Draft Environmental and Social Impact Assessment 48MW Solar PV Project Mandamari

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IND: ReNew Clean Energy Project

Prepared by Arcadis India Pvt. Ltd.

ARCADIS Design & Consultancy for natural and built assets

DRAFT ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

48 MW Solar Power Project in Adilabad district, Telangana

Ref: D-ESM-20610

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTO

APPENDICES

Annexure I: MoEFCC Notification

Annexure II: Exemption of Consent to Establish and Consent to operate for White category industry (sample pages)

Annexure III: ILO Guidelines

Annexure IV: Framed Social Questionnaire

Annexure - V: Protected Monuments in Adilabad District

Annexure - VI: Stakeholders Participants List

Annexure - VII: Checklist for Preliminary Climate Risk and Screening

LIST OF ABBREVIATIONS:

AC	Alternating Current
ADB	Asian Development Bank
CGWB	Central Ground Water Board
CSR	Corporate Social Responsibility
CTE	Consent to Establish
CTO	Consent to Operate
DC	Direct Current
E&S	Environmental and Social Risk
EIA	Environment Impact Assessment
EP	Equator Principle
EPFI	Equator Principles Financial Institutions
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental Social Management Plan
FI	Financial Institutions
GAD	Gender And Development
GIIP	Good International Industry Practices
GRM	Grievance Redressal mechanism
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
PAP	Project Affected People
PCU	Power Conditioning unit
PV	Photovoltaic
PWD	Public Works Department
SMU	String Monitoring Units
SSA STD	Sarva Shiksha Abhiyan Standard
SHG	Self Help Groups

PPA	Power Purchase Agreement

1.0 INTRODUCTION

1.1 Background

M/s ReNew Power Venture Pvt. Ltd. is an independent power producer company and first IPP in India to cross an installed capacity of 1000 MW from clean energy projects. ReNew Solar Energy Pvt. Ltd. (A SPV of ReNew Power) is planning to develop a 48 MW (AC) solar PV power plant at Mandamarri village, Adilabad District, Telangana State. The power purchase agreement has been signed with the DISCOM which is Northern Power Distribution Company of Telangana Ltd.

The proposed project will be developed at Andugulapet and Mandamarri Villages of Adilabad District, Telangana. The solar intensity at the site has been assessed and found as favourable to develop solar power project. Telangana receives a global horizontal radiation (GHI) in the range of 5 to 5.5 kWh/m^2/day. The plant is expected to generate about 105,646 MWh annually.

A solar power plant is a superior and a clean option for power generation in comparison to non-renewable fossil fuels. Ministry of Environment, Forest and Climate Change (MoEF&CC) in its **Office Memorandum No. J-11013/41/2006-IA.II (I)** dated 13th May, 2011 (**Annexure I**) stated that the solar photovoltaic power projects are not covered under the ambit of EIA Notification, 2006 and therefore does not require prior environmental clearance. Moreover, solar power plant has been categorized under white category and exempted to obtain consent to operate (CTO) from state pollution control board. CPCB in its order published on 7th March 2016 has directed to all the SPCB about the categorization of industries. This categorization has been done on the basis of potential of industries to cause pollution. All the non-polluting industries has been categorized under white category and does not requires consent to operate (CTO). Only, intimation to SPCB while starting the industry will suffice.

ARCADIS India has been appointed by ReNew Power, as an independent environment consultant to undertake the ESIA study. The ESIA was conducted to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the proposed solar plant. The goal of the ESIA is to enhance sustainability of vital ecosystem, to improve or restore ecosystem health and biodiversity. Environmental sustainability in relation to the proposed solar power generation project will be enhanced by designing the solar power plant that gives competitive advantage over existing energy sources. The overall benefits of the proposed solar power system are expected to outweigh the potential negative impacts (if any). The Environmental and Social Impact Assessment (ESIA) study for the project has been undertaken in accordance with terms of reference approved by ADB for this project, International Finance Corporation's (IFC) Performance Standards (PS) on Social and Environmental Sustainability, 2012; Environment, Health and Safety Guidelines, Equator Principles; Relevant ILO conventions covering labour standards. The study will also assess the sustainability of the project w.r.t the local and national regulations relevant to the project.

1.2 Project Location

The project is spread over two sites of 160 and 140 acres (located at a distance of 1 km from each other). Both the sites will be connected using a 33 KV overhead line. The generated electricity will be evacuated to the 132 KV utility substation located at Mandamarri Village. The length of transmission line between power plant and utility substation is expected to be approximately 2 km. The salient features of the project are summaries in Table 1.1.

Table 1-1: Salient Features of Project

SN	Salient Features	Details
1	Project Owner	ReNew Solar Energy Pvt. Ltd.
2	Total Project Capacity	48 MW
3	Location of Site	Andugulapet
4	Project Coordinates	18.985290 N, 79.446397E
5	Total Land Area	300 acre
6	Type of Landuse	Agricultural and barren land
7	Proposed Technology	Solar PV module based on C-Si technology
8	Project Life	25 years

1.3 Project Phase and Status of Permits

The 48 MW proposed solar power plant is in initial phase of construction where site boundary has been constructed. The status of permits and approvals obtained has been summarised below:

Table 1-2: The status of permits and approvals

S.N	Permits/Approvals	Status
1	Consent to Establish from Telangana Pollution Control Board	Not required. However, Telangana Pollution Control Board needs to be informed while starting the project.
2	NOC from State Electricity Board for grid connection.	Reportedly, the same has been received from the State Electricity Board
3	NOC from village Panchayat for land uptake	Reportedly, the same has been received from the village panchayats
4	Power Purchase Agreement	Signed with Northern Power Distribution Company of Telangana Ltd.
5	Private land uptake from land owners	Completed

Figure 1-1: Project Location Map

1.4 Purpose of ESIA Study

The main purpose of the ESIA study is to identify, evaluate and manage environmental and social impacts that may arise due to implementation and operation of the proposed project. The document has been made to comply with the requirements of ADB, IFC's Performance Standards, IFC EHS guidelines, 2007 as well as applicable local and national regulations. The objectives of ESIA study are:

- To identify and establish the baseline environmental and socioeconomic conditions, to analyse the environmental and social risk and impacts of the project and its associated components (facilities like transmission line, access road etc.)
- To prepare an inventory of biodiversity (flora and fauna) of project site prior to implementation of the project to evaluate the possible impacts on avifauna, if any.
- Review of the land lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc.) on the purchased/ leased land through suitable survey using acceptable socioeconomic tools. This will help in assessing the impact of the project on the community/ villagers.

- Socio-economic survey involving consultation with local community, stakeholders, household surveys to identify the needs and problems of community with respect to the project activities.
- To suggest appropriate safeguards for the associated environmental and social risk, which may not lead to project investment and activities at risk.

1.4.1 Approach and Methodology of the ESIA study

The approach and methodology applied for undertaking the environmental and social impact assessment study is as provided.

- Desktop review of project related documents
- Reconnaissance survey to understand site specific issues.
- Discussion with the local community in the project influenced villages to understand their perception of the project and identification of key issues.
- Baseline noise level, air, water, soil, ecology and biodiversity data collection of the site through primary and secondary data source surveys.
- Identification of environmental and social risks associated with the project.
- Preparation of an environmental and social management action plan (with timelines & responsibilities) to manage these risk and impact.

1.4.2 Limitations

The study is based on the project planning information and document provided by the project proponent, community consultation and observation recorded during site survey. With the time constraints and initiation of ESIA study in July month, environmental monitoring has been conducted in monsoon season therefore result may shows lower concentration. The baseline condition is an extrapolation of surrounding areas to site. Any significant change in the proposed activities may result in variation of outcomes. Presented information and fact has been analysed and inferences has been drawn through the professional judgement.

1.4.3 ESIA Team

ARCADIS has mobilized a diverse team of multidisciplinary experts for conducting the ESIA study. A number of these experts are accredited professionals by Quality Council of India to conduct regulatory EIA. Combination of these experts have provided consultancy services to over 75 wind power projects across India with over 750 MW installed capacity and 1000 MW of combined solar and wind power projects. The experts have been continuously working with funding agency and understand the modalities and procedures of evaluating and addressing environment and social risk associated with large scale investment.

1.4.4 Structure of ESIA Report

Chapter 1: Introduction

Chapter 2**:** Project Description

Chapter 3**:** Applicable Policies, Legal and Administrative Framework

Chapter 4**:** Description of Environment

Chapter 5: Analysis of Alternatives

Chapter 5**:** Social and Environmental Impact Assessment

Chapter 6**:** Environmental and Social Management Plan

Chapter 7**:** Conclusions

2.0 PROJECT DESCRIPTION

The proposed solar power plant is being developed under Telangana Solar Power Policy 2015. The proposed plant is planned to be commissioned by May 2017. The technical features of project is provided in **Table 2.1** and satellite imagery of the project site is shown in **Figure 2.1**

Table 2-1: Technical Features of Project

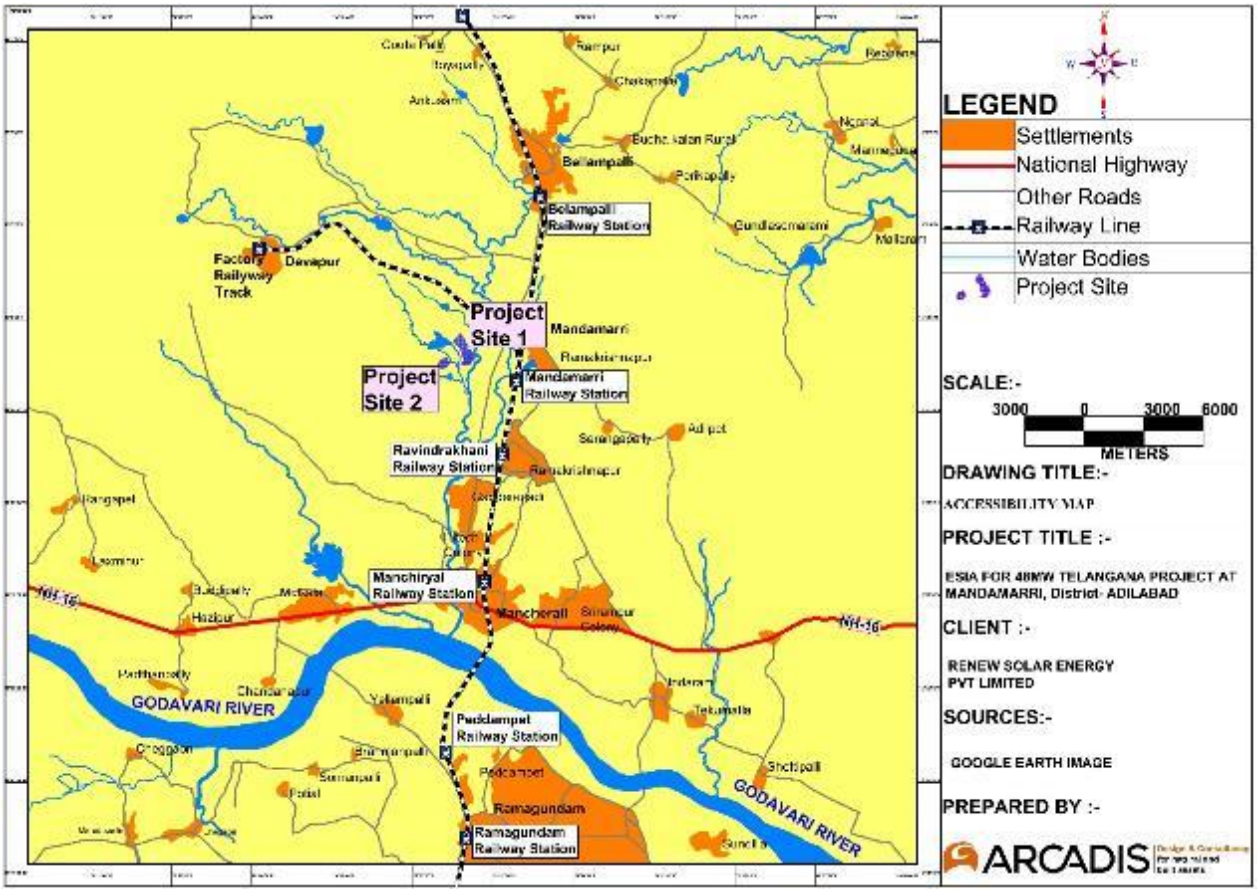
Particulars	Details
Project Capacity	48 MW
Annual Global Horizontal Irradiation (kWh/m^2)	1,887
Annual GII (kWh/m^2)	2341.6
Module peak power (Wp)	315
Number of Modules	182,847
Total Module Area (m^2)	354,062
Pitch (m)	5.5
Peak power of plant (MWp)	57.597
First Year Energy Yield (MWh/annum)	105,646
First Year Specific Yield (kWh/kWp)	1,816
Performance Ratio (PR) (%)	77.60%

2.1 Present status of Project

The project site visit was conducted in July 2016 and found that project is in construction phase. Project site boundary and site has been prepared. Further, unpaved access road has also been constructed. To some extent village road is also being used as access road. The project site and immediate vicinity are presented in Photographs 2.1.

Figure 2-1 Satellite imagery showing the proposed project site

Figure 2-2 Accessibility of the project site



2.2 Site Suitability and Justification of Project

Following analysis describes the site suitability for a Solar PV power plant development, these analysis include:

- **Solar radiation at the site:** Solar radiation map of India indicates that Telangana receives a global horizontal irradiation (GHI) in the range of 5 to 5.5 kWh/m^2/day. The first year energy yield prediction of the site data was estimated to be 105,646 MWh/annum.
- **Topography:** The project site is spread across an open area with very mild slope in multiple directions. Erection of solar panels is being undertaken through varying the height of the poles required for mounting solar panels. Hence, the installation is easy and reduces the cost of technical modifications required to adjust for undulations at the ground.
- **Substation proximity:** The proposed solar power plant will be connected to 132KV substation, located 2 km away from the project site.
- **Accessibility:** There is kutcha road (mud road) from the natural canal upto both the land points. Kutcha road has to be strengthened to a metalled road for movement of the heavy vehicle coming inside plant. The approximate distance of the Kutcha road is about 1.75 km from the natural canal. Mandamarri is the nearest railway station with a distance of 5 km. The nearest airport is Hyderabad airport at a distance of 280 km. Figure 2.2 below shows the accessibility of the project site.
- **Geological and soil conditions:** To ascertain soil parameters of the proposed site for construction of foundations for module mounting structures, control room, HT lines & array yard, drainage etc., the sub soil investigation through certified soil consultant has been carried out. Geological and soil investigations report confirm soil strength to support structures.

- **Near and far shading effects due to objects like transmission lines, trees, hills, wind farms etc.** Small trees and shrubs are present in project site surrounding.

In light of above discussion, the site has been found to be technically feasible for a solar power development as per all factors discussed above.

2.3 Project Settings

The key physical features of the project site have been described below:

- The proposed site has mix terrain (flat and undulating). The project site is surrounded by agricultural fields. However, project site land is mostly non-agricultural land.
- There are no shading elements such as mountains or trees available on the site.
- The vicinity of project site has natural canal and ponds. A natural canal is flowing at 1 km east of the project site. This natural canal further connect the Godavari River flowing in south direction at approx. distance of 20 km. One water pond also exist at approx. distance of 200 m west of project site.
- The nearest village settlement to the project site area is Andugulapet village settlement at a distance of 500m – East from the project boundary.

Figure 2-3 Photograph of Project Site and Surrounding

Project Site-1

East

North

West

South

Project Site-2

East

North

West

South

Approach Road to Project Site

Project Site

Community Pathway provided by Renew Power

2.4 Project Design, Technology and Component

The proposed 48 MW solar power plant will be based on C-Si technology. The system consists mainly of the following components:

PV Modules: All solar module mandatorily have to adhere to IEC specification given in IEC 61215 for crystalline silicon module. For optimum energy generation Crystalline Silicon 315Wp module of Hareon Solar has been chosen for this project.

Transformers: Each Inverter transformer will be 3 phase, 50Hz, 4MVA capacity. There will be 12 transformers of 4 MVA to step up inverter voltage level from 400V to 33kV for 48MW power plant and there will be two power transformer for 48MW plant in the switchyard section having of 3-phase, 50 Hz,33/132kV 25MVA/30MVA. This 132KV voltage level of 48MW power plant is transmitted to Utility substation through 132KV S/C Transmission Line.

Substation at Mandamarri Village

Mounting Structure: A fixed module mounting system of 15° inclination has been chosen for the PV plant. The mounting structures will comply with the appropriate industrial standards and will be capable of withstanding on-site loading and climatic conditions. Material to be used shall be a combination of hot-dipped galvanised mild steel and pre-galvanised cold rolled sheets sheared to form structural members for module mounting. The pre-galvanised sheets post process shall be appropriately coated with anti-corrosion compounds for the project life cycle. The structure designed will have five rows of modules placed in portrait orientation with 16 modules in each row. In total there shall be 80 modules in one mounting structure. The layout is designed with a pitch 20 (distance between the fronts of one row to the front of the next row) of 10.081m.

Power Evacuation: The 33kV output from inverter stations in the project site are combined together at 33kV switchboard and transmitted to 132kV substation. Power is further stepped up to 132kV through three power transformers rated at 33/132kV, 25/30MVA, which is then evacuated at 132kV substation located at 2 km from site through S/C transmission line.

Transmission Line: As per detailed project report (DPR), a transmission line of length 5kms and 33kV capacity would be laid to the feeder bay in Mandamarri 132kV Telangana Power Transmission Company Ltd. (TPTCL) substation. Necessary metering and protection will be provided to ensure acceptable billing and safety to equipment and work force. The approach route identified for the transmission line was based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering these factors has been selected for the transmission lines:

- Transmission line route does not fall under any habitations and thick vegetation.
- No households or community structures are located in the route of the transmission line.
- All environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance were avoided while selecting the route.
- Right of way/ access roads are shared with local residents of the area wherever possible.

2.5 Climate Change Effect on Solar Power Plant

Energy from solar power plant is directly related to fluctuating weather conditions. The vulnerability of solar power components due to climate change has been studied in various researches and publication. In Solar power plant, photovoltaic panels with an operating life time of 25 years are vulnerable to hail, wind and extreme temperature (Patt et al. 2010). Solar cell output usually rated at 25^{0}C and it decreases for each temperature rise of 1^{0}C after that hence increase in temperature will decrease the performance of solar cell. As the solar radiation assessment has been conducted for the proposed project and module has been designed in line with the assessment finding therefore solar power performance is not anticipated to reduce unexpectedly over the period of 25 years (project life cycle).

Cloud cover is another factor which influence the performance of solar panel's output and this performance can decrease by 40%-80% within a few seconds. However, it increases dramatically as the sky clear (Kleissl 2010).

Higher wind speed can also increase dust particles deposit over the panels which decrease solar photovoltaic cell output (Goosens and Van Kerschaever 1999), but higher wind can also cool the modules, increasing efficiency and output.

Another component of solar power plant is inverter. Studies, consistently show that the inverter, which Converts direct current power output into alternating current (DC to AC), is the most unreliable component of a photovoltaic system, accounting for up to 69% of unscheduled maintenance costs (Patt et al. 2010). However, they are not usually directly exposed to the weather and are not especially vulnerable to climate change.

Following checklist of ADB has been referred for preliminary climate risk screening:

Screening Questions		Score	Remarks
Location and Design of Project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	Not likely Solar modules have been selected considering the temperature range in the area (42- 45 ^{0}C in Adilabad)
	Would the project design need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Likely Natural drains of seasonal nature exist near the project site which becomes active during the monsoon therefore project component and site design should consider the risk of local flooding
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days	0	Not likely Project can be establish within a short time period of 4-5 months (approx..) therefore impact of climate change on material and

	and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?		maintenance is not expected
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	Not likely
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	1	Likely Although project has been designed after consideration of temperature variation (annually), significant variation in temperature over the period of project life cycle may affect its performance.
Total sum of scores		**2**	

Risk evaluation

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project. In The proposed project, total scores is 2 which means project is of low risk due to climate change.

2.6 Resource Requirement

2.6.1 Land Requirement

Project Site

The solar power is proposed on private land. The project site is an open vast area with mild undulations. Land in the project influenced area is predominantly used for rain-fed agriculture and grazing. Grazing activities are limited to post-monsoon months, when adequate vegetation is present. Agriculture in the area is majorly

dependent on rainfall. One natural canal exist east of the project site at a distance of 1 km which is being used by farmers for irrigation.

Temporary boundary has been constructed for both the patches. During dialogue with representative of land developer (M/S SSPL), it was informed that, only private land is involved for the proposed solar power project. Around 300 acre of private land has been procured for the project site area as per documents shared by Renew Power team. The proposed solar project spreads over two different patches of land (first patch about 160 acre and another patch of 140 acre) in Andugulapet village. Majority of the land owners are from Andugulapet village and some land owners are from Mandamarri town area. However the land owners of Andugulapet village are living in Mandamarri town but their land falls under Andugulapet village. The procured land was mostly dependent on rain-fed agriculture pattern, non-cultivated and undulating land. The compensation for the purchased land is reportedly above the existing government circle and market rate. Reportedly, no physical displacement happened due to the project and private land has purchased through good faith negotiations based on willing sellers and willing buyer basis, which was confirmed on the basis of following;

- Sample copy of sale deed
- Primary consultation with landowners
- Consultation with land aggregator
- Analysis of market value of land to verify compensation provided to landowners are higher than the circle rate.

Table 2-2: Village wise land distribution

SN	Village/Town	Land in acre	Land type (Pvt./ Govt.)
1	Andugulapet	300	Private

Table 2-3: Project component wise land breakup

SN	Project Components	Required Land (Acres)	Remarks
1	Solar site	300	Including access road and sub station
2	Transmission Lines	0.071	Around 8 transmission line tower falls under 2 Km length of transmission line. Land requirement for one tower is 6 m X 6 m.
Total		**300.071**	

Land for access road

Village road (approx. 2 km long) is being used to access the project site. This village road connects project site with SH-1. To reach the project site, this village road also crosses one natural canal. There is no bridge over this natural canal. One culvert bridge is planned to be constructed by the project proponent which will facilitate crossing of canal without disturbing the water flow. All the necessary permission required to construct the culvert bridge is being taken by the project proponent. The road is narrow (width 10-12 feet) and paved within the village. However, near the canal and further to the project site this road is unpaved. This village road is being used by project proponent for the mobilization of manpower and machinery during the construction.

Land for transmission line & PSS

Reportedly, 8 transmission line tower will be constructed requiring 6m x 6m land for each tower. Government grid station is located in Mandamarri Mandal which is 2 km away from the project site. A relatively small area of 6m x 6m will be used by paying a one-time compensation based on negotiation with land owners (which includes the compensation for crops in the Right of Way of transmission towers & transmission line).

Private land purchase process

As per discussions with the representative of land developer (SSPL), only private land has been purchased for the proposed project. The private land has been purchased by land aggregator after negotiation and willing seller and willing buyer basis. Procedure for site identification and land uptake has been developed by Renew and the same has been followed in this project.

General procedure of Land purchase

- Based upon the solar resource assessment, a first draft layout is prepared from which a set of locations that can be procured is available. Based upon further survey to establish feasibility of locations, the first set of target lands is identified.
- Discussions/ negotiation with land owners are held through land aggregator and purchase terms agreed upon. Land documents are collected and tittle is vetted.
- Locations may be dropped if the sale/ purchase terms of the land cannot be agreed upon, or if the title vetting does not establish satisfactory land documentation. In such case, other available option for locations are pursued. This is the reason why this project has been spread over two sites located at approx. 1 km distance from each other.
- A location is acquired once an agreement to sale (ATS) and Power of Attorney (PoA) is received from land owner / farmer. The land is then transferred to land aggregator or Project Company by way of a lease deed. At this stage Renew starts applying for all necessary clearances for the locations.
- After this sale deed needs to be done with the seller to complete the entire land purchase process and before any security charge can be created on the land parcels. All sale deeds done in the name of Project Company are done only after comfort on land documentation and clear title.
- All the land acquired for the project if a private land, it is obtained at market price or negotiation with farmers. Each farmer is offered the same price on a per acre basis for his farm.
- The government circle rate in the proposed project area is more than rupees 1.5 lakh per acre as reported by land aggregator.

2.6.2 Water Requirement

During the present construction phase, water is required for preparing RCC foundations for module mounting structures, building control room and security rooms, and domestic purposes such as drinking and washing by the construction workers and staff. During operations, water will be required for cleaning of solar panels and also for domestic purposes for the operations staff. The estimated quantities of water required during the construction and operation phases are presented below in **Table 2.3**

Table 2-4 Water requirement during construction and operation phase

Phase	Activity	Max. Consumption
Construction	Civil works water requirement	6 KLD
	Domestic use – drinking (during peak construction phase).	13.5 KLD
Operation	Washing of solar panels once per month	100 KL
	Domestic use – drinking and washing by 10-12 site personals and security guards	0.5 KLD

During construction phase, the demand is met by tankers carrying 6000 litres/day. About 30 cans of packaged water of 20 litres capacity per day is required to meet the drinking water needs. In operational phase, ground water will be used for module washing while RO water will be made available for the drinking purpose.

2.6.3 Manpower Requirement

About 300 labours is estimated to be employed in the peak phase which involves the foundation structural work, fencing, cleaning and erection of mounting structure. Some female workers is also expected to be engaged. The contractor workforce will be comprised of both skilled and unskilled labours. Some workers may be sourced from the nearby villages depending on their skills and capabilities. In the operational phase, a total of 10-12 personnel will be required onsite including security guards, operation and maintenance officer and site engineers.

2.6.4 Waste Water Treatment and Disposal System

During the construction phase, the waste water or sewage from site office toilets will be disposed in a septic tank. Waste water will be generated during the operation phase due to solar module washing on a monthly basis. Proper storm water channels would be constructed along the periphery of the project site for draining of site run off to the dry water channel passing through the northern part of the site from west to east direction. The domestic waste water would be managed through septic tanks already constructed.

2.6.5 Logistic Arrangement

Labour Camp: During the site visit, no labour camp was observed. The plan is to hire unskilled labours locally therefore reducing the requirement of labour camp. Onsite labour camp will be constructed to house only the migrant labours once construction activities starts. All the basic facilities and amenities such as drinking water, separate kitchen, creches for children, sufficient toilet and rest room will be provided in the labour camp.

Project Vehicles: Project vehicles such as water tanker, tractors, JCB, and cars will be hired to support various operations during construction phase and further efforts will be made to hire vehicles from local community.

2.6.6 Implementation Schedule for the Project

As per the Detailed Project Report (DPR), project is scheduled to commence in May 2017

3.0 APPLICABLEREGULATIONS, GUIDELINES AND STANDARDS

This section describes regulations, statutory guidelines and obligatory standards that are applicable to the social and environmental performance of the proposed project.

3.1 National Regulations

Environmental Protection has been given the constitutional status. Directive Principles of State Policy states that, it is the duty of the state to 'protect and improve the environment and to safeguard the forests and wildlife of the country'. It imposes Fundamental duty on every citizen 'to protect and improve the natural environment including forests, lakes, rivers and wildlife'.

