

Initial Environmental Examination

Project Number: 44932
August 2012

IND: 145 MW Grid-connected Solar Project

Prepared by Hiraco Renewable Energy Pvt. Ltd.

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Initial Environmental Examination

20 MWp Hiraco Solar Power Project

August 2012



Prepared by
Hiraco Renewable Energy Pvt. Ltd.

The company hereby acknowledges that as per the mandate letter signed between company and Ernst & Young Pvt. Ltd. (EY) on 6th January 2012, EY has assisted the company in preparation of the Initial Environmental Examination Report based on data and information provided by the company to EY.

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Abbreviations

ADB	-	Asian Development Bank
CER	-	Certified Emission Reduction
EIA	-	Environment Impact Assessment
ESCA	-	Environment and Social Compliance Assessment
ESMMP	-	Environment and Social Mitigation and Monitoring Plan
GETCO	-	Gujarat Energy Transmission Corporation Limited
GPCB	-	Gujarat Pollution Control Board
GRC	-	Grievance Redressal Committee
GUVNL	-	Gujarat Urja Vikas Nigam Limited
IEE	-	Initial Environmental Examination
IFC	-	International Finance Corporation
NAAQS	-	National Ambient Air Quality Standards
Nallah	-	Drain or Stream
PPA	-	Power Purchase Agreement
PV	-	Photo Voltaic
SIPC	-	Salinity Ingress Prevention Circle
HREPL	-	Hiraco Real Estate Private Limited

Standard Weights and Measures

ha (hectare) – 10,000 square meters
km (kilometer) – 1,000 meters
kV – kilovolt (1,000 Volts)
kW – kilowatt (1,000 Watts)
kWh – kilowatt-hour
MWp – Mega Watt Peak
MU – Million Units

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Executive Summary

Background

Hiraco Renewable Energy Private Limited (HREPL) was incorporated on 4th November 2010 to setup a 20 MWp solar photo-voltaic (PV) power project at villages Bapodar & Kerala, District Porbandar, in the state of Gujarat (India). Porbandar is a coastal region and is surrounded by Jamnagar district in the North, Junagadh district in the south and Arabian Sea in the West. The project is implemented under the Solar Power Policy 2009 of Gujarat. HREPL has already signed a Power Purchase Agreement (PPA) for 25 years with Gujarat Urja Vikas Nigam Limited (GUVNL) with permission from Government of Gujarat, for sale of the power generated from the project.

Objectives

The objectives of the proposed IEE study include:

- ▶ Identify the major issues that may arise as a result of proposed works on biophysical, socio-economic and cultural environment of the project area;
- ▶ Recommend site specific environmental impact mitigation measures, prepare and implement environmental monitoring plan for the project, and
- ▶ Addressing the requirements of ADB's Safeguard Policy Statement and IFC Environment, Health and Safety Guidelines.

Study Methodology

The findings and conclusions of the report are based on the analysis of the information collected during field visits in the project area and data collected through secondary sources such as Forest Atlas and published GOIs data from 2001 population census statistics data, as well as relevant project documentation received from regulatory authorities such as Gujarat Energy Transmission Corporation Limited (GETCO), Gujarat Pollution Control Board (GPCB), and other Government Departments.

Baseline Environmental Condition

The project site is not located in or near a sensitive ecosystem. Review of the secondary literature and site visits confirmed the absence of unique or ecologically significant flora and fauna. The nearest wildlife sanctuary, Porbandar Bird Sanctuary is about 25 km away from the project site and Barda Wildlife Sanctuary, is about 40 km away from the project site. (Source: www.mapsofindia.com/gujarat/.../barda-wildlife-sanctuary.html; <http://www.indianwildlifetourism.com/bird-sanctuaries-india/porbandar-bird-sanctuary.html>)

The water requirement for the project is minimal. The main consumption of water in the project is for cleaning of the solar modules. The total water requirement at the project site is estimated to be about 10,500 litres per day.

The total land required for the Project's solar power generation facility is 62.63 Hectares (ha).

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The land acquired for the project is totally private land and has been purchased on a voluntary basis (willing seller-willing buyer basis) from the land owners. The land purchased for the project is classified as agriculture land but the fertility of the land has been degraded over a period of time due to problem of salt water ingress in the area. (Source: <http://www.cspc.org.in/download/Porbandar.pdf>). As per the land owners, the sale of land came as an opportunity to earn income from an otherwise unproductive land. The payment provided against the land purchased has helped these farmers to find alternative land in a more fertile area or start an alternate livelihood.

The solar power plant will be using the following associated facilities for the project: access roads, transmission lines and sub-station. The project will utilize the existing village road; no new roads will be built as part of this project. The length of the access road to the site from the main road is around 3 kilometers. The power generated from the proposed solar power plant would be evacuated through a 66 KV transmission line to Rana Kandorna Sub-Station of GETCO, situated about 13.5 km from the project site and shared with 15MW Solar Power Plant namely, Moser Baer Energy and Development Limited. The substation of GETCO is existing for more than 10 years.

The land where the Project's solar power generation facility is being constructed is not owned, used, occupied, or claimed as ancestral domain or asset of any tribal groups. The project is therefore expected to be classified as category C for both involuntary resettlement and IPs.

Legal policies and institutional framework

This report has been prepared with reference to the ADB's Safeguards Policy Statement (SPS) that specifies safeguards requirements on applicable environment and social legislation.

MoEF in its Office Memorandum No. J-11013/41/2006-IA.II (I) dated 13th May, 2011 stated that the Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification, 2006 and hence, no environmental clearance is required. Hence, the Solar Power PV Projects does not require preparation of Environmental Impact Assessment Report and pursuing Environmental Clearance from Central Government or State Level Environmental Impact Assessment Authority. However, the project has either complied with or has taken steps to ensure compliance with the other relevant national and local statutory regulations applicable on the proposed project

Benefits due to Proposed Project

The proposed Project brings in multifold advantages. Not only will it produce clean, pollution free energy, it will also generate employment opportunity to the people living in and around that area. Thus, generation of allied employment and income generation activities will improve the quality of life of the community.

CDM benefit

The project is expected to generate approximately 33425 CERs on an annual basis over the next 10 years (crediting period).

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Potential Environmental and Social Impacts

The IEE report comprises of baseline data on existing conditions on physical and biological environment, and social environment together with the anticipated environmental impacts and proposed mitigation measures. Field surveys were undertaken to assess physical and biological environment and data collection from secondary sources has been done to support the findings of the field survey. The field studies were supported by review of secondary data.

All the issues such as acquisition of land, ecology, influx of people during construction phase, shelter and sanitation, the equipments and machineries, environmental health and safety, occupational hazard, social and environment management and monitoring plan have been dealt in detail in the respective sections of the Report. However these are briefly enumerated below to have a quick assessment of the situation.

Environmental Parameter	Level of Impact	Reason	Proposed Mitigation Measures
Air Impact	Low	Insignificant air emissions during the construction phase while no emissions are envisaged from the process/operation as it's a solar based power project	<ul style="list-style-type: none">▶ Sprinkling of water▶ Proper handling of excavated soil
Water	Low	<ul style="list-style-type: none">▶ Plant will require a very low amount of water for cleaning of modules and domestic consumption.▶ No hazardous effluent is envisaged to be discharged from the plant that may have an impact.	<ul style="list-style-type: none">▶ In the case of wet cleaning of solar panels, the amount of water needed is insignificant▶ HREPL water requirement will only be 10,500 litres per day and will be sourced from bore wells at site▶ Domestic effluent shall be discharged in soak pits.▶ Workers shall be encouraged to maintain cleanliness at the project site
Land	Medium	Impact of change in land use	<ul style="list-style-type: none">▶ CSR activity will be undertaken by the Company based on community consultations▶ Giving priority in jobs to the local people with first priority given to the project affected family
Noise	Low	<ul style="list-style-type: none">▶ No sources of noise within the project area except the diesel generator (DG) sets which would be used only during the construction phase of the project and would be acoustically enclosed▶ As no sensitive locations in the vicinity of the project site.	DG Sets with acoustic enclosures to be used at the project site during the construction stage to maintain the noise level within permissible limits.
Ecosystem	Low	<ul style="list-style-type: none">▶ As no ecologically sensitive place lies within 10 km radius from the project site	Although there is no significant vegetation cover within the study area, plantation activities will be

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			carried out.
Socio-economic	Low	<ul style="list-style-type: none"> ▶ The project will not in any way affect the dignity, human rights, livelihood systems and culture of the residents of the village. Moreover, the lands where the project's solar power generation facility are being constructed are not owned, used, occupied, or claimed as ancestral domain or asset of any tribal groups. ▶ The peak labour population is approximately 650-700 laborers for three months during the construction phase and may have an impact on the social fabric of the area surrounding the project. However, this impact is envisaged to be insignificant due to the following reasons: <ul style="list-style-type: none"> ▶ Temporary labour colonies, equipped with basic amenities, will be provided ▶ The impact is temporary in nature as it is restricted to the construction phase of the project. After construction phase, the areas acquired by labour colonies shall be reverted to the status at the preconstruction phase. <p>Therefore, conflict of the migrating labour with locals will not take place</p>	<p>A Resettlement Framework will be adopted by the Company to mitigate involuntary resettlement impacts (if any).</p> <p>Construction labour will be housed on temporary construction camps specially developed for this purpose with all basic amenities.</p>

Conclusions

The IEE study of the proposed PV based Solar power project indicates that the benefits from the implementation of the proposed solar power project are significant and long term in nature. The study also establishes that the adverse impacts, if any, can be easily mitigated or avoided. The proposed Solar PV project falls under '**Category-B**' as per ADB's Environmental Categorization due to limited adverse environmental impacts and these are limited to site specific, largely reversible and can be readily addressed through mitigation measures.

The Environmental Compliance Audit Report attached as Appendix A determines the project's compliance with respect to the ADB Safeguard Policies and defined monitoring and mitigation plan.

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CHAPTER 1: INTRODUCTION

1.1 Background

Hiraco Renewable Energy Private Limited (HREPL) was incorporated on 4th November 2010 to setup a 20 MWp solar power project at villages Bapodar & Kerala District Porbandar, in the state of Gujarat (India). The project is implemented under the Solar Power Policy 2009 of Gujarat. Crystalline Silicon PV (Photo Voltaic) solar cells shall be used in the project to generate electricity. HREPL (the 'Company') has already signed a Power Purchase Agreement (PPA) for 25 years with Gujarat Urja Vikas Nigam Limited (GUVNL) with permission from Government of Gujarat, for sale of the power generated from the project.

Table.1: Project details

Sl. No	Particulars	Descriptions
1	Project site	Hiraco
2	Village Name (s)	Bapodar & Kerala
3	District Name	Porbandar
4	Name of the state	Gujarat
5	Latitude	21' 37' 39.4" (North)
6	Longitude	69' 49' 57.1" (East)
7	Road Accessibility	Road connectivity via Porbandar
8	Nearest Airport	Porbandar
9	Nearest City	Porbandar
10	Land available (Hectares)	62.63
11	Water requirement (LPD)	10,500
12	Annual Global Irradiance (kWh/m ²)	2059
13	Type of PV Module	Cr-Si
14	Proposed Capacity (MW)	20
15	Capacity of modules proposed (Wp)	230 to 245

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16	Total no of PV modules (Number)	85560
17	Inverter model	Sunny central 800KW 3 Phase PCU
18	Annual electricity supplied to grid (MWh)	35249
19	Annual Plant Load factor (%)	20.22
20	Project Cost (Million INR)	2365

1.2 Need for the Project

Fast economic growth of the state of Gujarat has resulted in increase in electricity consumption by the industrial and commercial sectors. With the current available capacity, Gujarat is not in a position to meet its requirement either in terms of energy requirement or peak capacity requirement. Energy requirements of the Gujarat state has increased from 53693 MU in FY 2001-02 to 70412 MU in FY 2009-10 with an energy shortfall of 3149 MU in FY 2009-10.

The Electricity Act 2003 stipulates minimum percentage of energy to be derived out of renewable energy sources which shall be binding on all states. Also the Gujarat Electricity Regulatory Commission has made it mandatory for distribution licensees in the state to purchase a fixed percentage of their total power procurement through renewable energy sources, both solar and non solar.

