disclosure arises from the universal belief that transparency and accountability are fundamental for fulfilling any development mandate and is in strengthening public involvement in the decision making process.

As per ADB's classification, for all Categories "1" and "2" projects, the project proponent or third party experts must have consulted with project affected communities in a structured and culturally appropriate manner. The public consultation should involve affected communities; the process must ensure their Free, Prior and Informed Consultation (FPIC) and facilitate their informed participation. The following public consultation measures shall be envisaged for the project:

- The developer shall disclose the construction schedule on the notice board at the site location before the commencement of construction works to ensure that local population are notified and informed of said activities.
- The developer should involve their local representatives to inform them about the implementation of social and environmental activities
- The developer should inform affected peoples through notice displayed at site location on compensation and assistance to be paid for the loss of trees
- Attempts shall be made to ensure that vulnerable groups understand the process and their specific needs are taken into account

11. CONCLUSION & RECOMMENDATION

Impacts are manageable and can be managed cost effectively - Environmental impacts are likely to result from the proposed transmission system development. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at the stage of EIA should be taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites or through the careful selection of sites and access routes.

The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:

- Significantly improvement in the economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- There is negligible removal of trees for the transmission line, which is the main positive impact to the proposed project area. Compensatory afforestation shall take place where tree removal is unavoidable.
- Environmental pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to proposed project.
- No reliable baseline information of water, air and noise/vibration exists with respect to transmission line and substation locations.
- Proper GRM have to be implemented by the developer to overcome public inconvenience during the proposed project activities.
- It is highly recommended to establish a tree replanting programme corresponding number of trees that are cut or even more.

Based on the environmental and social assessment study conducted for the project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions should be made in the project to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people. The environment and social impact associated with transmission line project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate

provision for environment and social impacts which cover monitoring, measuring and mitigation.

Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The main project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

From this perspective, the project is expected to have a small "environmental footprint". No endangered or protected species of flora or fauna are reported at the project sites. Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The Project is not considered highly sensitive or complex. Hence, the proposed project has limited adverse environmental and social impact which can be mitigated following the ESMP & shall be pollution free renewable source of power.