In India the Ministry of Environment, Forests and Climate Change (MoEFCC) is the apex administrative body for (i) regulating and ensuring environmental protection; (ii) formulating the environmental policy framework in the country; (iii) undertaking conservation & survey of flora, fauna, forests and wildlife; and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Several laws have been framed for protection of environment and for Occupational Health & Safety in India by the Central Government. The relevant regulation pertaining to the project activity has been discussed as under. The compliance to all environmental, health, safety and social regulation have been presented in **Table 3.1**

Table 3-1 Applicable Environmental, Health, Safety and Social Regulation

SN	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
1	The Air (Prevention & Control of Pollution) Act 1981	State Pollution Control Board (SPCB)	As per this rule, Consent To Establish and Consent to Operate is required to be obtained. However, development of solar power plant falls under white category and therefore it is exempted to obtain CTE and CTO from state pollution control board. Reference: CPCB notification No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016	*Solar power plant is exempted to obtain CTO. However, SPCB needs to be informed by the project proponent while starting the project.*
2	The Water (Prevention & Control of Pollution) Act 1974	State Pollution Control Board (SPCB)	As per this rule, Consent To Establish and Consent to Operate is required to be obtained. However, development of solar power plant falls under white category and therefore it is exempted to obtain CTE and CTO from state pollution control board. Reference: CPCB notification No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016	*Solar power plant is exempted to obtain CTO. However, SPCB needs to be informed by the project proponent while starting the project.*
3	Forests (Conservation) Act, 1980 and Rules 1981	Forest Department	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests.	*Not Applicable* *No forest land is involved for the project.*
5	Environmental Impact Assessment (EIA) Notification 2006 & MoEFCC Office Memorandum dated 30thJune'11.	MoEFCC	The EIA Notification 2006 and thereafter the MoEFCC Office Memorandum dated, 13th May 2011 exempts solar power project from obtaining prior Environmental Clearance from the regulatory authorities. But, under the provision of MoEFCC office memorandum dated 30th June 2011, requisite permission is required to be obtained from competent authority for water and land usage.	*Not Applicable. However, permission is required for usage of water. Reportedly, the permission has been taken from the concerned village Panchayat.*
6	Environment (Protection) Seventh Amendment Rules 2009	CPCB	Ambient air quality monitoring has to be carried out and the concentration limits for the air quality parameters should be in compliance with NAAQS 2009. Activities in the project especially during	*During construction phase and if required during operation phase*

			construction should not result in exceeding National Ambient Air Quality Standards (NAAQS) for ambient concentrations of air pollutants (such as particulate matter). If violation of the Rules takes place then the penalty will be decided on the basis of the parent Air Act 1981.	
7	Noise (Regulation and Control) Rules 2000 amended in 2010	TPCB	The Rules stipulate ambient noise limits during day time and night time for industrial, commercial, residential and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the EPA Act 1986.	*During construction phase and if required during operation phase*
8	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008	TPCB	These Rules outline the responsibilities of the generator, transporter and recycler/re-processor of the hazardous wastes for handling and management in a manner that is safe and environmentally sound. Project proponent need to obtain consent from State Pollution Control Board for generation and storage of hazardous waste like transformer oil, etc. irrespective of quantity of waste. As per the law the occupier and the operator of the facility should be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.	*Not Applicable during construction phase* *Proposed project is using a clean technology and does not generate hazardous waste as listed under Hazardous waste management and handling rule.*
9	Environment (Protection) Second Amendment Rules 2002	MoEFCC	The DG sets installed during construction should comply with maximum permissible noise levels and noise control measures for diesel generators up to 1000 KVA capacity as specified in the Act.	*The power requirement during construction phase is met through DG sets, which will adhere to prescribed CPCB noise level limits and noise control measures.*

10	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	Ministry of Labour and Employment	This Act provides for safety, health and welfare measures of buildings and construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens and temporary living quarters within or near the work site. This Act also requires application of the following: Building or other construction workers' (regulation and Employment Conditions of Service) Central Rules 1998 & Workman's compensation Act, 1923 to buildings and other construction workers. These will be followed by contractor & developer during construction and operation phase.	*Applicable during construction phase* *Project proponent will ensure through its contractors that basic amenities are provided to the labours. Project proponent through its contractors should also ensure all vendors employed should have valid labour license. Compensation to workers (own and vendors) should not be below daily wage rate as specified by Government. Muster roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with.* *Failure to comply results in financial penalty /imprisonment of the principal employer along with vendor and closure of project*
11	Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008, (CET)	Min. of Power , Central Electricity Authority Telangana Power Transmission Company Ltd. (TPTCL)	The Act is applicable for the solar power plant as the plant is going to be having electrical appliances and facilities installed for grid connected power generation. As per the act, all equipment's and system installed should comply with the provision of the statute, regulations and safety codes.	*Applicable both during construction and operation phase* *Project proponent under provisions of the CET regulations ensure that the health and safety requirements and provisions for transmission lines specified under the rules are compiled.*
12	Workmen's Compensation Act, 1923 & Rules 1924	labour welfare board	The Act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer should be liable to pay compensation in accordance with the provisions of this Act.	*Applicable during construction phase* *Project proponent should ensure through its contractors in case of any accident/ injury/ loss of life the workmen should be paid a minimum compensation as calculated under this act both during*

				construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.
13	The Contract Labour (Regulation and Abolition) Rules, 1971 Contract Labour (Regulation And Abolition), 1973	labour welfare board	The Contract Labour (Regulations & Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registering the establishment. The Act and its Rules apply to every establishment in which 20 or more workmen are employed on any day on the preceding 12 months as contract labour and to every contractor who employs or who employed on any day preceding 12months, 20 or more workmen. It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of a seasonal nature if work is performed more than 60 days in a year.	*Applicable during construction phase* *All vendors employed including contractors should have valid labour license. Compensation to contract workers (own and vendors) should not be below daily wage rate as specified by Government of India. Mustard roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty. Failure to comply results in financial penalty.* *Renew should also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and in compliance with the standards.*
14	Minimum Wages Act, 1948	labour welfare board	This Act provide for fixing minimum rates of wages in certain employments and requires the employer to provide to every worker engaged in a scheduled employment to be paid wages at a rate not less than the minimum rate of wages fixed by such notification for that class of employees in that employment without any deductions except as may be	*Applicable during construction phase*

			authorized within such time and subject to such conditions as maybe prescribed.	
15	The Child Labour (Prohibition and Regulation) Act, 1986	labour welfare board	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work.	*Renew Power should ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. Renew Power should include a clause in the subcontractor agreements prohibiting employment of child labour.*
16	Companies Act, 2013	Renew Power	According to Schedule 135 sub -section 1, the companies meeting the threshold criteria (Minimum networth of rupees 500 Crore, Turnover up to "1000 Crore" and having a net profit of at least '5crore') specified should spend in every financial year, at least 2% of the average net profits of the Companymade during the three immediatelypreceding financial years in pursuance of CSR policy.	*The projectwill need to comply with the requirement as stated in the law.*
17	Panchayat (Extension to Scheduled Areas) Act 1996	Renew Power	Provisions of this rules are: • A state legislation on panchayats in the scheduled area should take care of the customs, religious practices and traditional management practices of community resources • Every village shall contain a Gram Sabha whose members are included in the electoral list for the panchayats at village level • Planning and management of minor water bodies are entrusted to the panchayats • The Gram Sabhas have roles and responsibilities in approving all development works in the village, identify beneficiaries, issue certificates of utilization of funds; powers to control institutions and functionaries in all social sectors and local plans • Every Gram Sabha to safeguard and preserve the traditions and customs of people, their cultural identity, community resources and the customary mode of dispute resolution	

3.2 ADB safeguards and compliance

The project has been planned and initiated in line with the requirement of ADB safeguards. A brief description of safeguard requirement and project details is given in table below:

ADB Policy	Objective	Project Details
ADB'S SAFEGUARD POLICY STATEMENT (2009)	ADB's safeguard policy framework consists of three Operational policies on the environment, Indigenous Peoples and involuntary resettlement.	
	Environmental Safeguards: To ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.	*The present ESIA study encompasses identification of environmental sensitivity and potential risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Recommendation of environment management plan and mitigation measures.*
	Involuntary Resettlement Safeguards 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.	*Land purchase was devoid of structures or habitation. The private land has been purchased through negotiations on willing to sell and willing to buy basis. The land rates paid are more than the government rates. Moreover, crop compensation has also been paid to land owner in case of transmission line.*
	Indigenous Peoples Safeguards	*There is no adverse impact due to the project on ST person. Only private land has been procured for this*

	To design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.	*project. All the land owners have been discussed and price paid was mutually agreed.*
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.	*The project will follow ADB Policy on Gender Development. Participation of women workers will also be ensured wherever possible in the project. Additionally, women empowerment will also be a part of CSR activities.*
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, 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 points (a) and (b).	*Renew Power has developed ESMS in line with the requirement of ADB's Social Protection Strategy (2001). This ESMS is applicable on all the projects initiated by Renew Power*

ADB policy on Public Communication policy	ADB shall ensure that the project or program design allows for stakeholder feedback during implementation. ADB shall ensure that relevant information about major changes to project scope and likely impacts is also shared with affected people and other interested stakeholders. The borrower and/or client shall provide relevant environmental, resettlement, and indigenous people's information, including information from the documents referred such as EIA, IEE etc to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them.	*The project team held meeting with Village Sarpanch and other people to disclose the project and taking their view. To receive the comments of villagers and other stakeholder, arrangement will be made under grievance redressal mechanism. This mechanism not only facilitate receiving of stakeholder's concern but also help to address the comment in time bound manner.* Renew Power believe in clear and thorough communication with the community during the project life cycle and the same will be implemented.
ADB policies on 2010 on Gender mainstreaming guidelines	ADB's Policy on Gender and Development will adopt mainstreaming as a key strategy in promoting gender equity. Gender considerations shall be mainstreamed into all ADB activities, including macroeconomic and sec-tor work, and lending and technical assistance (TA) operations. The key elements of ADB's policy will include gender sensitivity, gender analysis, gender planning, mainstreaming, and agenda setting. Focus on Developing member countries	*Not Applicable.* *Renew Power through CSR interventions will work with women/girl child on key thematic areas such as Education, Health and Empowerment.*
ADB policies on participation guides	Participation in ADB-assisted operations refers to the processes through which stakeholders influence or contribute to designing, implementing, and monitoring a development activity. Participation, rather than merely a goal in itself, helps achieve improved development results. By ensuring stakeholders understand and can participate in the decisions, resource allocations, and activities that affect their lives, it ensures attainment of the benefits from this engagement.	*Stakeholder participation in this project has been ensured through stakeholder discussion and project disclosure. Further, CSR program will also be prepared in line with the discussion held with community.*

3.3 ADB Prohibited Investment Activities List (PIAL)

The proposed project has been assessed with the ADB prohibited investment activities list and found that it does not fall under this list.

List:

The following do not qualify for Asian Development Bank financing:

(i) production or activities involving harmful or exploitative forms of forced labor[1] or child labor[2];

(ii) production of or trade in any product or activity deemed illegal under host country laws or regulations or international conventions and agreements or subject to international phaseouts or bans, such as (a) pharmaceuticals[3], pesticides, and herbicides[4], (b) ozone-depleting substances[5], (c) polychlorinated biphenyls[6] and other hazardous chemicals[7], (d) wildlife or wildlife products regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora[8],and (e) transboundary trade in waste or waste products[9];

(iii) production of or trade in weapons and munitions, including paramilitary materials;

(iv) production of or trade in alcoholic beverages, excluding beer and wine[10];

(v) production of or trade in tobacco;[10]

(vi) gambling, casinos, and equivalent enterprises; [10]

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[1] *Forced labor means all work or services not voluntarily performed, that is, extracted from individuals under threat of force or penalty.*

[2] *Child labor means the employment of children whose age is below the host country's statutory minimum age of employment or employment of children in contravention of International Labor Organization Convention No. 138 "Minimum Age Convention" (www.ilo.org).*

[3] *A list of pharmaceutical products subject to phaseouts or bans is available at http://www.who.int.*

[4] *A list of pesticides and herbicides subject to phaseouts or bans is available at http://www.pic.int.*

[5] *A list of the chemical compounds that react with and deplete stratospheric ozone resulting in the widely publicized ozone holes is listed in the Montreal Protocol, together with target reduction and phaseout dates. Information is available at http://www.unep.org/ozone/montreal.shtml.*

[6] A group of highly toxic chemicals, polychlorinated biphenyls are likely to be found in oil-filled electrical transformers, capacitors, and switchgear dating from 1950 to 1985.

[7] A list of hazardous chemicals is available at http://www.pic.int.

[8] *A list is available at http://www.cites.org.*

[9] *As defined by the Basel Convention; see http://www.basel.int.*

[10] *This does not apply to project sponsors who are not substantially involved in these activities. Not substantially involved means that the activity concerned is ancillary to a project sponsor's primary operations*

(vii) production of or trade in radioactive materials[11], including nuclear reactors and components thereof;

(viii) production of, trade in, or use of unbonded asbestos fibers[12];

(ix) commercial logging operations or the purchase of logging equipment for use in primary tropical moist forests or old-growth forests; and

(x) marine and coastal fishing practices, such as large-scale pelagic drift net fishing and fine mesh net fishing, harmful to vulnerable and protected species in large numbers and damaging to marine biodiversity and habitats.

[11] This does not apply to the purchase of medical equipment, quality control (measurement) equipment, and any equipment for which ADB considers the radioactive source to be trivial and adequately shielded.

[12] This does not apply to the purchase and use of bonded asbestos cement sheeting where the asbestos content is less than 20%.

3.4 Social and Environmental Performance Standards of the International Finance Corporation

The International Finance Corporation has laid down a set of eight Performance Standards that the project developers need to comply with while establishing the project. The provisions of the Performance Standards relevant to the solar power projects are summarized below:

Table 3-2 IFC's Environmental and Social Performance Standards

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
PS 1: Social and Environmental Assessment and Management Systems	Conduct an Environmental and Social Impact Assessment (ESIA) of the project, appropriate to the nature of the project's environmental and social risks and potential impacts.	Arcadis has been appointed by Renew Power to undertake ESIA study to identify the environment and social risks that may arise due to the project and recommend mitigation measures for the same as provided in Chapter 6 The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The proposed project is a solar power project and will have environmental and social impacts resulting from loss of grazing land, generation of noise, construction activities etc. ***PS 1 is therefore applicable for the proposed project.***	Renew Power has developed an Environmental and Social Management System at the corporate level as well as adhere to the environment and social management plan recommended for its solar project at the ground level. Renew Power is required to fulfil the following requirements: ▪ Environmental and social action plan; ▪ Identification of risks and impacts; ▪ Management program; ▪ Organizational capacity and competency; ▪ Training for security and safety workers; ▪ Emergency preparedness and response; ▪ Stakeholder engagement/ grievance redressal; and ▪ Monitoring, reporting and review.
	Establish Environmental and Social Management Plans commensurate with the findings of the ESIA and consultation with affected communities	An Environmental and Social Management Plan has been prepared and incorporated in Chapter 7 of the ESIA report taking into consideration the potential social and environmental impacts or risks already identified & assessed in ESIA.	
	Establish Action Plans where specific mitigation measures and actions are required for the project to comply with applicable laws, regulations and the	An ESMP has been prepared and incorporated in Chapter 7 of the ESIA report for implementation of mitigation measures in compliance with the statutory requirements and Performance Standards	

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	requirements of these Performance Standards		
	Provide organizational capacity and contractor / employee training to enable project to achieve continuous environmental and social performance	Organizational structure with roles and responsibilities of the team within the organization is defined in Chapter 7	
	Establish and maintain a timely process of community engagement, including a grievance mechanism, focusing on disclosure of information and consultation with local communities affected by project risks or adverse impacts that is free from external manipulation, interference or coercion to ensure relevant and understandable access to project information.	A community engagement plan needs to be developed and implemented as well as adequate reporting needs to be done. This should aim to inform the community project related adverse impacts or risks. The grievance redresses mechanism has been developed in ESIA	
	Establish procedures to monitor and measure the effectiveness of the environmental and social management program, including internal reporting of the program's effectiveness to the project's senior management, disclosure of Action Plans (including material changes to such Plans) to affected communities, and external reporting to affected communities on the results of Action Plans, commensurate with the concerns of the affected communities	System of monitoring with periodic audits will be established	
PS 2: Labour and Working Conditions		The PS 2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as	Renew Power through its contractors should ensure that adequate facilities and amenities are provided in the labour accommodation for the migrant workers (20%) including: adequate living/sleeping facilities and space per person;

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		well as workers engaged by the client's primary suppliers (supply chain workers). The proposed project involves employment of direct and contracted workers during construction and operation phases. Locals will be hired to carry out unskilled work. ***PS 2 is therefore applicable for the proposed project.***	potable water that meets national standards and standards as laid down by ILO; toilets, washing and cleaning facilities; canteen/mess or fuel for cooking; locker/storage facilities; and facilities for management and disposal of garbage, sewage and other waste. The company will periodically review and monitor the condition of the accommodation given to workers. The worker accommodation standards as laid down by ILO is presented in **Annexure III** of the document. The company, as a part of the contractor should regularly monitor compliance to the aforesaid guidelines/requirements and ensure that these are met. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system. During site visit, it was found that no labour camps are set up onsite.
	Establishment of a Human Resources Policy consistent with the requirements of this Standard that informs employees of their rights under national labour and employment laws		The contractors should have well framed HR policies. The workers/labours engaged by the contractors should be informed about their rights under national labour and employment laws.
	Document and communicate to all employees' conditions and terms of employment.	Applicable during construction and operation phase	Renew Power will engage labours through contractors, however the same should be supervised by Renew Powerso that the engagement of workers is in accordance to applicable rules and regulations. Renew Powerthrough contractor will ensure adequate provisions of facilities such as access to clean water, sanitary facilities and other necessary facilities at the labour camps and construction sites.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Practice non-discrimination and equal opportunity in making employment decisions	Applicable during construction phase	Complied. Equal opportunity will be given to both men and women depending on their skills and capacity wages, work hours and other benefits should be as per the national labour and employment Laws.
	Provide a mechanism for workers to raise workplace concerns.	Applicable during construction and operation phase	Grievance Redressal Mechanism (GRM) has been framed under the ESMS and the same will be implemented at project level. This is applicable both during construction and operation phase and should be supervised by Renew Power.
	Provide workers with a safe and healthy work environment, taking into account risks inherent to the particular project sector	Applicable during construction and operation phase	The contractor should follow its EHS policy while operating onsite. In absence of EHS policy of contractor, EHS policies of ReNew Power will be applicable. .
PS 3: Resource Efficiency & Pollution Prevention		The PS-3 is applicable to projects resulting in increased levels of pollution and requires project to avoid, minimize, or reduce adverse impacts on human health and environment by adopting pollution preventive and control technologies throughout the Project life cycle. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for the development of project will result in generation of wastes like wastewater, waste oil and construction debris .The operation phase will result in noise emissions and generation of minor quantities of waste such as transformer oil.	Water for project construction phase will be sourced via tankers from nearby borewell. Permission from the Village Panchayat shall be taken prior to using the borewell. Drinking water supply will be met by packaged drinking water. The project, is expected to contribute to significant GHG avoidance beginning in FY2016-17. No material impact on ambient air quality is expected on account of this project. However, temporary impacts on ambient air quality and noise levels may be expected during construction. Renew Power should implement measures during construction: for management of excavated earth and construction rubble; and minimization of fugitive dust emissions. Further, Renew Power

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		PS 3 is therefore applicable for the proposed project.	should ensure through its contractors that other wastes (packing material, metal, debris, cement bags, drums/cardboards etc.) are collected, stored and disposed to re-users or in appropriate authorized debris disposal areas. Limited concreting work is expected for structure foundations, sub-station, and transmission towers. Cement concrete mixers will be expected to be used at site since significant concreting work is not expected. Concreting and other construction activities including use of earth moving equipment and increased traffic for material movement is expected to result in increase in ambient noise levels. However, this increase is short term during construction stage only. The construction work will be carried out only during day time and no noise generating equipment will be operated at night. No material impact on surface or groundwater resources is expected on account of the project, except that the water sourcing requirement during the construction phase will need to safeguard the immediate and medium term needs of water by the local communities. The sub-contractors should ensure that the water made available to workers and employees' meets national potable water quality norms. The project site if equipped with appropriate facilities for collection, treatment and disposal of sewage (septic tank and soak pit) which is used both during construction and operation phases should be provided.
	The project proponent should ensure that adequate control techniques are provided to minimize emissions or achieve a pre-established performance level and	During the construction phase, the vehicles involved for hauling of equipment's and	Renew Power through its contractors will ensures sprinkling of water to reduce dust in the air.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	minimize pollution from project activities. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release.	materials to the project site may increase the pollution level and dust in the air.	Besides, Renew Powershould also ensure use of vehicles having valid PUC certificates.
	The client will implement technically and financially feasible and cost effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core business activities.	During construction and operation phase.	Renew Power should plan and implement pollution control measures. Practices like minimal release of waste, safe disposal of waste, wastewater management etc. should be considered prior to each phase.
PS 4: Community Health, Safety and Security		This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. The proposed project will involve transportation of components such as mounting structures, electrical equipment's, solar modules, which may pose safety risks to the local communities. **The PS 4 is therefore applicable for the proposed project.**	The Applicability will be limited to construction period with movement of heavy machinery / vehicles. Unskilled labour and security staff should be engaged from local community. Renew Power through its contractors will try to engage maximum workers from the neighbouring villages. It should be ensured by Renew Power that the subcontractors use vehicles having valid PUC certificate. Proper signage's should be provided along the access road and project site indicating –Construction in process and other safety alarm signs.
	Evaluation of risks and impacts of the project on health & safety of the affected community during the project lifecycle and establish preventive/mitigation measures to reduce/ minimize the impacts. Disclosure of action plans to affected community and the government agency.	During Construction Phase	The potential occupational hazards arising from the project activities and the impacts on health & safety of the affected community have been identified and assessed in Chapter 6 of ESIA.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Design, construct, operate and decommission of Structural elements or components in accordance with good industrial practice to reduce impact on community health & safety.	During Construction Phase	An occupation health safety plan has been formulated (Chapter 7) of this report. All steps to reduce the impact on the health and safety of the community to minimal will be taken.
	Minimization of impacts on the health and safety of the community caused by natural hazards that could arise from the land use changes due to project activities.	During Construction Phase and Operational phase	A management plan has been formulated as part of ESIA process to address the issue.
	Prevent or minimize the potentials for community exposure to communicable diseases during project activities	During Construction Phase	CSR Plan and activities has been provided as a part of ESIA.
PS 5: Land Acquisition and Involuntary Resettlement	PS 5 is applicable when there is physical and/or economic displacement due to acquisition of land for the project. This PS does not apply to resettlement resulting from voluntary land transactions (i.e. market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures if negotiation fails). The impacts arising from such transactions should be dealt with as under PS1, though sometimes, when risks are identified, the project proponent may decide to adhere to PS 5 requirement even in willing-buyer-seller cases	**PS5 is not applicable for this proposed project.**	Under the proposed project 300 acre of private land has been procured and this has not resulted in any economic or physical displacement. The land procured for the proposed project is not being used for agricultural activities and it is without habitation. Land has been procured on willing to buy and willing to sell basis. Lands against the will of landowners were not acquired and therefore project site has been spread over two land parcel (located 1 km distance from each other). Further, a community pathway has been provided by Renew Power to provide free access to community people.
	Avoidance or at least minimization of involuntary resettlement by exploring alternative project designs balancing	Not applicable	No resettlement of people is required.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	environmental, social and economic costs and benefits; and by acquiring land through negotiated Settlements.		
	Compensation and benefits for displaced person as per Performance Standard	Not applicable	No locals has been displaced. Price given to the land owners were decided after mutual discussion and consent. The price paid to the land owners were above than the Circle rate.
	Disclosure of all relevant information and consultation with affected persons and communities in decision making process related to resettlement.	Not applicable	No resettlement has taken place due to the project activity.
	Establish a grievance mechanism to record and resolve communities' concerns and grievances about the relocation and compensation	During the construction and operation phase	Grievance redressal mechanism is already in place with ReNew Power and the same will be implemented at project level.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	As a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle.	The applicability of this PS should be established in ecology and biodiversity section of the ESIA. Implementation of the actions necessary to meet the requirements of this PS should be managed through the Management Plan. The operation phase of the proposed Project should ensure protection of local flora and fauna of the site and its surrounding. ***PS6 is applicable to the project***	Land taken for the project represent modified habitat. Further, Protected Area (N.P; WLS, Biosphere Reserve etc.) and Important Bird areas do not exist within 10km study area.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
PS 7: Indigenous Peoples	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities	Adilabad district is a government declared scheduled area where significant ST and SC population exist. The district has different group of ST such as Gonds, Naikpods, Kolams, Pardhans, Koyas, Manne, Andhs, Thoties, Lambadas and Yerukalas. As the proposed project falls under Scheduled area therefore procurement and transfer of agricultural land from the ST people to non ST people is prohibited. Discussion with project team and land aggregator reveals that no land has been taken from ST people. Only private land has been taken following legal procedure. Considering the fact of not taking ST land in proposed project, impact on indigenous people is not anticipated.	Renew power land team to ensure that no landhas been taken from ST person. Further, NOC from Gram Sabha and Panchayat should be taken prior to the development of project.
PS 8: Cultural Heritage –	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.	This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes. No notified cultural Heritage is located near the project area. **Hence, PS8 is not applicable.**	Chance find Procedure to be formulated in case of discovery in nearby project site of any artefacts and Cultural heritage in the future.

3.5 Categorization of Projects

Analysis of project based on the facts given below indicates that proposed project has very limited environmental and social impacts and can be categorised as B category project on basis of following criteria:

Categorization Criteria

- **Category A Projects:** Projects with potential significant adverse social or environmental risks or/and impacts that are diverse, irreversible or unprecedented;
- **Category B Projects**: Projects with potential limited adverse social or environmental risks or/and impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;
- **Category C Projects:** Projects with minimal or no adverse social or environmental risks or/and impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks;

3.6 EHS Guidelines of IFC

IFC has issued Environmental, Health, and Safety Guidelines in 2007. The key requirements stated in the EHS guidelines have been discussed in **Table 3.3.**

Table 3-3 IFC's EHS guidelines

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
I	**ENVIRONMENTAL ATTRIBUTES**	
i	Air Emissions and Ambient Air Quality	Please refer the section on ambient air quality in Sec 4.3.1 and 6.2.1
Ii	Energy Conservation	Please refer the section on Resource Efficiency & Pollution Prevention in sec. 3.2
iii	Wastewater and Ambient Water Quality	Segregating or diverting clean water runoff to prevent it mixing with water containing high solids content, to minimize the volume of water to be treated prior to release. Refer mitigation measures for water under Table 7.1 and under section 6.2.5
iv	Water Conservation	Refer mitigation measures in Section 6.2.5 and Table 7.1
v	Hazardous Materials Management	Refer mitigation measures in Section 6.2.7 and Table 7.1
vi	Waste Management	Refer mitigation measures in Section 6.2.7 and Table 7.1
vii	Noise	Refer mitigation measures in Section 6.2.3 and Table 7.1
viii	Contaminated Land	Refer mitigation measures in Section 6.2.2 and Table 7.1
II	**OCCUPATIONAL HEALTH AND SAFETY**	
i	General Facility Design and Operation	Please refer the section on Project Design and Technology in Sec.2.4
Ii	Communication and Training	This has been provided in Section 7.1.1 as well as in Section 7.5.2 and 7.5.3.
iii	Physical/Chemical/Biological Hazards	Discussed in Section 6.2.10
iv	Personal Protective Equipment (PPE)	The logistic arrangement for the workers wrt housing space, drinking water, food has been described in Sec 2.5.5. The Occupational health and safety aspects has been mentioned in sec. 7.5.7 and Table 7.1
v	Monitoring	Please refer Section 7.2
III	**COMMUNITY HEALTH AND SAFETY**	
i	Water Quality and Availability	Please refer Section 4.2.5 and 4.2.6
Ii	Structural Safety of Project Infrastructure	Detailed in Section 2.4
iii	Life and Fire Safety (L&FS)	Discussed in Section 6.2.10 and section 7.5.1

iv	Traffic Safety	Provided in Table 7.1 as well as Sec. 7.5.8 Providing adequate road drainage based on road width, surface material, compaction, and maintenance.. Vehicles should have PUC certificate. Refer mitigation measures for Transport and Traffic
v	Transport of Hazardous Materials	Provided in Table 7.1
vi	Disease Prevention	Provided in Table 7.1
vii	Emergency Preparedness and Response	Detailed in Section 7.5.1
IV	CONSTRUCTION AND DECOMMISSIONING	
i	Environment	Baseline environmental conditions have been described in chapter 4.
ii	Occupational Health and Safety	The logistic arrangement for the workers w.r.t housing space, drinking water, food has been described in Sec 2.5.5. The Occupational health and safety aspects has been mentioned in sec. 7.5.7 and Table 7.1 Proper training should be given to workers working on site. Personal protective gears should also be provided to the workers.
iii	Community Health and Safety	Measures to be taken to address the Community, Health and Safety issue has been addressed in Table 7.1 and the impacts during construction phase is given in Sec. 6.2.10 and management plan given in sec. 7.5.2, 7.5.3 and 7.5.6 Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. Keep stationary source of noise such as DG sets (currently used only for back up) at farthest point from the settlements. During construction phase, safety flags on the roadsides should be displayed during work in progress. The solar project site location should also be fenced/ to prohibit public access to solar power . Follow periodic Grievance Redressal Mechanism framed for site and timely register complaints if any received by locals , investigate and resolve in the best possible manner.

3.7 Equator Principles

The Equator Principles comprise of a group of ten principles adopted by the Equator Principle Financial Institutions (EPFIs) in order to ensure that the projects funded by them are developed in a manner that is socially responsible and reflect sound environmental management practices. The applicability of each of the principles with respect to proposed project is discussed below:

Table 3-4 Compliance to Equator Principles

Equator Principle	Applicability	Project Information/Application
Principle 1: Review and Categorisation	As the project is seeking financing from EPFIs, the project has to be categorized based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of IFC (Exhibit I)	Based on the IFC environmental and social screening criteria the proposed solar power project is identified as a "Category B" project with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and can be readily addressed through mitigation measures
Principle 2: Social and Environmental Assessment	An Environmental and Social Assessment has to be carried out for the project that addresses relevant social and environmental impacts and risks of the proposed project (illustrative list of issues as found in Exhibit II) and also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.	This report presents the Environmental and Social Impacts Assessment carried out for the project. The project has not acquired any settlement land and hence does not trigger the requirement of Resettlement and Rehabilitation.
Principle 3: Applicable Social and Environmental Standards	This Principle requires the Environment and Social Assessment to refer to the applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines including the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines.	The ESIA report has been prepared including the requirements of IFC performance standards and EHS guidelines.
Principle 4: Action Plan and Management System	The action plan will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment	The action plan is given in Chapters 6 of this ESIA report.
Principle 5: Consultation and Disclosure	The project affected communities are required to be consulted in a structured and culturally appropriate manner.	Undertaken during land identification and purchase directly and indirectly through Land Aggregator. Documentation to be strengthened.
Principle 6: Grievance Mechanism	Proponent is required to establish a grievance mechanism as part of the management system	Grievance redress procedure has been developed by Renew Powerand the same needs to be implemented at project level. Proper complaints register should be maintained onsite. This is applicable during both construction and operation phase.
Principle 7: Independent review	An independent social or environmental expert, not directly associated with Renew Power is required to review the Assessment, action plans and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.	Arcadis has been appointed as third party expert to assess the environment and social impact of the project as per IFC safeguards through ESIA study.