1.3 Purpose/Objectives of IEE

The purpose of conducting IEE is to provide information about the general environmental settings of the project area, identify impacts of the project activities on bio-physical, socio-economic and cultural environment of the project, recommend site specific environmental mitigation measures, prepare and implement environmental monitoring plan for project area and to make sure that IEE addresses the requirements of the following:

- ▶ ADB's Safeguard Policy Statement, July 2009
- ▶ Relevant host country laws, regulations, applicable treaties and agreements
- ▶ IFC Environment, Health and Safety Guidelines for Electric Power Transmission and Distribution, April 2007
- ▶ IFC Environment, Health and Safety General Guidelines, April 2007

The assessment of the project has been carried out for both positive and negative impacts. It is expected that the adoption of green power generation technology will not have any significant adverse impact on the environment. The project, apart from generating clean power will also carry associated socio-economic benefits for the local community.

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1.4 Methodology and approach of IEE

The following activities were undertaken for the purpose of conducting IEE:

- ▶ Data collection from secondary sources such as Forest Atlas and published GOIs data from 2001 population census statistics data, as well as from authorities such as Gujarat Energy Transmission Corporation Limited (GETCO), Gujarat Pollution Control Board (GPCB), and other Government Departments.
- ▶ Preparation of checklist for collecting project related information against applicable guidelines
- ▶ Review of national and local laws / regulations and procedures relating to land acquisition, resettlement and rehabilitation etc.
- ▶ Review of land allocation documents, permits and other relevant documents
- ▶ Field visits to collect data relevant to the study area
- ▶ Interviews on a sample basis with the following stakeholders:
 - ▶ Employees at the site
 - ▶ Land owners
 - ▶ Contract labour including their family members staying at the labour camps
 - ▶ Local community people around the site

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CHAPTER 2: LEGAL POLICIES AND INSTITUTIONAL FRAMEWORK

Due to ever-increasing demand for energy, the Government of India is taking up concerted efforts to meet energy requirements by lowering the demand-supply gap and strategically developing energy security of the country. India has formulated strategies to explore the potential of all renewable energy resources like hydro, wind and solar along with biomass.

There are a number of drivers which are attracting investment for utilization of the solar energy to produce electricity. Some of these are highlighted below:

- ▶ Government of India has announced Jawaharlal Nehru National Solar Mission which envisages setting up of Solar Power Projects of 20,000MW capacity by 2022.
- ▶ State Regulatory Commissions have specified a percentage of the total purchases to be made from non-conventional energy sources (Renewable Purchase Obligation).
- ▶ The Government of Gujarat, in order to promote grid connected solar energy generation, has come out with Solar Power Policy-2009 which is operational up to 31.04.2014. The Government of Gujarat has allotted 716 MW of Solar Power projects to 34 national and international project developers against 500 MW.
- ▶ There are a number of benefits like reduced dependence on fossil fuels, flexible in terms of location and least impact on environment. Moreover, there is a huge unexplored potential in terms of solar radiance available in the state of Gujarat.

In view of the above, the 20 MWp Solar Power Project of HREPL being implemented in the state of Gujarat is in line with the Indian government's policies around promotion of solar energy projects to provide clean and sustainable energy for the nation.

2.1 Regulatory Framework

This section provides a brief summary of India's relevant national environmental legislation. Ministry of Environment and Forests (MoEF) is the nodal agency for drafting the new environmental legislations and giving the Environmental Clearance (EC) to the projects.

MoEF in its Office Memorandum No. J-11013/41/2006-IA.II (I) dated 13th May, 2011 stated that the Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification, 2006 and hence, no environmental clearance is required. Hence, the Solar Power PV Project does not require preparation of Environmental Impact Assessment Report and pursuing Environmental Clearance from Central Government or State Level Environmental Impact Assessment Authority.

For the Gujarat State, the State Level Environment Impact Assessment Authority (SEIAA) and the State Level Expert Appraisal Committee (SEAC) were constituted vide the MoEF, GOI, Notification No. S.O.948 (E) dated 12-06-2007 and the Gujarat State, Forests and Environment Dept. Resolution No. ENV/10.2006/176/P dated 25/07/2007. In addition, the Gujarat State Pollution Control Board's guidelines for project proponents apply to all state projects.

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Apart from the above, other relevant national and local statutory regulations that are to be followed by proposed project are summarized below:

- ▶ The Water (Prevention and Control of Pollution) Act, 1974
- ▶ The Air (Prevention and Control of Pollution) Act, 1981
- ▶ The Environment Protection Act, 1986, Rules there under (with amendments)
- ▶ The Ozone Depleting Substances (Regulation and Control) Rules, 2000
- ▶ The Indian Forest Act, 1927 as amended
- ▶ Batteries (Management and Handling) Rules, 2001
- ▶ National Environmental Appellate Authority Act 1997
- ▶ The Wildlife (Protection) Act 1972
- ▶ Noise Pollution (Prevention & Control) Rules 2000
- ▶ Hazardous Wastes (Management, Handling and Tran-boundary movement) Rules, 2009
- ▶ Solar Power Policy-2009 of Gujarat
- ▶ Land Acquisition Act, 1894 and its subsequent amendment
- ▶ Minimum Wages Act, 1948
- ▶ Child Labour (Prohibition and Regulation) Act, 1986
- ▶ Contract Labour (Regulation and Abolition) Act, 1970
- ▶ National Rehabilitation and Resettlement Policy, 2007
- ▶ Factories Act, 1948
- ▶ Workers Compensation Act, 1923

2.2 ADB's Environmental and Social Assessment Framework

This report has been prepared with reference to ADB's Safeguards Policy Statement (SPS) that specifies environmental and social safeguards requirements to the proposed project.

2.2.1 ADB's Safeguard Policy Statement (2009)

ADB's safeguard policies (SR) as per the Safeguard Policy Statement of 2009 are generally understood to be operational policies that seek to avoid, minimize or mitigate adverse environmental and social impacts. The policy framework consists of three operational policies on the environment, Indigenous people and involuntary settlement. All the three safeguard policies involve a structured process of impact assessment, planning and mitigation to address adverse environmental and social effects of projects throughout the project cycle.

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

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As per the SPS (2009), the HREPL Solar project is likely to fall under the environmental category “B” project.

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

In order for the Project to meet the requirements of SR 2, a Social Safeguard Compliance Audit report would be prepared covering the land acquisition process for the solar power plant site through the private land owners on a willing seller-willing buyer mode. If there would be any involuntary resettlement impacts, a resettlement plan will be prepared based on the following principles:

- ▶ Any disruption with regard to human habitation and areas of cultural significance (if any) to be avoided
- ▶ Compensation for temporarily affected assets (if any) to be based on replacement rates and shall be paid prior to initiation of the project
- ▶ Meaningful consultations with affected people in the issues of land acquisition, or loss of livelihood, if any, shall be conducted
- ▶ Employment opportunities to be provided to project affected people and local villagers during project construction activities
- ▶ Establish a grievance redressal mechanism to receive and facilitate resolution of the concerns of affected persons (if any)

SR 3 on Indigenous Peoples require that the Indigenous people are identified and if present, they should benefit from the development projects and the project should avoid or mitigate potentially adverse effects on indigenous people caused by the Project.

A survey would be conducted of the project site and the areas in the vicinity to identify if there are any project affected families from the declared scheduled tribes or other designated tribal communities. The Company will explore to the maximum extent possible alternative project designs to avoid negative impacts on relocation of ST (if any) that will result in adverse impacts on their identity, culture, and customary livelihoods.

2.2.2 ADB's Gender and Development Policy (1998)

ADB Policy on Gender and Development (GAD) requires projects to consider gender issues in all aspects of ADB operations, accompanied by efforts to encourage women's participation in

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the decision-making process in development activities. In this project, the GAD policy will be taken into consideration during the planning of community development programmes in the nearby villages.

2.2.3 ADB's Social Protection Strategy (2001)

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

- a) Carry out activities consistent with the intent of ensuring legally permissible equal opportunity fair treatment and non discrimination in relation to recruitment and hiring, compensation, working conditions and terms of employment for its workers (including prohibiting any form of discrimination against women during hiring and providing equal work for equal pay for men and women engaged by the Borrower);
- 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 labour or forced labour;
 - ii. who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of (a) ensuring legally permissible equal opportunity and fair treatment and non discrimination for their workers, and (b) not restricting their workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; and whose subcontracts contain provisions which are consistent with paragraphs (i) and (ii).

The Company shall develop HR policies and procedures applicable for employees including contract workers to ensure compliance with ADB's Social Protection Strategy and applicable labour laws.

2.2.4 The IFC Performance Standards

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

The following Performance Standards are applicable to the project:

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

The proposed practices to be adopted at the project site to ensure compliance with the IFC standards have been discussed in the following chapters.

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CHAPTER 3: PROJECT DESCRIPTION

3.1 Project Overview

The project involves setting up of a 20 MWp Solar PV Power Project, at village Bapodar and Kerala, District Porbandar, in the state of Gujarat, India. The Company has already signed a PPA for 25 years with Gujarat Urja Vikas Nigam Limited (GUVNL) with permission from Government of Gujarat. The power generated from the proposed solar power plant would be evacuated through a 66KV transmission line to Rana Kandorna Sub-Station of GETCO. The Rana Kandorna substation and transmission line is shared with 15 MW solar power plant Moser Baer Energy & Development Limited. The project got commissioned in the month of April 2012.

3.2 Project location

The proposed site is located in villages Bapodar and Kerala, District-Porbandar of the state of Gujarat, India. The proposed solar plant area is located at Latitude 21° 37' 39.4" North and Longitude 69° 49' 57.1" East. The location of the project is at an elevation of about 15-20 metres from the mean sea level. The soil texture is sandy and surface topography is almost flat. Hence limited site preparation/leveling activity is needed to make the land flat as per the requirements of solar PV power plant. The entire area is shadow free as there are no shading elements like mountains, large sand dunes, etc on the site. Figures 1 and 2 depict the map of the region indicating the project location.

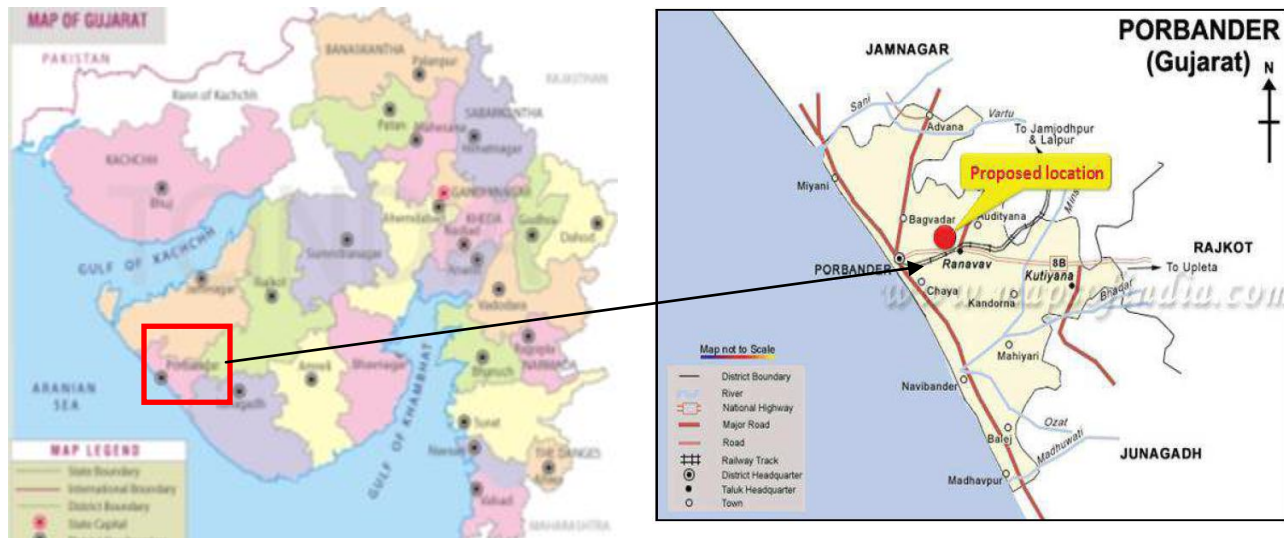


Figure 1: District map of Gujarat and Porbandar district marking the project location (Source: Detailed Project Report and www.tcindia.com)

