ARCADIS Design & Consultancy for natural and built assets

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY

For 20 MW Solar Power Project at Village Karekal in Bellary district of Karnataka

December, 2018

Prepared for:

Clean Solar Power Bellary Private Limited (CSPBPL)

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LIST OF ABBREVIATIONS

AC	Alternating Current
ADB	Asian Development Bank
BEE	Bureau of Energy Efficiency
BPL	Below Poverty Line
CGWB	Central Ground Water Board
CHNC	Community Health & Nutrition Cluster
CPCB	Central Pollution Control Board
CPR	Common Property Resources
CSPBPL	Clean Solar Power Bellary private Limited
CSR	Corporate Social Responsibility
CTE	Consent to Establish
CTO	Consent to Operate
DC	Direct Current
DISCOM	Distribution Company (India)
DMHO	District Medical & Health Officer
DWCRA	Development of Women and Children in Rural Areas
EP	Equator Principle
E&S	Environmental and Social Risk
ECC	Emergency Control Centre
EHS	Environmental Health and Safety
EIA	Environment Impact Assessment
EPC	Engineering, Procurement & Construction
EPFI	Equator Principles Financial Institutions
ESDD	Environment & Social Due Diligence
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental Social Management Plan
ESMS	Environmental Social Management System
ESSG	Environmental Social Safety and Governance
FI	Financial Institutions
GHG	Green House Gases
GHI	Global Horizontal Irradiation
GRM	Grievance Redressal Mechanism
GSS	Grid Substation
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
ILO	International Labour Organization
IUCN	International Union for Conservation of Nature
KLD	Kilo Litre per day
Lpcd	Litre per capita per day

LRP	Livelihood Restoration Plan
MNRE	Ministry of New and Renewable Energy
MoEF&CC	Ministry of Environment, Forest and Climate Change
NAAQS	National Ambient Air Quality Standards
NABARD	National Bank for Agriculture and Rural Development
NABL	National Accreditation Board for Laboratory
O&M	Operation and Maintenance
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
PAP	Project Affected People
PF	Protected Forest
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PPS	Pooling sub station
PS	Performance Standard
PUC	Pollution under control certificate
PV	Photo Voltaic
R & R	Rehabilitation & Resettlements
RF	Reserve Forest
SBM	Swachh Bharat Mission
SECI	Solar Energy Corporation of India
SGWD	State Ground Water Department
SH	State Highway
SHG	Self Help Groups
SOP	Standard Operation Procedures
SPCB	State Pollution Control Board
SPD	Solar Power Developer
SPHO	Senior Public Health Officers
SPPD	Solar Power Park Developer
TDS	Total Dissolved Solids
USDA	United States Department of Agriculture
WPA	Wildlife Protection Act

EXECUTIVE SUMMARY

Background	**M/s. Clean Solar Power Bellary Private Limited (CSPBPL),** a 100% Subsidiary of **Hero Future Energies Private Limited (Here after known as HFE)**, have proposed to develop 20 MW grid connected solar photovoltaic power plant at Village Karekal, Bellary District of Karnataka. Hero Future Energies (HFE), established in 2012, and which has a footprint in Rajasthan, Maharastra, Karnataka and Tamil Nadu, is one of the leading independent power producers in renewable energy sector in India. The company has been established with a vision and mission to generate 3.5 GW of Renewable clean energy by 2022. The present installed capacity of HFE is around 1.2 GW and projects are distributed in different states in India. Further, HFE is successfully commissioned 10 MW solar PV plant with Karnataka power transmission Company Limited under the State policy and 30 MW solar PV projects under JNNSM Phase-II Batch-I programme. Hero Solar Energy Pvt. Ltd has won a bid for the generation for the development of 122 MW (AC) solar power projects in the state of Karnataka. The letter of award and allotment award was issued on 23.03.2016 vide letter no KREDL/07/RPO/GC/1200MWs-269/2016/1215 by Karnataka Renewable Energy Development Limited (KREDL). Subsequently, a Special Purpose vehicle (SPV) i.e. **M/s. Clean Solar Power (Bellary) Private Limited (CSPBPL)** was incorporated under the companies act 1956/2013. The proposed project is Located at Karekal village, District-Bellary in Karnataka which is connected by NH-72 with district headquarter and other major towns. Hero Future Energies Private Limited has appointed "**Arcadis India Private Limited**", as an independent consultant to carryout "Environmental & Social Impact Assessment Study" for 20MW solar power project, following the performance standards of "International Financial Corporation(IFC)".The ESIA was conducted to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the solar plant. The Environmental and Social Impact Assessment (ESIA) study for the project has been undertaken in accordance with terms of reference as per International Finance Corporation's (IFC) Performance Standards (PS) guidelines on Social and Environmental Sustainability, 2012; IFC's general guidelines of Environment, Health and Safety, Relevant ILO conventions covering labour standards. The study will also assess the sustainability of the project w.r.t the local and national regulations relevant to the project.
Project Overview	The 20 MW ac solar power plant at Karekal Village is being developed by M/s. Clean Solar Power Bellary Private Limited (CSPBPL), a 100 % subsidiary of Hero Future Energies Private Limited (Here after known as HFE). CSPBPL will purchase 124 acres of Private land directly from the land owner on willing to Sell willing to Buy basis. • The project is in Operational Phase during time of site visit and Commissioned on September. 2017.

	• There is a 33/110 kV pooling substation through 33 KV cables, which is located inside the project boundary. • The grid sub-station is located at Village Karekal, District- Bellary. The distance between pooling Substation and Grid substation is 9.35 km. • The transmission line is passing through the agricultural Land and dry land. There are 33 Towers located on the Transmission Line.
Applicable IFC's Performance Standards and ADB SPS	The Environment and Social Management Plan (ESMP) for the project has been designed considering the requirement and framework of Indian environmental legislation, IFC's Performance Standards, Relevant ILO conventions covering labour standards and IFC's Industry Specific EHS guidelines. PS1: Social and Environmental Assessment and Management Systems, PS2: Labour and Working Conditions, PS3: Resource Efficiency & Pollution Prevention, PS 4: Community Health, Safety and Security. Also, IFC's core labour standards are applicable to the project. The other performance standards PS5: Land Acquisition and Involuntary Resettlement PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. and PS7: Indigenous Peoples and PS:8 Cultural Heritage are not applicable for this project.
PS1: Social and Environmental Assessment and Management Systems	The project will have environmental and social impacts due to generation of onsite air emissions, noise generations, domestic wastes from site, offices and rest rooms, and generation of constructional debris particularly during the construction period. CSPBPL has developed an Environmental and Social Management Plan (ESMP) at the corporate as well as and adhere to the environment and social management policy recommended for its solar project at the ground level. CSPBPL fulfils the following requirements: • Environmental and social action plan; • Identification of risks and impacts; • Management program; • Organizational capacity and competency; • Training for security and safety workers; • Emergency preparedness and response; • Stakeholder engagement/ grievance redressal; and Monitoring, reporting and review. **Hence PS1 is applicable.**
PS2: Labour and Working Conditions	The PS2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers). Technically skilled personnel are hired for the operation and maintenance activities of the respective solar power plant. Locals are hired as security guard along with migrant labours, in case the labour requirements are not available locally. To this effect, labour accommodation provided during the construction phase of the project. It should follow the Guidelines of IFC Worker's

	Accommodation: Process and Standards while providing labour accommodation. **PS2 is therefore applicable for the project.**
PS3: Resource Efficiency & Pollution Prevention	The project involves use of resources like land and water. Improper handling of broken and damage solar panel may result in soil contamination. Improper handling of transformer oil may lead to contamination of soil and ground water. *During construction* CSPBPL should take proper Measures during construction period for management of construction debris and minimization of fugitive dust emissions. Further, CSPBPL should ensure through its contractors that other wastes (packing material, scrap metal, cement bags, drums/cardboards etc.) are collected, stored and disposed in a predefined area. *During operation* During operation Period, the water is required for cleaning of solar module & domestic purpose. Improper handling of broken / damaged solar panels may result in contamination of soil and ground water. In addition to this, handling of broken / damaged solar panels may result in contamination of soil and ground water. Diesel / transformer oil/ spent oil may also contaminate soil and water. As a mitigation measure HFE has taken paramount care to store and dispose off all hazardous waste generated due to the project as per the requirements of the Hazardous Waste (Management, Handling and Trans-Boundary Movement) **Hence PS3 is applicable**
PS4: Community Health, Safety and Security	This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. Therefore, traffic must be managed for the project vehicles to cross the road and enter the project boundary. Further, at the project site, appropriate access control is required to put in place. This control will include barricading of project site; safety signage; illumination and other measures to mitigate the risk of accidents for public during the construction phase. **During operation** The project will generate electrical energy and transmitting the same through high voltage power line, thereby exposing the community to electrical injury. Construction of boundary wall may result in restriction of access / increased distances from common property. Disagreements over common property usage between project site officials may lead to anxiety among the community. Improper handling of hazardous waste including but not limited to broken / damaged solar panel may contaminate land and groundwater with heavy metal (including but not limited to cadmium) thus impacting the community using groundwater. Impact on community due to frequent visits of people from outside the community with diverse cultural background would be envisaged. **PS4 is therefore applicable for the project.**
PS 5: Land Acquisition and	As information provided by the representative that the land allocated for 20 MW Project (awarded to Hero Future Energies Pvt. Ltd.) are private agriculture land.

Involuntary Resettlement	The land parcels was procured on willing to buy and sale basis and at mutually agreed price, which is higher to prevalent market rates. Under the proposed project, 124 acres of private land has been procured. The project has not resulted in any economic or physical displacement and is also envisaged as the land purchased for the project is dry agricultural land (cultivation depends on rain-fall) and is without habitation. **Hence, PS5 is not applicable.**
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	The proposed project site is in barren dry Land and the habitat is modified in Nature. No forest area is located within the project site and within the 10 km radius of the project site. Very less vegetational cover around the project site is observed during site visit. The vegetation observed along the road side and on the agricultural fields are common to this area and climatic conditions. Also, there is no species with high conservation value is observed in the study area. No Endangered Plant or animal species are observed or reported during the field survey. No schedule -I species according to Wild Life Protection act,1972 is also reported or observed from the project site. **Hence PS -6 is not applicable for the project**
PS 7: Indigenous Peoples	The study area (located in Bellary district) does not fall in any notified tribal area of Karnataka state. As per Census, 2011, tribal population (Scheduled Tribe) present in the study area village is around 21 percent. No land has been procured from Indigenous People. **Hence, PS 7 is not applicable.**
PS 8: Cultural Heritage	This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes. No notified Cultural Heritage site is located near the project area. **Hence, PS 8 is not applicable.**
Key Project Impacts – Construction Phase	*Impact on drainage*: existing drainage pattern of the project site and study area was studied during the time of site visit. It is observed that one natural nallah is passing through the project site. This nallah is generally carried the surface runoff from this area particularly during monsoon period. At the time of visit there was no water observed in this nallah. Therefore, mitigation measures should be taken by the project proponent to minimise the impact on this natural drainage system particularly during the construction period. *Access restriction:* It is observed that no village roads which connects the nearest villages located inside the boundary wall of the project site. Nearest village, karekal, is about 5 km from the project site. Therefore, the question of access restriction is not envisaged in this project. *Impact on air quality:* Generation of fugitive dust due to earth work, movement of project vehicles, transportation of fine material (if not covered) and emission from diesel generators is envisaged particularly during the construction phase. Impact will be limited to the construction phase only and site specific in nature.

	Water resources: Water will be used during the construct phase for foundation work and for domestic purpose. The source of water was ground water and supplied by external vendor. As per CGWB categorisation w.r.t to the groundwater development, the mandal in which project site falls are mentioned under "Safe" category. Hence, impact on the ground water is anticipated to be low, based on the water requirement and duration of construction phase. *Traffic Load:* Project site connects to National Highway-72 connecting Bellary town through Major District Road, will be used for movement of trailer trucks carrying solar plant parts and other heavy vehicles for the project activity along with the movement of labours and other project materials. *Impact on Flora and fauna: the proposed project site is located on the private dry barren land. No forest land* is located at the project site or its surrounding. During the construction work activity will be limited to only ground clearing of vegetation mainly grasses and shrubs species. Proposed project site is surrounded by patches agricultural Fields. Vegetation is mainly Observed along the road side and on the Agricultural land. No Schedule I animals observed during the field visit. therefore, no major impacts on flora and fauna is envisaged except clearance of ground vegetation during the site preparation.
Key Project Impacts – Operation Phase	*Soil contamination:* Storage / improper disposal of broken / damaged solar panel and used oil from transformer may result in soil / ground water contamination. Impact on water resources: Water will be required mainly for washing of solar panels. During operation phase water will be supply through bore well which is located inside the site premises. Moreover, jet water spray method/dry cloth wiping method would be further adopted for minimizing the consumption of water. Occupational health and safety of workers: Accidents like electrocution, short circuits may lead to occupational health and safety issues, for which proper training to workers need to be given to combat the same as well as it needs to be further ensured that the workers wear appropriate PPE's according to their nature of work involved. *Social Welfare:* To reduce the dissatisfaction among the local people regarding the project activity, maximum job opportunity through direct & indirect employment opportunity should be provided to the local people. In this regard CSPBPL will be responsible. Besides, a community development plan along with a grievance redressal mechanism should be followed. Complaints received by local people should be registered, investigated and timely resolved. *Ecological Impact:* Enough height of the project boundary fencing will prohibit the entry of wildlife into the project area. It would also be expected that glare effect from the solar plant will not be impacted to the avian species in the region as there is no known migratory path crosses the project site.
Key Mitigation Measures	Appropriate mitigation measures have been recommended in the ESIA report. It is recommended to implement the ESMP during the entire life cycle of project. These measures will minimise the impacts on air, water, soil, noise quality, solid and liquid effluent waste, ecology and socio-economic conditions. The activities

	of the project during both construction and operation phase will help in improving the socioeconomic condition of the surrounding area. *Construction Phase* • Drainage study and drainage management plan should be formulated prior to site levelling and modification of site topography. • Water sprinkling on road should be undertaken to reduce dust emissions during transportation. • Fine material (e.g. sand etc.) should be covered during transportation. • Proper PPE's viz. gloves, glasses, helmet and shoes and reflective jackets etc. should be worn by workers/labours while handling solar panels as well as during other activity during construction phase. • Silent DG set will be Used. • Hazardous materials such as transformer oil, Broken Solar Panels should be stored at designated locations in enclosed structures over impermeable surface. • Complaint register should be maintained onsite to receive complaints from local people and workers and needs to be timely address. Such complaints should be acted on and escalation matrix be provided. • Strict prohibition shall be implemented on trapping, hunting or injuring wildlife within subcontractors and shall bring a penalty clause under contractual agreements. • Camp and kitchen waste (if any) shall be collected in a manner that it does not attract wild animals. • Temporary barriers like wire fencing shall be installed on excavated areas. ***Operational Phase:*** • Appointment of authorised recycler/ vendor for broken / damaged solar module and transformer Oil. • Implement the recommended complaint resolution procedure (Grievance Redressal Mechanism) to assure that any complaints regarding any issue related to project activity is not left unnoticed. The complaints should be registered, investigated and timely resolved. • Moreover, to minimize the "Lake effect", visual frightening techniques like "Scare crow" may be considered to frighten any bird trying to land on panels.
Conclusion	The solar power project at Karekal Village, in Bellary district is not likely to have any significant adverse environmental impacts that are sensitive, diverse or unprecedented and irreplaceable. It is envisaged to have moderate impact due to issues related to community safety during the construction period, insignificant impact due to generation of dust and fugitive emissions during construction phase only (short duration) and minor impact on resource utilization like land and socio-economic conditions of project area villages. There is no impact on cultural resources in the study area. The impacts anticipated during the operation phase is fugitive emissions from movement of

project vehicles within the site (air environment) which is minimal, surface run off and onsite drainage of storm water (water environment), impact on soil due to storage and spillage of transformer oil (land environment), disposal of broken / damaged solar panel during operation phase, which can be mitigated by adopting suggested mitigation measures.

Based on the conclusion drawn from the ESIA study with respect to the kind of impacts of the project on environment, resources, biodiversity, labours and community, the project is categorized as **Category B** from the perspective of environment safeguard. From the perspective of IFC the project is categorised as ***Category B.***

This Executive Summary should be read in conjunction with the full report and reflects an assessment of the Site based on information received by Arcadis at the time of reporting.

1 INTRODUCTION

1.1 Background

M/s. Clean Solar Power Bellary Private Limited (CSPBPL), a 100% Subsidiary of Hero Future Energies Private Limited (Here after known as HFE), have proposed to develop 20 MW solar Power Project at Krekal Village, Bellary District, Karnataka.

Hero Future Energies (HFE), established in 2012, is one of the leading independent power producers in renewable energy sector in India. The company has been established with a vision and mission to generate 3.5 GW of Renewable clean energy by 2022. The present installed capacity of HFE is around 1.2 GW and projects are distributed in different states in India.

Hero Solar Energy Pvt. Ltd has won a bid for the generation for the development of 122 MW (AC) solar power projects in the state of Karnataka. The letter of award and allotment award was issued on 23.03.2016 vide letter no KREDL/07/RPO/GC/1200MWs-269/2016/1215 by Karnataka Renewable Energy Development Limited (KREDL). Subsequently, a Special Purpose vehicle (SPV) i.e. M/s. Clean Solar Power Bellary Private Limited (CSPBPL) was incorporated under the companies act 1956/2013.

The proposed project is Located at Karekal village, District-Bellary in Karnataka District which is connected by SH-72 with district headquarters and other major towns.

Hero Future Energies Private Limited has appointed "**Arcadis India Private Limited**", as an independent consultant to carryout "Environmental & Social Impact Assessment Study" for 20MW solar power project, following the performance standards of "International Financial Corporation(IFC)"The ESIA was conducted to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the solar plant.

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

Arcadis India Pvt. Ltd. (Arcadis) as an environment consultant has been appointed by Hero Future Energies Private Limited to undertake the ESIA study for 20 MW solar PV ground mount at Village Karekal, District- Bellary, Karnataka. The ESIA was conducted to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the solar plant. Environmental sustainability in relation to the solar power generation project will be enhanced by designing the solar power plant that gives competitive advantage over existing energy sources. The overall benefits of the solar power system are expected to outweigh the potential negative impacts. The Environmental and Social Impact Assessment (ESIA) study for the project has been undertaken in accordance with terms of reference as per International Finance Corporation's (IFC) Performance Standards (PS) guidelines on Social and Environmental Sustainability, 2012; IFC's general guidelines of Environment, Health and Safety; Relevant ILO conventions covering labor standards. The study will also assess the sustainability of the project w.r.t the local and national regulations relevant to the project.

1.2 Project Location

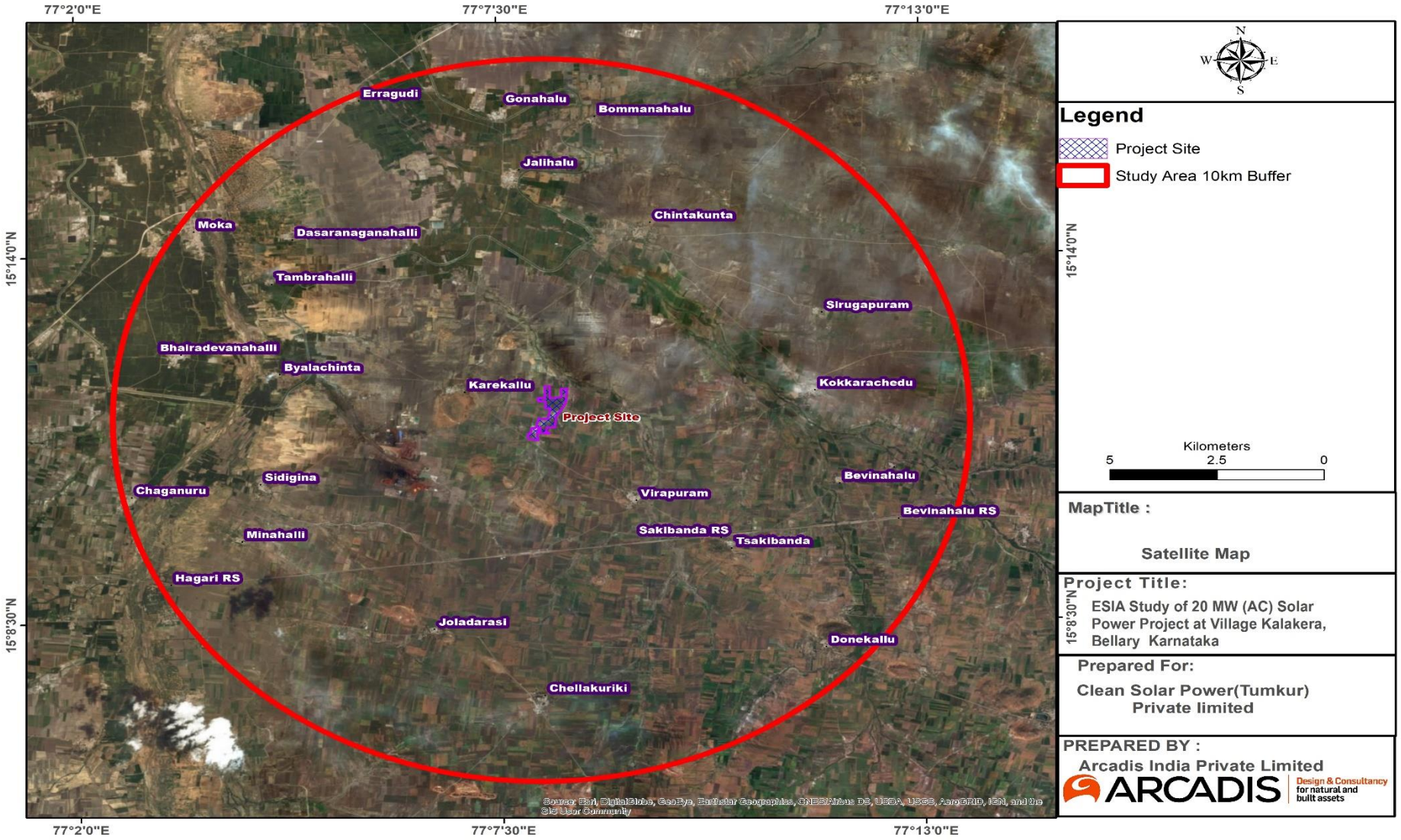
The 20 MW solar PV ground mount power plant at Village Karekal, taluk- Bellary, District Bellary, Karnataka. Power from the solar photovoltaic plant will be evacuated to 110/33/11 kV grid substation (GSS), located at Karekal, which is 9.35 km from the Project sites. The total length of the transmission line is 9.35 km and there are 33 towers on the transmission Line.

The location salient features of the project are given in **Figure 1-1 and in Table 1-1 respectively.**

Table 1-1: Salient Features of Project

S. N.	Salient Features	Details
1	Project Owner	Clean solar Power Bellary Private Limited
2	Total Project Capacity	20 MW
3	Location of Site	Village- Karekal
4	Tehsil/Mandal	Bellary
5	District	Bellary
6	State	Karnataka
7	Project Coordinates	15° 11.689'N 77° 8.233'E
8	Nearest Town	Bellary
9	Nearest Village	Karekal Veerapura
10	Nearest Rail Station	Bellary railway Station
11	Total Land Area	124 acres
12	Ownership of land	Private
13	Land holding type	Approximately 124 Acres of land at karekal village has been procured exclusively for the purpose of the 20 MW solar power project. It was observed that the land procured for the 20 MW Solar Project is almost a contiguous stretch of land.
14	Present status of the project	The project is in operation phase. The project was commissioned on September 2017.
15	Power evacuation	33/110 kV Pooling substation.
16	Solar PV Technology	Multi-crystalline /Thin film modules are proposed to be used.
17	Project Life	25 years

Figure 1-1: Satellite Imagery



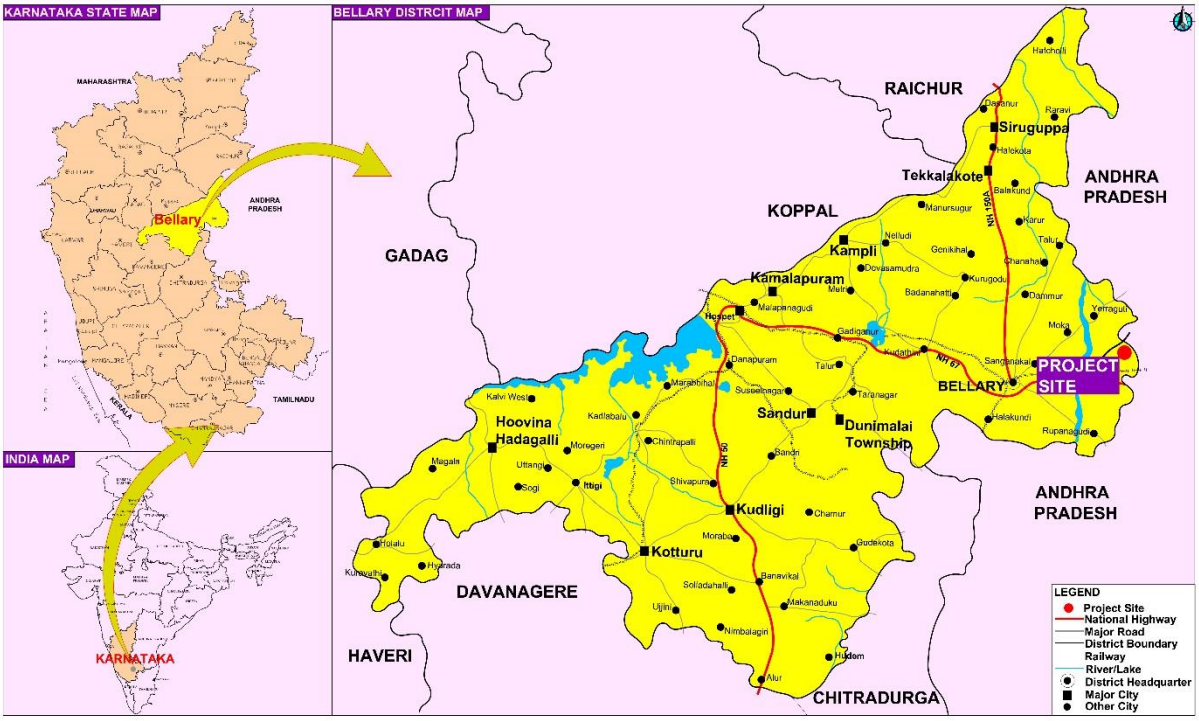
1.3 Project Phase and Status of Permits

The project is in operational stage at the time of survey. The land has been purchased directly from the land owner based on willing to sell and willing to buy. The construction of solar plant was completed during the time of this ESIA study. The required permits and approvals for the construction and operation of the project are summarized below:

Table 1-2: Required Permits & Approvals for the Project

S.N	Permits/Approvals	Status
1	Consent to Establish from Karnataka Pollution Control Board (KSPCB)	Not required. The Solar power energy is categorised under white Category industry as per KSPCB notification dated 14.07.2016.
2	Power Purchase Agreement	Received (Appendix F)
3	Approval for extraction of ground water	If Required.
4	Land procurement	124 Acres of private land procurement is completed through willing buyer-seller basis and good faith negotiation.

Figure 1-2: Project Location Map



1.4 Purpose of ESIA Study

The main purpose of the ESIA study is to identify, evaluate and manage environmental and social impacts that may arise due to implementation and operation of the project. The document has been made to comply with the requirements of IFC's Performance Standards, IFC's general guidelines of Environment, Health and Safety; Relevant ILO conventions covering labor standards, as well as applicable local and national regulations. The objectives of ESIA study are:

- To identify and establish the baseline environmental and socioeconomic conditions, to analyse the environmental and social risk and impacts of the project and its associated components (facilities like transmission line, access road etc.)
- To prepare an inventory of biodiversity (flora and fauna) of project site prior to implementation of the project to evaluate the possible impacts on flora &fauna.
- Review of the land lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc.) on the purchased/ leased land through suitable survey using acceptable socioeconomic tools. This will help in assessing the impact of the project on the community/ villagers.
- Socio-economic survey involving consultation with local community, stakeholders, household surveys to identify the needs and problems of community with respect to the project activities.
- To suggest appropriate safeguards for the associated environmental and social risk, which may not lead to project investment and activities at risk.

1.4.1 Approach and Methodology of the ESIA Study

Preliminary documentation review was undertaken prior to mobilization for site visit. During site visit, potential environmental and social risks associated with the project were assessed. Mitigation measures / further studies were proposed based on the assessment. Detailed approach and methodology adopted to conduct ESIA for the project is described below.

- **Preliminary Discussion with project proponent:** At this stage, size and location of the project, scheduled date of site visits, scope of work, timelines for report submissions, concerned point of contacts were understood from the project proponent. List of further information required such as status of applications made, clearances obtained, project schedule, proposed plant layout, toposheets, solar specifications, noise curves etc. was formally requested from project proponent.
- **Desktop Review of the project area:** After confirming the project area and site location, review of the site area was undertaken using readily available sources such as google earth, google maps, GIS, land use maps of the area. With the help of desktop review, assessment was made on how the site/project and its components such as proposed solar park locations, pooling substation, transmission line etc. are located regarding the nearby villages, forest areas, bird sanctuaries, or any other protected areas (if any), major water bodies, rivers, national and state highways, commercial and defence airports (if any).
- **Review of relevant secondary information:** Secondary information on geology, hydrology, prevailing natural hazards like floods, earthquakes etc. have been collected from literature reviews and authenticated information made available by government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socioeconomic data has been obtained from Census of India 2011.
- **Site Investigation through site visit:** After gaining a fair idea from the desktop review of the project area, a team of experienced professionals including an environmental expert, a social expert and a biodiversity expert visited the project area for site reconnaissance and consultations with relevant stakeholders such as project area related community, project developers, relevant government offices such as local forest department office, revenue department office etc. were held.

To understand and assess the environmental and social risks associated with the project, the study area was divided into core area (500 m around each of the solar park location) and buffer area (10 km around the site location).

- **Investigation of Project Components:** After getting the exact locations of different project components such as proposed Solar Plant, PSS, GSS, proposed transmission line, the environmental and biodiversity expert visited all the project component locations along with the client representative. Further, observations were also made pertaining to what is the land use of the area i.e. agricultural or barren, private or government, whether assigned by local/ state government to some vulnerable communities, whether a reserved forest land etc. All the afore mentioned observations are noted in a standard format for reference which is used during report preparation.
- **Community Consultations:** The social expert conducted village community consultations in presence of site representatives. During community consultations, baseline information of villages pertaining to population, different castes, presence of any vulnerable communities, availability of water and electricity, schools and primary health clinics, general occupation of local people, other income sources etc. has been sourced. During consultation, the social experts tried to understand the probable perspective of village communities towards the proposed project.
    - **Consultation with project developer:** Concerned persons from developer's team have been interviewed to understand the land procurement process, project construction schedule, estimated workers required during construction and operations, plans for arrangement of water required during construction and operation, procedures to address occupational health and safety, waste management plan, emergency response plan etc.
- **Identification of Potential Environmental and Social Impacts:** The assessment process has taken into consideration the impacts due to project sitting, land preparation, and construction and operation of the project. The risks and impacts of the proposed Solar project have been assessed on the social and physical environment. To study the environmental and social impact, study area was divided into core area and buffer area based on the extent of influence of project activities. Primary impacts are assessed for a radius of 500m around the project site and secondary impacts are assessed beyond this radius for the proposed project. The Environmental & Social Impact Assessment (ESIA) has been taken into consideration for the following:
    - Applicable National Regulations;
    - IFC's Performance Standards; Equator principle
    - Outcomes of the community consultation
    - Baseline environmental monitoring;
    - IFC General EHS Guidelines.
- **Development of Project Specific Environmental and Social Management Plan:** The project related activities are understood through desktop review of documents like permits/clearances (if any), maps, etc. and reconnaissance survey to the project location and surrounding area was conducted for familiarization with the project location. The site setting, and sensitivities was identified, and the environmental and social risks associated with the project with respect to applicable national regulations, IFC performance standards was

understood. The identified gaps will thereby lead to derive an environmental and social management and action plan (with timelines & responsibilities) to address these gaps.

1.4.2 Limitations

The ESIA study has been carried out based on project planning information and documents provided by the project proponent, stakeholder consultation and observations during ESIA study. It is also worth to mention that field visit is conducted during the operational phase of the proposed project. Therefore, the status of landscape prior to the implementation of project could not be appreciated during the time of the site. Any major changes in the proposed activities may result in significant deviations of outcomes or impacts.

1.4.3 ESIA Team

ARCADIS has mobilized a diverse team of multidisciplinary experts for conducting the ESIA study. A number of these experts are accredited professionals by Quality Council of India to conduct regulatory EIA. Combination of these experts have provided consultancy services to over 50 solar power projects across India with over 3000 MW installed capacity. The experts have been continuously working with funding agency and understand the modalities and procedures of evaluating and addressing environment and social risk associated with large scale investment.

2 PROJECT DESCRIPTION

The 20 MW AC solar power plant at village Karekal, Dist.- Bellary, Karnataka. Hero Future Energies Pvt Ltd has formed a Special purpose vehicle Clean Solar Power Bellary Private limited for the generation of Solar power. The land has been purchased directly from the land owner on the basis of willing to sell and willing to buy.

- The project is in Operational Phase.
- There is a 33/110 kV pooling substation through 33 KV cables, which is located inside the project boundary.
- The grid sub-station is located at Village Karekal, taluk, District- Bellary. The distance between pooling Sub-station and Grid substation is 9.35 km.

The transmission line is passing through the agricultural and barren Land. There are 33 Towers located on the Transmission Line.

The technical features of project are provided in **Table 2-1** and lay out map of the project site is shown in **Figure 2-1.**

Table 2-1: Technical Features of Project

Site	Bellary Solar Plant
Co-ordinates	15° 11.689'N 77° 8.233'E
PV Module	Multi Crystalline/ thin Film
Inverter	1000- 1250 kW
AC Capacity (MW)	20 MW AC
Tilt	15º
No. of Module	80640
Evacuation	33/110 kV pooling substation through 33 KV cables
Type of System	Fixed type
Module Efficiency	More than 17.05%
No. of inverters	20 units
Solar Data Source	Solar GIS
Radiation (GHI) kWh/m2	1900 kWh/m^2 – 2050kWh/m^2

2.1 Present Status of Project

The site visit was conducted in September 2018 and found that project is in operation phase. Land procurement is completed by CSPBPL. The proposed land is generally dry agricultural land with flat terrain. Site is accessible through nearest MDR which connects NH-72. The project was commissioned on September, 2017. Accessibility to the project site and immediate vicinity are presented in **Figure 2-2**.