Equator Principle	Applicability	Project Information/Application
Principle 8: Covenants	The covenants would be a part of the contract documents between Renew Power and financing agency as well as contractors and technology suppliers	E&S Covenants should be embedded within the contracts drawn between Renew Power and the contractors hired for construction activities and technology providers and waste handlers. Periodic reporting to the project developers
	EPFIs will, for all Category A Projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.	Arcadis has been appointed as third party expert to assess the environment and social impact of the project as per IFC safeguards as ESIA study. The requirements of the principle are also met by adhering to requirements of PS 1
	This should be prepared by the EPFI	Based on the audit and monitoring reports submitted by independent agencies the EPFI will report the findings publicly at least once a year

4.0 DESCRIPTION OF ENVIRONMENT

This chapter describes the existing environmental settings of the project site and its immediate surroundings. This includes physical environment comprising air, water and land components, biological environment and socio-economic environment. Attributes of the physical environment like air, water, soil and noise quality in the block and surrounding area were assessed primarily through monitoring and analysis of samples collected from the area. Air, water, soil and noise primary monitoring was conducted by "Avon Food Lab" (a NABL accredited laboratory). Arcadis personnel were responsible for selecting the monitoring stations and supervision of onsite monitoring. Primary monitoring was conducted in July, 2016.

Information on geology, hydrology, prevailing natural hazards like floods, earthquakes etc. have been collected from literature reviews and authenticated information made available by Government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socioeconomic data have been obtained from the Census of India, 2011 reports.

4.1 Study Area

The project site is located in Andugulapet village, Mandamarri Mandal of Adilabad District in Telangana State. Based on the secondary information of the region, the monitoring locations were identified to obtain the representative baseline information. Monitoring stations for air and noise were selected in proximity to the project site, vehicular traffic on main and access roads, settlements also taking consideration of the wind direction. Monitoring locations for surface water quality was selected based on the drainage pattern of the area. Soil sample locations were selected based on the land use and land cover of the study area. Locations of ecological and social surveys were also selected based on receptor locations; in addition, special emphasis is given to areas within 500m radius of the project site, transmission towers and access roads.

4.2 Baseline Conditions

4.2.1 Climate and Meteorological Conditions

The climate of the Adilabad district is characterized by hot summer and is generally dry except during the South-West monsoon season. In the year, May and December are represent the hottest and coldest months.

Temperature: The mean daily minimum and maximum temperature during December month is 15^0C & 29^0C whereas in the May month, mean daily minimum and maximum temperature is recorded as 28^0C & 46^0C

Rainfall: The normal annual rainfall in the district is 1,157 mm. The rainfall increases from S-W towards N-E direction. The five years rainfall data obtained for Adilabad district is presented in **Table 4.1**.

Table 4-1 Five Year Rainfall Data – Adilabad District

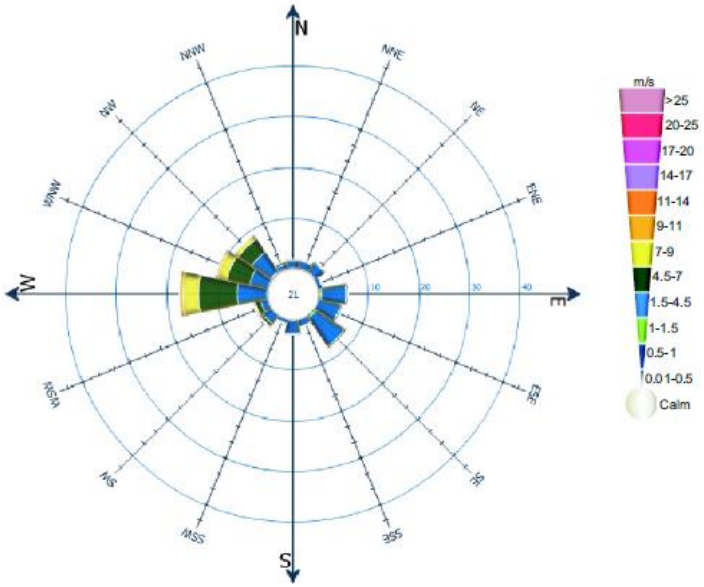
Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2010	5.2	10.0	0.7	3.6	8.8	98.2	408.0	421.6	298.8	110.3	56.1	4.0
2011	0.0	2.0	0.8	29.6	16.0	101.7	296.5	306.0	150.4	5.3	0.0	0.0
2012	2.9	0.0	0.0	6.5	0.0	76.9	332.2	292.9	250.0	70.8	16.6	0.0
2013	2.5	42.5	0.4	13.4	6.4	342.4	594.4	259.1	168.0	174.2	0.6	3.8
2014	0.0	7.9	89.6	11.8	37.1	84.8	161.0	214.8	222.5	24.3	6.7	0.9

Relative Humidity: The relative humidity is high generally during the south-west monsoon season. The air is generally dry during the rest of the year, the district part of the year being the summer season when the humidity in the afternoon is 25%.

Wind speed:

The annual wind rose prepared from daily surface wind data recorded for Hyderabad (nearest IMD observatory). Data indicates that 37% of the years the winds are from the west (W). The wind also blows from East (E), on 18% of the time. The wind rarely comes from the ENE and from SSW. The annual wind rose indicate that highest wind speed greater than 11 miles/second come from the westerly (W) direction.

Annual Wind Rose



Source: Indian Meteorological Department (IMD), Hyderabad

4.2.2 Topography

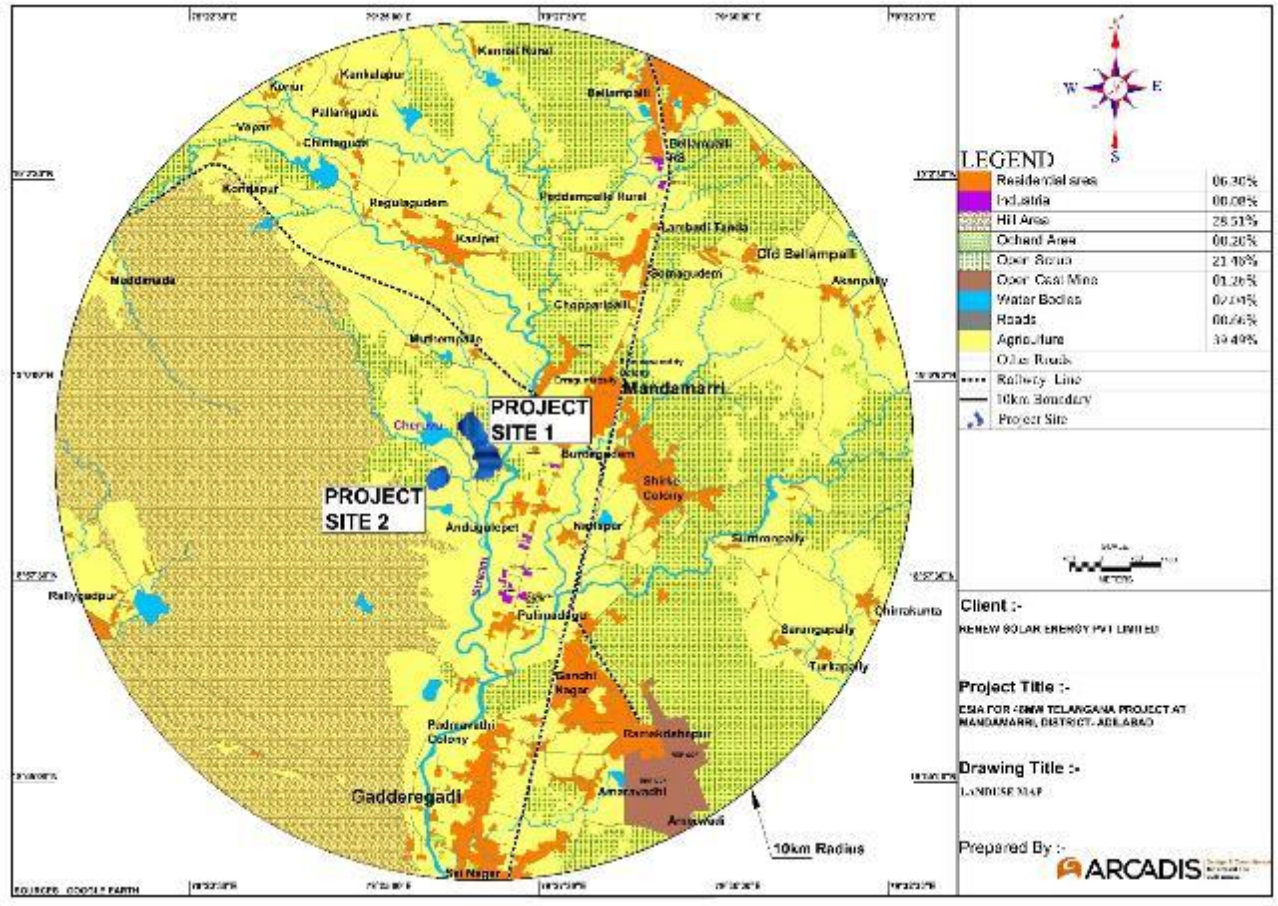
The topography of the project site is an open area with mild undulations. The elevation difference of about 20m is observed within the project site. Agricultural land are immediate surroundings on the northern and eastern side of the project site. However, the immediate surrounding has barren land. Some of the site pictures are shown in **Photo 4.1**.


Photo 4-1 Topography of the project site

4.2.3 Landuse Analysis

The land-use and land-cover of the study area (10kms) has been interpreted from visual interpretation, survey maps of the area, and subsequently by ground checking during field surveys. The land use within 10 km radius of project site represent agricultural landuse (39.49%) followed by hilly area (28.51%) and open scrubland (21.46%). Water body occupies about 2.04% while settlement indicate 6.30% of total landuse area. Land use map showing a radius of 10 km of the project site is provided in **Fig 4.1.**

Figure 4-1 Land use map

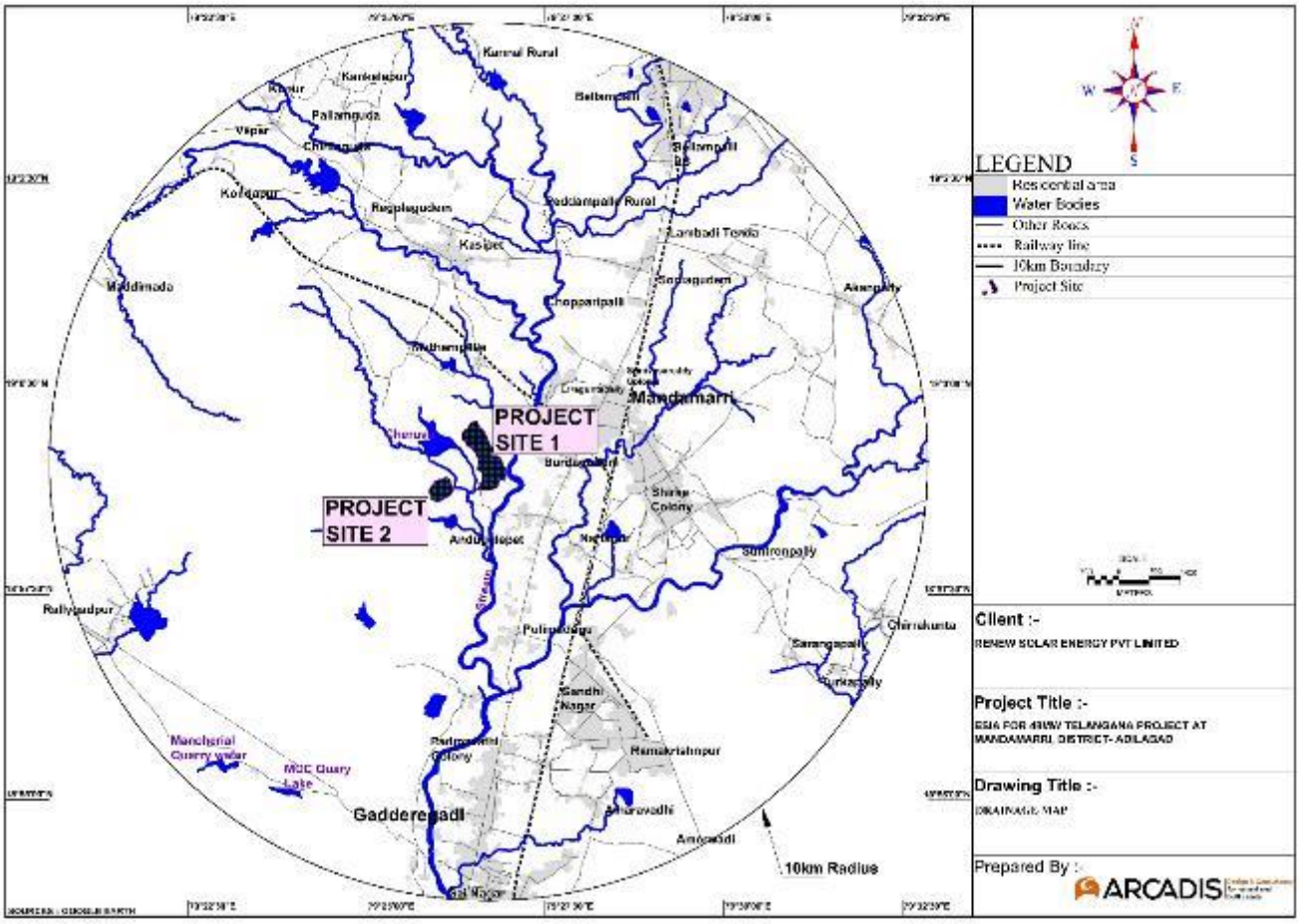


4.2.4 Drainage

Adilabad district falls under Godavari basin. Within 10km radius of the project site, several tributaries originated and ultimately connected with Godavari River. With respect to our project site, natural drainages also exist some of which are dry and become active in Monsoon. One natural canal exist at 1 km east of project site. One has to cross this canal to access the project site. One pond also exist at 200 m west of project site which remains dry through the year and receives water during the monsoon. Godavari basin is divided into 38 major watersheds. The district has two major irrigation projects namely Kaddam Narayanreddy Project and S.R.S Saraswati Canal. The drainage map of project site presented in Figure 4.2.

Photo 4-2 Access Road passes through Drainage

Figure 4-2 Drainage map

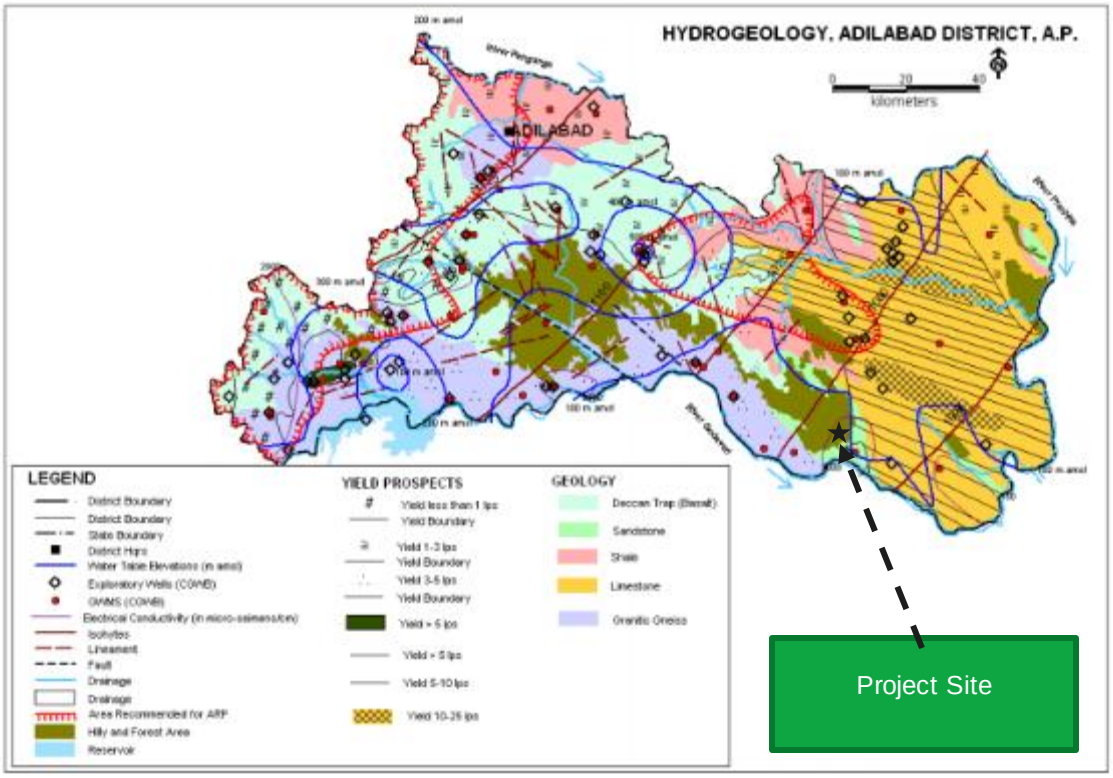


4.2.5 Hydrogeology

Geologically major parts of the Adilabad district is occupied by pink and grey granties and gneisses with dolerite dyke as intrusions. The shale, limestone and sandstone of Penganga formation overlie grantie/gneisses and occur in North of Adilabad and Asifabad area and between Mancherial and Asifabad town. The project site lies near the Mancherial town and represent the similar geological formation. The sandstone, shale and limestone are of sedimentary origin but are mostly hard and compact due to which the rocks behave similar to consolidated crystalline rocks and the aquifer are formed due to weathering and fracturing. The limestone form the good aquifers due to development of solution channels where they are silicious. Wells penetrating these formations usually get dried during the summer. The average yield of dug wells from these formations varies between 30 to 60 m3/day.

The general hydrogeological conditions of the district are depicted in **Figure 4.3**.

Figure 4-3 Hydrogeology map of Adilabad district



Source: Groundwater information booklet, Adilabad district, CGWB

4.2.6 Ground Water Resources

The[13] net ground water availability of Adilabad district is 3592 ha m. The major water bearing formation of the district is composed of Grantie & Geneisses, basalt, sandstone, limestone and shale. The dynamic ground water resources of the district have been assessed and found that there is no overexploited and critical area within the district. Only two area Nirmal and Dandepally falls within semi-critical area. Project site is located in Andugulapet village and Mandamarri Mandal which is included in list of safe area by CGWB. The table below gives the groundwater availability and stage of development for Mandamarri block versus the district in total. As per CGWB, the block has been categorised as "**safe**".

13 Groundwater information booklet, Adilabad district, 2013

Table 4-2 Groundwater availability and stage of development (31.03.2009)

Mandal	Category of Mandal	Net Annual Ground water availability (ham)	Existing Gross Ground water Draft for all uses (ham)	Provision for domestic, and industrial requirement supply to next 25 year (2033) (ham)	Net Ground water Availability for future irrigation d development (ham)	Stage of Ground water Development ((13/10)*100) (%)	Category
Mandamarri	Command	0					
	Non-Command	2246	668	431	1240	30	Safe
	Block Total	2246	668	431	1240	30	Safe
	District Total	148369	40462	12390	106507	27	-

Depth to Water Level: As per CGWB, the depth to water level in general varies from 10 mbgl to 20 mbgl in the area during the pre-monsoon period and from 2mbgl to 5 mbgl during the post-monsoon period. Maps showing the ground water levels pre and post monsoon is provided below.

Figure 4-4 Pre- Monsoon Depth To Water Level Map For The Project Area.

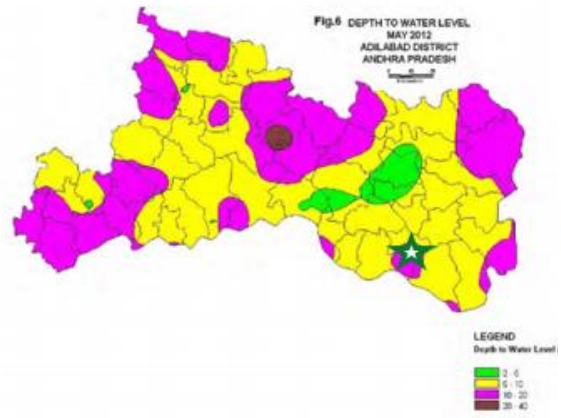
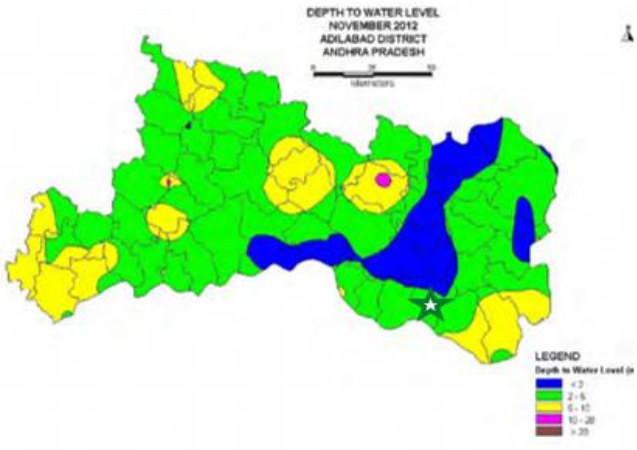


Figure 4-5 Post- Monsoon Depth to Water Level Map for the Project Area

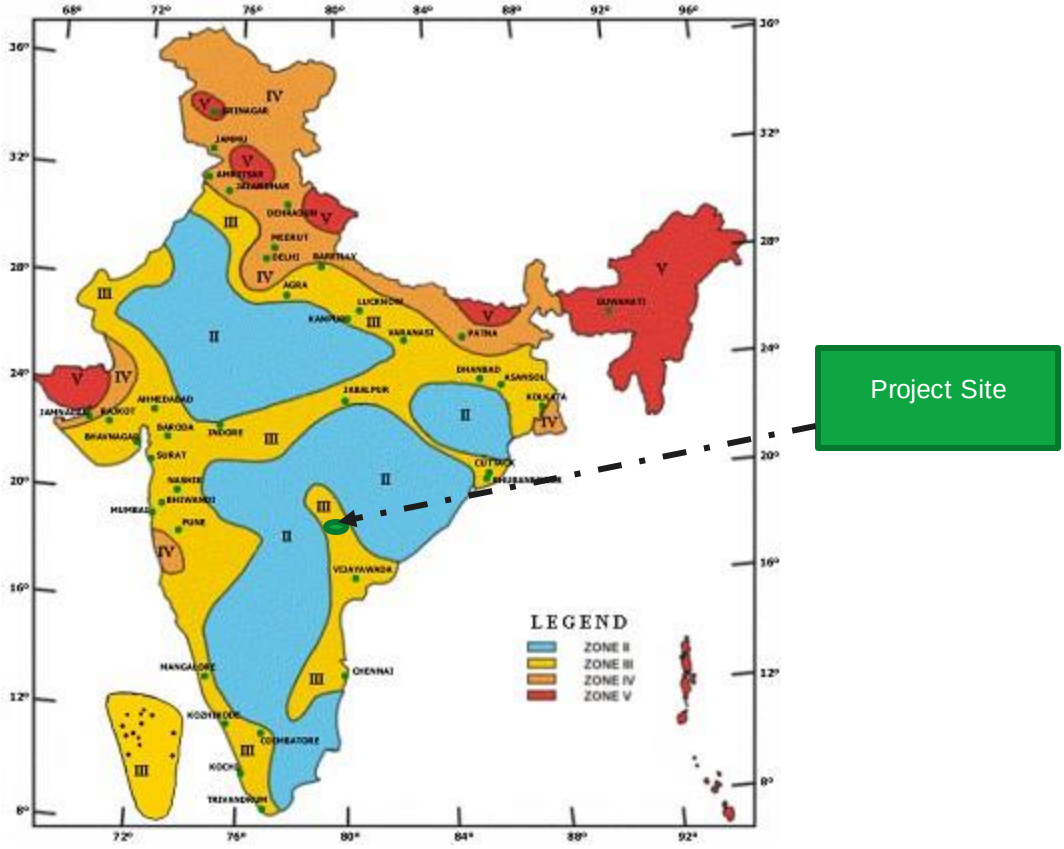


Source: District Groundwater information booklet, Adilabad district, CGWB, 2013

4.2.7 Seismic hazard

The proposed project is situated in ***Zone III Low damage risk*** zone of getting affected due to earth quakes. As such the materials used for construction of mounting structures for solar panels should have earthquake resistant properties to withstand and resist damage due to earthquakes which may lead to financial losses due to damage to the plant.

Figure 4-6 Seismic map



4.3 Environmental Monitoring

The existing baseline conditions serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning project activities in the area. A detailed assessment of the existing environment was undertaken for the purpose mentioned above.

4.3.1 Ambient Air Quality

Ambient air monitoring was carried out at two locations for 24 hours (4-hourly sampling for gaseous pollutants (CO) and 8-hourly sampling for particulate matter) with a frequency of twice per week. The monitoring was conducted for one week during the period of July 2016. Monitoring stations were chosen on the basis of their proximity to settlements, topography and predominant wind direction. The details of the monitoring locations is given below in **Table 4.3.** Monitoring result of ambient air quality indicates that ambient air quality in the study area is good. Concentration of all the parameters monitored is found within the limits prescribed by CPCB.

Table 4-3 Ambient air quality monitoring location details

Station Code	Location	Wind direction
AQ1	Andugulapet	East to West
AQ2	Sub station	East to West
AQ3	Mandamari Town	East to West

Table 4-4 Ambient Air Quality Monitoring Results

S.No.	Parameters	Unit	Andugulapet	Substation	Mandamari Town	Specification as per CPCB
1	PM10	$\mu g/m3$	60	64	68	100
2	PM2.5	$\mu g/m3$	34	36	36.7	60
3	SO2	$\mu g/m3$	5.3	5.5	6.4	80
4	NO2	$\mu g/m3$	11.7	13	12.4	80
5	CO	$mg/m3$	0.50	0.54	0.54	2000

4.3.2 Ambient Noise Quality

The ambient noise monitoring was conducted at two locations near project site and Andugulapet village. The noise monitoring network was established based on the understanding of the proposed project activities and professional judgment. Sound pressure level (SPL) measurements in dB (A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring station and equivalent noise levels in the form of Leq day and Leq night were computed.

Inference:

The average day time noise level ranges from 47.9- 48.5 dB (A) and average night time noise level ranges between 36.7-37.1dB (A). It is found that day time and night time noise levels are well within CPCB limits specified for Residential area as per **Noise Pollution (Regulation and Control) Rules, 2000**.

Table 4-5 Noise level monitoring results

Location Code	Location	Area Category	Daytime (Ldn) dB (A)		Night times (Ln) dB (A)	
			Results	Limits	Results	Limits
N1	Andugulapet	Residential	48.5	55	36.7	45
N2	Project Site	Residential	47.9	55	37.1	45

4.3.3 Surface Water Quality

As no perennial water bodies exist in the study area therefore surface water sample was not taken.

4.3.4 Groundwater Quality

Results of physical & chemical analysis of ground water samples from Andugulapet village was studied to have an idea of the quality of ground water in the study area. Monitoring results are presented in the **Table 4.6**. Results indicates that ground water has higher concentration of Total hardness, chlorides, TDS, Calcium, Magnesium and Total Coliform. Concentration of these parameters are more than the prescribed limit under acceptable limit and indicates that ground water required treatment prior to the drinking.

Table 4-6 Groundwater monitoring location details

S.No.	Parameters	Unit	Result	IS:10500 Acceptable limits
1.	pH Value	-	7.1	6.5-8.5
2.	Temp.	^{0}C	29.7	Agreeable
3.	Turbidity	NTU	ND	1
4.	Total Hardness (as $CaCO_3$)	mg/L	378.4	200 max.
5.	Iron (as Fe)	mg/L	ND	0.3 max
6.	Chlorides (as Cl)	mg/L	1007.5	250 max
7.	Fluorides (F)	mg/L	ND	1 max
8.	Total Dissolved solids	mg/L	518.4	500 max
9.	Calcium (Ca)	mg/L	90.7	75 max
10.	Magnesium (as Mg)	mg/L	36.95	30 max
11.	Nitrate (as NO_3)	mg/L	6.4	45 max
12.	Copper (as Cu)	mg/L	ND	0.05 max
13.	Mercury (as Hg)	mg/L	ND	0.001 max
14.	Arsenic (as As)	mg/L	ND	0.01 max
15.	Zinc (as Zn)	mg/L	ND	5 max
16.	Alkalinity	mg/L	93	200 max
17.	Total coliform	MPN/100 ML	33	Shall not be detectable
18.	Feacal coliform	MPN/100 ML	Absent	Shall not be detectable

ND: Not Detected

4.3.5 Soil Environment

The major soil types in the Adilabad District are Black cotton soil and red loamy soil. Red loamy soil are derived from the country rocks while black cotton soil mainly derived from basalt rock. In sedimentary formation the soils are deep upto 5 m. The major soil type in project area is red loamy soil. The red loamy soil is formed by decomposition of granite, genesis charnocite and diorite rock. The concentration of nitrogen, phosphorous and organic material is deficient but rich in potash. The soil fertility is less. The soil quality support production of Jowar, pulses, linseed, millet, wheat and cotton.

