ARCADIS Design & Consultancy for natural and built assets

FINAL REPORT

Environmental & Social Impact Assessment (ESIA) of Proposed Hybrid project of solar 421.9 MW and wind 105 MW in Jaisalmer and Barmer Districts of Rajasthan

FEBRUARY 2022

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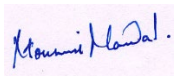
004-Final V.04	07-02-2022	Mousumi Mondal  Pinal Patel  Karthick CS 	Dr. Bipal Jana 

Disclaimer:

Information contained in this report is based on the observations during survey and interview with stakeholders. The interpretation of data and judgment is based on the professional experience and represent professional opinion of the interpreter.

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LIST OF ABBREVIATIONS

AC	Alternative Current
AWC	Anganwadi Centre
BPL	Below Poverty Line
CGWB	Central Ground Water Board
CSR	Corporate Social Responsibility
CTE	Consent to Establish
CTO	Consent to Operate
CFE	Consent for Establish
DC	Direct Current
DNP	Desert National Park
E&S	Environmental and Social Risk
EIA	Environment Impact Assessment
EPFI	Equator Principles Financial Institutions
ESIA	Environment and Social Impact Assessment
ESMP	Environmental Social Management Plan
FI	Financial Institutions
GRM	Grievance Redressal Mechanism
GW	Ground Water
IFC	International Finance Corporation
ICDS	Integrated Child Development Scheme
ILO	International Labour Organization
IUCN	International Union for Conservation of Nature
IPP	Independent Power Producer
ISTS	Inter State Transmission System
Lpcd	Litre per capita per day
KLD	Kilo Litre per day
RSPDCL	Rajasthan Solar Power Development Corporation Limited
RSPCB	Rajasthan State Pollution Control Board
Km	Kilo meter
LA	Livelihood Assessment
LOA	Letter of Authority
M	Meter
m bgl	Meter below ground level
MNRE	Ministry of New and Renewable Energy
MOEFCC	Ministry of Environment, Forest and Climate Change
NTPC	National Thermal Power Corporation
PAP	Project Affected People
PCB	Pollution Control Board
PGCIL	Power Grid Corporation Of India Limited

PUC	Pollution under control certificate
PS	Performance Standard
R & R	Rehabilitation & Resettlements
RF	Reserved Forest
SHG	Self Help Group
WPA	Wildlife Protection Act
SBM	Swachch Bharat Mission
SECI	Solar Energy Corporation of India Limited
SOP	Standard Operation Procedures
SCADA	Supervisory Control and Data Acquisition
SPCB	State Pollution Control Board

EXECUTIVE SUMMARY

Background	SBE Renewables Ten Project Private Limited (proponent) proposes to develop a Hybrid project of solar 421.9 MW and wind 105 MW in Jaisalmer and Barmer districts in the state of Rajasthan. The proponent has won the project through reverse auction conducted by SECI (Solar Energy Corporation of India Limited) on 5 Dec 2018 under the RFS floated by SECI on 22 June 2018 for setting up of ISTS (Inter State Transmission System) connected Solar Wind Hybrid Power Projects. SBE Renewables Ten Projects Pvt Ltd, a SoftBank Group ('Group') company, is a wholly owned step-down subsidiary of SB Energy Holdings Limited ("SBEHL"). SB Energy is a subsidiary of Adani Green Energy Ltd. The LOA (Letter of Authority) was awarded for the project on 25 Jan 2019 with a tariff of INR 2.67/kWh. Power Purchase Agreements was executed with SECI for the off take of the entire power produced from the Project for a period of 25 years on 31st of December 2019. SECI had issued two separate LOAs of 150 MW and 300 MW capacity and accordingly, two separate PPAs have been executed by the proponent. Considering this is an ISTS project, the Project Company shall be responsible for the land acquisition as well as development of the project following applicable rules and regulations. The grid developed by PGCIL (Power Grid Corporation of India Limited) located at Fatehgarh, Jaisalmer district, Rajasthan has been identified as the connecting GSS. Arcadis India Private Limited (hereafter referred as Arcadis) was appointed by SBE Renewables Ten Project Pvt Ltd to undertake an Environmental and Social Impact Assessment (ESIA) study of the mentioned hybrid power project in accordance with IFC's Performance Standards, Equator principles, World Bank Group's EHS Guidelines and applicable sector guidelines and national environmental laws and regulations. The main purpose of the ESIA study is to identify, evaluate and manage environmental and social impacts that may arise due to construction and operation of the project. The document has been prepared following IFC's Performance Standards, World Bank Group's EHS Guidelines and applicable sector guidelines, as well as applicable local and national regulations. The main objectives of the ESIA study may be highlighted as follows: • 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.) • Review of the land sourcing 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, Land sellers, 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. • Shadow flickering and noise assessment and study of impact of flickering and noise on the nearby communities. The site visit for the ESIA study has been undertaken to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the hybrid wind-solar plant. 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 Environmental and Social Impact Assessment (ESIA) study for the project has been undertaken in accordance with the scope of work assigned to Arcadis.
Project Overview	The proposed Hybrid project of solar 421.9 MW and wind 105 MW will be spread over 1090.223 ha. of government land parcel of which approximately 833.65 Ha. of land will be

	required for the Solar plant and 256.571 Ha. of land will be required for the Wind project. Land has been allotted to SBE on sub lease basis. The project is in construction stage. As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for 100% locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent. The identified land parcels are unused, fallow, and barren site. Topography is undulating to flat terrain at most of the locations with presence of few hillocks inside the boundary. Most of the locations are accessible through internal village road or kutcha road. NH 15 is passing through the site. Few water bodies are located near WTG location SBE-65, though they are seasonal/ rain-fed. PPA (Power Purchase Agreement) has been signed between the proponent and Solar Energy Corporation of India Limited on 31st day of December 2019.
Applicable IFC's Performance Standards	The following IFC's performance standards (PS) are applicable for this project: • PS 1: Assessment and Management of Environmental and Social Risks and Impacts, • PS 2: Labour and Working Conditions, • PS 3: Resource Efficiency & Pollution Prevention, • PS 4: Community Health, Safety and Security. • PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, The following IFC's performance standards are not applicable for this project: • PS 5: Land Acquisition and Involuntary Resettlement, • PS 7: Indigenous People • PS 8: Cultural Heritage
PS1: Social and Environmental Assessment and Management Systems	The project will have environmental and social impacts due to generation of onsite air emissions, noise, domestic wastes from site office and rest rooms, and generation of hazardous wastes from the construction site. SBE has developed Environmental & Social Management System (ESMS) which needs to be followed and implemented to manage the risks associated with its operations. This ESIA report includes evaluation of project specific environment and social risks arising from the project activities along with recommended mitigation measures. SBE should also appoint qualified E&S personnel with appropriate responsibility to implement/ oversee/ monitor the ESMS. **Hence, PS1 is applicable.**
PS2: Labour and Working Conditions	Labourers would be involved during construction and operation phase. As reported about 2000 workers/labours are estimated to be deployed during peak construction phase. The contractor's workforce will comprise of skilled, semi-skilled and unskilled labours, which may be sourced from the nearby village settlements depending on their skills and capabilities. There is a huge potential for employment of migrant labours on site. Labour camps will be constructed within the periphery of Site for solar project and for wind project arrangement will be made in nearby Villages /Town. **Hence, PS 2 is applicable.**
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 spent oil may lead to contamination of soil and ground water. Though topsoil is very limited in the area, wherever fertile land/ agriculture suitable land exists, Topsoil management is required during site levelling. Construction activities may lead to air and noise emission which needs to be managed. Broken / damaged solar panels may

	result in contamination of soil and ground water. The project would involve clearing of ground vegetation along with construction and demolition waste. Water will be required only for both construction as well as operation phases along with domestic purpose. Diesel/ transformer oil/ spent oil may contaminate soil and water. **Hence, PS3 is applicable.**
PS4: Community Health, Safety and Security	During construction phase the project envisages influx of labourers from nearby villages and these migrant labourers are expected to interact with community hence there is a possibility of conflict between migrant labourers and local community. Company and contractors will ensure proper stakeholder consultations, grievance redressal mechanism, communication to workers and other stakeholders to avoid any conflict between migrant labour and local community. Shadow flicker and noise emission during wind turbine operation may impact community health and safety but majority of the receptors are found to be rest house structures with temporary usage (Pump house, resting shade, Agricultural storage, during agricultural work) hence the impact is expected to be moderate. In India, there are no specific guidelines for wind power project on noise levels. As per IFC's General EHS Guidelines: Environmental, Noise Management, noise impacts should not result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location off-site. The increment in ambient noise level due to WTG operations during daytime is within permissible limits prescribed for residential area (55 dbA). However during night-time the increment in ambient noise level due to WTG operations is anticipated to increase up to a range of 1.5 to 4.0 dB(A), and exceeding the permissible limit (45 dbA) during the operational phase of the project. Heavy vehicles would use the existing village roads. Several staff will remain involved during the operation period. The generated electrical energy will be transmitted through high voltage power line, thereby exposing the staff and community to electrical injury cannot be ignored. Construction of boundary wall may result in restriction of access/ increased distances from common property. Interaction of community with project staff especially security staff would occur. **Thus, PS 4 is applicable.**
PS5: Land Acquisition and Involuntary Resettlement	A total of 1090.223 Ha. of government land will be leased for the proposed hybrid power project. Out of that, 833.65 Ha. of government land will be leased for solar project from Rivdi village of Fatehgarh taluka in Jaisalmer district and 256.571 Ha. for wind project in seven (7) villages viz. Bherupura, Devka, Junejo Ki Dhani, Manihari, Harwa, Rajdel and Mati ka Gol of Shiv taluka in Barmer district. The government revenue land has been allotted to SBE on sublease basis. Lease deeds for the entire land has been executed through revenue department with the project proponent. The proposed project is to be developed on the government land by executing long term lease agreement and there by the project developer is not directly involved in land lease from any private parties. Appropriate compensation will be paid by the concerned Government department for the structures/ assets developed by the farmers on the government land. Since the project developer does not involve in any land acquisition or involuntary displacement is engaged due to the project development activities, PS 5 is therefore not applicable for the project.
PS 6: Biodiversity Conservation and Sustainable Management of Living	There is no eco-sensitive areas located in 10 km radius from the project site. However, Desert National Park is located at approximately 30 km from the land parcel in solar site- Survey No 295 and 45 kms from WTG- SBE 37. The nearby area within 10 km radius of the proposed project site is mainly dominated by open scrubby vegetation, stony wasteland, and few grazing lands. Project site is almost at equal distance from Jaisalmer and Barmer, conferring to Avibase 371 species are recorded from Jaisalmer while 312 species are recorded from Barmer, and

Natural Resources	257 species are recorded from Desert National Park. While in E-bird 325 species of birds are recorded from Jaisalmer and 227 species from Barmer. In the landscape 5 species are critically endangered including great Indian Bustard, seven species are Near threatened and Vulnerable while 3 species are endangered according to IUCN red list. Apart from Great Indian Bustard four other critically endangered species are Sociable lapwing, Red-headed vulture, White-rumped Vulture and Indian Vulture. Looking at the fact that DNP is not very far, good raptor species and vulture species are present in the landscape and so there are chances of this bird getting collide with the wind turbine or transmission line. The project area comprises of non-forest wastelands and fallow lands. Among the project area solar pocket is around 72 km from the GIB priority area and wind pocket is 90 km from the GIB priority area. And project area is falling under GIB potential, according to WII guidelines powerlines can be laid in the potential area with proper mitigation measures. Though the priority area is at significant distance from the project area there is possibility of GIB visiting the project site during local migration. **Therefore PS 6 is applicable for the project**.
PS 7: Indigenous Peoples	No impact on tribal community has been envisaged as the project development will be on government land. No Bhil community/ People have their land in the proposed solar site or wind site. So, PS 7 is not applicable. **Hence, PS 7 is not applicable**
PS8: Cultural Heritage	There is no designated archaeological or cultural heritage site within 10 Km radius of the study area village and there no cultural or religious important place is affected due to the project. **Hence, PS 8 is not applicable.**
Key impacts during construction phase	**Impact on water body:** Few Surface water (seasonal/ rain-fed) exists near some WTG locations. Therefore, surface water may be impacted through usage and thus, moderate impact on existing drainage is envisaged and this impact is limited to construction phase only. **Impact on air quality:** Generation of fugitive dust due to movement of project vehicles, transportation of fine material (if not covered) and emission from diesel generators and vehicles. Impact will be limited to the construction phase only. **Water resources:** As reported to Arcadis, water will be sourced from safe authorized sources through vendor and supplied by tanker during construction phase and will be under the scope of the EPC Contractor. Drinking water requirement during the construction phase will be met via local tankers/ approved vendors. As per the categorization by CGWB the Blocks where the project sites are located falls under over exploited category. Hence, impact on the ground water is anticipated to be High. As per Project DPR, water availability for site construction may be delivered by from authorized bore wells outside the plant area but the water quality may need to be assessed by the developer for construction use. In case if Ground water is used then prior approval from the appropriate Government Water supply authority shall be taken. Water can also be made available by tankers and open reservoirs, though the authorized water suppliers. Additionally, plant may also develop its own internal water harvesting system as feasible after the topography study to elevate the ground water level in the area. The Project may have in-house developed semi-automatic module cleaning system which uses compressed air and water for module cleaning. The Project Company is exploring dry (Waterless) cleaning technologies which will be included intermittently with semi-automatic cleaning system

	currently implemented. It is proposed to develop rainwater harvesting cum storage facilities within site to meet the water requirement of the project as well as for the benefit elevating ground water level. Water requirement as per MNRE is 5.5 KL per MW of solar for 10 wet cycles in a year which amounts to 55 KL per MW of solar per year or total 23,100 KL per year (or 77 KLD considering 300 days in a year) for the entire solar project. **Conflict between migrant and local community:** During construction phase the project envisages influx of labourers from nearby villages and migrant labourers, these labours are expected to interact with community, there is a possibility of confrontation between migrant labourers and local community. **Traffic Load:** The project site is connected to the National Highway (NH-15). The selected land for WTGs is adjacent to the NH-15. This will be used for movement of trailer trucks carrying the equipment and materials. This movement is expected to result in increase in ambient noise levels. However, this increase is short term during construction stage only. **Impact on Ecology:** There will be minimal clearing of vegetation during the construction phase. As per published secondary information (eBird & IUCN) no critically endangered wild species observed in the area. However, animals like Nilgai, Chinkara, Indian Hare could be impacted during the construction phase due to the movement of vehicles carrying raw materials. Therefore, the impact on ecology is envisaged to be Moderate.
Key impacts during operation phase	**Soil & ground water contamination**: Improper handling of broken/ damaged solar panels spent oil may result in contamination of soil and ground water. Diesel/ transformer oil/ spent oil may contaminate soil and water. **Water resources**: As reported to Arcadis, water will be sourced from safe authorized sources through vendor and supplied by tanker and will be under the scope of the EPC Contractor. Drinking water requirement will be met via local tankers/ approved vendors. As per the categorization by CGWB the Blocks where the project sites are located falls under over exploited category. Hence, impact on the ground water is anticipated to be High. As per Project DPR, the Project may have in-house developed semi-automatic module cleaning system which uses compressed air and water for module cleaning. The Project Company is exploring dry (Waterless) cleaning technologies which will be included intermittently with semi-automatic cleaning system currently implemented. It is proposed to develop rainwater harvesting cum storage facilities within site to meet the water requirement of the project as well as for the benefit elevating ground water level. Water requirement as per MNRE is 5.5 KL per MW of solar for 10 wet cycles in a year which amounts to 55 KL per MW of solar per year or total 23,100 KL per year (or 77 KLD considering 300 days in a year) for the entire solar project. Water will also be required for domestic purposes by the operations staff. Considering the distribution of impact within the site, long duration with intensity, significance of impact is assessed as **High.** **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:** Locals may get dissatisfied due to influx of migrant labour. To reduce dissatisfaction among local people regarding the project activity, maximum job opportunity should be provided to the locals on priority during construction phase. Besides, a community development plan along with a grievance redressal mechanism should be followed. It should be ensured that a complaint register is maintained onsite so that any complaints from the stakeholders, locals or labors can be registered, investigated, and timely resolved.

	Ecology & Biodiversity: WTG locations which were at proximity to water bodies (WTGs SBE-47, NEW5, SBE-49 and SBE-61) which were prone to collision of birds due to proximity of a seasonal water body (holding water in season) along with an Agricultural Plot holding water (locally called as Khadin) were dropped from consideration. It is generally reported that maximum avian deaths are caused due to collision with transmission lines & WTG blades, hence the project proponent will be using bird diverters at 20ms at closer to the Transmission line or sensitive locations, painting the WTG blades and other necessary steps as per standard guidelines. Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors near to the WTGs. While planning project transmission lines, feasibility should be checked for avoiding water bodies crossings. This can be considered for water bodies that could be important when they turn into suitable habitats. Towers be regularly checked to avoid any nesting in any suitable gaps or platforms. Flash lamps on the WTGs should be installed to reduce the collision risks during nights. Vehicular movements during operation phase are to be set up with speed limits to avoid road kills. All due to the possible avifaunal collision risk the impact on ecology is envisaged to be **moderate.** ***Community Health and Safety***: Impact may be envisaged due to electromagnetic fields, noise, shadow flicker and accidental blade throw. But with appropriate mitigation measures, the same can be minimized. ***Noise:*** Wind turbines produce noise through a number of different mechanisms, which can be roughly grouped into mechanical and aerodynamic sources. Wind turbines noise could impact on annoyance, sleep and health of the residents at close proximity to the wind turbines. Reconnaissance survey highlighted majority of the receptors to be rest house structures with temporary usage (seasonal usage, Pump house, cattle shade, resting shade as shelter during agricultural work). • The increment in ambient noise level due to WTG operations during daytime and night time is within permissible limits prescribed for residential area (55 db (A)). However, during night time the increment in ambient noise level due to WTG operations is anticipated to increase up to a range of 0.4 to 4.3 dB(A) and exceeding the permissible limit (45 db (A)) during the operational phase of the project. • Distances of the identified noise sensitive receptors from the nearest WTGs varies from 137 m to 300 m • Out of 7 Identified receptors of noise sensitive areas, AH (NR 34), BF (NR 58), AI (NR 35) are village settlements, AW (NR 49) is assumed to be a shed storage area having demarcated boundaries, AO (NR 41) and BB (NR 54) are independent houses, E (NR 5) appears to be a shed of agriculture-storage, where all seems to be permanent structures and for them mitigation measures suggested in this report is to be followed. ***Shadow flicker impact****:* Shadow Flicker Modelling results show that out all the 11 identified receptors will receive shadow for more than 30 hours per year from total 24 WTGs with minimum being 31:53 hours / year to maximum being 121:43 hours / year with distances from WTGs ranging between 179 m to 2.2 km. All of these receptors seem to be permanent structures and mitigation measures suggested in the report shall be followed. Identification of structures depicted in **Table 37.** The modelling results is provided in **Appendix. G.** ***Blade Throw:*** A failure of the rotor blade can result in the “throwing” of a rotor blade, or part thereof, which may affect public safety which are mainly because of mechanical failures. The overall risk of blade throw is extremely low with regular maintenance. Mandatory safety standards in turbine design, manufacturing, and installation as well as more frequent maintenance have made the occurrence of blade throw a rare phenomenon. Wind turbines can also be equipped with vibration sensors that can react to any imbalance in the rotor blades and automatically shut down the turbine if necessary, to avoid any chance of blade

	throw. The impact due to potential blade throw is expected to be of local spread, long duration and low intensity with mitigation measures and the overall impact is assessed to be insignificant.
Key Mitigation Measures	Appropriate mitigation measures have been planned and recommended in the ESIA report. 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** • Proper water sprinkling of road should be undertaken to reduce the fugitive emissions during transportation. • Wind turbines should be designed in accordance with the international acoustic design standards. • Grievance Redressal mechanism should be followed by SBE and its sub-contractors. It should be ensured that a complaint register is maintained onsite so that any complaints from the locals or labours can be registered, investigated and timely resolved. • Proper PPE's viz. gloves, glasses, helmet and shoes should be worn by workers/labours while handling solar panels as well as during other activity during construction phase. • It should be ensured that the accommodation provided to the migrant workers should meet national and international standards laid down by ILO, IFC. Basic amenities such as electricity, potable drinking water, waste disposal, health & sanitation facility and kitchen to be provided. • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated by using for example silencers, acoustic louvers and enclosures. • 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/fencing shall be installed on excavated areas. • The speed limit of the heavy vehicles should be maintained. • All the vehicle should have valid PUC certificate. • Hazardous materials such as waste oil, used oil should be stored at designated locations in enclosed structures over impermeable surface. • Hazardous Waste authorization as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 should be obtained • NOC for ground water abstraction or surface water procurement should be obtained in the event developer/project proponent install bore well for ground water abstraction or procure borewell water or procure surface water to meet water requirement for the project activity as it is a highly water scarce area. • Complaint register should be maintained onsite to receive complaints from locals and workers **Operational Phase:** • Sourcing of water from approved vendors should be considered by EPC contractor. As