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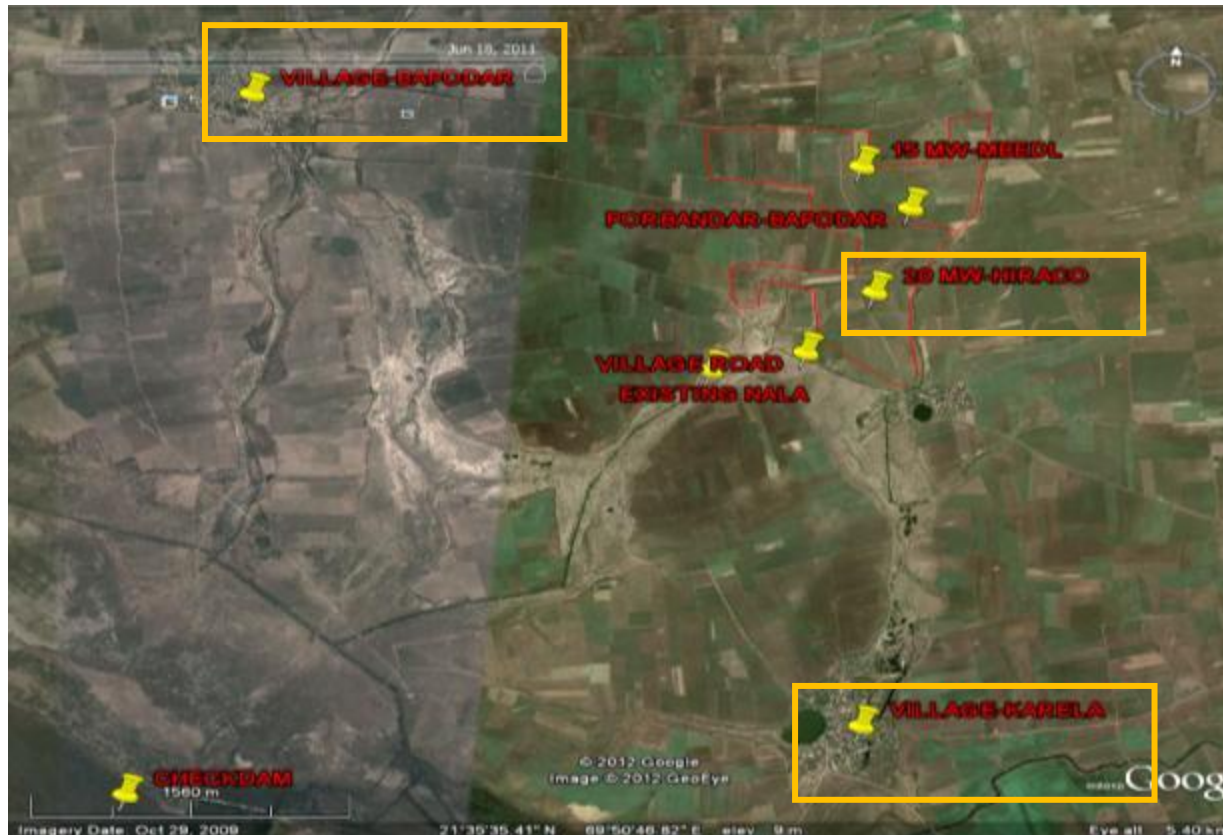


Figure 2: Satellite view of Village Bapodar and Kerala (Porbandar), Gujarat (Source: Detailed Project Report)

3.3 Connectivity

The selected project location has well established connectivity and accessibility through road, rail, air and port.

- Air : Porbandar has an airport which is 5 km away from the city
- Rail : Porbandar is connected with Rajkot, Surat, Vadodra, Surendranagar, Jamnagar, Ahmedabad, Mumbai and Delhi by Western railways
- Road : National highway 8B and 8E pass through the district, connecting Porbandar with Rajkot and Jamnagar
- Port : The district has a 106 km long maritime border facing the Arabian sea with an all weather port at Porbandar

3.4 Access Road

The project will utilize the existing village roads; no new roads will be built as part of this project. The length of the access road to the site from the main road is around 3 kilometers. The company plans to construct a 6 m wide road inside the plant for heavy vehicle movement and around 3 m wide road along the boundary wall for the movement of light vehicle.

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Figure 3: Photographs showing the existing access roads leading to the site

3.5 Technical description

Crystalline Silicon Photovoltaic (PV) is used in the proposed project for generating electrical power by converting solar radiation into direct current. This phenomenon takes place due to the photovoltaic effect exhibited by the semiconductors.

The selected location for the proposed project lies in “warm and humid climate zone of India. The instantaneous ambient temperature over the location reaches more than 42°C in summer; however the intensity of solar radiation is also very high. From the land type, meteorological study and annual behavior of solar radiation over the location near village Bapodar, Porbandar, Gujarat, the crystalline solar PV technology has been identified as the most feasible technology.

Solar PV Module: The Crystalline Silicon solar PV Module of 230 Wp to 245Wp capacity manufactured by one of the world’s largest solar PV modules manufacturer i.e. Hanwha have been selected for setting up the 20 MW power plant.

Inverter: 800 kW AC capacity inverter of world’s leading inverter manufacturer (SMA) has been selected for the analysis. The cumulative capacity of the inverters is 20 MW AC.

Solar PV Array: The power plant shall be a combination of 11 units and each unit shall be a combination of 2 sub-units of 800 kWp PV systems. As per the requirement of the inverter input, the number of modules in series is fixed as 24. Therefore, the total number of parallel string, which is a combination of 24 series connected module, shall be about 160 for each inverter.

3.6 Land requirement

The land requirement for the Project’s Solar Power Plant depends upon the technology deployed, conversion efficiency and solar radiation incident in the Project location. 62.63 Hectares of land is available for the 20 MWp Solar PV Project. The area break-up is provided below:

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Table 2: Project Area break-up details

Particulars	Area in hectare
Total plant area	62.63
PV module area	41.28
Balance of plant	1.21
Open area	20.14

Table 3: Land Ownership Status

Use of land	Private Land	Govt. Land	Forest Land	Total
Total Project Area	62.63	Nil	Nil	62.63
Acquisition Status	Total land required for the project has been acquired			62.63

The land acquired for the project site is totally private land and has been purchased on a voluntary basis (willing seller-willing buyer basis) from the land owners. A third party (land arranger) was appointed by the Company for helping in the purchase of land for the project.

3.7 Water requirement

The water requirement for the project is minimal. The main consumption of water in the project is for cleaning of the solar modules with minimal requirement for domestic usage. The total water requirement at the project site is about 10,500 litres per day.

Table.4: Water requirement

Particulars	Data values
Water Consumption Per MW (Crystalline Silicon) required for Cleaning for Module	500 Litres /day
Water Consumption for domestic usage construction phase	500 Litres / day
Total water usage for Hiraco project (20MW)	10,500 Litres /day

During construction, water would be sourced locally from nearby villages. The water requirement during the operational phase would be sourced from bore wells at site. Majority of people/farmers in the region are sourcing water from the bore wells at several locations. Apart from this, farmers have also developed various check dams and farm ponds in Ghed area.

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HREPL will make efforts to conserve water through optimal utilization during the operation phase of the project.

3.8 Waste water treatment and disposal system

Water is required for the cleaning purpose of solar PV modules to remove accumulated dust. The water required for the cleaning purpose is minimal and whatever minimal water is discharged through the cleaning process is absorbed in the ground. Also, water discharged in the process does not include any hazardous chemical or material. For storm water drainage during rainy season, an internal drain has been constructed connecting to the natural storm water canal adjacent to the site. The storm water is finally discharged into the government constructed check dam which is at a distance of around seven km from the project site.

Another source of waste water is from basic sanitation facilities provided to the workers at the labour camp and site office. Soak-pits would be constructed at the project site for the collection of waste water generated from the labour camps and site office. During operation phase of the project, waste water generated from the domestic purposes would be discharged into the soak-pits.

3.9 Power transmission line

The power generated from the proposed solar power plant would be evacuated through a 66kV transmission line to Rana Kandorna Sub-Station of GETCO, situated about 13.5 km from the project site. As the project is planned under the Solar Power Policy (2009) of the state of Gujarat, and as per the terms of Power Purchase Agreement, it is the responsibility of GETCO to arrange, provide and maintain the power transmission evacuation facilities upto the 66 KV switchyard of the project. However, in the interest of meeting the commissioning schedule for the project, it was agreed between GETCO and the Company that the Company would manage the construction of transmission lines under the overall supervision and approval of GETCO. GETCO will reimburse the transmission line expenses to SPVs on the basis of GETCO SOR (schedule of rates) while supply of towers, overhead conductors and other items will be issued as free issue items for such works.

To that effect, the Company has awarded transmission line contract to contractors who are nominated and approved by GETCO.

Under these contracts, the works have been executed by GETCO approved contractors and in line with GETCO's existing policies and frameworks. The transmission line was made operational in month of April, 12. The transmission line is shared with 15 MW Solar Power Plant namely Moser Baer Energy and Development Limited

Sr. No.	Aspect	Description
1	Route Particulars	
i)	Length (KM)	13.5 kms
ii)	Land acquired for towers and corridor ROW	Nil. Only permission for Right of Way has been obtained from the affected land owners.

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iii)	Land acquired for access roads along transmission corridor	Nil
iv)	Width of RoW for transmission line	4 meter to 5 meter
v)	Terrain	Flat with gentle slope
	Hilly/Plain	Plain
	Agriculture/Waste Land	Agricultural Land (Private) :75% Govt.Land : 25%
	Wet/Marshy	Nil
	Estuarine	Nil
	Other type of land	Yes (Dry land)
2	Environmental/Social Details	
i)	Name of District / District details (through which transmission line pass)	Porbandar district, Gujarat
ii)	Town/Village falling in corridor route alignment (Nearby)	The line is routed in such a way to avoid villages and fixed nature of settlements
iii)	House/residences within transmission line RoW	None
iv)	Type of forest (if applicable): Reserve / Protected / Mangrove / Wild life area / any other environment sensitive area	The transmission line does not pass through any Reserve / Protected /Mangrove / Wild life area /any other environmentally sensitive area
v)	Type of Fauna and Flora noticed along corridor route; presence of any Endangered species	No endangered species of fauna or flora are present
vi)	Historical or cultural monuments affected	None
vii)	Ground clearance of the transmission line	10 m after sag
3	Interference with other utilities	
i)	Railway	Nil
ii)	Other Transmission Line Corridors intercepting the project line route	Nil
iii)	River Crossing	Nil
iv)	Road Crossing	The transmission line is crossing road near Ranadorna Village, Porbander district of Gujarat

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3.10 Project Implementation schedule

An implementation schedule, outlining the sequence of major activities and the time required for engineering, construction, installation and commissioning of the 20MWp solar PV power plant is provided below. The solar plant commissioned and start exporting power to the grid in the month of April 2012.

Table.5: Implementation schedule of project

Activity	Oct'11	Nov'11	Dec'11	Jan'12	Feb'12	Mar'12	Apr'12
Hiraco							
Foundations							
Modules Shipment at Indian Port- Hanwha							
Discharge and Custom Clearance							
Module Availability at site							
Structure Availability							
Structures Erection							
Module Erection							
Inverters Shipment							
Inverters at Site (SMA - 800 watt)							
Inverter Room / LT Room - Building ready							
Inverters Erection							
TL availability							
Testing and commissioning							
Erection by Areva							
Date of Commissioning							April 2012

3.11 CDM benefit

In 1997, Kyoto Protocol ("Protocol") linked to United Nations' Framework Convention on Climate Change resolved to reduce the greenhouse gases (GHGs) responsible for global warming. As an effort to minimize the global warming, Protocol sets binding targets for thirty-seven industrialized countries, five per-cent below GHG emission levels prevailing in 1990, between 2008 and 2012. The Protocol established three market-based mechanisms allowing developed countries to meet the emission reduction targets.

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Clean Development Mechanism (CDM) is one of the three project based mechanisms formulated under the Protocol. CDM establishes a win-win situation for both developed countries as well as developing countries.