Figure 2-1: Project lay out map Showing the Project Site

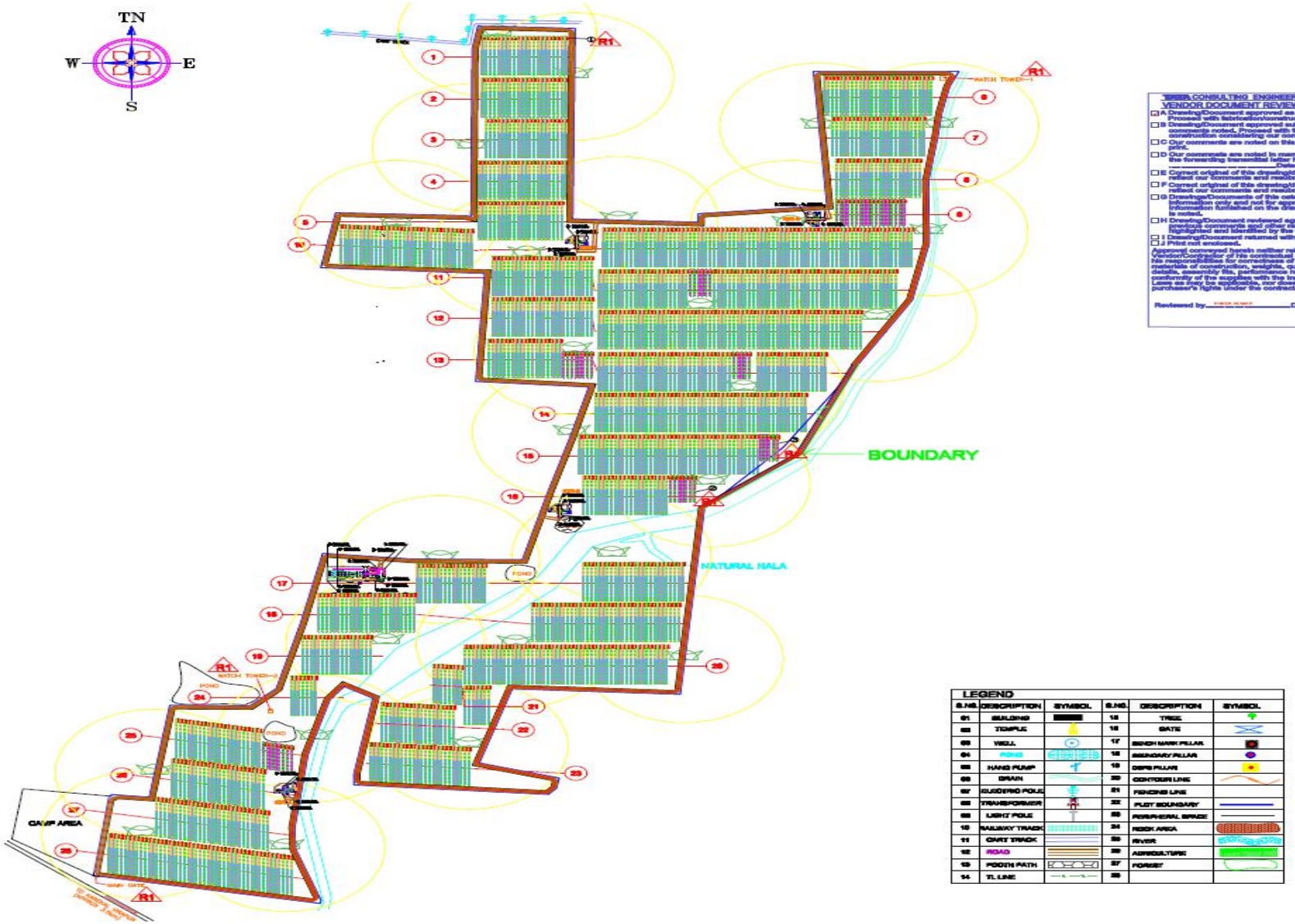
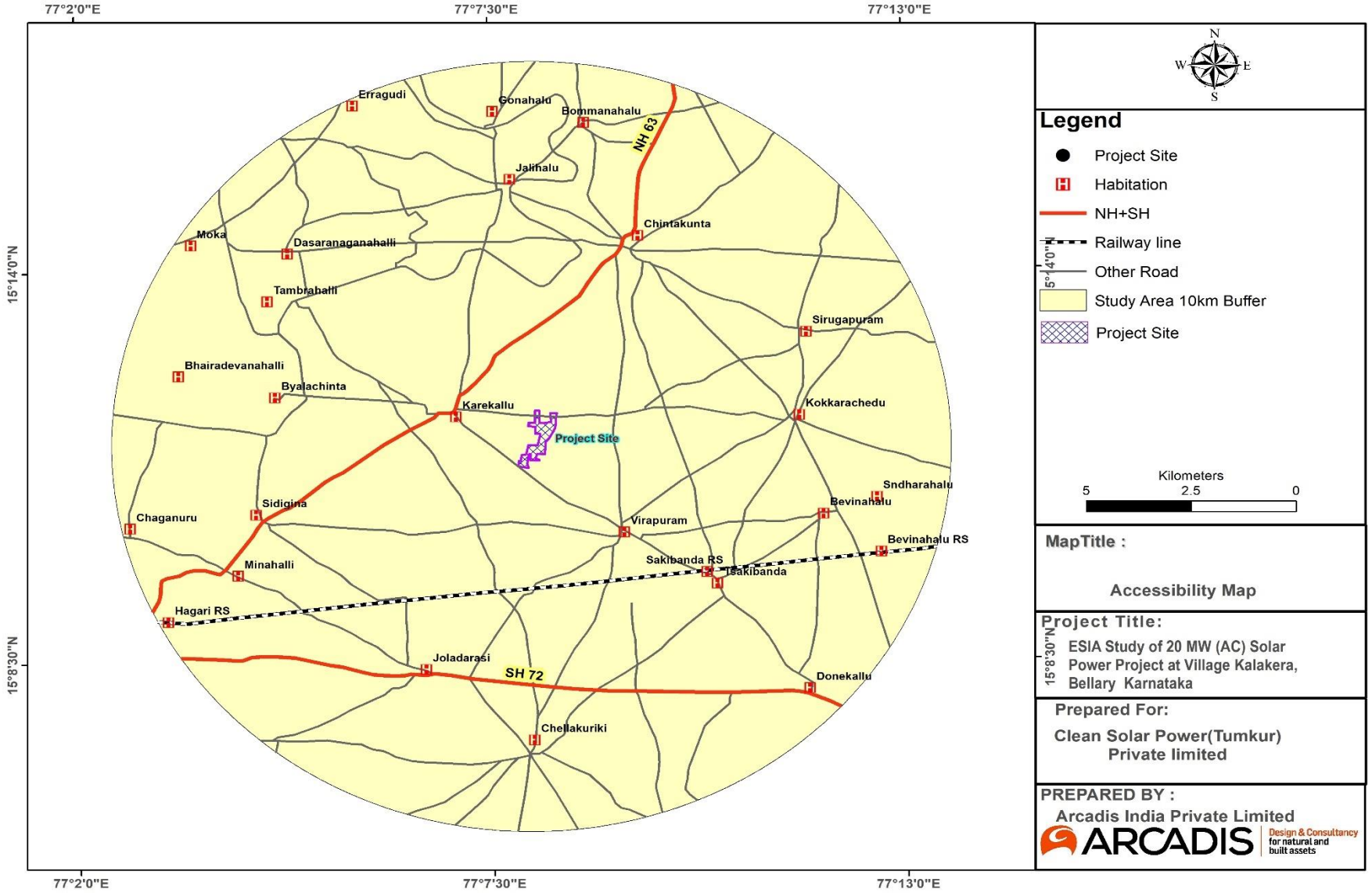


Figure 2-2: Accessibility of the Project Site



2.2 Site Suitability and Justification of Project

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

- **Solar radiation at the site:** The state of Karnataka is blessed with abundant solar energy and receives maximum soar radiation intensity throughout the Year. According to Solar radiation map of India, Karnataka receives a global horizontal irradiation (GHI) in the range of 5.5 to 6.0 kWh/m^2.
- **Topography:** The proposed area for the development of 20 MW AC solar plant is dry agricultural land and flat in nature. Mainly black soil is observed in this area. Installation of solar panel will be easy and reduce the cost of technical modifications requirement of Levelling of Ground.
- **Substation proximity:** Power from the solar photovoltaic plant of 20 MW capacity will be evacuated to 33/110 kv substation. The Pooling substation will be connected to a 110/33 kv grid substation (GSS). The GSS is located at Karekal village. The total length of the Transmission line would be 9.35 Km.
- **Accessibility**: The site is easily accessible through MDR connecting NH-72. Existing major district roads will be utilized as access road to the site. Nearest Railway station is Bellary which is located approximately 40 km away from the project site. Hubli airport, is about 199 Km from Bellary is the nearest airport.
- It is also noted that the project site was devoid of any habitation.

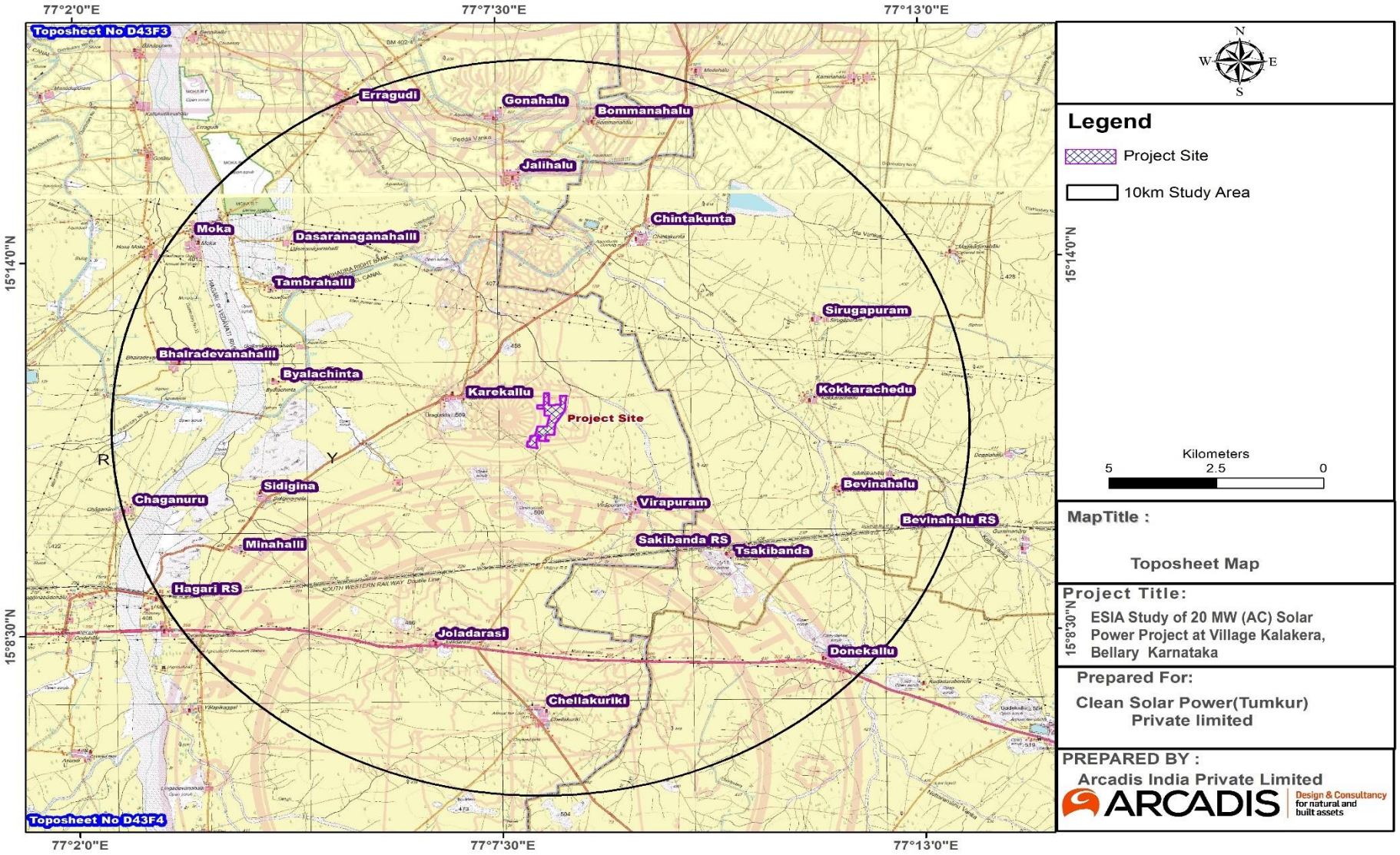
Considering above justification, the site has been found to be technically feasible for a solar power development.

2.3 Project Settings

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

- The site has flat terrain consisting mostly of agricultural dry land. Project site is surrounded by patches of agricultural fields. No forest land was observed within the 5 km radius of the project site.
- There are no shading elements such as mountains or tall trees available on the project site.
- The area is falling under basin area of Krishna River. The main drainage system of this area is Tungabhadra Canal. Tungabhadra Right bank tunnel is located around 6.5 km from the project site is west direction. This is the only source of irrigation water in this region. Beside this, few numbers of small pond also located around project site. Although, no water was observed in the pond during the site visit.
- No reserve forest / protected forest or ecological sensitive area is located within 5 km of the project site.
- The nearest village settlement from the site is Karekal village which is located within 2.5 km aerial distance from the project site.

Figure 2-3: Project site on Survey of India Toposheet Map



2.4 Project Design, Technology and Component

The 20 MW solar power plant will be based on Multi-Crystalline solar PV technology. The main equipment of a PV Project are PV modules, inverters, mounting systems, PSS and GSS. The system consists mainly of the following components:

PV Modules: PV modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect. PV modules technologies are divided in two main groups:

- *Crystalline Modules:* PV modules are composed by several cells (mainly 60 or 72) electrically connected. Cells are made by crystalline or polycrystalline silicon. This technology is predominant in large scale PV facilities to its high performance under different climatic conditions, maturity, low cost and huge number of providers.
- *Thin film:* Thin film PV modules are composed by a layer of PV material deposit over an isolating base. PV material could be made by different products (TeCd, s-Si.), but only TeCd has got a relevant market share and is suitable for large scale PV plants. This technology has a good production under low radiation and high temperature conditions, but on the other hand there are short number of manufacturers and short track record.
- *PV Module:* Polycrystalline Silicon Modules, 72 cells module, 16.5% efficiency,310W expected unitary power
- Crystalline silicon PV modules (c-Si) solar cells are currently the most common solar cells which is widely acceptable and in use all over the world mainly because c-Si is stable than others. The efficiency range is 15% to 25% and it relies on established process technologies with an enormous database. Hence it is decided to select this technology with best enhancements as upgraded in this project.

Inverters: A solar inverter, or PV inverter is most complicated part of a PV system, converts the variable direct current (DC) output of a PV solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid. Main types of inverters are:

- *String Inverters:* Small size inverters (1-10 kW) which are directly connected to the PV modules. This type of inverters has the advantage of an easy installation and maintenance tasks. But in large scale PV plants have several problems, such as the large amount of equipment required, lower performance and high price.
- *Central inverters:* Big inverters with a capacity up to 1MW. Skilled personnel is required to install and maintain this equipment, but the performance is very high and are cheaper than string inverters.

Mounting System: PV modules must be attached to a structure. This structure could be fix or may have a movement to follow the sun path.

- *Fix Structure:* No movement of the module. Structure has some inclination to improving the production.
- *One axis tracking system*: Structure has a movement from east to west, in order to follow sun path. Tilt of the module is fixed.
- *Two axis tracking system:* Structure could be moved in two axis then the module surface is able to be perpendicular to solar radiation every moment, and therefore get the maximum radiation.
- *Structure:* Fix Seasonal Mounting Structure from a reputable Indian manufacturer, Galvanized Steel, Tilt: 15º

Evacuation Plan: The SPV based power projects envisages a power export of 38 Mn units from the plant in the first year of operation. The grid connection will be at 110 kV level in Karekal sub Station. The exportable power from the plant shall be evacuated by stepping up the power from 300 v to 110 kV through transformers. CTs, PTs isolators, lighting arrestors, circuit breakers and TVM for TRANSCO measurement will be arranged. Switchyard Arrangement and other requirements will be in line with TRANSCO specification and Grid Code.

Metering: Tarif main metering shall be accommodated in outdoor kiosk on Plant land. Trivector meter that shall be provided in the plants control building or as per TRANCO's requirement will have main and checking arrangement, and these shall be arranged upon with the TRANSCO. The Tarif meter shall register import as well as export parameter.

Control and SCADA system:

The Centralized SCADA system will have a provision to incorporate all monitoring and control inputs from Module Monitoring systems, Inverter monitoring systems and Weather Station and Pyranometer monitoring stations. All the HV & MV breakers will be controlled through SCADA system. The HMI unit of SCADA will display all breakers and line parameters. The electrical system will be displayed in the mimic of SCADA. The SCADA will control all breakers with suitable interlocking. The line parameters like MW, MVR, Voltage, current, frequency will be part of SCADA display system. The SCADA will also capture ambient air temperature, wind speed and solar irradiance through suitable measuring devices. The SCADA will have a suitable gateway for data transfer to SLDC 60870-101/104 format. The suitable media and means will be designed by the vendor. SCADA will be provided with suitable UPS. SCADA should be able to take input from security CCTV system camera.

Approach Route: The approach route for the transmission line will be based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering these factors will be selected for the transmission lines:

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

2.5 Climate Change Effect on Solar Power Plant

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

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

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

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

2.6 Resource Requirement

2.6.1 Land

The Bellary 20 MW solar power project site is located on an open area with flat terrain. Land in the project influenced area was predominantly dry and designated as agricultural land. Grazing activities are very limited to post-monsoon months, when meagre amount vegetation is present. Agriculture in the area is totally dependent on rainfall and Tungabhadra irrigation canal. Large portion of the land remains dry most part of the year. Advent of the new solar projects in the region will open opportunities for utilization of barren/ dry land which is left unused otherwise.

Type of Land: 124 acres land for Hero Future Energies (HFE) 20 MW solar power project is contiguous. The topography of the project site is largely plain land with surrounded by agricultural land. As observed during ESIA study the land in the project influenced area is unused dry land with scanty vegetation observed in the plot. The large portion of the land remains dry for most part of the year.

Land Scenario: It has been informed by the Hero Future Energies (HFE) representative, that due procedures were followed for the land procurement process as per the government regulations (Land conversion, notification, consultations, local community consultations, Panchayat approval, etc.). Hero Future Energies (HFE) representative has also informed that the owners of private lands were offered a compensation amount which is higher than the circle rates.

Land for Access Route: The land for the 20 MW solar project is located at karekal village. No human activities or structure was noticed in the project site. Hence it is assumed that no issue may rise for the access route in future.

The construction of access road normally involves removal of vegetation and modification of topography. As observed, the land area is dry undulated land with occasional and scanty shrubs, hence only scanty vegetation is seen in the form of shrubs around the project site. The existing village bituminous road connects to the nearest village.

Land for Transmission line: Project layout would be done after completion of boundary marking.

The few pertinent factors for the route of the transmission line from PSS to GSS are as follows:

- One Pooling Substation (PSS) has been decided for the 20 MW Solar Power Project
- Identify route for movement of project vehicles which, should not include narrow village road and road passing through cluster of settlements.
- Transmission line should be planned without any habitation or cultivation field or without any hindrance along the route;
- House or community structures shouldn't be located under the transmission line;
- No vegetation area should fall under the transmission route.
- The transmission route should be devoid of any environmental sensitive area.

Right of Way (RoW) for the transmission route would be done after completion of boundary marking. No cultivation land nor any habitation should come on the way of transmission route.

Land Procurement Procedure: The 20 MW solar power project have procured 124 acres private land. As observed during ESIA study, it is assumed that lands in the study area is private ownership.

A brief general procedure of land purchase is given below:

- Based on micro siting land must be identified by the project proponent/ developer.
- The title of the property, ownership of land and registration documents needs to be checked and verified in the office of the sub-registrar of the circle in the proposed project area.
- A search of the records and documents that may affect the registration, ownership and title of the land may be carried out at the sub-registrar's office.
- If land records are found in proper order, the developer/ land team can proceed for negotiation with owners of private lands. In case of Govt lands, process should be initiated as per the rules and norms with the concerned departments and authorities.
- Compensation/ selling rates must be mutually agreed by both seller and buyer parties on good faith negotiation.
- Based upon the fixed rate through agreement process for land transfer in favour of buyer should be initiated.
- Mutation and registration of the lands, through Agreement to Sale (ATS), must be made in buying company's name in the revenue records.
- A percentage on basic land value is charged (as per Sub Registrar Office of the circle) for transfer and conversion of the land.

Table 2-2: Village wise Govt. circle rate of land in Study Area

Taluk & District	Village Name	Land type and unit	
		Dry, No Source of Irrigation, Other (Per Acre)	Bagayat, Dry (Per Acre)
Taluk Bellary (District Bellary)	K.Veerapura	INR 350000.00	INR 22000.00

2.6.2 Water Requirement

Water is required for both construction and operational phase. During the project construction phase, water is required for preparing RCC foundations for module mounting structures, building control room and security rooms, and domestic purposes such as drinking and washing by the construction workers and staff. During operations, water will be required for cleaning of solar panels and for domestic/municipal purposes for the operations staff. As reported by the project proponent, the estimated quantities of water required during the construction phase is 10 Kld . water would be required for domestic purpose as well which includes drinking water facilities for 150 workers. During operation phases water will be required mainly for cleaning of solar cell and domestic purpose. The water requirement is presented below in Figure 2-4**.**

Figure 2-4: Water Requirement during Construction and Operation Phase

Phase	Activity	Max. Consumption	
Construction	Civil works water requirement	10 KLD	Through water tanker (Authorize vendor)
	Domestic use – considering 150 labours	6.75 KLD	water tanker (Authorize vendor)

			RO water through authorize vendor for drinking purpose
Operation	Washing of solar panels (1.938 m2 each panel)	Reportedly 0.5 to 1 litre per module per month Considering 1 lit each for 80640 no's of modules, the water requirement comes around 80.64 KL per month.	Water tanker (Authorize vendor)
	Domestic use	2 KLD (approximate)	RO water through authorized vendor for drinking

2.6.3 Manpower Requirement

Construction Phase

About 150 labours comprising of skilled and unskilled labours, are estimated to be employed in the peak construction phase which involves the foundation work, fencing, cleaning and erection of mounting structure. Some female workers are also expected to be engaged. The contractor workforce will comprise of both skilled and unskilled labours. Some workers may be sourced from the nearby village depending on their skills and capabilities.

These (semi-skilled and unskilled) labours will be supervised and monitored by 15 skilled personnel from EPC contractor in the peak construction phase. HFE personnel will be deployed directly at site during construction.

Operational Phase

During operational phase, a few personnel is required onsite including security guards, operation and maintenance officer and site engineers etc.

HFE would deploy technical, skilled persons as per the requirement on site during operation. Additionally, labors, comprising of semi-skilled and unskilled, would be deployed for security, module cleaning, vegetation abatement, module tilting etc.

2.6.4 Raw Materials

The construction related materials viz. stone aggregates, sand and bricks etc.for the project are likely to be sourced from the vicinity area.

2.6.5 Waste Water Treatment and Disposal System

During the construction phase, the waste water or sewage from site office toilets will be disposed in a soak pit/septic tank. Waste water will be generated during the operation phase due to solar module washing. Proper storm water channels would be constructed along the periphery of the project site for draining of site run off. The domestic waste water would be managed through septic tanks.

2.6.6 Logistic Arrangement

Labor Camp: The project is in the operational stage and land procurement is completed during the time of site visit. The company through their EPC contractor and sub- contractor had hired unskilled labours locally for reducing the requirement of labour camp. Labour camp was developed inside the Premises to accommodate migrant labour during the construction period. All the basic amenities such as drinking water, kitchen, toilet facilities, etc. was provided in the labour camp following the ILO recommendations.

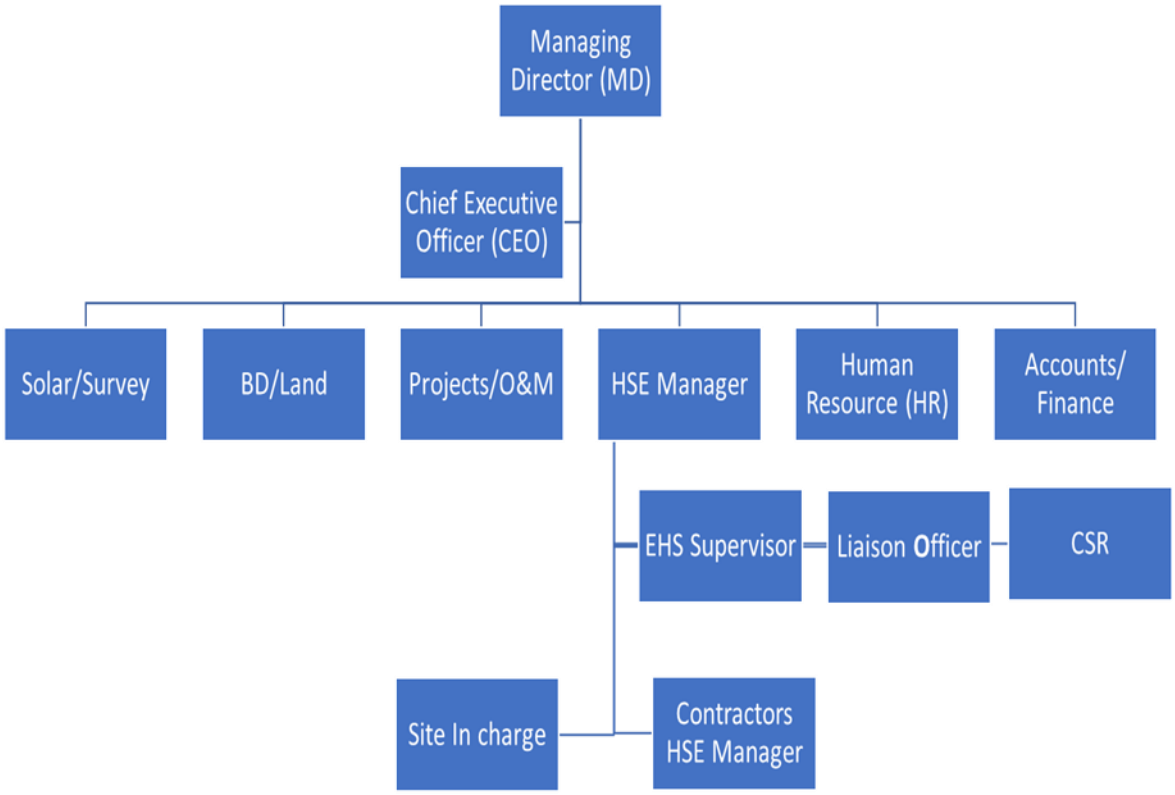
Project Vehicles: Project vehicles such as water tanker, tractors, JCB, and cars will be engaged to support various activities during construction phase and in Operation Phase. Further efforts will be made to hire vehicles from local community.

2.6.7 Organizational Structure

To ensure smooth completion of various operations or activities of project during construction and operational phase, HFE has its own Integrated Management System policy. During the project phase, project operations will be managed by Project Manager and environmental, health & safety issues will be monitored by HFE regional EHSS Officer.

Organizational Structure for the specific proposed 20MW Solar Power Plant, at Karekal village is appended in **Figure 2-5**.

Figure 2-5: Organizational Structure of 20 MW Solar Power Project at Karekal, Karnataka.



The given Organization Structure for 20MW Solar Power Project is subject to change/ alter based on the altered situation and requirements.

3 APPLICABLE REGULATIONS, GUIDELINES AND STANDARDS

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

3.1 National Regulations

In India, the Ministry of Environment, Forests and Climate Change (MoEF&CC) is the apex administrative and regulatory body for (i) regulating and ensuring environmental protection; (ii) formulation of the environmental policy framework in the country; (iii) conservation of biological diversity and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Several laws have been framed for protection of environment and for Occupational Health & Safety in India by the Central Government. The relevant regulation pertaining to the project activity has been discussed as under. The compliance to all environmental, health, safety and social regulation have been presented in **Table 3-1**

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

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
1	Karnataka Solar Policy 2014-2021	Karnataka Electricity Regulatory Commission (KERC), Karnataka Power Corporation limited (KPCL), Karnataka Power Transmission Corporation limited (KPTCL), Karnataka Renewable Energy Development limited (KREDL),	As per the policy, KERC will decide the tariffs and to issue regulations regarding percentage of renewable purchase obligations and decide charges with respect to wheeling, bank subsidy, cross subsidy charges. Condition for getting accreditation to avail Renewable Energy Certification shall be governed by CERC and KERC regulations.	*HFE have followed the legal permissions and procedures and will comply with the obligations mentioned therein for the Solar Project site at Karekal village* in Bellary district *for the 20 MW Solar Power Plant.*
2	The Air (Prevention & Control of Pollution) Act 1981	Karnataka State Pollution Control Board (SPCB)	Development of solar power plant falls under green category. As per Karnataka State Pollution Board Office notification, solar PV power projects is exempted from obtaining any NOC/Consent for establishment under pollution control laws from State Pollution Control Board.	Not applicable. Solar power plant is exempted to obtain CTO/CTE.
3	The Water (Prevention & Control of Pollution) Act 1974	Karnataka State Pollution Control Board (SPCB)	As per Karnataka State Pollution Board Office notification, solar PV power projects is exempted from obtaining any NOC/Consent for establishment under pollution control laws from State Pollution Control Board.	Not Applicable. Solar power plant is exempted to obtain CTO/CTE.
4	Forests (Conservation) Act, 1980 and Rules 1981	Forest Department, State Government	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests.	Not Applicable. As reported, no forest land is involved for the development of this project.
5	Wild Life (Protection) Act,1972	Forest Department, State Government	The objective is to provide protection to the listed endangered flora and fauna and ecologically important	Not Applicable.

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
			protected areas. Classification of species under various conservation schedules are carried out under this law.	
6	Environmental Impact Assessment (EIA) Notification 2006 & and subsequent amendments.	MoEF&CC	Based on The EIA Notification 2006 and it sub sequent amendments, Office Memorandum dated, 13th May 2011 exempts solar power project from obtaining prior Environmental Clearance from the regulatory authorities.	Not Applicable.
7	Noise (Regulation and Control) Rules 2000 amended in 2010	KSPCB	The Rules stipulate ambient noise limits during day time and night time for industrial, commercial, residential and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the Environment (Protection) Act 1986.	Applicable. Noise Generation during construction and operation phase should be monitored by the project proponent.
8	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008 Hazardous and Other Wastes (Management and Trans boundary Movement) Amendment Rules, 2016.	KSPCB	These Rules outline the responsibilities of the generator, transporter and recycler/re-processor of the hazardous wastes for handling and management in a manner that is safe and environmentally sound. Project proponent need to obtain consent from State Pollution Control Board for generation and storage of hazardous waste like transformer oil, etc. irrespective of quantity of waste. As per the law the occupier and the operator of the facility should be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.	Applicable during construction phase. Generation of transformer oil at site attracts the provision of the rules and hazardous wastes have to dispose as per Guidelines of State Pollution control Board and MoEF&CC. Project developer needs to obtain consent from KPCB for storage of transformer oil, if required. Though not covered under the rule, the broken solar panels is recommended to be stored properly and return back to the manufacturer or an authorised recycler.
9	Solid Waste Management Rules, 2016	KSPCB/ CPCB	The rules stipulates scientific management and disposal of solid waste generated from various sources and applicable to urban local body, census town, notified areas, notified industrial townships, special economic zones, industry, place of historical	Solid waste generation from the project site attracts the provision of the rules. The solid waste generated from the project has to be collected in a segregated way

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
			importance and other places as may be notified by respective State government from time to time	and disposed of as per the provision in the rule.
10	Batteries (Management and Handling) Rules, 2001 and its amendments.	KSPCB/CPCB	It shall be the responsibility of the consumer to ensure that used batteries are not disposed of in any manner other than procedure mentioned in the Batteries (Management and Handling) Rules, 2001 and its successive amendments.	Used Lead acid batteries if generated should not be disposed of in any manner other than procedure mentioned in the Batteries (Management and Handling) Rules, 2001 and its successive amendments.
11	Plastic Waste Management Rules, 2016	KSPCB/CPCB	The objective is to address the scientific management of Plastic waste, the plastic waste management Rules, 2016 are notified with objectives such as - • Increase minimum thickness of plastic carry bags from 40 to 50 microns and stipulate minimum thickness of 50 micron for plastic sheets also to facilitate collection and recycle of plastic waste. • Expand the jurisdiction of applicability from the municipal area to rural areas. • To bring in the responsibilities of producers and generators, both in plastic waste management system and to introduce collect back system of plastic waste by the producers/brand owners, as per extended producers' responsibility. • To introduce collection of plastic waste management fee through pre-registration of the producers, importers of plastic carry bags/multi-layered packaging and vendors selling the same for establishing the waste management system.	Project proponent should take steps to minimize generation of plastic waste. The waste generator shall handover segregated waste to urban local body or gram panchayat or agencies appointed by them or registered waste picker's, registered recyclers or approved waste collection agencies.

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
12	Electricity Act, 2003	State Electricity Board	The sections of the Electricity Act, 2003 are relevant for laying (and repairs) out of transmission lines and development of Pooling Substation and Grid Substation for the supply of Electricity energy.	Project Proponent should obtain license under the electricity act and ensure compliance of Health and Safety requirements as per guidelines.
13	Environment (Protection) Second Amendment Rules 2002	MoEF&CC	The DG sets installed during construction should comply with maximum permissible noise levels and noise control measures for diesel generators up to 1000 KVA capacity as specified in the Act.	The power requirement during construction phase will be met through DG sets which will adhere to prescribed CPCB noise level limits and noise control measures.
14	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	Ministry of Labour and Employment	This Act provides for safety, health and welfare measures of buildings and construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens and temporary living quarters within or near the work site. This Act also requires application of the following: Building or other construction workers' (regulation and Employment Conditions of Service) Central Rules 1998 & Workman's compensation Act, 1923 to buildings and other construction workers. These will be followed by contractor & developer during construction and operation phase.	Applicable during construction phase. Project proponent will ensure through its contractors that basic amenities are provided to the labours. Project proponent through its contractors should also ensure all vendors employed should have valid labour license. Compensation to workers (own and vendors) should not be below daily wage rate as specified by Government. Master roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty /imprisonment of the principal employer along with vendor and closure of project.
15	Workmen's Compensation Act, 1923 & Rules 1924	Labour Welfare Board, Karnataka	The Act requires if personal injury is caused to a workman by accident arising out of and during his employment, his employer should be liable to pay compensation in accordance with the provisions of this Act.	*Applicable during construction phase.* Project proponent should ensure through its contractors in case of any accident/ injury/ loss of life the workmen should be paid a

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
				minimum compensation as calculated under this act both during construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.
16	The Contract Labour (Regulation and Abolition) Rules, 1971 Contract Labour (Regulation and Abolition), 1973	Labour Welfare Board, Karnataka	The Contract Labour (Regulations & Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registering the establishment. The Act and its Rules apply to every establishment in which 20 or more workmen are employed on any day on the preceding 12 months as contract labour and to every contractor who employs or who employed on any day preceding 12months, 20 or more workmen. It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of a seasonal nature if work is performed more than 60 days in a year.	*Applicable during construction phase.* It is the responsibility of EPC contractor to have valid license and ensure provision of appropriate welfare measures viz. arrangement for sanitation facilities, drinking water, first aid etc for the onsite contractual workers & labourers. In addition, Trunkey Developer as, principal employer needs to obtain registration certificate from EPC contractor for undertaking project work.
17	Minimum Wages Act, 1948	Labour Welfare Board, Karnataka	This Act provide for fixing minimum rates of wages in certain employments and requires the employer to provide to every worker engaged in a scheduled employment to be paid wages at a rate not less than the minimum rate of wages fixed by such notification for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed.	Applicable
18	The Child Labour (Prohibition and Regulation) Act, 1986	Labour Welfare Board, Karnataka	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work.	*Both EPC contractor and HFE have ensured that no child labour will be engaged at site for construction or operation works either directly*

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
				or by the sub-contractors. HFE have included a clause in the subcontractor agreements prohibiting employment of child labour.
19	The Bonded Labour System (Abolition) Act 1976	Ministry of Labour& Employment	The Bonded Labour System (Abolition) Act 1976: States that all forms of bonded labour stand abolished and every bonded labour stands freed and discharged from any obligations to render any bonded.	Project Proponent should ensure compliance of the act conditions.
20	Companies Act, 2013	Hero Future Energies Private Limited	According to Schedule 135 sub -section 1, the companies meeting the threshold criteria (Minimum net worth of rupees 500 Crore, Turnover up to "1000 Crore" and having a net profit of at least '5 crore') specified should spend in every financial year, at least 2% of the average net profits of the Company made during the three immediately preceding financial years in pursuance of CSR policy.	The project will need to comply with the requirement as stated in the law.
21	ESI Act, 1948 (Employees State Insurance Act, 1948)	Ministry of Labour& Employment	The ESI Act provides for certain benefits to employees in case of sickness, maternity and employment injury.	Applicable to Proposed Solar PV Plant and Project Proponent should ensure compliance through O&M Contractors as per the applicability.
22	Panchayat (Extension to Scheduled Areas) Act 1996	HFE	Provisions of this rules are: A state legislation on panchayats in the scheduled area should take care of the customs, religious practices and traditional management practices of community resources. Every village shall contain a Gram Sabha whose members are included in the electoral list for the panchayats at village level. Planning and management of minor water bodies are entrusted to the panchayats. The Gram Sabhas have role and responsibilities in approving all development works in the village, identify beneficiaries, issue certificates of utilization of funds;	The project will need to comply with the requirement as stated in the law.

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
			powers to control institutions and functionaries in all social sectors and local plans. Every Gram Sabha to safeguard and preserve the traditions and customs of people, their cultural identity, community resources and the customary mode of dispute resolution	

3.2 Social and Environmental Performance Standards of the International Finance Corporation

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

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

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
Performance Standard (PS) - 1 Assessment and Management of Environmental and Social Risks and Impacts	Conduct an Environmental and Social Impact Assessment (ESIA) of the project, appropriate to the nature of the project's environmental and social risks and potential impacts.	Arcadis has been appointed by HFEPL to undertake ESIA study to identify the environment and social risks that may arise due to the solar power project and recommend mitigation measures for the same as provided in **Chapter 6** The PS 1 is applicable to project with environment and/or social risks and/or impacts. The project is a solar power project and will have environmental and social impacts resulting generation of noise, construction activities etc. **PS 1 is therefore applicable for the project.**	HFE have developed an Environmental and Social Management System at the corporate level as well as adhered to the environment and social management plan recommended for its solar project at the ground level The Environment and Social policy is provided in **Appendix** J the ESMS encompasses the following requirements: • Environmental and social action plan; • Identification of risks and impacts; • Management program; • Organizational capacity and competency;

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Establish Environmental and Social Management Plans commensurate with the findings of the ESIA and consultation with affected communities	An Environmental and Social Management Plan has been prepared and incorporated in **Chapter 7** of the ESIA report taking into consideration the potential social and environmental impacts or risks already identified & assessed in ESIA.	• Training for security and safety workers; • Emergency preparedness and response; • Stakeholder engagement/ grievance redressal; and • Monitoring, reporting and review.
	Establish Action Plans where specific mitigation measures and actions are required for the project to comply with applicable laws, regulations and the requirements of these Performance Standards.	An ESMP has been prepared and incorporated in **Chapter 7** of the ESIA report for implementation of mitigation measures in compliance with the statutory requirements and Performance Standards	
	Provide organizational capacity and contractor / employee training to enable project to achieve continuous environmental and social performance	Organizational structure with roles and responsibilities of the team within the organization is defined in **Chapter 2.**	
	Establish and maintain a timely process of community engagement, including a grievance mechanism, focusing on disclosure of information and consultation with local communities affected by project risks or adverse impacts that is free from external manipulation, interference or coercion to ensure relevant and understandable access to project information.	A community engagement plan needs to be developed and implemented as well as adequate reporting needs to be done. This should aim to inform the community project related adverse impacts or risks. Grievance Redressal Mechanism (GRM) will be implemented in this project	
	Establish procedures to monitor and measure the effectiveness of the environmental and social management program, including internal reporting of the program's effectiveness to the project's senior management, disclosure of Action Plans (including material changes to such Plans) to affected communities, and external reporting to affected communities on	System of monitoring with periodic audits will be established at the site.	