	per Project DPR, water for site construction may be delivered from authorized bore wells outside the plant area but the water quality may need to be assessed by the developer for construction use. In case if Ground water is used then prior approval from the appropriate Government Water supply authority shall be taken. Water can also be made available by tankers and open reservoirs, though the authorized water suppliers. Additionally, plant may also develop its own internal water harvesting system as feasible after the topography study to elevate the ground water level in the area. As suggested in DPR, site team supervises and keeps all record washing schedule as well monitors soiling loss to optimize cleaning cycle periodicity. Most of the solar projects have in-house developed semi-automatic module cleaning system which uses compressed air and water for module cleaning. The Project Company is exploring dry (Waterless) cleaning technologies which will be included intermittently with semi-automatic cleaning system currently implemented. Arcadis recommends waterless robotic cleaning system as an appropriate mitigation measure to conserve water level in the surrounding area. • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding noise and shadow flickering or any other issue related to project activity is not left unnoticed. The complaints should be registered, investigated, and timely resolved. • To minimize “Lake effect”, visual frightening techniques should be considered to frighten any bird trying to land on panels and prevent birds from landing. • Use of curtains, higher fencing and planting trees can be explored at locations which will get impacted due to shadow flicker, if required provisions should be made. • Rainwater harvesting structures/ water conservation structures should be used to meet the operational water needs • Hazardous waste viz. waste oil, used transformer oil, used grease, wastes or residues containing oil, empty barrels/ containers/ liners wastes or residues containing oil etc. will be collected and stored in paved and enclosed area with secondary containment and subsequently sold to authorized recyclers/ Transfer storage disposal facility (TSDF) in compliance with RSPCB norms. • Vehicular movements during construction phase are to be set up with speed limits to avoid road kills. • Bird diverter should be installed in transmission line which the client will be complying with respect to the sensitive areas. • Painting the tip of the blades for better visibility • Towers be regularly checked to avoid any nesting in any suitable gaps or platforms. • Flash lamps on the WTGs should be installed to reduce the collision risks during nights. • If any nests of ground dwelling birds/ reptiles are found the Forest Department is to be notified so that the eggs of reptiles/ birds don’t get displaced. • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding noise and shadow flickering or any other issue related to project activity is not left unnoticed. The complaints should be registered, investigated, and timely resolved. • Visibility enhancement objects such as marker balls, bird deterrents, or diverters can be installed along the transmission line to avoid bird collision. • The tip of blades should be painted to increase visibility and avoid collision • The powerline collisions and electrocution are considered as major threats to avian

	species. Large birds such as cranes and bustards are more susceptible to collisions due to low visibility and height of these structures with respect to the altitude of the flight (Tere and Parasharya 2011). The birds of prey and soaring birds are more vulnerable to collision with power transmission lines (Harness et al. 2013). The waterbodies nearby can be the roosting spots of many migratory birds especially in winter. Presence of cranes landscape are known for their toughest migration by crossing Himalayas and spending winter in western Rajasthan (Jain et al. 2005). The basic minimum is to install and maintain bird diverters or reflectors on entire power transmission lines to be laid for the project as per the IFC guidelines. Its efficacy should also be tested. We are providing following preliminary observations. Firm mitigation measures can only be provided after robust, multi season, systematic study. 1. Use of bird diverters or deflectors to make the powerlines more visible. 2. Sufficient spacing between conductors and powerlines to accommodate the wide wingspan of large raptors like Vultures and eagles. 3. Proper insulation of cables closes to poles that are used for perching by the birds. 4. Avoid clustering of powerlines. 5. Pre and post construction monitoring of bird mortality and displacement evaluation along the powerlines and timely intervention, if required. These mitigations are also a part of the mitigation table. **Decommissioning Phase:** • Decommissioning consists of the removal of facility components, the management of excess materials and waste and the restoration of Project Location lands and waters, as applicable to facilitate the anticipated future use of the land. • This Decommissioning Plan should be done to assist the project proponent in fulfilling regulatory requirements as mandated by government agencies for the decommissioning of the Project. • The project proponent will adhere to the decommissioning requirements provided in their decommissioning report and will ensure that the project location is restored to a condition appropriate for its future use. • Decommissioning of the project and any ancillary equipment can be conducted in such a manner as to ensure that there will be no significant negative environmental effects.
Conclusion and Recommendation	The Hybrid power project is not likely to have significant adverse environmental impacts that are sensitive, diverse or unprecedented. 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 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), impact on soil due to storage and spillage of hazardous wastes used oil and transformer oil (land environment) as well as use of ground water (if any) resources during operation phase, which can be mitigated by adopting suggested mitigation measures. Considering the short duration, localized distribution and low intensity, noise and shadow flicker impact has been assessed as **Low** significance and can be controlled with the recommended mitigation measures. However, the avifaunal collision risk due to operation of wind turbines cannot be ruled out and hence the overall impact on birds and bats due to the project activity during the operational phase is “Moderate”. All mitigations for avoiding the same are to be implemented.
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.	

1.0 INTRODUCTION

1.1. Background

SBE Renewables Ten Project Pvt. Ltd. has proposed to develop a Hybrid project of solar 421.9 MW and wind 105 MW each on a total of 1090.223 Ha. of government land. As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on govt. land. Lease deeds for the entire land has been executed through revenue department with the project proponent. Out of the total 1090.223 Ha. of government land, 833.65 Ha. of land will be used for Solar project from Rivdi village of Fatehgarh taluk in Jaisalmer district and 256.57 Ha. of land will be used for Wind project from 7 villages of Shiva Taluk in Barmer District. Presently, the project is in construction phase and will be developed by SBE in government land parcels.

SBE Renewables Ten Project Private Limited (developer) has won the project through reverse auction conducted by SECI (Solar Energy Corporation of India Limited) on 5 Dec 2018 under the RFS floated by SECI on 22 June 2018 for setting up ISTS (Inter State Transmission System) connected Solar Wind Hybrid Power Projects. SBE Renewables Ten Projects Pvt Ltd, a SoftBank Group ('Group') company, is a wholly owned step-down subsidiary of SB Energy Holdings Limited ("SBEHL"). SB Energy is a subsidiary of Adani Green Energy Ltd.

The LOA (Letter of Authority) was awarded for the project on 25 Jan 2019 with a tariff of INR 2.67/kWh.

Power Purchase Agreements was executed with SECI for the off take of the entire power produced from the Project for a period of 25 years on 31st of December 2019. SECI had issued two separate LOAs of 150 MW and 300 MW capacity and accordingly, two separate PPAs have been executed by the proponent.

Considering this is an ISTS project, the Project proponent shall be responsible for the land acquisition as well as development of the project following applicable rules and regulations. The grid developed by PGCIL (Power Grid Corporation of India Limited) located at Fatehgarh, Jaisalmer district, Rajasthan has been identified as the connecting GSS.

Land Allotment process is completed, and lease deeds have been signed.

The identified land parcels are unused, fallow, and barren site. Topography is undulating to flat terrain at most of the locations with presence of few hillocks inside the boundary. Most of the locations are accessible through internal village road or kutcha road. NH 15 is passing through the site. Few seasonal/ rain-fed water bodies are located near WTG location SBE-65.

PPA (Power Purchase Agreement) has been signed between SBE Renewables Ten Projects Private Limited and Solar Energy Corporation of India Limited on 31st day of December 2019 for 450 MW power plant.

Arcadis India Private Limited (hereafter referred as Arcadis) was appointed by SBE Renewables Ten Pvt Ltd to undertake an Environmental and Social Impact Assessment (ESIA) study of the project as per the standard TOR shared by IFC through SBE.

As reported, land lease has resulted in economic displacement however, there is no physical displacement and resettlement is envisaged with the proposed entire project site.

As per Indian solar radiation map of India, Rajasthan state receives good amount of solar radiation. Rajasthan receives around 5.5 - 6 kWh/sq. m/day which is potentially adequate for the installation of the PV plant.

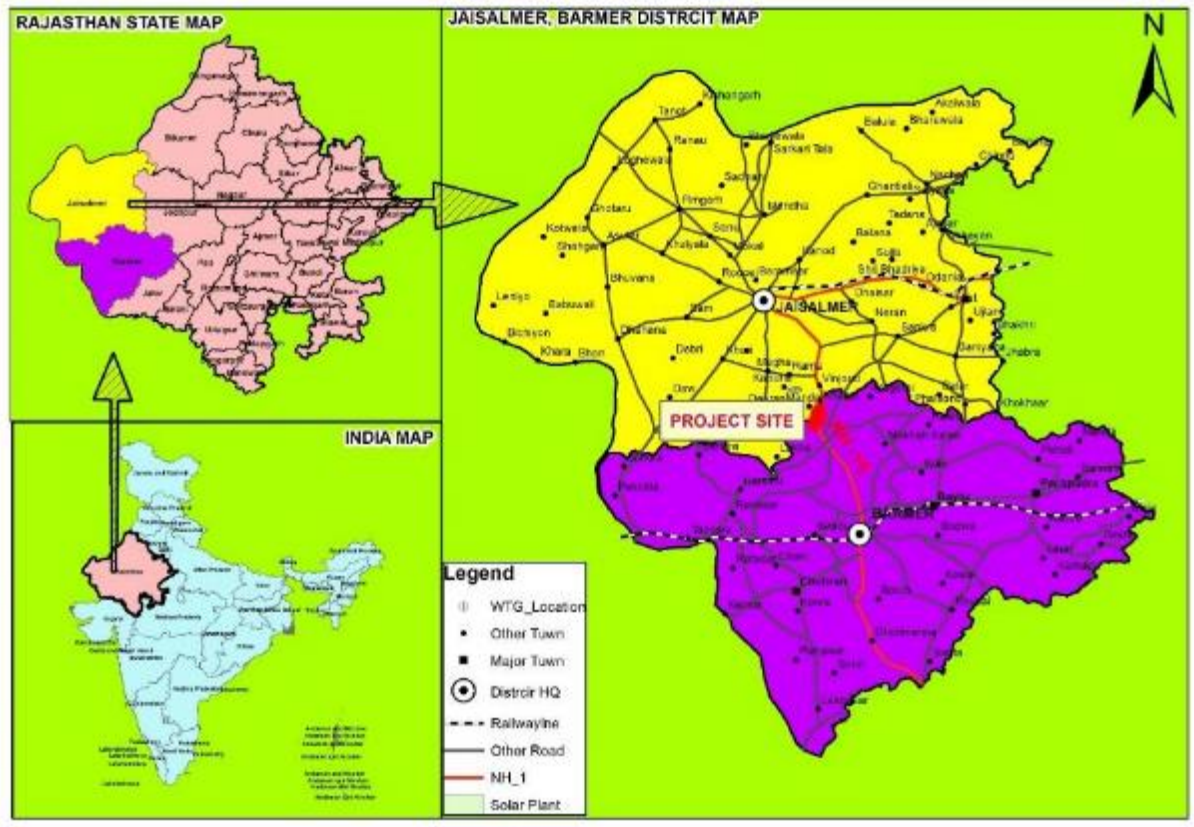
SBE has finalized the Engineering, procurement, and construction (hereafter known as EPC) contractor for development of this proposed project to SPGS and WPGS supply and service contracts have been awarded. EPC contractor will be responsible for installation of solar panels, WTG structures, construction of transformers and laying of transmission line. Post construction, operation, and maintenance (O&M) contractor will be responsible for long term operation and maintenance of the projects.

This ESIA report has been prepared based on baseline survey through site visit, desktop survey, documentation review, consultation with stakeholders and in accordance with International Finance Corporation's Performance Standards (IFC-PS) on Environmental and Social Sustainability, 2012; Environment, Health and Safety Guidelines of World Bank Group, Equator Principles; Relevant ILO conventions covering labour standards. The study has also assessed the requirements with respect to the local and national regulations relevant to the project.

1.2. Location of the Site

The solar project site falls in Rivdi village of Fatehgarh taluka in Jaisalmer district and the wind project is in seven (7) villages Bherupura, Devka, Manihari, Junejo Ki Dhani, Harwa Rajdel and Mati ka Gol of Shiv taluka in Barmer Rivdi District. The location map is depicted **in Figure 1-1**.

Figure 1-1: Project Location Map



1.3. Salient Features of Project

The salient features of the project are summaries in **Table-1.**

Table-1: Salient Features of Project

S. N.	Salient Features	526.9 MW hybrid wind-solar project
1.	Project Owner	SBE Renewables Ten Pvt. Ltd. (SB Energy is a subsidiary of Adani Green Energy Ltd.)
2.	Project Capacity	Hybrid project of solar and wind capacities of 421.9 MW and 105 MW each
3.	Location of Site	**solar site**: Villages of Rivdi from Fatehgarh taluk of Jaisalmer for and **wind site**: Villages Devka, Rajdel Mati ka Gol, Bherupura, Hadwa, Manihari, Junejo ki dhani from Shiva taluk of Barmer .
4.	Taluka	Fatehgarh in Jaisalmer & Shiva in Barmer
5.	District	Jaisalmer & Barmer
6.	State	Rajasthan
7.	Project Coordinates	**Barmer Site centre (wind):** Longitude 71° 12' 13.356"E, Latitude 26° 19' 9.311" N **Jaisalmer Site centre (solar):** Longitude 71° 3' 41.914"E, Latitude 26° 27' 47.619" N
8.	Nearest Town	Dedha (17 km to Sam)
9.	Nearest Railway Station	Jaisalmer railway Station
10.	Nearest Airport	Jaisalmer Airport
11.	Total Land Area	As per lease deeds executed, land possession for both solar and wind is 100% complete. 1090.223 Ha. ○ Solar –833.653 hectares, this is entirely govt land. As on date, mutated and possession taken for @ 100% land ○ Wind – 256.571 hectares, this is also entirely govt land. As on date, Possession taken for all the locations.
12.	Type of land	Government Land.
13.	Status of land	As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all the locations as per lease deeds. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent.
14.	Type of Land use (10 km radius from site)	Barren land
15.	Present status of the project/project phase	Construction
16.	Power evacuation	Separate 220/33kV substation for solar and wind, connecting to PSS at 220kV, transmission from PSS to GSS at Voltage of 220 kV
17.	Location of PSS	26°42'29.26"N, 71°16'27.33"E
18.	Transmission Line Length	Grid Sub-station (GSS) is PGCIL 220 kV ISTS Fatehgarh II Substation which is approximately 50 km from Solar Site. Connectivity Approval from PGCIL is under process. Stage-I & II power evacuation approvals has been received from PGCIL and a Transmission Agreement (Connectivity Agreement) has been executed with PGCIL. LTA agreement has been signed in May 2020. Section 68 approval has been received.

S. N.	Salient Features	526.9 MW hybrid wind-solar project
		Following the Stage-II connectivity agreement, the Borrower has executed the Transmission Agreement with M/s PGCIL. As confirmed by SBE, the status of RoW for Transmission towers is that construction has been started. Tx Line ROW land will be as per 30 m and will be taken up separately, It is reported that the survey for the transmission route has been completed, however, the route finalization is underway. Consultations were carried out in few identified villages like Harwa, Devka, Devikot, Rivdi, Bhiyaasar, Mati ka gol, Sangramon ki dhani, Sanguar and Kair Fakiron ki dhani, Kota and Unda from where transmission route would pass. This Hybrid project is divided into individual solar and wind capacities of 421.9 MW and 105 MW each. Wind Turbine Generators will be connected through Internal 33 kV Transmission Line to the Plant's Internal 33/220 kV Switchyard. This Wind Cluster's internal Pooling Substation will be connected to 33/220 kV Hybird Pooling substation located within the Solar project area through 220 kV Single Circuit Transmission Line. Similarly Solar part will be evacuated through 33 kV Internal Transmission Line / HT Cables at the Hybrid pooling 220/33 kV Internal Switchyard located within the solar project area. This Hybrid Pooling 220/33 kV internal switchyard is then evacuated at 765/400/220 kV Fatehgarh-2 PGCIL Substation through 220 kV D/C Transmission Line. As per latest DPR, Transmission Line –Wind Pooling Substation to Hybrid (Solar) Pooling Substation: 20-22 km Transmission Line – Hybrid (Solar) Pooling Substation to PGCIL Substation: 36-40 km. The Project Company will undertake Transmission Route Survey and take necessary permissions from the designated authorities as a part of detailed engineering activity and prior to Construction of Transmission Line.
19.	Land required for transmission Route	Survey for transmission route has been complete and tentative route has been finalised.
20.	Grid Sub-station	PGCIL 220 kV ISTS Fatehgarh II Substation
21.	Mode of Implementation	EPC (Engineering, Procurement and Construction)
22.	Solar PV Technology	Poly crystalline solar PV
23.	Project Life	30 years (based on Land Sub Lease Agreement) & PPA with SECI is for 25 years
24.	Connectivity Approval from PGCIL	Stage 1 and 2 approval received, and LTA agreement signed on 27 May 2020

1.4. Key Permits and Compliance Status

The project is at construction stage. The required permits and approvals for the construction and operation of the project are summarized below **Table 2**

Table 2: Status of Permits and Approvals

S. N	Permits/Approvals	Status	Remarks (if any)
1	Consent to Establish from Rajasthan Pollution Control Board (RSPCB) under Water (Prevention & Control of Pollution) Act, 1974 and the Air (Prevention & Control of Pollution) Act. 1981	Not Applicable	As per CPCB notification No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016 Hybrid power project falls in White category and therefore white category industries do not require to obtain consent of the board, an intimation to the RSPCB shall suffice (APPENDIX A).
2	Hazardous Waste authorization as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	Not Applicable	Solar and wind projects are exempted from purview of Hazardous Waste authorization as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
3	NOC from Village Panchayat	Need to be obtained	NOC from Gram Panchayat will be obtained after Lease Agreement is signed with GoR.
4	Factory License under factories act 1948	Need to be obtained after Commissioning of the Project	With reference to the factories act 1948, the same is applicable because this hybrid plant generating, transforming, or transmitting electrical energy and more than 10 workers are employed/working at site.
5	Power Purchase agreement	Available	PPA is signed between SBE and SECI Limited on 31st day of December 2019
4	Approval for extraction of ground water	Needs to be obtained if ground water extraction is proposed.	Central Ground Water Board (CWGB) approval for extraction of groundwater requires to be obtained in case project proponent intends to install bore wells/dug wells for ground water extraction during construction and operation phase.

1.5. 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, World Bank Group's EHS Guidelines and applicable sector guidelines, 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.)
- Review of the land sale 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, Land sellers, 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.

- Shadow flickering and noise assessment and study of impact of flickering and noise on the nearby structures.

1.5.1. Approach and Methodology of the ESIA Study

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

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

1.5.2. Limitations

The study is based on observation recorded during site reconnaissance survey, the project planning information and document provided by the project proponent/ Client, stakeholder consultation and desktop review. Any meaningful change in the activities at a later stage may result in variation of outcomes. Presented information and fact has been analyzed and inferences have been drawn through professional judgement. Baseline environmental monitoring has been conducted. As the project is in preconstruction stage, contractors and other details have not been finalised. Hence the resource requirements have been taken as approximation and based on assumptions given by the client.

WTG profiling is carried out via baseline survey, desktop review and Site photographs, videos provided by client.

During Arcadis team visit to the site, land leasing/allotment was under progress and therefore, apparently, land parcels were not clearly demarcated and reportedly the same will be undertaken after allotment by revenue department to SBE. Hence, Arcadis team has to rely upon site representative of SBE to understand the site area. As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all the locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent.

Ecological report was prepared based on published secondary information only without site visit. So, to get clear picture of the site-specific understanding proper biodiversity assessment on the in and around project site is suggested.

Consultation with stakeholders was carried out together with SBE site representative and same is provided in **Appendix E (Table 1, 2 & 3)** recorded through photographic evidence.

1.5.3. ESIA Team

Arcadis 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 100 no's each of solar & wind power projects across India with over 14000 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.

For the purpose of conducting this ESIA study, professionals involved are Ms. Mousumi Mondal and Ms. Ankita Chhavi as main experts along with Ms. Pinal Patel and Mr. Karthick C S for the final revision. Representatives of SBE accompanied Arcadis professionals Santu Gorai, Bonhisikha Banerjee and Chhavi Ankita during site visit and will be referred to as the 'site representative' in the report.

2. PROJECT DESCRIPTION

The proposed project is under construction stage during this ESIA study. As reported by site representative of SBE, the construction works yet to be started and expected to be commissioned in Q3 2021.

The technical features of project are depicted in **Table** 3 and satellite imagery of the project site is shown in **Figure 2-1.**

Table 3: Technical Features of Project

Particulars	526.9 MW hybrid solar-wind project at Jaisalmer & Barmer dstricts
Project Capacity	This Hybrid project is divided into individual solar and wind capacities of 421.9 MW and 105 MW each.
Solar PV Technology	Poly crystalline solar PV
Inverter	To be among reputed Tier 1 inverter suppliers, SB Energy in past has procured inverters from Sungrow (3.125 MW Central) and Kehua (3.125 MW Central) No. of Inverters 135
Module Make	• LONGi Solar • Jinko Solar
Robotics Cleaning System	SB Energy plants deploy 100% waterless cleaning systems, in past SB Energy has procured robotics based waterless cleaning system from Eccopia and Sol-Bright As per latest DPR, as per the standard industry practice this activity may be outsourced to local vendor. Depending upon site location and surroundings module cleaning work will be carried out two-three times in a month. Site team supervises and keeps all record washing schedule as well monitors soiling loss to optimize cleaning cycle periodicity. Most of the solar projects have in-house developed semi-automatic module cleaning system which uses compressed air and water for module cleaning. The Project Company is exploring dry (Waterless) cleaning technologies which will be included intermittently with semi-automatic cleaning system currently implemented
EPC Contractor	To be among Tier 1 EPC contractors (under process of appointment). SB Energy in past projects has worked with Sterling & Wilson, Mahindra Susten, Tata Solar and L&T
O&M Contractor	Third party Tier 1 O&M contractor to be appointed closer to commissioning of the project – in past SB Energy has appointed Sterling & Wilson
Wind OEM	SBE is in discussions with both Vestas and Suzlon and they have not yet finalised the OEM supplier Further, Wind OEM supplier will be responsible for installation of WTGs For civil foundation work, they have appointed Kintech who's scope will include land acquisition, civil work, transmission line construction, sub-station, internal roads, approvals etc.
Wind Contractor for Land/ BoP/Evacuation	Engineer and Engineer Pvt Limited Engineer and Engineer Pvt Limited to be responsible for land acquisition, permits, civil works, Liasoning and construction of evacuation infrastructure.