As a part of the renewable energy source, solar power projects are eligible to generate (CERs) under the approved small scale methodology (AMS ID). Crediting period of the CERs for the projects could be a fixed 10 year crediting period or a variable crediting period of 7 years not extending beyond 3 such periods (21 years). Approach to calculate CERs required to be followed under AMS ID is mentioned below

Baseline Information:

As per the AMS ID, Baseline Emission factor / Emission Intensity of the NEWNE grid is calculated in line with Combined Margin (CM) approach providing weightages to Operating Margin (OM) and Build Margin (BM) emission factors. Central Electricity Authority (CEA), a statutory body incorporated under the Ministry of Power, Govt. of India, annually publishes "Baseline Carbon Dioxide Emission Database". As part of the Baseline Carbon Dioxide Emission Database, OM and BM for both NEWNE and Southern grids are disclosed publicly. For the most recent year, CEA in its publication "Baseline Carbon Dioxide Emission Database - Version 07" has released the required data. The process of calculation of CM emission factor for NEWNE grid is given below:

Table.6: Estimation of Baseline emission factor (tCO₂/MWh)

Particulars	Unit	2008-09	2009-10	2010-11	Weighted Average	Weight	
Simple Operating Margin (incl. Imports)	tCO ₂ /MWh	1.01	0.98	0.97	0.98	0.75	0.74
Net generation	GWh	421,802.63	458,043.08	476,986.72			
Build Margin (not adjusted for imports)	tCO ₂ /MWh			0.86	0.86	0.25	0.21
Combined Margin (incl. Imports) (Wt. Avg of OM & BM)	tCO ₂ /MWh						0.95
Baseline Emissions Factor	tCO ₂ /MWh						0.95

Electricity Generation:

As mentioned in the document earlier, Project will operate at a load factor of 20.22% which in turn is expected to generate 35,425 MWh (Net).

Baseline Emission (BE):

Project would generate approximately 35,425 MWh of electricity and displace equivalent amount of electricity from the NEWNE grid which otherwise would have been generated by the fossil fuel based power plants. According to the methodology AMS ID., Baseline Emissions of the project is the CO₂ emissions avoided by the project considering the grid is emission intensive. An annual baseline emission for the project is outlined below:

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Table.7: Emission reduction calculation (tCO₂/MWh)

	Unit	Value
Net electricity	MWh	35425
Combined margin	tCO ₂ /MWh	0.9523
Baseline emissions	tCO ₂	33425

Emission reductions (ERs):

Eligible CERs is the difference between Baseline Emission, Project Emission and Leakage of the Project. Project Emissions and Leakages are attributed to the onsite emissions due to the construction and operation of the project. Since the project is a renewable energy project with no on-site combustion of fossil fuel, project emissions and leakage are considered nil. Therefore, the annual emission reduction eligible for the project are equivalent to annual baseline emission computed above.

The annual emission reductions for the entire crediting period of 10 years are expected to be 33,425 per annum.

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CHAPTER 4: Environmental and Social Baseline Status

The proposed site is located at villages Bapodar & Kerala, District Porbandar of Gujarat State in India. Porbandar district is one of the 26 districts of Gujarat state in Western India. Porbandar city is the administrative centre of this district. The district covers an area of 2,295.35 sq km. Porbandar is a coastal region and has a pleasant climate. The baseline conditions of the region are as follows:

4.1 Physical resources

4.1.1 Topography

The coastal tract in Porbandar district is characterized by loamy and sandy soils having good percolation capacity characterized by coastal alluvium. Terrain is almost flat in the project area with gentle slope, and is located at an elevation of about 15-20 metres from the mean sea level.

4.1.2 Geology

The district has diversity in hydrogeological environments which is attributed to its geomorphic characteristics, offering numerous landforms characters viz. cliffy shoreline, tidal creeks, coastal dunal ridges, point bars, large surficial depressions etc. The miliolitic lime stone forms the potential aquifer for groundwater supply. (Source: Coastal Salinity Prevention Cell, <http://www.cspc.org.in/>)

4.1.3 Soil

Ninety percent of land type in the district is highly sandy and saline, which can yield crops only under optimum rainfall conditions. Medium black soil in patches is found in low-lying areas of Harij and Chanasma which is suitable for cultivation of castor and cotton. In parts of Sami, Patan and Harij tehsils, the soil is poor and saline, and sub-soil water is brackish. The main crops in the district are Bajra, jowar, groundnut, cotton. Alluvial soils are found in the tehsils of Santalpur and Radhanpur, which constitute the main wheat growing areas. In rainy season, potatoes are grown mainly in riverbeds.

4.1.4 Land use

The proposed project site is primarily agricultural land. Few shrub thickets were also observed on the project site.

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Figure 4: Photograph showing the Project Land

4.1.5 Earthquake zone

The proposed solar power project site falls in Seismic Zone – 3 that is classified as Moderate Damage Risk Zone. Therefore, applicable seismic coefficients have been applied during the detailed design and engineering phase of the project to withstand the impacts of earthquakes in the area, if any. The following figure depicts the earthquake hazard risk zonation of the project site.

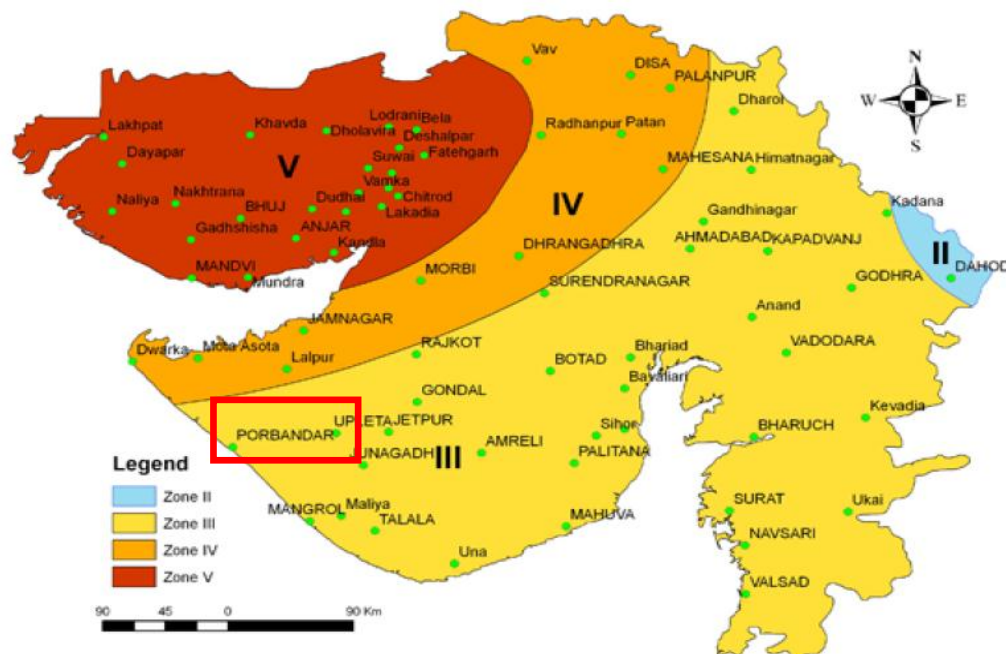


Figure 5: Seismic Zoning Map of Gujarat state depicting project area in Zone III (Source: Institute of Seismological Research (ISR), Government of Gujarat)

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4.1.6 Wind Zone

The proposed project alignment falls under range where wind power density is between 200-250W/sq.m

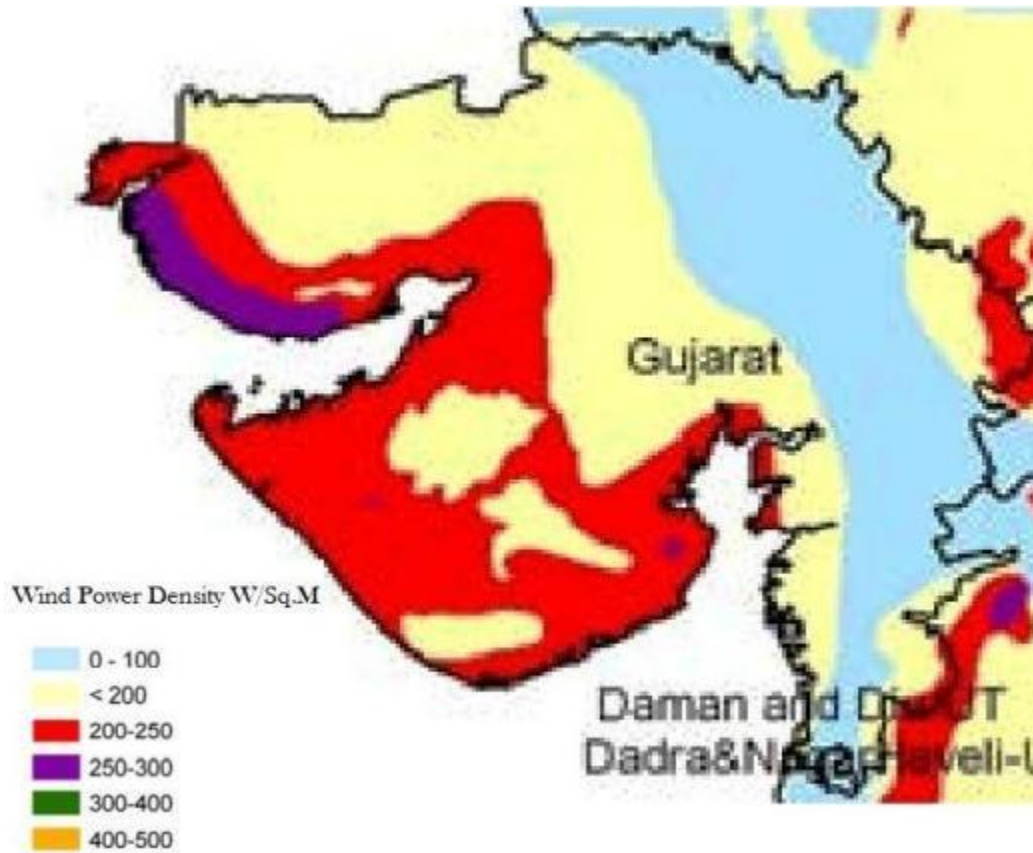


Figure 6: Wind Power Density Map of Gujarat State (Source: Centre for Wind Energy Technology, Chennai, February 2010 sourced from Indian Windpower 2010 Directory)

4.1.7 Climate

Porbandar is a coastal region with three seasons in the year. Due to the typical coastal climate, the annual variation in ambient temperature is very limited. The summer season in the region continues from March to June with the daytime temperature crossing over 42°C. Monsoon season is from July to September and winter from October to February. The summer temperature varies from 24°C to 42°C and the winter temperature range from 10°C to 24°C. (Source: Coastal Salinity Prevention Cell, <http://www.cspc.org.in/>)

4.1.8 Rainfall

The district receives 592 mm rainfall during south-west monsoon that occur in 30-35 rain-days. The coastal area records average rainfall of 4500 mm during June to September. The coastal area has six rain gauge stations located in Porbandar taluka. At the location, the monsoon

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duration is of the maximum humidity (more than 60%) while lowest humidity is observed in the month of March (~39-40%). (Source: Coastal Salinity Prevention Cell, <http://www.cspc.org.in/>)

4.1.9 Water resources

The coastal line of Porbandar has both surface and ground water resources which are used for irrigation and domestic purposes.

The major seasonal rivers of the district are Bhadhar, Sorthi, Vartu, Kalindri and Minsar. The upper catchments of all these rivers have dams which store water for irrigation and drinking needs. Few villages in coastal areas receive benefits of irrigation through link channel created by Salinity Ingress Prevention Circle, (SIPC) along the coastline.

Geo-hydrologically Porbandar district comprises of sedimentary rocks – miliolite limestone known as Porbandar stone and alluvial deposits. Deccan trap basalt also occupies considerable area of the district. Few villages south of Kutiyana, Ranavav and Porbandar taluka fall under "Ghed Area " which comprises of alluvial deposits and has inherent salinity even at shallow depth.

Western flank of the district is bounded by the Arabian Sea. Due to proximity to the sea, the area is affected by seawater ingress resulting into deterioration of ground water quality. Potable ground water zone is restricted in the northern and north-eastern portion of Porbandar taluka. General depth of open wells ranges from 10 - 25 m to 75 -100 m in case of Down-to-hole (DTH) bores. Major part of Ranavav taluka falls under semi-critical zone. Potable ground water zone is restricted in the northern and western part of the taluka. Kutiyana taluka is comprised of Deccan trap basalt and alluvial formation, which is affected by salinity and excessive fluoride content in ground water. (Source: Coastal Salinity Prevention Cell, <http://www.cspc.org.in/>)

Majority of people/farmers in the region are sourcing water from the bore wells dug at several locations. Apart from this, farmers have also developed various check dams and farm ponds in Ghed area. But the water stored in the dams or the water recharged turns saline within 2-3 months and the ground water is very saline on the surface

4.1.10 Air Quality and Noise

The Ambient Air Quality measurements along the project road and in the vicinity shall remain within the limits of the revised National Ambient Air Quality Standards. Overall, the impact of generated noise on the environment during construction period is insignificant, reversible and localized in nature.