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	the results of Action Plans, commensurate with the concerns of the affected communities		
PS 2: Labour and Working Conditions		The PS 2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers). The project will involve employment of direct and contracted workers during construction and operation phases. **PS 2 is therefore applicable for the project.**	HFEPL has ensure that adequate facilities and amenities will be provided in the labour accommodation for construction workers including: adequate living/sleeping facilities and space per person; potable water that meets national standards and standards as laid down by ILO; toilets, washing and cleaning facilities; canteen/mess or fuel for cooking; locker/storage facilities; and facilities for management and disposal of garbage, sewage and other waste at the labour camp. The company will periodically review and monitor the condition of the labour camps at all the mentioned project sites. The worker accommodation standards as laid down by ILO. The company, as a part of oversight procedures are regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met at project sites. Internal audits and follow up on corrective actions need to be undertaken to assess efficacy of the oversight system at the project site.
	Establishment of a Human Resources Policy consistent with the requirements of this Standard that informs employees of their rights under national labour and employment laws.		HFE have developed site specific HR policy in line with the HR Policy at their corporate level. They or their appointed contractor, have informed their employees about their

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			rights under national labour and employment laws.
	Document and communicate to all employees' conditions and terms of employment.	Applicable during construction and operation phase at the project site	HFEPL has been engaged labors directly or through contractors. However, the management of laborer's have been supervised by HFEPL so that the engagement of workers is in accordance to applicable rules and regulations.
	Practice non-discrimination and equal opportunity in making employment decisions	Applicable during construction phase	Equal opportunity to both men and women depending on their skills and capacity wages, work hours and other benefits have been practiced as per the national labour and employment Laws at the project sites.
	Provide a mechanism for workers to raise workplace concerns.	Applicable during construction and operation phase	Grievance Redressal Mechanism are framed under the ESMS and the same will be implemented at project level. (Appendix J) This is applicable both during construction and operation phase and should be supervised by HFE.
	Provide workers with a safe and healthy work environment, considering risks inherent to the project sector	Applicable during construction and operation phase	Provide workers with a safe and healthy work environment, considering risks inherent to the project sector
PS 3: Resource Efficiency & Pollution Prevention		In case the solar panel contain any hazardous material, chances of ground water and soil contamination cannot be ruled out. Site visits revealed that the proposed site is surrounded by patches of agricultural fields. CSPBPL will be accountable for collection and safe disposal of hazardous material (If any) generated during the construction and operation period. CSPBPL needs to safeguard it's liability by keeping	During operational and constructional phases ground water will be used. Permission from state ground water authority is necessary for using the ground water. Safe drinking water will also be supplied to the workers. Long term Impact on ambient air quality is not envisaged for this project. However, temporary impacts on ambient

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		record of mitigation measures to safeguard against any future liability. Waste oil and other hazardous chemicals released from construction activities may result in contamination of ground and nearby surface water. **PS 3 is therefore applicable for the project.**	air quality and noise levels may be expected during construction phase. CSPBPL should implement measures during construction for management of construction debris and minimization of fugitive dust emissions. Further, CSPBPL should ensure through its contractors that other wastes (packing material, metal, debris, cement bags, drums/cardboards etc.) are collected, stored and disposed off to re-users or in appropriate debris disposal areas. No impact on surface or groundwater resources is expected on account of the project. The sub-contractors should ensure that the water made available to workers and employees' meets national potable water quality norms. The project site should have appropriate facilities for collection, treatment and disposal of sewage (septic tank / soak pit) which is used during construction and operation phases.
	The project proponent should ensure that adequate control techniques are provided to minimize emissions or achieve a pre-established performance level and minimize pollution from project activities. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release.	During the construction phase, earth work and movement of vehicles for hauling of equipment's and materials to the project site may increase the pollution level and dust in the air.	HFE through its contractors have ensured sprinkling of water to reduce dust in the air. Besides, HFE have also ensured use of vehicles having valid PUC certificates.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	The client will implement technically and financially feasible and cost-effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a focus on areas that are considered core business activities.	During construction and operation phase.	HFE have planned and implemented pollution control measures. Practices like minimal release of waste, safe disposal of waste, wastewater management etc. will be considered in all phases of project life cycle.
PS 4: Community Health, Safety and Security	Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with attention to vulnerable groups.	This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. The project will involve transportation of components, which may pose safety risks to the affected communities. Impacts due Electrocution and Firing due to short-circuit, Accidents during cutting, chipping and piling, Physical injuries, Trip and fall hazards or by Diseases due to unhygienic condition etc. **The PS 4 is therefore applicable for the project.**	The applicability will be both to the construction and operation phase at K. Veerapura village and other nearby villages. In addition to the movement of heavy machinery / vehicles during the construction phase, effects due to glare effect generated due to solar panels will pose an impact on the community if properly not mitigated. The Action Plan and any other relevant project-related information is to enable the influenced communities and relevant government agencies to understand these risks and impacts, and will engage the influenced communities and agencies on an on-going basis consistent with the requirements of the PS.
	Evaluation of risks and impacts of the project on health & safety of the affected community during the project lifecycle and establish preventive/mitigation measures to reduce/minimize the impacts. Disclosure of action plans to affected community and the government agency.	During Construction Phase	The potential occupational hazards arising from the project activities and the impacts on health & safety of the affected community have been identified and assessed in this report
	Design, construct, operate and decommission of Structural elements or components in	During Construction Phase	An occupation health safety plan has been formulated in this report. All steps

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	accordance with good industrial practice to reduce impact on community health & safety.		to reduce the impact on the health and safety of the community to minimal will be taken.
	Minimization of impacts on the health and safety of the community caused by natural hazards that could arise from the land use changes due to project activities.	During Construction Phase and Operational phase	A management plan has been formulated as part of ESIA process to address the issue.
	Prevent or minimize the potentials for community exposure to communicable diseases during project activities	During Construction Phase	CSR Plan and activities has been provided as a part of ESIA.
PS 5: Land Acquisition and Involuntary Resettlement	PS 5 is applicable when there is physical and/or economic displacement due to acquisition of land for the project. This PS does not apply to resettlement resulting from voluntary land transactions (i.e. market transactions in which the seller is not obliged to sell, and the buyer cannot resort to expropriation or other compulsory procedures if negotiation fails). The impacts arising from such transactions should be dealt with as under PS1, though sometimes, when risks are identified, the project proponent may decide to adhere to PS 5 requirement even in willing-buyer-seller cases	124 acres of Private lands are being procured for the 20 MW Bellary Solar Power project. There is no case of physical and/or economic displacement due to land purchase for the project. It was also told by the HFEPL representative that location falling on Private land for the 20 MW Solar Project are not resulting in any involuntary resettlement issue as the lands taken are being procured on good faith negotiations on willing to buy and sell basis and at mutually agreed price. It was further informed by HFEPL that there is no human habitation in the identified private land for the 20 MW solar project for HFE. **Hence considering that livelihood is not impacted, PS 5 is not applicable.**	No actions required.
	Avoidance or at least minimization of involuntary resettlement by exploring alternative project designs balancing environmental, social and economic costs and	Not applicable	No resettlement of people is required.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	benefits; and by acquiring land through negotiated Settlements.		
	Compensation and benefits for displaced person as per Performance Standard	Not applicable	No locals will be displaced. However, proper compensation should be paid to the private land owner, whose land is Identified for project site, access road or transmission line tower construction.
	Disclosure of all relevant information and consultation with affected persons and communities in decision making process related to resettlement.	Not applicable	No resettlement was required place due to the project activity
	Establish a grievance mechanism to record and resolve communities' concerns and grievances about the relocation and compensation	During the construction and operation phase	HFE have developed an Environmental and Social Management System at the corporate level A GRM Policy has also be framed under the system. It incorporates procedures for lodging of grievances, processing of grievances, resolving grievances and closing of grievances. Grievance redressal framework for onsite implementation is being formulated. The grievances would be addressed through Suggestion Box, Community Meetings and Meetings with Authorities responsible for welfare and development of the village. There is a Grievance Redressal Cell (GRC) on site.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Impacts on biodiversity of the project area should be avoided. When avoidance of impacts is not possible, proper mitigation measures and its implementation to conserve the floral and faunal Diversity in and around project area should be taken.	During site visit it was observed that no forest area is located in the project site or within the in the 10 km study area around the project site. As reported by the project proponent no forest land also involved in the project site. The project site is surrounded	Following actions are required to be taken to minimise the effects on existing ecological condition around the Plant site- **During Construction Phase**

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		by dry agricultural fields. Very low vegetational cover observed in the study area during the site visit. Vegetation of the project area is dry deciduous in nature and no species with high conservation value is observed in the study area. All species are very common to the area and as well as climatic conditions of the site. No Endangered or critically endangered species are observed during the site visit. Further, project site does not fall within any ecological sensitive area and no ecological sensitive are is located within the 10 km radius of the study area. No schedule -I species according to Wild Life Protection act, 1972 is reported from the project site. **Hence, PS -6 is not applicable for the project.**	• Activities generating high noise shall be restricted to day time only. • Camp and kitchen waste shall be collected in a manner that it does not attract any domestic animals. • The footprints of the construction activities shall be kept to minimum to reduce disturbance to flora and fauna. • Create awareness among the labours about the wild life of the area. **During Operation Phase** • Solar panels shall have an anti-reflective coating to minimize the light reflecting off the panels so that there is very less impact due to glare from the panels. • More-over to minimize effect of "Lake effect", visual frightening techniques like "Scare crow" may be considered to frighten any bird trying to land on panels and prevent birds from landing.
PS 7: Indigenous People	PS7 recognizes that Indigenous People, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. Indigenous People are particularly vulnerable if their lands and resources are transformed,	The study area (located in Bellary district) does not fall in any notified tribal area of Karnataka state. As per Census 2011, tribal population constitute around 21 percent of the total population in the study village area.	No actions required

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. Therefore, Indigenous People may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities	No land has been procured from tribal population. Project Proponent has ensured the ESIA team that no ST land has been taken, neither any of their assets are being affected for the 20 MW Bellary Solar Power Project in the proposed area. **PS 7 is not applicable for this project**.	
PS 8: Cultural Heritage	PS8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this PS on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.	This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are to be used for commercial purposes. No notified cultural heritage site is located near the project areas. **Hence, PS8 is not applicable.**	The PS is not applicable as there is no impact anticipated on the cultural heritage of the proposed project site due to the project activities. No monument or structure of religious importance were observed within 5 KM. Chance find procedure should be applied during construction phase for the proposed project. Though, no such evidential proof was found in the study area village

3.3 Categorization of Projects

3.3.1 Categorization of Projects as per IFC guideline

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood because of the client's social and environmental assessment and to specify IFC's institutional requirements. The categories used by the IFC are:

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

IFC therefore categorizes the project primarily according to the significance and nature of its impacts. IFC defines the project's area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

The project can be categorized as **Category B projects** based on limited environmental and social impacts envisaged.

4 DESCRIPTION OF ENVIRONMENT

This chapter describes the existing environmental settings of the project site and its immediate surroundings. This includes physical environment comprising air, water and land components, biological environment and socio-economic environment. Attributes of the physical environment like air, water, soil and noise quality in and around the project area were assessed primarily through monitoring and analysis of samples collected from the area. Primary monitoring was conducted by a NABL certified laboratory.

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

4.1 Study Area

The project site is located at the Karekal village in the Bellary district in Karnataka. To understand and assess the environmental and social risks associated with the project the study area was divided into core area (i.e. Project area and its surrounding up to 500 m) and buffer area (10 km around the project site).

4.2 Baseline Conditions

4.2.1 Climate and Meteorological Conditions

The Bellary district, located in the eastern part of the State, lies between 15°30' to 15°50' north latitude and 75°40' to 77o11' east longitude.

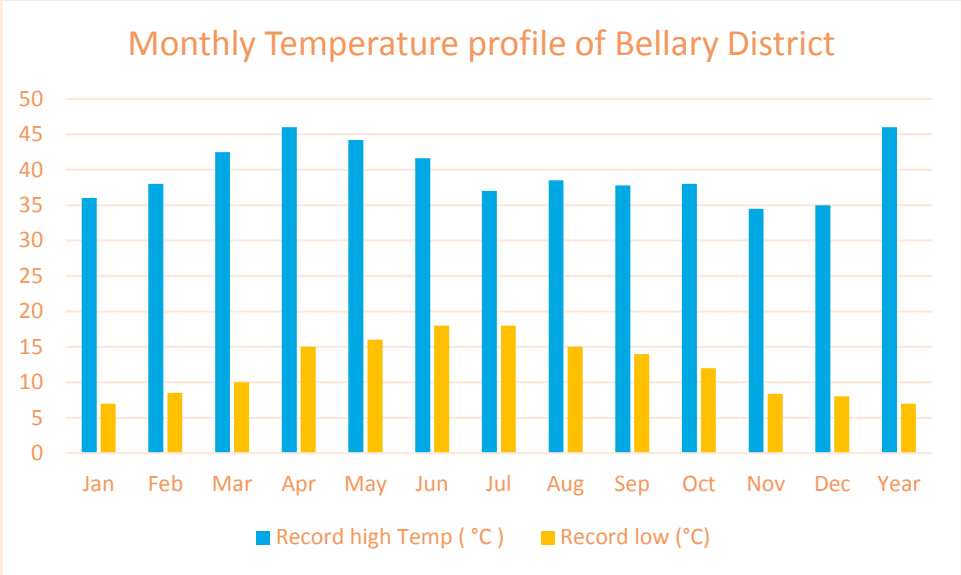
It has geographical area of 8447 km ^{2} with consisting of two sub division and seven talikas. The teo sub divisions are namely Bellary sub division and Hospet sub division. The area falls in the zone of Krishna and Bhima river basin. The district is bounded by raichur District in the north, Koppal District in the west, Anantpura and Kurnool district of Andhra Pradesh in the east and Chtradurga District in south.

Major drainage of the district is the Tungabhadra river which flows along the border. Two tributaries that is Chikkahagari and Hagari runs from south to north. The study area experiences semi- arid type of climate where summer is drier and maximum temperature varies from 28°C to 46°C. Summer is generally dry in nature compared to winter due to lack of moisture in the air.

Table 4-1: Monthly Temperature profile of Bellari District

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high Temp (°C)	36	38	43	46	44.2	42	37	39	38	38	35	35	46
Record low (°C)	7	8.5	10	15	16	18	18	15	14	12	8.4	8	7
Daily mean (°C)	23	26	28	31	31.3	28	27	27	27	26	23	22	26.5

Fig 4.1: Monthly Temperature profile of Bellari District, Karnataka



4.2.2 Rainfall

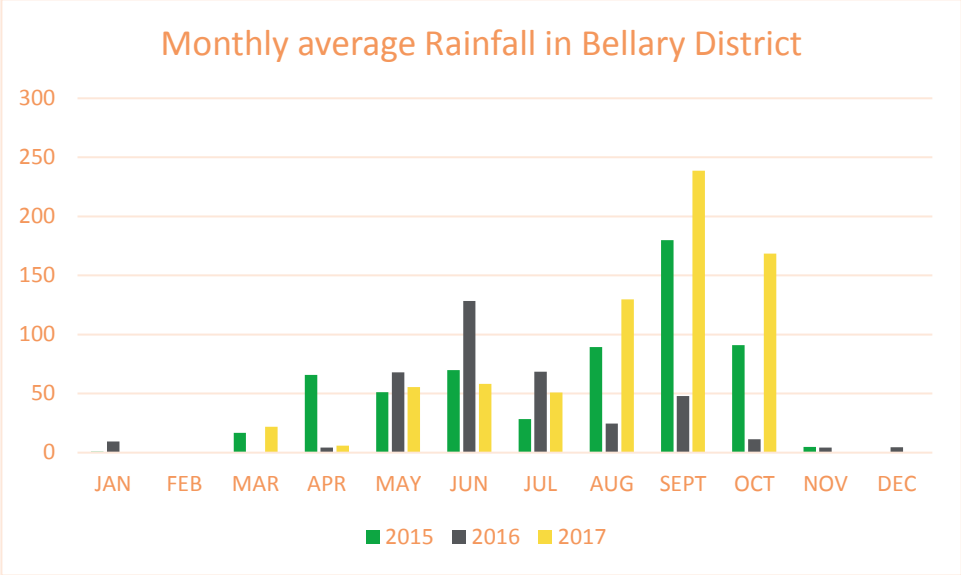
The average annual rainfall of Bellary district is 611 mm. The rainfall is contributed by south-west monsoon which accounts almost 63 % of rainfall in a year. Maximum rainfall recorded in the month of August and September. Winter is basically dry in nature and recorded lowest rainfall. The average monthly rainfall of the last three years is given below in Table 4.2

Table 4-2: Monthly Average Rainfall in Bellary, Karnataka

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2015	0.7	0	16.7	65.8	51.2	69.9	28.3	89.3	179.8	91	4.9	0.3
2016	9.4	0	0	4.2	67.9	128.5	68.4	24.7	47.9	11.4	4.2	4.6
2017	0	0	21.9	5.8	55.6	58.1	50.8	129.9	238.8	168.5	0	0

Source: CGWB, Monthly rainfall distribution – Bellary district

Fig 4.2: Monthly average rainfall profile of Bellary district in Karnataka



4.2.3 Solar radiation

Solar radiation is radiant energy emitted by the sun from a nuclear fusion reaction that creates electromagnetic energy. The spectrum of solar radiation is close to that of a black body with a temperature of about 5800 K. About half of the radiation is in the visible short-wave part of the electromagnetic spectrum. The other half is mostly in the near-infrared part, with some in the ultraviolet part of the spectrum.

There are a variety of solar radiation data sources that has been accessed. These datasets either make use of ground-based measurements at well controlled meteorological stations or use processed satellite imagery. With an extensive background in solar radiation analysis, Solar GIS datasets are being used worldwide for solar radiation prediction and energy prediction at site.

The project site located in semi-arid area and receive immense sunlight throughout the year and has good potential for harnessing of solar energy. The daily average of Global Horizontal Insolation (GHI) at the project site is given in **Table 4-3** below. The ranges vary from 118 kWh/m^2 in December to 214 kWh/m^2 in May (Source: DPR).

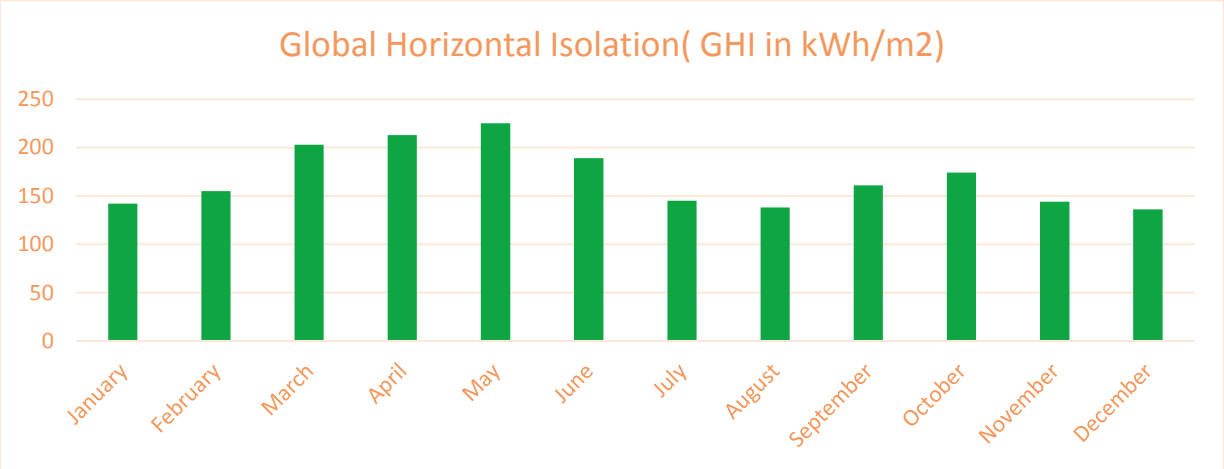
Table 4-3: Daily Average of Global Horizontal Radiation (GHI) in kWh/m^2

Month	Global Horizontal Insolation (kWh/m2)
January	142
February	155
March	203
April	213
May	225
June	189
July	145
August	138
September	161

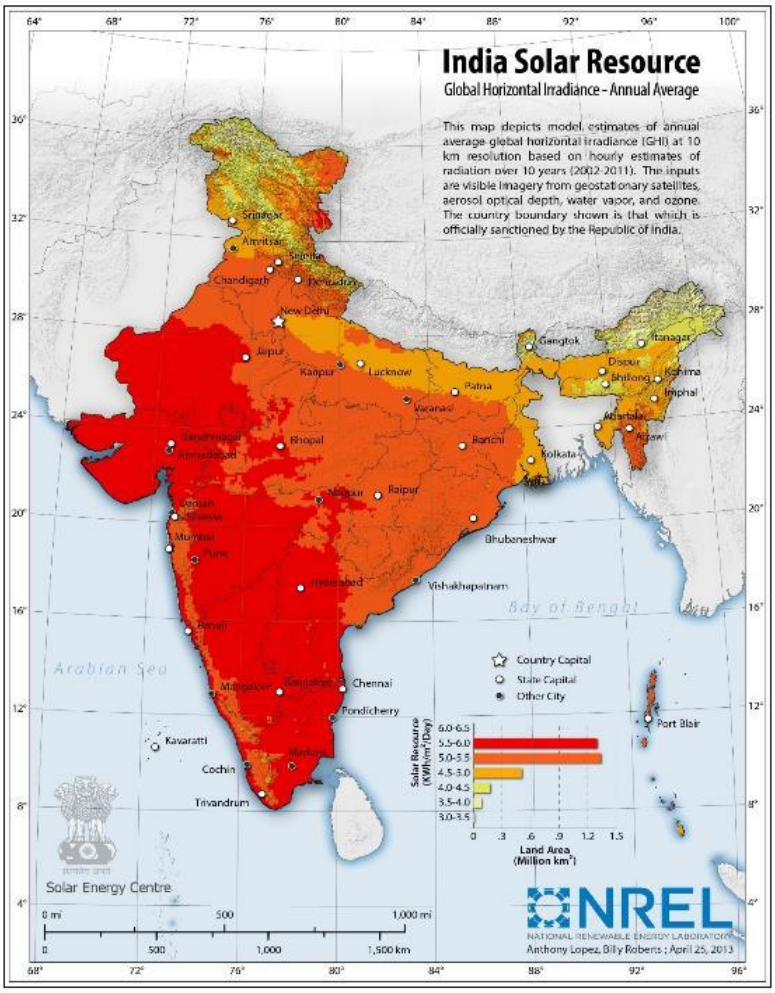
October	174
November	144
December	136

The average GHI 2016 kWh/m^2 at site which is very good for setting up solar PV power plant. The data obtained from the Solar GIS is shown graphically in the figure below:

Figure 4-3: Mean Global Daily Irradiation on a Horizontal Plane at Site



India's Solar Radiation Profile



Source: National Renewable Energy Laboratory

4.2.4 Topography

The Bellary District is located in the eastern part of the Karnataka is surrounded by Raichur district in North,Koppal district in West, Chitradurga District in the south and Kurnool and Anantpur district of State of Andhra Pradesh in the east. The district located between 15o30' to 15o50' north latitude and 75o40' to 77o11' east longitude.

The topography of the area is mainly flat land with mind undulation. The district can be classified as norther median region with monotonous, treeless extensive plateau landscape the Tungabhadra river forms the eastern and northern boundary of the district. 56.47 % area of this district are under agricultural activities. The average elevation of this district is 493.71 mts mts above mean sea level. The elevation of the study area varies from 420 m above msl to 560 m above msl. The area is part of Krishna river basin. The main drainage system is Tungabhadra. Tungabhadra right bank canal is observed within the study area(i.e. within 10 km radius of the project site). The distance from the project site to Tungabhadra right bank canal is 6.5 km.

The project site is spread over dry area with flat terrain. The site is surrounded by patches of agricultural fields. Erection of solar panels will be undertaken through varying the height of the poles required for mounting solar panels. Hence, the installation will be easy and reduce the cost of technical modifications required to adjust for undulations at the ground. Some of the site pictures are shown in Figure 4-1**.**

Figure 4-1: Digital Elevation Map of Project Site

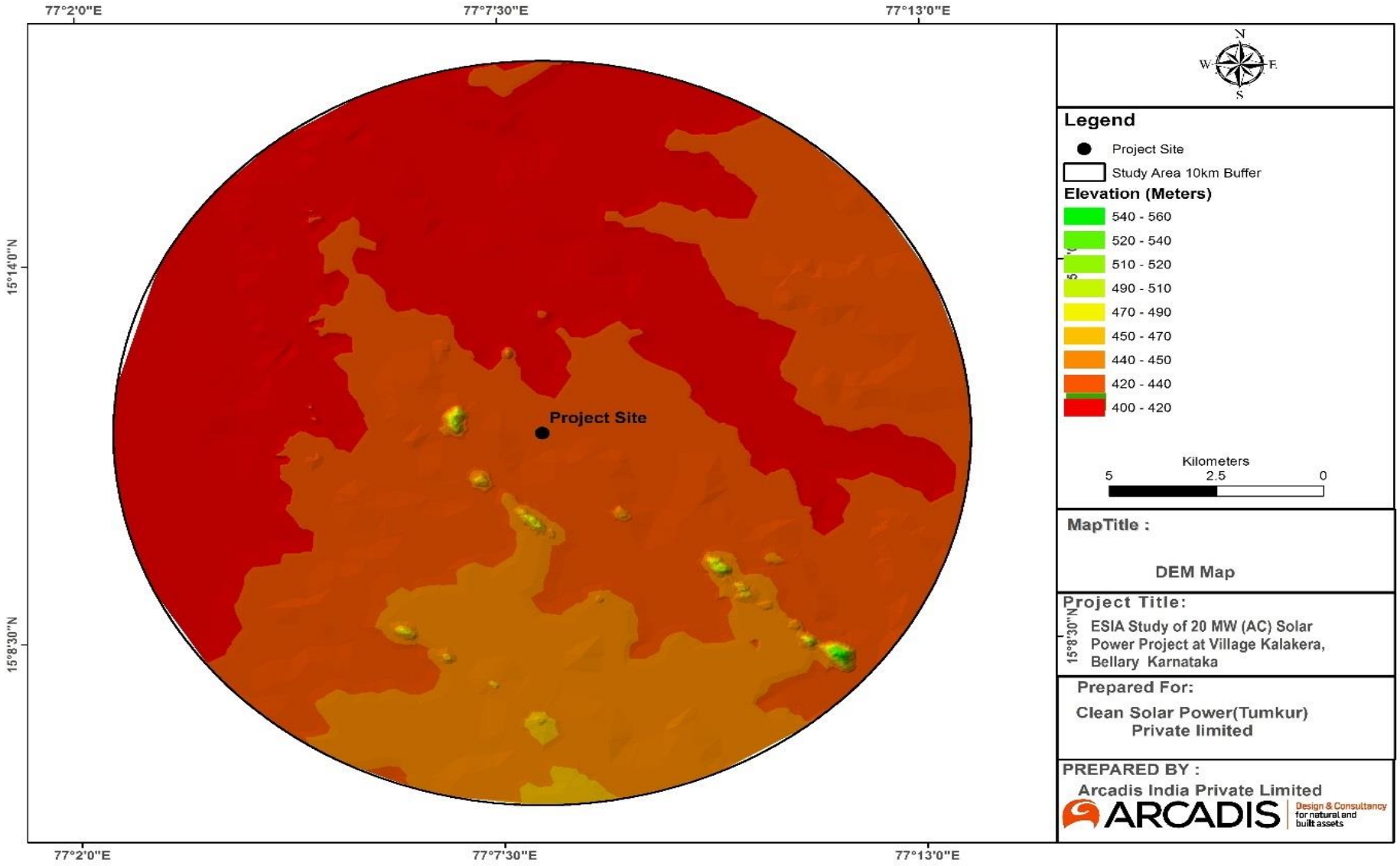


Figure 4-2: Photograph of the Project Site

4.2.5 Geology & Soil

The Bellary district is located on the eastern part of the Karnataka, represent a plateau area. The area is part of the deccan plateau which is characterized with ravines. The topography can be classified as monotonous, treeless extensive plateau area. Hill area is observed in the central part of the district whereas eastern and western part of the district is covered by plain lands. The sandur hills divides the district in two parts and runs in north west directions.

The soil is predominantly black Soil. Black soil has been derived from the granite, gneisses and schistose rock. Black soil is observed throughout the study area and thickness varies from 0.2 m to 1.0 m. Infiltration rate of soil varies from medium to poor depends on formation process.

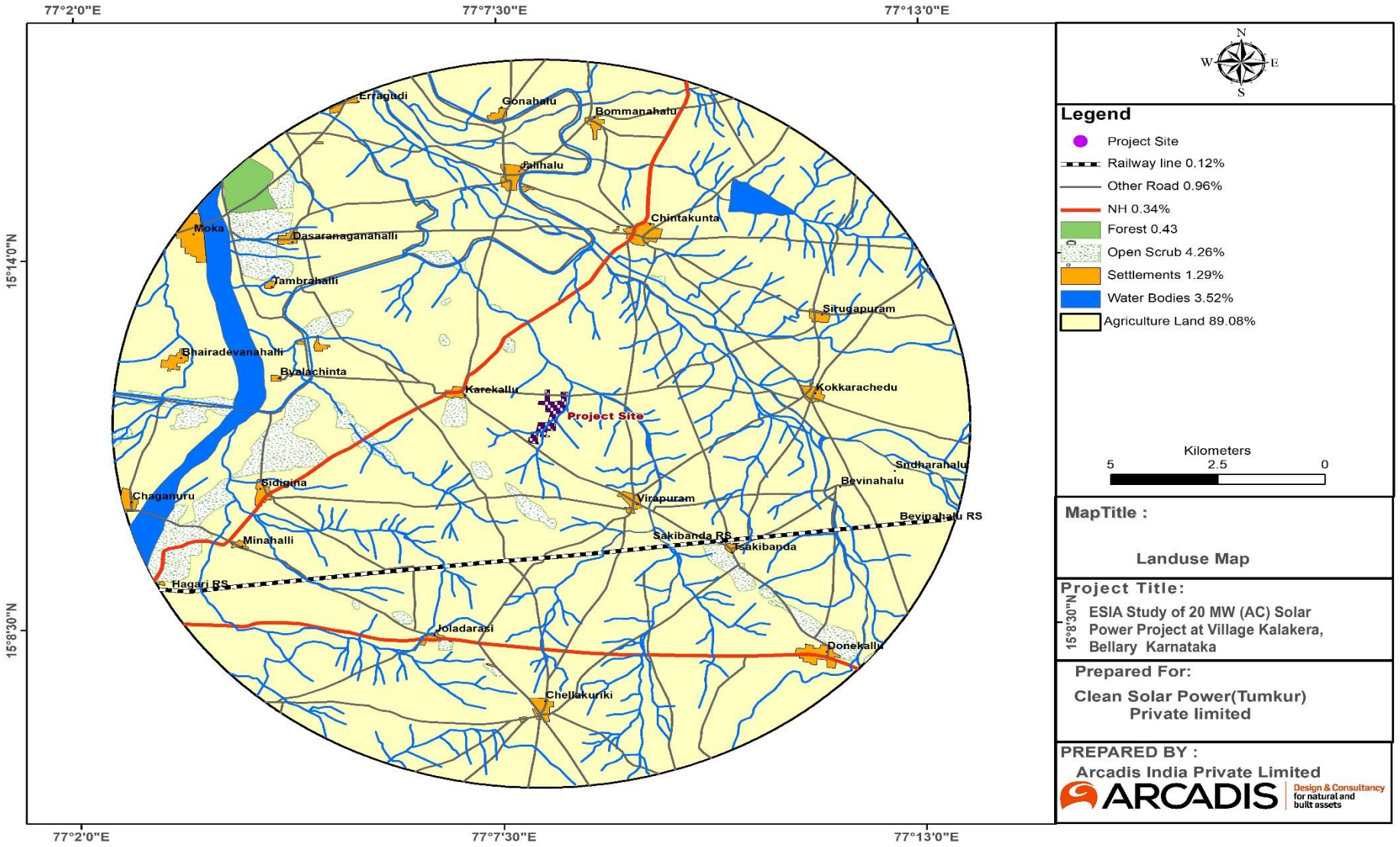
4.2.6 Landuse Analysis

The land-use and land-cover of the study area (10 kms) has been interpreted from visual interpretation, google earth satellite imagery of the area, and subsequently by ground truth verification during field surveys. The land use within study area represent agricultural land (89.08%) followed by, water bodies (3.52 %), Scrub land (4.36 %), settlements (1.29%) and Roads and rail network (1.42%). No forest land is observed within the 10 km radius of the project site. Land use map showing a radius of 10 km of the project site is provided in **Figure 4-5.**

Table 4-4: Land-use of the study area

Category	Percentage
Agriculture Land	89.08
Water bodies	3.52
Scrub land	4.36
Settlement	1.29
Forest	0.43
Roads and rail net work	1.42
Total	100.00

Figure 4-3: Land Use Map



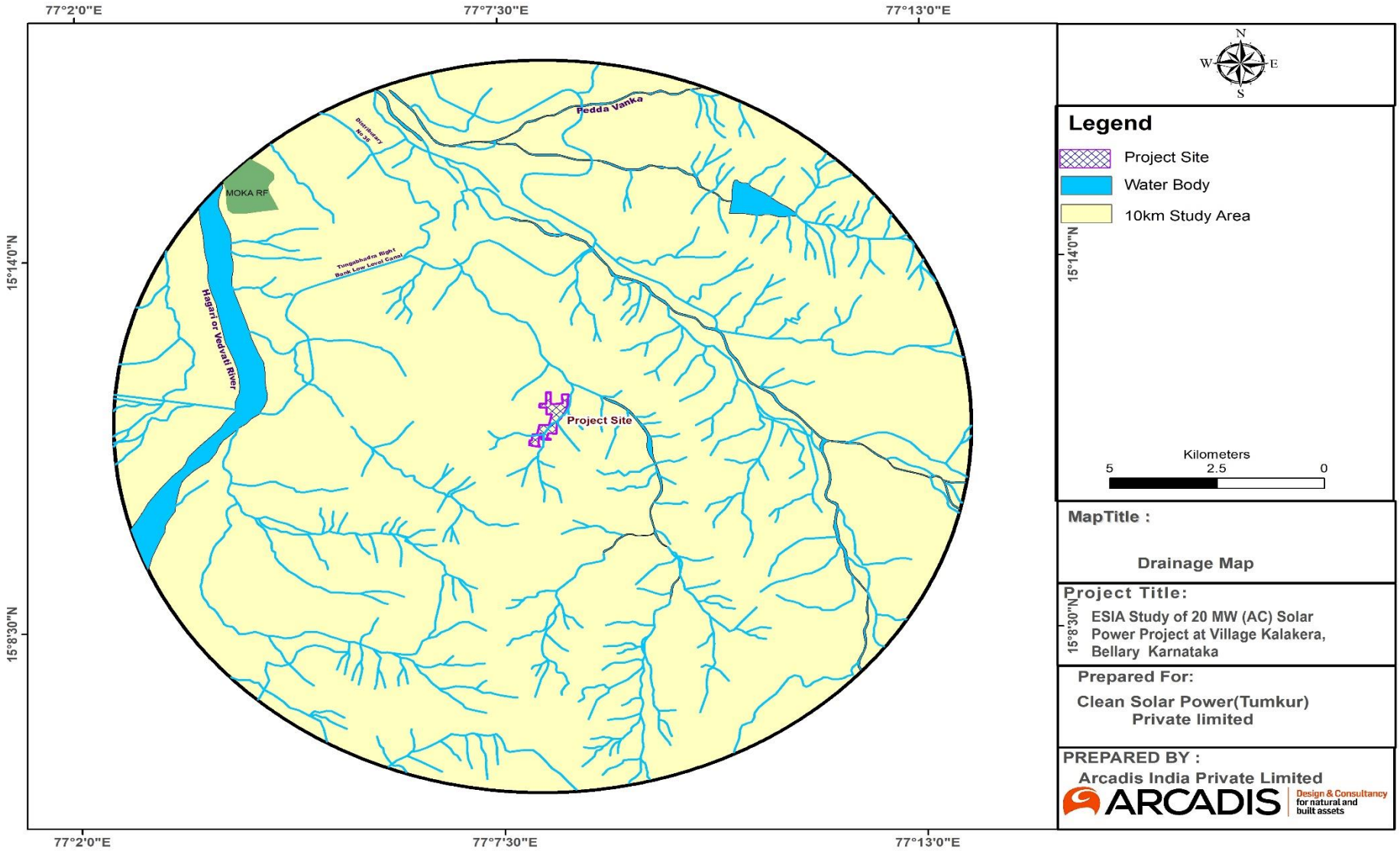
4.2.7 Drainage

Climate is semi-arid in nature in Bellary district of Karnataka. Mean annual rainfall is 611 mm. 63 % of the annual rainfall is received during the south west monsoon which generally start from first week of June. District also witness dry weather during winter season.

The study area is part of the Krishna river basin. The drainage is Tungabhadra which is perennial in nature. The drainage pattern is dendritic to sub dendritic. Chikka Hagari and Hagari are the main tributaries of Tungabhadra which runs south to north. The rivulets and tributaries are generally become dry during the summer season. This river system along with the Tungabhadra right bank canal are the main source of water for the agricultural purpose in this area.

Tungabhadra canal is located around in 6.5 km from the project site in western side. One natural nallah is passing through the project site. Past record does not show any evidence of flood in the study project site. The drainage map of project site presented in **Figure 4-6.**

Figure 4-6: Drainage Map

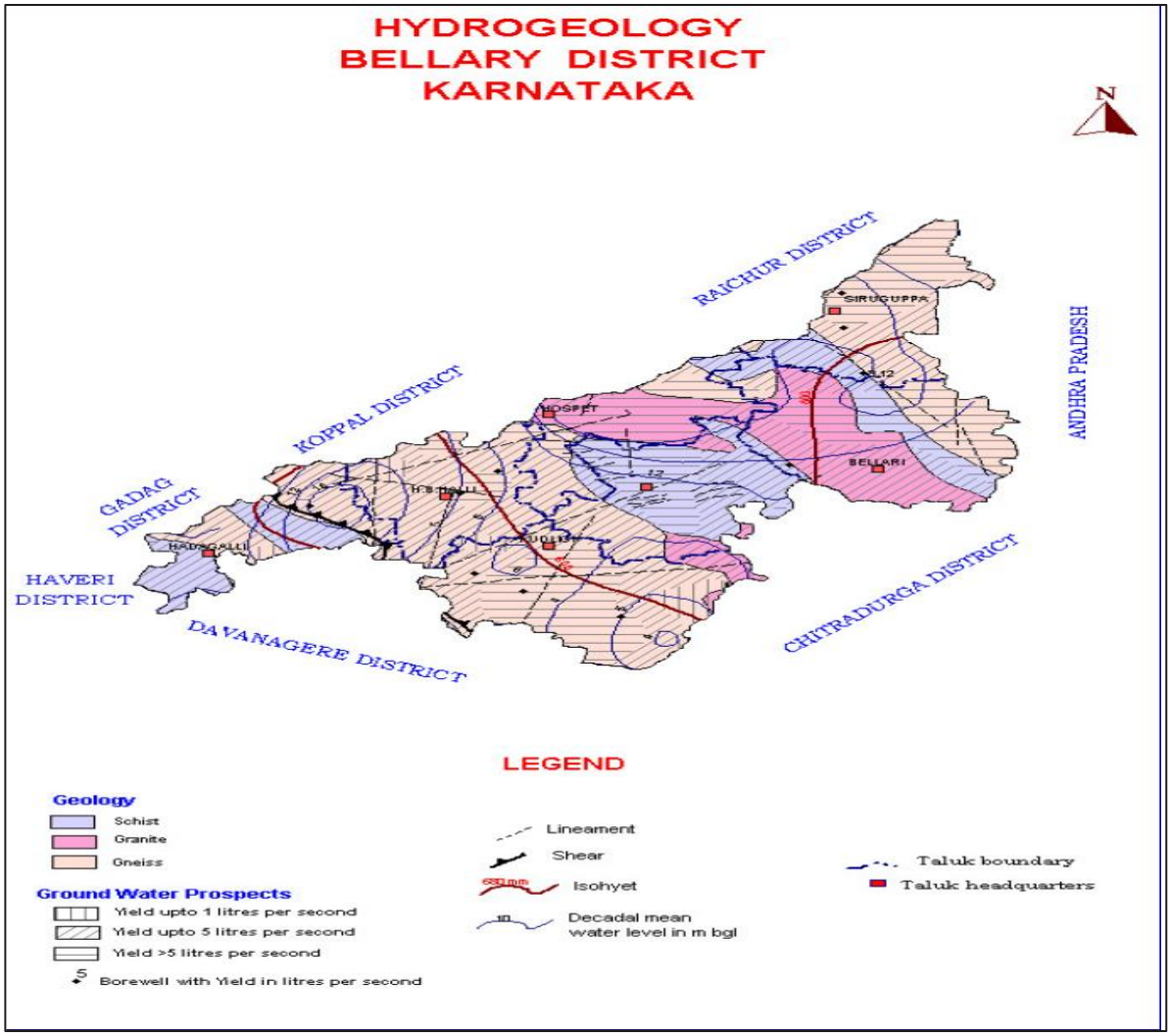


4.2.8 Hydrogeology

In this district, major ground water bearing features are granite, gneiss and vesicular basalt. The ground water occurs in the fractured and weathered zones. The main source of ground water is precipitation.