Source: Details provided by SBE

2.1. Present Status of Project

The project is under construction phase. As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all the locations as per

executed lease deeds. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Survey of the land has been completed. Lease deeds for the entire land has been executed through revenue department with the project proponent.

Figure 2-1: Satellite Imagery (Google Map) Showing the Project Site

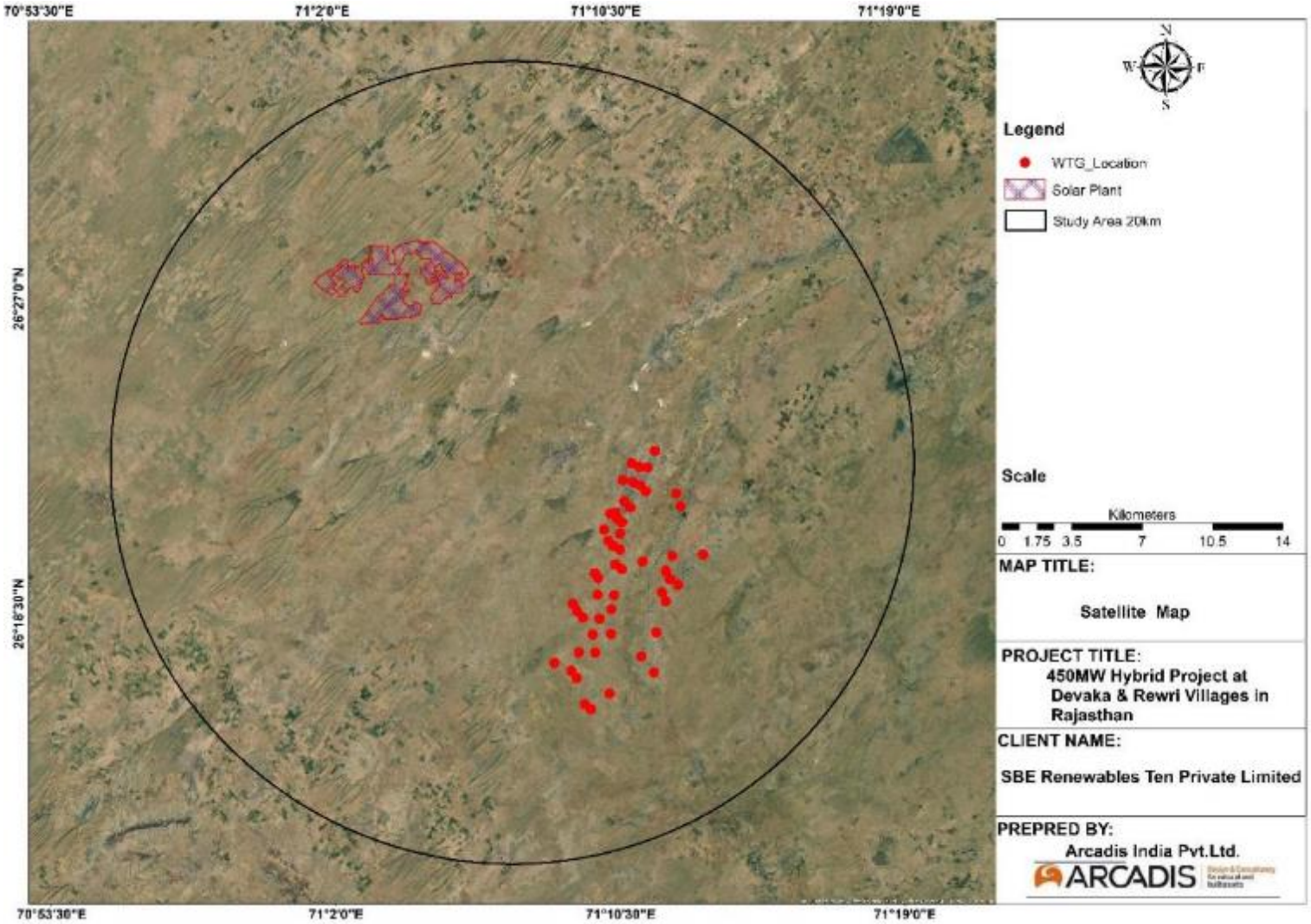
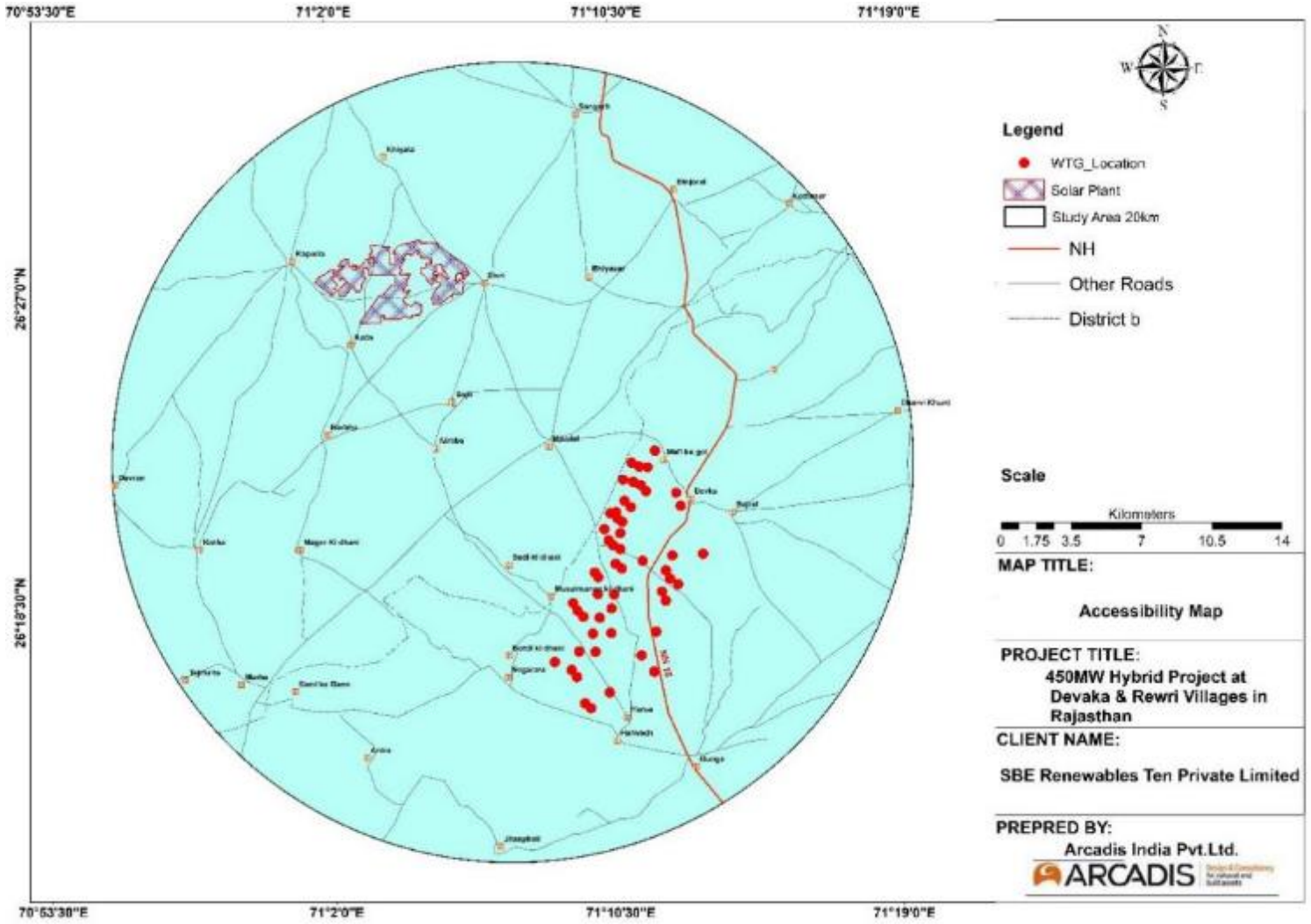


Figure 2-2: Accessibility of the Project Site



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:** Average annual solar radiation at the proposed site at horizontal surface is 5.5 - 6 (Meteonorm) which is potentially adequate for the installation of the PV plant. The power generated will also help to cut out the dependency on the coal to generate the electricity. It is anticipated that grid outage and transmission losses will be considerably low, and this will help to optimize the electricity feed in the grid.
- **Topography:** The project site is spread across an open area with the land being flat with mild undulation.
- **Substation proximity:** Separate 220/33kV substation for solar and wind, connecting to PSS at 220kV, transmission from PSS to GSS at Voltage of 220 kV. The Grid Sub-station (GSS) is PGCIL 220 kV ISTS Fatehgarh II Substation which is approximately 50 km from Solar Site. Application to Connectivity Approval from PGCIL is under process.
- **Clean Technology:** CPCB has categorised Hybrid power projects under White category which pertains to those industrial sectors which are practically non-polluting and having Pollution Index score up to 20.
- **Accessibility:** The site is located about 17 km from Dedha Town. Site is accessible through various internal village roads and NH-15. Jaisalmer railway station (47 KM) are reachable nearest railway stations.The accessibility map is depicted in **Figure 2-2.**
- **Geological and soil conditions:** As per CGWB report (western region Jaipur, 2013 edition), Barmer district forms part of Great Thar Desert of Rajasthan. In this arid region, there are sand dunes, alluvial areas dotted with few hillocks and hill chains scattered in the area. In the eastern part of the district, the area between Bilara and Barmer is covered by alluvium deposited due to fluvial action of Luni river system. The eastern part of the district exhibits gentle undulating topography interrupted by small ridges of hard rocks. Soils of the district have been classified as follows a) Red desertic soils b) Desert soils c) Sand dunes d) Lithosols and Regosols of hills.

  Jaisalmer district is a part of the ‘Great Thar Desert’. The terrain around Jaisalmer town, within a radius of about 60 km is stony and rocky. The area is barren, undulating with its famous sand dunes. There are no rivers worth the name in the area nor are there any perennial streams in the area. Soils of the district are classified as follows a) Desert soil b) Sand dunes c) Red desertic soil d) Saline soil of depressions. Small nallas are purely seasonal and ephemeral with the result that there is lack of effective discharge in the event of heavy precipitation.
- Soils of the district are classified as follows: Desert soil: Desert soil area is occupied by alluvium and wind-blown sand, yellowish brown, sandy to sandy loam, loose, structure less, well drained with high permeability occurring in major part of the district.

  Sand dunes: These are non-calcareous soils, sandy to loamy sand, loose, structure less and well drained. These occupy northern, western, southwestern, north-eastern parts of the district.

  Red desertic soil: These are pale brown to reddish brown soils, structure less, loose, and well drained. Texture varies from sandy loam to sandy clay loam. These soils occur in eastern, central and south-eastern parts of the district.

  Saline soil of depressions: This type of soil is found in salt lakes. They are dark grey to pale brown, heavy soils with water table very near to the surface and are distinctly saline.

- At the time of site visit, habitation near to Site was absent. Also, through site photographs, google earth imageries and desk-based study it is learnt that site is devoid of any habitation.
- No obstacle in the form of trees, buildings exists in the vicinity that could lead to near shading
- The location well addresses the significant land availability, connectivity and accessibility, meteorology and favourable global solar irradiance, shadow free area and required infrastructure.

2.3. Environmental and Social Settings

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

- Project site is spread across an open area with mild undulation
- The project will be carried out in Rivdi village of Seo taluk in Jaisalmer district and in 7 villages (Mati Ka gol, Manihari, Harwa, Junejon ki Basti, Bhairopura, Rajda and Deoka) of Sam block in Barmer District. comprising of 1090.223 ha.
- Villages of Rivdi from Sam taluk of Jaisalmer for **solar site** and Villages Devka, Rajdel Mati ka Gol, Bherupura, Hadwa, Manihari, Junejo ki dhani from Sheo taluk of Barmer for **wind site**
- There are no shading elements such as mountains or huge trees available on the site.
- No large-scale industries located in and around immediate vicinity of the project area.
- Approx. 63 structures have been identified on the proposed project land for both solar and wind project. This structure number also includes structures falling within 300 m radius from zero-point location of WTG. Majority of the structures are permanent in nature like underground water tank (*Tanki*), Residential houses and few temporary structures like huts used for storage of fodder and food grains etc. Also, two government structures like check dam and borewell are reported at the solar project site while two abounded structures are in Devka village. The land parcel has mild undulation and hence small amount of excavation and levelling of land would be carried out.
- The entire region is reportedly drought prone. No major/large scale water bodies/lakes are located within 10 km from project area.

SBE in process of finalizing various contractors for the project (EPC, modules, inverters, robotics suppliers), as per the primary project information shared by SBE following details are mentioned.

PV Modules: From the technology assessment poly crystalline solar PV technologies have been optimized at the location of Solar park. Using the TIER-1 manufacturers of the key components following models have been chosen for energy yield estimation and project design. SB Energy in past has procured modules from Trina, Risen, ZnShine, Jinergy and Suntech. Project developers may choose the technology/ supplier/ manufacturer etc. using their own techno-commercial approach at the project implementation stage.

Inverter: From the technology assessment section the central inverters with outdoor arrangements have been optimized for the location of Solar Park. The outdoor inverters may effectively reduce the project implementation duration and cost. Project developers can take the decision of inverter selection at the implementation stage; however, in order to carry out the energy yield estimation it is proposed to use Tier 1 inverter suppliers, SB Energy in past has procured inverters from Sungrow and Kehua.

SCADA: The PV power plant will be monitored through the SCADA system. This will enable monitoring the status of inverters to gather information on energy generation. Periodic reports of the plant's performance will be provided by the monitoring system. A suitable display system can also be installed suitably in the plant to access live data on the performance of the solar system. Remote data access

will be provided through secured gateway connectivity. The status of all breakers shall also be monitored.

Power Evacuation: Separate 220/33kV substation for solar and wind, connecting to PSS at 220kV, transmission from PSS to GSS at Voltage of 220 kV. The Grid Sub-station (GSS) is PGCIL 220 kV ISTS Fatehgarh II Substation which is approximately 50 km from Solar Site. Application to Connectivity Approval from PGCIL is under process.

2.4. Resource Requirement

2.4.1. Land Scenario/ Status of land

The proposed 526.9 MW Hybrid Power Project is located on government land parcels measuring approximately 1090.223 Ha. of Government land. Of which, 833.65 Ha. of proposed government land will be leased for Solar from Reevadi village of Seo taluk in Jaisalmer district and 256.57 Ha. for wind project in 7 villages (Mati Ka gol, Manihari, Harwa, Junejon ki Basti, Bhairopura, Rajda and Deoka) of Sam block in Barmer District.

SBE has engaged Kintech Private Limited who is to be responsible for WTG foundations and related civil works, making access roads to Wind sites, construction of entire evacuation infrastructure including pooling substations for wind and solar sites, 33kV tx line network for wind sites, 220kV Tx line connecting wind and solar plant to PGCIL GSS at Fatehgarh, ROW for Tx Lines. Kintech is responsible for construction of 33/220kV Pooling Sub-station (PSS) at Wind site and Solar Site and construction of 33kV Tx Line within wind farm and 220kV Tx Line from Wind PSS to Solar PSS and further to GSS (PGCIL Fatehgarh S/s).

As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while rest of it is in progress while for Wind Project, 634 Acres govt. land allotted, where possession already taken for 68 locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent.

SBE has appointed Engineer and Engineer Pvt Limited to arrange land. Towards land sourcing, SBE has signed Land Development Agreement dated 31 Aug 2020 with them to facilitate the allotment of Government Land by way of Lease Deed and acquisition of Private Land (if required by the project company for RoW) and subsequent allotment of the same by way of lease/sub- lease basis in the name of the project company for an initial period of 29 years and 11 months (twenty-nine years and eleven months) from the effective date of lease/sub-lease.

During Arcadis team's visit to the site, land leasing/allotment was under progress and application has been filed with the RRECL. Therefore, land parcels identified for the project have been demarcated based on the identified land and reportedly the same will be undertaken after allotment by revenue department to SBE. Hence, Arcadis team has been relying upon the site representative of SBE to understand the site area. During site visit, the site was greenfield, and few standing crops were noticed in identified land parcels at solar site.

The solar & wind site are proposed in government revenue land parcels. As reported, these land parcels are government declared waste land as per revenue record. Solar site is located on contiguous land and wind is scattered locations. Land parcels is already leased for long term lease basis 30 years & extendable by another 10 year.

Solar site: The proposed project is surrounded by two large settlements Rivdi & Kapuria and two small settlements locally called as Dhani (hamlet) Sangram ki Dhani & Tamachi ki Dhani of Rivdi village. It is seen that these settlements especially Sangramo ki dhani and Tamachi ki dhani is falling adjacent to the proposed project boundary

Settlement & Structure:

There are 63 structures which are identified on the proposed project land for solar site. Majority of the structures are permanent in nature like underground water tank (18) and few temporary structures like huts used for storage of fodder and food grains (12), cattle shed (20 and common property (2). No residential structure is impacted. Also, two government structures like check dam and borewell are reported at the proposed solar project site.

Grazing & Access issue:

The solar project site, it is seen that local communities are using proposed government land for grazing of their animals, and it is commonly found during site visit. The village road going to Sangram Ki Dhani is not impacted by the proposed project. Currently as per the consultations carried out with the villagers, there will not be any access issues faced by the villagers. The village road going to Sangram Ki Dhani is not impacted by the proposed project. Project proponent will develop alternative approach road to Tamchi Ki Dhani as communicated during site visit.

There is no designated land for grazing in Rivdi village as a result, cattle are dependent on open land for grazing which includes both government as well as private land parcel.

Wind Site: Site visit and consultations with local communities were carried out in all 7 Villages of WTG locations and it is seen that WTG locations have been identified on government land. However, the proposed project land is surrounded by private land and agriculture activities are being practiced in Harwa and Devka which is evident during monsoon reason (Jun-September). Rest of the year, it is dry land with not much vegetation and no agricultural activities reported. The region falls under rainfed zone and agricultural activity is fully dependent on monsoon. The land is cultivated in Kharif season only. A total 48 survey numbers of government land are identified for WTG locations for wind energy project is spread over seven villages Out of 48 survey numbers, there is farming activities on 7 survey numbers.

Permanent and temporary structure

A total 23 number of households are impacted by the project. Approx. 29 structures have been impacted due to wind project. Majority of the structures are permanent in nature like residential houses (13) and few temporary structures like huts used for storage of fodder and food grains (12), common property (2), religious place and 1 underground well. Also, two abandoned structures are reported on government land in Devka village.

Transmission Route: It is reported that the survey for the transmission route has been completed, however, the route finalization is underway. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent. As per the updates on the T- line, ROW land will be 30 m. Consultations were carried out in few identified villages like Harwa, Devka, Devikot, Rivdi, Bhiyaasar, Mati ka gol, Sangramon ki dhani, Sanguar and Kair Fakiron ki dhani, Kota and Unda from where transmission route would pass. It was observed that few villages are already having Wind turbine from other developers. Local communities are mostly involved in agricultural, and agriculture related allied activities. Animal husbandry is commonly practiced in all communities and it is another major source of livelihood. Land entitlements are seen across all communities and even marginalized communities are

having sizable number of land ownership. On and average, all communities having 10-12 acres (20-22 bigha) of land.

Since this is entirely Revenue Land, SBE is required to make an application to RRECL which then recommends for allotment of the said project land to District Collector for allotment. After obtaining necessary NOCs and approvals from relevant govt. departments, allotment order is issued by District collector and lease deed is signed. At present, owner is Govt. of Rajasthan and Application has been made to RREC for allotment of land.

Lease Rent @ 5% of DLC for 30 years with an increase of 5% every two years and one-time Land Cost @ 100% of DLC applicable at the time of allotment.

No conversion is required as land will be allotted by Govt. of Rajasthan for specific purpose of establishment of Solar/Wind Energy Project. However, for valuation purpose present rate of DLC is Rs.3,31,000/-Ha for Solar and Rs.2,81,000/-Ha for Wind.

2.4.2. Water Requirement

During the project construction phase, water is required for preparing RCC foundations for module mounting structures, building control room and security rooms, and domestic purpose such as drinking and washing by the construction workers and staff. As reported to Arcadis, water will be sourced from safe authorized sources through vendor and supplied by tanker during construction phase and will be under the scope of the EPC Contractor. Drinking water requirement during the construction phase will be met via local tankers/ approved vendors. As per the categorization by CGWB the Blocks where the project sites are located falls under over exploited category. Hence, impact on the ground water is anticipated to be High.

As per Project DPR, water availability for site construction may be delivered by from authorized bore wells outside the plant area but the water quality may need to be assessed by the developer for construction use. In case if Ground water is used then prior approval from the appropriate Government Water supply authority shall be taken. Water can also be made available by tankers and open reservoirs, though the authorized water suppliers. Additionally, plant may also develop its own internal water harvesting system as feasible after the topography study to elevate the ground water level in the area. The Project may have in-house developed semi-automatic module cleaning system which uses compressed air and water for module cleaning. The Project Company is exploring dry (Waterless) cleaning technologies which will be included intermittently with semi-automatic cleaning system currently implemented. It is proposed to develop rainwater harvesting cum storage facilities within site to meet the water requirement of the project as well as for the benefit elevating ground water level.