4.2 Ecological resources

The project site is not located in or near a sensitive ecosystem. Review of the secondary literature and site visits confirmed the absence of unique or ecologically significant flora and fauna. The nearest wildlife sanctuary, Porbandar Bird Sanctuary is about 25 km away from the project site and Barda Wildlife Sanctuary, is about 40 km away from the project site

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Major agricultural crops

In Ranavav taluka, the major source of livelihood for farmers includes rain-fed agriculture and animal husbandry. Nearly 50% farmers carry out animal husbandry as supportive activity. Due to this, the farmers prefer to grow crops which also provide fodder for animals. Popular crops grown in Porbandar District include oil seed crops like groundnut, cotton (desi) and other food crops like gram, wheat, cumin, bajara, green gram, coriander, sorghum, etc.

The other crops like pulses and horticulture crops like coconut, mango, sitafal (custard apple) are declining with increasing salinity in coastal area.

Due to saline ingression, the water availability has become an issue for agriculture and prolonged exposure to saline water has affected the productivity of the land. (Source: Coastal Salinity Prevention Cell, <http://www.cspc.org.in/>)

4.3 Socio – economic status

The total land acquired by HREPL falls within the villages of Bapodar and Kerala situated in Ranavav Taluk, Porbandar District, Gujarat State.

a) Village-Bapodar

Bapodar is a mid-sized village located in the district of Porbandar, Gujarat (India). Bapodar is at a distance of around 14 km from its Taluka - Ranavav and around 22 km from district Porbandar. As per the records of Census 2001, the village has a population of about 1729 persons living in around 367 households. Population wise Bapodar village has around equal male -female ratio. Around 70% of the village population consists of the Hindu community. The Hindu castes in the village include Nagar Brahman, Maidh or Mer-Kshatriya and Krushaks etc. All the landowners from whom land was purchased were also from the Hindu community. Majority of the households rely on agriculture as their main source of income in the village.

Table 8: Population details of Bapodar village

Total Population	1729
• Male Population	848
• Female Population	881

b) Village Kerala

Kerala is a small village located in the district of Porbandar, Gujarat (India) and is located adjacent to village Bapodar. It is at a distance of around 12 km from district Porbandar and 346 km distance from the main city at Gandhinagar (Gujarat). As per the records of Census 2001, the village has a population of about 368 persons living in around 78 households. Population wise Kerala village has around equal male - female ratio. Around 70% of the village population consists of the Hindu community. The Hindu castes in the village include Nagar Brahman, Maidh or Mer-Kshatriya and Krushaks etc. All the landowners from whom land was purchased were also from the Hindu community. Majority of the households rely on agriculture as their main source of income in the village.

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Table 9: Population details of Kerala village

Total Population	368
• Male Population	195
• Female Population	173

The Project construction and operation will not in any way affect the dignity, human rights, livelihood systems and culture of the residents of the village. Moreover, the lands where the Project's solar power generation facility are being constructed are not owned, used, occupied, or claimed as ancestral domain or asset of any tribal groups. The project is therefore expected to be classified as category C for both involuntary resettlement and IPs.

Table 10: Demographic details of the Porbandar District as per Census 2001

Total Population	536835
• Male Population	275821
• Female Population	261014
Total Workers	215,134
• Main Workers	173594
• Marginal Workers	41,540
• Non-Workers	321,701
Literate Population	316172
• Literate (Male)	184717
• Literate (Female)	131455
Number of SC (Largest Three)	
• Mahyavansi etc.	37,762
• Bhambi etc.	3,772
• Bhangi etc.	3524
Number of ST (Largest Three)	
• Rabari	5306
• Bhil	535
• Charan	212

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CHAPTER 5: Potential Environmental and Social Impacts and Their Mitigation and Monitoring Plan

For developing the Environmental and Social Mitigation and Monitoring Plan (ESMMP) the key physical, biological and socio-economic environmental components have been identified. The impacts of various project activities on these environmental components during pre-construction, construction, operation and decommissioning phase of the project along with its mitigation action planned and monitoring frequency have been identified in this section.

5.1 Pre-Construction phase

No significant environmental impacts are envisaged during the Pre-construction phase of the project. The activities and their anticipated impacts during the pre-construction phase include the following:

5.1.1 Acquisition of land

The land acquired for the project site is totally private land and has been purchased on a voluntary basis (willing seller-willing buyer mode) from the land owners. The land acquired for the project is agricultural land but was not much productive for the land owners because of the salt water ingression in the area

Potential impact	Mitigation action plans	Monitoring frequency	Responsibility
Loss of land, livelihood, assets, etc	<ul style="list-style-type: none">▶ The Company shall conduct meaningful consultations with affected people in the issues of land acquisition, or loss of livelihood, if any▶ Compensation for land and any existing assets shall be negotiated on the basis of current Gujarat government norms▶ Avoid farming season wherever possible for the acquisition▶ Giving priority in jobs to the local people with first priority given to the project affected family	Continuous throughout the land acquisition process	Land acquisition team and HR/Admin team

5.1.2 Temporary use of project land for storage of project equipments, materials, etc.

The mobilization of construction equipments and construction materials shall require space for storage and parking of construction vehicles and equipment. Space shall also be required for construction material storage yards, disposal sites, and labour camps to avoid environmental impact and public inconvenience.

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Potential impact	Mitigation action plans	Monitoring frequency	Responsibility
Impact on soil and water and soil	<ul style="list-style-type: none"> ▶ The equipments and construction material shall be placed at least 500m away from water bodies (if any), natural flow paths and residential areas ▶ Equipments and materials shall be stored at designated areas with concrete flooring to avoid any spillages which may lead to soil or ground water contamination. 	Continuous during pre-construction	EHS team

5.1.3 Site Clearing and Leveling

Before initiating the construction work, clearing of the vegetation cover (shrubs, bushes etc., if any) and leveling work shall be carried out. The site clearing work may lead to loss of vegetation cover and topsoil to some extent in the plant area. It is proposed to construct line drains for storm water collection to minimize the soil erosion. Apart from localized construction impacts at the plant site, no adverse impacts on soil in the surrounding area are anticipated. Also, as the proposed project land is flat, it is less susceptible to erosion.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Soil erosion	<ul style="list-style-type: none"> ▶ Planning and designing the development within the natural constraints of the site; ▶ Minimizing the area of bare soil exposed at one time (phased grading); ▶ Avoiding the unnecessary clearing of the site, ▶ The topsoil in non-built up areas would be restored and such portions of the site would be replanted with appropriate plant species to stabilize soil 	Continuous	EHS team/Civil Department
Air pollution	<ul style="list-style-type: none"> ▶ Water sprinkling shall be practiced ▶ Construction machinery shall be properly maintained to minimize exhaust emissions of CO, SPM and Hydrocarbons. 	Continuous	EHS team

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5.1.4 Establishment of labour camp

Provision of civic amenities for construction labour and movement of truck drivers for transporting construction material shall be provided at the site. The labour camps at the project site will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Adequate drinking water facilities, sanitary facilities and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

Potential impact	Mitigation action plans	Monitoring frequency	Responsibility
Health Risks	<ul style="list-style-type: none">▶ Provision of separate mobile toilet facilities for men and women shall be made.▶ The domestic effluent shall be properly disposed off in soak pits.▶ Contractor shall provide garbage bins to all workers' accommodation for dumping wastes regularly in a hygienic manner in the area	Continuous	EHS team and the Contractor
Chances of spread of sexually transmittable diseases like AIDS	<ul style="list-style-type: none">▶ Awareness programmes to be conducted regularly for workers on AIDS, and other health related issues.▶ Health checkup facilities for employees and contract workers	During Construction	Medical representative at site
Water pollution	<ul style="list-style-type: none">▶ Separate Mobile Toilet facilities shall be made available for male and female workers. The domestic effluent shall be properly disposed off in soak pits.	Continuous	Contractor
Land contamination	<ul style="list-style-type: none">▶ Basic sanitary facilities shall be provided for the workers staying at the labour camp and at the project site.▶ Dustbins shall be provided at the camp by the contractor	Continuous	Contractor

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5.2 Construction phase

The activities and their anticipated impacts during the construction phase included the following:

5.2.1 Construction of internal roads, and development of other areas

Internal roads and boundary wall shall be constructed at the site. Foundations of the solar panels, LT houses and switchyard shall also be constructed at the site.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Impact on Air quality-- The impact on air quality will be for short duration and confined within the project boundary and is expected to be negligible outside the plant boundaries. The impact will, however, be reversible, marginal and temporary in nature.	▶ Activities like digging and filling are to be avoided in conditions of very high wind and covers to be provided for loose construction material at construction site	Continuous	EHS team
	▶ Construction equipments are to be properly maintained to minimize exhaust emissions	Six monthly	Contractor
	▶ Water sprinkling shall be practiced	Continuous	Contractor
Impact on Water quality	<p>▶ The construction will be more related to mechanical fabrication, assembly and erection; hence the water requirements would be meagre. Soak pits will be made for disposal of sanitary sewage generated by the workforce. The overall impact on water during construction phase due to proposed project is likely to be short term and insignificant.</p> <p>▶ Also, consumption of water should be monitored and attempt should be made to avoid spills / wastages and ensure optimal consumption</p>	During planning layout and construction work	EHS and Civil team

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5.2.2 Movement of vehicles

Vehicle movement shall prevail at the site to transfer the material and workers at site. Apart from this, third party vehicles delivering the material and equipments shall also be there.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Air pollution	<ul style="list-style-type: none">▶ All the vehicles entering the site to be asked to have updated PUC (Pollution under control) certificate.▶ Vehicle speed is to be restricted to 15km/hour at site▶ Trucks/dumpers are to be covered by tarpaulin sheets during off site transportation of friable construction materials and spoil▶ Maintenance of vehicles shall be carried out regularly▶ Sprinkling of water shall be practiced at the site	Continuous	Contractor and EHS team
Soil contamination	<ul style="list-style-type: none">▶ Proper maintenance of vehicle shall be carried out to avoid any leakage of oil or grease	Annually	Contractor and O&M team
Water contamination	<ul style="list-style-type: none">▶ Proper maintenance of vehicle shall be carried out to avoid any leakage of oil or grease	Annually	Contractor and O&M team
Safety risks	<ul style="list-style-type: none">▶ Vehicle speed is to be restricted to 15km/hour at site▶ Necessary safety trainings shall be provided to the drivers of construction vehicles for speed restrictions and do's and don'ts to be followed during movement of construction vehicles	Continuous	Contractor & EHS team

5.2.3 Excavation and drilling

Excavation and drilling shall be carried out at site for the construction of foundation and base of solar panels, LT houses, security rooms, admin building, switchyard, etc.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Occupational health hazards	<ul style="list-style-type: none">▶ Provision of adequate personal protective equipment like safety helmets, face masks, safety shoes, safety goggles etc. for the safety of	Continuous	EHS team / Contractor and Civil team

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	workers ▶ Training shall be imparted to workers on occupational safety and technical aspects of job undertaken by them		
Air pollution	▶ Water sprinkling at regular intervals during excavation and drilling activities shall be practiced to avoid generation of dust.	Continuous	Contractor
Noise pollution	▶ Regular maintenance of plant equipment shall be carried out ▶ Noise prone activities are to be restricted to the extent possible during night time. ▶ Personal protective equipments shall be provided for workers performing drilling at site	Annually Continuous Continuous	EHS team and Contractor

5.2.4 Use of D.G sets

D.G sets shall be used at site to provide electricity to labour camps in the night time. Also, in case of non-availability of power from grid, D.G sets shall be used to provide electricity at the site for construction activity.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Air pollution	▶ D.G set to be optimally used with proper orientation and adequate stack height ▶ Stack monitoring carried out on regular basis. ▶ Proper maintenance of the DG Set carried out on regular basis	At time of installation Annually Annually	EHS team / Contractor
Noise pollution	▶ Acoustic enclosures are to be provided with the D.G sets to minimize the noise levels	Installation period	EHS team

5.2.5 Storage of diesel

Diesel shall be stored on-site so as to ensure availability for D.G sets.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Soil contamination	▶ A covered area shall be defined for storage of HSD with concrete flooring	Planning stage	Stores in-charge and EHS team

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Safety risks	<ul style="list-style-type: none"> ▶ The diesel storage area shall not be proximity of the labour camps ▶ Inflammable substance shall not be allowed at the project site. 	Continuous	Security guard and EHS team
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5.2.6 Handling of broken solar panels