Ground water in this area generally developed through dug well and bore wells which is mainly use for irrigation purpose. In bellary district, the average depth of water table varies from 1.72mbgl to 19.48 m bgl.In pre- monsoon season the depth of water table is 6.78 m bgl whereas, in post monsoon water table is 5.94 m bgl. (*Source: Central Ground Water Board Report, Bellary District, 2013).* The hydrogeological conditions in the district are presented in **Figure 4-**.7

Figure 4-7: Hydrogeology Map of Yadgir District, Karnataka



Source: Groundwater information booklet, Bellary district, CGWB

4.2.9 Ground Water Resources

Ground water resources in the district has been estimated by the Central ground water Board(CGWB)in 2013. As per CGWB report, net ground water availability of the district is 52961 ham. Based underground water development data only the Hospet and sandur taluk falls in the safe category. whereas, all the remaining taluks are witnessing certain degree of over withdrawal of ground water resources. Taluk wise estimate of dynamic groundwater resources is given in **Table 4-5.**

Table 4-5: Block wise Ground Water Resources of Bellary district

TALUK	NET ANNUAL GROUND WATER AVAILABILITY	EXISTING GROSS GROUND WATER DRAFT FOR IRRIGATION	EXISTING GROSS GROUND WATER DRAFT FOR DOMESTIC AND INDUSTRIAL WATER SUPPLY	EXISTING GROSS GROUND WATER DRAFT FOR ALL USES	ALLOCATION FOR DOMESTIC AND INDUSTRIAL USE FOR NEXT 25 YEARS	WATER AVAILABILITY FOR FUTURE IRRIGATION	AVERAGE CROP WATER REQUIREMENT	BALANCE GROUND WATER IRRIGATION POTENTIAL AVAILABLE	CATEGORISATION (%)			
									SAFE (%)	SEMI-CRITICAL (%)	CRITICAL (%)	OE (%)
	HAM	HAM	HAM	HAM	HAM	HAM	(M)	HAM	%	%	%	%
Bellary	12703	2202	683	2886	1111	9447	0.89	10585	41			59
Hadagali	6242	5565	518	6083	875	608	0.82	743				OE
H.B.Halli	7544	6047	549	6596	881	699	0.71	980	24	32		44
Hospet	6654	1393	948	2341	1351	3910	0.85	4623	Safe			
Kudlugi	9634	6047	342	6389	532	3198	0.76	4213	40	50		10
Sandur	8778	1638	567	2204	889	6252	0.88	7136	96	4		
Siruguppa	1606	778	525	1303	863	10003	0.89	11208	51			49
Total	52961	23670	4132	27202	6502	34117	0.82	39488				

Source: *Central Ground Water Board Report, Bellary District*

Pre- and Post-monsoon water level:

The depths to water levels reported during post monsoon period is in the range of 1.22 to 17.61m bgl. whereas the average depth to water level during pre-monsoon is 6.78m and in post monsoon it is 5.94m. Seasonal variation in the water level depth indicates ground water recharge through precipitation. During pre-monsoon season, there is a depletion of ground water and during post-monsoon season, the ground water replenished by seasonal rainfall. The depth to water levels observed during pre and post-monsoon period is given in **Figure 4-8** and **Figure 4-9.**

Figure 4-4: Depth to Water Level Map of Bellary District, Karnataka – Pre-monsoon

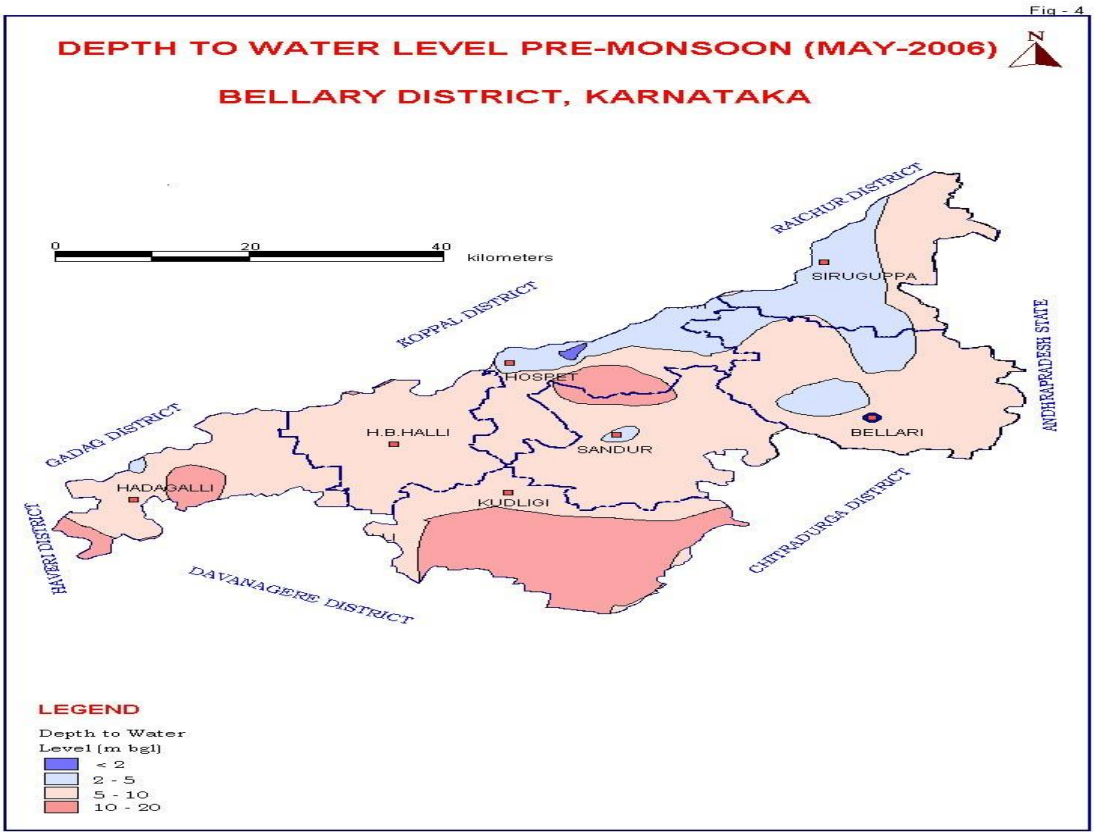
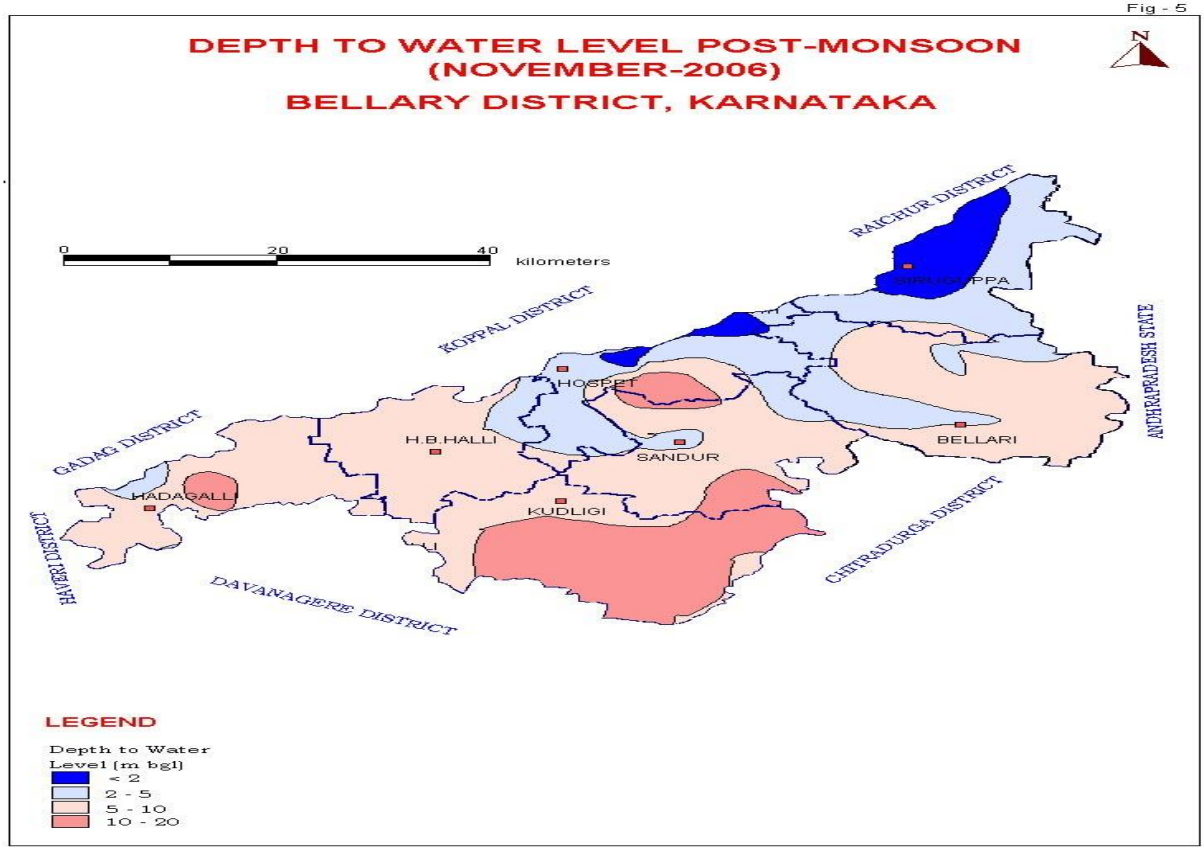


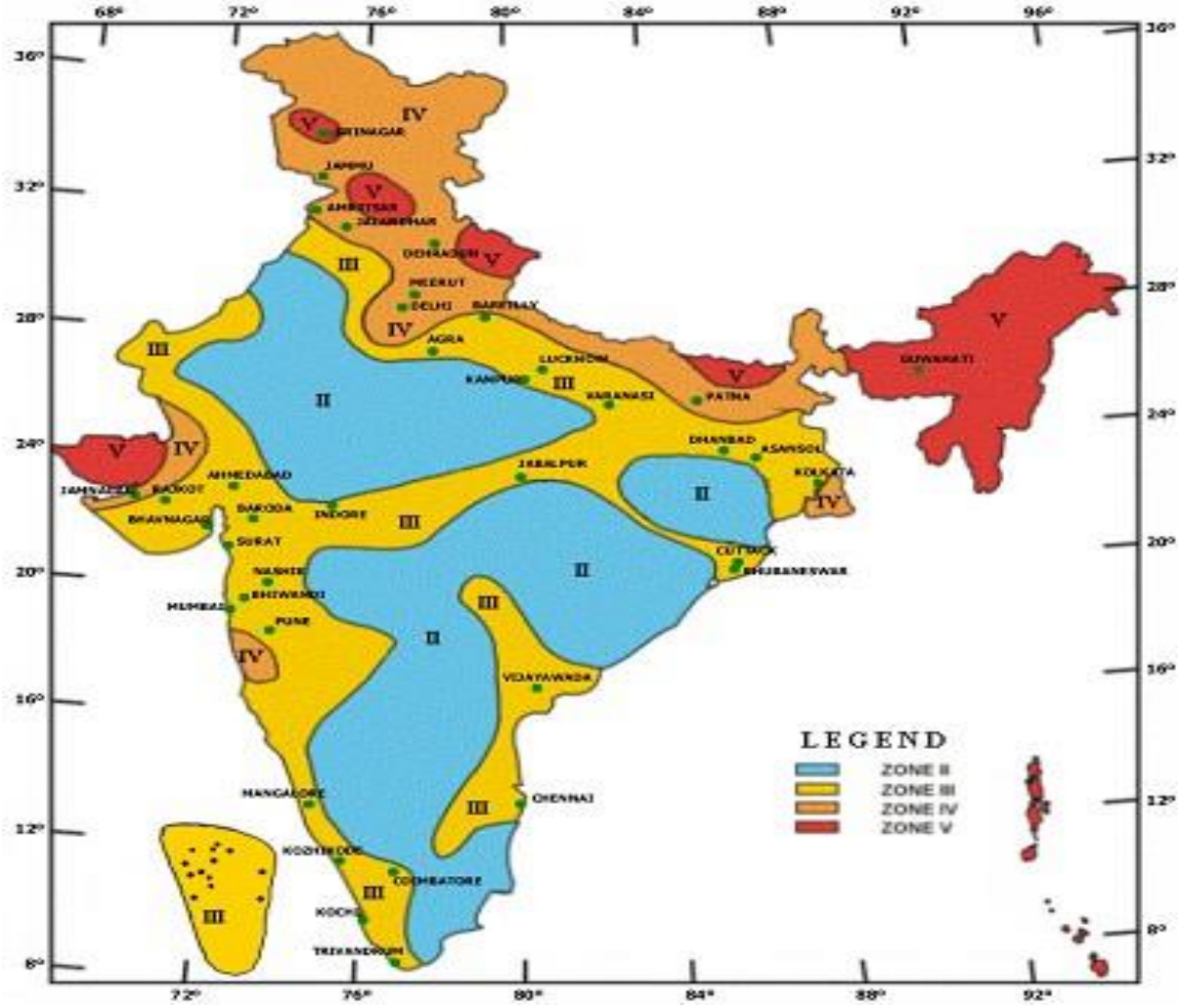
Figure 4-5: Depth to Water Level Map of Bellary District, Karnataka- Post Monsoon



4.2.10 Seismic Hazard

The project site is located in **seismic zone II** as per the seismic zoning map of India (IS 1893–2002). Accordingly, implying that potential threats of damage due to earthquake are quite weak. The seismic zoning map of India has been shown in **Figure** 4-6

Figure 4-6: Seismic Map

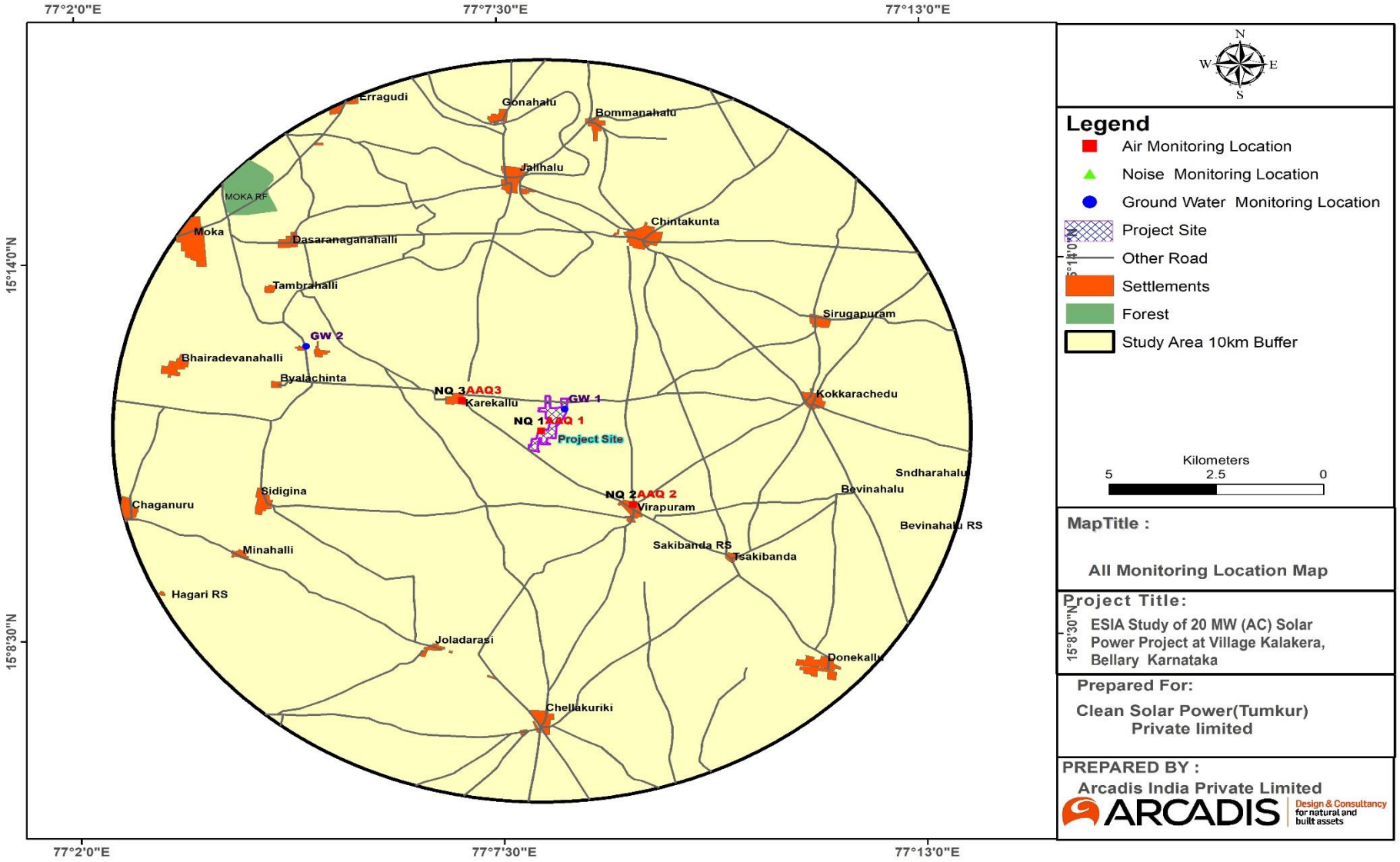


Source: www.isr.gov.in

4.3 Environmental Monitoring

The project is in the preconstruction stage during ESIA study. Baseline environmental monitoring has been carried out for ambient air quality, surface water& ground water quality, noise quality conducted by NABL/MOEF&CC Accredited Laboratory as per the applicable standard methods & analysis. The result of the environmental monitoring represents the baseline environmental condition in the region. Location of environmental monitoring stations are depicted in **Figure** 4-7**.**

Figure 4-7: Monitoring Location Map



4.3.1 Ambient Air Quality

The existing quality of the ambient air environment serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning project activities in the area. A detailed assessment of the existing air environment was undertaken for the purpose mentioned above. The ambient air quality monitoring was conducted at 3 representative locations during September 2018. The baseline air quality status of the study area was primarily assessed by monitoring for particulates and gaseous pollutants at these stations. The monitoring locations was selected based on the prevailing wind direction. The monitoring network was established based on the following key criteria.

- Important receptor locations (e.g. prominent villages, ecological sensitive areas etc.);
- Prevailing Wind Direction.
- Site reconnaissance survey and professional judgment.

The ambient air quality monitoring was carried out in accordance with guidelines of Central Pollution Control Board (CPCB) June 1998 and National Ambient Air Quality Standards (NAAQS), November 2009. Air quality monitoring was carried out for 24 hours a day for Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NO_x), 8 hours a day for Carbon Monoxide (CO).

Figure 4-8: Ambient Air Quality Monitoring Results

S.No.	Parameters	Units	AAQ1	AAQ2	AAQ3	National Ambient Air Quality Standards (NAAQS)
1	Particulate Matter (PM_{10})	$\mu g/m^3$	42	52	61	<100
2	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	20	25	30	<60
3	Sulphur Dioxide (SO_2)	$\mu g/m^3$	5	7.2	7.4	<80
4	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	13.5	16.4	20.6	<80
5	Carbon monoxide as CO	mg/m^3	<1.0	<1.0	<1.0	<2.00

Interpretation of Air Quality Results

On comparison of obtained Ambient Air Quality Values with NAAQ Standards, the value of PM_{10} and PM 2.5 is observed below the permissible limit in all three locations. The highest value of PM_{10} and $PM_{2.5}$ i.e. 61 $\mu g/m^3$ and 30 $\mu g/m^3$ is recorded at the Project site. The obtained values of SO_2, NO_2 and CO are well within the prescribed standards.

4.3.2 Ambient Noise Quality

The ambient noise monitoring was conducted during the month of September at three locations within the study area. The noise monitoring network was established based on the understanding of the project activities and professional judgment. The location of the ambient noise quality stations has been represented in the Figure 4.10 for reference.

Sound pressure level (SPL) measurements in dB(A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring stations and equivalent noise levels in the form of Leq day and Leq

night. The results so obtained were compared with the standard specified in Noise Pollution (Regulation and Control) Rules, 2000. The summary of noise quality results are presented in Table 4-7below.

Table 4-7: Noise Level Monitoring Results

	Main Control Room	K Veerapur Village	Karekal Village
Leq day dB(A)	**45.8**	**48.3**	**50.7**
Leq Night dB(A)	**39.3**	**40.8**	**43.9**

Interpretation of Noise Quality Results

On comparison of obtained noise level results of all the three locations i.e near main Control Room, at K veerapur Village and karekal village, it is observed that all levels are within prescribed permissible limits. Further during day time and night time, the noise level is slightly higher at Karekal Village among these three places.

4.3.3 Transport & Communication

The project area has good road connectivity. Access roads within the study area villages are bituminous, concretized. The project site is well connected with nearest town bellary through SH 72. Nearest major Railway station is Bellary which is nearly 40 km from the project sites. Nearest Domestic Airport is Hubli airport which is around 250 km from the project site.

4.3.4 Surface Water Quality

Surface water characteristics were assessed against water quality criteria as per CPCB guidelines for water resources. One sample was collected near Tungabhadra canal which is nearly 6.5 km from the project site. The dissolved oxygen (DO) level was observed 4 mg/l at indicating favorable conditions for the growth and reproduction of normal population of fish and other aquatic organisms. BOD level was 6 mg/l . The surface water sample is analyzed to be neutral in nature having pH value of 8.2. Hence, the best use class of the surface water body according to the CPCB Water Use Classification conforms to Class B (Outdoor bathing (Organized) inland surface water quality.

Table 4-8: Surface Water Monitoring Results

S.No	Parameters/Characteristic	Test Method	Units	Test Results
1	pH at 25 deg C	IS:3025 part 11 1983 RA-2012	-	8.2
2	Conductivity at 25 deg C	IS: 3025 Part 14 1984 RA-2013	µmhos/cm	148
3	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	94
4	Color	IS: 3025 Part 4 1983 RA-2006	Hazen	5
5	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	1.2
6	Temperature at Site	IS: 3025 Part 38 1989 RA-2003	º C	25.8
7	Total Suspended Solids	IS: 3025 Part 17 1984 RA-2012	mg/L	20
8	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	4
9	Chemical Oxygen Demand	IS: 3025 Part 58 2006	mg/L	40
10	BOD (3 days at 27ºC)	IS: 3025 Part 44 1993 RA-2009	mg/L	6
11	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	30

S.No	Parameters/Characteristic	Test Method	Units	Test Results
12	Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	20
13	Calcium as Ca	IS: 3025 Part 40 1991, RA-2009	mg/L	8
14	Magnesium as Mg	IS: 3025 Part 46 1994, RA-2003	mg/L	2.4
15	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	15
16	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	17.4
17	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	1.2
18	Sulphate as SO_4^{--}	IS: 3025 Part 24 1986,RA-2003	mg/L	27.7
19	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.06
20	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.18
21	Total Nitrogen	IS: 3025 Part 34 1988, RA-2003	mg/L	<0.1
22	Cyanides as CN	IS: 3025 Part 27 1986, RA-2009	mg/L	<0.001
23	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001
24	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
25	Arsenic as As	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.02
26	Phenolics as C_6H_5Oh	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001
27	Boron	IS 3025 Part 57 2005	mg/L	<0.001
28	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
29	Zinc as Zn	IS 3025 Part 49 1994	mg/L	<0.001
30	Total Phosphorus	IS 3025 Part 31 1988, RA-2003	mg/L	<0.02
31	Mercury as Hg	IS 3025 Part 48 1994	mg/L	<0.001
32	Oil and grease	IS 3025 Part 39 1991	mg/L	<1.0
33	Coli form Organisms	IS: 1622:1981 RA 1996	MPN/100 ml	$28*10^{-2}$
34	Faecal Coliform	IS: 1622:1981 RA 1996	MPN/100 ml	$20*10^{-2}$
35	Pesticides	USEPA	µg/L	<0.001

BDL= Below Detection Limit

4.3.5 Groundwater Quality

One ground water sample was collected from study area. The samples were analyzed for physicochemical and bacteriological parameters and results compared with IS: 10500 (2012) drinking water standards to identify and interpret any deviation in the statutory limits set for parameters under this standard. The results for relevant ground water quality parameters have been discussed below.

Table 4-9: Groundwater Monitoring Results

S.No	Parameters/Characteristic	Test Method	Units	Test Results
1	pH at 25^0C	IS:3025 part 11 1983 RA-2012	--	7.34
2	Conductivity at 25^0C	IS: 3025 Part 14 1984 RA-2013	µmhos/cm	7070

S.No	Parameters/Characteristic	Test Method	Units	Test Results
3	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	4652
4	Total Suspended Solids	IS: 3025 Part 17 1984 RA-2012	mg/L	<1.0
5	Turbidity	IS: 3025 Part 10 1984 RA-2002	NTU	3.6
6	Colour	IS: 3025 Part 4 1983 RA-2006	Hazen	<05
7	Taste	IS:3025 part 08 1984 RA-2002	-	Agreeable
8	Odor	IS:3025 part 05 1983	-	Unobjectionable
9	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	2400
10	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986, RA-2003	mg/L	800
11	Calcium as Ca	IS: 3025 Part 40 1991, RA-2009	mg/L	496
12	Magnesium as Mg	IS: 3025 Part 46 1994, RA-2003	mg/L	278.4
13	Chlorides as Cl^-	IS: 3025 Part 32 1988, RA-2009	mg/L	1020
14	Sodium as Na	IS: 3025 Part 45 1993, RA-2009	mg/L	511
15	Potassium as K	IS: 3025 Part 45 1993, RA-2009	mg/L	8.2
16	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986,RA-2003	mg/L	1139.3
17	Nitrates as NO_3	IS: 3025 Part 34 1988, RA-2003	mg/L	69.3
18	Iron as Fe	IS: 3025 Part 53 2003, RA-2003	mg/L	0.4
19	Flourides as F^-	IS: 3025 Part 60 2008	mg/L	2.1
20	Phosphates as PO_4	IS: 3025 Part 31 1988, RA-2003	mg/L	0.18
21	Phenolic Compounds	APHA 23rd Edition 5330D	mg/L	<0.001
22	Cyanide as CN^-	IS 3025 Part 27 1986	mg/L	<0.001
23	Residual Chlorine as Cl^-	IS 3025 Part 26 1986	mg/L	<0.001
24	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001
25	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
26	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.02
27	Arsenic as As	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01
28	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.02

S.No	Parameters/Characteristic	Test Method	Units	Test Results
29	Manganese as Mn	IS: 3025 Part 24 2006	mg/L	<0.001
30	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
31	Nickel as Ni	IS 3025 Part 54 2003	mg/L	<0.001
32	Boron	IS 3025 Part 57 2005	mg/L	<0.001
33	Anionic Detergents	IS 13428 Annex K	mg/L	<0.001
34	Mineral Oil	APHA 23rd Edition 2012	mg/L	<0.001
35	Aluminium as Al	IS 3025 Part 55 2003	mg/L	<0.001
36	Mercury as Hg	IS 3025 Part 48 1994	mg/L	<0.0002
37	Pesticides	USEPA	µg/L	<0.001

Interpretation of Ground Water Quality Results:

pH and Turbidity

The pH and turbidity values of water sample collected were within the desirable limit of IS: 10500 drinking water standards thereby establishing its potable use. The pH value is 7.34.

Total Dissolved Solids

The concentration of total dissolved solids (TDS) in ground water is a measure of its suitability for domestic use. In general, TDS values at 500 mg/l or below is considered be most desirable for such purpose being specified under IS: 10500 drinking water standards. The TDS value for the ground water sample analyzed was found to be 4652 mg/l at the project site which exceed the permissible limit as per IS: 10500-2012.

Chlorides

Chloride concentration in ground water is 1020 mg/l at the project site, the desirable limit of chloride is 250 mg/l while the permissible limit of the said parameter (in absence of an alternate source) is 1000 mg/l. At concentration above 250 mg/l chlorides renders a salty taste to water which may be objectionable in terms of human consumption.

Total Hardness

Hardness of water is an important parameter in determining the suitability of water for domestic uses particularly for washing activity. Hardness of water is correlated to the presence of bivalent metallic ions viz. calcium and magnesium. Total hardness values for the ground water sample was found to be 2400 mg/l at project site which is slightly above the stipulated standard of 200 mg/l specified under IS: 10500-2012.

Iron and Fluoride

Iron is considered as an important ground water parameter since at higher concentration it interferes with laundering operations and imparts objectionable stains. The concentration of iron in ground water sample was observed 0.4 mg/l. Fluoride content in the ground water also recorded within the permissible limit and observed as 2.1 mg/l .

Heavy Metals

The presence of heavy metals in the ground water samples were below the threshold limits.

4.4 Ecological Environment

Ecology & biodiversity study was carried out during first week of September 2018 with the aim to assess the existing ecological resources of the project site and the study area. The study was aimed to conduct primary baseline survey to assess the nature of the existing habitat, local flora and fauna, ecological sensitivity, locations of wetlands/water bodies, land use pattern etc. Apart from that, published secondary information were also reviewed to collect the secondary information.

This information will further use to assess potential ecological impacts that can be generated from the project activities. Understanding of the significant risks and impacts is important to implement mitigation measures or suggest changes if the associated risks are huge. Such mitigation measures will help reduce the impacts and develop ecological monitoring parameters.

Main objectives for Ecological surveys:

Flora-

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

Fauna-

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

4.4.1 Methodologies for Ecological Surveys

Desktop Review

A desktop review available literature was conducted to determine the land use and land cover (Topo sheet, Satellite imagery and map of Study area), Classification of Vegetation (Champion and Seth, 1962), floral and faunal diversity in the study area.

In order to provide representative ecological status for the project a study area is defined for ecological study. As solar power plants have no moving part or no emission is envisaged from the project activity. Most of the project related impact (if any) will be confined to the project site only and access roads. So project development area and 100m around the project site was considered as the “high risk zone” or “core study area”, and 5-km radius surrounding the project site is considered as the “buffer zone” or the zone of influence of the project.

Baseline Survey

Baseline survey was carried out to determine the existing ecological conditions and was designed to fill any data gaps, and to facilitate an adequate assessment of the project’s impacts upon ecology and the

development of appropriate mitigation measures. Survey was conducted in 1st week of September 2018 for habitat survey, flora & faunal diversity in the study area. Baseline survey has two parts-

(i) Secondary data collection and (ii) Primary data collection

Secondary Data Collection

Secondary baseline data regarding sensitive ecological habitat (National Park, Sanctuary, Ecological Sensitive Area, Migratory Corridor, habitat of endangered, vulnerable and range restricted species etc.), flora & fauna in the study area, forest cover was collected from Forest Divisional Office and other published documents. Stakeholder consultations (Forest Department, Local People etc.) were also carried out to understand the major flora & fauna in the study area, pressure on forest resources, and presence of any Schedule I species.

Primary Survey

Habitat Survey

Different habitats identified by desktop review and reconnaissance visit were visited. Data regarding the type and quality of habitat with reference to flora and fauna that it supports and might support is collected.

Flora Survey

The primary floral survey was conducted to record site specific floral species and its diversity. At the time of the survey, deciduous vegetation was recorded from the proposed project site. Further data were gathered from secondary sources like governmental department records, forest officials and residents. None of the species recorded falls in the IUCN red list category.

Faunal Survey

To assess the presence of fauna in the project site, a transact survey area was carried out. The project site and the nearby areas were visited to find out the presence of faunal species in the area either by direct sighting or through secondary identification procedure. The faunal survey focused mainly on two group's viz. mammals and avifauna of the study area. Data related to the other faunal species were also noted, based on the direct sightings and from authentic secondary sources like standard field guides.

4.4.2 Habitat Survey

According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the project site falls under the Biogeographic Province – 6E- Deccan South.

The site survey also included understanding of important habitats in the area. A "Habitat" according to IFC is defined as a terrestrial, freshwater or marine geographical unit or airway that supports assemblage of living organisms and their interactions with the non-living environment. As per IFC, habitats are divided into - Natural, Modified or Critical for implementation of IFC Performance Standard-6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources). Critical habitats are subsets of Natural habitats. Ecological sensitivity map of the project site is provided in figure 4-10.

10.

Types of Habitat in the Study area

Agricultural field

During survey, it is observed that majority of the study area is comes under the agricultural land and project site is surrounded by patches of agricultural fields. Some patches of dry barren lands also observed in this area which are not contiguous in nature and project site is located on one of this barren dry land. Vegetation cover is minimum and very sporadic in nature. Vegetation mainly found on the road side and on the agricultural fields. Agriculture is largely depending on ground water and also surface water from the Tungabhadra canal. No forest land is observed in the project site or within 10 km radius of the study area. Thus, habitat in the project area can be classified as 'Modified' as per IFC guidelines.

Barren and dry land

Project site can be classified as dry barren land with minimum vegetation cover. Surface is mostly bare and presence of hardly any large vegetation or scrub. There is hardly any fertile topsoil and bare rock surface is devoid of any nutrients or moisture, so these plants grow in fissures in rocks where soil or organic matter has accumulated. These vegetations are adapted to survive in drought like conditions. For most of the year this vegetation maintain a dry dehydrated morphological state to survive dry season. Only after rainfall or during monsoon these plants rehydrates and becomes green.

4.4.3 Flora and Faunal Profile of the Study Area

(A) Floral Profile

The proposed project site is dry in nature with minimum vegetational cover. Only some scattered vegetation is observed in the project site. Ground is devoid of any kind of understory and mainly bare in nature. The primary floral survey was limited to record site specific floral species (both woody trees/small tree species as well as ground vegetation). Assessing the existing floral profile was necessary to understand the baseline conditions of the area as the project activities might lead to loss of significant ecological resources, if present. The information will add on to the knowledge of ecological resources and help in further evaluating the possible risks due to project activities and feasibility of the proposed mitigation measures.

Floral Profile of project site and its surrounding area –

During field visit, it is observed that project site is devoid of any large tree species. Only small grasses are observed in the project site. Large tree generally observed along the road side and along the bund on agricultural field. Some tines it is also observed in patches just outside the village area. Trees are mainly deciduous in nature. Thorny species also observed in the study area. Floral composition of study area given in the following table 4-10.

Table 4-10: Floral species recorded from the Study Area

Sl No	Scientific Name	Common Name	Family
1	*Acacia nilotica*	Babool	Fabaceae
2	*Anona squamosa*	Sitafal	Annonaceae
3	*Azadirachta india*	Neem	Meliaceae
4	*Calotropis gigantea*	Akanda	Apocynaceae
5	*Carissa carandas*	Karounda	Apocynaceae
6	*Delonix regia*	Gulmohar	Fabaceae
7	*Ficus bengalensis*	Baat	Moraceae

8	*Ficus religiosa*	peepal	Moraceae
9	*Mangifera indica*	Aam	Anacardiaceae
10	*Eucalyptus sp*	Eucalyptus	Myrtaceae
11	*Saraca asoca*	Ashoka	Fabaceae
12	*Prosopis juliflora*	Vilayeti Babool	Fabaceae
13	*Tamarindus indica*	Imli	Fabaceae
14	*Tectona grandis*	Teak	Lamiaceae
15	*Ziziphus jujuba*	Bor	Rhamnaceae

(B) Faunal Profile

During site visit no primary evidences of large or medium mammals were found in the project site and study area. But consultation with forest department and local villagers have reported the presence of mammals like Jackal, Common hare, House Rat, etc reported from the study area. No forest land is observed in the vicinity of the project site and within the 10 km buffer area. Therefore, the presence of Wild animals in the study area is very rare. The most common reptiles which are found in this area is common krait **(***Bungarus caeruleus).* Although, during site visit, no reptiles are seen or found in the study site. No schedule -I species as per Wild Life (protection) Act 1972 also reported from the study area. Following faunal species were reported from the study area.