Water requirement as per MNRE is 5.5 KL per MW of solar for 10 wet cycles in a year which amounts to 55 KL per MW of solar per year or total 23,100 KL per year (or 77 KLD considering 300 days in a year) for the entire solar project.

Water will be required for domestic purposes by the operations staff. The indicative estimated quantities of water required during the construction and operation phases are presented below **Table 4**

Table 4: Water Requirement During Construction and Operation Phase

Phase	Activity	Max. Consumption
Construction	Civil works water requirement (53 WTG @ 60KLD/ WTG)	3180 KLD
	Domestic use – drinking (during peak construction phase) considering 2000 persons @ 110 lpcd	320 KLD

Operation	Domestic use – considering 150 operation and maintenance (O&M) site personals and security guards @ 45 lpcd	6.75 KLD

As reported by SBE, construction phase water need will be sourced through vendor and supplied by tanker and for operation phase it may be sourced through approved/ authorized water tanker vendors. As confirmed by Developer, the likely source for water will be approved source i.e., nearby canal. Or any other govt approved source. Water procurement will be under scope of EPC Contractor, no water will be directly procured by SBE.

Drinking water requirement during the construction & operation phase will be met via local tankers/ approved/ authorized vendors.

2.4.3. Manpower Requirement

As reported, approximately 2000 labours are estimated to be deployed in the peak construction phase for the foundation structural work, fencing, cleaning and erection of mounting structure. The contractor workforce will comprise of both skilled and unskilled labors. Majority workers will be sourced from the nearby villages depending on their skills and capabilities.

In the operational phase, a total of 150 personnel (approximate) expected to be required onsite including security guards, operation and maintenance officer and site engineers for O&M activities.

2.4.4. Wastewater Treatment and Disposal System

During the construction phase, the wastewater or sewage from site office toilets will be disposed in a septic tank. Proper storm water channels would be constructed along the periphery of the project site for draining of site run off. The domestic wastewater would be managed through septic tanks followed by soak pit.

2.4.5. Logistic Arrangement

Labour Camp: The project is in construction phase and land identification & land leasing process is under process. SBE will engage the contractor for construction purpose. Unskilled labors will be hired locally, and the technical work will be undertaken by the skilled personnel who will stay in rented accommodation nearby to the site area village. As reported by SBE, labour accommodation for solar plant shall be constructed at site after EPC contractor will be mobilized and labour camps will be constructed within the periphery of Site. And for wind project, it is constructed in nearby villages/towns. The village where the labour camp will be and how many people will be residing there has not been decided yet.

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

2.4.6. Implementation Schedule for the Project

The proposed project is expected to be commissioned in Q3 of 2021 as reported by site representative of SBE.

Organizational Structure

Organizational structure at project level, represent communication and working relationship at project level. At project level, implementation of management plans and corrective actions are the

responsibilities of EHS specialist. In construction and operational phase, site EHS specialist will supervise the third party EHS engineer performance to implement the management action plans in coordination with site manager. On the performance and completion status, site EHS reports to Head EHS.

Social, Health, Environment and Safety Management System (SHES) Committee:

SHES committee is formed at corporate level to review the performance of project on environmental, health, safety and social aspects. Regular updating of SHES is the responsibility of SHES committee in addition to support the top management to achieve the goals as committed in the Policy. SHES committee is formed consisting of one member from HR, Finance, Project and Quality Health, Safety and Environment (QHSE) departments. The QHSE Head is the SHES coordinator for implementing this SHES and will need to interface with several other departments to ensure smooth and efficient functioning of the SHES. SBE employees will be responsible for compliance with EHS regulations and requirements in their work areas.

Key responsibilities are as follows:

- Work in conformance to organizational policies for environmental and social performance
- Understand the SHES
- Complete training on environment, health, safety and social aspect according to work area
- Reporting Environment, Health, Social and Safety (EHSS) related issues & incidents in respective area.
- Ensure fulfilment of requirement of SBE 's ESMS through contractors by providing them training and information on E&S management system (if required) and making necessary provision in their agreement.

Given the footprint of the project will be limited to the sites and their immediate vicinity and the range of stakeholders' dependent on the project site for various usages, SBE should ensure that its hired contractors deploy a social officer or site In-charge to manage social (including labor and community) issues.

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 body for (i) regulating and ensuring environmental protection; (ii) formulating the environmental policy framework in the country; (iii) undertaking conservation & survey of flora, fauna, forests and wildlife; and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Several laws have been framed for protection of environment and for Occupational Health & Safety in India by the Central Government. The relevant regulation pertaining to the project activity has been discussed as under. The compliance to all environmental, health, safety and social regulation have been presented in **Table 5.**

Table 5: Applicable Environmental, Health, Safety and Social Regulations

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability /Remarks
1.	The Air (Prevention & Control of Pollution) Act 1981	Rajasthan state Pollution Control Board (RSPCB)	With reference to the CPCB modified direction No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016 Hybrid power project falls in White category and it is mentioned in the notification that there shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice.	*Not Applicable but RSPCB should be informed and SBE will ensure the same*
2.	The Water (Prevention & Control of Pollution) Act 1974	RSPCB	With reference to the CPCB modified direction No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016 Hybrid power project falls in White category and it is mentioned in the notification that there shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice.	*RSPCB needs to be informed and SBE should ensure the same.*
3.	Guidelines/Criteria for evaluation of proposals/requests for ground water abstraction (With effect from 16.11.2015)	Central Ground Water Authority	As per the Central Ground Water Authority (CGWA), Guidelines/Criteria for evaluation of proposals/requests for ground water abstraction (With effect from 16.11.2015). This guidelines for abstraction of ground water in Notified/Non-Notified areas needs to be followed. Developer contractors needs to take NOC from CGWA.	*Applicable* *This stands applicable in the event developer/project proponent install bore well for ground water abstraction to meet water requirement for construction and operational phase.*
4.	Forests (Conservation) Act, 1980 and Rules 1981	Forest Department	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests and Climate Change (MoEF&CC)	*Not Applicable* *As reported, no forest land is involved for the development of this project.*
5.	Environmental Impact Assessment (EIA) Notification 2006 & MoEF&CC Office Memorandum dated 30th June'11.	MoEF&CC	The EIA Notification 2006 and thereafter the MoEF&CC Office Memorandum dated, 13th May 2011 exempts Hybrid power project from obtaining prior Environmental Clearance from the regulatory authorities. But, under the provision of MoEF&CC office memorandum dated 30th June 2011, requisite permission is required to be obtained from competent authority for water and land usage.	*Not Applicable.* *Hybrid power projects (wind & solar) are not covered under the 2006 EIA notification and therefore, exempt from EIA process for obtaining environmental clearance.*

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability /Remarks
6.	Environment (Protection) Seventh Amendment Rules 2009	CPCB	Ambient air quality monitoring should be carried out and the concentration limits for the air quality parameters should be in compliance with NAAQS 2009. Activities in the project especially during construction should not result in exceeding National Ambient Air Quality Standards (NAAQS) for ambient concentrations of air pollutants (such as particulate matter). If violation of the Rules takes place, then the penalty will be decided based on the parent Air Act 1981.	*Applicable during construction phase and during operation phase*
7.	Noise (Regulation and Control) Rules 2000 amended in 2010	RSPCB	The Rules stipulate ambient noise limits during daytime and night-time for industrial, commercial, residential and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the EPA Act 1986.	*Applicable during construction phase and during operation phase* *Installation of solar panels, construction activities may generate significant amount of noise. During operation phase noise generation is expected from inverter room.*
8.	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008 Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016.	RSPCB	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.	*The operation phase of the project will result in generation of some quantities of hazardous waste, mostly in the form of waste/used oil released from transformer. In this regard, with reference to the stated rule, transformer oil and their tank bottom sludges is defined as used oil and included in schedule I of list of processes generating hazardous wastes.* *During the construction DG sets will be used for the civil work. As per the site protocols, oil for DG sets is stored in containers. The operation phase of the project will result in generation of some quantities of hazardous waste, mostly in the form of waste/used oil released from transformer as well as broken solar panels. SBE needs to tie-up with any CPCB/ SPCB authorised hazardous waste recycler who has obtained consent/authorization for storage of transformer waste oil. All the hazardous waste generated due to the project should be stored and disposed as per the requirements of Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016. i.e., on a paved surface in a*

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability /Remarks
				designated area with adequate secondary containment, with adequate labelling and before it is disposed to an PCBA approved vendor. *Broken solar panels are recommended to be disposed through an authorised vendor.*
9.	Wildlife (Protection) Act 1972, Wildlife (protection) Amendment Act 2002 and 2003 amendment.	Chief Conservator Wildlife, NBWL/State Forest Department and MoEF&CC	The Act provides for the protection of wild animals, birds and plants; and for matters connected therewith or ancillary or incidental there to. The application of the Order of the Honourable Supreme Court in WP 460 of 2004 dated 04.12.2006 in the matter of Goa Foundation v. Union of India and other wherein the Honourable Supreme Court has directed that all projects which require environmental clearance and are located within the distance of 10Km of National Park and Sanctuaries must be placed before the standing Committee of the National Board for Wildlife constituted under the Wildlife (Protection) Act, 1972.	*Not applicable.*
10	The Water Prevention and Control of Pollution), Cess Act, 1977 including Rules 1978 and 1991	Rajasthan State Pollution Control Board	This Act provides for levy and collection of Cess on water consumed and water pollution caused. It also covers specifications on affixing of meters, furnishing of returns, assessment of Cess, interest payable for delay in payment of Cess and penalties for non-payment of Cess within the specified time. Industries consuming water less than $10m^3$/day have been exempted from levy of Cess provided they are not generating hazardous wastes.	*Not applicable in case construction water to be sourced from authorized venders only.*
11	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 shall be met through DG sets, which will adhere to prescribed CPCB noise level limits and noise control measures.*
12	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,	*Applicable during construction phase* *Project proponent will ensure through its contractors that basic amenities are provided to the labourers. Project proponent through its contractors should also ensure all vendors employed should have valid labour license. Compensation to workers (own and vendors)*

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability /Remarks
			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.	*should not be below daily wage rate as specified by Government. Muster roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with.* *Failure to comply results in financial penalty /imprisonment of the principal employer along with vendor and closure of project*
13	Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008, (CET)	Min. of Power, Central Electricity Authority	The Act is applicable for the Wind - Solar Hybrid Power Project as the plant is going to be having electrical appliances and facilities installed for grid connected power generation. As per the act, all equipment's and system installed should comply with the provision of the statute, regulations and safety codes.	*Applicable both during construction and operation phase* *Project proponent under provisions of the CET regulations ensure that the health and safety requirements and provisions for transmission lines specified under the rules are complied.*
14	Workmen's Compensation Act, 1923 & Rules 1924	Labour Welfare Board, Rajasthan	The Act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer should be liable to pay compensation in accordance with the provisions of this Act.	*Applicable during construction and operation phase.* *Project proponent should ensure through its contractors in case of any accident/ injury/ loss of life the workmen should be paid a minimum compensation as calculated under this act both during construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.*
15	The Contract Labour (Regulation and Abolition) Rules, 1971	Labour Welfare Board, Rajasthan	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	*Applicable during construction and operation phase.* *All vendors employed including contractors should have valid labour license. Compensation to contract workers (own and vendors) should not be below daily wage rate as specified by Government of India. Muster*

S.N.	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability /Remarks
	Contract Labour (Regulation and Abolition), 1973		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.	*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.* *SBE through its contractors should also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and in compliance with the standards.*
16	Minimum Wages Act, 1948	Labour Welfare Board, Rajasthan	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 during construction and operation phase*
17	Factory License under factories act 1948	Central Government	With reference to the factories act 1948, the same is applicable because this solar plant generating, transforming or transmitting electrical energy and more than 10 workers are employed/working at site.	*Applicable.* *SBE should obtain the same for this project during Project Commissioning.*
18	The Child Labour (Prohibition and Regulation) Act, 1986	Labour Welfare Board, Rajasthan	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work.	*SBE should ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. SBE should include a clause in the subcontractor agreements prohibiting employment of child labour.*
19	Companies Act, 2013	SBE	According to Schedule 135 subsection 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.*

3.2. Environmental and Social Performance Standards of the International Finance Corporation

The International Finance Corporation (IFC) has laid down a set of eight Performance Standards (PS) and project developers need to comply with applicable PS while establishing the project in the event the project is financed by IFC or multinational funding institution. The provisions of the Performance Standards relevant to the Hybrid power projects are summarized below:

Table 6: IFC's Environmental and Social Performance Standards

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	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 was appointed by SBE Renewables Ten Pvt Ltd to undertake ESIA study to identify the environment and social risks that may arise due to the Hybrid power project and recommend mitigation measures for the same as provided in **Chapter 6.** The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The project is a Hybrid power project and will have environmental and social impacts resulting generation of noise, construction activities etc. **PS 1 is therefore applicable for the project.**	SBE has developed an Environmental and Social Management System at the corporate level as well as adhere to the environment and social management plan recommended for its wind-solar hybrid project at the ground level. SBE is required to fulfil the following requirements: • Environmental and social action plan. • Identification of risks and impacts. • Management program. • Organizational capacity and competency. • Training for security and safety workers. • Emergency preparedness and response. • Stakeholder engagement/ grievance redressal; and • Monitoring, reporting and review.
	Establish Environmental and Social Management Plans commensurate with the findings of the ESIA and consultation with affected communities	An Environmental and Social Management Plan has been prepared and incorporated in Chapter 7 of the ESIA report taking into consideration the potential social and environmental impacts or risks already identified & assessed in ESIA.	• ESMS – SBE is having a ESMS Check list for Project Phase as well as operation phase. This check list will be used for ESMS Audit on monthly basis and the same shall be considered during the monthly contractor performance evaluation • EHS Manual – SBE has a standard contract manual for its Contractors. Based on that contract EHS manual, Contractor prepare and submit their project

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
	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.	specific EHS manual which are validated and approved by SBE during the mobilization phase of the project. • Ensuring the Implementation – The Monthly audits are conducted based on the EHS manual in the name of SAY-DO audit. • Labour camp Requirement also be mentioned in the EHS manual. • EHS&S Rev1 EPC Domestic – SBE EHS&S Contract condition for Contractors, SAY Do Format – Monthly SAY-DO Audit format, ESIM Audit Tool are examples of Project ESIM Audit tool during construction and operation phase
	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.	This should aim to inform the community project related adverse impacts or risks. The grievance redressal mechanism has been developed and presented in Sl. No 6.7.7. Also, SBE's Grievance Redressal Mechanism (GRM) is in place which is recommended for implementation 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 the results of Action Plans, commensurate with the concerns of the affected communities	System of monitoring with periodic audits will be established at all the six study area villages.	
PS 2: Labour and Working Conditions		The PS 2 applies to workers directly engaged by the client (direct workers), workers	SBE should ensure that adequate facilities and amenities are provided in the labour accommodation for construction workers including adequate living/sleeping

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
		engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers). The project involves employment of 2000 nos. direct and contracted workers during construction and 350-375 no's during operation phases. Locals will be hired to carry out unskilled work. **PS 2 is therefore applicable for the project.**	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. The company will periodically review and monitor the condition of the labour accommodation. The worker accommodation standards as laid down by ILO is presented in the below sections. The company, as a part of oversight procedures will need regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met at all the project sites. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system at all the said project sites.
	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		SBE has HR policies at the corporate level. SBE should inform their employees their rights under national labour and employment laws. The company will need to communicate with the contractors on its SHES system and HR policies. As per the PS 2 requirements, SBE will ensure access to grievance mechanisms, health & safety, benefits and welfare provisions etc. to all workers. Provision of trainings and capacity building support will have to be provided to the contractors. The company, as a part of the contractor oversight procedures will need regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system. SBE will also require the developer to ensure usage of relevant personal protective equipment, implement work permit and incident/accident recording/ reporting systems etc.).

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
	Document and communicate to all employees' conditions and terms of employment.	Applicable during construction and operation phase	SBE would engage labourer through its contractors, however the same should be supervised so that the engagement of workers is in accordance to applicable rules and regulations. SBE and their contractor will ensure adequate provisions of facilities such as access to clean water, sanitary facilities and other necessary facilities at the labour accommodation and construction sites.
	Practice non-discrimination and equal opportunity in making employment decisions	Applicable during construction phase	Need to be complied. Equal opportunity should be given to both men and women depending on their skills and capacity wages, work hours and other benefits should be as per the national labour and employment Laws.
	Provide a mechanism for workers to raise workplace concerns.	Applicable during construction and operation phase	SBE 's Grievance Redressal Mechanism (GRM) should be in place under integrated management policy the same will be implemented at project level. This is applicable both during construction and operation phase and should be supervised by SBE. This is applicable both during construction and operation phase and should be supervised by SBE
	Provide workers with a safe and healthy work environment, considering risks inherent to the particular project sector	Applicable during construction and operation phase	SBE or their contractor should follow its EHS policy while operating onsite. In absence of EHS policy of contractor, EHS policies of SBE will be applicable. SBE or their contractor should appoint an EHS manager onsite, who has well defined roles and responsibilities at all the solar power site
PS 3: Resource Efficiency & Pollution Prevention		PS-3 is applicable to projects resulting in increased levels of pollution and requires project to avoid, minimize, or reduce adverse impacts on human health and environment by	During construction water is sourced through vendor and supplied by tanker and during operation phase water will be sourced through the same means. Drinking water needs during the construction phase will be met via local tankers/approve vendors. Drinking water supply will be met by local tankers/packaged water. In the event, project proponent installed bore well in future for ground water extraction in the operational phase,

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
		adopting pollution preventive and control technologies throughout the Project life cycle. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for the development of project will result in generation of wastes like wastewater, waste oil and construction debris. The operation phase will result in noise emissions and generation of minor quantities of waste such as transformer oil which may result in contamination of ground and nearby surface water. **Hence PS 3 is applicable for the project.**	permission from regulatory authority shall be obtained prior to extraction of ground water through borewell. The project is expected to contribute to significant GHG avoidance beginning in FY 2021 – 2022. No material impact on ambient air quality is expected on account of this project. However, temporary impacts on ambient air quality and noise levels may be expected during construction phase. However, temporary impacts on noise levels and shadow may be expected during operational stage. Project developer should implement measures to minimize noise and shadow in this stage. SBE should implement measures during construction for management of excavated earth and construction rubble, and minimization of fugitive dust emissions. Further, SBE 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 authorized debris disposal areas. No material impact on surface or groundwater resources is expected on account of the project, except that the water sourcing requirement during the construction phase will need to safeguard the immediate and medium-term needs of water by the local communities. The sub-contractors should ensure that the water made available to workers and employees' meets national potable water quality norms. The project site if equipped with appropriate facilities for collection, treatment and disposal of sewage (septic tank and soak pit) which is used both during construction and operation phases should be provided. Further, SBE should ensure through its contractors that other wastes (packing material, metal, debris, cement bags, drums/cardboards etc.) are collected, stored and

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
			disposed to re-users or in appropriate authorized debris disposal areas. Limited concreting work is expected for structure foundations, sub-station, and transmission towers. Cement concrete mixers will be expected to be used at site since significant concreting work is not expected. Concreting and other construction activities including use of earth moving equipment and increased traffic for material movement is expected to result in increase in ambient noise levels. However, this increase is short term during construction stage only. The construction work will be carried out only during daytime and no noise generating equipment will be operated at night.
	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, the vehicles involved for hauling of equipment's and materials to the project site may increase the pollution level and dust in the air.	Project developer should ensure water sprinkling as and when needed on the unpaved roads to reduce dust emission. All the project vehicles should have valid PUC.
	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.	SBE should plan and implement pollution control measures. Practices like minimal release of waste, safe disposal of waste, wastewater management etc. should be considered in all phases of project life cycle.
PS 4: Community Health, Safety and Security		This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. The project will involve transportation of components such as mounting structures, electrical equipment's, solar	The Applicability will be limited to construction period with movement of heavy machinery / vehicles. Unskilled labour and security staff should be engaged from local community. SBE through its contractors will try to engage maximum workers from the neighbouring villages. During operation phase effects due to shadow flickering and noise generated due to wind turbines will pose an impact on the community if properly not mitigated.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
		modules, which may pose safety risks to the local communities. While Hybrid power projects have a limited and controlled footprint major issue is related to glare or reflection. Considering scale of project substantial movement of heavy vehicles are envisaged. Impacts due to generation of noise and shadow – flicker effect will be assessed on habitations that are close to wind turbines. ***The PS 4 is therefore applicable for the project.***	The construction phase will involve movement of vehicles on the approach road passing through villages on both the land parcels proposed. The traffic must be managed near villages/settlements/social infrastructure like school, etc. Further, at the project site, the company will need to exercise appropriate access control, barricading of excavated areas; safety signage; illumination and other measures to prevent the risk of accidents for public during construction and operation. It should be ensured by SBE that the subcontractors use vehicles having valid PUC certificate. The Proper signage's should be provided along the access road and project site indicating 'Construction in Process' and other safety alarm signs, preferably in local language. Also, the project envisages influx of labours from different nearby areas. As such community health and safety need to be taken care by the project developer and ensure safety measures to be put in place both during construction and operation phase of the project.
	Evaluation of risks and impacts of the project on health & safety of the affected community during the project lifecycle and establish preventive/mitigation measures to reduce/ minimize the impacts. Disclosure of action plans to affected community and the government agency.	During Construction Phase	The potential occupational hazards arising from the project activities and the impacts on health & safety of the affected community have been identified and assessed in Chapter 6 of ESIA.
	Design, construct, operate and decommission of Structural elements or components in accordance with good industrial practice to reduce impact on community health & safety.	During Construction Phase	An occupation health safety plan has been formulated (Chapter 7) of this report. All steps to reduce the impact on the health and safety of the community to minimal will be taken.
	Minimization of impacts on the health and safety of the community caused by natural hazards that could arise from the land use changes due to project activities.	During Construction Phase and Operational phase	A management plan (ESMP) has been formulated as part of ESIA process to address the issue.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
	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	As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all the locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent. The proposed 526.9 MW Hybrid Power Project is proposed to be developed on government land parcels measuring approximately ≈1090.223 Ha, of which, ≈833.65 of proposed government land has been leased for Solar from Reevadi village of Seo taluk in Jaisalmer district and 256.571 Ha. for wind project in 7 villages (Mati Ka gol, Manihari, Harwa, Junejon ki Basti, Bhairopura, Rajda and Deoka) of Sam block in Barmer District. Since the project developer is not involved	GRM and SEP as developed as part of ESIA / ESMS to be implemented to address the grievances if any related to lease of Government.
	Avoidance or at least minimization of involuntary resettlement by exploring alternative project designs balancing environmental, social and economic costs and benefits; and by acquiring land through negotiated Settlements.		
	Compensation and benefits for displaced person as per Performance Standard		
	Disclosure of all relevant information and consultation with affected persons and communities in decision making process related to resettlement.		
	Establish a grievance mechanism to record and resolve communities' concerns and grievances about the relocation (if any) and compensation		