During transportation, handling, installation and operation, there is a chance of damage to the solar PV panels. These damaged panels are required to be handled with care owing to presence of traces of metals like cadmium, selenium, etc. and presence of recoverable materials like glass, aluminum and semi-conductor materials.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Land contamination	<ul style="list-style-type: none"> ▶ Broken or damaged solar panels shall be immediately shifted to a designated area in scrap yard to avoid any type of land contamination. A photograph is to be taken of the broken panel at the site to cater to Insurance settlement claims ▶ The storage area shall have a concrete base 	Continuous	Site in-charge and EHS team
Health risks	<ul style="list-style-type: none"> ▶ PPE shall be provided to the workers handling the broken solar panels ▶ The workers at site shall be apprised about the potential health risks associated with handling of solar panels 	Continuous	Site in-charge, EHS and HR team

5.2.7 Handling of waste

Both hazardous and non-hazardous waste shall be generated during the construction activity. All the waste shall be properly managed in order to minimize the following potential impacts:

Potential impact	Mitigation action	Monitoring frequency	Responsibility
<ul style="list-style-type: none"> ▶ Air Pollution ▶ Soil Contamination ▶ Water Contamination 	<ul style="list-style-type: none"> ▶ The excavated material generated will be reused for site filling and leveling operation to the maximum extent possible. ▶ The scrap metal waste generated 	Continuous	EHS team and Scrap Committee

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	<p>from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers.</p> <ul style="list-style-type: none"> ▶ Food waste and recyclables viz. paper, plastic, glass etc will be properly segregated and stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be collected and composted at site ▶ Hazardous waste viz. waste oil etc will be collected and stored in paved and bunded area and subsequently sold to authorized recyclers. Necessary manifest for the same will be maintained. 	<p>Continuous</p> <p>Within 90 days</p>	
Safety risks	<ul style="list-style-type: none"> ▶ Adequate PPE's shall be identified and provided to the workers at site. 	Continuous	EHS team

5.2.8 Removal of trees

The project activities during construction phase shall involve clearing of two trees at the project site.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Loss of two trees	<ul style="list-style-type: none"> ▶ Green belt development shall be carried out at the project site wherever feasible 	Six monthly	EHS team

5.2.9 Installation and operation of Concrete mixing machines

Concrete mixing machines shall be installed on temporary basis at the project site.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Noise pollution	<ul style="list-style-type: none"> ▶ Noise shielding to be used where practicable and fixed noise sources to be acoustically treated for example with silencers, acoustic louvers and enclosures. ▶ Provision of make shift noise 	At the time of installation	Technical team

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	barriers near high noise generating equipment to minimize horizontal propagation of noise		
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5.2.10 Construction labour management

There will be certain number of migrant labours which shall be staying at the site with/without their families and there would be influx of labour from vicinity of the project site. Appropriate facilities shall be arranged for the labour.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Child labour and forced labour	<ul style="list-style-type: none"> ▶ Provision of clause in contractor's agreement that bans child labour and forced labour at project site. ▶ Adequate procedures to avoid or prevent hiring/entry of child labour at the project site 	Continuous	HR and EHS team
Health and safety risks	<ul style="list-style-type: none"> ▶ Temporary creche facility may be provided in case of migrant laborers children residing in the camps to ensure safety 	Continuous	HR and EHS team
Water wastage	<ul style="list-style-type: none"> ▶ Emphasis shall be given on optimization of water usage and supply of potable drinking water for labour camps 	Weekly	Contractor
Pressure on forest produce	<ul style="list-style-type: none"> ▶ Fuel shall be made available to construction workers so as to reduce pressure on forest produce or local fuel wood resources 	Weekly	Admin team / Contractor

5.3 Operation phase

Solar power projects are environment friendly and easy to operate as most of the procedures are automated and requirement of manpower is minimal. Therefore, no significant negative impacts are envisaged during the operation phase of the project.

5.3.1 Switchyard operation

A dedicated team shall be deployed at the site for the switchyard operation which shall be responsible to pass on the electricity to the sub-station. Since it is a high voltage area, safety precautions are required to be undertaken.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
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Safety risks	<ul style="list-style-type: none"> ▶ Regular safety training shall be imparted to employee on electrical safety ▶ Rubber mats to be provided near all high voltage areas ▶ Cardiopulmonary resuscitation (CPR) charts to be displayed in the switchyard area 	Continuous At the time of installation	Technical team
Soil contamination	<ul style="list-style-type: none"> ▶ Regular maintenance and monitoring of the transformers shall be carried out to avoid leakage of transformer oil 	Annually	Technical team

5.3. 2 Use of ground water resources

Minimal quantity of water would be required for the purpose of cleaning solar panels and for domestic use by the employees including contract works employed during the operational phase. The water requirement would be sourced from bore wells at site.

Potential Impact	Mitigation Action	Monitoring Frequency	Responsibility
Depletion of Ground water	<ul style="list-style-type: none"> ▶ A water meter shall be installed at water intake works to monitor total water consumption 	Monthly	EHS Team
	<ul style="list-style-type: none"> ▶ Water reduction measures through periodic checking of pipeline leakages ▶ Spills / wastages to be avoided and ensure optimal consumption 	Weekly	EHS Team

5.4 Decommissioning phase

The project has an expected lifetime of 25 years after which the project shall be decommissioned. The site may further be used for similar power project which will not require much of remediation. However, if the site is used for some other purpose land restoration shall be an important exercise.

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A decommissioning plan has been prepared for the project activity and the key impacts envisaged due to the decommissioning activities are highlighted below:

5.4.1 Removal and disposal of Solar panels

Solar panels shall be removed after the end of the lifetime and shall be disposed in accordance of a pre-defined procedure.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Safety risks	▶ Safety shoes, helmet and gloves shall be provided to the workers involved in removal of solar panels	Before initiation	EHS team and contractor
Soil contamination	▶ The removed solar panels shall be immediately shifted to designated storage area to avoid contact with soil ▶ In case of breakage or damage to solar panels, the panels shall be immediately shifted to a designated area in scrap yard to avoid any type of land contamination.	Continuous	EHS team

5.4.2 Restoration of area

If the project site is not intended to be used for similar type of project, the same shall be restored to its natural state.

Potential impact	Mitigation action	Monitoring frequency	Responsibility
Land degradation	▶ All the excavated construction material/debris from the foundations shall be disposed in a pre-determined landfill and shall not be disposed at the project site ▶ Re-vegetation shall be done as appropriate of the exposed area. ▶ All the waste generated till date shall be disposed in accordance of the applicable legislation	Continuous	Civil team and contractor EHS team EHS team

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5.5 Budgetary estimates for implementing ESMMP:

An estimated budget of INR 0.2 to 0.3 million is planned for conducting assessments on an annual basis for Soil, Air, Noise & Water quality from third party agency (i.e. an approved NABL Laboratory) during the operational phase of the project.

5.6 Organization Structure for Environmental management of project

HREPL has an EHS Department at Corporate and business unit level, headed by Senior Manager-EHS who is responsible for day-to-day implementation of the Project. The EHS department is responsible for coordinating and implementing all environmental and social activities at the project site. During project implementation, the EHS department will be responsible for reflecting the occurrence of new and significant impacts resulting from project activities and integrating sound mitigation measures into the environment mitigation and monitoring plan.

The EHS head is responsible for implementing safeguard issues associated with the project through a qualified EHS team consisting of managers, engineers and supervisors.

- ▶ The duties of the EHS department at corporate level are to:
- ▶ Monitor the implementation of mitigation measures during pre-construction, construction, operation and de-commissioning phases of the project
- ▶ Prepare standard operating procedures (SOP) for different project sites.
- ▶ Advise and coordinate field unit's activity towards effective environment management practices
- ▶ Co-ordinate with the Ministry of Power, GPCB, and other concerned agencies to obtain relevant permission, clearances for the projects with respect to environment, health and safety.

The duties of the EHS department at site level are to:

- ▶ Implement the EHS manual guidelines and environmental good practices at site.
- ▶ Advise and coordinate the contractor(s) activity towards effective management of environment, health and safety aspects.
- ▶ Train all HREPL employees including contract workers at site to make them aware on various EHS practices and guidelines to be followed at site.
- ▶ Carrying out internal EHS audits at defined intervals, identify the existing EHS gaps at the site and report the findings of the audit to the EHS head.

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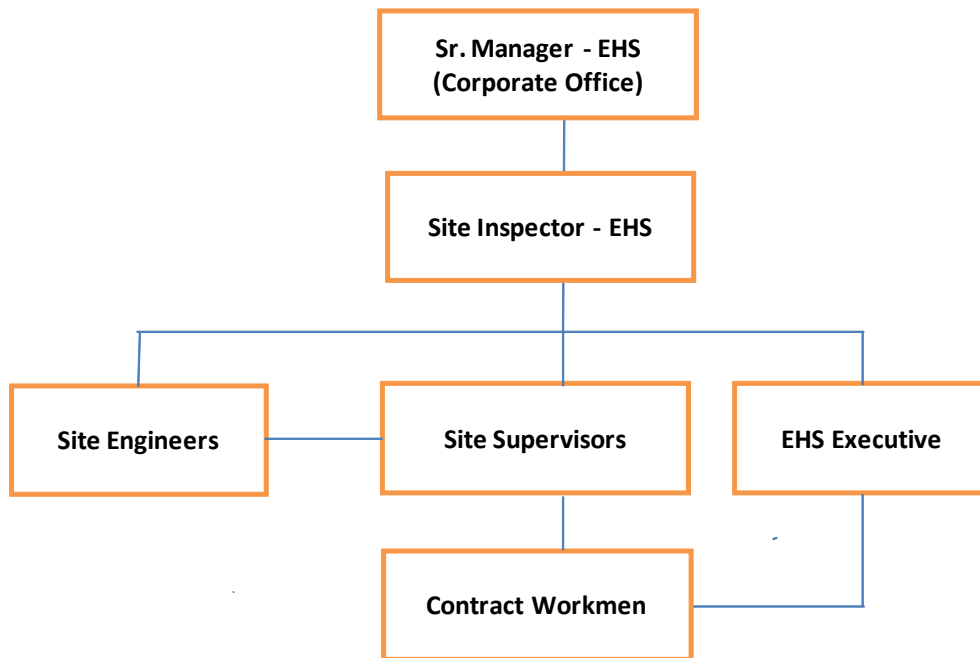


Figure 7: Organization Structure of Environment Management Unit for project

HREPL is fully committed to its environmental and social responsibility and discharges this responsibility in adherence to principles of good corporate governance guidelines. Its staff and contractors are fully committed to their environmental responsibility and discharge their responsibility within HREPL's EHS guidelines and operational framework.

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CHAPTER 6: Environmental Impact specific to construction of the transmission line

As per the terms of PPA, it is the responsibility of GETCO to arrange, provide and maintain the power transmission evacuation facilities upto the 66 KV switchyard of the project. However, in the interest of meeting the commissioning schedule for the project, it was agreed between GETCO and the Company that the Company would manage the construction of transmission lines under the overall supervision and approval of GETCO. To that effect, the Company has awarded transmission line contract to contractors who are nominated and approved by GETCO. Under these contracts, the works have been executed by GETCO approved contractors and in line with GETCO's existing policies and frameworks.

The transmission line for the project has been routed so as to avoid interference with threatened flora and fauna, environmentally sensitive areas as well as human settlements. Thus, the potential impacts from construction of transmission line are insignificant and temporary in nature. These impacts and the mitigation measures taken up at the site during the construction phase are as follows:

S. No.	Potential Impact	Mitigation action	Monitoring Frequency	Responsibility of Implementation	Responsibility of Supervision
1	Soil erosion, Air Pollution due to clearing of vegetation (shrubs, bushes)	Avoiding the unnecessary clearing of the vegetation	At time of land clearing	GETCO approved Contractor	HREPL
2	Air and Noise Pollution due to Transportation of equipment to site	1.Minimize vehicular trips to the extent possible 2. Proper maintenance of vehicles to minimize air and noise emissions	Continuous	GETCO approved Contractor	HREPL
3	Soil Movement, Air Emissions due to Excavation, digging of pits	Minimal quantity of waste would be generated during the construction period due to the excavation of the tower	Continuous	GETCO approved Contractor	HREPL

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		foundations. The excavated soil would be backfilled after the construction work.			
4	Air Emissions, Noise Pollution due to Structural work/Mechanical Work	PPEs to be used by the workers	Continuous	GETCO approved Contractor	HREPL
5	Wastage of water resources due to use of water for construction activities	<ul style="list-style-type: none"> ▶ Optimized utilization of water for construction purpose ▶ Emphasis shall be given on optimization of water usage and supply of potable drinking water for labour working at construction site 	Continuous	GETCO approved Contractor	HREPL
6	Physical hazards related to working at height due to Erection of towers, line stringing	<ul style="list-style-type: none"> ▶ Safety practices to prevent physical hazards to employees should be employed ▶ Training imparted to employees on regular basis ▶ PPEs to be provided to 	Continuous	GETCO approved Contractor	HREPL

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		workers			
7	Issues related to construction labour management (Limited number of contractual workforce (maximum of 10-15) are employed during construction phase)	<ul style="list-style-type: none"> ▶ Provision of clause in contractor's agreement that bans child labour and forced labour at project site. ▶ Adequate procedures to avoid or prevent hiring/entry of child labour at the project site 	Continuous	GETCO approved Contractor	HREPL

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CHAPTER 7: Analysis of Alternatives

In order to assess the optimum feasibility of the solar energy projects for power generation in the state, a comprehensive site assessment has been conducted by the Company for the project, keeping following points under consideration : Higher solar radiation intensity, Land availability, Connectivity and accessibility, Shading aspects, Water availability, Power evacuation facilities (nearest available substations of GETCO).