Table 4-11: Faunal Species reported from the study area

Sl No	Common Name	Scientific Name	IUCN Status	WPA, 1972 Status
1	Jackal	*Canis aureus*	LC	Schedule II
2	The Common Hare	*Lepus nigricollis*	LC	Schedule IV
3	Bandicoot Rat	*Bandicota indica*	LC	Schedule V
4	House Rat	*Rattus rattus*	LC	Schedule V
5	Common Krait	*Bungarus caeruleus*	LC	Schedule IV
6	Indian rat snake	*Ptyus mucosa*	LC	Schedule II, Part II

Avifauna

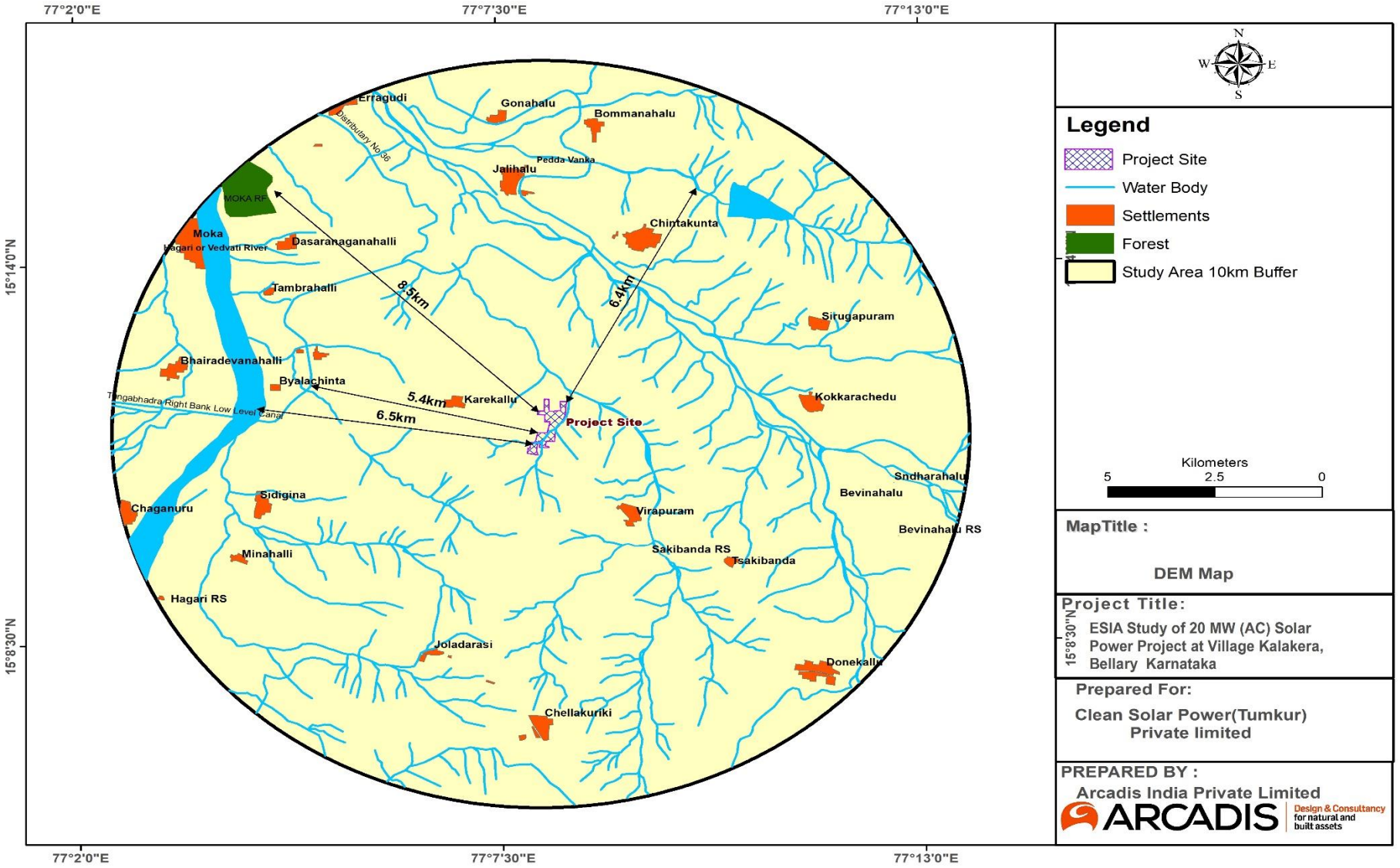
Total 23 species of birds were reported during field observation, consultation with local people and Forest department. Among Them bird species such as Paddy field pipit, Common Myna, Little swift, Cattle egret, Rock Pigeon Indian Roller etc. were observed during field visit. It is also reported by forest department that no migratory bird species observed in this area. Also there is no migratory route reported in the vicinity of the project site.

The species of birds recorded in the project area and surrounding area during site visit is listed in the **table 4-12.**

Table 4-12: List of Avifauna reported from the Project Area

SL No.	Scientific Name	Common Name	Order	IUCN Status	WP. 1972 Status	Resident/ Migrant
1	*Acridotheres tristis*	Common Myna	Passeriformes	LC	Schedule IV	R
2	*Bubulcus ibis*	Cattle egret	Pelecaniformes	LC	Schedule IV	R
3	*Centropus sinensis*	Greater coucal	Cuculiformes	LC	Schedule IV	R
4	*Columba livia*	Rock Pegion	Columbiformes	LC	Schedule IV	R
5	*Coracias benghalensis*	Indian Roller	Coraciiformes	LC	Schedule IV	R
6	*Corvus splendens*	House crow	Passeriformes	LC	Schedule IV	R
7	*Dicrurus macrocercus*	Black Drongo	Passeriformes	LC	Schedule IV	R
8	*Egretta garzetta*	Little egret	Pelecaniformes	LC	Schedule IV	R
9	*Francolinus pondicerianus*	Grey Francolin	Galliformes	LC	Schedule IV	R
10	*Leptocoma zeylonica*	Common Sunbird	Passeriformes	LC	Schedule IV	R
11	*Merops orientalis*	Green Bee-Eater	Coraciiformes	LC	Schedule IV	R
12	*Microcarbo niger*	Little cormorant	Suliformes	LC	Schedule IV	R
13	*Passer domesticus*	House sparrow	Passeriformes	LC	Schedule IV	R
14	*Ploceus philippinus*	Baya Weaver	Passeriformes	LC	Schedule IV	R
15	*Prinia inornata*	Plain prinia	Passeriformes	LC	Schedule IV	R
16	*Prinia sylvatica*	Jungle Prinia	Passeriformes	LC	Schedule IV	R
17	*Psittacula krameri*	Rose ringed parakeet	Psittaciformes	LC	Schedule IV	R
18	*Pycnonotus cafer*	Red vented Bulbul	Passeriformes	LC	Schedule IV	R
19	*Spilopelia chinensis*	Spotted dove	Columbiformes	LC	Schedule IV	R
20	*Spilopelia senegalensis*	Laughing Dove	Columbiformes	LC	Schedule IV	R
21	*Sxicoloides fulicatus*	Indian Robin	Passeriformes	LC	Schedule IV	R
22	*Turdoides malcolmi*	Large gray babbler	Passeriformes	LC	Schedule IV	R
23	*Turdoides striata*	Jungle Babbler	Passeriformes	LC	Schedule IV	R

Figure 4-10: Ecology Map of the Project Surrounding



4.5 Socio Economic Profile of the Study Area

This section describes the socio-economic condition in the study area and relates the village level socioeconomic conditions with taluk and district level. The objective of analysis of information at village, taluk and district level is to identify the existing facilities and gaps at village level which can be considered as need of the study area.

The site for the present solar power project is in K.Veerapura village of Bellary taluk in Bellary district, Karnataka. Site visit was undertaken along with primary and secondary data collection from various sources. Interviews were also undertaken with representatives of project proponent (HFE), EPC contractor (Mahindra Construction) Construction engineering company), land sellers, local villagers and government officials in different departments. Information and required documents related to project site, land details etc. were collected from the project proponent and personnel of EPC contactors present at site.

4.5.1 Objective

The main objective of the consultations was to develop an understating of the community in general of the project affected area. Through the consultative process the areas which the project is impacting the individuals and the community, is also perceived. Along with that, the feasible mitigation measures of the impacts are also identified.

The observations made in this section are intended to capture the status of the project and, therefore, briefly mention the 'way ahead' to successfully complete the ESIA study. The understanding of the project profile was carried out with the project proponent and details of the same will be included in the ESIA report.

4.5.2 Methodology

The social assessment is primarily based on the analysis of the secondary data obtained from the Census of India 2011, district portal website and primary consultation with community & different level stakeholder with the help of framed sample questionnaire for village profiling. Considering the nature of the project, operations and understanding of the demographic characteristics of the area from the secondary data it is designed to capture occupational patterns, societal set up, access to basic amenities along with socio - economic profiling of village and communities.

The following methodology was adopted:

Consultation with local representatives of project proponent;

Field observation for profiling the study area village;

Consultation with land owners;

Consultation with local sub-registrar office;

Consultation with all level stakeholders in the study area village (e.g. Panchayat Members, Village Heads, Teachers, Youth Group, Farmers, Health Worker, ICDS Workers etc.)

4.5.3 Demographic Profile of District and Study Area Village

The proposed project is located at K.Veerapura village under Sidigineamolea Gram Panchayat in Bellary taluk of Bellary district, Karnataka. The details of the study area for which socio-economic profiling has been carried is depicted in **Table 4-4.**

Table 4-4: Project Location

State	District	Mandal/ Taluk	Gram Panchayat	Village
Karnataka	Bellary	Bellary	Sidigineamolea	K.Veerapura

Source: Hero Future Energies Pvt. Ltd. (HFE)

Demographic Profile of the District

In 2011, Bellary has population of 24,52,595 of which male and female are 12,36,954 and 12,15,641 respectively. Average literacy rate is 67.43 percent where male and female literacy are 76.64 percent and 58.09 percent respectively. Sex Ratio in Bellary is 983 per 1000 male. The Socio- Economic profile of the Bellary District is presented in **Table 4-5.**

Table 4-5: Socio- Economic Profile of the Bellary District

Particulars		Project Influence Area		
General	Area in sq.m	8461		
	No. of Households	4,87,418		
	Sex ratio (Per 1000)	983		
	Child Sex ratio (Per 1000)	960		
	Density/Km2	290		
Population	**Particulars**	**Male**	**Female**	**Total**
	Rural	7,74,093	7,58,263	15,32,356
	Urban	4,62,861	4,57,378	9,20,239
	Total Population	12,36,954	12,15,641	24,52,595
	Population Growth Rate	20.13	21.88	20.99
	Childs Population (0-6)	175,543	168,609	344,152
	Schedule Castes %	20.90	21.29	21.10
	Schedule tribes %	18.23	18.59	18.41
Literacy Rate	Literacy in No.	8,13,440	6,08,181	14,21,621
	Literacy %	76.64	58.09	67.43
Economic Activities	Total Workers %	56.85	34.03	45.54
	Main Workers %	51.88	26.96	39.52
	Marginal Workers %	4.98	7.07	6.01
	Non-Workers %	43.15	65.97	54.46
Category of Workers	Cultivators %	25.70	18.70	23.11
	Agriculture Labor %	25.03	55.63	36.36
	Main Household %	1.90	2.30	2.10
	Other workers %	47.38	23.37	38.49

Source: Census of India 2011

Demographic Profile of the Tehsil/Village in the study area

The socio - economic profile of the tehsil/village is essentially based on the census data and other government records. The present socio-economic description provides an insight of

demographic features, population density, work participation rate and the vulnerable population. The demographic profile of the selected village surveyed in the study area is depicted in **Table 4-5.**

The total population of Bellary taluk is 3,60,484 of which 1,81,595 male and 1,78,889 female population respectively. Total population of village K.Veerapura is 2,549 of which male and female constitute 1,264 & 1,285 respectively. Sex ratio of Bellary tehsil is 985 and 1017 for K.Veerapura village.

Table 4-6: Population within the Project study Area

Particular	Total Population	Male Pop.	Male %	Female Pop.	Female %	Sex Ratio
Taluk - Bellary	3,60,484	1,81,595	50.38	1,78,889	49.62	985
Village- K.Veerapura	2,549	1,264	49.59	1,285	50.41	1017

Source: Census of India 2011

4.5.4 Schedule Caste (SC) & Scheduled Tribe (ST)

The socially marginalized and economically poor sections constitute the vulnerable groups. Often their means of livelihood are dependent upon locally available resources. It is important to make proper estimations of the marginalized groups to ensure that their assets and socio-economic conditions are properly assessed.

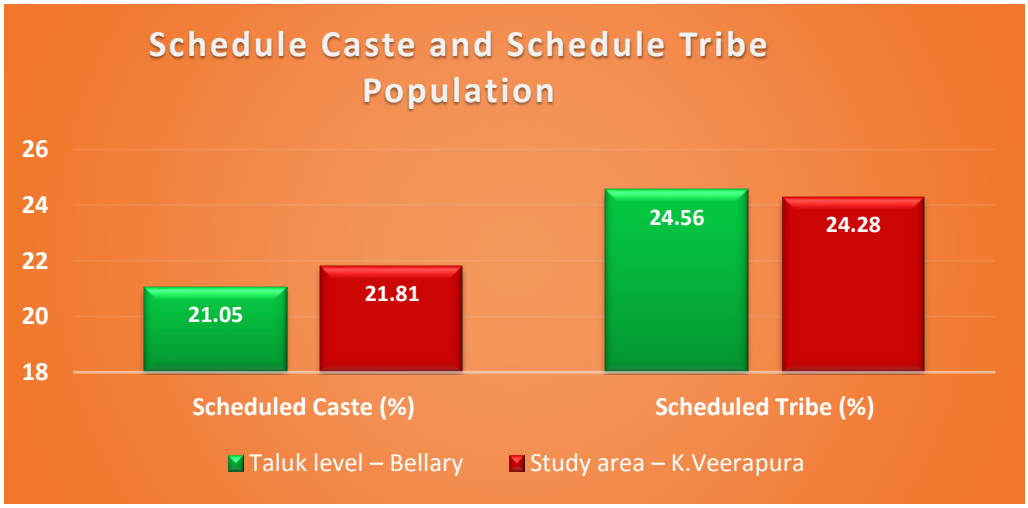
As per 2011 census, 21.05 percent of the population belonged to Scheduled Castes (SC) and 24.56 percent to the Scheduled Tribes (ST) in Bellary Taluk. In village K.Veerapura , SCs and STs constitute 46.09 of the total population. This indicates that a considerable share of population in the study area belong to weaker sections. **Table 4-7** depicts the distribution of scheduled Castes & Tribes.

Table 4-7: Study Area SC & ST Population

Study Area	Scheduled Caste (No.)	Scheduled Caste (%)	Scheduled Tribe (No.)	Scheduled Tribe (%)
Taluk level – Bellary	75,878	21.05	88,541	24.56
Study area – K.Veerapura	556	21.81	619	24.28

Source: Census of India 2011

Figure *4-11*: Schedule Caste and Schedule Tribe Population



4.5.5 Literacy in the Study Area

Literacy is one of the most significant indicators of human and social development. This not only reflects on the educational attainment of the population but also reflects on the status of women, caste equation and economic condition of an area.

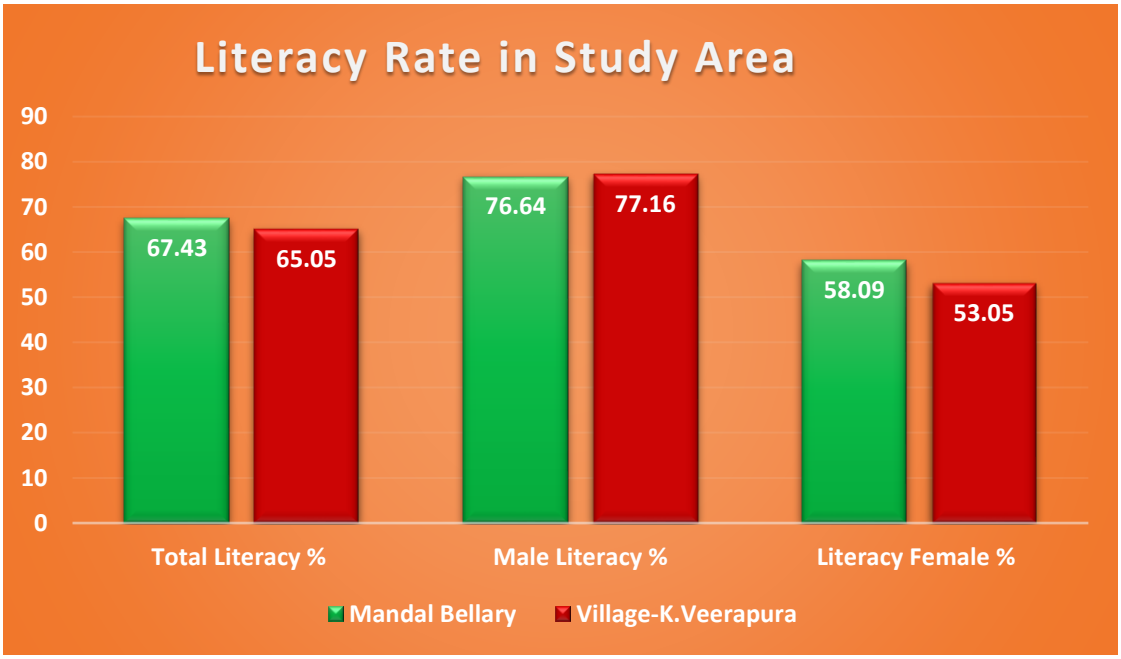
As per census 2011, average literacy rate in Bellary tehshil is 67.43 percent. The literacy rate of K.Veerapura is 65.05 percent of which male and female literacy is 77.16 percent and 53.05 percent. Detail of the literacy scenario is given in **Table 4-16**.

Table 4-8: Study Area Literacy Scenario

Study Area	Total Literacy (No.)	Total Literacy %	Male Literacy (No.)	Male Literacy %	Literacy Female (No.)	Literacy Female %
Mandal Bellary	14,21,621	67.43	8,13,440	76.64	6,08,181	58.09
Village-K.Veerapura	1,465	65.05	865	77.16	600	53.05

Source: Census of India 2011

Figure *4-12*: Literacy Rate in Study Area



4.5.6 Workers and Occupation

The predominant economic activity in the study area is agriculture and allied activities. This section will highlight the classification of workers in the study area. Out of the total workers in the K.Veerapura village, 87.76 percent are main workers and rest 12.24 percent is marginal workers. From the total working population, cultivators constitute 38.94 percent, agriculture labour are 55.31percent and household industries and Other workers are 0.97 & 4.78 percent respectively in study area village. **Table 4-9** to Table 4-10: Classification of Workers in the study Area**Table 4-10** give the detail about the categorization of workers.

Table 4-9: Category of Workers in the study Area

Village	Total Worker	Total Worker %	Total Main Worker	Total Main Worker %	Total Marginal Worker	Total Marginal Worker %
Tehsil-Bellary	1,86,607	51.77	1,63,774	87.76	22,833	12.24
K.Veerapura	1130	44.33	657	58.14	473	41.86

ource: Census of India 2011

Table 4-10: Classification of Workers in the study Area

Village	Total Cultivator	Total Agri-Labour	Main Household Industries	Total Other Workers	Total Cultivator %	Total Agri Labour %	Main Household Industries %	Total Other Workers %
Tehsil-Bellary	62,662	87,121	2,660	34,164	33.58	46.69	1.43	18.31
K.Veerapura	440	625	11	54	38.94	55.31	0.97	4.78

Source: Census of India 2011

Figure *4-13*: Literacy Rate in Study Area

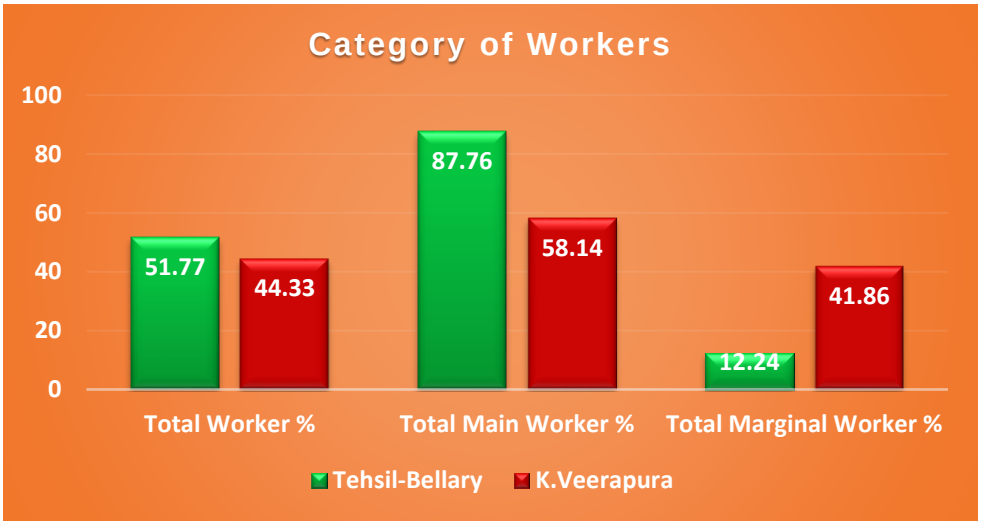


Figure *4-14*: Classification of Workers *in* Bellary

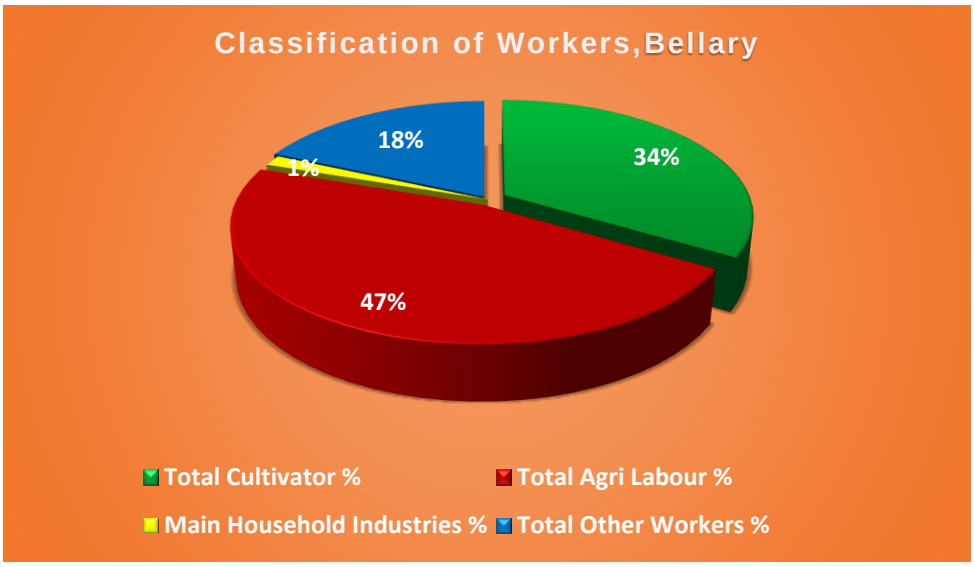
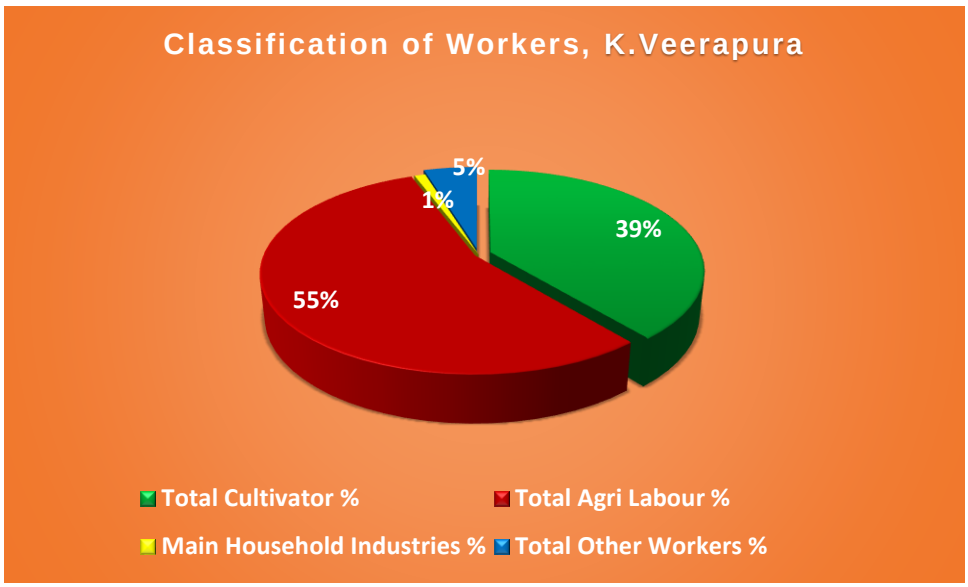


Figure *4-15*: Classification of Workers, K.Veerapura



4.5.7 Wages

According to Karnataka Minimum Wage Rule for 2016-17, the minimum wage for contract laborer in agricultural sector is Rs. 303.98/ day for various relevant activities. It is inclusive of variable dearness allowance of Rs. 200.00/ day and variable dearness allowance (VDA) of 103.98/ day. [1] The wages and VDA are of varied range depending on the level of skill (termed as unskilled, semi-skilled and skilled) in different other sectors.

4.5.8 Livelihood Source

As per Census 2011, about 39 % and 55 % of the working population is directly dependent on agriculture, as cultivators and agriculture-based laborer respectively in study area village K. Veerapura. In Bellary taluk more than 80% of the total population are engaged in agriculture activities as cultivators

[1] *Source: http://labour.kar.nic.in/labour/2016-17%20Minimum%20wages%20rates.pdf*

and agricultural laborer. Thus, agriculture continued to play an important role in the economic growth of the region

Cropping Pattern

Wheat, maize, tur, red gram, tomato, onion etc. food crops along with cotton is cultivated in the project area villages. As informed by the farmers and the community members a crop wise productivity in the study area and market price is given in **Table 4-**.

Table 4-19: Production & Productivity and Price of Major Crops

Sl. No.	Crop	Harvest Period	Productivity (q/acre)	Price/ Quintal (in INR)
1	Tur	June – December	3-5 quintal per acre	INR 3000 – 3500
2	Cotton	June to December	10 – 12 quintal per acre	INR. 3000 - 5000
3	Red Gram	July – December	3 - 5 quintal per acre	INR 5000 – 6000

Source: Primary Consultation in the Study Area Village

Figure4-1: Rice Cultivation in village K.Veerapura

Figure 4-2: Rice field around the site area

4.5.9 Livestock

Karnataka has rich livestock resources especially goat and sheep population. The livestock population of the study area consists mainly of milk producing animals. The village have notable number of livestock population and small ruminants (around 70-80% HH) i.e. buffaloes, cow, sheep and goats. Animals are grazed at open fields surrounding the cropping fields. Open fields are often used as grazing lands. Farmers mostly use agricultural waste after harvest as fodder for livestock.

4.5.10 Local Employment and Migration

During consultation with the community it was observed that agriculture, animal husbandry, daily and wage agriculture labour are important sources for livelihood in the study area village. Also, the same has been reported in Census 2011. People migrates to big cities like Mumbai or Bengaluru to work as daily wagers, labourers etc.

4.5.11 Gender Empowerment Status

In Bellary district, female mostly engaged in agricultural activities as cultivator and agriculture labour which is more than 80 percent of the total female working population as per census 2011. This is same in case of Bellary taluk and K.Veerapura village. Women workers in the state are still not better placed, specifically by financial status because the workforce is concentrated in activities which are unorganized, informal, seasonal, insecure, menial and poorly paid, especially in the unorganized sectors like agriculture, masonry etc. Women are involved in SHGs activities available in the study area.

As observed during field visit that the socio-economic status of women needs improvement. During consultation with the women participant it was observed that child marriage, lack of participation of in household or economic decision making and minimum economic freedom are commonly practiced in the study area. The women are entirely responsible for household chores. In addition to this they are also engaged in agriculture and agriculture allied activities as agriculture labour, animal rearing, harvesting, feeding the cattle, and taking care of livestock.

4.5.12 Vulnerability Groups

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

As per consultation with the community members and Panchayat Members during visit of Arcadis ESIA Team, around 85% BPL families reported to be present in the study area village- K.Veerapura in Bellary taluk. During community consultation, it was observed that some vulnerable groups like landless households, and 5 physically handicapped are present in the study area village- K.Veerapura given in **Table 4-.**

Table 4-20: Vulnerable Groups in Study Area - K.Veerapura

Village Name	Vulnerable group			
	Physically Handicapped	BPL	Widow	Landless HH
K.Veerapura	5	85%	-	-

Source: Primary Consultation in Study Area Village

The project proponent may be required to focus on providing employment opportunity to the vulnerable members and implementation of program under CSR activity for them. During dialogue with HFE representative, it was informed that land has not been procured from any vulnerable household or family.

4.5.13 Land Holding

During discussions with the local community in the study area, it was understood that the average land holding size varies between 8-10 acre per household in K. Veerapura. Average land holding size in Karnataka is shown in the following **Table 4-.**

Table 4-21: Distribution of Average Size per Holding - All Social Groups

State	Average size per holding in Hactre					
	Marginal	Small	Semi Medium	Medium	Large	All size groups
Karnataka	0.45	1.43	2.71	5.78	14.90	1.63

Source: Agricultural Census, 2011

4.5.14 Irrigation

As information revealed during consultation with the community, bore wells are the main sources for irrigation in the study area village (K.Veerapura), it is evident that the agriculture in this region is majorly dependent on rain.

Pic 4-3: Source of Irrigation water in the study area Village

4.5.15 Social & Physical Amenities and Infrastructure

The Social and physical infrastructure and amenities available in the study area denotes the Social and economic wellbeing as well as the Quality of Life (QoL) of the region. A multitude of infrastructure facilities are available in the study area are in fields of education, health care, hygiene, recreational& cultural, communications, transportation, etc. Even other than the urban areas, the study area possesses moderate to law level of infrastructure facilities.

A review of infrastructure facilities available in the area has been done based on the information given in the Bellary District Census Handbook, the data of National Informatics Center, for the year 2011 as well as from other resources and K.Veerapura study village visit are described in the subsequent sections.

Education:

As observed during visit and consultation in the study area village K.Veerapura , it has 1 government primary school. K.Veerapura has 1 secondary school and 1 senior secondary school. For college, students go to Bellary (36 km). The available educational facilities in the area as per 2011 census are given in **Table 4-11.**

Table 4-112: Educational Facilities

Sr. No.	Village Name	Govt. Primary School (Nos.)	Govt. Secondary School (Nos.)	Govt. Senior Secondary School (Nos.)
1	K.Veerapura	1	1	1

Source: Census of India 2011

Figure 4-4 : Basic Facilities at School in K.Veerapura Village

Sitting arrangement in school at K. Veerapura

Distribution of Cycle at School in K. Veerapura

Medical Facilities:

Project area village: In the study area village, the health amenities are inadequate. As informed during consultation people generally avail local unregistered medical practitioners or nearby health centers outside the village. Fever is the common disease among the village.

As observed during consultation K.Veerapura village has a community health centre (CHC). There There is no maternity and child welfare centre in the village. For better treatment, they travel up to Sindineamolea PHC (Primary Health Centre) i.e. located around 12 Km from the village. Sindineamolea PHC is equipped with Medicine Store, Vaccines etc. There is one Anganwadi Centre (AWC) in K.Veerapura village. The educational facilities are given in **Table 4-12.**

Table 4-123: Health Facilities

Sr. No.	Village Name	Primary Health Centre	Primary Health Sub Centre	Community Health Centre	Maternity and Child Welfare Centre
1	K.Veerapura	0	0	1	0

Source: Census of India 2011

Pic 4-5 :: Out- reach health camp at K. Veerapura

Pic 4-6: Anganwadi Centre at K. Veerapura

Pic 4-5: Basic Facility Available in Kitchen In anaganwadi Centre

Pic 4-6: Children In Anganwadi Centre

Schemes Sponsored by Health Department

Several schemes are adopted by both the central and state governments to reach out to the remote most rural population of the state. The same is followed by the medical administration of Bellary district as well. A few of such programmes are,

(1.) Universal Immunization Program: (Immunization/Vaccination/IPPI/Vit-A, Prophylaxis)

(2.) Family Welfare program: (Eligible couple survey, Family Planning operations, temporary methods incentives to beneficiaries etc.)

(3.) Madilu Programme & Prasooti Araike: Rs 1000/- is being paid as incentive to BPL pregnant women who deliver at Govt health facilities.

(4.) District Mental Health programme- Mano Chaitanya.

(5) National Blind Control Programme

(6.) NVBDCP: Prevention and control of vector borne diseases like malaria, dengue, chicken guinea, filariasis, japanese encephalitis etc.

Drinking Water Facility:

It was informed by both Panchayat Samiti and community that bore well system exists in the village. Water is also supplied through tanker to different localities. There is piped water and RO water available INR 2/= per 10 liters to individual households. Hand pumps and bore wells are used in the village. Main source of drinking water is ground water, which is pumped mostly by bore well and stored in small capacity tanks with tap connections.

As told by the community members that water supply is not adequate to cater the need in the area. The quality of water is also not good which is affecting the health as expressed during interaction with the villagers.

Pic 4-7 : RO Plant at K. Veerapura

Pic 4-8 : Over head water Tank at K. Veerapura

Sanitation:

Almost all the households of the study area have their own sanitation facilities in form of sanitary latrines Sanitary grant is provided to the villager under the Central Government Scheme Swachh Bharat mission. K.Veerapura is an open defecation free village.

Cooking Source:

A major section of the population in the surveyed village uses fuel wood (70%) and LPG (30%) as fuel for cooking.

Communication and Transportation facilities:

Private and Govt. Buses are the major mode of transportation in the study area. Private autos are another major mode of transport for the villagers. Taxi, vans and tractors are also available. During site visit, it was observed that the access road is 200 meters away from village. Access road in the study area is black topped, gravel kuccha roads, all weather roads. Telephone and mobile connectivity are also available.

Power supply:

As per the information the power supply facility is good in the village K.Veerapura . Power supply for all users had been provided for 18-20 hours a day. Tariffs are being charged for these connections.

Common Property Resources (CPR)

During consultation with villagers, it was noted that the K.Veerapura village have some Common Property Resources (CPR) like temples, cremation ground etc. for each community separately as presented in **Table 4-**. In terms of CPR, the likely impact from the project development was not observed and discussed with the villagers.

Table 4-24: Common Property Resources

Study Area Village	Common Property Resources (CPR)		
	Temple	Cremation Ground	Community Hall
K.Veerapura village	4	1	1

Source: Primary Consultation at Study Area Village

4.5.16 Archaeology and Cultural Heritage Sites

As observed during field visit there is no structure of archaeological and cultural heritage on the proposed project site. No monument or structure of religious importance were observed within 5 Km radius of the study area village.

4.5.17 Stakeholder Consultation

Consultation was carried out with various stakeholders such as the representative of Project Proponent, EPC contractor, Panchayat members, school teachers, community health workers and ICDS Anganwadi workers from the project study area. People consulted are appended here below in **Table 4-.**

Table 4-25:Consultation with Different Stakeholders

Stakeholder type	Name & Designation	Department/Address	Date
Project Proponent	Mr. B.R. Chowdhury, Site Manager	Hero Future Energies	11/9/18
Panchayat Member	Debhe Bheema Reddy	K.Veerapura	11/9/18
Anganwadi (ICDS Centre)	Geeta **Lack basic infrastructure facilities** like electricity, bed, mattresses, toilet, drinking water etc.	Anganwadi Centre, K.Veerapura	11/9/18
Educational Institution	G. Habeeb, Head Mistress **Basic infrastructure facilities** available like Drinking water, Separate Sanitation, Electricity, Fan, Bulb, Library, Black board **Lack of facilities** such as Computer, Green board, RO water filter	Primary School, K.Veerapura	11/9/18
Land Owner	Mallikaarjuna age 45, OBC	K.Veerapura	11/9/18

Consultation was held with the local people of the study area. Details given in (Appendix D). Discussion was based on a set of questionnaires including project specific negative and positive impacts, socio-economic resource, and demographic profile of the village. Expectations of local's w.r.t the project development was also discussed.

a. Consultation with Project Proponent (Hero Future Energies Pvt. Ltd.)

Representatives of the project proponent has informed the visiting ESIA team that the private land is being procured on wiling-buyer- seller basis and good faith negotiation, in the project area exclusively for the purpose of 20 MW solar power project owned by HFE. The land that has been procured is clearly demarcated. The land parcel marked exclusively for the 20 MW solar project is approximately around 124.19 acres.

b. Consultation with Land Owner

Private land has been procured on wiling-buyer- seller basis and good faith negotiation. Consultation was done with one land seller for understanding the likely livelihood impact. During consultation with the land seller it was revealed, he feels that the solar project will contribute to the development in the area.

c. Consultation with Anganwadi Worker

As observed during field visit there is one Anganwadi Centre (AWC) in K.Veerapura village. As informed by the Anganwadi Worker, the Anganwadi Centre has enrolment children, mothers of neo-natal child and pregnant women, who visit the centre regularly. The major problem that the Anganwadi Centre is facing that they don't have drinking water facility, electricity, mattresses and toilet facility. Water is carried from the nearby primary school tap.

d. Consultation with School Staff, Govt. Primary School, K.Veerapura

As observed during visit and informed during consultation, the study area village K.Veerapura has 1 government primary school,1 Middle School and 1 Senior secondary school available. . For higher studies people go to Balleri (40 km).

e. Consultation with Community Members

As informed during consultation agriculture is the major livelihood resource the project area village K.Veerapura . Majority of the population is involved in agriculture, a major part of which are agriculture labourers. There is no health facility in the study area village, locals rely on quacks. Drinking water facility needs to be improved exclusively for the village. Majority of households of the study area have their own sanitation facilities in form of sanitary latrines in the study area village. Health facility is not present in the project area village.

Details of Stakeholders consultation has been provided in Appendix E**.**

Key Findings of Consultation

Some notable key findings of different level stakeholder consultation are appended below:

- Agriculture is the major livelihood resource in the area. Quiet a notable amount of population is involved in agriculture, a major part of which are agriculture labourers.
- The main crops are Maize, Tur, Pulses and Bajra.
- Rain-fed agriculture pattern are practiced in project area.
- The main source for irrigation is borewells.
- There is 1 community health centre in the study area village.
- Common health problems like fever present in the village.
- Drinking water and sitting arrangements are main areas of concern that needs improvement in the govt. primary school of the study area`
- Computer, Green board and RO water filter facilities are the main areas of concern that needs improvement in the school of the study area.
- No monument or structure of religious importance were observed within 5 Km radius of the study area village.
- Majority of households of the study area have their own sanitation facilities.
- Localised borewell and water tank system were observed to be present in the village area.

Pic 4-9: Consultation with Site Manager Ballari

Pic 4-10: Consultation with Panchayat Member K.Veerapura

Pic 4-11: Consultation with teachers atlocal School

Pic 4-12: Consultation in Primary Health Center

Pic 4-13: Consultation with ICDS worker and ASHA worker

Pic 4-14: Consultation with Land Owner

5 ANALYSIS OF ALTERNATIVES

The section gives analysis of alternatives with respect to the project. The following scenarios have been considered:

- Current or No Project Scenario
- Alternate methods of power generation
- Alternate location for the project

5.1 Current or No Project Scenario

There is a need to bridge the gap between the demand and supply, renewable/non-conventional sources of power to supplement the conventional sources. The project intends to contribute towards bridging this demand supply gap being a non-conventional source of power generation.