4.4 Ecological Environment

Reconnaissance survey was conducted during mid-week of July 2016 with the aim to assess the existing ecological resources on or near the project site. The main objective of the survey was to collect ground data on flora and fauna of the area. The site surroundings were assessed to understand the biological diversity of the area. Published/ unpublished secondary information was also collected on the same from government officials, journals and local residents of the area.

The project site is located at Mandamarri in Adilabad district comprises of private agricultural wasteland. The vegetation of the region mostly comprises of scrub lands predominated by Bambusa spp (Bamboo), Prosopis juliflora (Jand) etc. According to Champion and Seth (1968) classification the Forests of Mancherial Division fall under Tropical Dry Deciduous & Bamboo Mixed Forests (Dry Teak bearing Forests, Dry Mixed Forests). The project site is climatologically located in dry region. The area is drained by the tributaries of mainly Godavari System. Various small water bodies is located near the project site.

Pranahita Wildlife Sanctuary is located is at a distance of approximately 48.43 Km north-east of the project site. Kawal Wildlife Sanctuary is located in Jannaram mandal of Adilabad district at a distance of approximately 50 km north-west from the project site. No identified bird area (IBA), National Parks, Wildlife Sanctuaries or established migratory path are located within 10 km from the project site.

The project development area and 500m around the project site was considered as the “high risk zone” or “core study area”, so it was considered as the core of the study area. For access tracks and grid connections, the survey area was considered 500m either side of the proposed limits of variation of the route. Area within 5 km-10 km of the project site considered to be the “zone of influence” or the “buffer study area” of the project.

Main objectives for Ecological surveys:

Flora:

- Identification of floral species, endangered as well as endemic species (if any), important habitats, forests area within the study area;
- Surveys to identify local, widespread floral species, any endangered or endemic species and protected species in the study area;
- Identification of aquatic flora near the water bodies found in the study area;
- Identification of any notified area under international conventions, national or local legislation for their ecological, landscape, cultural or other related values within the study site.

Fauna:

- Identification of fauna (terrestrial & aerial) by direct sighting and through secondary means like, nests, roosts, pug marks, droppings, etc.
- Identification and classification of species recognized as critically endangered, endangered, threatened etc. as per IUCN Red list and scheduled species as per WPA (1972).
- Identification of areas important for breeding, foraging, resting or over wintering areas include migratory corridors/ avian migratory routes.
- Identification and assessment of aquatic fauna near the study area.

Avifauna:

The avifauna study in the project area (both core and buffer zone) was done to achieve the following objectives:

- Identification of different bird and bat habitats in the study area, estimation of bird and bat species diversity and species distribution pattern.
- To draw their IUCN status & schedule status according to Indian Wildlife Protection Act (IWPA) 1972.

- Identification of important locations such as roosting, nesting sites, migratory routes, breeding and feeding areas of species or birds that congregate in large numbers (eg. migratory birds) in the study area.
- Identification of feeding areas, water bodies and favorable areas for avian fauna.
- Impact assessment due to solar power project on avifauna.
- Formulation of mitigation measure and management plan to reduce the impact.

4.4.1 Methodologies for Ecological Surveys

Flora Survey

The primary floral survey was conducted to record site specific floral species and its diversity. A walk through of the project area was carried out covering the project site and transmission route connecting the project site to GSS. Nearby area around the power plant site, proposed access roads and surrounding area was also covered to understand the floral diversity.

The Phytosociological analysis of the local vegetation (mainly grasses, herbs & shrubs) was conducted near the project site (at three locations) during the primary survey. The plots in these locations were selected randomly on the basis of similarity in vegetation component. As mentioned above, the ground cover was predominantly covered by grass/ sedges and annual herbaceous species. Tree species were sparsely distributed in the area. At each site five quadrats were laid (each of 5 m X 5 m) and the species were listed & recorded from each plot/ quadrat. The relative frequency, relative density, relative abundance and Important Value Index (IVI) were computed from the primary survey.

Importance Value is a measure of how dominant a species is in a given area. It is a standard tool used by biologists to inventory a forest/or any vegetation. Species diversity was also estimated as Shannon-Weaver Index following Shannon and Weaver (1963).

$H = - SUM [(pi) \times ln (pi)]$

Where, “H” is the species diversity index; “S” the total number of species; “Pi” the proportion of total sample belonging to “i"th species (i.e. ni/N, n is the number of individuals of each species and N is the number of individuals of all species).

At the time of the survey, shrubs and ephemeral layer of ground flora consisting of seasonal and perennial were recorded. Woody tree species were not included in the phytosociological analysis as they were sparsely located in the area. None of the floral species recorded at site falls in the IUCN red list category

Faunal Survey

To assess the presence of fauna in the project site, a walk through the survey area was carried out. The project site and nearby areas were visited to find out the presence of faunal species in the area. The faunal survey focused mainly on three group viz. mammals, avifauna and herpeto-fauna of the study area. The faunal survey was conducted in different parts of the study area using the existing road, paths and trails. Data related to the other faunal species were noted based on the direct sightings and from authentic secondary sources. Standard field guides was used for identification of fauna during the survey. Secondary sources like published books and reports, government departmental records, interviews with forest department and local residents were further used to gather information and support primary observations.

Habitat Survey

According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the project site falls under the Biogeographic Province – 6D-Deccan peninsula-Central Plateau. The Biogeographic zones of India is shown in Figure 4.7.

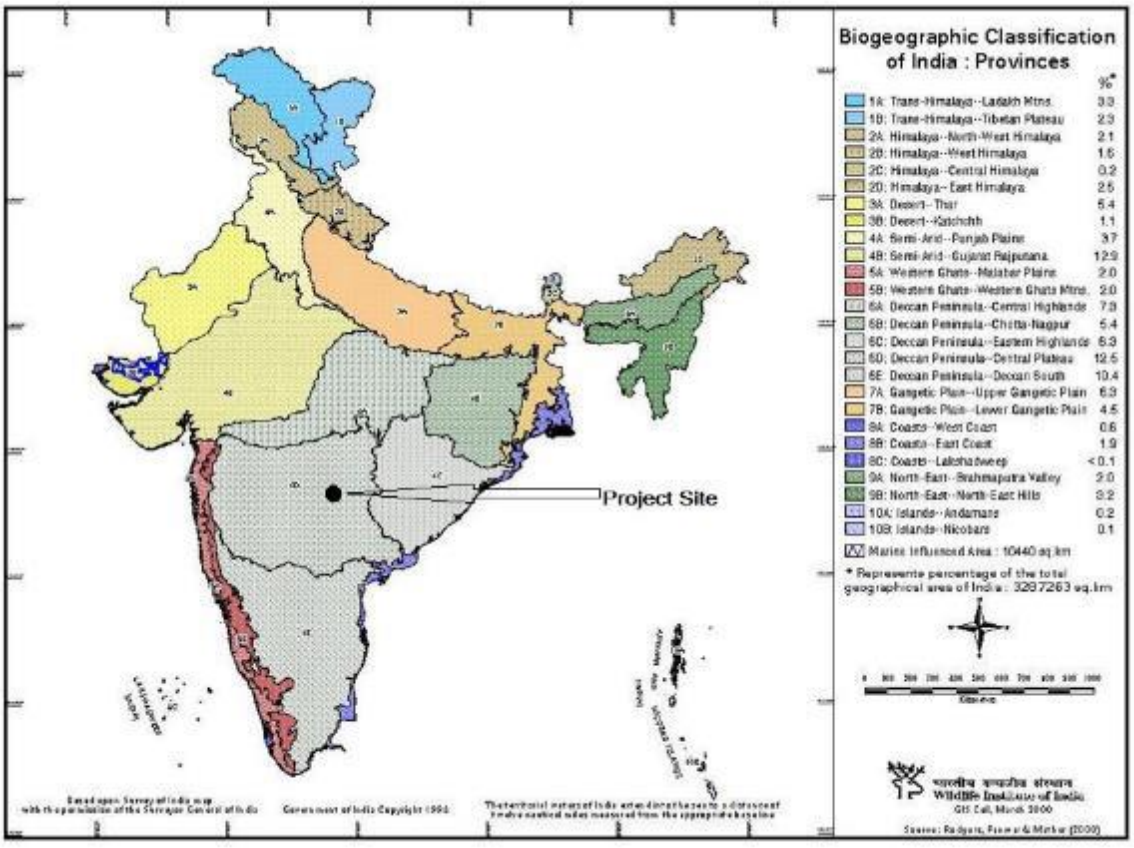
The site survey also included understanding of important habitats in the area. A “Habitat” according to IFC is defined as a terrestrial, freshwater or marine geographical unit or airway that supports assemblage of living organisms and their interactions with the non-living environment. As per IFC and ADB, habitats are divided into - Natural, Modified or Critical for the purpose of implementation of IFC Performance Standard-6

(Biodiversity Conservation and Sustainable Management of Living Natural Resources) and ADB's Environmental Safeguards. Critical habitats are subsets of Natural habitats.

Based on the risks and impacts identification process, the requirements of the ADB's Environmental Safeguards are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).

During the primary survey, it was found that the habitat was primarily "Modified". The project site and nearby land was mostly agricultural land or barren agricultural land. On agricultural land paddy was being cultivated in large quantities along with other crops. The land was also invaded by weeds or shrubs/ herbs. Commonly Bambusa spp., Acacia nilotica, Azadirachta indica and Prosopis juliflora were observed. Common grasses like Parthenium hysterophorus, Cynodon dactylon, etc. were also found. It was observed that grazing was also common in the area. Small parts of the agricultural land is used for grazing purposes as reported by the local people. No Reserved Forest or Protected Area is located near the project site.

Figure 4-7: Biogeographic Zones of India



4.4.2 Terrestrial Ecology

Mandamarri in Adilabad district is situated in the central India. The project site is located in the central Deccan peninsular region and the mighty Godavari River flows south of the project site approximately 58 km away. Vegetation of the project site is mainly of dry deciduous type.

Floral Profile

Flora of the proposed project site comprises of dry deciduous vegetation. The primary floral survey was limited to record site specific floral species (mainly ephemeral layer of ground flora). the site surroundings were assessed to understand the floral diversity of the area. Trees species like Azardirachta indica, Eucalyptus spp. Acacia nilotica, Acacia catechu, etc. were commonly found. In the villages, agricultural fields and roadside plantations species like Azadirachta indica, Prosopis juliflora, Ficus religiosa, Prosopis cineraria, etc. were commonly observed.

Such floral profile is necessary for understanding the baseline conditions of the area as the project activities might lead to loss of significant ecological resources, if present. The information will add on to the knowledge of ecological resources and help in further evaluating the possible risks due to project activities and feasibility of the proposed mitigation measures.

Floral Survey

Floral survey was conducted at three locations in Andugulapet village surrounding the project area. Five transects were laid down at each survey locations and the ground cover was recorded. The phytosociological analysis is carried out the results are explained below:

Location 1 (18.973867°N; 79.447794°E):

A total of 40 species of shrubs/herbs/grass were recorded during the field survey. The Phytosociological analysis is presented in the Table 4-7. The IVI of Cynodon dactylon was found to be highest with 18.7 followed by Cenchrus biflorous (15.6), Martynia annua (14.8), Bothriochloa pertusa (13.8) and Borreria articularis (13.2). Other species such as Cyperus triceps, Apluda mutica, Aristida setacea, Echinochloa spp etc. were also found to be more visible and distributed.

From the above analysis, the Shanon-Wiener Index (H) is found 2.77. Many studies proposed that the H value of more than 3 is considered to be a good diversity. Although the “H” value found to be less than 3, but the ground cover still can be considered to be well diversified.

Table 4-7: Phytosociological Analysis of Herbaceous Species From The Primary Flora Survey in Andugllapet (Location 1)

Species Name	RF	RA	RD	IVI
Achyranthus aspera	2.00	1.3	1.0	4.3
Abutilon indicum	3.33	1.2	1.5	6.1
Aerva lanata	2.67	1.3	1.3	5.3
Ageratum conyzoides	2.00	1.6	1.2	4.8
Apluda mutica	2.67	4.3	4.3	11.3
Amaranthus sp.	3.33	1.9	2.4	7.6
Andropogon sp.	2.67	1.8	1.8	6.3
Argemone mexicana	2.67	2.1	2.0	6.8
Aristida setacea	3.33	3.6	4.4	11.3
Boerhaavia diffusa	2.00	2.2	1.6	5.8
Borreria articularis	3.33	4.4	5.5	13.2
Bothriochloa pertusa	3.33	4.7	5.8	13.8
Calotropis procera	2.67	1.1	1.1	4.8
Cassia auriculata	2.00	2.2	1.6	5.8
Cenchrus biflorous	3.33	5.5	6.8	15.6

Species Name	RF	RA	RD	IVI
Cenchrus cilliaris	2.67	3.4	3.3	9.4
Chloris spp.	0.67	0.9	0.2	1.7
Cymbopogon martini	2.00	1.2	0.9	4.0
Cynodon dactylon	3.33	6.9	8.5	18.7
Cyperus triceps	3.33	4.3	5.4	13.1
Digitaria ciliaris	3.33	2.5	3.1	9.0
Digera arvensis	1.33	4.6	2.3	8.2
Eremochloa ophiuroides	2.67	1.1	1.1	4.8
Echinochloa spp	3.33	3.5	4.3	11.1
Euphorbia hirta	2.00	2.3	1.7	6.0
Lantana camara	0.67	0.9	0.2	1.7
Malvastrum coromandelianum	3.33	0.9	1.1	5.3
Martynia annua	3.33	5.1	6.4	14.8
Mimosa pudica	2.00	2.3	1.7	6.0
Oldenlandia spp	1.33	2.8	1.4	5.6
Parthenium hysterophorus	3.33	2.3	2.9	8.6
Phyllanthus amarus	2.00	1.0	0.8	3.8
Prosopis juliflora	2.67	2.1	2.0	6.8
Ricinus communis	1.33	3.3	1.6	6.2
Sida acuta	2.00	1.7	1.3	5.0
Sida cordifolia	2.67	1.1	1.1	4.8
Solanum indicum	2.67	1.0	1.0	4.6
Themeda quadrivalvis	2.00	2.0	1.5	5.5
Tridax procumbens	3.33	2.8	3.4	9.6
Xanthium indicum	1.33	1.1	0.5	3.0
H value= 2.77				

Location 2 (18.984858°N; 79.451996°E):

A total of 34 species of shrubs/ herbs/ grass were recorded during the field survey. The Phytosociological analysis is presented in the Table 4-8. The IVI of Cenchrus cilliaris was found to be highest with 20.2 followed by Echinochloa spp (18.1), Borreria articularis (17.6), Bothriochloa pertusa (17.4), Aristida setacea (17.4), Cynodon dactylon (16.2), Digitaria ciliaris (15.8) and Cyperus triceps (15.8). Although species such as Parthenium hysterophorus and Euphorbia hirta were found to be important species in this area but the other annuals/ephemerals such as Amaranthus spp., Boerhaavia diffusa, Prosopis juliflora etc. were also found to be more visible and distributed.

From the above analysis, the Shanon-Wiener Index (H) is found 2.55. Many studies proposed that the H value of more than 3 is considered to be a good diversity. Although the “H” value found to be less than 3, the ground cover in this region was comparatively diversified.

Table 4-8: Phytosociological Analysis of Herbaceous Species From The Primary Flora Survey in Andugllapet (Location 2)

Species Name	RF	RA	RD	IVI
Abutilon indicum	2.31	1.6	1.1	5.1
Aerva lanata	3.08	1.1	1.0	5.2
Ageratum conyzoides	3.08	1.2	1.1	5.4
Amaranthus sp.	2.31	3.4	2.4	8.1
Apluda mutica	3.08	5.5	5.2	13.8
Aristida setacea	3.85	6.2	7.3	17.4
Asparagus racemosus	1.54	1.1	0.5	3.1
Boerhaavia diffusa	3.08	1.9	1.8	6.7
Borreria articularis	3.85	6.3	7.5	17.6
Bothriochloa pertusa	3.85	6.2	7.3	17.4
Calotropis procera	3.08	1.1	1.0	5.2
Cenchrus cilliaris	3.85	7.5	8.8	20.2
Chloris spp.	2.31	1.6	1.1	5.1
Cymbopogon martini	3.08	0.8	0.8	4.6
Cynodon dactylon	3.85	5.7	6.7	16.2
Cyperus triceps	3.85	5.5	6.4	15.8
Digera arvensis	2.31	1.8	1.3	5.4
Digitaria ciliaris	3.85	5.5	6.4	15.8
Echinochloa spp	3.85	6.5	7.7	18.1
Eleucine indica	2.31	2.3	1.6	6.3
Euphorbia hirta	2.31	4.1	2.9	9.3
Evolvulus alsinoides	2.31	0.7	0.5	3.5
Lantana camara	2.31	0.9	0.6	3.8
Malvastrum coromandelianum	2.31	2.1	1.5	6.0
Oldenlandia spp	3.08	1.5	1.4	5.9
Parthenium hysterophorus	3.08	4.7	4.4	12.2
Phyllanthus amarus	2.31	1.1	0.8	4.1
Prosopis juliflora	2.31	2.0	1.4	5.7
Ricinus communis	3.85	1.8	2.1	7.8
Sida acuta	2.31	2.1	1.5	6.0
Solanum indicum	3.08	1.1	1.0	5.2
Solanum nigrum	2.31	1.3	0.9	4.4
Themeda quadrivalvis	3.08	0.8	0.8	4.6
Tridax procumbens	3.08	3.1	2.9	9.1

Species Name	RF	RA	RD	IVI
H value= 2.55				

Location 3 (18.979788° N; 79.454965° E):

A total of 38 species of shrubs/ herbs/ grass were recorded during the field survey. The Phytosociological analysis is presented in the Table 4-9. The IVI of Borreria articularis was found to be highest with 18.7 followed by Cynodon dactylon (18.0), Bothriochloa pertusa (17.8), Martynia annua (16.4) and Cenchrus cilliaris (16.0). Other species such as Apluda mutica, Aristida setacea, Eremochloa ophiuroides, Parthenium hysterophorus etc. were also found to be more visible and distributed.

From the above analysis, the Shanon-Wiener Index (H) is found 2.72. Many studies proposed that the H value of more than 3 is considered to be a good diversity. Although the "H" value found to be less than 3, but the ground cover still can be considered to be well diversified.

Table 4-9: Phytosociological Analysis of Herbaceous Species From The Primary Flora Survey in Andugllapet (Location 3)

Species Name	RF	RA	RD	IVI
Achyranthus aspera	3.50	1.5	1.7	6.7
Abutilon indicum	2.80	1.5	1.4	5.6
Aerva lanata	2.80	2.5	2.4	7.7
Ageratum conyzoides	3.50	1.1	1.2	5.8
Apluda mutica	3.50	4.8	5.6	13.9
Amaranthus sp.	3.50	2.3	2.7	8.6
Andropogon sp.	2.10	1.9	1.7	5.7
Argemone mexicana	2.10	2.1	1.5	5.7
Aristida setacea	3.50	4.3	5.0	12.7
Asparagus racemosus	0.70	0.5	0.1	1.4
Boerhaavia diffusa	2.10	2.7	1.9	6.6
Borreria articularis	3.50	7.0	8.2	18.7
Bothriochloa pertusa	3.50	6.6	7.7	17.8
Calotropis procera	2.10	2.1	1.5	5.7
Cassia auriculata	2.10	1.3	1.2	4.7
Cenchrus cilliaris	3.50	5.7	6.7	16.0
Cymbopogon martini	2.10	1.8	1.2	5.1
Cynodon dactylon	3.50	6.7	7.8	18.0
Cyperus rotundus	2.80	3.1	2.9	8.7
Digitaria saunginalis	2.80	2.4	2.2	7.4
Eclipta alba	1.40	1.1	0.5	3.0
Eremochloa ophiuroides	3.50	3.9	4.6	12.0

Species Name	RF	RA	RD	IVI
Euphorbia hirta	2.80	2.8	2.6	8.2
Ipomoea batata	0.70	1.6	0.4	2.7
Jatropha curcas	2.10	2.3	1.6	6.0
Lantana camara	0.70	1.1	0.2	2.0
Malvastrum coromandelianum	2.10	2.1	1.5	5.7
Martynia annua	3.50	6.0	7.0	16.4
Oldenlandia spp	2.80	1.6	1.5	5.9
Parthenium hysterophorus	3.50	3.4	4.0	10.9
Phyllanthus amarus	2.10	1.1	0.7	3.9
Prosopis juliflora	2.80	1.9	1.7	6.4
Sida acuta	2.80	1.9	1.7	6.4
Sida cordifolia	1.40	1.3	0.6	3.3
Solanum indicum	2.80	1.2	1.1	5.1
Themeda quadrivalvis	2.80	1.6	1.5	5.9
Tridax procumbens	3.50	1.9	2.2	7.7
Xanthium indicum	2.80	1.6	1.5	5.9
H value= 2.72				

All of these species recorded during the site visit were common and none of the plant species recorded from the primary survey and or reported to occur in this region is listed in IUCN red data category

Photo 4-3 Flora of the Proposed Project Area

Calotrpis procera

Acacia catechu

Borassus flabellifer

Prosopis juliflora (

Lantana camara

Tectona grandis

Vinca rosea

Cynodon dactylon

Azadirachta indica

Echinochloa spp

Parthenium hysterophorus

Digera arvensis

Bambusa vulgaris

Nerium odorum

Cocos nucifera

Sida cordifolia

Eremochloa ophiuroides

Ficus religiosa

Albizzia lebbeck

Dalbergia latifolia

4.4.3 Faunal Profile

Mammal

During the walk through survey around the proposed project area, no wildlife was directly sighted. Dialogue with the locals also confirmed that no wildlife do exist in that area. At some vegetated area, squirrel and mongoose were sighted during the primary survey which are very common in that type of habit.

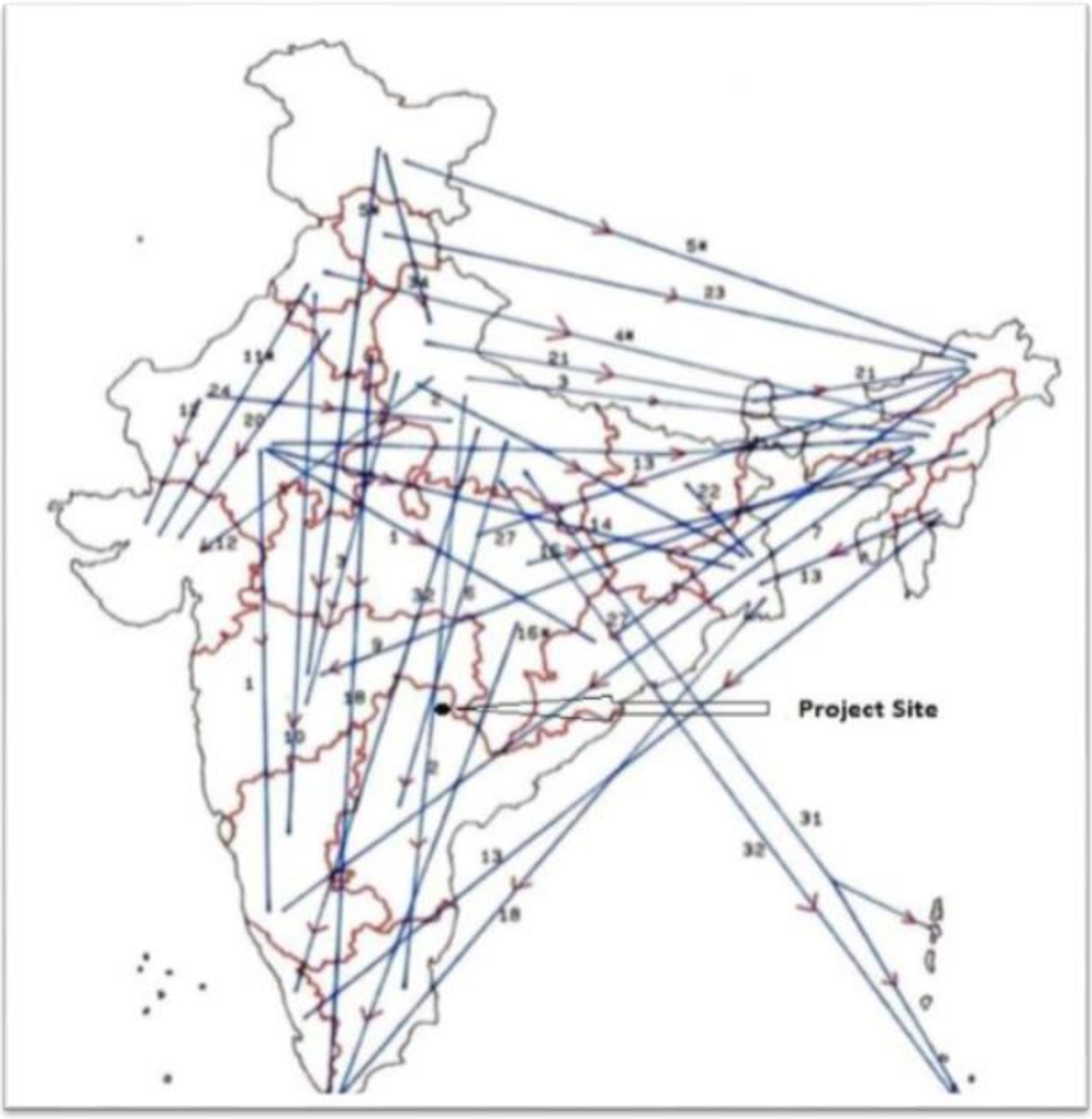
For information, it is necessary to mention that, Pranahita Wildlife Sanctuary is located at a distance of approximately 48 km north-east of the proposed project site. Common mammals found in the sanctuary are Cheetah, Black Buck, Nilgai, Sloth Bear, Tiger, etc. Another Protected Area, Kawal Wildlife Sanctuary is also located in Jannaram mandal of Adilabad district at a distance of approximately 50 km north-west from the proposed project site. Commonly reported mammals in the sanctuary are Sambhar, Nilgai, Barking Deer, Indian Bison (Gaur), Sloth Bear, etc.

Avifauna

From the primary walkthrough survey around the proposed project site, a total of 24 species of birds were sighted and recorded. Amongst them, Egrets, black drongo, Eurasian collared and Laughing dove, red wattled lapwings were abundantly sighted near the project site. Black Headed Ibis & Black Winged Kite were sighted during the survey fall under 'Near Threatened' category as per IUCN's Red List and in Schedule-I species category as per Wildlife (Protection) Act, 1972 respectively. The species of birds recorded from the project study area during site visit is listed in the Table 4.10 below and photo documentation of the same is presented after this section.

No Important Bird Area (IBA) is located in this region. The nearest IBA is located around 150 km from the study area. According to a study conducted by Bopinwar S. et al, 2012, the seasonal movements or migratory routes of birds like white stork and Greyleg goose are located towards the north-eastern boundary of the Telangana state. The map showing the pathway is attached as Figure 4.8 below.