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
		in land acquisition and no physical or economic displacement anticipated for this project. **Therefore PS 5 is not applicable for this project**.	
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	As a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle.	• The project site is located 30 kms from the land parcel in solar side project area- Survey No 295 and 45 kms from WTG- SBE 37 from Desert National Park. • The project area consists of a mixed habitat. Natural as well as modified in the project area for the solar plant as well as the wind project site. As per the requirements for a mixed habitat the client is committed to implementing measures to minimize habitat fragmentation, such as biological corridors; restoring habitats during operations and/or after operations; and implementing biodiversity offsets.	Following actions are required to be taken • **During Construction Phase** • Activities generating high noise shall be restricted to daytime and will be mitigated to minimize the noise level outside the site boundary. • General awareness regarding flora plantation shall be enhanced through trainings, posters, etc. among the staff and labourers. • Fencing along with proper lighting along the fencing must be constructed. • Food waste shall be collected in a manner that it does not attract scavenging animals. • Temporary barriers shall be installed on excavated areas. • The footprints of the construction activities shall be kept to minimum so as to reduce disturbance to flora and fauna. • If any nests of ground dwelling birds/ reptiles are found the Forest Department is to be notified so that the eggs of reptiles/ birds don't get displaced. • Pre-clearance biodiversity survey protocol is to be carried out to identify important biodiversity features (e.g., nests, roosts, burrows) prior to construction to be included in construction-phase ESMS.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
		• Champion and Seth (1968) have classified these DNP forests as Tropical Dry Deciduous & Tropical Thorn Forests. • Also, no forest land is involved in this project. • Based on secondary literature 5 critical endangered species are present in the landscape viz, Sociable lapwing, White-rumped Vulture, Red-headed Vulture, Indian Vulture, Great Indian Bustard. **PS -6 is applicable for the project.**	• **During Operation Phase** • Fencing of appropriate height should be properly maintained along with lighting. • 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. Moreover, to minimize "Lake effect", visual frightening techniques may be considered to frighten any bird trying to land on panels and prevent birds from landing. • As WLPA, 1972 Any accidental death due to species listed in the schedule will lead to legal action against the responsible party irrespective of the location where the incident occurred. • The power pole configuration should be designed to minimize avian electrocution risk • Bare phase wires, jumper wires etc. should be covered by a non-conductor insulated material. • Bird diverters / line markers should be installed for increasing the visibility ad detection of the earth wires. • Painting the tip of the blades for better visibility • Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors near to the WTGs • While planning project transmission lines, feasibility should be checked for avoiding water bodies crossings. This can be considered for water bodies that could be important when they turn into suitable habitats. • Native vegetation must be planted or allowed to grow around the wind-turbines, such that their canopy

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
			screens potential prey on the ground from raptors flying overhead. • Appropriate storm-water management measure shall be implemented to avoid creating ponds which can attract birds and bats for feeding or nesting in the windfarm area • Training of local staff and security guards for spotting of bird carcass and reporting the same. This will help to ensure the strategic actions when the species are spotted in the region. • Towers be regularly checked to avoid any nesting in any suitable gaps or platforms. • Flash lamps on the WTGs should be installed to reduce the collision risks during nights. • Mandatory shutting down of turbines at specific locations or times during peak migration and breeding season of the birds (Further detailed study required to identify avifauna migratory routes) • Strategic placement of wind turbines by avoiding sensitive locations within the designated area such as congregation of vultures around carcass dump sites, or waterbodies as they would be hotspots of winter migratory birds. • Regulate blade speed periodically to reduce collision risks during winter season and monitored by SB Energy technical team • Fewer but larger turbines may also reduce collision risks (Barclay et al 2007, Smallwood and Karas 2009). Also, the spacing between the turbines can be strategized to reduce risks.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
			• During construction and post construction monitoring of the birds is essential to identify and address any long-term environmental impacts • Painting single wind turbine black. A recently published research article provides evidence that painting a single wind turbine blade black reduces collision by 70% and is particularly effective for large birds of prey especially vultures. The paper was published in Ecology and Evolution by researchers from the Norwegian Institute for Nature Research, Norway, and the Lake Ånnsjön Bird Observatory, Duved, Sweden. • A fatality monitoring program will be implemented in the wind site and certain high-risk sections of the transmission line during the operations phase following Good International Industry Practice. The fatality monitoring will be described in the Operations Phase Monitoring and Management Plan. • In consultation with the communities, outline and agree on an approach to remove livestock carcasses from the project site and/or modify disposal practices so that they do not attract vultures and other raptors to the wind energy facility. The Carcass Livestock Disposal Program will be described in the Operations Phase Monitoring and Management Plan that will be finalised by client. • An Operations Phase Biodiversity Management Plan will be developed by client for both the wind and transmission line describing (i) the Fatality Monitoring Program; (ii) the Carcass Livestock Disposal Program; (ii) an Adaptive Management Plan,

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
			including quantitative fatality thresholds and reporting requirements; and (iv) a maintenance schedule for the bird flight diverters on the on-site collector lines and on transmission line.
PS 7: Indigenous Peoples	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. Therefore, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities	The consultation revealed that local ST community are not socially secluded. They live with the mainstream population & have access to all common property resources. Also, as reported, no ST land was planned/undertaken for the project. Considering the fact of not taking ST land in project, and no physical and or economical displacement of tribal populations is necessitated, therefore, no adverse negative impacts are envisaged due to project development. There is no impact expected due to construction/traffic/noise/shadow flicker etc. No Bhil community/Indigenous People have their land in the proposed solar site or wind sites. Therefore, PS 7 is not applicable.	-
PS 8: Cultural Heritage	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients	***PS8 is not applicable.***	Chance find procedure could be formulated under PS 8 in case of discovery of any artefacts and/ or settlement in the future at proximity of the project area.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Requirements
	protect cultural heritage during their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.		

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 as a result 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 number, generally site-specific, largely reversible and readily addressed through mitigation measures.
- **Category C Projects**: Projects with minimal or no adverse social or environmental risks or/and impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks.
- **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.

With respect to the intensity of impacts due to project activities on environment, resources, biodiversity, labors and community, the project can be categorized as **Category B** (as per IFCs categorization of projects), which specifies that this project is expected to have limited adverse environment and social impacts, which can be mitigated by adopting suitable mitigating measures.

3.4. World Bank Group's EHS Guidelines and applicable sector guidelines

IFC has issued Environmental, Health, and Safety Guidelines in 2007. The key requirements stated in the EHS guidelines have been discussed in **Table 7** .

Table 7: World Bank Group's EHS Guidelines and applicable sector guidelines

S. N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
I	**ENVIRONMENTAL ATTRIBUTES**	
i	Air Emissions and Ambient Air Quality	Please refer the section on ambient air quality in Sec 4.3.1 and 6.2.1
Ii	Energy Conservation	Please refer the section on Resource Efficiency & Pollution Prevention in sec. 3.2
iii	Wastewater and Ambient Water Quality	Segregating or diverting clean water runoff to prevent it mixing with water containing high solids content, to minimize the volume of water to be treated prior to release. Refer mitigation measures for water under Table 7.1 and under section 6.2.5
iv	Water Conservation	Refer mitigation measures in Section 6.2.5 and Table 7.1
v	Hazardous Materials Management	Refer mitigation measures in Section 6.2.7 and Table 7.1
vi	Waste Management	Refer mitigation measures in Section 6.2.7 and Table 7.1
vii	Noise	Refer mitigation measures in Section 6.2.3 and Table 7.1
viii	Contaminated Land	Refer mitigation measures in Section 6.2.2 and Table 7.1
II	**OCCUPATIONAL HEALTH AND SAFETY**	
i	General Facility Design and Operation	Please refer the section on Project Design and Technology in Sec.2.4
Ii	Communication and Training	This has been provided in Section 7.1.1 as well as in Section 7.5.2 and 7.5.3.
iii	Physical/Chemical/Biological Hazards	Discussed in Section 6.2.10
iv	Personal Protective Equipment (PPE)	The logistic arrangement for the workers w.r.t. housing space, drinking water, food has been described in section 2.6.5 and 6.2.10. The Occupational health and safety aspects has been mentioned in sec. 6.2.10 and Table 7.1
v	Monitoring	Please refer Section 7.2
III	**COMMUNITY HEALTH AND SAFETY**	
i	Water Quality and Availability	Please refer Section 4.2.5 and 4.2.6
Ii	Structural Safety of Project Infrastructure	Detailed in Section 2.4
iii	Life and Fire Safety (L&FS)	Discussed in Section 6.2.10 and in section 7.5.1
iv	Traffic Safety	Provided in Table 7.1 as well as in Sec. 7.5.8 Providing adequate road drainage based on road width, surface material, compaction, and maintenance. Vehicles should have PUC certificate. Refer mitigation measures for Transport and Traffic
v	Transport of Hazardous Materials	Provided in Table 7.1

vi	Disease Prevention	Provided in Table 7.1
vii	Emergency Preparedness and Response	Detailed in Section 7.5.1
IV	**CONSTRUCTION AND DECOMMISSIONING**	
i	Environment	Baseline environmental conditions have been described in chapter 4.
ii	Occupational Health and Safety	The logistic arrangement for the workers w.r.t housing space, drinking water, food has been described in Sec 2.6.5. The Occupational health and safety aspects has been mentioned in sec. 6.2.10. Proper training should be given to workers working on site. Personal protective gears should also be provided to the workers.
iii	Community Health and Safety	Measures to be taken to address the Community, Health and Safety issue has been addressed in Table 7.1 and the impacts during construction phase is given in Sec. 6.2.10 and management plan given in sec. 7.5.2, 7.5.3 and 7.5.6 Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. Keep stationary source of noise such as DG sets (currently used only for back up) at farthest point from the settlements. During construction phase, safety flags on the roadsides should be displayed during work in progress. The solar project site location should also be fenced/ to prohibit public access to solar power. Follow periodic Grievance Redressal Mechanism framed for site and timely register complaints if any received by locals, investigate and resolve in the best possible manner.

3.5. Equator Principles

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

Table 8: Compliance to Equator Principles

Equator Principle	Applicability	Project Information/Application
Principle 1: Review and Categorisation	As the project is seeking financing from EPFIs, the project has to be categorized based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of IFC (Exhibit I)	Based on the IFC environmental and social screening criteria the Hybrid power project is identified as a "project with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and can be readily addressed through mitigation measures
Principle 2: Social and Environmental Assessment	An Environmental and Social Assessment has to be carried out for the project that addresses relevant social and environmental impacts and risks of the project (illustrative list of issues as found in Exhibit II) and also propose mitigation and management measures relevant and appropriate to the nature and scale of the project.	This report presents the Environmental and Social Impacts Assessment (ESIA) carried out for the project. Land lease has been completed by SBE prior to the development of this project the land parcels were devoid of settlements (as reported) hence does not trigger the requirement of Resettlement and Rehabilitation.
Principle 3: Applicable Social and Environmental Standards	This Principle requires the Environment and Social Assessment to refer to the applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines including the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines.	The ESIA report has been prepared including the requirements of IFC performance standards and EHS guidelines.
Principle 4: Action Plan and Management System	The action plan will describe and priorities the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment	The management plan is given in Chapters 7 of this ESIA report and management plans for addressing for climate change risk and risk towards human rights is given in Section 7.5.11
Principle 5: Consultation and Disclosure	The project affected communities are required to be consulted in a structured and culturally appropriate manner.	Since this is entirely Revenue Land, SBE is required to make an application to RRECL which then recommends for allotment of the said project land to District Collector for allotment. After obtaining necessary NOCs and approvals from relevant govt. departments, allotment order is issued by District collector and lease deed is signed. At present, owner is Govt. of Rajasthan and Application has been made to RREC for allotment of land.
Principle 6: Grievance Mechanism	Proponent is required to establish a grievance mechanism as part of the management system	Grievance redress procedure has been developed by SBE and the same will be implemented at project level. Proper complaints register should

Equator Principle	Applicability	Project Information/Application
		be maintained onsite. This is applicable during both construction and operation phase.
Principle 7: Independent review	An independent social or environmental expert, not directly associated with SBE is required to review the Assessment, action plans and consultation process documentation to assist EPFI's due diligence and assess Equator Principles compliance.	Arcadis has been appointed as third-party expert to assess the environment and social impact of the project as per IFC safeguards to through ESIA study and ESDD study. One ESDD for construction and operation phase each will be conducted
Principle 8: Covenants	The covenants would be a part of the contract documents between SBE and financing agency as well as contractors and technology suppliers	E&S Covenants should be embedded within the contracts drawn between the contractors and technology providers and waste handlers. Periodic reporting should be done
Principle 9: Independent Monitoring and Reporting	EPFIs will, for all Category A Projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.	Arcadis has been appointed as third-party expert to assess the environment and social impact of the project as per IFC safeguards as ESIA study. The requirements of the principle are also met by adhering to requirements of PS 1
Principle 10: Reporting and Transparency	This should be prepared by the EPFI	Based on the audit and monitoring reports submitted by independent agencies the EPFI will report the findings publicly at least once a year

4. DESCRIPTION OF ENVIRONMENT

This chapter describes the existing environmental settings of the project area and its immediate surroundings. This includes physical environment comprising air, water and noise components, biological environment and socio-economic environment. Attributes of the physical environment such as air, water, soil and noise quality in the block and surrounding area were assessed primarily through monitoring and analysis of samples collected from the area.

Information on geology, hydrology, prevailing natural hazards such as floods, and earthquakes 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

To understand and assess the environmental and social risks associated with the project, the study area was divided into core area (5 km around the project site) and buffer area (10 km around the project site).

While selecting locations for primary monitoring of air, noise and water emphasis is given to collect the representative baseline data. Monitoring stations for air and noise has been selected depending upon its proximity to settlements as well as approach roads and availability of power for carrying out monitoring. Three monitoring locations for air and noise each, one monitoring location for surface water and groundwater each has been selected at project site and nearby settlements.

4.2. Baseline Conditions

4.2.1. Climate and Meteorological Conditions

Barmer:

As per CGWB report, the district experiences arid to semi-arid type of climate. Mean annual rainfall (1971-2012) of the district is 374 mm whereas normal rainfall (1901-1970) is lower than average rainfall and is placed at 314 mm. Rainy days are limited to maximum 15 in a year. Almost 80% of the total annual rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September. Probability of annual rainfall exceeding 650 mm is only 10%. However, there is 90% probability that the annual rainfall will be more than 190 mm. The probability of occurrence of mean annual rainfall is 45%. Drought analysis based on agriculture criteria indicates that the district is prone to mild and normal type of droughts. Occurrence of severe and very severe type of drought is very rare. As the district lies in the desert area, extremes of heat in summer and cold in winter are the characteristic of the desert. Both day and night temperatures increase gradually and reach their maximum in May and June respectively. The temperature varies from 49^{o}C in summer to 1^{o}C in winter.

Atmosphere is generally dry except during the monsoon period. Humidity is the highest in August with mean daily relative humidity at 81%. The annual maximum potential evapotranspiration in the district is quite high and is highest (264.7 mm) in the month of May and lowest (76.5 mm) in the month of December.

Recorded high temperatures ranging from 41°C and lowest temperature 9°C.

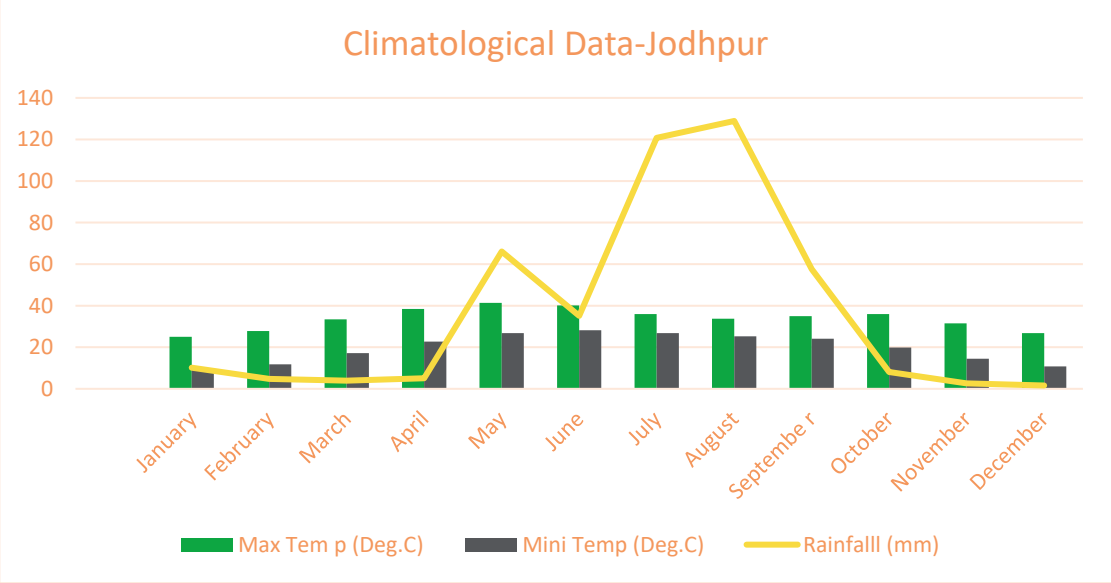
Table 9: Climate Data for Barmer (1901-2000)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest °C	25.0	27.08	33.04	38.4	41.04	40.01	36.00	33.07	35.00	36.00	31.05	26.08
Lowest °C	9.06	11.08	17.02	22.7	26.08	28.02	26.08	25.03	24.01	19.09	14.05	10.08
Average Rainfall(mm) monthly total	10.02	4.08	3.09	5.01	66.01	35.01	120.8	128.09	57.06	8.01	2.06	1.06

Source: India Meteorological Department -Climatological table & CGWB District groundwater brochure Barmer,2013

The monthly mean rainfall distribution of Barmer district for the ten-year period (1901-2000) has been represented below:

Figure 4-1: Monthly mean rainfall distribution of Barmer



Jaisalmer:

As per CGWB the district experiences arid type of climate. Normal rainfall in the district during the period 1951-2000 is 181mm. Mean annual rainfall during the period 2001 – 2011 has been higher than the normal rainfall. Almost 90% of the total annual rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September. As the district lies in the desert area, extremes of heat in summer and cold in winter are the characteristic of the desert. Both day and night temperatures increase gradually and reach their maximum in May and June. The temperature varies from 48 degrees in summer to 2 degree in winter. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity is 43%. The annual maximum potential evapotranspiration in the district is 1850 mm and it is highest in the month of June and lowest in the month of December.