Karnataka is rich in solar resources and solar energy will complement the conventional sources of energy in a large way. The State of Karnataka is blessed with about 240 to 300 sunny days with good solar radiation of 5.4 to 6.2 kWh/m2/day. The solar energy potential in Karnataka is estimated in excess of 24,700 MW. However, the actual potential for solar energy is significantly higher than the estimated capacity, considering the recent technological advances and increasing efficiencies brought in solar energy segments.

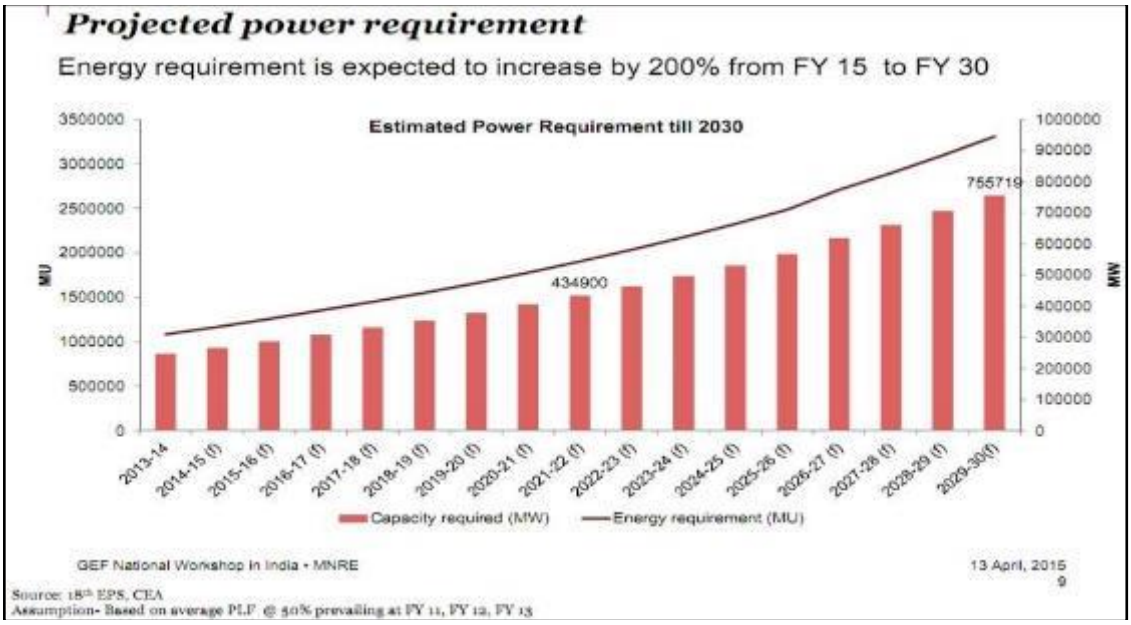
The present project brings an opportunity to utilize the potential for solar power generation. A “No Project Scenario” will not address the issue of power shortage. An alternative without the project is undesirable, as it would worsen the power supply-demand scenario, which would be a constraint on economic growth of the surrounding region.

5.2 Energy Security

In 2007 the Ministry of Environment Forests and Climate Change (MoEF&CC), Ministry of Power (MoP) and the Bureau of Energy Efficiency (BEE) issued a paper entitled ‘India: Addressing Energy Security and Climate Change’. In India the need for expanding the role of domestic Renewable Energy (RE) sources is a logical next step. Wind power is already in a position to provide a significant portion of India’s planned capacity addition up to 2030, with simple regulatory and grid modernization initiatives. Unlike oil, coal or LNG, wind& solar power is not subject to fluctuating fuel prices which drain India’s limited foreign reserves, and in addition, wind & solar power helps in reducing the carbon footprint of the economy. In the **Figure 5-1**, India’s projected power requirement until 2030 has been indicated.

This project is a step towards achieving energy security in India.

Figure 5-1: India's Projected Power Requirement



5.3 Alternate Methods of Power Generation

There are various non-renewable and renewable energy sources which can be utilized for power generation. Each option has its own advantages and disadvantages. Based on the site conditions, availability of resources, environmental & social concerns and project cost suitable option for power generation need to be selected. Comparison of advantages and disadvantages of various non-renewable and renewable energy is represented in table given below.

Source of Energy	Advantages	Disadvantages
Coal	• Relatively cheap form of energy availability in large scale worldwide • Easily transported to power stations • Reliable for energy with steady output • Coal is available in India	• Non-renewable energy source • Large water requirement • High emission of air pollutants and generation of fly ash • Source of greenhouse gases • Mining of coal causes impacts on land and surrounding environment.
Oil & Gas	• Oil and gas can be easily transported by pipes or ships. • Natural gas is the "cleanest" of the fossil fuels	• Non-renewable energy source • Working environment risks to staff and environment • Burning of oil and gas can cause pollution & health impacts • Releases GHG and hence causes global warming and climate change • India imports majority of Oil and Gas requirement and hence high dependency of raw material outside the country
Nuclear	• Nuclear fuel does not create greenhouse gases when making energy. • Only a very small amount of nuclear fuel is needed to make a lot of energy.	• Expensive, especially in capital costs, maintenance costs • The waste produced from nuclear energy is radioactive and Safe long-term disposal of nuclear waste can be difficult.

Source of Energy	Advantages	Disadvantages
	• Does not produce significant atmospheric pollutants.	
Solar	• Energy from the sun is exhaustive & free. • Solar energy does not create greenhouse gases.	• Only specified places are right for solar power. • Solar energy cannot be produced at night
Wind	• Wind power does not create greenhouse gases. • The energy used to build one of the large turbines is repaid in 3-6 months. They last for 25 years.	• Need a lot of turbines to make electricity. • Location specific resource • Wind turbines can only be used where it is windy. On days where there is little wind, less energy will be generated.
Hydroelectric	• Hydroelectricity creates no greenhouse gases. • Energy from water is free and will not run out. • Hydroelectric energy is more reliable than wind or solar power.	• Hydroelectric power needs enough water to turn the turbines. • Dams are expensive to build. • Building large dams can cause damage to water courses which affects people and wildlife and it can be difficult to find the right site. • Small dams for local buildings on weirs do not have these problems.
Biomass	• Biomass fuel is cheap and could use rubbish that we might otherwise throw away. • Biomass fuels will not run out. • Biomass crops that are grown absorb the same amount of pollution whilst they are growing as they release when they are burned, so do not create extra greenhouse gases in the atmosphere.	• Growing biomass crops needs a lot of space and could replace growing valuable food crops. • Biomass fuels that are not grown (such as waste products) create greenhouse gases when burned.

The conventional sources of power generation have high environmental cost when compared to non-conventional sources like solar, wind, hydro, etc. Further, its construction periods are longer with higher environmental risks from emissions. On the contrary power source from solar energy is most eco-friendly mode available. It does not have any kind of emissions during operation. While wind power requires high wind zones to be set up and micro siting along with detailed meteorological analysis is required, site selection for solar power is relatively easier. Solar Power Energy is a clean power project with no emissions and feasible for the project area keeping in mind the good solar potential of Karnataka throughout the year.

5.4 Alternate Location for the Project

Solar energy projects are site specific and its feasibility depends on a number of factors which can be broadly categorized as solar resource assessment, land availability, cost of land and impact on community.

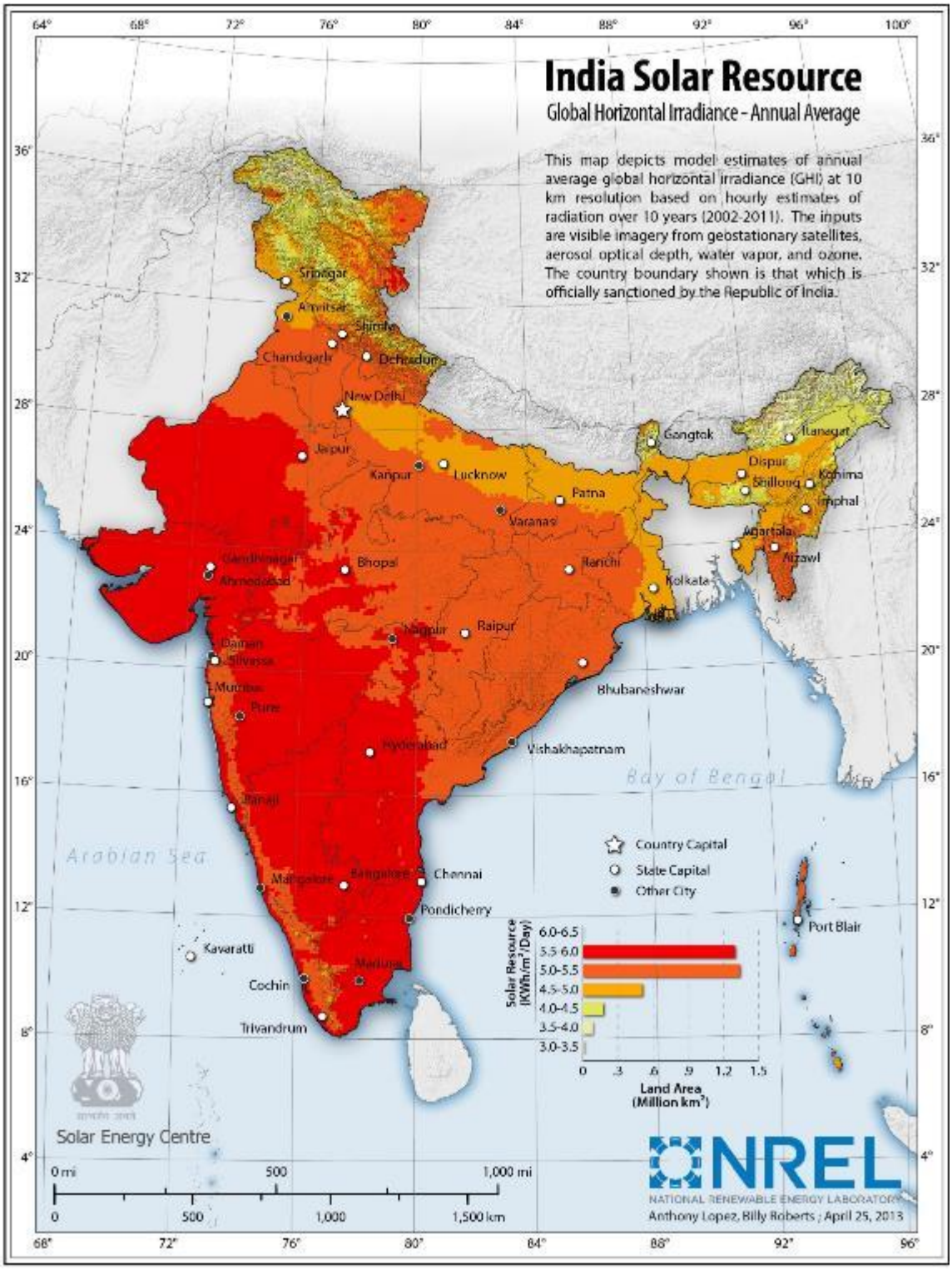
5.4.1 Identification of Sites for Solar Plant

Global horizontal irradiance map of India is shown in **Figure 5-2**. The western and southern region of India has good solar potential with solar resource within the range of 5.5-6.0 kWh/m^2. The state of Karnataka falling in the southern region also have good solar resource potential and can be harnessed.

The key factors considered for the final selection of solar plant site included the following:

- **Land Availability:** Land has been procured directly on the basis of willing to sell and willing to buy. A Special Purpose vehicle (SPV) i.e Clean Solar Power (Bellary) Private Limited (CSPBPL) was incorporated under the companies act 1956/2013. for the development of solar Plant in Karekal Village in bellary district of Karnataka expected to be followed existing pertinent guidelines for avoiding forest and other ecologically sensitive areas, natural drainage channels etc.
- **Solar radiation at the site:** Solar radiation map of India indicates that Karnataka receives a global horizontal irradiation (GHI) in the range of 5.5 to 6 kWh/ m^2/ day.
- **Topography:** The project site is spread across an open, dry area and surrounded by patches agricultural fields. The terrain is flat in nature with slight undulation. Hence, the installation will be easy and reduce the cost of technical modifications required to adjust for undulations at the ground.
- **Substation proximity:** Power from the solar photovoltaic plant of 20 MW capacity will be evacuated to a 110/33/11 KV grid substation (GSS). GSS at Karekal which is already in operational stage.
- **Accessibility**: The site is easily accessible through NH-72 which connects Project sites to Bellary town. Existing village roads are also utilized as access road to the site. Nearest Railway station is Bellary which is located approximately 40 km away from the site. Hubli is the nearest airport is about 186 Km from Site.
- There are no shading elements such as mountains or dense trees available on the site.
- The site is devoid of any habitation.

Figure 5-2: Solar Resource Potential Map



Source: http://www.nrel.gov/international/images/india_ghi_annual.jpg

5.4.2 Alternate Routes for Transmission Lines

CSPBPL will be in charge of the Pooling Substations, Interconnection Substation and 110 KV line between them. Project Company will be in charge of lay the 33 kV cables from the project plot to the pooling Substation.

Reportedly, the route for the transmission line will be selected keeping in mind the following factors:

- Transmission line route will be planned to avoid any habitations along the route.
- Areas requiring extensive clearing of vegetation will be avoided.
- Selection of the transmission route avoids any environmental sensitive site like schools, health centres, etc.
- Right of way/access roads will be shared with the common user of the substation.

The shortest possible route after considering the above factors will be selected for the transmission lines. Consideration of all the above factors will reduce the environmental and social footprint of the transmission line.

5.5 Conclusion

Various factors will be considered such as solar resource potential at the project site, favorable environmental and social settings, lowest GHG emissions in the project life cycle, availability of land and other resources. Considering these factors, it can be concluded that the site is the good location for development of solar power project. There are also other solar power projects that are located in the same solar park which are in operation, under construction or planning. This is due to availability and suitability of solar power potential, land and other allied infrastructure availability and various government supporting policies.

6 ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

6.1 Approach & Methodology

There may be few potential environmental & social impacts due to the project activity during construction & operation phases. During the construction phase, the impacts may be regarded as temporary or short-term ranging from 6-12 months; while a few long-term impacts may also be envisaged during the operation stage. Primary impacts are assessed for a radius of 5km around the project site and secondary impacts are assessed within the study area (10 km radius from project site). Further the impacts have been assessed over the study area of 10 km radius of the project site. The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of solar power. It will certainly meet the ever-increasing demand of power that will bridge the gap between demand and supply of power.

The methodology adopted to assess the significance of impact associated with project activities during construction and operational phase has taken following criteria into consideration. Details of screening criteria are given in **Table 6-1.**

Table 6-1: Screening Criteria for Environmental and Social Impact Assessment

Impact	Distribution of impact	Duration of Impact	Intensity
Low/ Short	Influence of impact within the project site boundary and RoW of Transmission line (Site)	Limited for duration of less than 6 months (Short)	Limited local scale impact resulting in temporary disturbance/ loss of environment/ social components (low)
Moderate/ Medium	Spread of impact within 3 km from the of the project site boundary (Buffer)	Impact may extend up to 2 years (Medium)	Local scale impact resulting in short term change and/ or damage to the environment components. (Moderate)
High/ Long	Influence of impact beyond 3 km from the project site boundary (Widespread)	Impact extends beyond 2 years (Long)	Regional impact resulting in long term changes and/ or damage to the environment components. (High)

6.1.1 Significance Evaluation Matrix

Significance evaluation matrix as shown in **Table 6-2** has been used to evaluate the significance of identified potential environmental impacts. This matrix includes criteria as discussed above to analyse the significance of impact. Colour codes have been given to signify the impact intensity.

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

Table 6-2: Impact Significance Matrix

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

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

Table 6-3: Impact Aspect Matrix for Construction and Operation Phase

	PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT					
	Aesthetics and Visual impacts	Air Quality	Noise Quality	Top soil removal / Soil Quality	Land Use	Local Drainage and Physiography	Surface water quality	Ground Water Resources	Ground water quality	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Migratory Birds	Agriculture	Domesticated Animals	Loss of land and livelihood source	Common Property Usage Conflict	Local Job and Economic Opportunity	Cultural and Behavioral Conflict	Community Health and Safety	Occupational Health and Safety
A. Construction Phase																					
Land lease/purchase process																		P			
Sourcing and transportation of construction material etc.	L	M	L	L						L							L		L	L	M
Storage and handling of raw material and debris	L	L		L	L				L											L	M
Establishment of labour camp and labour working condition.	L	L	L	L	L			L	L								L	P	M		L
Operation of DG sets		M	L	L																	L
Site Clearance	L	M	L	L	M	L				L						L		P		L	M
Foundation excavation		M	L	L	L		L	L										P		L	M

	PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT					
	Aesthetics and Visual impacts	Air Quality	Noise Quality	Top soil removal / Soil Quality	Land Use	Local Drainage and Physiography	Surface water quality	Ground Water Resources	Ground water quality	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Migratory Birds	Agriculture	Domesticated Animals	Loss of land and livelihood source	Common Property Usage Conflict	Local Job and Economic Opportunity	Cultural and Behavioral Conflict	Community Health and Safety	Occupational Health and Safety
Transportation of solar plant components to site and storage		M	L				L											P	L	L	M
Transformer yard construction		M	L	L	M													P		L	M
Substation construction			L	L	M													P		L	M
Laying of transmission lines	L	L	L	L	L											L	L	P	L	L	M
B. Operation Phase																					
Vehicular movement carrying Officials on site during routine inspection, maintenance and operation of solar power plant		L	L																		
Periodic maintenance of all solar modules (washing modules)							L														L
Maintenance of ancillary facilities such		L																			

	PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT					
	Aesthetics and Visual impacts	Air Quality	Noise Quality	Top soil removal / Soil Quality	Land Use	Local Drainage and Physiography	Surface water quality	Ground Water Resources	Ground water quality	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Migratory Birds	Agriculture	Domesticated Animals	Loss of land and livelihood source	Common Property Usage Conflict	Local Job and Economic Opportunity	Cultural and Behavioral Conflict	Community Health and Safety	Occupational Health and Safety
as store, yard, site office																					
Inspection of transmission lines																					L
Security of solar power plant in operation																		P			L
Operation of solar power plant																				L	L

6.2 Impacts on Physical Environment

6.2.1 Air Quality

Construction Phase:

During construction phase, various project components such as site preparation, transmission cable laying, development of approach roads, internal road network and porta cabin construction will require land clearing, levelling, excavation, grading activities, vehicle movement and DG set operation. More over 10-12 vehicles will be used during the construction period. This results in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of health effects to construction workers onsite and to a lesser extent to nearby receptors from wind-blown dust (on the villages nearby to the project site) due to transportation of raw materials. However, most of these project activities are expected to be restricted within the project boundary. Further, the movement of vehicles carrying raw materials on unpaved area within the project site and on access road causes fugitive dust emission and may extend to surrounding of project site like nearest settlements. Hence, the distribution of impact can be considered medium, duration of impact is short and intensity of the impact as medium. Since the impact is widespread, but for short duration and of low intensity, the impact can be termed of a **Moderate significance**. But, the impact is reversible, and temporary in nature, if the following mitigation measures are adopted.

Mitigation Measures:

- All the project vehicles should have valid Pollution Under Control (PUC) certificate. Ensure regularly maintenance of project vehicles during construction and operational phase
- Vehicles speed to be restricted to 20-30 km/hr on unpaved road.
- Raw material should be covered with tarpaulin sheet during transportation and in storage area.
- Water sprinkling on transportation road/ haul road to minimize the dust generation.
- Emission from the DG set should be maintained, and standard should be monitored as per the MoEF &CC/ CPCB guidelines.
- Fine materials should be transported in covered vehicle.
- Turn off the machineries when not in use

Operational Phase:

During operational phase, there would be minimal vehicular movement about 2-4 nos. project vehicles for O&M purpose. Since major source of emission into the ambient air will be absent during the operational phase therefore impact can be termed as insignificant.

Mitigation Measure:

- Restrict movement of vehicles on unpaved surface within the site.
- All the project vehicles shall have valid Pollution Under Control (PUC) certificate.
- Water sprinkling in and around project area to minimize the dust generation.

6.2.2 Soil Quality

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

Construction Phase:

The project is in operation phase. The impact anticipated here is loss of top soil due to excavation, site levelling for erection of module structures and construction of access roads. However, these activities and associated impacts are limited to be within the project boundary and during construction phase only. Considering the activities limited within the site, short duration of construction phase and low intensity, significance of impact is evaluated as low. Soil contamination may result due to accidental spillage and inappropriate storage of diesel during construction phase. Improper handling of broken solar modules may also lead to soil contamination. However, distribution of impact within the project boundary and short duration of construction phase with low intensity makes impact of low significance and can be controlled with the recommended mitigation measures:

Mitigation Measures:

- Provide appropriate storage of top soil in a designated area and surface of the top soil should be covered to prevent its loss during high wind situation.
- Allow only covered transportation of top soil within the project site and surrounding area.
- Top soil may be used for plantation purpose during operational phase and it can be given to nearby agricultural field after taking consent with the landowners/farmers.
- Store hazardous material like diesel or transformer oil in isolated room and on impervious surface to prevent seepage into project site soil.
- Filling and transfer of oil to and from the container shall be on impervious surface.
- Broken solar panels should be stored on paved surface and be handed back to manufacturers / authorised recycler.

Operational Phase:

During operational phase, project activities such as excavation and usage of chemicals such as diesel will be absent except chances of accidental release of used oil from transformer. Therefore, impact associated with these activities such as top soil loss and soil contamination are minimal. Impact can be considered as insignificant. Improper handling of broken / damaged solar modules may also lead to soil contamination.

Mitigation Measure:

- Broken solar panels should be stored in paved surface and be handed back to manufacturers / authorised recycler.
- Plantation in and around project area should be developed which helps to binding the top soil and subsequently reduce the soil loss.

6.2.3 Noise Quality

The environmental impacts on ambient noise level is envisaged due to several project activities especially during the construction phase. Impacts on ambient noise environment during operational phase is minimal or negligible.

Construction Phase

The major noise generating sources in the project are operation of vehicular traffic, and construction equipment like dozer, scrapers, concrete mixers, generators, pumps, compressors, rock drills, pneumatic tools, and vibrators. The project site is surrounded by agricultural fields with no continuous noise generating sources in the vicinity of the project site. Assuming, the operation of these equipment's is expected to generate noise in a range of 75 – 90 dB (A).

Mitigation measures

- Silent DG set will be used at the project site.
- Restrict major noise generating activities during night time 10:00 pm to 6:00 am
- Provide personal protective equipment (e.g. Ear Muffs) to all workers wherever noise is generated due to machinery operation.
- Regular maintenance of project vehicles

Operational Phase:

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

6.2.4 Alteration of Natural Drainage Pattern

Existing drainage pattern of the project site and study area was studied during the time of site visit. It is observed that one natural nallah is passing through the project site. This nallah is generally carries the surface runoff from this area particularly during monsoon time. At the time of visit there was no water observed in this nallah. So mitigation measures should be taken by the project proponent to minimize the impact on this natural drainage system particularly during the construction period

Construction Phase:

During construction phase, excavation and site levelling activities, will be carried out which in turn may result in change of contour level and natural drainage system. Therefore, change in contour level may affect the flow of surface runoff from project site. After the levelling and paving, increment in surface runoff is expected which should be diverted to the natural drainage/canal exists in nearby area.

Considering the extent of impact inside and outside of project boundary following mitigation measures are suggested to implement:

Mitigation Measures:

- Site levelling should be done with minimum alteration in contour level
- Design storm water drainage management system to discharge the surface runoff in the nearby natural drainage
- Natural drainage pattern of the site should be followed as much as possible. It would be beneficial not to disturb the existing drainage pattern.
- The exit of runoff from the project site in the adjacent surrounding land area should be restricted.

Operational Phase

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

6.2.5 Water Resources

Water is required for various project activities. Fulfilment of this water requirement through ground water may have impact on water availability. But, as reported, water will be provided by private vendor through water tank during the construction phase. During operational Phase, water demand will be met through construction of Bore well.

Phase	Activity	Max. Consumption
Construction	Water is required for Civil work and domestic use of Construction workers	10 KLD
Operation	Water is required for Washing of solar panels and domestic use of worker	8 KLD

Construction Phase

In the construction phase, water requirement for construction activities and domestic use of Construction workers is estimated about 10 KLD. Further, construction activities will be limited only to 4-6 months' duration therefore a long-term water requirement is not expected. Considering the limited distribution of impact (within the site), short duration of activities and low intensity, significance of impact is assessed as **Low.**

Operational Phase

In operational phase, the water requirement would approximately be 8 KLD for 20 MW project including cleaning of PV cells, domestic/ municipal consumption of water for site personnel and security guards. Considering the distribution of impact in within the site, long duration with moderate intensity, significance of impact is assessed as **low.**

Mitigation Measures:

- Ensure optimal usage of water viz., storage and reuse of wash water after module washing and plantation of low water requirement species.
- Construction of rain water harvesting pit to recharge the ground water table. Due to favourable site topography, the storm runoff may be harvested and recharged to groundwater within the project area of land allotted to the company. Water use and harvesting/recharging in the project will be a key performance indicator that will be monitored through the project O&M phase.

6.2.6 Solid Waste Disposal

Construction Phase:

Solid waste during the construction phase consists primarily of construction debris, excess concrete and cement, excavated material, rejected components and materials, packing materials (pallets, crates, plastics etc.) and human waste. The broken solar panels will be properly packed and stored inside the project site in a pre-designated area. However, taking in consideration the impact within site, short duration and moderate intensity, the impact is considered as **low.**

Mitigation Measures

- The excavated material generated will be reused for site filling and levelling to the maximum extent possible.
- Broken solar plant should be handled properly. It would be beneficial if broken solar panels are segregated and stored in a designated area for further processing. Ensure contractual obligation that necessitates broken solar panels will be accepted by manufacturer.
- Use of proper segregation system so that food waste and recyclable waste viz. paper, plastic, glass, scrap metal waste etc. are segregated and stored in designated waste bins/ containers during the construction phase. The recyclables should be periodically sold to local recyclers.
- Waste oil from transformer will be collected and stored in paved and enclosed area and subsequently sold to SPCB authorised recyclers.

Operation phase:

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

Mitigation measures

- Use of proper segregation system so that food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. are segregated and stored in designated waste bins/ containers. The recyclables should be periodically sold to local recyclers while food waste will be disposed through govt. approved waste handling agency.
- Ensure broken solar panels are properly packed and stored inside the project site.

6.2.7 Impact on Land and Landuse

Construction Phase

During construction phase, impact on land use is anticipated due to various activities such as site levelling, filling and development of solar power plant. Land use classification will change into industrial land-use after the development of solar power plant. Impact on natural drainage system may be anticipated. Further, impact will be of long term and permanent in nature, but impact will not be of adverse nature.

Mitigation measures

- changes in contour level should be avoided to the extent possible
- Maintain natural drainage system

Operation Phase

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

6.2.8 Impact on Local Ecology

Impacts on Ecology during Construction Phase

Destruction and Loss of Vegetation

Project construction involves land clearance, leveling, etc. causing the loss of vegetation. The clearance of vegetation will be restricted to the project site. Clearing of vegetation is also required for the development of access route and transmission lines. The study area falls under semi-arid zone and natural vegetation in the study area is under pressure from very low rainfall and high temperature. The study area is surrounded by patches of agricultural fields and there is no forest land observed in the 5 km radius of the study area. It is also observed during the field survey that vegetational cover in the study area is very low. As a result, vegetation is generally observed along the road sides. Vegetation is also observed along the bund of the agricultural fields. The level of impact generated from removal of this understory especially small vegetation and grasses (ground cover) can be termed as negligible as the species are very common and have least conservation value.

Disturbance to fauna

IFC Performance Standard 6 recognizes that protecting and conserving biodiversity - the variety of life in all its forms, including genetic, species and ecosystem diversity - and its ability to change and evolve. This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve

biological diversity and promote use of renewable natural resources in a sustainable manner. Performance Standard 6 is designed to protect and conserve biodiversity.

Construction and associated activity like movement of vehicle will be temporary in nature. No wild fauna, besides some domesticated animals, has been sighted during the Site visit. Temporarily, they may abandon the site during the construction period due to project activity and migrate to nearby areas. Thus, the impact on fauna of the area is minor.

More over project area is not a designated or qualifying site of national and international importance for biodiversity the impact on disturbance to fauna of the area is of minor significance.

Significance of impacts

Due to influx of labour and project personal during the construction phase, there is a probability of "man-animal conflict". But the impact would be temporary and expected to be limited to the construction phase only.

The impact on fauna and flora will have very low intensity with a local spread for a short duration which will result in an overall low impact without mitigation. However, with proper implementation of suggested mitigation the impact can be reduced to insignificant.

Mitigation Measures

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

- All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance to local faunal population in the region.
- Activities generating high noise shall be restricted to day time and will be mitigated to minimize the noise level outside the site boundary.
- Movement of construction and transport vehicles shall be restricted to dedicated paths to minimize any harm to small animals within the site.
- Transportation of construction material shall be restricted to day time hours in order to minimize noise and disturbance to fauna in the area.
- General awareness regarding wildlife shall be enhanced through trainings, posters, etc. among the staff and labourers.
- Strict prohibition shall be implemented on trapping, hunting or injuring wildlife within subcontractors and shall bring a penalty clause under contractual agreements.
- Camp and kitchen waste shall be collected in a manner that it does not attract wild animals.
- Temporary barriers shall be installed on excavated areas and around the project site to restrict the movement of wild animals inside the project area especially at night.

Operation Phase

Impacts during operation phase are likely to be restricted to the maintenance activities within the project site like ground cover clearing under PV arrays and from internal road network within site. Apart from a relatively small direct loss of habitat, the shading of the soil by the solar panels is likely to impact ground vegetation.

However, there is potential for avian distraction due to glare/reflection from solar panels. PV solar energy facilities appear to be an "evolutionary trap" for birds who perceive them to be bodies of water on which they attempt to land. Insects, the prey of insectivorous birds, are also apparently attracted by this so-called "Lake Effect." It might cause fatality or injury as birds make contact with the hard-solar panels or surrounding ground as they attempt to land mistaking it for water (Upton, 2014). But the "lake

effect" phenomena and its impact on avian fauna is very poorly understood, and detailed study is required to establish threat from such phenomenon.

Significance of Impacts

Considering the impact to have a distribution within site and low intensity, the impact significance is considered as low.

Mitigation Measures

- Vegetation clearing through bush cutting for maintenance activities shall be done manually wherever possible.
- Any area which some vegetation cover does not have to protect the soil, shall be re-vegetated with locally occurring species/grasses and monitored to ensure recovery is taking place.
- General awareness regarding wildlife shall be enhanced through trainings, posters, etc. among the staff and labourers.
- Moreover, to minimize effect of "Lake effect", visual frightening techniques like "Scare crow" may be considered to frighten any bird trying to land on panels and prevent birds from landing.

6.3 Socioeconomic Impact

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

6.3.1 Loss of Land/Livelihood Conflict

Construction Phase

As observed the project area is surrounded by agricultural fields. Agriculture in the area is majorly dependent on rain and large portion of the land remains dry most part of the year. Overall irrigation scenario is not in the optimal state in the area. There was no habitation or cultivation field present in the project site. land was procured from private land owner on willing-seller-buyer basis through good faith negotiation. The rates received by the land owner are higher than the prevalent market and circle rates.

Hence, taking the distribution of impact as within site for short duration and medium intensity, the impact significance can be termed as '**Moderate'.**

Mitigation Measures:

- Providing preference for livelihood opportunities to the families who lose their land due to the project activity.
- Stakeholder engagement plan and community development plan should be implemented for project if possible.
- It should be ensured that maximum employment is given to the locals w.r.t their capacity and skills.
- Grievance Redressal Mechanism is being followed onsite. Complaints from the locals is being registered, investigated and resolved.

Operation Phase:

- There would be no impact on land during operation phase. There would be requirements of security guards for plant site, hence local employment opportunity would be generated, and this would be a positive impact of the project as it would enhance the economic opportunities to the locals.

Mitigation Measures:

- Based on need assessment, CSR initiatives should be implemented in the project affected village.
- Community development plan should be implemented.
- It should be ensured that employment is given to the locals w.r.t their capacity and skills, wherever possible.
- Grievance Redressal Mechanism (GRM) should be followed onsite. Complaints from the locals should be timely registered, investigated and resolved.

6.3.2 Engagement of Local and Migrant Labour

Construction Phase:

The social impact associated with the engagement of local and migrant labour in the project is conflict between labour and contractor or developer which in turn may result in suspension of project and reputational risk on project developer. Considering the project in construction phase indicators have been discussed to provide sense of what should not be done with respect to labour engagement. The issues discussed here in the form of indicators IFC PS 2 and Indian Labour Act. The distribution of impact is buffer area, duration is short, and intensity is moderate, the impact significance can be termed as "**Moderate**"

Considering the sensitiveness associated with the engagement of child, forced labour, HFEPL should laid down policies through which it should demonstrate compliance to all the above factors. Its contractors should be made aware of all its policies for labour requirements and incorporated in their contracts prior to the starting of the project.

Mitigation Measures:

- Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards
- The project proponent should include clause or provisions related with non-engagement of forced and child labour, gender equity, non-discrimination on employment and opportunity and freedom to express their view in contractor's agreement and HR policy
- Project proponent through its contractors should ensure that labour is being adequately paid by the contractors. Also ensure that wages are being paid as per the requirement of minimum wages act
- Project proponent will conduct internal audits as when required to monitor the performance of contractor.
- Project proponent through the contractor will inform the labour about emergency preparedness plan and communication system to be followed during emergency.
- Project proponent through contractor should ensure that labour receive training on health and safety issues involved in the project.

Operation Phase

Locals can be hired as security guards for the project site. This will enhance the local employment and would be a **Positive Impact**.

6.3.3 Labour Camp (Onsite)

Construction Phase:

There may have some chances that conflict between the migrated labours and the local community arise. Considering the possibilities of such conflicts and the existing situation the distribution of impact is buffer area, duration is short, and intensity is moderate, the impact significance can be termed as "**Moderate**"

Mitigation Measures:

The project proponent will set up onsite labour camp for migrated labours employed through contractors to restrict the interaction between them with local community as to avoid any conflict.

6.3.4 Social Issues Regarding ROW

Construction Phase:

It was observed during site visit that, the land for 20 MW solar power project is located in isolation and distant from any human habitation and/ or cultivation field. Hence, there is no chance regarding issues arise on Right of Way for transmission line etc. and thereby obstruction of places of importance at entre of the project site. Considering the existing present condition and the records, information that has been received during site visit from the Project Proponent the impact significance can be termed as "**Low**".

Mitigation Measures:

- The layout for access roads and transmission lines should consider minimum land requirement and should minimise use of agricultural land and avoid human habitation;
- Site Management should ensure that all agreements will be executed properly and documented
- Any waste generated during the construction phase should not be accumulated near the religious structure as this might affect the sentiment of the locals

6.3.5 Community Engagement

Construction Phase:

There are chances that the local community's interest may impact with any sort of undue activities. Considering the future possibilities of such impacts the impact significance can be termed as "**Moderate**".

Mitigation Measure:

- The Projects construction phase efforts will be made to engage with the community through the Panchayati Raj Institution representatives and key identified leaders of the community at site area in K.Veerapura , Bellary Taluk in Bellary district.

6.3.6 Occupational Health & Safety Impact

Construction Phase:

Occupational Health & Safety Hazards for workers

Occupational Health and safety hazard associated with project activities (during construction) in Solar Power Plants are identified as follows:

- **Electrocution and Firing due to short-circuit**: It should be ensured that proper training be given to workers before they initiation of any project activity as well as the workers wear their appropriate Personal Protective Equipment (PPE) viz. helmets, safety jackets, safety shoes, goggles, gloves etc. as per their nature of work involved.
- Possible injuries associated with working with transmission line laying
- Accidents during cutting, chipping and piling
- ***Physical injuries:*** These can occur when workers involved in loading/unloading activities don't adhere to proper ergonomics discipline. Injuries like muscle strain, ligament tear, slip disc can occur which may prove to be fatal.
- **Diseases due to unhygienic condition**: It should be ensured that proper and adequate number of toilets should be constructed for the labourers so that hygienic conditions prevail in the site area.
- **Violation of privacy and dignity of women involved**: There can be a violation of the privacy and dignity of the women involved in the work force as there is no enclosed or exclusive provision for women. Hero Future Energy, following their own Environment, Health and Safety ("EHS") Management Policy and abide by the IFC Standards, will ensure that the dignity and privacy of women is maintained through separate and protected provision for sanitation facilities during operation phase of these project as well as in other future projects.

Also, there can be dissatisfaction among the labourers due to many conflicts/issues unresolved, hence there should be a complaint register onsite. HFE or their contractor have ensured to have regular medical check-up of their hired laborer's. HFE has a tie up Purneendu Clinic for any health care related concerned and emergencies. Hence, taking the distribution of impact as within site, duration as short and intensity as moderate, the impact significance can be taken as **"Moderate"**.

Mitigation Measures:

- All material will be arranged in a systematic manner with proper labelling and without protrusion or extension onto the access corridor.
- Loading and unloading operation of equipment should be done under the supervision of a trained professional.
- Proper PPEs should be provided to workers handling welding, electricity and related components. Workers handling electricity and related components shall be provided with shock resistant gloves, shoes and other protective gears.
- There should periodical training to educate the workers for proper use of PPE's.
- There should be proper monitoring system to ensure that each individual labourer is using the PPEs properly.
- Fire extinguishing equipment should be provided in adequate number on site to handle any possible fire outbreaks
- An accident reporting and monitoring record should be maintained
- Display of phone numbers of the city/local fire services, etc. at site should be done

- There should be arrangement for hygienic and scientific sanitation facilities for all the labourers working in the site.
- There need to have enclosed and exclusive provision for women to protect the privacy and dignity of the women involved in the work force.
- Provision of the Contract Labour Rules, 1971 require the operator of a construction site to provide adequate sanitation facilities to worker within the site premises (Latrine: One per 25 male/female; Urinal One per Male/female).
- Hero Future Energies (HFE) should ensure that labour receive training on health and safety issues involved in the project.
- Hero Future Energies (HFE) should inform the labour about Emergency Preparedness Plan (EMP) and communication system to be followed during emergency.
- Hero Future Energies (HFE) should involve their Welfare Coordinator.