Figure 4-8: Migratory routes of birds within India



Source: Bopinwar et al. 2012

Route No.	Birds
2	White stork
6	Eastern grayleg goose

Although no migratory bird species was recorded from the project site or nearby area, it cannot be ruled out that no migratory bird visits this area

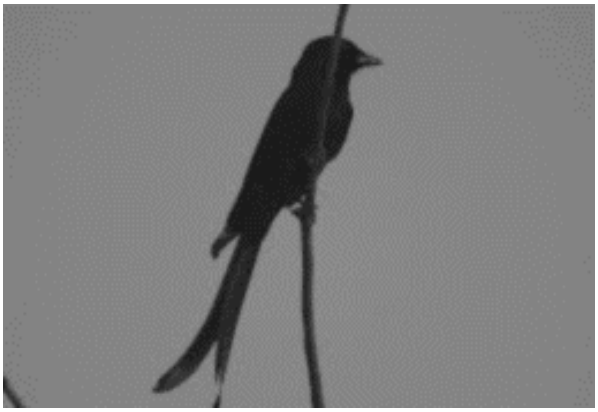
Table 4-10: List of Avifauna Sighted During Visit

S. No.	Common Name	Scientific Name	IUCN Status	WPA Schedule	Migratory Status
1	Baya Weaver	*Ploceus philippinus*	LC	Schedule IV	Resident
2	Black Drongo	*Dicrurus macrocercus*	LC	Schedule IV	Resident
3	Black Winged Stilt	*Himantopus himantopus*	LC	Schedule IV	Resident/ Local migratory
4	Black Headed Ibis	*Threskiornis melanocephalus*	NT	Schedule IV	Resident
5	Black Shouldered Kite	*Elanus axillaris*	LC	Schedule I	Resident
6	Common Myna	*Acridotheres tristis*	LC	Schedule IV	Not migratory
7	Eurasian Collared Dove	*Streptopelia decaocto*	LC	Schedule IV	Resident
8	Green Bee-eater	*Merops orientalis*	LC	Schedule IV	Not migratory
9	House Crow	*Corvus splendens*	LC	Schedule IV	Resident
10	House sparrow	*Passer domesticus*	LC	Schedule IV	Resident
11	Jerdon's Bushlark	*Mirafra affinis*	LC	Schedule IV	Resident
12	Cattle Egret	*Bubulcus ibis*	LC	Schedule IV	Resident
13	Indian Silverbill	*Lonchura malabarica*	LC	Schedule IV	Resident
14	Indian Roller	*Coracias benghalensis*	LC	Schedule IV	Resident
15	Laughing Dove	*Streptopelia senegalensis*	LC	Schedule IV	Resident
16	Oriental Skylark	*Alauda gulgula*	LC	Schedule IV	Resident
17	Pied Kingfisher	*Ceryle rudis*	LC	Schedule IV	Resident
18	Red vented Bulbul	*Pycnonotus cafer*	LC	Schedule IV	Resident
19	Red wattled Lapwing	*Vanellus indicus*	LC	Schedule IV	Resident
20	Rock Pigeon	*Columba livia*	LC	-	Not migratory
21	White Browed Wagtail	*Motacilla maderaspatensis*	LC	Schedule IV	Resident
22	White Throated Kingfisher	*Halcyon smyrnensis*	LC	Schedule IV	Resident
23	Wire Tailed Swallow	*Hirundo smithii*	LC	-	Resident
24	Black Ibis	*Pseudibis papillosa*	LC	Schedule IV	Resident

LC: Least Concerned; NT: Near Threatened

Photo 4-4 Sighted Avifaunal Species

Common Myna



Black Drongo

Green bee eater

White throated kingfisher

Eurasian Collared Dove

Black Headed Ibis

Laughing Dove

Red Vented Bulbul

Indian Roller

Black Winged Kite

Pied Kingfisher

Wire tailed Swallow

Red Wattled lapwing

Baya Weaver

Indian Silverbill

House Crow

White Browed Wagtail

Cattle Egret

Black winged Stilt

Oriental Skylark

Red Naped Ibis

House Sparrow

Jerdon's Bushlark

Herpetofauna

No reptile or amphibian species was directly sighted during the study period. Although agricultural fields and bushy areas are known to be the habitat of common reptiles like garden lizard (Calotes versicolor), snake species like Rat snake (Ptyas mucosus), Common cobra (Naja naja) etc. Dialogue with the local people confirmed the presence of these species in and around the study area

4.4.4 Aquatic Environment

There are small seasonal water bodies which gets filled up with storm water during monsoon are located near the project area. Also there is a nallah (seasonal water drainage channel) crossing the access route to the project site. The water gets filled in this *nallah* only during monsoon. The rest of period it remains dry or with less water. It was also observed that the locals use the water from the nallah for washing and bathing purposes

4.5 Socio Economic Environment

This section describes the socioeconomic condition in the study area and relates the village level socioeconomic conditions with tehsil and district level. The objective of analysis of information at village, tehsil and district level is to identify the existing facilities and gaps at village level which can be considered as need of the study area. The social assessment was primarily based on the analysis of the secondary data obtained from the census survey (2011 and District statistical handbook), district portal website, community consultations and primary survey with the help of framed sample questionnaire for village profiling as referred in Annexure IV. It was designed to capture occupational patterns, societal set up, access to basic amenities and socio-economic profiling of villages and communities considering the nature of the project operations and understanding of the demographic characteristics of the area from the secondary data.

The proposed solar project falls under Andugulapet Gram Panchayat under the jurisdiction of Mandal Mandamarri and district Adilabad respectively as presented in **Table 4-11**. Only Andugulapet village has been considered in the study area for socio economic profiling along with Mandamarri Mandal. Socio economic profiling has been carried out with their demographic profile and is provided in below section.

Table 4-11: List of villages for Socio-economic profiling

Sl. No	State and District	Mandal/Tehsil	Village & Panchayat
1	Telangana and Adilabad	Mandamarri	Andugulapet

4.5.1 Demographic Profile

The demographic profile in terms of total population, number of households, household size and sex-ratio of the selected villages surveyed in study area has been discussed in section below and details are presented below.

Population and sex ratio

Adilabad district: As per census 2011, district Adilabad has a population of 2,741,239 of which male and female population are 1,369,597 and 1,371,642 respectively. The sex ratio in Adilabad district is 1001 per 1000 male which is higher than average state sex ratio of 988. Details as shown in **Table 4-12.**

Mandal: As per census, Mandal Mandamarri has a population of 100,109 of which male and female population are 51,324 and 48,785 respectively. The sex ratio in Mandamarri is 951 per 1000 male which is lower than the district average of 1001.

Village Andugulapet: As per census 2011, the total households of Andugulapet Panchayat is 428 and the total population is 1690 persons with females being 838 and males being 852. The household size around 4 and the sex ratio is 984 which is less than the district average of 1001 but higher than the Mandal average of 951. Details as shown in Table 4-12.

Table 4-12: Demographic Profile of the Study Area

SN	Particular	Total Population	Ave. HH Size	Male Pop.	% M	Female Pop.	% F	Sex Ratio
A	District level							
1	Adilabad	2,741,239	4.2	1369597	49.96	1,371,642	50.04	1001
B	Mandal/ tehsil level							
1	Mandamarri	100,109	4.0	51324	51.27	48,785	48.73	951
C	Village level							
1	Andugulapet	1690	3.9	852	50.41	838	49.59	984

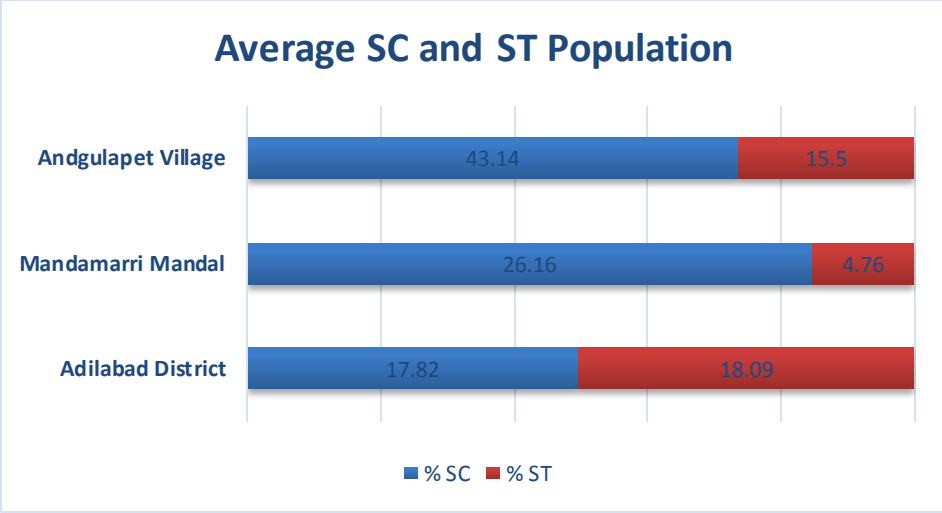
Source: Census of India, 2011

4.5.2 Schedule Caste and Schedule Tribes (SC/ST)

Mandal and District: As per census 2011, the average SC and ST population in Adilabad district constitute 17.82% and 18.09 % of the total population. In Mandal Mandamarri SC and ST population constitute 26.16% and 4.17% of the total population, ST population is found to be lower than the district average as shown in **Figure 4-9**.

Village Andugulapet: As per census 2011, Most of the population in village consists of Scheduled Castes (SC).the average SC population in village Andugulapet is 43.14% which is higher than Mandal average (26.16%) and district average (17.82%). The average ST population is 15.50% which is higher than Mandal average (4.17%) and lower than District average (18.09%). Details as shown in Fig 4-9.

Figure 4-9: SC and ST population in the study area



Source: census of India 2011

As per the Integrated Tribal Development Agency (ITDA) which was established in August, 1975 having its headquarter at Adilabad, out of the total population of the district, 4.89 lakhs persons are Scheduled Castes and 4.96 lakhs persons are Scheduled Tribes forming 17.82% and 18.08% of the total population respectively. Different groups of Scheduled Tribes such asGonds, Naikpods, Kolams, Pardhans, Koyas, Manne, Andhs, Thoties, Lambadas and Yerukalas are living in the district out of which Gonds are maximum in number. The Kolams and Thoties are the most backward & poorest and classified as Primitive Tribal Group (PTG) for special attention. Even the poorer Mannes (Telugu Speaking Kolams) are extended with the same benefits with a

special government order. With respect to the Mandamarri Mandal, it's come under the scheduled area of Telangana.

Agriculture is the main source of livelihood for almost 90% of tribal households. Open access of land has always been the basis of the tribal economy and the cultivation of land is the main economic activity.

4.5.3 Literacy in the study area

District and Mandal: As per census 2011, average literacy rate of Adilabad district is 61.01 % out of which male and female literacy is 70.81% and 51.31% respectively. The average literacy rate of Mandal Mandamarri is 70.65%, out of which male and female literacy is 78.97% and 61.95% respectively.

Village Andugulapet: As per census 2011,, there are 908 literates in Andugulapet panchayat of which male and female literates are 66.49 % and 52.12 % respectively. The average literacy rate of village is found to be below the district average (61.01%) and Mandal average (70.65%). However, the average female literacy of the village is higher than the district average (51.31%). Details as shown in **Table 4-13.**

Table 4-13: Literacy rates of Study area

S. No	Particular	Total Literate	%	% Male	% Female	Illiterates	% Illiterates
A	District level						
1	Adilabad	1,483,347	61.01	70.81	51.31	947,900	38.99
B	Mandal/ tehsil level						
1	Mandamarri	65,243	70.65	78.97	61.95	27,100	29.35
C	Village level						
1	Andugulapet	908	59.39	66.49	52.12	621	40.61

Source: census of India 2011

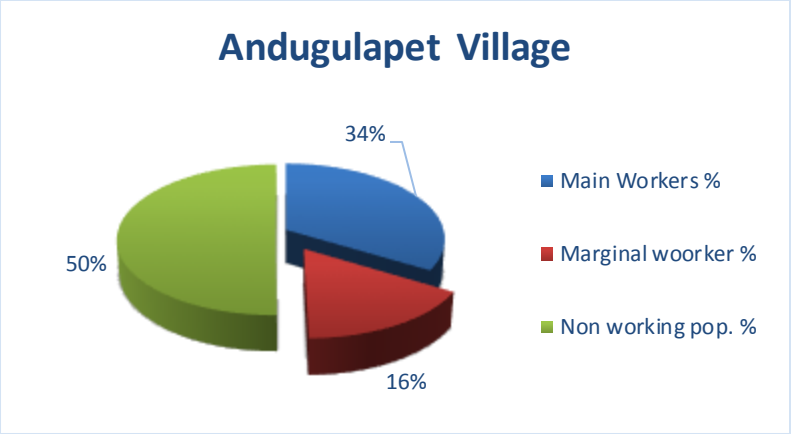
4.5.4 Workforce participation and occupation

Adilabad district: As per census 2011, the work participation rate in the district is 56.58 % and 43.42 %, respectively, for males and females. The district primarily depends on agriculture, with 51% of the workforce working as agricultural labourers and cultivators. In all, 25.12% and 25.95% of the total population constitutes agricultural labour and cultivators. Household workers in the district are 5.24 % which is below the average of agriculture and cultivators.

Mandamarri Mandal: As per census 2011, at the Mandal level, agriculture labour is only 7.44% and cultivators 2.72 %. Household workers in the Mandal is 1.65%.

Andugulapet village: As per Census 2011, the average percentage of agriculture labours, cultivator and other workforce participation are 36.94%, 1.78% and 28.15 % respectively in the study are village. House hold workers in the village is 0.59%. Comparative analysis of workforce participation data with the district and Mandal data shows that major livelihood in the study area is related to agriculture. Majority of the population in the study area depends on agricultural activities and work as agricultural labourers. Among the working population in the study area village, about 33.61% has been designated as "main workers" while the remaining 16.21% are designated as "marginal workers". The distribution of main and marginal worker is shown in **Figure 4-10.** Details of work force participation of district, Mandal and village level has shown in **Table 4-14**.

Figure 4-10: Occupation profile in the study area village



Source: census of India 2011

Table 4-14 : Workforce Participation for Study Area Village/Tehsil/District

Particular	Total Worker	Work Participation Rate	% Cultivator	% Agriculture Labour	% Household Worker	% Other Worker
District level						
Adilabad	1,323,667	48.29	25.95	25.12	5.24	24.25
Mandal/ tehsil level						
Mandamarri	33,958	33.92	2.72	7.44	1.65	55.69
Village level						
Andugulapet	842	49.82	1.78	36.94	0.59	28.15

Source: census of India 2011

Gender Empowerment Status

The female work participation in Telangana is lower than that of male but is the highest amongst all the states in India. However, the women workers in the state are not better placed economically since the workforce is concentrated in activities which are unorganized, informal, seasonal, insecure, menial and poorly paid. There is also significant wage disparity between the males and females workforce.

In Adilabad district, female workforce participation is around 43.42%. In the project influenced village Andugulapet the average female work participation is 39.67%. Additionally, female labours are engaged in sowing, weeding, plant protection, grading, kitchen gardening, cleaning of grains, harvesting, feeding the cattle, irrigating fields, taking care of livestock, growing vegetables and partially engaged with SHGs.

The average literacy rate of female is found as lower than compared to the male in the village and Mandamarri Mandal as mentioned in above section. During consultation with women participant it was observed that, early marriage and child marriage, minimal participation of women in household or economic decision making and lesser economic freedom is common in the area. The women are entirely responsible for household chores and additionally engaged as agriculture labour, harvesting, feeding the cattle, and taking care of livestock.

Self Help Groups (SHGs) Concept

"According to the National Bank for Agriculture and Rural Development (NABARD), a self-help group is a small economically homogeneous and affinity group of rural poor voluntarily coming together: to save small amounts regularly; to mutually agree to contribute to a common fund; to meet their emergency needs; to have collective decision making; to solve conflicts through collective leadership and mutual discussion"

As per Society for Elimination of Rural Poverty, Telangana, as on 2nd August 2016 total SHGs no. 36,482 has been formed and 26,607 are linked with different bank branches of Adilabad district. SHGs were trained on SHG concept & management, meeting process, conflict resolution and fund management. Indira Kranti Patham (IKP) is a state wide poverty reduction project to enable the rural poor to improve their livelihoods and quality of life through their own organizations. Many schemes are being implemented in the district for the women empowerment as shown in **Table 4-15.**

Significant number of Self Help Groups (SHGs)/ Mahila Mandal has established in Andugulapet village. During consultation with SHGs members at Andugulapet village it was observed that more than 30 SHGs has been formed at the village level and majority of the SHGs were linked with banks and taken loans for farming, livestock, dairy, poultry farm, inter group finance on petty interest, and small business purpose. There are average 10 members in each group. They are also engaged in National Rural Employment Guarantee Scheme (NRGES) scheme in the area.

Consultation with SHGs member

Table 4-15: Some Important Schemes for SHGs in Adilabad district

SN	Name of the Schemes (IKP)	Benefits
1	Institution Building (I.B.)	Formation of Self Help Groups, imparting trainings to the members and strengthening the SHGs.
2	SHG Bank Linkage (B.L.)	Providing loans to the SHGs from banks, ensuring repayments, Pavala Vaddi and interest free loans to the eligible SHGs.
3	Sthreenidhi	Providing loans to the New SHGs from Sthreenidhi Bank.
4	Insurance	Coverage of insurance to all eligible members of the SHGs and settlement of claims. Providing scholarships to the children who are studying in IX standard to Intermediate.
5	Dairy	Formation of Dairy JLG, providing subsidy to the Dairy JLGs @ Rs.1.25 lakhs for SC/ST Groups and @ Rs.1.00 lakh to the others for establishment of Pala Pragathi Kendralu so as to strengthen the groups economically.

Source; DRDA-IKP Adilabad district portal site, 2013-14

4.5.5 Livelihood source

The predominant source of livelihood in Adilabad district is agriculture and animal husbandry with 70% of the district population depends on agriculture for their livelihood. The share of agriculture and allied sectors in gross domestic product (GDP) of the district ranges between 19% and 24%. Apart from agriculture sector, Adilabad district have good potential for service industries. In small scale sector the main existing industrial activities are rice mills, dal mills, saw mills, wood based industries, beedi manufacturing, stone ware pipes, plastic products and engineering items and have growth trend in Adilabad district.

During consultation it was confirmed that, agriculture is predominant source of livelihood in village. Cropping pattern is mostly dependent on rain from June to September. Mainly single cropping pattern in the area is practiced. Farmers are engaged during this period after that they work under NRGES and Govt. programs which are running in the area. Around 500 manpower from Andugulapet village are enrolled under NRGES as labour work. It was also reported that many people from the study area villages goes to nearby rice mill, coal mines at Mandamarri and stone querying unit in the district and some migrates to other cities like Hyderabad, Bangalore and other state for other job.

Agriculture and cropping pattern

As per Adilabad district NIC information, the predominant crop grown in the district is jowar which accounts for 31.8% of the total cropped area. Paddy account for 10.8%, pulses and non-food crops accounts for 34.7% of the total cropped area. Two cropping seasons namely, Khariff (June to September) and Rabi (October to March) with a little variation in these periods is prevalent in this area. Cotton is the main commercial crop of the district and nearly 48.73 % of the net area sown is covered. The major crops grown in the district in different seasons are given below:

Kharif: Cotton, soybean, cotton + red gram, soybean + red gram, jowar, black gram, green gram, maize, paddy, chillies and turmeric.

Rabi: Paddy, Bengal gram, groundnut and sunflower.

Cotton occupies an important place in the agriculture sector of this district. Adilabad has got 27% area under cotton cultivation of all the Telangana districts put together and 16% of the area under cotton cultivation in the entire state.

Paddy cropping in study area

Groundnut cropping in Andugulapet village

Livestock:

About 29 lakh families in Telangana State are engaged in livestock sector for their livelihood. As per district NIC information, animal husbandry is only second to agriculture in terms of contributing to the gross income and employment in the district. Total livestock population in the district is 33.25 lakhs.

During community consultation, it was observed that, the consulted villages has large populations of livestock and small ruminants. Buffalo, cow, sheep, goat and bull are the primary livestock. Sheep and goat rearing is the one of the main occupation of the shepherd community in the study area village. Significant number of poultry farms are present in adjoining village. Shepherd community uses open shrub, forest area and non-cultivated land for grazing of livestock.

Goat and sheep rearing in the study area village

4.5.6 Land holding pattern of the District and Mandal

As per agriculture census 2010-11, the small, semi and marginal farmers dominate the number of holdings in the district. A statement showing category wise number of farm holdings and area of operational holdings of

district and Mandal is furnished in **Table 4-16.** The average size of land holding is 1.4 ha in the district. During consultation with the community it was observed that the average land holding size in Andugulapet village is around 4-5 acre. The detailed information of land utilization in project influenced village is shown in **Table 4-17**.

Table 4-16: Estimated land holding in Mandamari Mandal and Adilabad district

SN	Size group(ha)	Adilabad district		Mandamarri Mandal	
		Total holdings		Total holdings	
		Number	Area (ha)	Number	Area (ha)
1	Marginal Farmers (Below 1 Ha)	259,177	123,211	4,539	1,823
2	Small Farmers (1-2 Ha)	143,934	205,874	1,427	1,981
3	Semi-Medium (2.0 - 3.99)	90,765	232,727	782	2,061
4	Medium Farmers (2-10 Ha)	23,989	131,980	227	1,307
5	Large Farmers (>10 Ha)	2,130	34,787	42	877
	ALL GROUPS	**519,995**	**728,579**	**7,017**	**8,049**

Source: http://agcensus.nic.in/2010-11

Table 4-17: Land Utilization in Project Influenced Village (Ha)

Village	Total Geographical Area (Ha)	Net Area Sown (Ha)	Forest Area (Ha)	Area under Non-Agricultural Uses (Ha)	Barren & Un-cultivable Land Area (Ha)	Permanent Pastures and Other Grazing Land Area (Ha)	Culturable Waste Land Area (Ha)	Fallows Land other than Current Fallows Area (Ha)	Current Fallows Area (a)	Area Irrigated by Source (Ha)
Andugulapet	1889	519	660	286	0	0	201	154	60	89

Source: District Census Hand Books-villages 2011

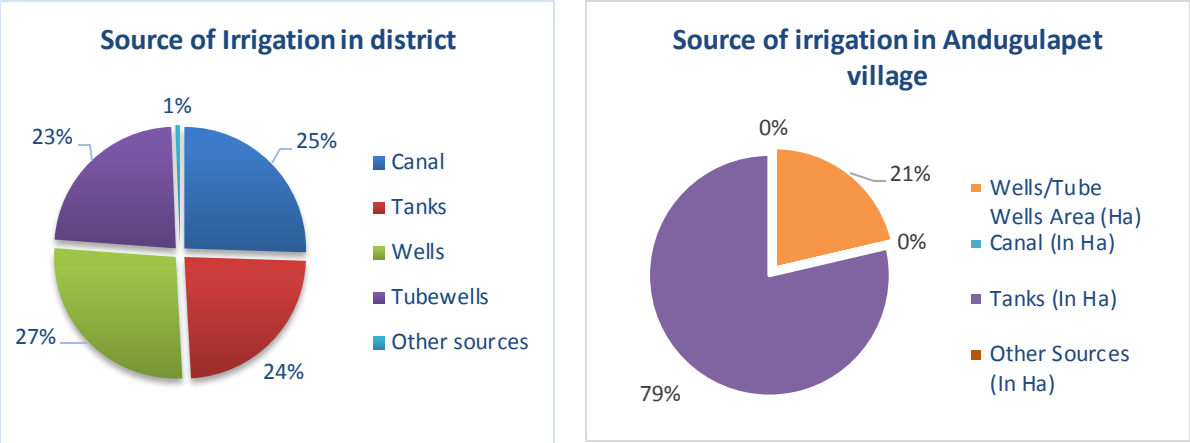
4.5.7 Irrigation

As per Comprehensive District Agricultural Plan (CDAP) Adilabad and Agriculture census 2010-11, the total rainfall of the district is 1,157 mm. The particulars of irrigated area by different sources are given in Figure 4-12. The major sources of irrigation in the district is from ground water through tube wells, wells and tank (74%) followed by canals (25%). Adilabad and Mancherial have limited areas irrigated by lift irrigation sources. The district has two major irrigation projects namely Kaddam Narayanreddy Project and S.R.S Saraswati Canal (Sri Ramsagar Project-Left canal) with registered ayacut of 68,500 and 35,735 ha and ayacut utilized is 50,000 and 32,735 ha respectively.

As per District Census Hand Book (DCHB) 2011, it was observed that, agriculture is dependent on rain, tube wells and tanks are the main source of irrigation in the project area village. During consultation it was observed

that, in the Andugulapet village lift irrigation system is one of the major source for irrigation. However, significant number of farmers have their own tube wells and rest are dependent only on rainfall for agriculture. The particulars of irrigated area in village by different sources are given in Figure 4-11.

Figure 4-11: Source of irrigation in the district and study area village



Source: Agriculture census 2010-11 and DCHB-2011

Minor irrigation schemes in Adilabad district: As per socio-economic outlook report of Telangana 2015, Adilabad district area under drip irrigation is 16,703 ha and sprinkler is 17,301 ha. During discussion, it is reveals that government has provision to provide bore wells, drip irrigation system and sprinkler on subsidize rate 30-90% to the SC & ST farmers.

4.5.8 Vulnerability

Vulnerable group is "Groups that experience a higher risk of poverty and social exclusion than the general population. Ethnic minorities, migrants, disabled people, the homeless, those struggling with substance abuse, isolated elderly people and children all often face difficulties that can lead to further social exclusion, such as low levels of education and unemployment or under employment."

During consultation with community members of Andugulapet village it was informed that some vulnerable groups such as landless family (40-50), physically handicapped (10) and widows (200) are residing in the village. Government provides pension to vulnerable group especially for widow and physically handicapped persons.

The project proponent may be required to focus on providing employment opportunity to the vulnerable community members and also implementation of programme under CSR activity for them. During dialogue with Renew project team, it was confirmed that land has not acquired from the vulnerable HHs family.

4.5.9 Social Infrastructure

Village and district level integrated education, health and basic amenities data available as per census 2011 (District Census Hand Book), it is described in following the below section. Village wise details amenities as per census 2011 provided in **Table 4-18**.

Education

As per district census hand book 2011, Adilabad district have two engineering college, one vocational training school/ ITI, two polytechnic, 16 degree college, 43 senior secondary schools, 347 secondary schools, 685 middle schools, and 1,563 primary schools.

In the Andugulapet village it was observed that the village had a primary and middle school. Secondary, senior secondary school and women degree college is available at Mandamarri Mandal which was 3-4 km away from the Andugulapet village. Other graduate colleges and vocational training are available at Mancherial which is more than 10 km from the project area. Apart from government institution many private institution were observed in the Mandamarri area, which are:

Primary school at Andugulapet village

1. Chaitanya Jr College. Mandamarri
2. Shivani Girls Jr College. Mandamarri
3. S R K Jr College R K Pur. Mandamarri
4. Saraswathi Jr College. Mandamarri
5. Vaagdevi Girls Jr Coll R K Pur, Mandamarri

Health

As per district census hand book 2011, Adilabad district have two Community Health Centre (CHC), 69 primary health centre (PHC) and 512 primary health sub centre. There are about 78 mobile health clinic but there are no family welfare centre in the district.

As per district census hand book 2011, in Andugulapet village there is no healthcare facility available, however, during consultation with community it was reported that health sub-centre is available at village level. The closest primary health centre and private clinic is available at Mandamarri which is 3 km away from the Andugulapet village.

PHC, Mandamarri

Based on consultation with staff nurse at PHC, Mandamarri, it was informed that the PHC has four beds and covers seven Panchayat and urban area of Mandamarri. There are total 10 health sub centre which comes under the PHC. There are around 50 staff including sub-centre staff and two MBBS doctors. Laboratory was available with some basic testing facilities such as malaria, pregnancy, HIV, and DOT. Ambulance facility was available on 108 dial number. Malaria and TB were the main concern in the area.

Drinking water and sanitation

Ground water from bore wells, tap and hand pumps is the main source for drinking water in the district. As per Central Ground Water Board report 2013, the ground water in the area has fluoride content. During consultation it was observed that tap water, hand pumps and bore wells are the main source for drinking in the study area village. There are around 10 hand pumps in functional condition. Ground water depth is more than 200-250 ft in Andugulapet village.

During consultation it was observed that, about 70 % households' have access to sanitation facility in the village and rest 30% house hold defecate in the open. However, sanitation scheme under Swacch Bharat mission is implemented in the area.

Transport and Communication

Mandamarri town is located 146 km towards east from district headquarters Adilabad. Mandamarri is the nearest town from Andugulapet which is 4 km away from the village. Road connectivity is there from Mandamarri to Andugulapet. Mandamarri and Ravindrakhani railway station are the nearest railway station from Andugulapet. Tamilnadu State Road Transport Corporation (TSRTC) runs buses from major cities to towns and villages in the district. Public bus service is the primary mode of transportation in the district. Regarding communication, post office is not available at Andugulapet village.

Transportation facility in study area

During site visit & consultation it was observed that, the Andugulapet village is connected with major district road (MDR). However, village internal access roads were partially paved and partially unpaved. Local bus service was the primary mode of transportation for the people of the study area.

Power supply

As per annual report 2013-2014 published by Power & Energy Division (Planning Commission Government of India), Andhra Pradesh state has been declared as completely electrified (including Telangana state) i.e. 100 percent villages are electrified. As per DCHB 2011, in Andugulapet village electricity facility is available for both domestic and agriculture purpose.

During consultation with community it was observed that, about 5-7 hours of power supply for agriculture and more than 22 hours of power supply for domestic purpose is available in Andugulapet village.

Table 4-18: Village Amenities in Study Area Villages

Village	Educational Institution	Health Facilities	Drinking water supply	Communication (PO&PH)	Transportation (Bus & Rail)	Approach Road	Power Supply
District: Adilabad							
Mandal/ (tehsil): Mandamarri							
Andugulapet	Primary (1), Middle school (1)	Health Sub Centre (1)	Tap Water, Well, hand pump	Not available	Bus Service	Approach paved road, Approach mud road	Electricity for domestic, Electricity for all purpose

Source – District Census Handbook (DCHB), 2011

Common Property Resource (CPR)

During site visit it was observed that significant number of CPR such as cremation ground, pond religious and worship place is present in Andugulapet village. A stream passing beside the project site and the water from this stream utilised by people for the irrigation and livestock. It was also confirmed that due to the solar power project the stream will not be affected.

Cultural and historical heritage in the district

As per Archaeology Survey of India and Department of Archaeology & Museum, Telangana, total 37 protected monuments sites is identified in the district. Gandhari killa (Gandhari Kota) out of the 37 listed monuments is a hill fort located near Bokkalagutta village in Mandamarri Mandal is the closest from the project site however is at a distance of more than 5 km from the site. During site visit it was confirmed that it will not be impacted due to proposed solar project.