Table 10: Climate Data for Jaisalmer (1901-2000)

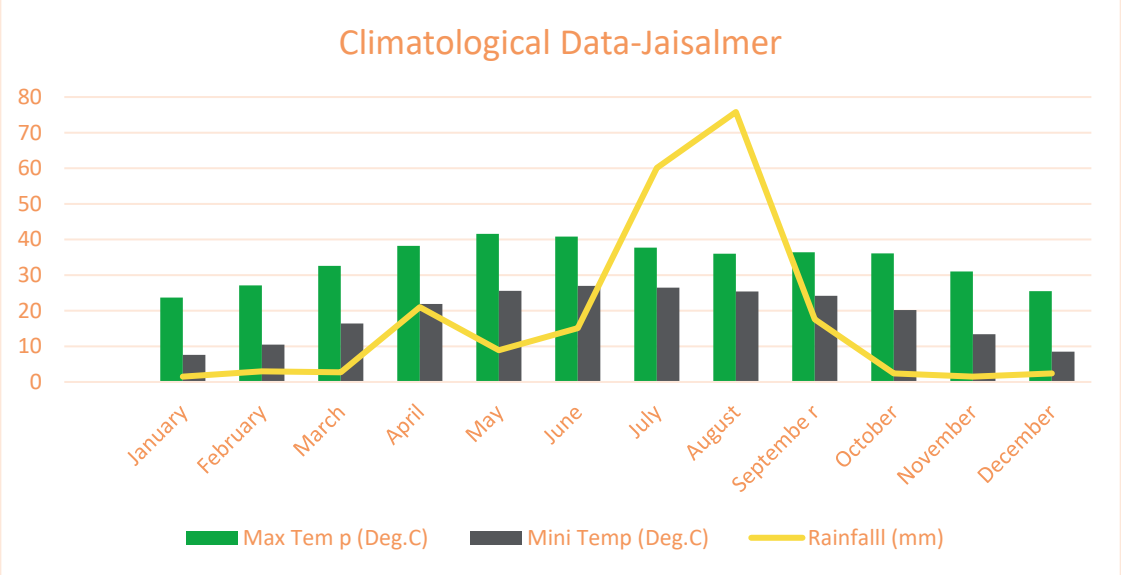
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest °C	23.7	27.1	32.6	38.2	41.6	40.8	37.7	36	36.4	36.1	31	25.5

Lowest °C	7.6	10.5	32.6	38.2	41.6	40.8	37.7	36	36.4	36.1	31	25.5
Average rainfall (mm) monthly total	1.5	3	2.7	21	8.9	15.1	60.1	75.8	17.6	2.4	1.5	2.4

Source: India Meteorological Department -Climatological table & CWWB District groundwater brochure Jaisalmer,2013

The monthly mean rainfall distribution of Jaisalmer district for the ten-year period (1901-2000) has been presented in below.

Figure 4-2: Monthly mean rainfall distribution of Jaisalmer

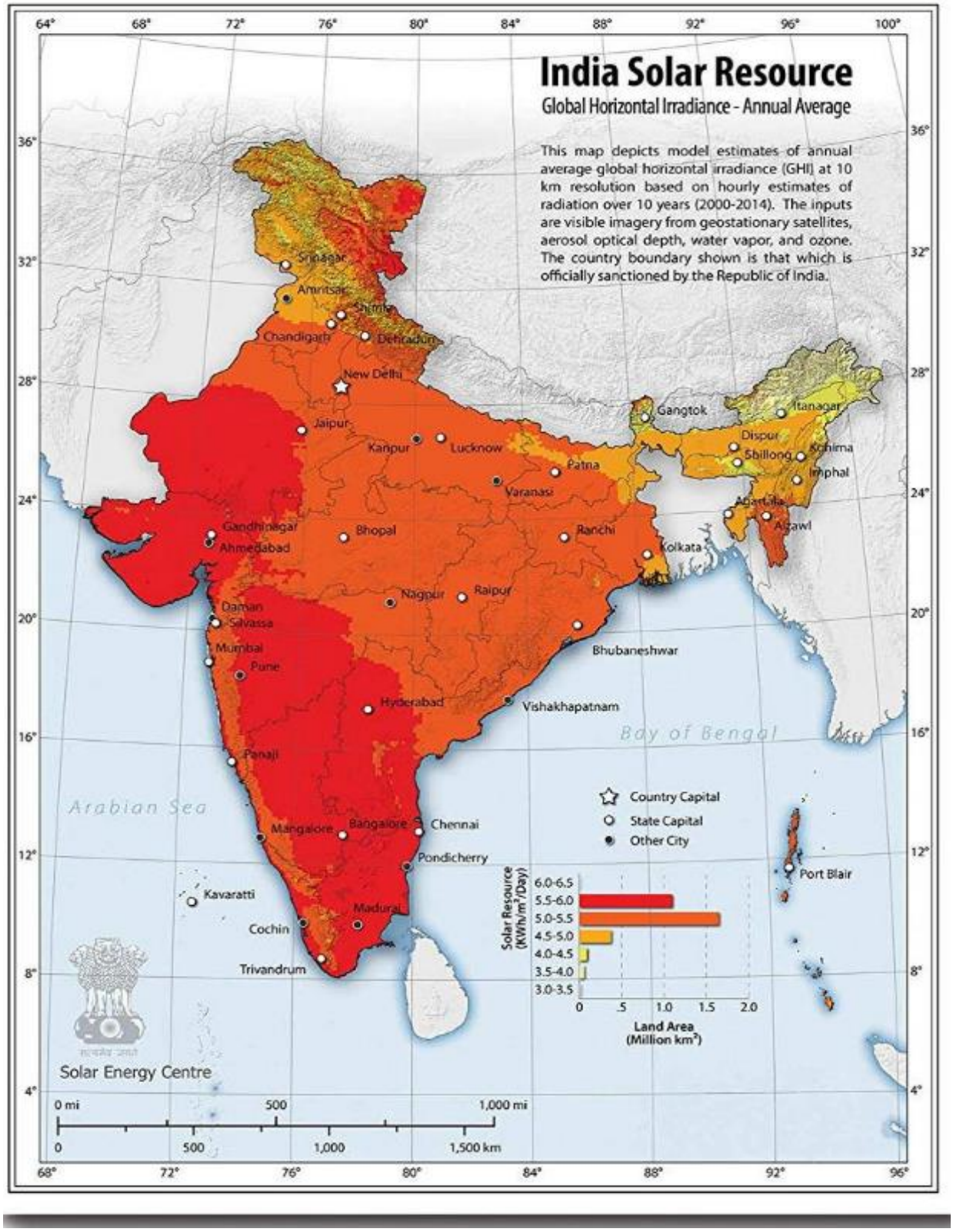


India's Solar Radiation Profile

Selection of project location for solar energy project is very critical with solar intensity playing a key role. Rajasthan receives considerable solar radiation intensity in India. In addition, the average rainfall is very low in the state.

Indian solar radiation map of India, which is based on the measured data of Nation Renewable Energy Laboratory (NREL) and satellite data, indicates that Rajasthan state receives good amount of solar radiation. Rajasthan receives around 5.5 - 6 kWh/sq. m/day.

Figure 4-3: Indian Solar Resources



Source: National Renewable Energy Laboratory

4.2.2. Topography

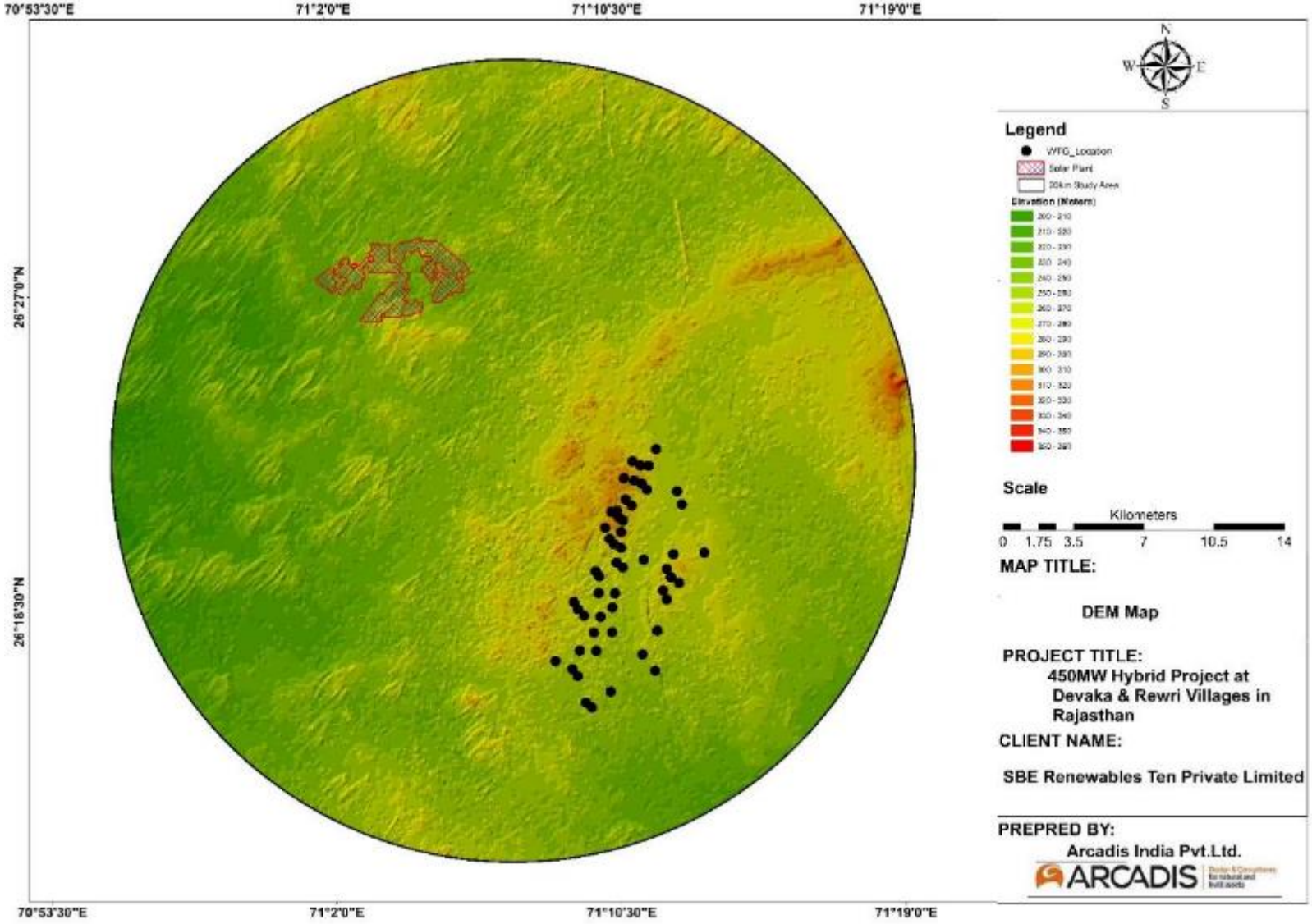
The project site for both wind and solar is spread across open area with mild undulation. Erection of solar panels and WTG structures would not require to be of varying pole height for mounting solar panels as the land is flat and not a large number of slopes exists. Hence, the installation is easy and reduces the cost of technical modifications required to adjust for undulations at the ground. The highest and lowest elevation is 266 m to 220m considering both the study areas. There were no agricultural activities observed in the land parcels of the project sites**.** The digital elevation map is depicted in **Figure 4-4.**

Figure 4-4: Topography of the Project Site

Barmer District Site photos (wind site)

Jaisalmer District Site photos (solar site)

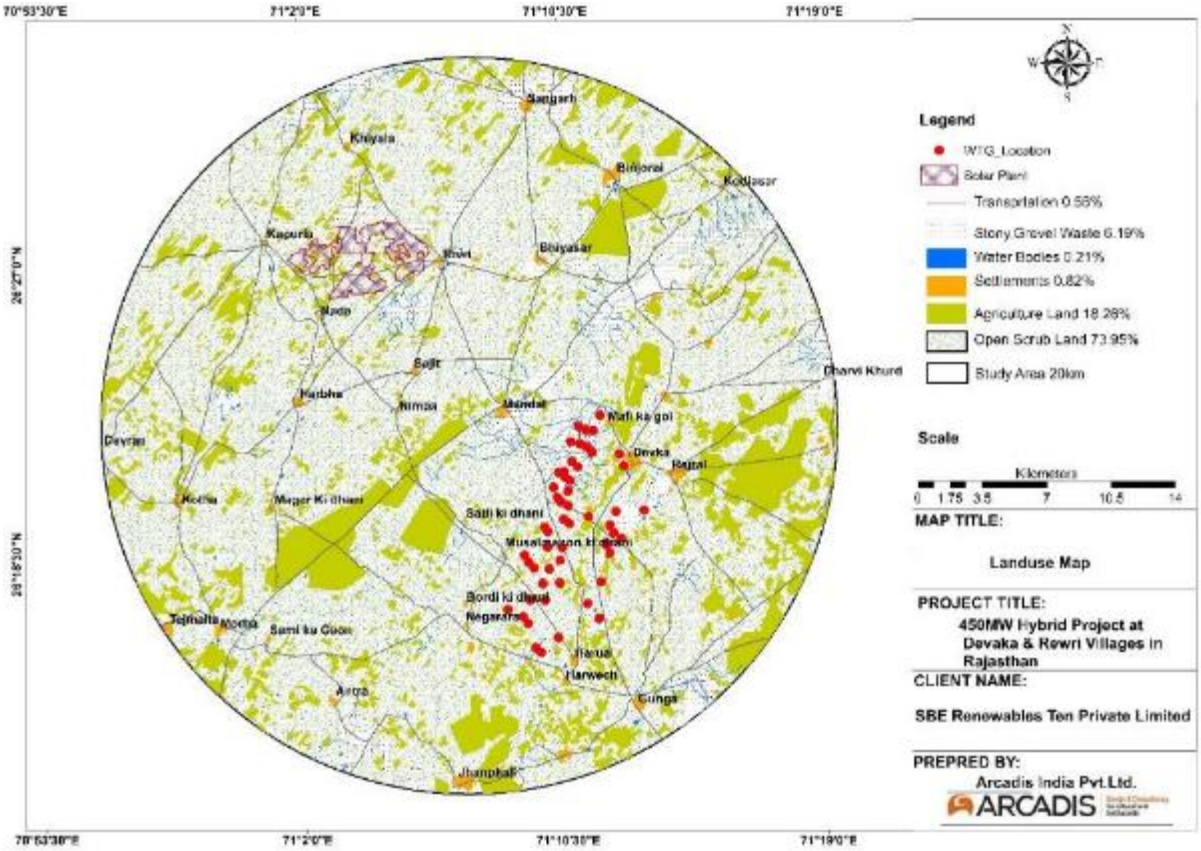
Figure 4-5: Digital Elevation Map



4.2.3. Land use Analysis

The land-use and land-cover of the study area (20 km including solar and wind) has been interpreted from visual interpretation, google earth satellite imagery of the area, and subsequently by ground truthing verification during site visit has been conducted. The land use within study area represents road transportation (0.56%), Agricultural land (18.26 %), open scrub land (73.95 %), seasonal water bodies (0.21 %), settlement (0.82%) and stony gravel waste (6.19%). The land use map of the study area is depicted in **Figure 4-6.**

Figure 4-6: Land Use Map



4.2.4. Drainage

Barmer

As per CGWB Barmer district forms part of Great Thar Desert of Rajasthan. In this arid region, there are sand dunes, alluvial areas dotted with few hillocks and hill chains scattered in the area. In the eastern part of the district, the area between Bilara and Barmer is covered by alluvium deposited due to fluvial action of Luni river system.

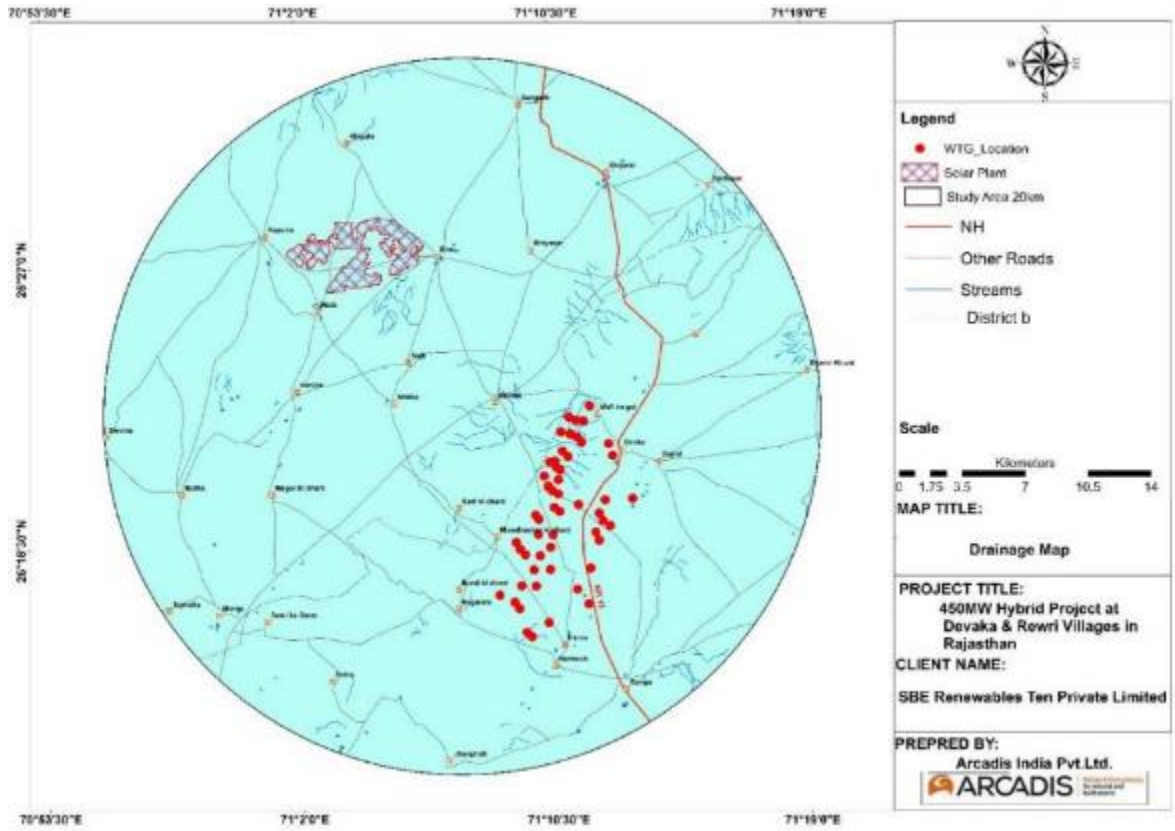
Barmer district falls in the Luni & Barmer Basins. Major River of the district is Luni, which flows in ENE – WSW direction. It enters Barmer district near village Jhak in Bilara tehsil and leaves the district near village Dhundhara. Total length of the Luni River in Barmer district is 125 km. Channel pattern of Luni is dendritic to sub-parallel. However, in major part of the district, the drainage is essentially ephemeral and internal. Important tributaries to the Luni river are Mithri and Bandi. Other streams in the district are Jojri, Golasmi, Guniamata and Bastua, which are all ephemerals.

Jaisalmer

As per CGWB report, Jaisalmer district is a part of the 'Great Thar Desert'. The terrain around Jaisalmer town, within a radius of about 60 km is stony and rocky. The area is barren, undulating with its famous sand dunes. There are no. rivers worth the name in the area nor are there any perennial streams in the area. Small nallas are purely seasonal and ephemeral with the result that there is lack of effective discharge in the event of heavy precipitation.

The drainage map of the study area is depicted in **Figure 4-7**.