Operation Phase: Occupational Health & Safety Hazards for Workers

Occupational Health and safety hazard associated with project activities (during operation) in Solar Power Plants are identified as follows:

- Electrocution/ Electrical Shocks: These may occur when the skin meets live power lines etc. The severity of the burn depends on voltage, current, time of contact etc.
- Firing due to short-circuit
- Diseases due to unhygienic condition
- The impact significance can be taken as Moderate.

Mitigation

- Provide and ensure wearing of personal protective equipment's viz., gloves, helmets, ear plug, safety belt etc.
- Ensure effective work permit system for critical activities such as electrical work and working at height
- Prepare emergency communication system and emergency preparedness plan
- Ensure proper sanitation facilities.

6.3.7 Labour Accommodation (Onsite and offsite)

Construction Phase

As per International Labour Organization (ILO) *"Housing provided to workers as part of the employment contract should meet certain minimum specifications in respect of the nature and standard of the accommodation and facilities to be made available. The guidelines and recommendation facilities like drinking water, separate kitchen, fans, beds, toilets and power supply has been provided to the workers/ labours in the labour camp set up in the project site."* [2]

Considering the future construction on anvil Hero Future Energies (HFE) should distinctly and exclusively consider and apply as far as possible the recommendations of ILO and other relevant apex bodies the following factors should be followed in the Solar Power Project site located at the designated project area.

[2] *Source: Labour Accommodation Standards, ILO*

- Housing space: Adequate housing space for labours will be provided. As per International Labour Organisation (ILO) standards, the floor area of workers' sleeping rooms should not be less than 7.5 square metres in rooms accommodating two persons, if a room accommodates more than four persons, the floor area should be at least 3.6 square metres per person.
- Adequate supply of safe potable water;
- Sanitation facilities for contract labourers: Proper functional toilets will be provided in the labour camp. The disposal of waste water is managed by the septic tanks and soak pits constructed in the camp.
- Proper and adequate drainage system to drain out the waste water to avoid any kind of contamination or spread of disease thereby;
- Adequate arrangements for comfortable and secure living within the sleeping room
- Arrangements for secured locker etc. for safe keeping of the labours' individual and personal belongings. which can be locked by the occupant to ensure privacy;
- Common Hygienic dining rooms, canteens or mess rooms, located away from the sleeping areas;
- There must have arrangements for safeguard of health issues and immediate arrangements for addressing accidental incidents.

Mitigation Measures:

- Hero Future Energies (HFE) will formulate their own Environmental Social Management System (ESMS). Following that an Emergency Preparedness Plan to deal with health and safety issues during project life cycle of a Solar Power Plant will be built.
- Hero Future Energies (HFE) will ensure that they will abide by the policy of safe guarding all issues regarding the health and safety of the workers who will be working under the Projects.
- **Emergency Preparedness and Plan for On-Site Emergencies:** the plan will define nature of emergencies that can be encountered during operation of a solar plant. Requirements of an Emergency Control Centre (ECC), firefighting facilities and medical facilities will also be detailed out. Roles and Responsibilities of personnel at site, communication channel to be followed, and procedures for different emergencies will also be detailed. Hero Future Energies (HFE) should ensure that all its hired contractors should abide by the requirements of plan formulated like undertaking mock drills, identification of first aiders and fire fighters, display of emergency numbers onsite etc.

6.3.8 Impact on Cultural/ Archaeological Site

The site does not contain any archaeological monuments or sites as per the Archaeological Survey of India. No historical and cultural monuments will be affected by the 20 MW Soler Project.

No such evidential proof was found even during field visit in the site area village of K.Veerapura of Bellary district. Though, to ensure whether alike remnants of old civilization are present and/ or in case of accidental discovery of artefacts during construction activities, chance find procedure is required to be planned and implemented.

No impact is envisaged both during construction and operation phase.

6.3.9 Access to Common Property Resources

Another issue which may cause social impact on indigenous people in terms of conflict between project developer and local community is restriction on community to access the common property resources,

any physical structure with historical, religious and aesthetic significance was also not found close to the project area village. Considering the absence of resources with cultural significance, disturbance to physical cultural resources and impact associated with it, is not anticipated for both the construction and operation phase.

As informed by the Hero Future Energies (HFE) representative, the access roads will be strengthened and further maintained till the project cycle within the village.

No impact is envisaged both during construction and operation phase.

6.3.10 Corporate Social Responsibility

Construction Phase

To empower the local community through different development and support programmes the project proponent should take some initiatives for Community Development Plan under their CSR Policy in the project affected village- K.Veerapura in of Bellary District.

The project proponent will develop their own CSR Policy in alignment with its CSR vision, principles and values, for delineating its responsibility as a socially and environmentally responsible corporate citizen. The Policy will lay down the areas of intervention, principles and mechanisms for undertaking various programs in accordance with Section 135 of the Companies Act 2013. As per CSR Policy, HFE is committed to inclusive growth and local stakeholder involvement as a fundamental value and strives to enhance:

- Social wellbeing
- Economic wellbeing
- Environmental wellbeing
- Local community initiatives

The CSR Activities may include:

- Creating provisions for Employment opportunities to the people who are skilled and semi-skilled in project area village;
- Supporting the Anganwadi Centres by facilitating them with provisions of exclusive Drinking Water and Toilet facilities for them in project area village;
- Facilitating the Anganwadi Centres/ Local Schools by providing them with amenities like Chairs, Benches etc.;
- Facilitating in development and creation of Health Infrastructure in the Project Area village, where it is found to be inadequate;
- Promotion of education, including special education and employment enhancing vocation skills especially among children, women, elderly and the differently abled and livelihood enhancement projects;
- Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centres and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups etc.

Operation Phase

The CSR activity must continue during Operation Phase to comply with the need and requirement of the areas development and to avoid any conflict during that phase.

6.3.11 Cumulative Impacts

Hero Future Energies (HFE) have purchased 124 acres of land. As land acquisition is involved in the solar power project, there are possibilities of impacts on the private land owners. All the settlements are located at a distance from the solar plant, hence no issues regarding the same is noticed there. Also, no obstruction to common property resources are anticipated. One of the cumulative effects is solar reflections known as Glint and Glare. But the new technology of solar panels are glare free with translucent panels. Solar panels are designed to absorb sunlight and produce electricity. With a continuous increase in both numbers and sizes of such PV developments cumulative concerns are likely to increase in near future.

For total 20 MW, solar power project 18 KLD water will be required for construction phase as well as water will be used for cleaning of PV cells and other regular activity. During operational phase total requirement of water would be around 8 KLD. Ground water Will be used during the Operational Phase, water will be provided during construction phase by local vendor. During operational phase, impact will be restricted mostly within the site, long duration with moderate intensity, significance of impact is assessed as **low**.

As a whole, 20 MW Bellari Solar project is required 124 acres land. Project site is surrounded by agricultural fields. No forest land will be required for the project. Site development activity is expected to produce some temporary pressure on the local biodiversity, mostly due to cleaning of ground vegetation, development of access road. There is also some scope of “man animal” conflict, but with proper prevention and sensitization process this risk can be reduced significantly.

Glare impacts are minimized by the inherent design qualities of the PV panels, which reduces reflectivity and the potential for visual discomfort or impairment. Additional PV panels in the area would not result in a greater intensity of glare due to the panel design and the law of reflectivity, which would not direct any reflected light along the ground surface. The project represents conversion from a natural environment of agricultural fields to build environment with an industrial character, masked with tan colored fencing. At the end of the proposed project’s useful life of approximately 25 years, it would be decommissioned and dismantled. Cumulative impacts associated with decommissioning of the proposed project would include the removal of all project components, including Line structures and wiring, as well as all towers, wiring, PV panels, and inverter structures. After removal of project components, the project sites would return to agricultural uses, in accordance with the Agricultural Reclamation Plan. Therefore, decommissioning would temporarily impact the proposed project’s contribution to local and regional cumulative impacts on visual resources. Temporary direct and indirect cumulative visual impacts would occur until re-growth of vegetation in the area is established. However, as discussed above, the project sites are void of highly scenic views or aesthetically unique or distinctive landscape and impacts to aesthetics would remain be less than significant. When considered in combination with the impacts of other projects in the cumulative scenario, the Project’s incremental contribution to aesthetics would not be cumulatively considerable.

7 ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

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

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

7.1 Training of Personnel & Contractors

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

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

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

7.2 Monitoring

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

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

7.3 Documentation & Record Keeping

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

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

Table 7-1: Environment Management Plan

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
CONSTRUCTION PHASE							
A	**Physical Environmental Management Plan**						
1	LANDSCAPE AND VISUAL	Impacts on landscape is envisaged due to construction activities in the site. Visual aesthetic of the site will also be affected.	LOW	• Ensure the construction site is left in an orderly state at the end of each work day • Construction machinery, equipment, and vehicles not in use should be removed in a timely manner to the extent possible • Proper handling of waste streams.	**NO IMPACT**		Contractor under the supervision of HFE's Personnel
2	GROUND WATER ABSTRACTION	Construction activities will be limited only to 4-6 months' duration Therefore a long-term water requirement is not expected. The water will be supplied to the project site by water tanker during the construction period. The source of water is ground water. Considering the limited distribution of impact (within the site), short duration of activities and low intensity, significance of impact is assessed as Low.	LOW	• Construction of rain water harvesting pit to recharge the ground water is envisaged. • If possible, collect the water after module wash and reuse it for module washing. • A efficient water management system should be practiced at the project site to minimise the net demand of water during the project life.	**LOW**	Maximum efforts should be made to reuse and recycle of waste/ used water to reduce water demand of the proposed project.	Project Developer/ Contractor under the supervision of CSPBPL Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
3	GROUND WATER QUALITY	Waste water from toilets constructed for site office can contaminate groundwater.	LOW	• Storage of oil shall be undertaken on paved impervious surface and secondary containment shall be provided for fuel storage tanks • Adequate drainage facility for easy escape of surface run-off from the project site. • Leak-proof holding tanks for sanitary waste water should be constructed to protect the seepage of waste water. • Waste water holding tanks / septic tank should be located at more than 500 m away from bore wells or any other underground water holding tanks. • It should be ensured that the waste water does not find its way into surface waters or water wells.	**LOW**	• Machinery and vehicles shall be thoroughly checked for the presence of leaks if any; • Storage of oil on site to be checked • Storage of sanitary waste water should be removed / cleaned periodically to avoid any leakage.	
4	**AIR QUALITY**	Generation of fugitive Dust due to movement of vehicles inside the project area during construction period and Emission from Diesel Generators	**MODERATE**	• Vehicles speed to be restricted to 20-30 km/hr on unpaved road. This will reduce dust generation • Raw material should be covered with tarpaulin sheet during transportation and in storage area. • Water sprinkling on the unpaved road/ haul road to minimize the dust generation .	**LOW**		Project Developer/ Contractor under the supervision of CSPBPL Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• All the project vehicles shall have valid PUC certificate. • Ensure regular maintenance of project vehicles during construction and operational phase. • Emission standard of the DG sets operated in the project area should be maintained as per MoEF&CC/ SPCB guidelines. • DG sets preferably placed away from settlement area. • It will be ensured that exhaust emissions of construction equipment adhere to emission norms as set out by MoEF&CC/ CPCB/SPCB.			
5	**SOIL QUALITY**	Loss of top soil	**LOW**	• Provide appropriate storage of top soil in an already designated area and hould be covered properly to prevent its loss in high wind and due to runoff. It is essential for top soil conservation. • Allow only covered transportation of top soil within project site. • Use top soil at the time of plantation on the approach road. • Construction debris shall be reused in paving on site approach road to prevent dust generation due to vehicular movement	**NO IMPACT**	• The workforce shall be sensitized to handling and storage of hazardous substances viz. fuel oil, machine oil/fluid etc. • The workers engaged in handling hazardous substances shall be briefed about the possible hazards and the	Project Developer/ Contractor under the supervision of CSPBPL Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		Soil Contamination		• In case of any accidental oil spill, the soil will be cut and stored separately for disposal as hazardous waste. • Store hazardous material (like Transformer oil) in isolated room with impervious surface. • Filling and transfer of oil to and from the container shall be on impervious surface.		need to prevent contamination.	
6	**NOISE LEVEL**	Impacts on noise level at the project site and its surrounding area envisaged due to vehicular movement to deliver construction materials and solar plant parts. Construction noise generated from using of machinery, and concrete mixing.	**LOW**	• Regular maintenance of construction machinery and equipment shall be carried out to ensure noise emissions are maintained at design levels. • Keep stationary source of noise such as DG sets (during construction phase) at farthest point from the settlements. • Restrict major noise generating activities during night time 10:00 pm to 6:00 am • Provide personal protective equipment to workers working near DG sets and other high noise source. • Local communities need to be informed about the vehicular movement before start of heavy vehicle carrying materials and machines to site. Sensitive locations should be identified and avoided as far as possible from the route and if	**NO IMPACT**	Be ensured that noise emissions of construction equipment adhere to emission norms as set out by MoEF&CC/ CPCB	Project Developer/ Contractor under the supervision of CSPBPL Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				unavoidable, drivers should be informed to restrict speed at those locations. • Diesel generator sets, if used; will adhere to noise standards of MoEF&CC.			
7	**SOLID WASTE**	Contamination of land	**LOW**	• Designated area within the project site should be allotted for the disposal of solid waste. • Distribute appropriate number of litter bins and containers properly marked as "Municipal Waste". • Solid waste should be collected and disposed of from the project site regularly to avoid any decomposition of solid waste. This will help to restrict the generation of foul smell from the designated site. • Domestic and construction waste like recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers. • Awareness among the project workers/contractors should be increased regarding management of solid waste.	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of CSPBPL Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
8	**CHANGE IN LOCAL TOPOGRAPHY**	Alteration in natural drainage pattern	**MODERATE**	• Don't allow the considerable alteration of contour level • Provide alternatives to collect surface runoff from the project site during the monsoon period • Don't allow exit of runoff from the project site in the adjacent areas. • Design storm water drain considering the natural contour level • Site preparation activities should be designed to avoid any significant elevation of the land or blocking or altering natural drainage channels in the project site. • Site preparation and development shall be planned only after a detailed drainage plan has been prepared for site. • If channels/drains get blocked due to accumulation of soil / waste materials, it will be ensure that they are cleaned especially during monsoon season.	**LOW IMPACT**	The drainage patterns of the area will be maintained.	Project Developer/ Contractor under the supervision of CSPBPL Personnel
B	**Ecological Environmental Management Plan**						
9	**ECOLOGY**	The project is located on the dry land surrounded by Agricultural Fields. Vegetations are mainly observed along the road site and on the side of Agricultural fields. No	**LOW IMPACT**	• All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance faunal population in the region.	**LOW IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		forest land is involved in this project. No schedule -I species as per the wild life protection act, 1972 has been observed in the study area during the site visit. Further no ecologically sensitive area is present within the 5 km buffer area of the project site.		• Movement of construction and transport vehicles shall be restricted to dedicated paths to minimize any harm to small animals particularly domesticated animals within the site. • Transportation of construction material shall be restricted to day time hours in order to minimize the man – animal conflict. • Speed of the vehicle should be controlled in and around the project area to minimize the accidental death of faunal population. • General awareness regarding wildlife among the construction workers shall be enhanced through putting signage, posters, among the staff and labourers. • During construction phase camp and kitchen waste shall be collected in a manner that it does not attract wild animals. • Temporary barriers shall be installed on excavated areas. • Plantation of native, fast growing trees on access roads and/or in nearby barren areas/ schools/ Panchayat office which may also give an alternate habitat to the faunal species especially the			CSPBPL Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				bird species and maintain the ecological balance			
B	**Social Management Plan**						
1	**ENGAGEMENT OF LOCAL AND MIGRANT LABOUR**	Conflicts between labour and contractor	**MODERATE**	• Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards • Hero Future Energies (HFE) will include clause or provisions related with non-engagement of forced and child labour, gender equity, non-discrimination on employment and opportunity and freedom to express their view in contractor's agreement and HR policy • Hero Future Energies (HFE) through its contractors shall ensure that labour is being adequately paid by contractors. Also ensure that wages are being paid as per the requirement of minimum wages act • Hero Future Energies (HFE) shall include clause to ensure access of necessary basic amenities and facilities such as drinking water, kitchen, toilet and crèches (for female workers children)	**LOW IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of Hero Future Energies (HFE) Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Hero Future Energies (HFE) shall conduct internal audits as when required to monitor the performance of contractor. • Hero Future Energies (HFE) through the contractor inform the labour about emergency preparedness plan and communication system to be followed during emergency • Hero Future Energies (HFE) through contractor should ensure that labour receive training on health and safety issues involved in the project.			
2	**LABOUR ACCOMMODATION (Onsite and offsite Labour camp)**	Conflicts between labour and local community	**MODERATE**	Hero Future Energies (HFE) may setup onsite labour camp for labours employed through contractors to restrict the interaction of migrated labour with local community as to avoid any conflict. It is to note that the project developer Larsen & Toubro has already developed a Labour Camp with all facilities is located within the project site. As the site for labour camps is located in isolation there is minimum chance for any conflict with the villagers.	**LOW IMPACT**	Grievance Redressal mechanism is being followed and monitored	Project Developer/ Contractor under the supervision of Hero Future Energies (HFE) Personnel
3	**LAND PROCUREMENT**	• Loss of Land • Livelihood • Obstruction to places of relevance	**MODERATE**	• It should be ensured that maximum employment will be given to the locals w.r.t their capacity and skills.	**LOW IMPACT**	• Hero Future Energies (HFE) Energies Land and Project Team to understand	Project Developer/ Contractor under the supervision of Hero Future

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		• Manhandling Natural Resources of Utility		• Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding project related components are promptly and adequately investigated and resolved • Provide some alternate way/road so that project should not obstruct the villagers access • The layout for access roads and transmission lines should consider minimum land requirement and should avoid procurement of agricultural land; • Any waste generated during the construction phase should not be accumulated near the religious structure as this might affect the sentiment of the locals.		mitigation measures • Construction contractors should adhere to social obligations, labour laws and international commitments • Hero Future Energies (HFE) through contract agreement, should ensure that The contractor should provide the migrant workers adequate information on expected social behaviour and hygiene practices to be followed at site • Hero Future Energies (HFE) to ensure that all site personnel and migrant labourers avoid using any community infrastructure facilities like water bodies, electricity etc., without prior	Energies (HFE) Personnel Social Management team for grievance Handling

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
						permission from the Panchayats	
4	**IMPACT ON INDIGENOUS PEOPLE AND ARCHEOLOGICALLY IMPORTANT SITES**	Unrest among the community due to dislocation of any structure or thing of cultural belief Impact on indigenous people due to land intake from ST people and use of village resources	**No Impact**	No land purchase from ST Population. If there is any land purchase from indigenous people, proper guidelines and all formalities and compliances will be followed before land purchase in future.	**No Impact**	-	-
5	**COMMUNITY ENGAGEMENT**	Community Empowerment	**MODERATE**	Given the short duration of the project construction phase efforts will be made to engage with the community through the Panchayati Raj Institution representatives and key identified leaders of the community.	**LOW**	Continuously throughout the project lifecycle. Grievance Redressal Mechanism should be followed, and grievance register should be maintained onsite.	Contractor under the supervision of Hero Future Energies (HFE) Personnel / PRI representatives
6	**OCCUPATIONAL HEALTH AND SAFETY**	Material handling and storage Possible injuries associated with working with transmission line laying Other occupational hazards	**MODERATE**	• All material will be arranged in a systematic manner with proper labelling and without protrusion or extension onto the access corridor. • Loading and unloading operation of equipment should be done under the supervision of a trained professional • Proper PPEs should be provided to workers handling welding, electricity and related components.	**LOW IMPACT**	• labor engaged for working at height should be trained for temporary fall • All the workers should be made aware of the possible occupational risks/hazards by the way of an OHS training/awareness program • Accident reporting, and monitoring	Contractor under the supervision of Hero Future Energies (HFE) Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Fire extinguishing equipment should be provided in adequate number on site to handle any possible fire outbreaks • An accident reporting and monitoring record should be maintained • Display of phone numbers of the city/local fire services, etc. at site should be done The labour engaged for working at height should be trained for temporary fall protection devices		record is being maintained on site • The labor engaged for working at height are being trained for temporary fall an mishaps are being recoeded. • All the workers have been made aware of the possible occupational risks/hazards by the way of an OHS training/awareness program • An accident reporting, and monitoring record should be maintained • Proper hygienic and scientific sanitation facilities for all the laborer's working in the site with spate exclusive arrangements for men & women to ensure the privacy and dignity of all individuals	

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
						• GRM is properly maintained and followed on site. • Contractor should inform the labor about Emergency Preparedness Plan (EMP) and communication system to be followed during emergency situation.	
OPERATION PHASE							
A.	**Physical Environment Management Plan**						
1	**HAZARDOUS WASTE MANAGEMENT**	Contamination of land and soil	**MODERATE**	• Broken solar panels, which will be collected in closed containers and will be disposed as per the standards.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ HFE Personnel
2	**SOLID WASTE MANAGEMENT**	Contamination of land	**MODERATE**	• Formulation of Proper Solid waste Management Policy. • Periodic collection and disposal of Solid waste from the project site. • Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". The waste generated should be disposed as per The Municipal Solid Wastes (Management and Handling) Rules, 2000& amended in 2016.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer / HFE Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Domestic waste will be composted and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers. • Awareness among the project personnel.			
3	**WASTEWATER MANAGEMENT PLAN**	Degradation of ground and surface water quality	**MODERATE**	• Ensure that constructed septic tanks during operation are well contained and impermeable to prevent leakage of wastewater into soil. • Ensure that septic tanks are emptied and collected by contractor at appropriate intervals to avoid overflowing.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer / HFE'sPersonnel
B	**Social Management Plan**						
1	**CORPORATE SOCIAL RESPONSIBILITY**	Community Empowerment	**MODERATE**	• Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards	**Low**	CSR Activities should be documented	Hero Future Energies (HFE) Personnel
				• Developmental needs and expectations (such as employment in the project or up-gradation of educational, health care facilities, cultural property and infrastructure) of local communities will be identified through the Gram Panchayat,		Should be conducted continuously through the project cycle.	Hero Future Energies (HFE) Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action/ Mitigation	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				villagers and local administration.			
				• Opportunities for contributing to the economic and developmental needs of villagers through skill training will be explored.		Pertinent training and orientation should be conducted continuously throughout the project cycle.	Hero Future Energies (HFE) Personnel
2	**OCCUPATIONAL HEALTH AND SAFETY OF WORKERS**	Electrocution Firing due to short-circuit Possible injuries associated with working at height Diseases due to unhygienic condition	**MODERATE**	• Provide and ensure wearing of personal protective equipment's viz., gloves, helmets, ear plug, safety belt etc. • Ensure effective work permit system following the laws of the state and central level for critical activities such as electrical work and working at height • Prepare emergency communication system and emergency preparedness plan • Ensure proper sanitation facilities.	**LOW**	Periodic EHS audits	Project Developer/ Hero Future Energies (HFE) Personnel

7.4 Environmental Monitoring Plan

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

Table 7-2: Environment Monitoring Program

A. Environmental Quality Monitoring Program

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
A.	**CONSTRUCTION PHASE**			
A1	Ambient Air Quality	Measurement of PM_{10}, $PM_{2.5}$, SO_x, NO_x, CO	Village near the project location	Once during construction phase
A2	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)		Once during construction phase
A3	Ground Water quality	IS 10500 parameters		Once during construction phase
A4	Surface Water quality	IS 10500 parameters	Nearby surface water body /canal /reservoir	Once during construction phase
A5	Soil Quality	Soil parameters viz. pH, SAR, Water holding capacity, Conductivity, Organic Carbon, NPK	Abutting village land & project site	Once during construction phase

7.5 Environmental Management Plans

The ESMP is comprised of some site-specific management plans viz. Emergency Management Plan, Waste Management Plan, Storm Water Management Plan, Environmental Monitoring Plan, Traffic Management Plan and Social Development Plan for the HFE's 20 MW Solar Power Plant at Karikal village in Bellary District of Karnataka. The management plans will be executed through Environmental Social Management System.

7.5.1 Emergency Preparedness and Response Plan

Purpose

Purpose

HFE, have developed a site-specific Emergency Management Plan for implementation at the entire project location, In the event of an emergency situation so that the loss of life and damage to the properties & natural resources are minimized. This plan outlines a series of emergency actions that will be executed by HFE& its Contractors to ensure preparedness and response to emergency situations throughout the life-cycle of the project.

Definition(s)

Emergency - Any unplanned situation, which presents a threat to the safety of workers and/or damage to the properties and other natural resources deemed valuable at the project site.

Emergencies

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

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

Emergency Management

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

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

Responsibilities

The SEHS Coordinator will be responsible for implementing this procedure, which includes

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

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

Setback:

The development of project site may alter the contour levels and natural drainage pattern which can cause local flooding in the area therefore adequate measures such as storm water drainage, rain water harvesting, etc. may result to local flooding.

Transmission Line:

Transmission Line should be routed in such a way that it causes least disruption to local communities.

Public Access:

Safety issues may arise with public access to Solar Plants (e.g., unauthorized entry to the Plants). Any public rights of way located within and close to the Solar Plants should be identified prior to construction to establish any measures that may be required to ensure the safety of their users. Prevention and control measures to manage public accesses include:

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

7.5.2 Community Liaison Plan

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

Objectives:

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

and the Contractors such areas have also been covered. The community liaison plan would concentrate on the following aspects:

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

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

7.5.3 Waste Management Plan

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

- To minimize the potential impact on human health and the environment.
- To Comply with Indian environmental regulation and IFC Performance Standards.
- To reduce operational costs and reduce any potential liabilities which may arise from waste handling operations.
- This plan also ensures that every waste stream and solid waste materials from the main plant site and bracketed facilities will be managed effectively.

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

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

7.5.4 Storm Water Management Plan

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

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

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

7.5.5 Community Property Resource

During the project construction phase, there might be some sharing of resources by the villagers and the workers working in the 20 MW Solar Power project at study area village. To an extent feasible this should be avoided to prevent potential conflicts between the project and the community. The movement of heavy vehicles and machineries might lead to conditions like disruption of electric wires and telephone wires in the project area and along transportation routes. All these damage utilities should be repaired/replaced to normal conditions, at the earliest. An account of the damage to the community resource should be documented and the root cause analysis carried out. The findings of the root cause analysis should also be documented and discussed with the agency/agencies found responsible for the incident. No water should be extracted from surface water bodies which are used by the community for drinking or domestic purpose. Any vacant or barren land, not assigned for project, should not be used for storage of fill/construction material, wastes etc.

As part of the Environmental and Social Management System proposed, a system should also be developed for recording such incidents and tracking the incident till it is closed to the satisfaction of the community etc.

Responsibility: As per norms of solar power projects HFE would take responsibility in this regard. HFE would take responsibility for construction of any road, required to be constructed before the existing road is diverted / closed for use by villagers. HFE (through their EPC Contractor/ project developer and implementing agency) should consult with the community to decide on the alignment of the road and also fix up the likely time line for the construction.

HFE and their contractors should ensure that the sharing of community resource is minimized by organizing necessary support infrastructure/facilities within premises. However, in case where sharing would be essential HFE and/ or their contractors should have an agreement with the project area Gram Panchayat for the sharing of the resource. In case of damage to community property HFE including its contractors should ensure that it is repaired or replaced to the satisfaction of the community at the earliest. HFE should maintain documentation of all incidents of damages to the community property. All cost for repair/replacement should be borne by HFE / their Contractor(s).

As part of the Environmental and Social Management System proposed, a system would be developed for recording such incidents and tracking the incident till it is closed to the satisfaction of the community.

7.5.6 Occupational Health and Safety Management Plan

The Occupational Health and Safety (OHS) of the employee and contractual labours will be maintained at the work sites during both construction and operation phase. The OHS Management measures should comply with the Indian Regulatory requirements under OHSAS and the Factories Act 1948, amended 1954, 1970, 1976 and 1987.

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

- Provide and ensure wearing of personal protective equipment's viz., gloves, helmets, ear plug, safety belt etc.
- Prepare emergency communication system and emergency preparedness plan
- Ensure provision and maintenance of drinking water and sanitation facilitation for construction workers in accordance with the provision of Contract Labour Act and Building and Other Construction Workers Act.
- Periodic cleaning of work areas will be undertaken and supervised by the contractors to ensure hygienic conditions on site.
- Workers will stop working in extreme natural climatic conditions i.e. heat wave, heavy rain etc.
- Ensure effective work permit system for critical activities such as electrical work and working at height
- All work places will have adequate fire alarms and firefighting equipment's to handle any outbreak of fire in O& M.
- Adequate drinking water will be supplied at workplace for workers onsite and water quality meets drinking water quality standards.
- Sufficient light and ventilation will be provided for workers working in confined space.
- Periodic health check-up camps for workers onsite will be organized to ensure prevention of occupational health hazards.
- All work areas should have First Aid Kits to manage injuries occurring in the area.
- The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.

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

- Operators are provided with adequate PPEs depending upon nature of the operation and occupation health and safety risks associated with it viz. electrical maintenance activities, replacement of solar panels etc.
- Special emphasis on electrical safety will be laid and all employees will be trained in electrical safety and First Aid
- Standard Operation Procedures (SOPs) will be developed for operational activities likely to have potential occupational health and safety risks
- Periodic medical examination will be undertaken for workers including contractor and subcontractor of the plant.

- Periodic inspections will be carried out to ensure all the above are implemented and any non-conformances will be recorded along with grievance related to OHS issues.
- An EHS coordinator will effectively implement and monitor the OHS Management System and ESMP.

7.5.7 Grievance Redressal Mechanism

HFE have developed a GRM Policy mentioning the procedures for lodging of grievances, processing of grievances, resolving grievances and closing of grievances. Issues raised through grievance redressal system are being addressed with remedial measures on site.

However, it must be ensured that:

- The grievance mechanism should be scaled to the risks and adverse impacts of the project.
- It should address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution.
- The mechanism should not impede access to the country's judicial or administrative remedies.
- The affected people will be appropriately informed about the mechanism

HFE have established a grievance redressal mechanism to receive and address specific concerns on environmental & social issues. If the client anticipates on going risks to or adverse impacts on affected communities, the client will establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address concerns promptly, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, and at no cost and without retribution. The mechanism should not impede access to judicial or administrative remedies. The project proponent will inform the affected communities about the mechanism in the course of its community engagement process.

- In efforts to develop an effective two-way communication a Grievance Redressal Mechanism should be developed by HFE. The broad outline of the mechanism is as follows:
- The decision on the grievance would be communicated to the aggrieved person within a timeframe to be stipulated during the preparation of the ESAP.
- There should be a single point of contact between the community and HFE/ project developer for the redressal of grievance.
- All grievances should be documented and indexed for future reference. The proceeding and actions against each of the grievance should be documented and should also carry this index number for easy traceability.
- If required, the aggrieved community member can also be made a part of the Redressal process so he is able to place his point of view.
- The Grievance Redressal committee should meet at regular interval and discuss on the grievance and take necessary action.

Communication with Contractor Staff: During the construction phase, there would be an influx of people into the project area. As these people could have cultural differences with the resident population there can be a potential of conflicts arising because of issues related to safety and privacy issues of the women in the surrounding villages, spread of various communicable diseases, nuisance caused by workers due to improper sanitation facilities, etc. It is thus a Community Interaction Brochure would be prepared specifically stating the 'Dos' and 'Don'ts' and requesting proper behavioral actions and

discipline amenable with the local customs and traditions during their association with the project. The brochure would also be highlighting the importance of any of nearby cultural place and need to maintain the sanctity and dignity of the place. This Community Interaction Brochure would be made available to all employees during their induction into the project and when they report back to the project after leave or absence. A record of the induction or refresher on the community interaction would be maintained.

Responsibility: HFE have prepared all the information disclosure booklets as discussed above. They would also ensure circulation of the booklet among the community in the project affected villages.

HFE would also ensure that the system is made community friendly so that the people who have grievance are encouraged to come forward and register their grievance. It would also ensure that the grievance of the community is discussed and recorded. It would ensure that the issues are closed to the satisfaction of the community members.

During construction HFE and its contractors would ensure that each of the people working on the project is aware of the Do's and Don'ts of community interaction. HFE and their contractors would ensure that the record of the induction and refresher is maintained. All the resources required for the implementation of the different subcomponents of the plan would be provided by HFE and its contractors.

7.5.8 Community Development Plan under CSR

As per the MNRE guidelines, a certain percentage of the total investment made on development of Solar Park (excluding investment on evacuation) and that for setting up of solar power projects in the solar park may be kept aside for the affected area development.

In line with the CSR Regulations, HFE have developed their own CSR Policy for delineating its responsibility as a socially and environmentally responsible corporate citizen. The Policy has laid down the areas of intervention, principles and mechanisms for undertaking various programs in accordance with Section 135 of the Companies Act 2013.

Companies Act, 2013 has introduced mandatory Corporate Social Responsibility Regulations which are effective from 1st April 2014. Section 135 of the Companies Act, 2013 ('the Act'), read with Companies (Corporate Social Responsibility Policy) Rules, 2014 ('CSR Rules') requires every company having:

- net worth of Rs.500 crore or more; or
- turnover of Rs. 1,000 crores or more; or
- net profit of Rs.5 crore or more

Corporate Social Responsibility

Construction Phase

To empower the local community through different development and support programmes the project proponent should take some initiatives for Community Development Plan under their CSR Policy in the project affected village karekal of Bellary District.

The project proponent will develop their own CSR Policy in alignment with its CSR vision, principles and values, for delineating its responsibility as a socially and environmentally responsible corporate citizen. As per CSR Act, HFE is committed to inclusive growth and local stakeholder involvement as a fundamental value and strives to enhance:

- Social wellbeing
- Economic wellbeing
- Environmental wellbeing
- Local community initiatives

The CSR Activities may include:

- Creating provisions for Employment opportunities to the people who are skilled and semi-skilled in project area villages;
- Supporting the Community/ Anganwadi Centres by facilitating them with provisions of exclusive Drinking Water and Toilet facilities for them in project area villages;
- Facilitating the Community Centre/ Anganwadi Centres/ Local Schools by providing them with amenities like Chairs, Benches etc.;
- Facilitating in development and creation of Health Infrastructure in the Project Area villages, where it is found to be inadequate;
- Promotion of education, including special education and employment enhancing vocation skills especially among children, women, elderly and the differently abled and livelihood enhancement projects;
- Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centers and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups etc.

Project proponent should create provisions for the above-mentioned matters and any other pertinent issues. Recommendation under CSR Policy are given in **Table 7-3**.

Operation Phase

The CSR activity may continue during Operation Phase to comply with the need and requirement of the areas development and to avoid any conflict during that phase.

Needs/ Gap Assessment for CSR Initiatives

Analysis of above socio economics description and community consultation in project area villages reveals that concern of villagers are linked with the fulfilment of basic needs and improvement of some infrastructural facilities at school/ Anganwadi/ health etc. levels. On the basis of discussion with villagers, land sellers and community members, following gaps have been identified which needs to be addressed:

Table 7-3: Key Needs/Gaps Identified and Recommendation for CSR activity

Key Areas	Gaps identified	Recommendation for CSR
Education	• Lack of higher education facilities • Low female literacy rate compared to male • Lack of vocational training in study area village • Lack of computer literacy in the village.	• Awareness program regarding female education at village level. This can be linked with vocational training programme of study area village • Providing computer literacy program at village level • Focus on girl education
Drinking water	• Limited no. of dug wells, RO water purifying systems, a few hand pumps and one panchayat owned Tank in the adjacent village/ hamlets are the main source of drinking water in the study area.	• Providing additional drinking water facilities with help of concerned government dept. • Clean or purified drinking water is expected to significantly affect the quality of life and health for the villagers.
Health	• There is no health facility in the village. • Alternate/ better health facilities are around 5 Km away from the village.	• Organizing awareness camp on general health awareness.

		• Health camps or mobile health clinics, with support of the govt. authorities, can be provided. • Awareness about various health related schemes
Agriculture/ Irrigation	• Agriculture is majorly dependent on rain with irrigation through bore wells. It was observed that the project affected village- K.Veerapura lacks adequate irrigation system.	• Proper link with irrigation programmes that can ease irrigation in the area • Rain water harvesting should be planned wherever possible with the project site to improve groundwater recharge.
Employment opportunities in the area	• As found during consultation there are no SHGs active in the study area. • Majority of the villagers are unskilled • Labourers are mostly seasonal workers and migrate only for a short while in the nearby towns, either as Masons, or carpenter or as seasonal spin mill workers.	• Mobilising local women populace for being active in formation of SHGs for development. • Organizing training/ capacity building program for entrepreneurship and linkages with bank. • Introduction of processing of dairy and other produce related to livestock.

7.5.9 Engagement of Labour

As the project is in construction stage, considering factors involved in construction stage the below matters are given.

Indicators in Labour Engagement

Abolition of child and forced labour: Engagement of child and forced labour by contractor or developer in any form for the project will be unfair with the children' right.

Gender equity and non-discrimination: Discrimination and imbalance in gender equity in employment and opportunity may lead to conflicts between contractor and labour.

Freedom of association and right to collective bargaining: Not giving freedom to labour to express their views and form association may cause conflicts between labour and contractor but this is not applicable for Solar Power plant as the labour requirement is of short duration restricted to construction phase only and number of labour employed is not very large for the same phase.

7.5.10 Road Safety and Traffic Management Plan

Scope and Purpose

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

During Construction Phase

The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.

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

During Operational Phase

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

- Use of horns near the villages along the access road to villages, main plant and internal roads should be restricted.
- The vehicular movements along the access roads and highways should be restricted during the night time.
- All the vehicles entering the access roads and plant should have Pollution under Control (PUC) certificates.
- The speed limit in the internal roads should be restricted to 20 km/hr. Proper warning signs and road safety awareness posters should be displayed to create road safety awareness among the personnel accessing the site.
- Periodic Road Safety and Traffic Management campaigns and awareness sessions should be carried out among the villagers and the plant workers/personnel to develop road safety awareness among the people likely to be impacted by the project.
- An emergency road safety plan should be framed by the Proponent to combat any emergency conditions/accidents along the highways, access roads and within plant area.
- The Proponent should frame and implement a “No Drug No Alcohol” Policy to prevent road accidents/incidents.
- The drivers should be given an induction on road safety and traffic management policy.
- A permanent parking lot should be provided within the main plant site (in individual work areas) and the associated facilities.
- Use of seat belts for both drivers and passengers should be made compulsory to minimize death & injuries in the event of an accident.

8 CONCLUSION

The project is categorized as ***Category B*** as per IFC guidelines and based on this assessment is made which specifies that this project is expected to have very limited adverse environment and social impacts which, can be mitigated by adopting suitable mitigating measures. An environment and social analysis has been carried out looking at various criteria such as topography, air, noise, water resources and water quality, ecology, demography of the area, climate, natural habitat, community and employee health and safety etc.