4.5.10 Government Schemes in District

- MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE SCHEME (MNREGS): Under this scheme, enhancement of livelihood security of the households in rural areas of the country by providing at least one hundred days of guaranteed wage employment in every financial year to every household whose adult members volunteer to do unskilled manual work.
- PRIME MINISTER'S EMPLOYMENT GENERATION PROGRAMME (PMEGP): PMEGP has been announced on 15th August, 2008 and launched in place of REGP Scheme. PMEGP is a credit-linked subsidy programme launched by Ministry of MSME in 2008-09 for creation of employment in both rural and urban area of the country.
- INTEGRATED WATERSHED MANAGEMENT PROGRAMME (IWMP): Improvement of Rural livelihoods through participatory Watershed Development with focus on integrated farming system for enhancing income, productivity and livelihood security in sustainable manner along with soil and water conservation is the aim of Watershed Development.
- SWARNA JAYANTHI GRAM SSWAROZGAR YOJANA (S.G.S.Y.): Subsidy @ Rs.10000/- provided to the SCs/STs swarozgaries and @ Rs.7500/- provided to the Backward Caste and others
- SOCIAL SECURITY PENSIONS (S.S.P): Under this scheme, pension amount from Rs.200/- to Rs.1000/- per month to Old Age, Widow, Weavers, is being provided. Rs.1500/- to the disabled persons and eligible members under Abhayahastham scheme.
- NATIONAL FAMILY BENEFIT SCHEME (N.F.B.S.): Under this scheme financial Assistance @Rs.5, 000/- provided to the BPL family of deceased person.
- RAJIV YUVAKIRANALU: Rajiv Yuva Kiranalu is conceived by the Govt. of Andhra Pradesh (further continued by Telangana Govt. after partition from A.P.) to build job specific skills among the unemployed and place them in appropriate private jobs

4.5.11 Stakeholder Consultation

A community consultation was carried out in Andugulapet village for collecting detailed information about prevailing socio-economic condition of village, demographic features and composition of the population, infrastructure amenities available in the villages and also to assess awareness, opinion and reaction of the inhabitants about the project. Consultations were also conducted with land owners, community, SHGs, Health Centre, land aggregator and Project proponent team. The list of consulted stakeholder for the proposed project is provided in **Table 4-19.**

Table 4-19: Consultation with different stakeholders

Sl. No.	Stakeholder type	Designation	Consultation type	Village/Department/Address
1	Community	Land sellers	One to one	Andugulapet
2		Village president, other community members	One to one and group discussion	Andugulapet
3		SHGs members	One to one and group discussion	Andugulapet
4	Project Proponent Team	Site in charge	One to one	Mancherial
5	Land developer /aggregator	Site in charge	One to one	M/S SSPL, Mancherial

Source: primary consultation

Consultation with land developer

During dialogue with Mr. G. Ramu who is representative of land developer/ aggregator (M/S SSPL) it was informed that, only private land is involved for the proposed solar project. Proposed solar project fall in Andugulapet village. Majority of land owners belongs to Andugulapet village, however around 5-6 land owners from Mandamarri town area. More than 300 acre of land including access road was purchased through good faith negotiation based on willing buyer and willing seller. The compensation for the purchased land is reportedly above the existing government circle and market rate. Land purchase process was started by aggregator six month ago. No compensation are due to any land seller as reported. Sale deed is completed for more than 300 acre of land. Village road is the main access for the solar project which is passing through the village. Majority of purchased land was non-cultivated and undulating type.

Consultation with land owners

Consultation with land owners from Andugulapet village were held on 12 July'16 at neutral place of Mancherial town. Consultation was done with four landowners out of the 40 land owners with whom sale deed was completed (10% sample). Private land has been purchased for the project. Based on land owner's consultation, sale deed was signed after mutual agreement between the landowners and M/S SSPL. Average land holding size in the project area village is around 4-5 acre per household. The sold land is mostly non–cultivated in the absence of irrigation system. During consultations, the landowners reported that the land sale is on willing buyer – willing seller basis. One land owners out of that four reported has purchased another residential parcels in the town area and another land owner has purchased agriculture land in the same village. Two landowners will utilize the money for making petty interest, FD in bank, and investment in business. Land aggregator has informed about the proposed solar project to landowner during land purchase process.

Key Findings of Consultation

- Consultation has been undertaken with land seller belonging to Andugulapet village.
- Only private land has been procured for the proposed project.
- Rain-fed agriculture pattern is practiced in the project area.
- The main crops are cotton, paddy, soybean, gram, maize, sunflower and groundnut.
- Livelihood is the area is primarily dependent on agriculture and "main workers" are engaged as cultivators and agriculture labour.
- Female literacy rate is lower than male literacy rate in the village.
- About 75% households have sanitation facilities in the village and 25% of the households practice open defecation.
- Drinking water facility is adequate in the project area villages. The groundwater depth is more than 200ft. Bore wells and tanks are the main source of drinking water.
- Health facility is inadequate in Andugulapet village. Malaria, TB and other general diseases are common problem in the area.
- Compensation has been paid to land owners more than government circle rate based on willing to sell and buy.
- Land has been procured through land aggregator M/s SSPL.
- No formal public disclosure have been done at village level. However, land aggregator has informed about the proposed solar project to individual landowner during land purchase process. Land owners are aware about the proposed solar project.
- NOC from Gram Panchayat is obtained from Andugulapet villages for the proposed project for developing and using existing internal village road and 132 KV electrical line in various areas of village, develop village naksha road and can alter the same in terms of movement of heavy vehicle within the limits of Gram Panchayat.

Public Disclosure

Renew power team and Land aggregator had discussion with village surpanch and landowners. They were informed about the proposed solar project and NOC taken from the village panchayat.However, minutes of

such meetings and photographic evidences were not recorded. It was observed that the villagers were aware of the upcoming project.

Community development Plan under CSR

CSR plan is being prepared by Renew power team. As per Renew power vision on CSR, community development is one of the importance component and initiatives to support this are being identified by Renew team. During the stakeholder consultation, Arcadis team has also collected people suggestion such as renovation of school building and village roads. Needs were also assessed during the consultation and presented in Table4-21.

Recommendations for CSR activities based on need assessment of the Study Area

Analysis of above socio economics description and community consultation in project influenced village reveals that concern of villagers are linked with the fulfilment of basic needs and improvement of some infrastructural facilities at community levels. On the basis of discussion with village communities, following needs have been identified which can be addressed by an adequate CSR activities given in **Table 4-20**. List of stakeholders participated and key findings recorded is presented in Table 4-21.

Table 4-20: Key needs/gaps identified and recommendation for CSR activity

Key Areas	Needs identified	Recommendation for CSR
Drinking water	Need of alternate clean drinking water sources in addition to bore wells.	• Providing additional bore wells in Andugulapet village with the help of concerned government dept. • Providing RO treated water in Andugulapet village.
Education	Low female literacy rate compared to male	• Awareness program regarding female education at village level. This can be linked with vocational training programme of Andugulapet village • Providing computer literacy program at village level
Health	Provision of Health facility is in study area village	• Organizing awareness camp on Malaria and TB. • Health camps or mobile health clinics can be provided.
Employment opportunities in the area	Need to have more employment opportunities in the study area.	• Organizing training/ capacity building programme for SHGs regarding entrepreneurship and linkages with bank. • Introduction of processing of dairy and other produce related to livestock.

Table 4-21: Land Owner Consultation

SN	Land Owner Name	Survey No.	Caste (OBC /BC/ OC/S C/ST)	Village	Key findings	Photo Documents

Venue: Neutral place out of the study area at Hotel Shriniwashan, Manchiryala, Adilabad

Date: 12th July'16

SN	Land Owner Name	Survey No.	Caste (OBC /BC/ OC/S C/ST)	Village	Key findings	Photo Documents
1	Mahesh	108	BC	Andugulapet	Total family members: 6 Earning members: 3 Livelihood source: agriculture and labour work Annual income (INR): 60,000 Area of land sold to Land Developer (in Acr): 4 Remaining land after sale (in Acr): 2 Utilization plan of compensate amount: Distributed money for petty interest. Awareness about the project: land developer has informed to landowner during purchase process. Activities on sold land: Non-cultivated land from 5 years	
2	Tirrupatti Reddy	122	OC	Andugulapet	Total family members: 7 Earning members: 1 Livelihood source: agriculture and bussiness (petrol pump owner) Annual income (INR): 2 lakh Area of land sold to Land developer (in Acr): 10 Remaining land after sale (in Acr): 16 Utilization plan of compensate amount: : spent in business and purchased another plot in nearest town Awareness about the project: land developer has informed to landowner during purchase process. Activities on sold land: Non-cultivated in the absence of irrigation facility	

SN	Land Owner Name	Survey No.	Caste (OBC /BC/ OC/S C/ST)	Village	Key findings	Photo Documents
3	B. Laxman (W/O Sarojanna -land owner)	108	ST	Andugulapet	Total family members: 6 Earning members: 1 Livelihood source: RMP practicenor, agriculture Annual income (INR): 60,000 Area of land sold to Land developer (in Acr): 2 Remaining land after sale (in Acr): 2 Utilization plan of compensate amount: FD in bank Awareness about the project: land developer has informed to landowner during purchase process. Activities on sold land: Non-cultivated	
4	Rajesh M.	236	ST	Andugulapet	Total family members: 5 Earning members: 1 Livelihood source: Agriculture Annual income (INR): 60,000 Area of land sold to Land developer (in Acr): 4 Remaining land after sale (in Acr): 8 Utilization plan of compensate amount: purchased another land in same village Awareness about the project: land developer has informed to landowner during purchase process. Activities on sold land: Non-cultivated	

Source; Primary consultation

Photo Documentation of Stakeholder's Consultation

Consultation with land aggregator and land owners, Andugulapet

Consultation with project site team

Consultation with SHG Members, Andugulapet

Consultation with PHC staff, Mandamarri

5.0 ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

5.1 Approach & Methodology

Primary impacts are assessed for a radius of 2 km around the project site and secondary impacts are assessed beyond this radius for the proposed project. Also, 100 m RoW along the transmission line route is also considered for impact assessment. The methodology adopted to assess the significance of impact associated with project activities during construction and operational has taken following criteria into consideration. Details of screening criteria are given in **Table 5-1**

Table 5-1: Screening Criteria for Environmental and Social Impact Assessment

Impact	Distribution of impact	Duration of Impact	Intensity
Low/ Short	Influence of impact within the project site boundary and RoW of Transmission line (Site)	Limited for duration of less than 6 months (Short)	Limited local scale impact resulting in temporary disturbance/ loss of environment/ social components (low)
Moderate/ Medium	Spread of impact within 2 km from the of the project site boundary (Buffer)	Impact may extends up to 2 years (Medium)	Local scale impact resulting in short term change and/ or damage to the environment components. (Moderate)
High/ Long	Influence of impact beyond 2 km from the project site boundary (Widespread)	Impact extends beyond 2 years (Long)	Regional impact resulting in long term changes and/ or damage to the environment components. (High)

5.1.1 Significance Evaluation Matrix

Significance evaluation matrix as shown in **Table 5-2** has been used to evaluate the significance of identified potential environmental impacts. This matrix includes criteria as discussed above to analyse the significance of impact. Colour codes have been given to signify the impact intensity.

Significance of environmental impact has been analysed and presented in further section of this chapter. The environmental impacts associated with the project activities have been identified and analysed to evaluate their significance. Because of clean category projects, environmental impacts are very few with minor significance and can be controlled through mitigation measures.

Table 5-2: Impact Significance Matrix

Distribution	Duration	Intensity	Significance
Within Site	Short	Low	LOW
Within Site	Short	Moderate	
Within Site	Medium	Low	
Within Site	Medium	Moderate	
Within site	Long	Low	
Buffer area	Short	Low	
Widespread	Long	Low	
Within Site	Short	High	MODERATE
Within Site	Medium	High	
Within Site	Long	Moderate	

Distribution	Duration	Intensity	Significance
Within Site	Long	Low	
Buffer area	Short	Moderate	
Buffer area	Medium	Low	
Buffer area	Medium	Moderate	
Buffer area	Long	Low	
Buffer area	Long	Moderate	
Widespread	Short	Low	
Widespread	Short	Moderate	
Widespread	Medium	Low	
Widespread	Medium	Moderate	
Widespread	Long	Moderate	
Within Site	Long	High	
Buffer area	Short	High	
Buffer area	Long	High	
Widespread	Short	High	HIGH
Widespread	Medium	High	
Widespread	Long	Moderate	
Widespread	Short	Low	
Widespread	Short	High	
			NO IMPACT
			POSITIVE IMPACT

5.2 Impacts on Physical Environment

5.2.1 Air Quality

Construction Phase:

During construction phase, various project components such as transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction will require land clearing, levelling, excavation, grading activities, vehicle movement and DG set operation. This results in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to nearby receptors from windblown dust (on the village access roads like the Andugulapet village road) due to transportation of raw materials. However, most of these project activities are expected to be restricted within the project boundary. Further, the movement of vehicles carrying raw materials on unpaved area within the project site and on access road causes fugitive dust emission and may extend to surrounding of project site like nearest settlements. Hence, the distribution of impact can be considered medium, duration of impact is short an intensity of the impact as medium. Since the impact is widespread, but for short duration and of low intensity, the impact can be termed of a ***Moderate*** significance. But, the impact is reversible, and temporary in nature, if the following mitigation measures are adopted.

Mitigation Measures:

- Vehicles speed to be restricted to 20-30 km/hr on unpaved road.
- Raw material should be covered with tarpaulin sheet during transportation and in storage area
- Water sprinkling on unpaved area but ensure use of tanker water purchased form suitable authorised vendor only.
- All the project vehicles shall have valid Pollution under Control (PUC) certificate. Ensure regularly maintenance of project vehicles during construction and operational phase
- Turn off the machineries when not in use

Operational Phase:

During operational phase, there would be minimal vehicular movement about 2-3 project vehicles for commuting purpose. Since major source of emission into the ambient air will be absent during the operational phase therefore impact can be termed as insignificant.

5.2.2 Soil Quality

These impacts are associated with the project activities such as piling of module mounting structure and storage of diesel, spent oil or transformer oil.

Construction Phase:

The project has been proposed on open scrub and agricultural land. Loose top soil is generated due to excavation on project site due to site levelling for erection of module structures towers and access roads. The impact anticipated here is loss of top soil because of inappropriate storage. However, these activities and associated impacts are limited to be within the project boundary and during construction phase only. Considering the activities limited within the site, short duration of construction phase and low intensity, significance of impact is evaluated as ***Low***. Soil contamination may result due to accidental spillage and inappropriate storage of diesel or used oil during construction phase. However, distribution of impact within the project boundary and short duration of construction phase with low intensity makes impact of ***Low*** significance and can be controlled with the recommended mitigation measures:

Mitigation Measures:

- Provide appropriate storage of top soil in an isolated and covered area to prevent its loss in high wind and runoff.

- Allow only covered transportation of top soil within the project site.
- Use top soil at the time of plantation and it can be given to nearby agricultural field after taking consent with the landowners/farmers.
- Plantation activities should be undertaken by Renew Power to appease the chances of soil erosion
- Store hazardous material like diesel and used oil in isolated room and on impervious surface to prevent seepage into project site soil
- Filling and transfer of oil to and from the container shall be on impervious surface
- Care should be taken with regard to possible changes in soil quality due to human activities, such as disposal of waste material and domestic effluents on soil of the surrounding area.

Operational Phase:

During operational phase, project activities such as excavation and usage of chemicals such as diesel and spent oil will be absent therefore impact associated with these activities such as top soil loss and soil contamination are not anticipated. Impact can be considered as insignificant.

5.2.3 Noise Quality

The environmental impact anticipated in the proposed project is the increment in ambient noise level due to various project activities.

Construction Phase

The major noise generating sources in the proposed project are operation of vehicular traffic, and construction equipment like dozer, scrapers, concrete mixers, generators, pumps, compressors, rock drills, pneumatic tools, and vibrators. The project site is located amongst barren fields with no continuous noise generating sources in the vicinity of the project site. But, the operation of these equipment's is expected to generate noise in a range of 75 – 90 dB (A). However, propagation of noise waves was assessed through the equation -1 and found that noise attenuates during propagation and lower down from 90 dB(A) to 47 dB(A) at 50 m distance from the source and the nearest settlement is about 1 km from the project site. Also, intermittent operation in large area of project site reduces the intensity.

$L_p = L_w - 10 \log_{10} (2\pi R^2) - \alpha R$ -------- *(Equation -1)*

Lp = sound pressure level (dB) at a distance of R from a noise source radiating at a power level,

Lw= sound pressure level (dB) at source; R = distance of receptor from source;

α =*frequency dependent sound absorption coefficient.*

The above given equation can be used with either broadband sound power levels or a broadband estimate of the sound absorption coefficient (α = 0.005dB (A)/meter).

The construction activity will be mainly carried out during day time. Considering the short duration, distribution within site and low intensity, impact has been assessed as **Low** significance.

Mitigation measures

- Use DG set with acoustic enclosure
- Restrict major noise generating activities during night time 10:00 pm to 6:00 am
- Provide personal protective equipment to workers wherever noise is generated due to machinery operation.
- Regular maintenance of project vehicles

Operational Phase:

Any significant noise generating activity during operation of solar power plant is absent therefore impact in terms of increment in ambient noise level is not anticipated during the operational phase of the project.

5.2.4 Alteration of Natural Drainage Pattern

Topography of the project site can be characterized as mix (flat and mild undulations) therefore levelling or filling is expected to alter the natural drainage pattern.

Construction Phase:

During construction phase, site levelling activities will be carried out which in turn may result in change of contour level and natural drainage system. As the natural drains exist adjacent to the project site and at 1 km distance in east direction therefore change in contour level may affect the flow of surface runoff from project site. After the levelling and paving, increment in surface runoff is expected which should be diverted to the natural drainage present in nearby area. If it is not done then surface runoff from the site may affect nearby agricultural field which may cause social agitation.

Considering the extent of impact outside of project boundary and high intensity, impact is considered as major significance and following mitigation measures are suggested to implement:

Mitigation Measures:

- Site levelling should be done with minimum alteration in contour level
- Design storm water drainage to discharge the surface runoff in the nearby natural drainage
- Do not disturb the natural drainage system
- The exit of runoff from the project site in the adjacent surrounding land area should be restricted
- Do not disturb the dry pond located at 200 m West of the project site

Operational Phase

In operational phase, project activities causing the alteration of natural drainage pattern will not exist, therefore associated impact is not anticipated.

5.2.5 Water Resources

Water is required for various project activities, fulfilment of this water requirement through ground water may have impact on water availability.

Construction Phase

In the construction phase, total water requirement for construction activities and labour camp is estimated about 19.5 KLD. Further, construction activities will be limited only to 3-4 months duration therefore a long term water requirement is not expected. As CGWB study indicates that Mandamarri mandal falls under safe zone therefore ground water table depletion is not anticipated due to construction activities.

Considering the limited distribution of impact (within the site), short duration of activities and low intensity, significance of impact is assessed as **Low**.

Operational Phase

Typically, ground water consumption during operation of solar power plant is high because of module cleaning requirement throughout the project life cycle. In operational phase, the total water requirement would approximately be 100 KL/month. The domestic water required is estimated to be 0.5 KLD, considering a total of 10-12 personnel onsite during operation phase including security personnel and technical staff on a 24 hours shift. Considering the distribution of impact in buffer area, long duration of activities and moderate intensity, significance of impact is assessed as **Moderate.**

Mitigation Measures:

- Dry wiping method using microfiber cloth can be adopted to minimize water consumption for solar panel cleaning.
- Ensure optimal usage of water viz., storage and reuse of wash water after module washing and plantation of low water requirement species
- Construct rain water harvesting pit to recharge the ground water table

5.2.6 Solid/Hazardous waste disposal

Construction Phase:

Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, excavated material, rejected components and materials, packing materials (pallets, crates, plastics etc.) and human waste. Reportedly, the broken solar panels will be properly packed and will be sent back to manufacturer. However, taking in consideration the impact within site, short duration and moderate intensity, the impact is considered as ***Low.***

Mitigation Measures

- The excavated material generated will be reused for site filling and levelling operation to the maximum extent possible.
- Ensure broken solar panels are properly packed and sent back to manufacturer
- Food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/ containers and periodically sold to local recyclers while food waste will be disposed through waste handling agency.
- Waste oil will be collected and stored in paved and enclosed area and subsequently sold to authorized recyclers.

Operation phase:

There will not be any substantial generation of solid waste, other than insignificant domestic waste, and broken solar panels. The broken solar panels will be sent back to the manufacturer. Considering the limited distribution of impact (within the site), long duration of activities and low intensity, significance of impact is assessed as **low**.

Mitigation measures

- Food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers.
- Ensure broken solar panels are properly packed and sent back to manufacturer

5.2.7 Impact on Land and landuse

Construction Phase

During construction phase, impact on landuse is anticipated due to various activities such as site levelling, filling and development of solar power plant. Land which belong to barren landuse will change into industrial landuse after the development of solar power plant. Some impact on natural drainage system is also anticipated. Further, impact will be of long term and permanent in nature but impact will not be of adverse nature.

Mitigation measures

- Do minimum changes in contour level
- Do not disturb natural drainage system

Operation Phase

No impact on land use is envisaged during the operation phase.

5.2.8 Impact on Biological Environment

Construction phase

The associated ecological impacts of the construction phase are due to following activities:

- Clearing and levelling of land
- Fencing of land
- Laying of solar module foundation and erection
- Laying of transmission towers and transmission lines
- Creating access roads

The impacts envisaged on ecology during construction phase are enlisted below:

- Loss of vegetation and avian habitat due to site clearance, road construction, building and PV array support construction etc.
- Erosion and clearing of topsoil (loss of habitat and habitat fragmentation).
- Disturbance/ displacement of fauna, including avifauna associated with noise and movement of construction equipment and personnel.

Destruction and loss of vegetation

Project construction involves land clearance, levelling, etc. causing loss of vegetation. The clearance of vegetation will be restricted to the project site. Clearing of vegetation is also required for access route and transmission lines. The proposed solar power plant site is divided in two patches and is located on barren agricultural land.

Clearance of ground cover shall be done during the construction period. As it is a modified habitat, the conservation status of the project site and its immediate surroundings found to be poor. The ground cover occupied by grasses/ sedges and other shrubs/ herbs were mostly seasonal and the level of impact generated from removal of this seasonal understorey (ground cover) can be termed as negligible as the species are very common and have least conservation value. Many of them are weeds. At the same time, the construction period is also short and the understorey will once again grow up at same area after a good shower of rain once the construction is over.

The agricultural lands located around project site have trees like neem, eucalyptus, etc. which may likely to be pruned/ cut from the project activities. Pruning of trees does not have any impact but the removal of tree species will have moderate level of impact. Adequate amount of plantation shall be undertaken by the project proponent in the study area (along the avenues, schools, community lands) which not only replenish the loss of tree cover of the area but also enhance the green cover of the tree sparse region.

Disturbance to Fauna

ADB's Environment Safeguards recognizes that protecting and conserving biodiversity is of utmost importance. The proposed solar power plant will result in habitat loss for resident species. Shy fauna are likely to avoid the area due to the human activity. There may also be a shift in small mammal and reptile community structure from the project area.

Transportation of construction equipment and construction activities is very likely to disturb faunal species of the area. Noise from construction and frequent movement of vehicles can also disturb the avifauna of the area. The project site does not fall in any of eco-sensitive areas such as national park, wildlife sanctuary area or conserve area. This project will have a small foot print area and the small mammalian species, birds and reptiles those were either sighted directly during primary survey or confirmed on their presence by the local seniors are very common and found all over the region. Temporarily, they may abandon the project activity area during the construction period and migrate to nearby areas. Thus the impact on fauna of the area is considered to be minor.

Significance of Impact

The impacts of construction phase on ecology will be both direct in terms of vegetation and habitat loss/ displacement and indirect due to increased noise and heavy equipment and vehicular movement which will be limited to construction phase only. Overall the impact significance is assessed to be minor. The impact would be temporary and limited to only approach roads and construction area.

The impact on fauna and flora will have minor intensity with a local spread for a short duration which will result in an overall minor. However with proper implementation of suggested mitigation the impact may be reduced to negligible.

Mitigation Measures

The following measures should be considered in the project design to mitigate the impact during construction phase due to the project:

- All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance to human as well as faunal population in the region.
- Activities generating high noise shall be restricted to day time and will be mitigated to minimize the noise level outside the site boundary.
- Recovery of ground storey (mostly grasses and herbs) vegetation under the PV panels and in other places that do not need to remain cleared shall be encouraged to grow.
- Movement of construction and transport vehicles shall be restricted to dedicated paths to minimize any harm to small mammals/ reptiles within the site.
- Transportation of construction material shall be restricted to day time hours in order to minimize noise and disturbance to fauna in the area.
- General awareness regarding wildlife shall be enhanced through putting signage, posters, among the staff and labourers.
- Strict prohibition shall be implemented on trapping, hunting or injuring wildlife present in and around the project site by the labour force and shall bring a penalty clause under contractual agreements.
- Camp and kitchen waste shall be collected in a manner that it does not attract wild animals.
- Temporary barriers shall be installed on excavated areas.
- The footprints of the construction activities shall be kept to minimum so as to reduce disturbance to flora and fauna
- Planting native, fast growing trees on access roads and/ or in nearby barren areas/ schools/ Panchayat office which may also give an alternate habitat to the faunal species especially the bird species and maintain the ecological balance

Impacts Due To Construction of Transmission Towers

The project activities during transmission tower construction, may 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. Only 8 transmission towers of area 6mX6m will be erected for a route length of approximately 2 km. Thus the associated impacts would be low. In this case, the removal of trees shall be fully compensated through plantation in and around the impacted area. The initial construction works along the alignment involving land clearance, cutting, filling, and leveling that may also cause loss of vegetation. None of the declared environmentally sensitive areas is located within the route alignment. It is not expected that any flora and fauna that are rare, endangered, endemic or threatened will be affected. Small mammals and reptiles may be affected due to construction activities and this is purely temporary in nature. 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 site.

Operation phase

Impacts during operation phase are likely to be restricted to the maintenance activities within the project site like ground cover clearing under PV arrays and from internal road network within site. Apart from a relatively small direct loss of habitat, the shading of the soil by the solar panels is likely to impact reptile composition in these areas, as the shading is likely to alter soil temperatures which has direct implications for cold-blooded

animals. Most reptiles are also sensitive to the amount of plant cover which is also likely to be affected by the arrays. At the same time, the presence of the arrays and electrical infrastructure would however create additional habitat for species which utilize such structures. Also during operation phase, solar photovoltaic power plant does not generate significant noise or air emissions to affect the faunal population of the area. However there is potential for avian distraction due to glare/ reflection from solar panels. As such these impacts are considered to have a low intensity, and an overall minor significance.

Assuming the below-mentioned mitigation measures are implemented, the operation phase impact significance is reduced to negligible

Mitigation Measures

- Vegetation clearing through bush cutting for maintenance activities shall be done manually wherever possible.
- Any cleared areas which do not have some vegetation cover to protect the soil shall be re-vegetated with locally occurring species and monitored to ensure recovery is taking place.
- Vegetation that needs to be reduced in height shall be mowed or brush-cut to an acceptable height, and not to ground level except where necessary.
- Solar panels shall have an anti-reflective coating to minimize the light reflecting off of the panels so that there is very less impact due to glare from the panels.
- Signage shall put all around the project site to bring the awareness amongst project personnel to be sensitive towards the small mammalian species and retiles reside in the project area

5.2.9 Socioeconomic Impact

Socio-economic impact assessment is designed to assist communities in making decisions that promote long-term sustainability, including economic prosperity, a healthy community, and social wellbeing. To assess and understand the social impacts associated with the project, social indicators have been identified and analysed.

(A) Loss of land/ livelihood conflict

Construction Phase

Non cultivated private land has been procured on willing to sell and willing to buy basis in the proposed project. Land parcels were not taken from the persons who were not willing to sell their land therefore total project site of 48 MW has been spread into two separate patches (located at 1 km distance from each other) The land is devoid of any settlement and physical structure and procurement of land does not result in physical displacement. As the non-cultivated land has been taken after paying the mutually agreed price (more than the land circle rate). Further, discussion with Renew Power team revealed that entire land was not taken from any person and the same was substantiated by the consulted landowners therefore significant economic displacement is not envisaged. Impact due to economic and physical displacement is not anticipated. However, moderate impact in following situation expected:

- Partially paid compensation to land owners
- Obstruction of villager's access due to construction of project boundary

Following mitigation measures are suggested to reduce impact significant:

- Renew Power land team to monitor the compensation details paid by land aggregator to all the land owners
- The project management shall undertake a formal consultation with all Farmers from whom land shall be obtained, gain an informed consent
- Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding project related components are promptly and adequately investigated and resolved

(B) Local Job and Economic Opportunity

During the construction phase, proposed project will create job opportunities for the skilled and unskilled labour. Job opportunities in terms of security guards may also be expected during the operational phase of the project therefore this impact is positive in nature. Although impact is positive, following risks are anticipated and mitigation measures are suggested:

- Lack of basic amenities and facilities
- Engagement of forced and child labour
- Discrimination towards female labour
- Inadequately paid labours

Mitigation Measures

- Renew Power to ensure access of necessary basic amenities and facilities such as drinking water, kitchen, toilet and crèches (for female workers children)
- Renew Power team to ensure no engagement of child labour and forced labour in any task related with the project
- Renew Power to ensure access of equal opportunity and benefit for the female worker
- Renew Power to ensure all the workers get compensation as mentioned in Minimum Wages Act

(C) Access to Common Property Resources

Another issue which may cause social impact on local people in terms of conflict between project developer and local community is restriction on community to access the land and other common property resources. However, considering the fact that Renew Power has provided road along the project boundary to eliminate the blockage of access road, no impact is envisaged.

Pathway along the boundary provided for free access by community

(D) Impact on Indigenous People and culturally/Archaeological important Site

The project site area is a scheduled area where some additional powers have been provided to Gram Sabha to protect the right of Scheduled Tribal groups (Indigenous people). Under special rules prepared for the Scheduled area such as PESA act and land transformation act, taking land from ST person in the scheduled area is prohibited. Further, Gram Sabha in scheduled area has right on resources of village and use of the resources can be permitted after taking consent of Gram Sabha.