Figure 4-7: Drainage Map



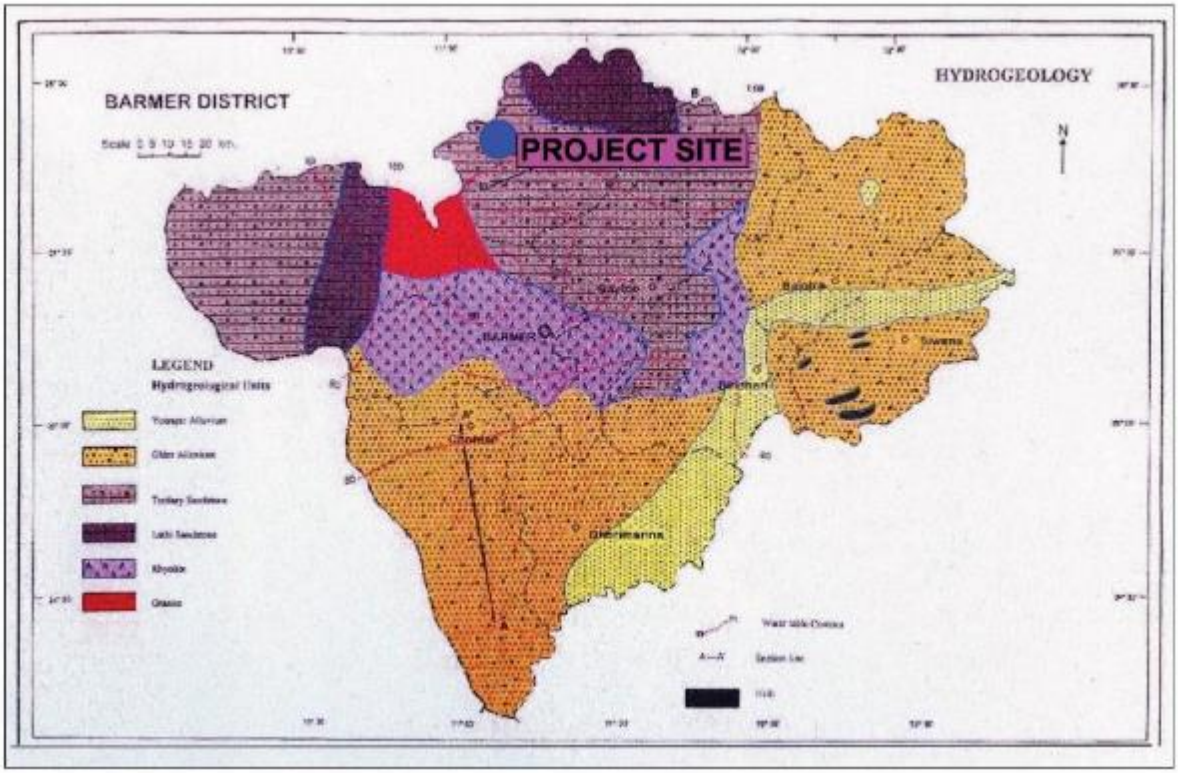
4.2.5. Hydrogeology

Barmer:

Ground water occurs under unconfined to semi-confined conditions in rocks of Barmer sandstone, Bilara limestone, Nagaur sandstone, Lathi sandstone and unconsolidated sediments (valley fills and alluvium). These form the chief source of ground water in the district. Confined condition is also met sometimes at deeper levels in the northwestern part of the district**. Our project Site falls in the semi consolidated formation of Tertiary Sandstone.**

Hydrogeological map of the district is presented in **Figure4-8:**

Figure 4-8: Hydrogeology Map of Barmer district

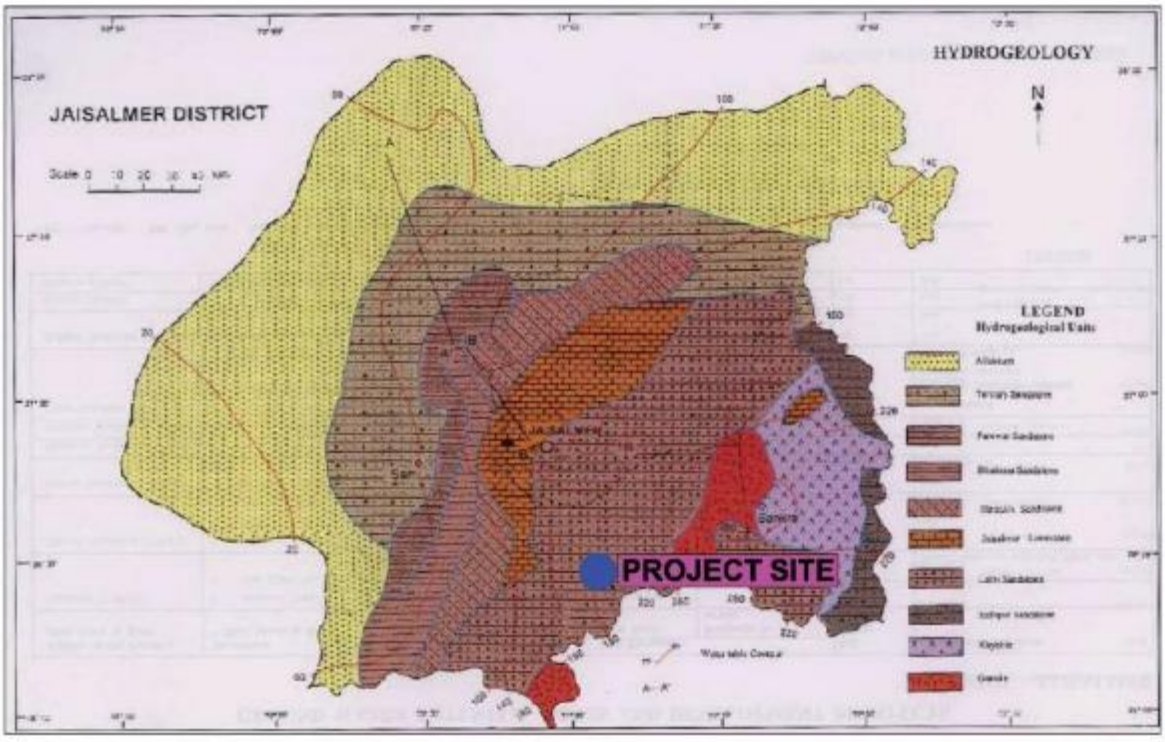


Jaisalmer:

Hydrogeological formations forming aquifer in the district vary from Proterozoic to Quaternary in age. The main water bearing formations in the district are granites, Lathi sandstone, Tertiary sandstone and Quaternary alluvium. In Quaternary alluvium, ground water occurs under semi-confined to unconfined conditions, in semi- consolidated Tertiary and Mesozoic formations, it occurs under unconfined to confined conditions and in weathered and fractured zones in hard rocks, it occurs under phreatic conditions. **Our project Site falls in the semi consolidated formation of Lathi Sandstone.**

Hydrogeological map of the district is presented in **Figure4-9**:

Figure 4-9: Hydrogeology Map of Jaisalmer district



4.2.6. Ground Water Resources

Barmer

As per CGWB report ground water resources have been estimated jointly by Central Ground Water Board and State Ground Water Department as per the norms recommended by GEC' 97 as of 2009. Annual replenishable ground water resource of the district has been estimated as 420.8565 mcm and net annual ground water availability as 388.8043 mcm. Gross ground water draft for all uses is estimated as 809.7057 mcm and over all stage of development is 208%.

Jaisalmer

Central Ground Water Board and Rajasthan Ground Water Department (RGWD) have jointly estimated the ground water resources of Jaisalmer district (as on 2009) based on GEC-97 methodology. Ground Water Resource estimation has been carried out for 12090 sq. km. area excluding saline area. The total annually replenishable resource of the district has been assessed to be 72.1216 MCM and net annual ground water availability has been estimated to be 68.3625 MCM. Gross annual ground water draft for all uses has been estimated to be 94.5896 MCM with stage of ground water development at 138%.

As per the categorization by CGWB the Blocks where the project sites are located falls under over exploited category.

Depth to water level

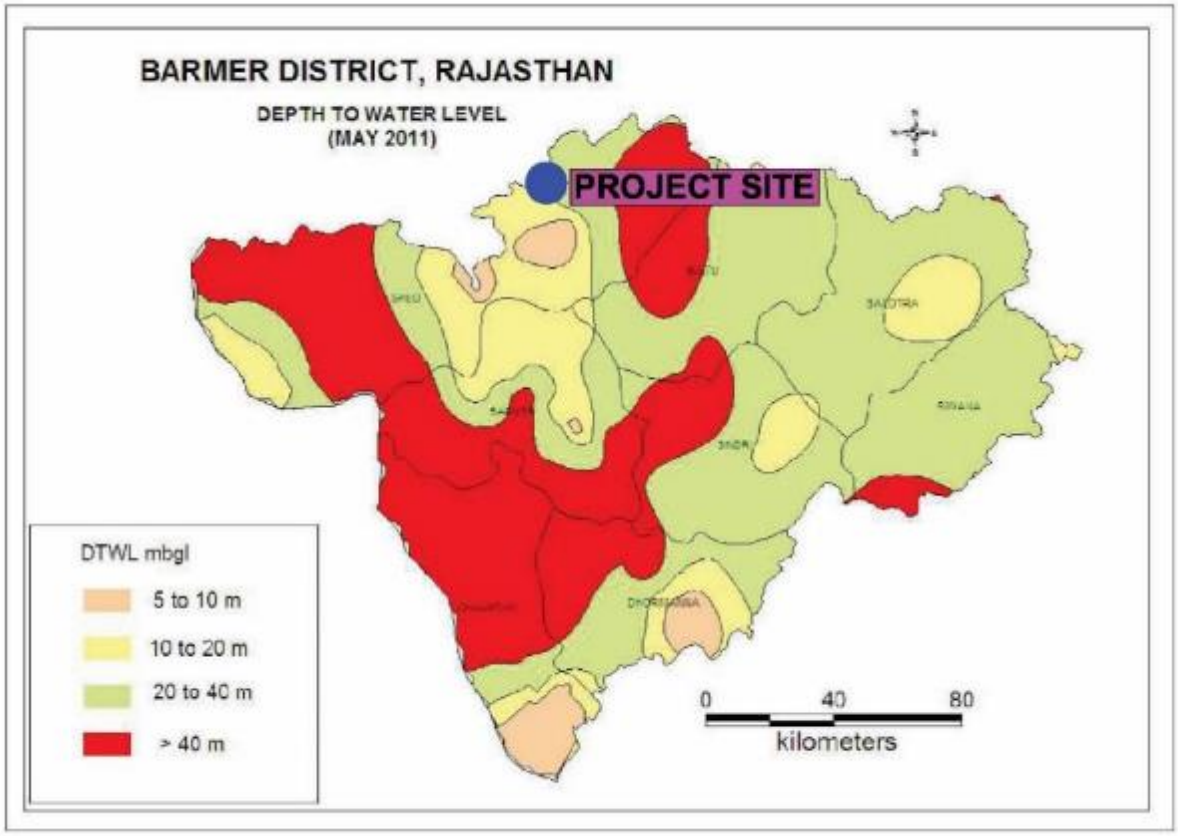
Barmer

During pre-monsoon (May 2011) depth to water level in the district generally ranges from less than 1m to more than 100 m below ground level (mbgl). It varied from and 0.01 to 82.51 m. Depth to water level in major part of the district varied from 20 m to more than 40 m bgl except for parts of Luni, Mandore, Bilara, Osian, Bhopalgarh and Bap blocks where shallower water levels upto 20 m bgl were observed (**Figure 4-10).**

During post monsoon (November 2011), depth to water level varied from 0.01 to 114.9 m bgl. Shallow water level upto 20 m bgl has been observed in western half of Bap, central part of Osian, southern part of Balesar, southern and eastern parts of Mandore and major parts of Luni and Bilara blocks. Water levels in the remaining areas have been found to be 20 to more than 40 m bgl (**Figure 4-11).**

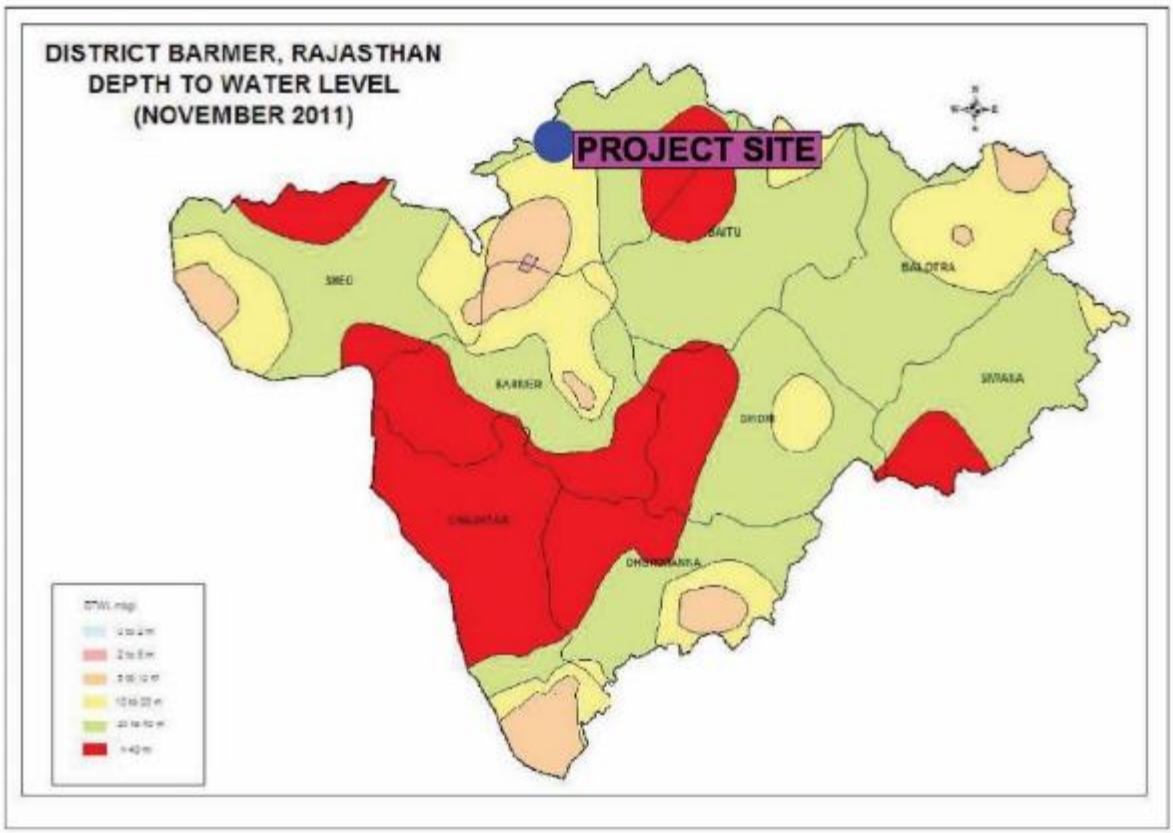
Depth of water level during both pre-monsoon and post-monsoon around the project Site varies from 10-40 m bgl.

Figure 4-10: Depth to water level during pre-monsoon -Barmer



Source: District Groundwater brochure, Barmer district, CGWB, 2013

Figure 4-11: Depth to water level during post-monsoon -Barmer



Source: District Groundwater brochure, Barmer district, CGWB, 2013

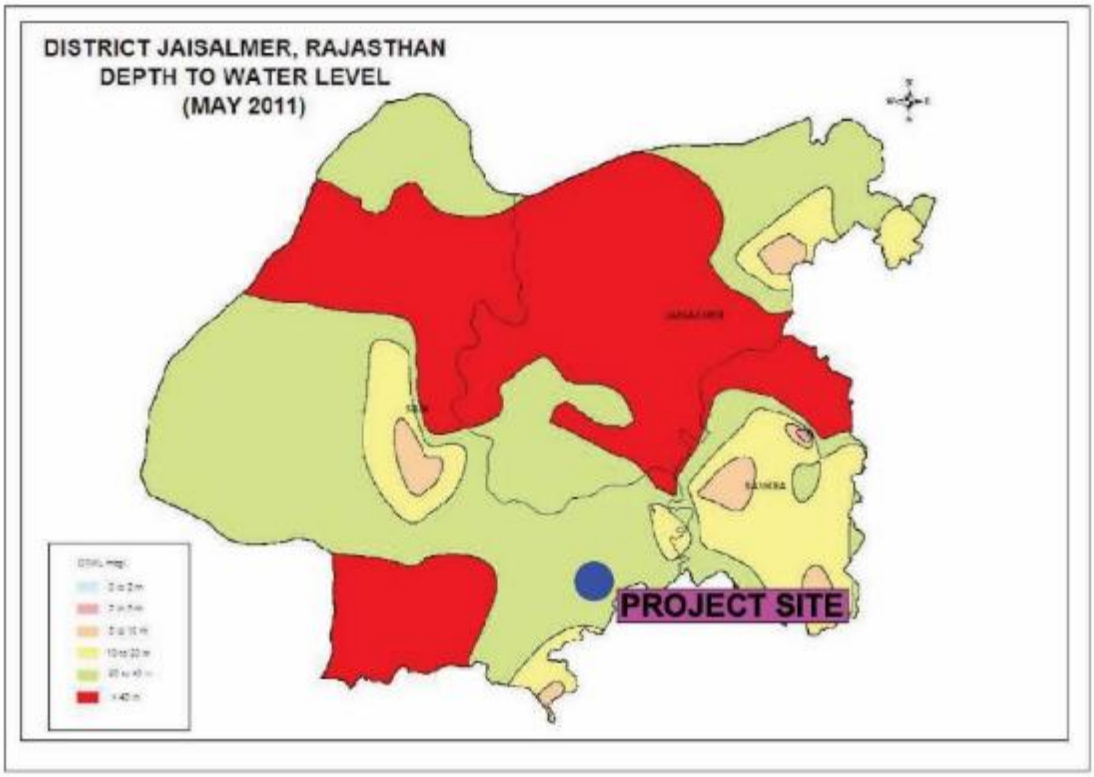
Jaisalmer

During pre-monsoon (May 2011), the depth to water level in the district varied largely from 1.85 to 108.86 mbgl. Over a major part of the district, water levels are deeper (more than 20 m). Water levels more than 40 m were recorded in northern and southern parts of the district. Shallow water levels less than 10 m have been registered in localized pockets in the district **Figure 4-12).**

During post-monsoon period (November 2011), the depth to water level varied from 1.24 to 116.1 mbgl. Wells in major parts of Jaisalmer and Sam blocks registered water levels deeper than 40 mbgl (**Figure 4-13).**

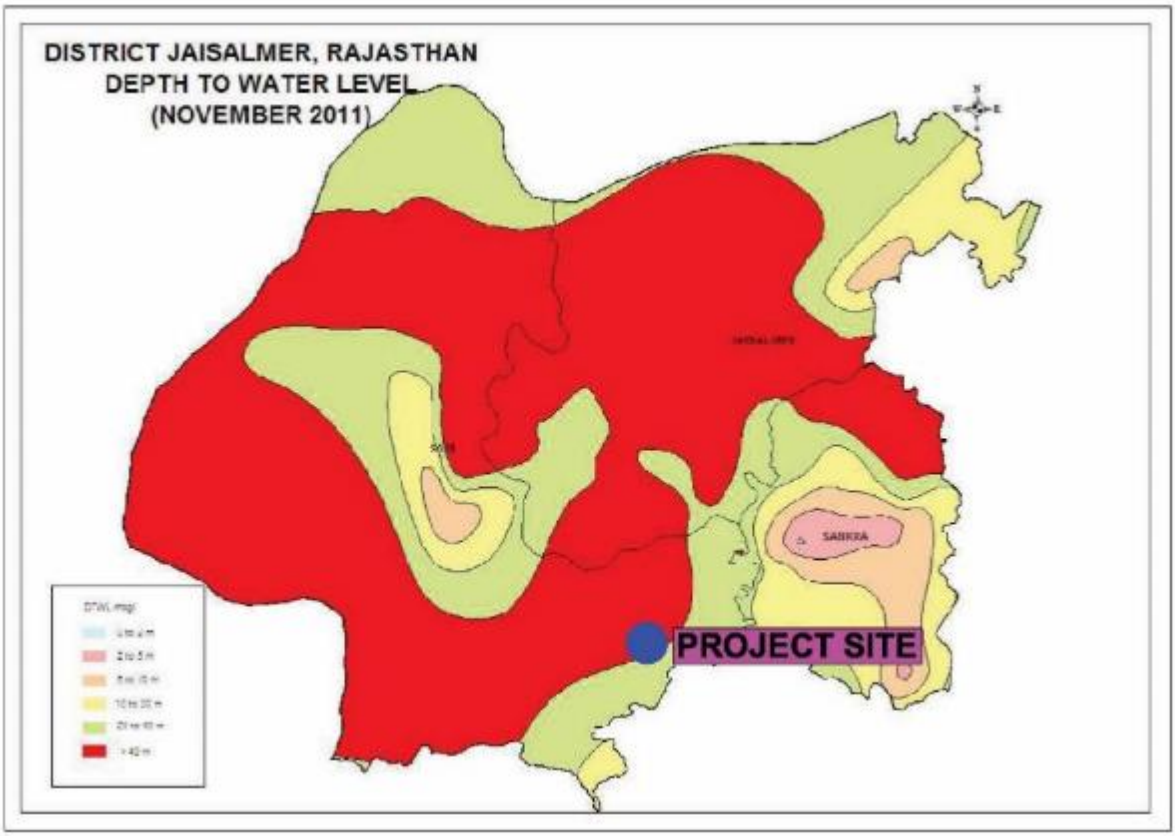
Depth of water level during pre-monsoon and post-monsoon around the project Site varies from 20-40 m bgl m respectively.