Brief Assessment of Project:

- **Location of project site w.r.t ecologically sensitive area:** The project area is not located within or nearby of any ecologically sensitive area. No forest land whether Reserve Forest, Protected Forest or Unclassed Forest is observed in the project area or its 5 km periphery. The project will be developed on dry land which is surrounded by agricultural fields. Vegetation is generally observed along the road side and on the bund of agricultural Fields.
  As reported, there is no animal corridor or migratory route of the avifauna, it is expected that glare effect from the solar plant will have minimal impact on terrestrial as well as avian species in the region.
- **Source of Pollution:** The solar power project is based on clean technology and does not likely to cause any significant pollution. Further, the project will help to reduce GHG emissions.
- **Resettlement:** No resettlement and rehabilitation involved in the project.
- **Community Willingness:** Community is aware about the project and does not show any unwillingness for the project due to clean technology. Hence, considering the overall factors and also as information retrieved from the community consultation Community are welcoming the project along with the rest of the development of the entire Solar Park project.
- **Project Benefit:** The produced electricity will be evacuated to the state electricity grid (GSS) and will help to cater the energy requirement
- **CSR plan:** The CSR plan focused on community development will be implemented by the CSEPL.

There is no adverse impact on the nature of habitat, any natural existing land resources and effect in the regular life of people. Most impacts are expected to occur during the construction phase which are of temporary in nature. The main project impacts are associated with clearing of ground vegetation, waste management and excavation and movement of soils. From this perspective, the project is expected to have a small "environmental footprint". Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts.

The project will have number of positive impacts which are:

- During the construction phase, local population often supply manpower for services such as those of drivers, vehicle vendors, contractors, watchmen etc.
- Natural drainage channels/ reservoirs in the study area should not be disturbed. To rule out future storm water problems, storm water channels are planned along the periphery of the project site.
- Water Resource will not be over exploited.
- Proper Grievance Redressal Mechanism (GRM) will have to be implemented by CSPBPL to overcome public inconvenience during the project activities. Based on the environmental and social assessment and surveys conducted for the project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the ESMP.

Therefore, the solar power plant site will not degrade the quality of surrounding environment, while improving the socio-economic conditions of the surrounding area.

APPENDIX A: MOEF&CC NOTIFICATION

No. J-11013/41/2006-IA.II(I)
Government of India
Ministry of Environment & Forests

Paryavaran Bhavan,
C.G.O. Complex, Lodi Road,
New Delhi-110003.
Telefax: 24362434

Dated the 13th May, 2011

Office Memorandum

Sub: Applicability of environmental clearance for Solar Photo Voltaic (PV) Power Projects – Regarding.

A reference has been received in this Ministry seeking clarification regarding applicability of EIA Notification, 2006 in respect of Solar Photo Voltaic (PV) Power Projects. The matter has been examined.

It is clarified that the Solar PV Power Project are not covered under the ambit of EIA Notification, 2006 and no environment clearance is required for such projects under the provisions thereof.

This issues with the approval of the Competent Authority.

(Dr. S.K. Aggarwal)
Director

To

1. All the Officers of IA Division
2. Chairpersons / Member Secretaries of all the SEIAAs/SEACs
3. Chairman, CPCB
4. Chairpersons / Member Secretaries of all SPCBs / UTPCCs

Copy to:-

1. PS to MEF
2. PPS to Secretary (E&F)
3. PPS to SS(JMM)
4. Advisor (NB)
5. Website, MoEF
6. Guard File

APPENDIX B: KARNATAKA SOLAR POLICY 2014-2021

GOVERNMENT OF KARNATAKA

No EN 21 VSC 2014 Karnataka Government Secretariat,
Vikasa Soudha,
Bengaluru, dated: 22.05.2014

NOTIFICATION

To harness the potential of Solar resources in the State, Government of Karnataka has published Solar Policy vide GO no EN 61 NCE 2011 dated 01-07-2011 for the period 2011-2016. In light of technological advantages unfolding in the sector and achievements made by Solar forefront States, Government formed a Technical Committee vide G.O. No: EN 61 NCE 2011 Dated: 05.09.2013 for suggesting amendments to the existing Solar Policy 2011-16. With change in technology, Solar power, a green source of Energy is being considered as one of the alternative to augment the current sources. To have Energy security and sustainability, more capacity addition in Solar power, it is felt necessary, for a revision in Solar policy. Taking inputs from various stake holders, the Technical Committee has given its recommendation for revision of Solar policy.

Accordingly Government of Karnataka has decided to revise its Solar policy.

Now therefore the Government of Karnataka revises the existing Solar policy and makes the following policy, namely the Karnataka Solar Policy 2014-2021.

Solar Policy 2014-2021

1. Preamble.

The Government of India's Jawaharlal Nehru National Solar Mission (JNNSM) launched in January 2010, with the objective of achieving 34152 MW of solar power capacity by 2022which will be around 3% of the total energy consumption and it is a concentrated effort to tap India's naturally available energy sources and contribute to low carbon sustainable growth in the country, while overcoming its ecological and energy security challenges.

Karnataka is rich in solar resources and solar energy will complement the conventional sources of energy in a large way. The State of Karnataka is blessed with about 240 to 300 sunny days with good solar radiation of 5.4 to 6.2 kWh/m2/day. Karnataka was the first southern state to notify its solar policy in 2011 and was the first state to commission utility scale solar project in India.

Assessment on Solar Potential in Karnataka estimates the energy potential as 20GW. However, considering different factors like availability of waste lands, evacuation infrastructure etc., the moderated potential may be around 10GW. Karnataka has the potential to evolve as a Solar Generation hub in India due to a host of factors.

To harness the potential of solar resources in the state, Government of Karnataka had issued a Solar Policy for the period 2011 - 16. In light of changes unfolding in the sector and achievements made by Solar forefront States, it is felt necessary to go aggressively for higher targets to achieve 3% contribution from Solar Source out of total energy consumption. The advantages of Solar energy are that the grid parity is realized in near future, lower transmission losses, environmental benefits, energy sustainability, lower gestation period, offset of day time peak load etc. considering the fact the Government of Karnataka has decided to review the policy.

APPENDIX C: ILO GUIDELINES

No.6

ILO HELPDESK

ASSISTANCE@ILO.ORG

International Labour Organization

Workers' housing

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

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

Guiding principles

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

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

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

Siting and construction

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

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

Housing Standards

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

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

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

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

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

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

Sanitation facilities

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

Health and safety

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

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

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

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

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

Inspection of premises

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

Vacating the premises upon termination of employment

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

Consultation

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

References

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

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

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

ILO Helpdesk
Multinational Enterprises Programme
International Labour Office
4, route des Morillons
1211 Geneva 22, Switzerland
Tel: +41.22.799.6264
Fax: +41.22.799.6354
assistance@ilo.org

APPENDIX D: SAMPLE QUESTIONNAIRE FOR COMMUNITY CONSULTATION

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

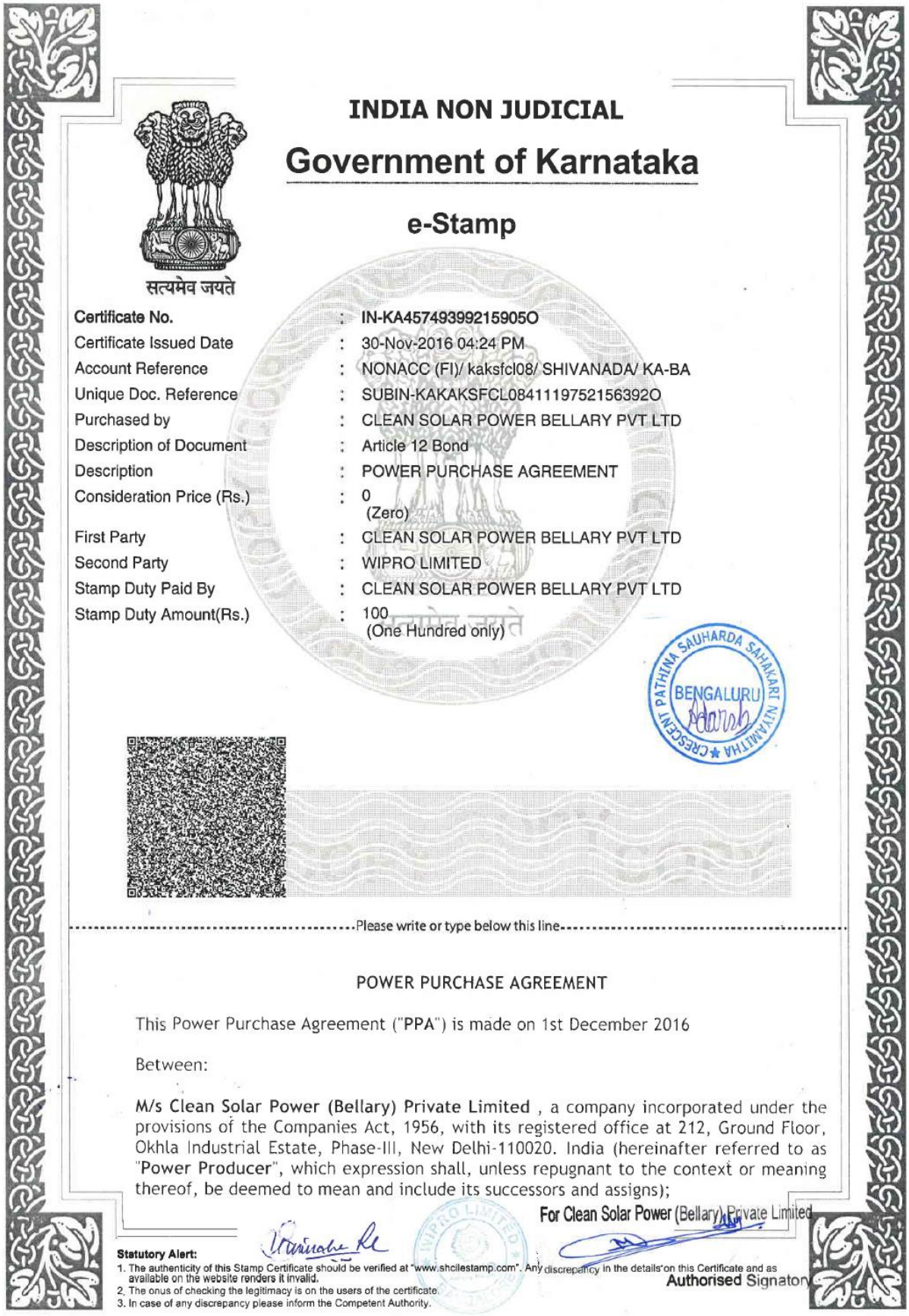
Irrigation Facility	Ponds		River		Groundwater		Others	
Average land holding size								
Land rights								
Livestock	Cow		Buffalo		Goat		Pig	Fowl
	Duck		Others					
Grazing areas								
Cooking medium and source	Fuel Wood		Kerosene		Cow Dung Cake		Crop Residue	LPG
	Others							
Common Property Resources (CPR)	Religious and Cultural Places		Sacred Places		Community Hall		Community Ponds	Cremation Ground
	Streams		Canal		River		Others	
Major rituals and festivals	Name		Period		Name		Period	
Fishing area			Name of the					
Forest	Wood		Timber		NTFP		Others	
Any Vulnerable Groups like- landless/homeless- people, Women headed HH, Orphans etc.								
Any program related to child / women health care program								
Any employment generation program								
HH & Cottage industries in the village / area								
Any Scheme / Program related infrastructure / any amenities								
Occurrence any Natural Calamities / industrial / anthropogenic Hazard								

APPENDIX E: SUMMARY OF STAKEHOLDERS CONSULTATION

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
Project Proponent Hero Future Energies (HFE)	• Asst. Site Manager	• Mr. Chowdhury B.R.	• Group interaction	• The background of the 20 MW Solar Power Project • The project is being executed under the SPV namely Clean Solar Power (Bellary) Pvt. Ltd. on behalf of HFE. • Request letter for land conversion has been sent to KREDL • Power Purchase Agreement (PPA) is completed. • Certificate of registration for BOCW (Building and Other Construction Workers) is procured. • Principal Labour Registration Certificate has been procured from Dept. of Labour, Govt. of Karnataka • Regular Power Evacuation approval has been received from Karnataka Power Transmission Corporation Limited (KPTCL). • All the project land is procured willing buyer-will seller basis and good faith negotiation. • It was also mentioned by him that no ST land was procured for the project.
Anganwadi Worker	• Anganwadi Worker, K.Veerapura	ICDS worker: • Geeta	• Group Discussion	• There is only one Angawadi Centre (AWC) in K.Veerapura village. • The Anganwadi Centre is facing shortage of drinking water facility. • Water is carried from the nearby primary school tap. • Issues raised: • Lack basic infrastructure facilities like electricity, bed, mattresses, toilet, drinking water etc.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
Panchayat Member	• Panchayat Member, K.Veerapura	Debhe Bheema Reddy	• K.Veerapura	•
School Staff	• Head Mistress Govt. Primary School, K.Veerapura	• G. Habeeb, Head Mistress	• Group interaction	• The school is co-educational. • Drinking water and sitting arrangements are main areas of concern that needs improvement • Basic infrastructure facilities available like Drinking water, Separate Sanitation, Electricity, Fan, Bulb, Library, Black board Lack of facilities such as Computer, Green board, RO water filter
Land Owner	• K.Veerapura	• Mallikaarjuna age 45, OBC	• K.Veerapura	• sale 9.4 acres, • occupation: Labour, • Monthly income 3 thousand per month, Loan clear & Bank deposit

APPENDIX F: POWER PURCHASE AGREEMENT



INDIA NON JUDICIAL

Government of Karnataka

e-Stamp

सत्यमेव जयते

Certificate No.	:	IN-KA45749399215905O
Certificate Issued Date	:	30-Nov-2016 04:24 PM
Account Reference	:	NONACC (FI)/ kaksfcl08/ SHIVANADA/ KA-BA
Unique Doc. Reference	:	SUBIN-KAKAKSFCL08411197521563920
Purchased by	:	CLEAN SOLAR POWER BELLARY PVT LTD
Description of Document	:	Article 12 Bond
Description	:	POWER PURCHASE AGREEMENT
Consideration Price (Rs.)	:	0 (Zero)
First Party	:	CLEAN SOLAR POWER BELLARY PVT LTD
Second Party	:	WIPRO LIMITED
Stamp Duty Paid By	:	CLEAN SOLAR POWER BELLARY PVT LTD
Stamp Duty Amount(Rs.)	:	100 (One Hundred only)

SAUHARDA SAHAKARI NIYAMITHA CRESCENT PATHINA BENGALURU

Please write or type below this line

POWER PURCHASE AGREEMENT

This Power Purchase Agreement ("PPA") is made on 1st December 2016

Between:

M/s Clean Solar Power (Bellary) Private Limited , a company incorporated under the provisions of the Companies Act, 1956, with its registered office at 212, Ground Floor, Okhla Industrial Estate, Phase-III, New Delhi-110020. India (hereinafter referred to as "Power Producer", which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns);

For Clean Solar Power (Bellary) Private Limited

Authorised Signatory

Statutory Alert:
1. The authenticity of this Stamp Certificate should be verified at "www.shcilestamp.com". Any discrepancy in the details on this Certificate and as available on the website renders it invalid.
2. The onus of checking the legitimacy is on the users of the certificate.
3. In case of any discrepancy please inform the Competent Authority.

AND

M/s Wipro Limited, a company registered under the companies Act 1913 and deemed to have been incorporated under the Companies Act 2013, with its registered office at Doddakannelli, Sarjapur Road, Bangalore 560 035, India (hereinafter referred to as "**User Member**" which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns).

The Power Producer and User Member are individually referred to as a "**Party**" and collectively as the "**Parties**".

WHEREAS

A. Power Producer, **M/s Clean Solar Power (Bellary) Private Limited**, a company promoted by **Hero Solar Energy Private Limited (HSEPL)**, as a Solar power project developer is establishing a solar power plant with an initial installed capacity of 20 **MW** , as a special purpose vehicle (Project);

B. The Power Producer has the exclusive rights to sell electricity generated by the Project to various consumers, including the User Member;

C. Based on the present provisions given by KERC / KPTCL and other competent authorities to wheel the Solar energy, Power producer has offered a proposal to User Member to consume the wheeled Solar energy for the facility situated in BANGALORE/MYSORE under BESCOM/CESC ,

D. It has been agreed between the Parties that the User Member shall purchase the Contracted Quantity(defined below) of energy from the Power Producer;

E. The Power Producer and the User Member wish to execute this PPA to set out their rights and obligations in respect of sale and purchase of the power generated by the Project.

NOW, THEREFORE, the Power Producer and the User Member agree as follows:

1. DEFINITIONS AND INTERPRETATION

1.1 DEFINITIONS

In this PPA unless the context otherwise requires:

"**Affiliate**" means with respect to a Party, an entity, firm, organisation which controls, is controlled by or is under common control with such Party, "control" shall mean the ownership of more than fifty percent (50%) of the (i) voting power to elect the directors of a company; or (ii) ownership in said entity, or the ability to direct the management or policies of the said entity by any means including shareholders' agreement, voting agreement or otherwise. 'Controls' and 'controlled' shall be construed accordingly;

"**Agreement**" shall mean this Power Purchase Agreement executed hereof, including the schedules, amendments, modifications and supplements hereto made in writing by the Parties from time to time;

"APPC" means Average Power Purchase Cost determined by state regulatory commission;

For Clean Solar Power (Bellary) Private Limited

Authorised Signatory

APPENDIX G: AGREEMENT TO SELL

I 15928/16-17

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ಉಪ - ನೋಂದಣಾಧಿಕಾರಿ ಬಳ್ಳಾರಿ.

AGREEMENT TO SELL

This Agreement to Sell is made and executed on this Thursday the Twentieth day of March, Two Thousand Seventeen (20/03/2017) at Bellary.

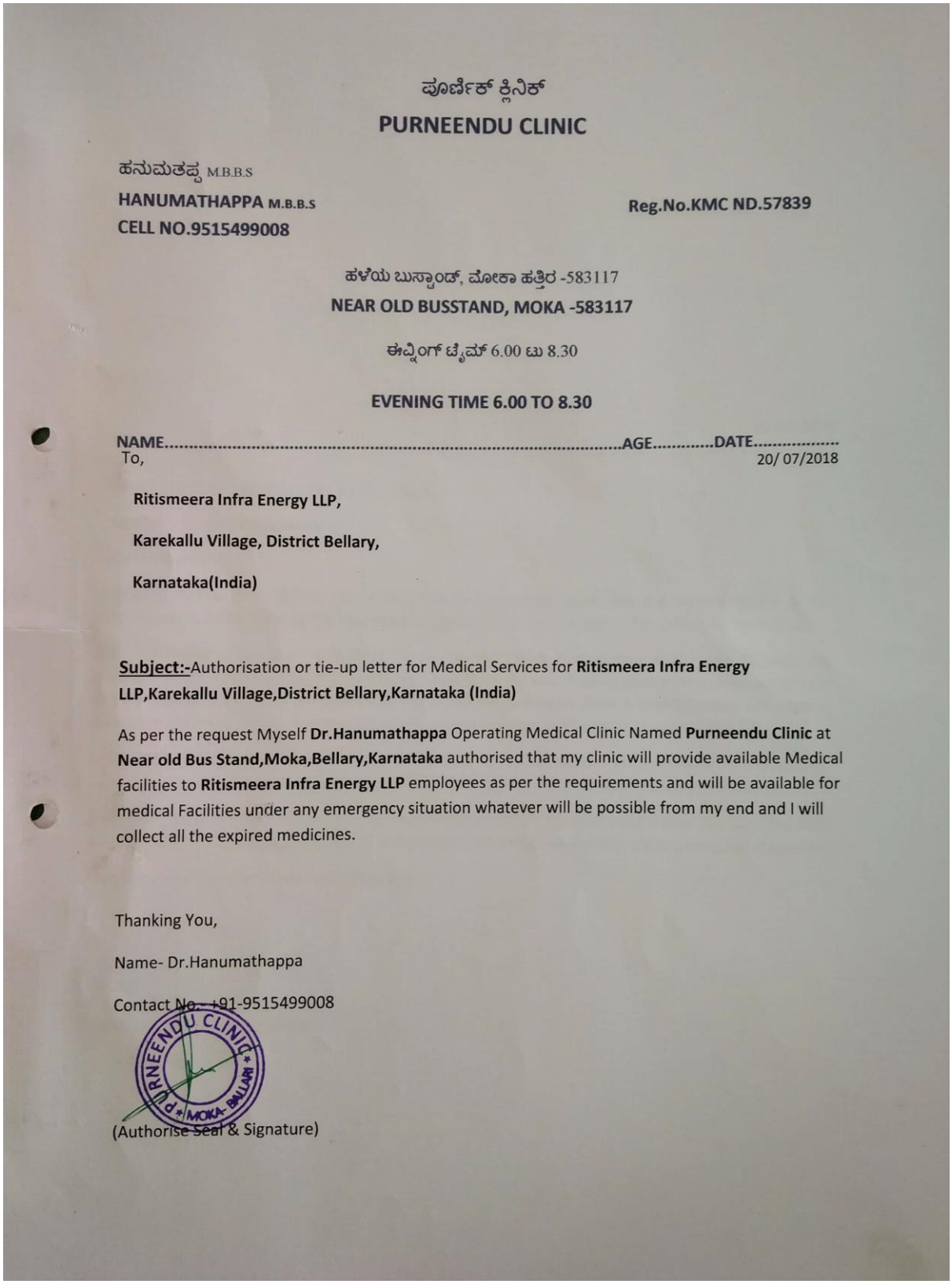
By and Between
1. **Sri.Yerigeri Basava Reddy** S/o.Naga Reddy Aged about 84 Years
2. (a). **Sri.Y.Ramachandra Reddy** S/o.Y.Basava Reddy Aged about 51 Years (b) Smt.Savitramma W/o.Sri.Ramachandra Reddy Aged about 45 Years (c). Kumari.Manasa D/o.Ramachandra Reddy Aged about 15 years Since Minor R/by Natural guardian Sri.Y.Ramachandra Reddy
3(a) Sri.Y.Rajeswari **W/o.Y.Thirumala Reddy** Aged about 55 years **3(b) Smt.Bhagyamma** D/o.Late.Y.Thirumala reddy Aged about 35 years **3 (c) Sri.Nagi Redy** S/o.Late.Y Thirumala reddy Aged about 34 years All are Residing at Karekallu Village, Moka Hobli, Bellary Taluk.

For Clean Solar Power (Bellary) Private Limited

Authorised Signatory

Page 1

APPENDIX H: MEDICAL TIE-UP



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PURNEENDU CLINIC

ಹನುಮತಪ್ಪ M.B.B.S

HANUMATHAPPA M.B.B.S **Reg.No.KMC ND.57839**

CELL NO.9515499008

ಹಳೆಯ ಬುಸ್ಟಾಂಡ್, ಮೋಕಾ ಹತ್ತಿರ -583117

NEAR OLD BUSSTAND, MOKA -583117

ಈವ್ನಿಂಗ್ ಟೈಮ್ 6.00 ಟು 8.30

EVENING TIME 6.00 TO 8.30

NAME.....**AGE**.....**DATE**.....

To, 20/ 07/2018

Ritismeera Infra Energy LLP,

Karekallu Village, District Bellary,

Karnataka(India)

Subject:-Authorisation or tie-up letter for Medical Services for **Ritismeera Infra Energy LLP,Karekallu Village,District Bellary,Karnataka (India)**

As per the request Myself **Dr.Hanumathappa** Operating Medical Clinic Named **Purneendu Clinic** at **Near old Bus Stand,Moka,Bellary,Karnataka** authorised that my clinic will provide available Medical facilities to **Ritismeera Infra Energy LLP** employees as per the requirements and will be available for medical Facilities under any emergency situation whatever will be possible from my end and I will collect all the expired medicines.

Thanking You,

Name- Dr.Hanumathappa

Contact No.- +91-9515499008

PURNEENDU CLINIC MOKA-BELLARY

(Authorise Seal & Signature)

ಪೂರ್ಣಿಕ್ ಕ್ಲಿನಿಕ್

PURNEENDU CLINIC

ಹನುಮತಪ್ಪ M.B.B.S

HANUMATHAPPA M.B.B.S **Reg.No.KMC ND.57839**

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ಈವ್ನಿಂಗ್ ಟೈಮ್ 6.00 ಟು 8.30

EVENING TIME 6.00 TO 8.30

20-07-2018

NAME.....**AGE**.....**DATE**.....

To,

Clean Solar Power (Bellary) Pvt.Ltd. (20 MW)AC

Karekallu Village,Bellary District

Karnataka(India)

WHEREAS PURNEENDU CLINIC has undertaken in segregation, collection and transportation of bio Medical waste dated **20/07/2018** to implement service for the 1 year here after called the agreement

AND WHEREAS it has been stipulated by you in the above saidagreement that the Segregation, collection and Transportation of Bio Medical Waste from the site of generation to the common storage of the hospital facility with compliance of the all Bio Medical waste Rules without causing any adverse effect and contamination to the human health and environment with ensured usage of PPE.

AND WHEREAS we have agreed to give the service for collection and transportation of bio medical waste generated from the site **Clean Solar Power (Bellary) Pvt. Ltd., Karekallu,Bellary, Karnataka**

Therefore, we hereby affirm that we are responsible on behalf of **clean solar power (Bellary) Pvt. Ltd.** we undertake to segregate, collection and transportation of the Bio Medical waste generated at the site.

This agreement is valid till date to **19/07/2019**

PURNEENDU CLINIC MOKA-BALLARI

(Signature and Seal of agreement)

Authorised person

APPENDIX I: HERO FUTURE ENERGIES SHES POLICY

HERO FUTURE ENERGIES ™

planet positive power

Occupational Health Safety & Environment Policy

Hero Future Energies Private Limited (HFE), the renewable energy venture of the Hero Group, is committed to safeguard occupational health, safety and environment of its employees, contractors, clients, stakeholder and the communities in which we operate. HFE is poised to attain sustainable development by improving occupational health, safety and environmental conditions at all our offices & project locations by adhering to the following practices:

- Adoption of safe work culture at all our project locations and offices.
- Identification and mitigation of significant environmental aspects and occupational health and safety hazards by practicing effective HSE Management System.
- Preventing employees, contractors and interested parties from injury and ill health.
- Preventing & controlling pollution by adopting good Environmental Management Practices.
- Providing regular HSE training to employees associated with us.
- Complying with all relevant legal and other requirements applicable to us.
- Communicating, involving and consulting employees in our HSE Management System.
- Ensuring this policy is communicated and available for employees and other interested parties.
- Ensuring reporting of all relevant incidents and investigating them to prevent recurrence.
- Conducting regular inspection and audits.
- Ensuring commitment towards sustainability by complying with the Green Code of Company, implementing 3R (Reduce, Reuse and Recycle) and I.E.R (Individual Environment Responsibility).
- Ensuring minimum Occupational Health & Safety impact on the society in which we operate by complying with National & International Standards applicable to us.
- Continuous improvement in the HSE performance at all our offices and project locations is an integral part of our work culture.

Sunil Jain
Chief Executive Officer

Rahul Munjal
Managing Director

Hero Future Energies Pvt. Ltd.
(A Hero Group Company)
P +91 11 49538000
F +91 11 49538022
E info@herofutureenergies.com
W www.herofutureenergies.com

APPENDIX J: THE ENVIRONMENT AND SOCIAL POLICY

AECOM
Built to deliver a better world

Annexure I Environment and Social Policy

Hero Future Energy (HFE) is committed to generate Clean Power leading to a Greener Planet for our future generations HFE intends to introduce environment and community friendly source of energy through renewable options. HFE is committed to environmental excellence in all its activities. HFE will maintain cordial relations with community we work with. We shall strive to limit our direct impacts on the environment and community while delivering our projects.

- We will provide utmost weightage to environmental and social considerations for all our operations;
- We shall strive for reduction of pollution and waste generation through improvement in operational efficiency;
- We will focus on energy and resources conservation measures ;
- We will involve with community and stakeholders to mutually benefit from all our projects;
- We will comply with all applicable laws and regulations
- We will preserve and enhance biodiversity in our projects
- We will ensure commitment towards sustainability by complying with the Green code of Company, implementing 3R (Reduce, Reuse and Recycle) and IER (Individual Environment Responsibility)
- We will communicate the environmental and social policy to all employees, customers and other stakeholders and ensure it is available to the public
- We will review the environmental and social policy to ensure their continuing applicability and relevance to our operations and evolving stakeholder expectations

The corporate policy shall be signed by the Chief Executive Officer of HFE.

The policy shall be communicated to HFE employees, contractors and associated stakeholders. The signed policy shall be displayed at the corporate office, all project companies and on the website of the company.

APPENDIX K: CSR POLICY

POLICY NO. HFE/CSR01	CSR POLICY
HERO FUTURE ENERGIES HERO FUTURE ENERGIES PVT. LTD.	

1.0 OBJECTIVE

1.1 HFE is dedicated to contribute in the Country's development by focusing on economic, social and environmental capital towards enhancing societal sustainability. Our endeavour is to provide inclusive growth at our project locations by working on improving/providing basic amenities to communities around our project sites and generate possibilities of employment.

1.2 To contribute to the Prime Minister's National Relief Fund or any other fund set up by the Central Government at the time of natural calamity or engage in Disaster Management system.

1.3 To contribute to any fund setup by the Central Government or State Government(s) including Chief Minister's Relief Fund, which may be recognized as CSR activity;

1.4 To promote sustainability in partnership with industry associations, like the Confederation of Indian Industry (CII), PHD, FICCI, NGO's, Government schemes like Swachh Bharat etc.

1.5 Undertake CSR programs in collaboration or through Raman Kant Munjal Foundation.

2.0 GUIDING PRINCIPLE OF THE POLICY

2.1 The Policy shall be governed by the provisions of the relevant Act made there under.

3.0 APPLICABILITY

3.1 This Policy is applicable to HFE for implementing CSR as per Clause **135** of the Companies Act, **2013**

3.2 Eligibility Criteria - The CSR provisions within the Act is applicable to Companies with an annual turnover of **1,000** crore INR and more, or a net worth of **500** crore INR and more, or a net profit of five crore INR and more. The Act encourages Companies to spend at least **2%** of their average net profit in the previous three years on CSR activities.

4.0 COVERAGE

4.1 This Policy lays down guidelines of implementing projects falling under CSR framework.

5.0 RESPONSIBILITY AND AUTHORITY

5.1 Approval, renewal and change in this Policy is the responsibility of HR, under approval of the CEO and MD.

5.2 Monitoring and implementation of this Policy is the responsibility of the CSR Committee.

6.0 REFERENCE

6.1 Clause **135** of the Companies Act, **2013**

POLICY NO. HFE/CSR01	CSR POLICY

HERO FUTURE ENERGIES

HERO FUTURE ENERGIES PVT. LTD.

11.0 RESPONSIBILITIES OF CSR WORKING COMMITTEE

11.1 The CSR committee shall formulate and recommend a CSR strategy and Policy to the Board, indicating the activities as specified in Schedule VII of the Act.

11.2 recommend the amount of expenditure to be incurred on the activities indicated in the Policy.

11.3 monitor the CSR policy regularly.

12.0 CSR STRATEGY

12.1 Our Company will implement projects which will have definite beginnings, ends, expected outputs and outcomes as well as budgets associated with it.

12.2 The projects that will be undertaken may be of a short duration (a few months) or multi-year.

12.3 We will implement projects either through in-house teams or in partnership with other agencies or a combination of both. In case of multi-year projects, same will be reviewed on an annual basis or as at such time as may be decided by the Committee..

12.4 Selected projects will be grouped as per their implementation period in a 1- year plan, 2-year plan and a 3-year plan. These plans will be presented annually at the meeting of CSR committee of the Board.

13.0 CSR PROGRAMMES

13.1 Project to be implemented under CSR in a specific area will depend on the needs of local community. People of the local community will be involved in decision making regarding programmes to be undertaken. A detailed due diligence of the area/community would be done to identify the critical needs and their prioritization and a project will be shortlisted.

13.2 Once the Project is shortlisted then a Detailed Project Report will be prepared therafter and presented to the Board level CSR Committee for Approval.

13.3 Following is a list of CSR Programmes that will be undertaken

13.3.1 Preserving natural resources eg. Creating water pools, Rain water harvesting.

13.3.2 Basic amenities eg. Providing access to water, electricity, education, toilets, health care etc.

13.3.3 Possibilities of employment

13.3.4 Any other that can be added to the list as and when finalised after discussion.

14.0 CSR Fund

14.1 The corpus for the purpose of carrying on the aforesaid activities would include the following:

14.1.1 2% of the average Net Profit made by the Company during immediately preceding three Financial Years.

14.1.2 any income arising there from.

14.1.3 surplus arising out of CSR activities carried out by the Company and such surplus will not be part of business profit of the Company.

15.0 CSR PROCESS

15.1 Following are the list of activities that will be undertaken as part of the implementation of CSR Process

15.1.1 Framing the CSR Strategy

15.1.2 Operationalizing the institutional mechanism

15.1.3 Due diligence of the implementation partner

15.1.4 Project development

15.1.5 Project approval

15.1.6 Finalising the arrangement with the implementing agency

15.1.7 Progress monitoring and reporting

15.1.8 Impact measurement

15.1.9 Report consolidation and communication

16.0 FOLLOW – UP AND REVIEW

16.1 After the CSR project has been implemented in any area, the CSR working Committee will do a follow-up on regular basis to check whether the desired outcome has been achieved or not and whether the project implemented is operating as per the plan. In case, there is a gap in the desired result and actual implementation then corrective action needs to be taken and reporting to be done accordingly.

17.0 CSR TO SUBMIT ANNUAL REPORT

17.1 CSR Committee shall in each calendar year prepare, in such form and at such time as may be prescribed, an annual report and submit the same to the employer and the District Officer.

18.0 ATTACHMENTS

Description	Format No.
CSR Committee	HFE/CSR01/F1
Detailed Project Report	HFE/CSR01/F2
Annual Report	HFE/CSR01/F3

19.0 AMENDMENT

This Policy is subject to change at the sole discretion of the Management but in accordance with the provisions of the Companies Act.

APPENDIX L: GRIEVANCE REDRESSAL MECHANISM

Grievance Redressal Mechanism

a) What is Grievance Redressal Mechanism Procedure?

Grievance Redressal Mechanisms focus to meet requirements, prevent and address community concerns, reduce risk, and assist processes that create positive social change.

b) Why it is necessary?

Managing community grievances is equally important, especially in the present arrangement of land purchase where there is a likelihood of people not being satisfied. There could be grievances due to the way construction activities are carried out or Labour movement in local area etc. HFE needs to mitigate such issues either by getting directly involved or by ensuring that mitigation is done by its contractors.

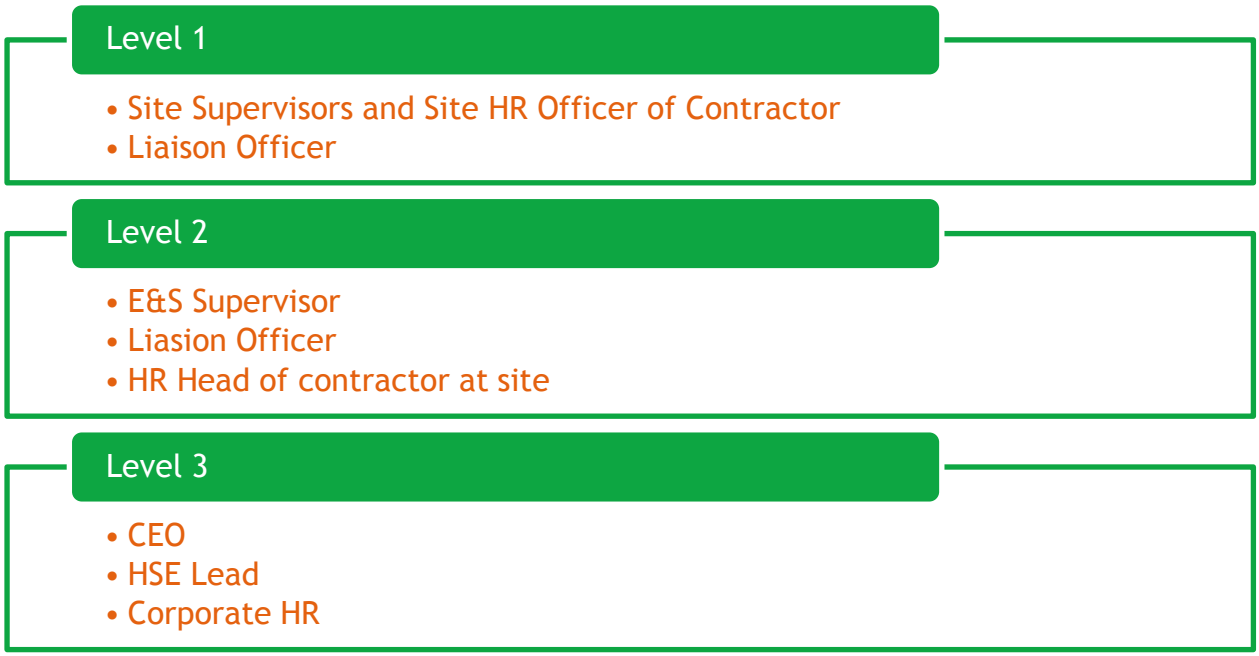
c) What is uniqueness of our Grievance Redressal Mechanism?

- Provides a predictable, transparent, and credible process to all stakeholders, resulting in outcomes that are fair, effective, and lasting;
- Builds trust as an integral component of broader community relations activities and between employees;
- Enables more systematic identification of emerging issues and trends, facilitating corrective action and community engagement.

d) Grievance Committee formation

A site level Grievance Redressal Committee (GRC) consisting of representatives from the contractors and HFE officials has formed. The GRC is designed at three levels – Levels I to III. The representatives proposed at different levels of the GRC are as below:

Three tier approaches



- The GRC meet at project site on monthly basis and on corporate level as and when the grievances are filed by the workers or persons from community.
- The complaints escalated to the higher level if the lower level fails to address the grievance to the satisfaction of complainant.

Arcadis India Pvt. Ltd.

3rd Floor, Tower B,

Logixtechno Park,

Plot No.5, Sector 127 Noida

T: (0120) 4368 400

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