Discussion with project team revealed that project was discussed with the community people and Village Sarpanch. However, evidences of such meeting was not maintained and available to see. During the focussed group discussion with community people, it was found that people are aware about the solar power project.

Discussion with project team and land aggregator also revealed that no land has been taken from the ST people. As the proposed project does not involve land of ST person and obtained NOC from Gram Sabha for the development project, adverse impact on indigenous people is not envisaged.

Moreover, the project sites and immediate area does not contain any archaeological monuments and structures of cultural belief. Further, historical sites as declared by Archaeological Survey of India is also absent therefore no impact is envisaged on culturally important and archaeological protected monument due to project.

5.2.10 Health and Safety Impact

(A) Occupational Health & Safety Impact

Construction Phase:

Occupational Health and safety hazard associated with project activities (during construction phase) in solar power plant are identified as follows:

- *Electrocution and Firing due to short-circuit*: It should be ensured that proper training be given to workers before initiation of any project activity. Personal Protective Equipment (PPE) viz. helmets, safety jackets, safety shoes, goggles, and gloves should be provided to the labour as per their nature of work involved.
- *Diseases due to unhygienic condition*: It should be ensured that proper and adequate number of toilets should be constructed for the labourers so that hygienic conditions prevail in the site area.

Besides, there can be dissatisfaction among the labourers due to many conflicts/ issues unresolved, hence there should be a complaint register onsite. Renew Power's contractor should ensure to have regular medical check-up of labourers

Mitigation Measures:

- Arrangement for hygienic and scientific sanitation facilities for all the labourers working in the site.
- There need to have enclosed and exclusive provision for women to protect the privacy and dignity of the women involved in the work force.
- There should periodical training to educate the workers for proper use of PPE's.
- There should be proper monitoring system to ensure that each and every individual labourers are using the PPEs properly.
- Workers handling electricity and related components shall be provided with shock resistant gloves, shoes and other protective gears.
- As per the provisions given in Performance Standard (PS) 2 of IFC there should have arrangements for safeguard of health issues and immediate arrangements for addressing accidental incidents.
- Availability of all the basic amenities such as canteen, drinking water, crèches (in case of female workers with children), proper rest room and adequate toilets should be ensured and built.
- The sanitation facilities for contract labourers should be immediately commissioned.

- Health and safety training of the labour, raising awareness about STDs, and HIV, and maintaining behaviour standards while moving in the community shall be done;
- Provision of the Contract Labour Rules, 1971 require the operator of a construction site to provide adequate sanitation facilities to worker within the site premises (Latrine: One per 25 male/female; Urinal One per Male/female).
- Contractors should inform the labour about the Grievance Redressal Mechanism (GRM) by which they can inform about any grievances.
- It should be ensured that labour is being adequately paid by contractors. The contractor should ensure that wages is being paid as per the requirement of Minimum Wages Act.
- Contractor should inform the labour about Emergency Preparedness Plan (EMP) and communication system to be followed during emergency situation.
- Contractor should ensure that labour receive training on health and safety issues involved in the proposed project.
- Employment opportunities shall be considered for the vulnerable section of the society such as economically weaker class, families with small land holding etc. from the local area.

Operation Phase:

There would be incidence of electrocution or short circuit as well as diseases due to unhygienic conditions during the operation phase.

(B) Community health & safety

Construction Phase

Health and safety risk to the community is associated with the movement of considerable project vehicles including heavy vehicles during construction phase of the project. Present project phase engages vehicles such as truck, JCB, site compactor, Hydra etc. on project site and access road. Activities like transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction require land clearing, levelling, excavation, grading activities, vehicle movement, DG set operation will take place. This will results in an increased level of dust and particulate matter emissions, as well as high traffic load, which in turn will directly and temporarily impact the local community. If improperly managed, there is a risk of nuisance and health effects. Village settlements near the project site and movement of project vehicles on village road may lead to congestion and accident also, if not managed.

Mitigation Measures

- Identify route for movement of project vehicles which, should not include narrow village road and road passing through cluster of settlements
- Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles
- Keep limited speed of project vehicles near settlements and within the project site
- Provide necessary training to the drivers for speed restrictions and on do's and don'ts during construction phase

Operational Phase

In operational phase very few (2-3 nos.) of vehicles will be required for commuting from home to site office. Therefore, impact associated with movement of project vehicles is not anticipated. However, risk of electrocution is anticipated in the operational phase of the project, which could be mitigated through boundary wall and restricted entry in project site.

6.0 ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

The Environment and Social management Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

Renew Power is committed to implement an effective Environmental and Social Management System (hereinafter referred as ESMS) to continuously manage and communicate the potential social and environmental impacts and risks imposed on the project employees (direct and indirect) and the local communities residing in the immediate vicinity of the project area. The outcomes of the Environmental and Social Impact Assessment of the proposed project have been used to formulate an Environment and Social management & Monitoring Plan for the project, presented in **Table 6.1**. The Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

6.1 Training of Personnel & Contractors

Renew Power should ensure that the job specific training and EHS Induction training needs are identified based on the specific requirements of ESMS and existing capacity of site and project personnel (including the contractors and sub-contractors). Special emphasis shall be placed on traffic management, stakeholder's engagement and grievance redressal. General environmental awareness shall be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimizing adverse environmental impacts, ensuring compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment shall be imparted to the contractors and sub- contractors prior to the commencement of the project.

An environment and social management training programme shall be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training programme shall ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities;
- Requirements of the specific Action Plans
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the project activities.
- A basic occupational training program and specialty courses shall be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments.
- Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.
- Workers with rescue and first-aid duties must receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers.
- Through appropriate contract specifications and monitoring, the employer shall ensure that service providers, as well as contracted and subcontracted labour, are trained adequately before assignments begin.

6.2 Monitoring

In order to implement the ESMP, the on-site team should adhere to a time-bound and action-oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP should be monitored on a regular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process should cover all stakeholders including contractors, labourers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. RENEW POWER should ensure that all the contractors comply with the requirements of conditions for all applicable permits, suggested action plans and scheduled monitoring. The inspections and audits should be carried out by an internal trained team and external agencies/experts. The entire process of inspections and audits shall be documented and key findings of which should be implemented by the proponent and contractors in their respective areas.

6.3 Documentation & Record Keeping

Documentation and record keeping system has to be established to ensure updating and recording of requirements specified in ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured. The following records should be maintained at site:

- Documented Environment Management System;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;
- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register and issues attended/ closed

Table 6-1 Environment Management Pan

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
CONSTRUCTION PHASE							
A	**Physical Environmental Management Plan**						
1	**LANDSCAPE AND VISUAL**	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	**LOW**	• Ensure the construction site is left in an orderly state at the end of each work day • Construction machinery, equipment, and vehicles not in use should be removed in a timely manner to the extent possible • Proper handling of waste streams	**NO IMPACT**		Contractor under the supervision of Renew Power's Personnel
2	**GROUND WATER ABSTRAC-TION**	The total water requirement is high. However, the region as per CGWB falls under safe zone but extraction of ground water over a long period may cause a serious concern. Hence the impact is envisaged.	**MODERATE**	• During construction phase, water should be sourced from authorised sources who have taken prior approval from CGWB. • Construct rain water harvesting pit to recharge the ground water • Use dry wipe method to clean the modules • Reduce the frequency of washing to save water • If possible, collect the water after module wash and reuse it for module washing	**LOW**	Maximum efforts should be made to reuse and recycle water to reduce water consumption.	Project Developer/ Contractor under the supervision of Renew Power's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
3	**GROUND WATER QUALITY**	• Possibility of contaminated runoff from the site entering the nearby water bodies. • Domestic water runoff from the portable toilets into neighbouring water bodies can lead to degradation of water quality. • Waste water from toilets constructed for site office can contaminate groundwater.	**LOW**	• Storage of oil shall be undertaken on paved impervious surface and secondary containment shall be provided for fuel storage tanks • Adequate drainage of road based on road width, surface material, compaction and maintenance • Leak-proof holding tanks for sanitary waste water should be constructedto protect the shallow ground water level. • Waste water holding tanks / septic tank should be located at more than 500 m away from bore wells or any other underground water holding tanks. • It should be ensured that the waste water does not find its way into surface waters or water wells.	**LOW**	• Machinery and vehicles shall be thoroughly checked for the presence of leaks if any; • Leakage of vehicles to be checked; • Storage of oil on site to be checked	
4	**AIR QUALITY**	• Fugitive Dust due to movement of project vehicles and site clearance • Emission from Diesel Generators	**MODERATE**	• Vehicles speed to be restricted to 20-30 km/hr. on unpaved road. This will reduce dust emission • Raw material should be covered with tarpaulin sheet during transportation and in storage area • Practices water sprinkling wherever required on unpaved area but ensure use of tanker water purchased form authorized vendor only • All the project vehicles shall have valid PUC certificate	**LOW**		Project Developer/ Contractor under the supervision of Renew Power's Personnel

S N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Ensure regularly maintenance of project vehicles during construction and operational phase • Turn off the DG sets & machineries which are not in use • DG sets preferablyshould be placed away from settlement area. • It will be ensured that exhaust emissions of construction equipment adhere to emission norms as set out by MoEFCC/ CPCB.			
5	**SOIL QUALITY**	Top Soil Loss	**LOW**	• Provide appropriate storage of top soil in an isolated and covered area to prevent its loss in high wind and runoff. • Allow only covered transportation of top soil within project site. • Use top soil at the time of plantation on the approach road. • Construction debris shall be reused in paving on site approach road to prevent dust generation due to vehicular movement • Re-vegetation shall be done in the area after the completion of construction, in order to reduce the risk of soil erosion	**NO IMPACT**	• The workforce shall be sensitized to handling and storage of hazardous substances viz. fuel oil, machine oil/fluid etc. • The workers engaged in handling hazardous substances shall be briefed about the possible hazards and the need to prevent contamination.	Project Developer/ Contractor under the supervision of Renew Power's Personnel
		Soil Contamination		• In case of anyaccidental spill, the soil will be cut and stored securely for disposal with hazardous waste. • Store hazardous material (like used oil) in isolated room with impervious surface.			

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Filling and transfer of oil to and from the container shall be on impervious surface. • Waste disposal grounds that are in use by the local people should be identified and permission from local administration for use of the same needs to be obtained for disposing domestic wastes.			
6	**NOISE LEVEL**	• Disturbance to habitants • Vehicular noise from heavy vehicles utilized to deliver construction materials and solar plant parts • Noise from DG sets • Construction noise from using mobile equipment, and concrete mixing	**LOW**	• Regular maintenance of construction machinery and equipment shall be carried out to ensure noise emissions are maintained at design levels. • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures. • Keep stationary source of noise such as DG sets (during construction phase) at farthest point from the settlements • Restrict major noise generating activities during night time 10:00 pm to 6:00 am • Provide personal protective equipment to workers working near DG sets and other high noise source. • Local communities need to be informed about the vehicular movement before start of heavy vehicle carrying materials and machines to site. Sensitive locations should be identified and avoided as far as possible from the route and if	**NO IMPACT**	It will be ensured that noise emissions of construction equipment adhere to emission norms as set out by MoEFCC/ CPCB	Project Developer/ Contractor under the supervision of Renew Power's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				unavoidable, drivers should be informed to restrict speed at those locations. • Diesel generator sets, if used; will adhere to noise standards of MoEFCC.			
7	**SOLID WASTE**	Contamination of land	**LOW**	• Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". • Domestic and construction waste like recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of Renew Power's Personnel
8	**CHANGE IN LOCAL TOPOGRAPHY**	Alteration in natural drainage pattern	**LOW**	• Don't allow the considerable alteration of contour level • Provide alternatives to collect surface runoff from the project site during the monsoon period • Don't allow exit of runoff from the project site in the adjacent areas. • Design storm water drain considering the natural contour level • Site preparation activities should be designed to avoid any significant elevation of the land or blocking or altering natural drainage channels in the project site. • Site preparation and development shall be planned only after a detailed drainage plan has been prepared for site.	**NO IMPACT**	The drainage patterns of the area will be maintained.	Project Developer/ Contractor under the supervision of Renew Power's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• If channels/drains get blocked due to negligence, it will be ensure that they are cleaned especially during monsoon season.			
B	**Biological Environmental Management Plan**						
9	**ECOLOGY**	• The construction activities may lead to loss of vegetation resulting in displacement of terrestrial species • Disturbance to local livestock population	**LOW**	• All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance to human as well as faunal population in the region. • Activities generating high noise shall be restricted to day time and will be mitigated to minimize the noise level outside the site boundary. • Recovery of ground storey (mostly grasses and herbs) vegetation under the PV panels and in other places that do not need to remain cleared shall be encouraged to grow. • Movement of construction and transport vehicles shall be restricted to dedicated paths to minimize any harm to small mammals/reptiles within the site. • Transportation of construction material shall be restricted to day time hours in order to minimize noise and disturbance to fauna in the area. • General awareness regarding wildlife shall be enhanced through putting signage, posters, among the staff and labourers.	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of Renew Power's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Camp and kitchen waste shall be collected in a manner that it does not attract wild animals. • Temporary barriers shall be installed on excavated areas. • The footprints of the construction activities shall be kept to minimum so as to reduce disturbance to flora and fauna. • Planting native, fast growing trees on access roads and/or in nearby barren areas/ schools/ Panchayat office which may also give an alternate habitat to the faunal species especially the bird species and maintain the ecological balance			
B	**Social Management Plan**						
1	**Hiring of Labour**	Creating Job Opportunities and Risk of labour dissatisfaction due to: Lack of basic amenities and facilities Engagement of forced and child labour Discrimination towards female labour	**MODERATE**	• Renew Power should include clause Renew Power to ensure access of necessary basic amenities and facilities such as drinking water, kitchen, toilet and crèches (for female workers children) • Renew Power team to ensure no engagement of child labour and forced labour in any task related with the project • Renew Power to ensure access of equal opportunity and benefit for the female worker	**LOW**	Periodic EHS audits should be conducted to monitor the vendor practices	Project Developer/ Contractor under the supervision of Renew Power's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		Inadequately paid labour		• Renew Power to ensure all the workers get compensation as mentioned in Minimum Wages Act			
2	**Land Procurement**	**Loss of Land/Livelihood**	**MODERATE**	• Renew Power land team to monitor the compensation details paid by land aggregator to all the land owners • The project management shall undertake a formal consultation with all Farmers from whom land shall be obtained, gain an informed consent • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding project related components are promptly and adequately investigated and resolved • Provide some alternate way/road so that project should not obstruct the villagers access	**LOW**	Renew Power Land and Project Team to understand mitigation measures	Renew Power Team and Vendor
3	**Impact on Indigenous people and archeologically important sites**	Unrest among the community due to dislocation of any structure or thing of cultural belief Impact on indigenous people due to land intake	**No Impact**	• No Impact	**No Impact**	-	-

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		from ST people and use of village resources					
3	**COMMUNITY HEALTH AND SAFETY IMPACT**	• Conflicts between labour and local community	**MODERATE**	• Renew Power to supervise the accommodation provided to migrant labours (semi-skilled) through contractors. • Renew Power to ensure to restrict the interaction of migrated labour with local community as to avoid any conflict.	**LOW**	• Grievance Redressal mechanism should be followed and monitored	Project Developer/ Contractor under the supervision of Renew Power's Personnel
4	**OCCUPATIONAL HEALTH AND SAFETY**	• Material handling and storage • Possible injuries associated with working with transmission line laying • Other occupational hazards	**MODERATE**	• All material will be arranged in a systematic manner with proper labelling and without protrusion or extension onto the access corridor. • Loading and unloading operation of equipment shall be done under the supervision of a trained professional • Proper PPEs shall be provided to workers handling welding, electricity and related components. • Fire extinguishing equipment shall be provided in adequate number on site to handle any possible fire outbreaks • An accident reporting and monitoring record should be maintained • Display of phone numbers of the city /local fire services, etc. at site should be done • The labour engaged for working onsite shall be trained for erecting solar modules.	**LOW**	• All the workers shall be made aware of the possible occupational risks/hazards by the way of an OHS training/awareness programme • An accident reporting and monitoring record should be maintained	Project Developer/ Contractor under the supervision of Renew Power's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
OPERATION PHASE							
A. PHYSICAL ENVIRONMENT MANGEMENT PLAN							
1	**HAZARDOUS WASTE MANAGEMENT**	Contamination of land and soil	**MODERATE**	• Broken solar panels, which will be collected in closed containers and then will be sent back to manufacturer	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Renew Power Personnel
2	**SOLID WASTE MANAGEMENT**	Contamination of land	**MODERATE**	• Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". The waste generated should be disposed as per The Municipal Solid Wastes (Management and Handling) Rules, 2000. • Domestic waste will be composted and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer / Renew Power Personnel
3	**GROUNDWATER ABSTRACTION**	Ground water depletion if extracted during operation phase (if permission is obtained from statutory authority)	**MODERATE**	• Ensure optimal usage of water viz., storage and reuse of wash water after module washing. • Rain water harvesting to be practised.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer / Renew Power Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
4	**WASTEWATER MANAGEMENT PLAN**	Degradation of ground and surface water quality	**MODERATE**	• Ensure that constructed septic tanks during operation are well contained and impermeable to prevent leakage of wastewater into soil. • Ensure that septic tanks are emptied and collected by contractor at appropriate intervals to avoid overflowing	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer / Renew Power Personnel
B	**SOCIAL MANAGEMENT PLAN**						
1	**CORPORATE SOCIAL RESPONSIBILITY**	• Community empowerment	**MODERATE**	• Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards	**NO IMPACT**	CSR Activities should be finalized and directed to the team for implementation	Project Developer/ Contractor under the supervision of Renew Power's Personnel
				• Developmental needs and expectations (such as employment in the project or up-gradation of educational health care facilities, cultural property and infrastructure) of local communities will be identified through the Gram Panchayat, villagers and local administration.		Should be conducted continuously through the project cycle.	Renew Power's Personnel
				• Opportunities for contributing to the economic and developmental needs of villagers through skill training will be explored.		Should be conducted continuously through the project cycle.	Renew Power's Personnel
2	**OCCUPATIONAL HEALTH AND**	• Electrocution • Firing due to short-circuit	**MODERATE**	• Provide and ensure wearing of personal protective equipment's viz., gloves, helmets, ear plug, etc.	**LOW**	Periodic EHS audits	Project Developer / Renew Power Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
	SAFETY OF WORKERS	• Diseases due to unhygienic condition		• Ensure effective work permit system for critical activities such as electrical work • Prepare emergency communication system and emergency preparedness plan • Ensure proper sanitation facilities.			

6.4 Environmental monitoring plan

The Environmental Monitoring Plan is formulated to ensure and demonstrate compliance with the Regulatory and Institutional Agency's EHS requirements. Monitoring of environmental and social parameters and comparing them with benchmarks set by regulatory and institutional authorities will help Renew Power assess the environmental performance and identify gaps or non-conformance ensuring immediate actions. The following environmental parameters (**Table 6.2)** will be monitored as when required during project operational phase for compliance.

Table 6-2 Environment Monitoring Program

A. Environmental Quality Monitoring

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
A.	**CONSTRUCTION PHASE**			
A1	Ambient Air Quality	Measurement of $PM_{2.5}$, SOx, NOx, CO	Nearest receptor viz. villages, schools, ecological habitat	Once during construction phase
A2	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)	Nearest receptor viz. villages, schools, ecological habitat	Once during construction phase
A3	Ground Water quality	IS 10500 parameters	Nearby villages	Once during construction phase
A4	Surface Water quality	IS 10500 parameters	Nearby surface water body	Once during construction phase
A5	Soil Quality	Soil parameters viz. pH, SAR, Water holding capacity, Conductivity, Organic Carbon, NPK	Abutting village land & project site	Once during construction phase

6.5 Environmental Management Plans

The ESMP is comprised of some site specific management plans viz. Emergency Management Plan, Waste Management Plan, Storm Water Management Plan, Environmental Monitoring Plan, Traffic Management Plan and Social Development Plan for the Renew Power 48 MW Solar Power Plant at Adilabad District of Telangana. The management plans will be executed through Environmental Social Management System.

6.5.1 Emergency Preparedness and Response Plan

Purpose

ReNew Power will develop a site specific Emergency Management Plan for implementation at the proposed site in the event of an emergency situation so that the loss of life and damage to the properties & natural resources are minimized as per the recommendation provided in this report. This plan outlines a series of emergency actions that will be executed by RENEW POWER & its Contractors to ensure preparedness and response to emergency situations throughout the life-cycle of the project.

Emergencies

The emergency situations that are probable to occur at the site and the probable causes are listed below:

- Fire at site during temporary construction phase which cannot be doused by fire extinguishers; Also fire due to short circuit at the plant and equipment during both construction & operation phase.
- Collapse of any structure
- Outbreak of endemic disease among a large section of construction workers due to contaminated drinking water, unhygienic conditions that have developed at workplace;
- Protests by the local community or other stakeholders at any point of the project lifecycle due to grievances;
- Serious injury or death of employee or sub-contracted worker at work, due to non-work related illness or work-related accident.
- Onset of any natural disaster like earthquake.

Emergency Management

The following steps shall be taken to ensure proper management of emergency or crisis situations:

- The nearest civil hospitals, private health care centres or practitioner clinic shall be identified and a agreements shall be made with the aforesaid medical centres/practitioners to provide prompt health care services (including ambulance services) in the event of an emergency situation at site.
- A list of important telephone numbers such as fire brigade, health care facility/practitioner, police station, EHS and Social Coordinator, project office, head offices shall be displayed at all the prime locations at site & the worker's camp (during construction phase).
- Regular liaising with the police, Gram Panchayat, district administration shall be carried out to ensure that prompt assistance is readily available in the event of an emergency.
- An Emergency Management (including Disaster Management) team comprising of 4-6 professionals both from the developer and contractors' side, during construction phase and 2-3 professionals during operation of the proposed project; shall be formed to combat any emergency situation and ensure safety of the life and property at site. For this purpose 2-3 personnel employed in the plant during operation phase shall be trained during emergency scenarios and their management measures including their roles and responsibilities in case of an emergency situation.
- The workers (staff & contractual workers from both Renew Power & contractors) shall be trained on their duties and emergency preparedness during an emergency. In case of an emergency, all site personnel shall be trained to follow the communication lines given below:
    a. Personnel at site affected by the emergency situations immediately inform the project office and the external agencies (such as police, fire brigade, ambulance services); In case, project office cannot be reached, the coordinator will be informed directly;
    b. The HSE officer on being informed about the emergency by project offices or by the employee directly; reaches site if necessary, and also follows-up with the aforesaid external agencies for aid;
    c. The HSE coordinator takes charge of the emergency response and direct further action and co-ordination, including escalating the matter to the CEO or other top-level managers as required.

Responsibilities

The HSE coordinator will be responsible for implementing this procedure, which includes

- Ensuring that the emergency preparedness measures are in place;
- Providing training to the personnel at site regarding reporting of the emergencies, and to site office personnel regarding response to emergency calls from the site personnel,
- Direct action-and co-ordination at the time of an emergency

Community health and safety hazards specific to solar energy facilities primarily include the following:

Public Access: Safety issues may arise with public access to solar plant site or to the solar energy facility substation. Any public rights of way located within and close to the solar energy facility site should be identified prior to construction to establish any measures that may be required to ensure the safety of their users. Prevention and control measures to manage public accesses include:

- Use gates on access roads.

- Where public access is not promoted to the site and/or there are no current rights of way across the site, consider fencing the solar energy facility site, to prohibit public access to the plant site.
- Provide fencing of an appropriate standard around the sub-station with anti-climb paint and warning signs.
- Post information boards about public safety hazards and emergency contact information.

6.5.2 Community Engagement Plan

The Community Liaison Plan is a critical element of the overall Social Management Plans. Regular transparent communication between both the project and the communities and vice versa is crucial in building positive relationships between the two parties. This relationship should be crucial for managing unexpected situations which might arise during the course of the project. This plan should be read with other social management plan because the liaison which needs to be done for the individual plan is detailed within the plan. The communication plan mainly focuses on the communication issues during the construction stage however it also includes some community Liaison measures for the operation phase as well.

Objectives:

The Performance Standards mandates continuous communication between project and the different stakeholders e.g. workers, local community. The onus of initiating the process of communication rests on the project proponent. The project proponent should ensure that disclosure of relevant project information that would help the affected communities understand the risks, impacts and opportunities of the project. The Community Liaison Plan is developed to ensure a clear communication channel between the project and the local community. Even though the focus of the plan is primarily on communication with the community areas where there are likely interactions between the community and the contractors such areas have also been covered. The community liaison plan would concentrate on the following aspects:

Communication with the Community: As mandated in the Performance standards Renew Power has disclosed the project details to make the community aware of the important features of the project. A project information booklet would be prepared and distributed in the project affected villages. This booklet should preferably be presented in local language. The booklet in addition to containing the salient features of the project should have a map depicting the boundaries of the plant and its ancillary facilities. The important landmarks e.g. the settlement, schools and the roads, etc. should also be demarcated so that it becomes easy for the people in the villages to relate to the ground conditions. In addition to the project information the booklet should also highlight the impacts on the community as presented in the ESIA document and the commitments for the safeguards including the entitlement matrix. To ensure wide circulation of the Project Information Booklet the booklet would be made available at all the schools, Anganwadi centres, and other public facilities in the project affected village. To ensure continuity of the flow of information to the community it is suggested that a quarterly

Community Information Booklet should be published. During the construction phase the booklet would contain the information about the progress of the project and also information which are pertinent to community e.g. disruption of the transportation links, outcome of consultation process on community development etc. It is proposed that the community Information Booklet be continued even during the operations stage where this also acts as a transfer of information from the project to the community. In addition it can also be used to share information between the communities e.g. achievement of a particular member of the community or any worker can be published in this booklet.

6.5.3 Waste Management Plan

The Waste Management Plan (WMP) will be applicable to the wastes arising during commissioning and operation of the proposed solar power plant of Renew Power. Major waste streams from the project include non-hazardous solid waste, wash water generated from panel washing and sewage. WMP is intended to serve as a guideline for Renew Power and the contractor(s) to manage wastes effectively during the project life cycle. The WMP describes how wastes will be managed during the project life cycle and how the project will:

- Minimize the potential to cause harm to human health and the environment.

- Comply with Indian Environmental Regulation and IFC Performance Standards.
- Reduce operational costs and reduce any potential liabilities which may arise from waste handling operations.
- This plan also ensures that every waste stream and solid waste materials from the main plant site and bracketed facilities will be managed effectively.

The EPC contractor will manage the waste generated during construction phase like construction debris, packing material, paint containers and filters. The management measures of the aforementioned solid wastes and the hazardous wastes are discussed in details below:

- The recyclable and non-recyclable non-hazardous solid waste generated onsite should be collected and stored in a temporary waste storage facility from where all wastes will be sent for recycling and disposal to appropriate facilities.
- The reusable wastes like wooden waste and cardboards from packing materials, empty cement bags, construction debris, etc. can also be given to locals for their use or give it back to original equipment manufacturer (OEM).

6.5.4 Storm Water Management Plan

The purpose of Storm Water Management Plan (SWMP) is to ensure prevention and control of any adverse impact caused by un-regulated storm water runoff from the main plant to the nearby natural drainage channels, surface water bodies, public and private properties.

Following measures will be taken as part of the Storm Water Management Plan:

- The peripheral drains will be provided outside the plant boundary during construction phase, which will prevent the silt contaminated surface run-off from site to enter into the adjoining lands.
- No surface run-off from within the solar power plant site will be directly discharged into any nallah/water body.
- Rain water collected from the project site will be used to recharge the ground water through onsite rain water harvesting tank/pits.
- Do not result in concentrated flows into natural watercourses i.e. provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural watercourses.
- Do not result in any necessity for concrete or other lining of natural watercourses to protect them from concentrated flows off the development.
- Do not divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.

6.5.5 Community Property Resource

During the project construction phase there might be some sharing of resources by the villagers and the workers working on the project. To an extent feasible this should be avoided to prevent potential conflicts between the project and the community. The movement of heavy vehicles and machineries might lead to conditions like disruption of electric wires and telephone wires in the project area and along transportation routes. All these damage utilities should be repaired/replaced to normal conditions, at the earliest. An account of the damage to the community resource should be documented and the root cause analysis carried out. The findings of the root cause analysis should also be documented and discussed with the agency/agencies found responsible for the incident. No water should be extracted from surface water bodies which are used by the community for drinking or domestic purpose. Any vacant or barren land, not assigned for project, should not be used for storage of fill/construction material, wastes, etc.

Renew Power and its contractors should ensure that the sharing of community resource is minimized by organizing necessary support infrastructure/facilities within premises. However, in case where sharing would be essential Renew Power (including contractors) should have an agreement with the Gram Sabha for the sharing of the resource. In case of damage to community property Renew Power including its contractors should ensure that it is repaired or replaced to the satisfaction of the community at the earliest. Renew Power

should maintain documentation of all incidents of damages to the community property. All cost for repair/replacement should be borne by Renew Power /contractor. As part of the Environmental and Social Management System proposed, a system should also be developed for recording such incidents and tracking the incident till it is closed to the satisfaction of the community.

6.5.6 Occupation Health and Safety Management Plan

The Occupational Health and Safety (OHS) of the employee and contractual labours will be maintained at the work sites during both construction and operation phase. The OHS Management measures shall comply with the Indian Regulatory requirements under OHSAS and the Factories Act.