The state of Gujarat comprises high wasteland and high annual solar radiation. The Gujarat Energy Development Agency (GEDA), the State Nodal Agency of Ministry of New and Renewable Energy (MNRE), Government of India has developed state solar power policy to promote generation of green and clean power, and productive use of waste lands, thereby engendering a socio-economic transformation and creation of environmental consciousness among citizens. The policy provides for efficient use of conventional energy, proactively establish and promote sustained use of new and non- conventional energy sources and applications to reduce emissions and related impacts of climate change.

As per the technical assessment undertaken across the Solar PV technologies, the crystalline solar PV technology appears to be the most feasible option for the proposed location because of the land type, meteorological study and annual behavior of solar radiation over the location near village Bapodar and Kerala, Gujarat. Also, the land available for acquisition for the project was not suitable for agriculture due to high salinity and also involved no displacement of any person.

Although India's generation and distribution capacity has grown significantly over the last decade, the electricity consumption has also steadily increased and many parts of the country continue to suffer power shortages both in terms of unmet demand during peak periods and an overall energy shortage. Also, under the Electricity Act, 2003, the State Electricity Regulatory Commissions (SERCs) set targets for distribution companies to purchase certain percentage of their total power requirement from renewable energy sources. This target is termed as Renewable Purchase Obligation (RPO). This project is expected to help in achieving both the demand-supply gap in energy requirement and RPO requirement.

The alternatives for power generation in the case of a 'no project scenario' would significantly depend on the fossil fuel based energy (comprising almost 70% of the energy in the Indian grid). This would result in higher greenhouse gas as well as air emissions from the generation of same amount of power due to consumption of higher carbon intensive fossil fuels such as coal, diesel, etc.

In the case of an alternative renewable energy based project based on biomass or wind, the availability of surplus biomass for the first, and an optimal wind power potential for the latter is a basic requirement for finalizing the project location. Wind based energy projects would also require acquisition of suitable land area for installation and operation of windmills. In the case of biomass projects, it has been noted that the smooth functioning of the project becomes a challenge due to non availability of trained manpower during the operation and maintenance phase. Thus, there are no additional environmental and social benefits even when other

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renewable energy projects are considered as alternatives. Rather, the project alternative offers a power source to meet India's increasing energy demands through clean energy, zero displacement or negative impacts on people and fauna / flora, with temporary environment and social impact during the construction phase alone. However, the robust environment and social mitigation and management plan that has been set out for the project is expected to address the temporary impacts as identified

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CHAPTER 8: Grievance Redressal Mechanism

Environmental and social grievances are handled in accordance with the project grievance redressal mechanism defined under the HR policy for contractors. The Grievance Redressal Mechanism (GRM) for the project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. This mechanism was established prior to construction and will remain active throughout the life cycle of the project. Open and transparent dialogue will be maintained with project affected persons as and when needed, in compliance with ADB safeguard policy requirements.

The major objectives of the Grievance Redressal Mechanism System are to:

- ▶ create a platform / process for prevailing proactive IR;
- ▶ make people accountable for timely redressal of grievances;
- ▶ establish a robust process for addressing contract worker grievances;
- ▶ create a healthy working atmosphere and drive active engagement at contract worker level;
- ▶ have a strategy, supporting long-term business requirements at site;
- ▶ prevent minor disagreements developing into more serious disputes later on;
- ▶ defend against legal intervention

A Grievance Redressal Committee (GRC) was formed at the project site to ensure affected person's grievances on both environmental and social concerns are adequately addressed and facilitate timely project implementation. The GRC comprises the following members:

- ▶ Project head;
- ▶ Liasoning officer – Site In charge/Admin;
- ▶ Land seller (local community representative)

Plan for handling grievances

Visit to villages made by company representative to capture project affected families grievances on continuous basis and recorded the same through public and individual meetings. Compliance status of previous points shared with public on periodic basis.

Record keeping

For record keeping purposes, grievance redressal registers maintained at the following locations on site:

- ▶ Register No. 1: Kept in Time Office.
- ▶ Register No. 2 onwards: Kept at various locations of the Plant as decided by the local HR Head.

The register contains information such as date, time, location and names of villager and the grievances, if any. The record also maintained about the information provided or discussed against the grievance.

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Communication has been made to all contractor staff regarding the 'Dos' and 'Don'ts' and they were apprised about the discipline amenable with the local customs and traditions during their association with the project.

The labour has also been communicated that they can register their grievances in grievance redressal registers. These grievances are being studied, analysed and appropriate solution to the queries/grievances provided to the concerned worker within 3 working days. In-Charge Time Office generate a monthly MIS of all grievances registered along with their resolution / response provided and send the same to the respective unit HR Head.

Grievance Redressal Mechanism for Local Community

- ▶ The Project Head is responsible for capturing, identifying, maintaining enquiries associated with community grievance in a register, and communicating progress to the concerned community member.
- ▶ A Register contains information such as date, time, location and names of villager and grievance; if any. The record will summarize what information was provided to or discussed with the individual land seller.
- ▶ At the site, there were 4 recorded grievances from the community. The grievances recorded were mainly requests for the Company to undertake activities like lighting facility to local temple, repair of roads, etc. There were no grievances related to land acquisition.

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CHAPTER 9: Consultation and Participation

During project construction, the Company held meetings and public consultations with the residents of Bapodar and Kerala villages. The Company made a presentation on the proposed project, development prospects, project impacts and measures to mitigate possible negative impacts. The prospects of improving social and economic status of the region as a result of a successful project implementation as well as corporate social responsibility (CSR) activities of the Company were also discussed. The CSR activities proposed by the Company and to be taken up during the operational phase of the project include:

- ▶ Community development programmes
- ▶ Education programme for children
- ▶ Women Empowerment programmes

A summary of stakeholder consultations conducted for seeking feedback and observations or comments from local communities around the project site is provided:

1. Informal consultations conducted in the month of May 2011
2. Formal consultation as per CDM conducted on 10 November 2011 which was attended by 40 people from nearby community



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Site visit consultations held in February 2012



During the site visit, discussions were undertaken on an informal basis with a group of 7-8 community members from Kerala and Bapodar villages who confirmed that they were made aware of the project by the Company. Some persons in the village had already been contracted as security guards for the project. They indicated their satisfaction with the project which will bring more jobs to the village and opportunities to set up small businesses for construction and operational workers.

CSR programme for community during operation phase

The Company has set out a budget of approximately INR 0.4 – 0.5 Million per annum to operationalize the CSR programme during the operation phase of the project. These programmes shall be structured, based on an identification of the community and shall be spearheaded by the Project Incharge at site.

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CHAPTER 10 : Conclusion and Recommendations

As already mentioned, the project activity will contribute to generation of 20 MWp of clean power into the state grid. This will not only boost the economic and industrial development of the area but will also contribute towards energy security.

This report assessed various existing environmental parameters in and around the project and the actions taken to minimize any significant negative impact. It is observed that the planned measures are already being implemented at the project site during the pre-construction and construction phase.

The project site is not located in a sensitive ecosystem, and is not significant from the historical and cultural perspective. It has been observed that most of the land purchased for the project is agricultural land but the land has lost its fertility over the period of time due to salt water ingress in the area. This nature of the project site coupled with the clean nature of solar power generation ensures that the Project will not cause any significant adverse environmental and social impacts during construction and operation. The same is evident from the observations delineated in the previous sections of the report.

The main project associated impacts are associated with clearing of shrub vegetation, waste management and management of labour camps at the site. Moreover, most of the associated impacts are limited to the extent of construction phase and are temporary in nature. Adequate mitigation actions are undertaken in line with management and monitoring of the set of recommended mitigation measures. Regular monitoring of the recommended mitigation measures shall also be carried out during the implementation phase of the project.

In fact, various initiatives proposed in the project's ESMMP such as the green belt development, community development programmes, etc. are likely to enhance the environmental and economic development in and around the project area. The company may take initiatives to further strengthen its process/procedures on waste management with special emphasis on handling of broken solar panels and handling and storage of oils/chemicals.

Based on the MoEF Guidelines of Government of India the proposed project does not require an environmental clearance. Considering the above, the project meets the classification criteria for category B, in accordance with ADB's Safeguard Policy Statement 2009.


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Appendix A: Environmental Compliance Audit Report


The project got commissioned on 18 April 2012. Internal audits were carried out by the corporate EHS team to assess the compliance status against the defined environmental and social mitigation and monitoring action plan in the IEE. Based on the assessment, it was observed that most of the potential adverse environmental and social impacts were mitigated to an acceptable level by implementation of the mitigation measures identified in the ESMMP. Provisions are being made in the project to cover the environmental mitigation and monitoring requirements across each of the project phases. The observations and recommendations, if any, are delineated below:


1.1 Pre-Construction phase

All the defined mitigation actions were found to be implemented in the pre-construction stage of the project activity to an acceptable extent. A snapshot of the actions undertaken is given below:

Anticipated Impact	Mitigation actions undertaken
Loss of land, livelihood, assets, etc	<ul style="list-style-type: none">▶ Formal and informal stakeholder consultations were carried out with the local community to provide an overview of the project activity and to understand their needs and concerns;▶ Appropriate compensation was provided to the land owners in line with prevailing rates. Few temporary structures at the site had to be removed for the project and based on the review of land deeds of the affected land owners on sample basis, it was observed that land owners were provided with appropriate replacement rates for the temporary structures▶ The Company has engaged local people to the extent practically possible for services like tractors, cars for employee transport, etc The Company had offered employment opportunity to few of the family members of the project affected landowners  <p>Photograph showing informal stakeholder consultation with the local community to understand their concerns about the project</p>

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	 <p>Photograph showing formal stakeholder consultation conducted at the project site</p>
Recommendations	None

Anticipated Impact	Mitigation actions undertaken
Land and water contamination	<ul style="list-style-type: none"> ▶ A designated area has been defined for storage of project equipment and material and the floor of the storage area has been concretized. ▶ Procedure has been defined for storage and handling of material and the measures required to be undertaken in case of a spill ▶ Separate mobile toilets were established at the site for men and women; Soak pits are dug at the site to dispose off the waste water generated at the site.  <p>Photograph showing separate toilet facilities for male and female workers at the project site</p>
Recommendations	None

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Anticipated Impact	Mitigation actions undertaken
Soil erosion	<ul style="list-style-type: none"> ▶ Grading has been done in phases to minimize the area of bare soil exposed at one time ▶ The unnecessary clearing of the site has been avoided. ▶ The topsoil in non-built up areas has been restored and such portions of the site has been replanted with appropriate plant species to stabilize soil ▶ An internal drain has been constructed for storm water collection to minimize soil erosion. ▶ External boundary wall has been constructed to protect the internal soil
Recommendations	None

Anticipated Impact	Mitigation actions undertaken
Air pollution	▶ Practice of water sprinkling was evident during the site visit
Recommendations	None

Anticipated Impact	Mitigation actions undertaken
Health risk	▶ First aid training has been provided to few of the workers at the site. The training certificates were available for verification at the site. Records of regular health and safety related awareness programs are also available at the site.
Recommendations	None

1.2 Construction phase

All the defined mitigation actions were found to be adequately implemented in the construction stage of the project activity. A snapshot of the actions undertaken is given below:

Anticipated Impact	Mitigation actions undertaken
Air pollution	<ul style="list-style-type: none"> ▶ All the excavated soil was properly covered to avoid the contact with wind and water sprinkling was regularly practiced; ▶ The speed limit has been set to 15 km/hr within the project site and all the suppliers are encouraged to carry a PUC (Pollution under control) certificate. ▶ Trucks/dumpers used for transportation of materials are covered by tarpaulin sheets ▶ Practice of water sprinkling was evident during the site visit ▶ Stack height in line with the legislative requirement was maintained for the D.G sets used at the project site

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	<ul style="list-style-type: none"> ▶ Ambient air quality monitoring was carried during the construction period. <i>Please see Appendix A (Attachment 1) for the Ambient Air Quality Monitoring Records.</i>
Recommendations	<ul style="list-style-type: none"> ▶ None

Anticipated Impact	Mitigation actions undertaken
Air Pollution, Soil and water contamination	<ul style="list-style-type: none"> ▶ The excavated material generated at the site has been completely reused for site filling and leveling operation ▶ The scrap metal waste generated from erection of structures and related construction activities has been collected and stored separately in a stack yard and sold to local recyclers. ▶ Food waste and recyclables viz. paper, plastic, glass has properly segregated and stored in designated waste bins/containers. The food waste is being collected and composted at site ▶ Hazardous waste viz. waste oil etc has been collected and stored in paved and bunded area and subsequently sold to authorized vendors. Broken solar panels are stored separately in the storage; Diesel is also kept in the store ▶ A waste management plan is in place for handling and disposal of the broken solar cells and handling and storage of oils/chemicals
Recommendations	<ul style="list-style-type: none"> ▶ Awareness amongst the workers at site about handling of broken solar panels may be enhanced ▶ On-site storage of diesel shall be minimized ▶ Regular maintenance of vehicle may be carried out to avoid any leakage of oil or grease

Anticipated Impact	Mitigation actions undertaken
Health & Safety risks	<ul style="list-style-type: none"> ▶ Vehicle speed at site is restricted to 15km/hour ▶ Use of PPE was evident during the site visit ▶ During interview most of the workers handling solar cells and hazardous waste were aware of the procedures to handle the same up to an acceptable level ▶ Workers are checked at the entrance for inflammable material, if any, and if found in possession are allowed to enter the premises only after confiscation of the same at the security gate and after being given a warning ▶ Training records of workers on occupational safety were available at the site ▶ Temporary creche facility was provided for children of migrant workers
Recommendations	<ul style="list-style-type: none"> ▶ PPE usage may be further strengthened by regular tool box talks or regular awareness sessions ▶ Procedures for handling broken solar cells and hazardous waste may be displayed at site.

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Anticipated Impact	Mitigation actions undertaken
Noise pollution	<ul style="list-style-type: none"> ▶ Regular maintenance of plant equipment is being carried out ▶ Noise prone activities are restricted to the extent possible during night time. ▶ Personal protective equipments are provided to workers performing drilling activities at site. Training records of workers on occupational safety were available at the site ▶ Acoustic enclosures provided with the D.G sets to minimize the noise levels ▶ Noise monitoring tests has been done during the construction phase of the project. The noise level as per the monitoring record is within the permissible limits. <i>Please see Appendix A (Attachment 2) for the noise monitoring records.</i>
Recommendations	None

Anticipated Impact	Mitigation actions undertaken
Resource (fuel wood) depletion Use of local fuel wood for domestic/cooking purposes	Labour should be made aware on the optimum use of fuel-wood for cooking
Recommendations	▶ None

Transmission line related measures during the construction phase

The transmission line for the project has been routed so as to avoid interference with threatened flora and fauna, environmentally sensitive areas as well as human settlements. Thus, the potential impacts from construction of transmission line are insignificant and temporary in nature. All the mitigation actions planned during the construction of the transmission line were found to be adequately supervised by HREPL

The mitigation measures undertaken during the construction of the transmission line are highlighted below:

Anticipated Impact	Mitigation actions undertaken
Soil erosion, Air Pollution due to clearing of vegetation (shrubs, bushes)	<ul style="list-style-type: none"> ▶ The unnecessary clearing of the vegetation has been avoided by the contractor. ▶ The minimal quantity of soil excavated during the clearing of vegetation has been backfilled immediately to prevent soil erosion
Recommendations	▶ None

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Anticipated Impact	Mitigation actions undertaken
Air and Noise Pollution due to Transportation of equipment to site	<ul style="list-style-type: none"> ▶ Proper maintenance of vehicles to minimize air and noise emissions has been carried out by the contractor. ▶ Noise prone activities are restricted to the extent possible during night time. ▶ Use of personal protective equipment like ear plugs, mufflers is enforced for the contractor's workmen by HREPL
Recommendations	▶ None

Anticipated Impact	Mitigation actions undertaken
Soil Movement, Air Emissions due to Excavation, digging of pits	<ul style="list-style-type: none"> ▶ Small scale excavation has been carried out for pole foundation work. The excavated material was backfilled and compacted after the construction work to prevent soil erosion or air emissions.
Recommendations	▶ None

Anticipated Impact	Mitigation actions undertaken
Air Emissions, Noise Pollution due to Structural work/Mechanical Work	<ul style="list-style-type: none"> ▶ Use of personal protective equipment like ear plugs, mufflers, dust masks, safety boots etc. is enforced for the contractor's workmen by HREPL ▶ Training has been imparted to contract workers by the contractor on a regular basis ▶ Workplace safety Instructions displayed at the site for awareness of the workers
Recommendations	▶ None

Anticipated Impact	Mitigation actions undertaken
Wastage of water resources due to use of water for construction activities	<ul style="list-style-type: none"> ▶ Water requirements for the project has been monitored and attempts were made to avoid spills / wastages to ensure optimal utilization ▶ Awareness programme regarding conservation of water has been conducted for the workers ▶ Potable drinking water for labour working at construction site has

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	been provided
Recommendations	▶ None

Anticipated Impact	Mitigation actions undertaken
Physical hazards related to working at height due to Erection of towers, line stringing	<ul style="list-style-type: none"> ▶ Safety practices to prevent physical hazards to employees have been employed at site ▶ Appropriate type of PPEs has been provided to workers at site and adequate monitoring is done to ensure consistent use of PPEs by the workers ▶ Safety Induction Training is mandatory for workers at site. Workers have also been trained on emergency preparedness
Recommendations	▶ Regular Safety Toolbox talks to be conducted at the site

Anticipated Impact	Mitigation action undertaken
Issues related to construction labour management [limited number of contractual workforce (maximum of 10-15) are employed during construction phase]	<ul style="list-style-type: none"> ▶ Provision of clause in contractor's agreement that bans child labour and forced labour at project site. ▶ Adequate procedures in place such as verification of valid age documents such as school leaving certificate, voter's identity card etc. to avoid or prevent hiring/entry of child labour at the project site

1.3 Operation phase

Anticipated Impact	Mitigation actions undertaken
Water depletion	<ul style="list-style-type: none"> ▶ Regular monitoring has been done to avoid spills / wastages to ensure optimal utilization of water
Recommendations	▶ Procedure may be adopted to recycle/reuse the collected water.

Anticipated Impact	Mitigation actions undertaken
Soil contamination	<ul style="list-style-type: none"> ▶ Maintenance schedule of the transformers was available at the site

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Recommendations	▶ Maintenance of transformer shall be carried out as per the schedule
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Anticipated Impact	Mitigation actions undertaken
Safety risks	<ul style="list-style-type: none"> ▶ Rubber mats are provided near all high voltage electrical equipments ▶ CPR charts are displayed in the switchyard area ▶ Appropriate signage board have been displayed at the switchyard to warn employees / visitors of possible dangers
Recommendations	▶ Training calendar shall be chalked out to impart knowledge to employees on electrical safety

Anticipated Impact	Mitigation actions undertaken
Weeding practices	▶ Removal of weeds (if any), growing beneath the solar modules and used as fodder for livestock of nearby villages
Recommendations	▶ Clearing of weeds growing within the project area to be carried out as and when required

1.4 Decommissioning phase

A decommissioning plan was available at the site. The same shall be cross checked with the activities undertaken at the time of decommissioning.

1.5 Applicable Environmental Laws, Regulations and Standards- Compliance Status

HREPL has taken all necessary steps to ensure compliance with the environmental statutory regulations applicable on the project.

1.6 ADB's Environmental and Social Assessment Framework

The project status assessed against the ADB Safeguard Policy is specified below:

ADB's Social Safeguard's Policy (2009)	Objective	Status
SR 1	SR1 on the environment requires that environment	As per the requirements of SPS (2009) and assessments based on IEE conducted at the

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	must be considered at all stages of the project cycle from project identification through implementation.	site, the HREPL Solar project is likely to fall under the environmental category “B” project.
SR 2	SR 2 on Involuntary Resettlement requires that all impacts (physical and economic displacement) brought about by land acquisition be mitigated properly following the principle of replacement value.	In order for the Project to meet the requirements of SR 2, a Social Safeguard Compliance Audit has been undertaken to assess the social impacts of the project in and around the project location. No major impacts could be envisaged during the social compliance audit process. Also, there were no permanent inhabitants dwelling on the site as confirmed by interviews with the local community during the site visit. For details, please refer Social Safeguard Compliance Audit Report.
SR 3	SR 3 on Indigenous Peoples require that the Indigenous people are identified and if present, they should benefit from the development projects and the project should avoid or mitigate potentially adverse effects on indigenous people caused by the Project.	As per the survey of the project site and the areas in the vicinity, there were no identified project affected families from the declared scheduled tribes or other designated tribal communities. The Project area also does not fall within the “Scheduled Area” of the state (which is determined by the Fifth Schedule of the Constitution on the basis of preponderance of tribal population; compactness and reasonable size of the area; underdeveloped nature of the area; and marked disparity in economic standard of the people). For details, please refer Social Safeguard Compliance Audit Report.
ADB’s Social Protection Strategy (2001)	The Social Protection Strategy requires that projects comply with applicable labour laws, and take measures to comply with the core labour standards for the ADB financed portion of the Project.	All the applicable labour laws requirements have been met during different phases of the project. The Company has HR Policies and procedures in place to ensure compliance with the applicable labour laws. Also, regular monitoring is done at the site to check the compliance status of the applicable labour laws and ADB requirements.

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Photos: HREPL Site



Photograph showing washing facility provided to workers during the construction phase



Photograph showing the drinking water storage tank at the project site during construction phase



Photograph showing the safety office at the project site



Photograph showing use of PPEs by the workers during the concrete mixing work

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Photograph showing the Tool Box Talk at the project site



Photograph of distribution of safety badges at Hiraco site

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Photograph showing safety pledge taken by employees including contract workers at site

site



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Attachment 1: Ambient Air Quality Monitoring Record (conducted by Government recognized laboratory)

Pollutant	Near LT room no.6 [on 24 hrs basis]	Near LT room no.2 [on 24 hrs basis]	Near switch yard [on 24 hrs basis]	Standards defined under legislation	
				Annual basis	24 hour basis
Sulphur Dioxide (SO ₂)	75	78	73	<60	<100
Particulate Matter <PM ₁₀ (ug/m ³)	51	42	40	<40	<60
Particulate Matter <PM _{2.5} (ug/m ³)	35	33	32	<40	<80
Nitrogen dioxide	32	27	36	<40	<80
Ozone	22	26	25	<100	<180
Lead as Pb	B.D.L	B.D.L	B.D.L	< 0.5	< 1
Carbon Monoxide	< 1	< 1	< 1		
Ammonia as NH ₃	31	36	33		
Benzene	B.D.L	B.D.L	B.D.L		
Benzeno	B.D.L	B.D.L	B.D.L		
Arsenic	B.D.L	B.D.L	B.D.L		
Nickel	B.D.L	B.D.L	B.D.L		

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Attachment 2: Ambient Noise Monitoring Record (conducted by government recognized lab)

Monitoring station	Day	Night	Standard
Near Pota cabin	55	48	75 (Day) / 70 (Night)
Near LT room no.1	62	46	75 (Day) / 70 (Night)
Near switch yard	54	45	75 (Day) / 70 (Night)
Near contractor office	61	41	75 (Day) / 70 (Night)
Near LT room no.5	61	44	75 (Day) / 70 (Night)
Near LT room no.4	59	46	75 (Day) / 70 (Night)
Near main gate	57	42	75 (Day) / 70 (Night)
Near LT room no.2	58	48	75 (Day) / 70 (Night)