Construction Phase: The following occupation health and safety measures will be adopted during the construction phase:

- Currently, the workers have been provided PPE's like face shields, helmets, goggles etc. However, it should be ensured that all workers wear their proper personal protective equipment (PPEs) i.e. safety shoes and goggle, helmet, coverall, gloves, ear plugs etc. as per their nature of work during construction related activities to ensure health and safety of workers at workplace.
- Ensure provision and maintenance of drinking water and sanitation facilitation for construction workers in accordance with the provision of Contract Labour Act and Building and Other Construction Workers Act.
- Periodic cleaning of work areas will be undertaken and supervised by the contractors to ensure hygienic conditions on site.
- Workers will stop working in extreme natural climatic conditions i.e. heat wave, heavy rain etc.
- All work places will have adequate fire alarms and firefighting equipment's to handle any outbreak of fire in O& M.
- Adequate drinking water will be supplied at workplace for workers onsite and water quality meets drinking water quality standards. Renew Power needs to ensure it through its contractors.
- Sufficient light and ventilation will be provided for workers working in confined space.
- Periodic health check-up camps for workers onsite will be organized to ensure prevention of occupational health hazards.
- All work areas should have First Aid kits to manage injuries occurring in the area.
- The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.

Operational Phase: Although no significant occupational health and safety risks are identified during operations, the following mitigation measures need to be adopted:

- Operators are provided with adequate PPEs depending upon nature of the operation and occupation health and safety risks associated with it viz. electrical maintenance activities etc.
- Special emphasis on electrical safety will be laid and all employees will be trained in electrical safety and First Aid
- Standard Operation Procedures (SOPs) will be developed for operational activities likely to have potential occupational health and safety risks
- Periodic medical examination will be undertaken for workers including contractor and subcontractor of the plant.
- Periodic inspections will be carried out to ensure all the above are implemented and any non-conformances will be recorded along with grievance related to OHS issues.
- An EHS coordinator will effectively implement and monitor the OHS Management System and ESMP.

6.5.7 Road Safety and Traffic Management Plan

The plan encompasses the addressal of community safety related impacts that may arise from the increased vehicular traffic due to movement of heavy equipment/machineries and vehicles along the site access and approach roads particularly during construction phase. The plan will be regularly updated by the contractor with the project progress and as vehicle movement requirements are identified in detail. Designated traffic coordinator will be responsible for overall coordination of traffic management.

During Construction Phase: The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.
- Any road diversions and closures will be informed in advance to the project vehicles accessing the above route. Usage of horns by project vehicles will be restricted near sensitive receptors viz. schools, settlements etc.
- Traffic flows will be timed wherever practicable during period of increased commuter movement in the day.
- Temporary parking facilities shall be provided within the work areas and the construction sites to avoid road congestion.
- Vehicular movement to be controlled near sensitive locations viz. schools, colleges, hospitals identified along designated vehicular transportation routes.
- Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.
- Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with local authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signage.
- The contractor(s) shall frame and implement a “No Drug No Alcohol” Policy to prevent road accidents/incidents.

During Operational Phase: Since limited vehicular movement is anticipated during operational phase considering only the daily movement of project personnel any impacts arising from the same can be effectively addressed through implementation of mitigation measures as discussed during the construction phase. In addiction following measures will be emphasised.

- Use of horns near the villages along the access road to villages, main plant and internal roads shall be restricted.
- The vehicular movements along the access roads and highways shall be restricted during the night time.
- All the vehicles entering the access roads and plant shall have Pollution under Control (PUC) certificates.
- The speed limit in the internal roads shall be restricted to 25 km/hr. Proper warning signs and road safety awareness posters shall be displayed to create road safety awareness among the personnel accessing the site.
- Periodic road safety and Traffic management campaigns and awareness sessions shall be carried out among the villagers and the plant workers/personnel to develop road safety awareness among the people likely to be impacted by the project.
- An emergency road safety plan shall be framed by the Proponent to combat any emergency conditions/accidents along the highways, access roads and within plant area.
- The Proponent shall frame and implement a “No Drug No Alcohol” Policy to prevent road accidents/incidents.
- The drivers shall be given an induction on road safety and traffic management policy.
- A permanent parking lot shall be provided within the main plant site (in individual work areas) and the associated facilities.

- Use of seat belts for both drivers and passengers shall be made compulsory to minimize death & injuries in the event of an accident.

7.0 CONCLUSION

The proposed project can be categorized as ***Category B*** which specifies that this project is expected to have limited adverse environment and social impacts which, can be mitigated by adopting suitable mitigating measures.

An environment and social analysis has been carried out looking at various criteria such as topography, air, noise, water resources and water quality, ecology, demography of the area, climate, natural habitat, community and employee health and safety etc.

Brief Assessment of Project:

- **Location of project site in ecologically sensitive area**: No ecologically sensitive area exist within and surrounding of project site
- **Source of Pollution**: The proposed solar power project is based on clean technology and does not cause pollution. Further, proposed project will help to reduce GHG emissions.
- **Resettlement:** No resettlement and rehabilitation involved in the project.
- **Community Willingness**: community is aware about the project and does not show unwillingness for the project due to clean technology. Further, landowners have provided their land on willing to sell and willing to buy basis
- **Project Benefit**: The produced electricity will be evacuated to the state electricity grid located at Mandamarri and will help to cater the energy requirement
- **Gender and Social Inclusion**: The CSR plan focused on community development and women empowerment will be implemented by the Renew Power
- **Indigenous People**: The project site falls under scheduled area. Adilabad district is government declared scheduled area and inhabitant of ST groups therefore land related rule and PESA Act becomes applicable. However, no land has been taken from ST people therefore negative impact and impact due to loss of livelihood on indigenous people is not anticipated.

There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people. There is no impact on cultural resources as well as indigenous people. Most impacts are expected to occur during the construction phase which are considered to be of a temporary in 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 any of the subproject sites. Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts.

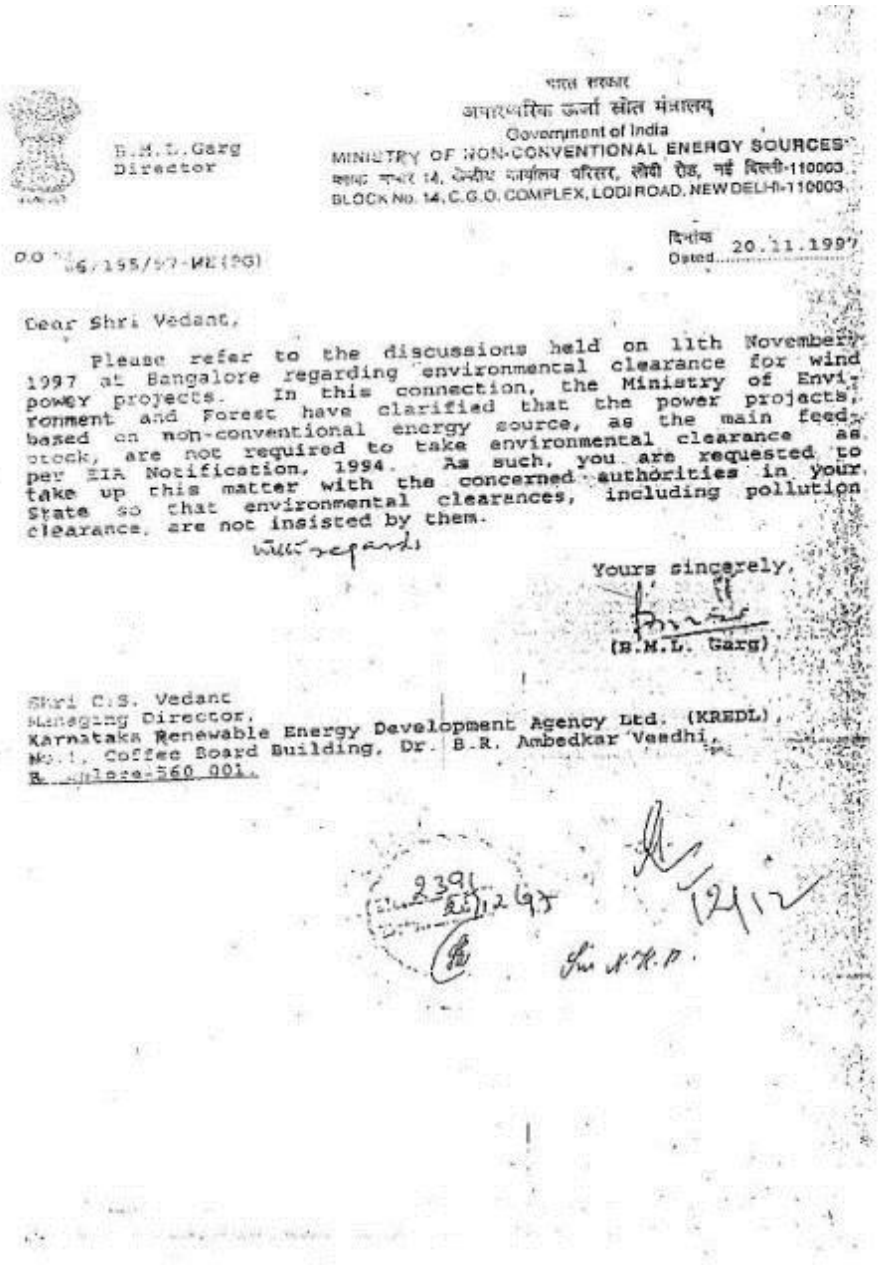
The proposed project will have number of positive impacts which are:

- The land has been procured for the project on willing to buy and willing to sell basis for which adequate compensation (i.e. more than the circle rate has been given to the land sellers. no economic and physical displacement happened in the project.
- During the construction phase, local populations often supply manpower for services such as those of drivers, vehicle vendors, contractors, watchmen etc.
- Natural canals exist adjacent and near the project site. It should not be disturbed. To rule out future storm water problems, storm water channels are planned along the periphery of the project site.
- A culvert bridge is proposed to construct over the natural drain which will help community to cross the drain without disturbing the water flow (especially during the monsoon).

Proper Grievance Redressal Mechanism (GRM) will have to be implemented by Renew Power to overcome public inconvenience during the proposed project activities. Based on the environmental and social assessment and surveys 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.

Therefore, setting up of the proposed Solar Power plant at the proposed site will not degrade the quality of surrounding environment, while improving the socio-economic conditions of the surrounding area.

Annexure I: MoEFCC Notification



भारत सरकार
अपारंपरिक ऊर्जा स्रोत मंत्रालय
Government of India
MINISTRY OF NON-CONVENTIONAL ENERGY SOURCES
ब्लाक संख्या 14, केन्द्रीय कार्यालय परिसर, लोदी रोड, नई दिल्ली-110003
BLOCK No. 14, C.G.O. COMPLEX, LODI ROAD, NEW DELHI-110003

B.M.L. Garg
Director

दिनांक 20.11.1997
Dated

D.O. No. 6/195/97-WE(SG)

Dear Shri Vedant,

Please refer to the discussions held on 11th November, 1997 at Bangalore regarding environmental clearance for wind power projects. In this connection, the Ministry of Environment and Forest have clarified that the power projects, based on non-conventional energy source, as the main feedstock, are not required to take environmental clearance as per EIA Notification, 1994. As such, you are requested to take up this matter with the concerned authorities in your State so that environmental clearances, including pollution clearance, are not insisted by them.

With regards

Yours sincerely,

(B.M.L. Garg)

Shri C.S. Vedant
Managing Director,
Karnataka Renewable Energy Development Agency Ltd. (KREDL),
No.1, Coffee Board Building, Dr. B.R. Ambedkar Veedhi,
Bangalore-560 001.

2391 12/97

12/12

Shri V.K.D.

Annexure II: Exemption of Consent to Establish and Consent to operate for White category industry (sample pages)

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
(पर्यावरण एवं वन मंत्रालय, भारत सरकार)
MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA

No.B-29012/ESS(CPA)/2015-16/ March 07, 2016

To

The Chairman
All the State Pollution Control Boards / Pollution Control Committees
(List Attached)

SUB: MODIFIED DIRECTIONS UNDER SECTION 18(1)(b) OF THE WATER (PREVENTION & CONTROL OF POLLUTION) ACT, 1974 and THE AIR (PREVENTION & CONTROL OF POLLUTION) ACT, 1981 REGARDING HARMONIZATION OF CLASSIFICATION OF INDUSTRIAL SECTORS UNDER RED / ORANGE / GREEN / WHITE CATEGORIES.

WHEREAS, under section 16 (2)(b) of the Water (Prevention and Control of Pollution) Act, 1974 and under Section 16 (2)(c) of the Air (Prevention & Control of Pollution) Act, 1981, one of the functions of the Central Pollution Control Board (CPCB), constituted under the Water (Prevention and Control of Pollution) Act, 1974, is to coordinate activities of the State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs); and

WHEREAS, under section 16 (2)(c) of the Water (Prevention and Control of Pollution) Act, 1974 and under Section 16 (2)(d) of the Air (Prevention & Control of Pollution) Act, 1981, one of the functions of the CPCB is to provide technical assistance and guidance to SPCBs and PCCs; and

WHEREAS, it was brought to the notice of CPCB, that different SPCBs /PCCs were following different criteria for classification of industrial sectors under Red/Orange/ Green category and that classification was being used by the SPCBs/PCCs for grant of consents to industries and for Inventorization / surveillance of industries.

WHEREAS, the issue regarding classification of industries was deliberated upon in the 56th Conference of Chairmen & Member Secretaries of CPCB & SPCBs/PCCs held on August 31, 2010 and a working group comprising of representatives from SPCBs & CPCB was constituted to prepare a consolidated list of industrial sectors falling under Red/Orange/Green category to bring uniformity in classification of industrial sectors across the country;

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'Parivesh Bhawan', East Arjun Nagar, Delhi - 110032
दूरभाष/Tel : 43102030, फैक्स/Fax : 22305792, 22307078, 22307079, 22301932, 22301948
ई-मेल/e-mail : cpcb@nic.in वेबसाईट/Website : www.cpcb.nic.in

WHEREAS , based on the series of consultations with SPCBs, different Government / Non-government Institutions including industries and MoEFCC , the following criteria on 'Range of Pollution Index 'for the purpose of categorization of industrial sectors has been finalized:

- Industrial Sectors having Pollution Index score of 60 and above - Red category
- Industrial Sectors having Pollution Index score of 41 to 59 -Orange category
- Industrial Sectors having Pollution Index score of 21 to 40 -Green category
- Industrial Sectors having Pollution Index score incl. & upto 20 -White category

WHEREAS, based on the revised criteria, the 'Final Report on Revised Categorization of Industrial Sectors under Red/Orange/Green/White' has been evolved. The 'Categorization' is based on the relative pollution potential of the industrial sectors and grouping of the industrial sectors based on the use of raw materials, manufacturing process adopted and pollutants likely to be generated;

WHEREAS, based on relative Pollution Index, the number of industries in various categories are as under :

i. The Red category of industrial sectors: 60
ii. The Orange category of industrial sectors: 83
iii. The Green category of industrial sectors: 63 and
iv. The Newly introduced White category: 36

WHEREAS, there shall be no necessity of obtaining the Consent to Operate" for White category of industries and an intimation to concerned SPCB / PCC shall suffice;

WHEREAS, the purpose of categorization is to ensure that the industry is established in a manner consistent with the environmental objectives and to prompt industrial sectors to adopt cleaner technologies, ultimately resulting in generation of no or minimum pollutants.

WHEREAS the new categorization system shall also facilitate in self-assessment by industries;

Now, therefore, in exercise of the powers delegated to the Chairman, CPCB under Section 18(1)(b) of the Water (Prevention & Control of Pollution) Act, 1974 and Section 18(1)(b) of the Air (Prevention & Control of Pollution), Act , 1981 the earlier Directions issued in June 2012 in the context of categorisation of industries as Red, Orange & Green are withdrawn with immediate effect and following **'Directions'** are hereby issued for compliance by all SPCBs and PCCs :

Annexure III: ILO Guidelines

No.6

ILO HELPDESK

ASSISTANCE@ILO.ORG

International Labour Organization

Workers' housing

Housing provided to workers as part of the employment contract should meet certain minimum specifications in respect of the nature and standard of the accommodation and facilities to be made available.

The following guidance is based on international labour standards. National or state regulation will often set baseline specifications as part of housing, labour, health or even fire safety regulations; they should be checked and followed. National employers and workers organizations may also be a good source of information on national law, collective bargaining agreements and customs pertaining to housing for workers; or may be able to refer you to the appropriate statutory authority.

Guiding principles

➡ In providing worker[1] housing, the objective should be to ensure "adequate and decent housing accommodation and a suitable living environment"[2] for workers. This includes upkeep, improvement and modernisation of housing and related community facilities.[3]

It is "generally not desirable that employers should provide housing for their workers directly".[4] Employers are encouraged to help their workers to obtain housing through autonomous private agencies, public housing schemes, or cooperatives.[5] This is because workers living at the work site on property owned or controlled by the employer tend to be less integrated into the local community, and more dependent on the employer. However, certain circumstances, such as when an undertaking is located far from normal centres of population, or where the nature of the employment requires that the worker should be available at short notice may require the employer to provide housing for his or her workers.[6]

If housing is provided by the employer "the fundamental human rights of the workers, in particular freedom of association, should be recognised."[7] Arrangements where accommodation and communal services are provided as payment for work should take care to ensure that the interests of the workers are protected. If rent is charged, it should not cost the worker more than a reasonable proportion of his or her income.[8]

Siting and construction

➡ The housing and related community facilities should be of durable construction, taking into account local conditions, such as liability to earthquakes.[9]

The location of workers' housing should ensure that workers are not affected by air pollution, surface run-off or sewage or other wastes.[10]

Housing Standards

➡ Housing should ensure "structural safety and reasonable levels of decency, hygiene and comfort".[11] The undertaking should ensure the following:

a) a separate bed for each worker;
b) adequate headroom, providing full and free movement, of not less than 203 centimetres;
c) the minimum inside dimensions of a sleeping space should be at least 198 centimetres by 80 centimetres;
d) beds should not be arranged in tiers of more than two;
e) bedding materials should be reasonably comfortable;
f) bedding and bedframe materials should be designed to deter vermin;
g) separate accommodation of the sexes;
h) adequate natural light during the daytime and adequate artificial light;
i) a reading lamp for each bed;
j) adequate ventilation to ensure sufficient movement of air in all conditions of weather and climate;
k) heating where appropriate;
l) adequate supply of safe potable water;
m) adequate sanitary facilities (see below);
n) adequate drainage;
o) adequate furniture for each worker to secure his or her belongings, such as a ventilated clothes locker which can be locked by the occupant to ensure privacy;
p) common dining rooms, canteens or mess rooms, located away from the sleeping areas;
q) appropriately situated and furnished laundry facilities;
r) reasonable access to telephone or other modes of communications, with any charges for the use of these services being reasonable in amount; and

[1] Workers' Housing Recommendation, 1961 (No. 115). The section entitled "Suggestions concerning methods of application," Part I, paragraph 6, encourages "equality of treatment between migrant workers and national workers". Therefore, this guidance applies equally to migrant workers and national workers.
[2] R. 115, General Principles, Part II, paragraph 2.
[3] R. 115, paragraph 3.
[4] R. 115, Part IV, paragraph 12(2).
[5] R. 115, Part IV, paragraph 12(1).
[6] R. 115, Part IV, paragraph 12(2).
[7] R. 115, Part IV, paragraph 12(3a).
[8] R. 115, Part II, paragraph 4, Part IV, paragraph 12(3c) and (4).
[9] R. 115, Suggestions Concerning Methods of Application, Part I, paragraphs 10-11.
[10] R. 115, Suggestions Concerning Methods of Application, Part IX, paragraph 43.
[11] R. 115, paragraph 19.

s) rest and recreation rooms and health facilities, where not otherwise available in the community.

In workers' sleeping rooms the floor area should not be less than 7.5 square metres in rooms accommodating two persons; 11.5 square metres in rooms accommodating three persons; or 14.5 square metres in rooms accommodating four persons. If a room accommodates more than four persons, the floor area should be at least 3.6 square metres per person. Rooms should indicate the permitted number of occupants.

As far as practicable, sleeping rooms should be arranged so that shifts are separated and that no workers working during the day share a room with workers on night shifts.

Sanitation facilities

➡ Adequate sanitary facilities should include a minimum of one toilet, one wash basin and one tub or shower for every six persons. They should be provided at a convenient location which prevents nuisances. Sanitary facilities provided should meet minimum standards of health and hygiene. They should also provide reasonable standards of comfort, including hot and cold fresh running water. There should be separate sanitary facilities provided for men and for women. Sanitary facilities should have ventilation to the open air, independently of any other part of the accommodation. Soap and hygienic paper should be adequately stocked.

Health and safety

➡ As far as possible, floors walls, ceilings and equipment should be constructed to minimize health risks.

The accommodations should be kept free of rats, mice, insects and vermin. In areas where mosquitoes are prevalent, workers should be provided netting.

Measures should be taken to prevent the spread of diseases. Separate facilities should be provided for sick workers to prevent the spread of transmissible diseases among the occupants. Fire safety measures should be taken, including installing and maintaining fire equipment (alarms, extinguishers, etc.). Workers should be trained in fire procedures. Bedding should not contain flammable materials. Radiators and other heating apparatus should be placed so as to avoid risk of fire, and shielded where necessary to prevent discomfort to occupants.

Safety exits should be clearly marked. Adequate means of escape should be provided and properly maintained.

Provisions should be made for workers' physical safety and well-being, and protection of their belongings. Measures should be reasonable and not unduly restrict workers' freedom of movement. Workers should be allowed visits for social relations or business, including trade union business.[12]

Inspection of premises

➡ Premises should be inspected frequently to ensure that the accommodation is clean, decently habitable and maintained in a good state of repair. The results of each such inspection should be recorded and be available for review.

Vacating the premises upon termination of employment

➡ When a worker's contract of employment is terminated, the worker should be entitled to a reasonable period of time to vacate the premises, in accordance with national law and custom.[13]

Consultation

➡ In the design of housing for workers, "every effort should be made to consult those bodies representative of future occupants best able to advise on the most suitable means of meeting their housing and environmental needs."[14]

References

➡ Workers' Housing Recommendation, 1961 (No. 115); full text available at: http://www.ilo.org/ilolex/english/recdisp1.htm.

➡ For comparison, you may also wish to consult the Maritime Labour Convention (MLC), 2006, Title 3, which gives detailed guidance for workers' accommodation for seafarers; full text available at: http://www.ilo.org/ilolex/cgi-lex/convde.pl?C186.

[12] R. 115, Suggestions Concerning Methods of Application, Part IV, paragraph 17.
[13] R. 115, General Principles, Part IV, paragraphs 12(3b) and Suggestions Concerning Methods of Application, Part IV, paragraph 15.
[14] R. 115, Suggestions Concerning Methods of Application, Part IX, paragraph 42.

ILO Helpdesk
Multinational Enterprises Programme
International Labour Office
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1211 Geneva 22, Switzerland
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Fax: +41.22.799.6354
assistance@ilo.org

Annexure IV: Framed Social Questionnaire

Name of the village				*Panchayat*				
Tehsil/Block				*District*				
Respondent					*Date:*			
Total Population		*Total Male*			*Total Female*		*HH No.*	
Religion	*Name*	*%*		*Name*	*%*			
Caste/Group	*Name*	*%*		*Name*	*%*			
	Name	*%*		*Name*	*%*			
Education Level	*Illiterate %*	*Primary %*		*Secondary %*	*H.S. %*		*Graduate %*	
Occupation	*Agriculture %*	*Business %*		*Service %*	*Labour %*		*Other %*	
Source Drinking water facility	*Tube well*	*Dug well*		*Stream*	*Piped water*		*Hand pumps*	
Sanitation facility	*Pit latrine %*	*Sanitary latrine %*		*Open defecation %*	*Other %*			
Electricity (Available %)				*Electricity availability in HH*				
Village road type/transport facility								
Schools (distance)	*Primary*	*Middle*		*H. S.*	*College*		*Anganwadi*	
Health Facility (distance)	*Health sub Centre*	*Primary*		*Hospital*	*Others*			
Major diseases								
Major crops cultivated	*Name*	*Period*	*Yield (q/acr)*	*Rate/q*	*Name*	*Period*	*Yield (q/acr)*	*Rate/q*

Irrigation Facility	*Ponds*	*River*	*Groundwater*	*Others*	
Average land holding size					
Land rights					
Livestock	*Cow*	*Buffalo*	*Goat*	*Pig*	*Fowl*
	Duck	*Others*			
Grazing areas					
Cooking medium and source	*Fuel Wood*	*Kerosene*	*Cow Dung cake*	*Crop Residue*	*LPG*
	Others				
Common property Resources(CPR)	*Religious and cultural places*	*Sacred places*	*Community hall*	*community Ponds*	*Cremation ground*
	Streams	*canal*	*river*	*Others*	
Major rituals and festivals	*Name*	*Period*	*Name*	*Period*	
Fishing area		*Name of the*			
Forest	*Wood*	*Timber*	*NTFP*	*Others*	
Any Vulnerable Groups like- landless/homeless- people, Women headed HH, Orphans etc.					
Any program related to child / women health care program					
Any employment generation program					
HH & Cottage industries in the village / area					

Any proposed Scheme / Program related infrastructure / any amenities
Occurrence any Natural Calamities / industrial / anthropogenic Hazard

Annexure - V: Protected Monuments in Adilabad District

S.No	Name of the Monument	Village	Mandal/Adilabad
1	Siva Temple	Asifabad	Asifabad
2	Siva Temple	wankidi	wankidi/
3	Vaishnavite Temple	Gangapur	Asifabad
4	Neolithic Implements	Pareshwar	Asifabad
5	Wood Fossils	Asifabad	Asifabad
6	Hindu Temple (Lakshmi Narayana Temple)	Jainad	Jainad
7	Mosque	Adilabad	Adilabad
8	Siva Temple	Gudihatnur	Boath
9	Cairns & Menhir	Gudihatnur	Boath
10	Stone Circle	Guraj	Boath
11	Neolithic Implements	PocheraWater Falls	Boath
12	Neolithic Implements	Dho-ur	Boath
13	Neolithic Implements	Islapur	Boath
14	Neolithic Implements	Kuntala	Neredigonda
15	Papahareswara Temple	Kandli	Bazarhathnoor
16	Fortifications	Lakshettipet	Lakshettipet
17	Neolithic Implements	Pangir	Bhainsa
18	Gopaliji's Temple & Other Temple, Inscriptions on the Tank Bund.	Bhainsa	Bhainsa
19	Idgah & Muslim Daraghas	Bhainsa	Bhainsa
20	Gnana Saraswathi Temple	Basara	Mudhole
21	Stone Circle	Sirla Degaon	Bhainsa
22	Fort	Shamgadh	Nirmal
23	Fort	Sonagadh	Nirmal
24	Neolithic Implements	Sonagadh	Nirmal
25	Stone Circle	Sonagadh	Nirmal
26	Mahadev Temple	Nirmal	Nirmal
27	Jami Masjid (Late Qutubshahi Style)	Nirmal	Nirmal
28	Fortifications	Nirmal	Nirmal
29	Saradmahal	Nirmal	Nirmal
30	Neolithic Implements	Narsapur	Ichoda
31	Neolithic Implements	Khanapur	Khanapur
32	Fossils	Sirpur	Sirpur (Kagajnagar)
33	Siva Temple	Utnur	Utnur
34	Fort & Idgah	Utnur	Utnur

S.No	Name of the Monument	Village	Mandal/Adilabad
35	Gandhari Kota	Timmapur (Gandharikota)	Mandamarri
36	Ancient Mound with two pairs of Carved Feet	Bhainsa	Bhainsa
37	Mahadev Temple	Sadulpur	Bela

Source; *Archaeology survey of India/Telangana*

Annexure - VI: Stakeholders Participants List

Stakeholder holder's participation list

Sr. No.	Person Name	Gender M/F	Designation	Village/township/local govt. institution	Date
1	G. Ramu	M	Project Incharge	Land Aggregator SR Power	12/7/16
2	Mahesh	M	Land owner	Andugulapet Village	12/7/16
3	Tirupathi Reddy	M	Land Owners	Andugulapet	12/7/16
4	B. Laxmon	M	Land owner	Andugulapet Village	12/7/16
5	Rajesh M.	M	Land owner	Andugulapet Village	12/7/16
6	L. Mallu	M	Sarpanch	Andugulapet village.	12/7/16
7	Shantamma	F	SHG Members	Andugulapet	13/7/16
8	Lakshmi	F	SHG Member	Andugulapet Villag	13/7/16
9	Sarita	F	Staff Nurse	PHC, Mandamarri	13/7/16
10	Mr. Praveen	M	Site incharge	Renew Power	13/7/16
11	Dhirendra Singh	M	Sociologist	ARCADIS	14/7/16
12	Girish Shukla	M	Env. Expert	ARCADIS	14/7/16
13	Sugandha Rastogi	F	Ecologist	ARCADIS	14/7/16

Annexure - VII: Checklist for Preliminary Climate Risk and Screening

A Checklist for Preliminary Climate Risk Screening

Country/Project Title:
Sector :
Subsector:
Division/Department:

Screening Questions		Score	Remarks[22]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?		
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?		
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?		
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?		
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?		

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High):_____

Other Comments:_____
_____

Prepared by: _____

_____

[22] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

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