Figure 4-12: Depth to water level during pre-monsoon -Jaisalmer



Source: District Groundwater brochure, Barmer district, CGWB, 2013

Figure 4-13: Depth to water level during post-monsoon -Jaisalmer



Source: District Groundwater brochure, Barmer district, CGWB, 2013

4.2.7. Seismic Hazard

The project site is located in seismic zones III as per the seismic zoning map of India. Accordingly, implying that potential threats of damage due to earthquake is moderately active. The seismic zoning map of India has been shown in **Figure 4-14.**

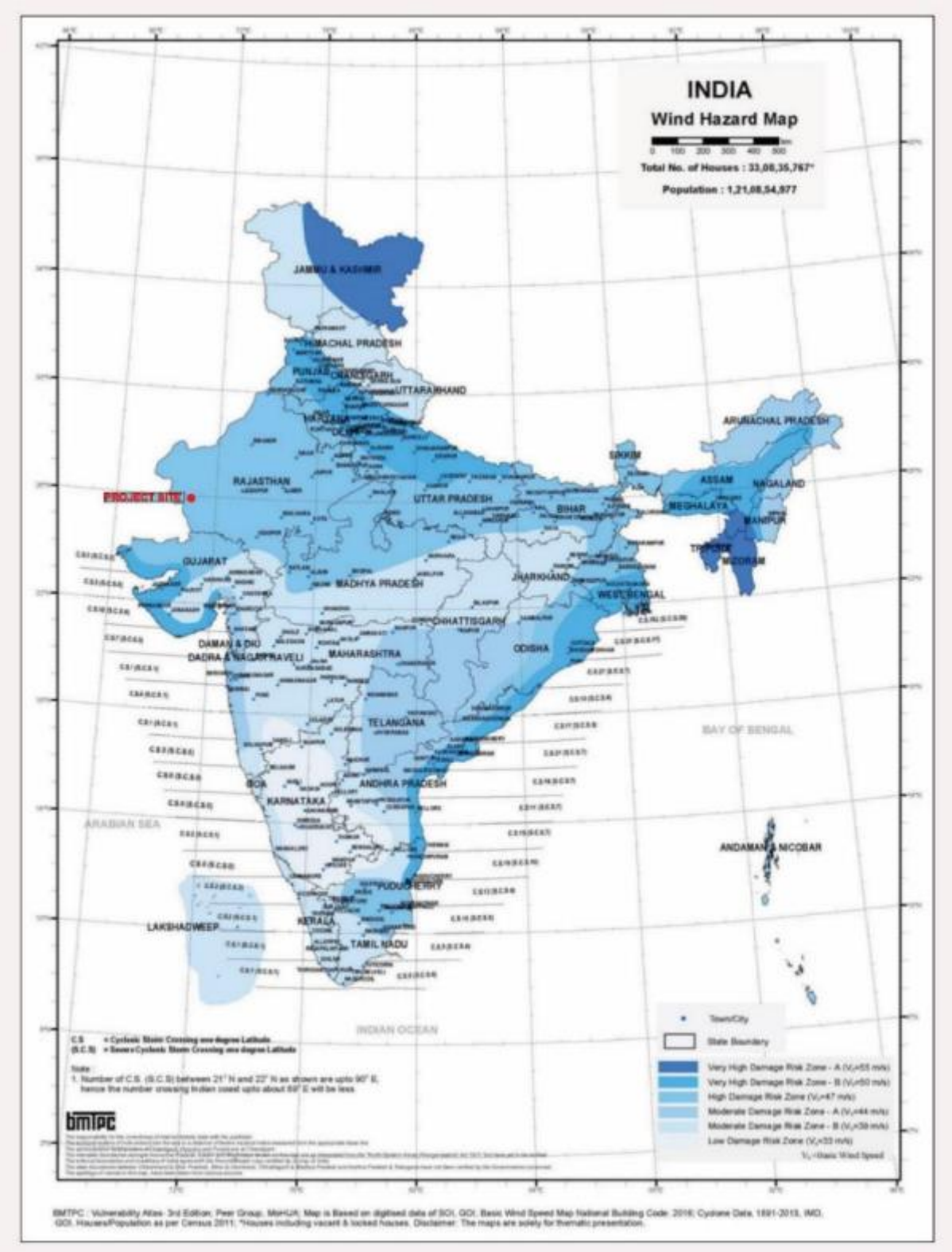
Figure 4-14: Seismic Map

Source: www.mapsofindia.com/maps/india/seismiczone.htm

4.2.8. Wind Hazard

The project site is located in High Damage Risk Zone as per the wind hazard map of India. Accordingly, implying that potential threats of damage due to earthquake is high. The wind hazard map of India has been shown in **Figure 4-15.**

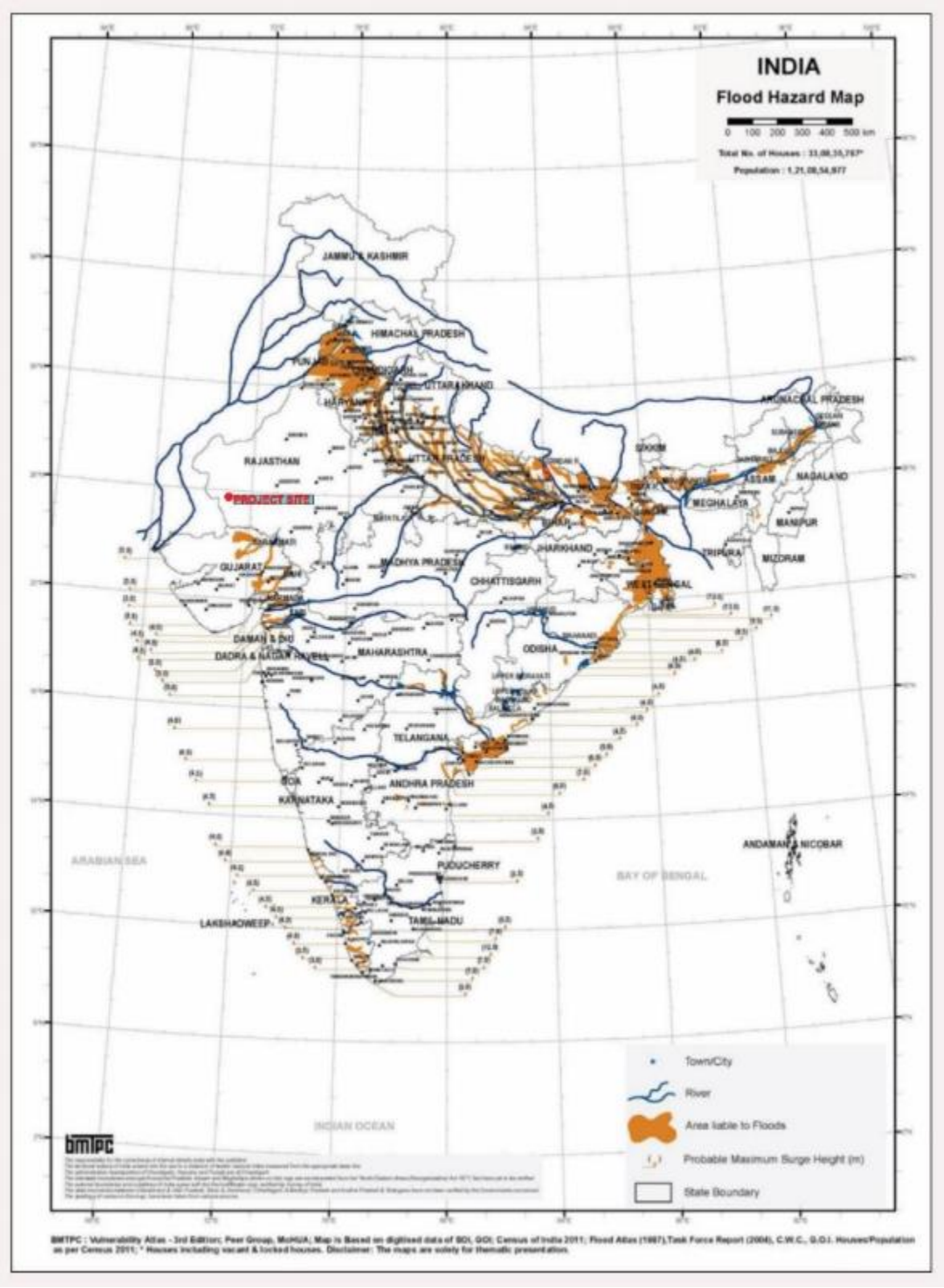
Figure 4-15: Wind Hazard Map



4.2.9. Flood Hazard

As per the flood hazard map of India, the project site is not located in area liable to flood. The flood hazard map of India depicted in **Figure 4-16.**

Figure 4-16: Flood Hazard Map



4.3. Environmental Monitoring

Environmental quality monitoring was conducted on 25th to 27th June 2020. Details of environmental quality monitoring location coordinates are depicted below in **Monitoring Location Map**.

4.3.1. Ambient Air Quality

Ambient air monitoring was carried out at three locations (24-hourly sampling for particulate & gaseous pollutants and 8-hourly sampling for CO). The monitoring was conducted on 25th to 27th June 2020. Sampling and analysis was done as per the guidelines prescribed by CPCB /IS-5182. Monitoring stations were chosen based on their proximity to sensitive receivers, settlements, topography, and predominant wind direction. The details of the monitoring locations are depicted below in **Table 11.**

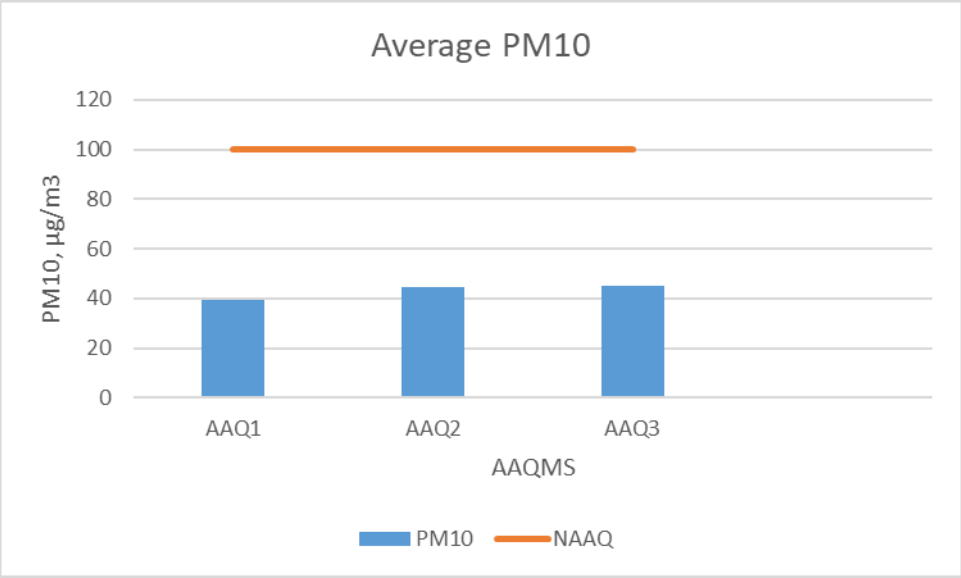
Table 11: Ambient Air Quality Monitoring Results

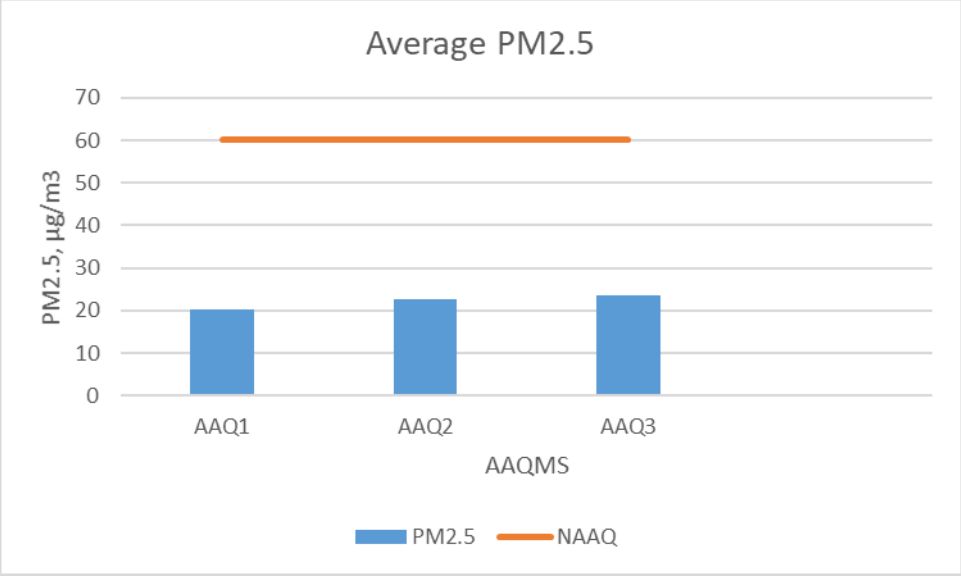
Sl. No.	Parameter	Unit	Locations			NAAQS Limit
			Devaka village (AAQ-1)	Harwa village (AAQ-2)	Reevari village (AAQ-3)	
1	Particulate Matter (PM_{10})	$\mu g/m^3$	39.2	44.5	45.3	100
2	Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	20.4	22.8	23.7	60
3	Sulphur Dioxide (SO_2)	$\mu g/m^3$	5.2	6.4	5.8	80
4	Oxide of Nitrogen (as NO_2)	$\mu g/m^3$	14.4	18.1	16.6	80
5	Carbon Monoxide (CO)	$\mu g/m^3$	<1.00	<1.00	<1.00	<2.00

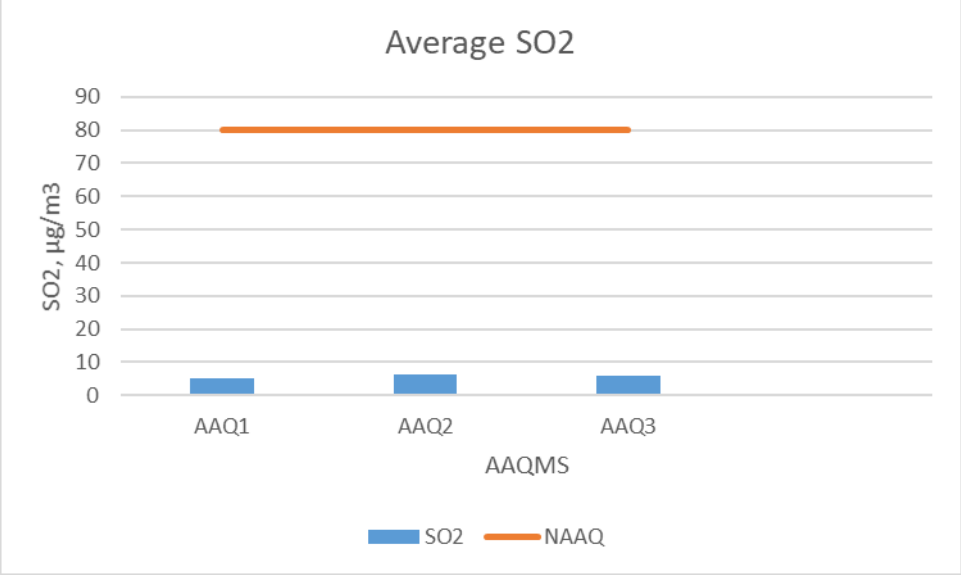
Interpretation of Air Quality Results

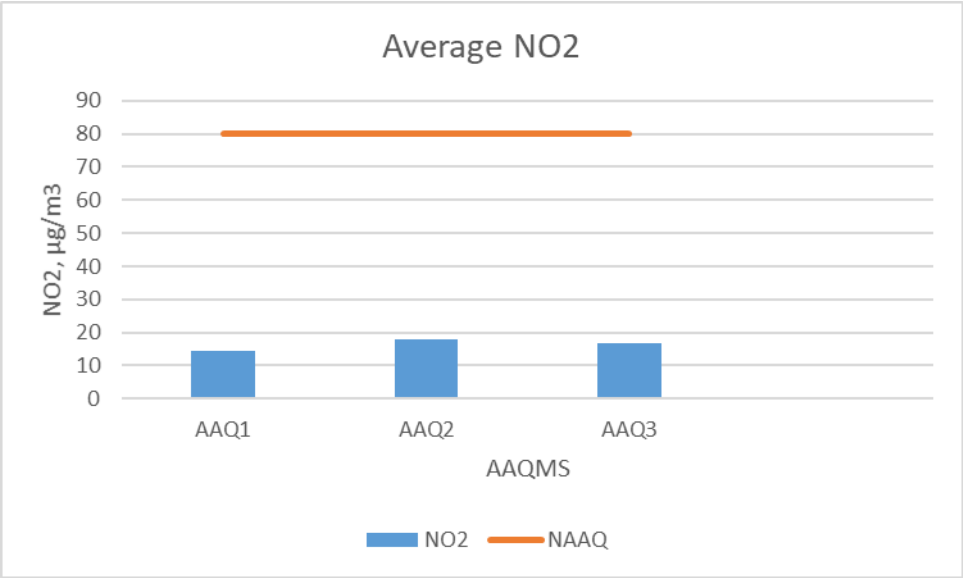
- Interpretation of Air Quality Results Concentrations of all the ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO) at all three monitoring stations were observed to be well within the NAAQS 2009 prescribed standards.
- Particulate Matter (PM_{10}) Concentration monitored was in the range of 39.2 $\mu g/m^3$ to 45.3 $\mu g/m^3$ i.e. well within the NAAQS permissible limit of 60 μ g/m3. $PM_{2.5,}$ Sulphur dioxide, Nitrogen Oxide and Carbon monoxide too were recorded well below the CPCB permissible limits as depicted in Table 11.
- No significant impact on the ambient air is anticipated at this stage.

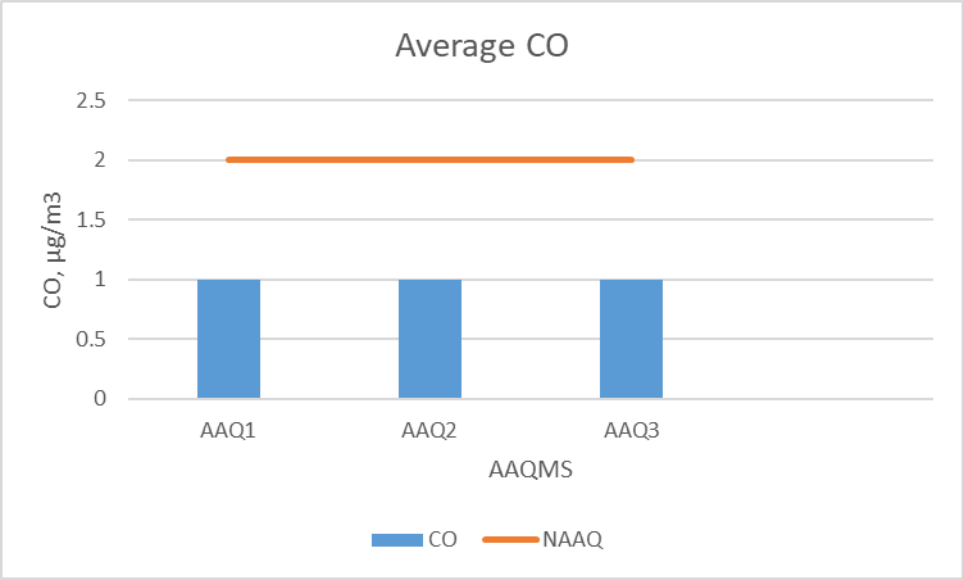
Figure 4-17: AAQ Monitoring Results Graphical Interpretation











4.3.2. Ambient Noise Quality

The ambient noise monitoring was conducted at three locations in the study area. The noise monitoring network was established based on the understanding of the project activities and professional judgment.

Sound pressure level (SPL) measurements in dB(A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring 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 is presented below.

Table 12: Noise Quality Monitoring Results

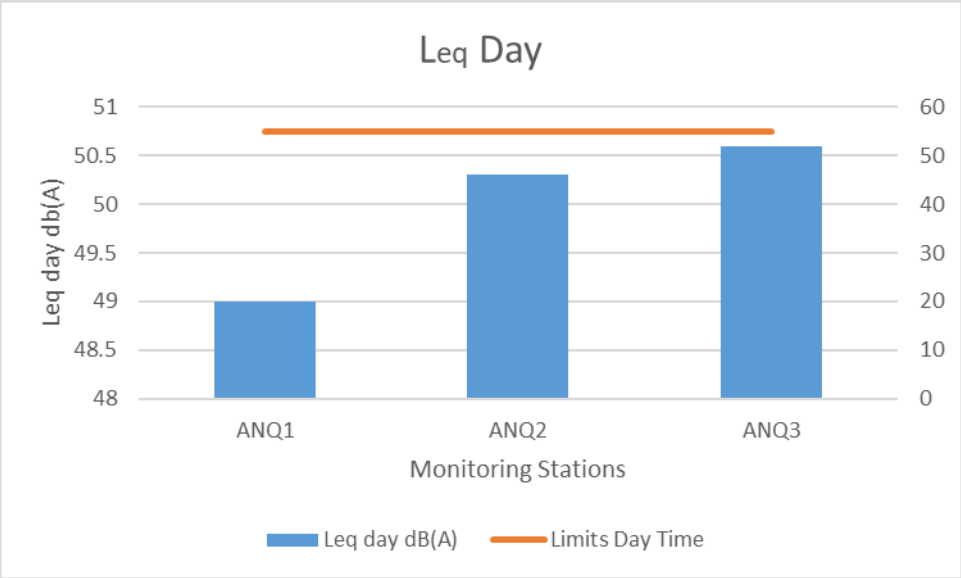
Sl. no.	Parameter	Unit	Results		
			Devaka village (ANQ-1)	Harwa Village (ANQ-2)	Reevadi Nagar (ANQ-3)
1	Leq Day	dB(A)	49	50.3	50.6

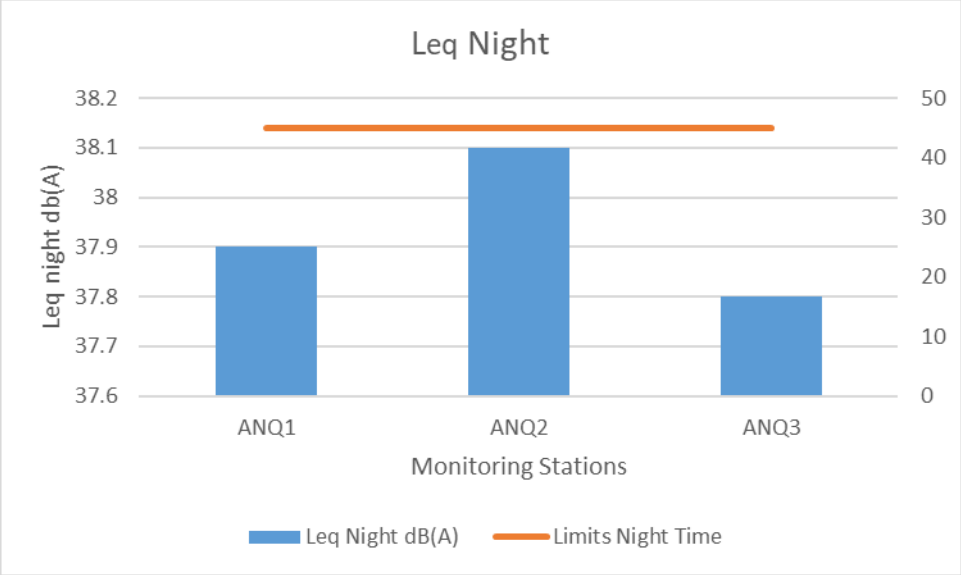
Sl. no.	Parameter	Unit	Results		
			Devaka village (ANQ-1)	Harwa Village (ANQ-2)	Reevadi Nagar (ANQ-3)
2	Leq Night	dB(A)	37.9	38.1	37.8
CPCB standard (day-Night) dB(A)			**55-45**	**55-45**	**55-45**

Interpretation of Noise Quality Results

On comparison of day and night equivalent values with Ambient Noise Quality Standards in respect to Residential areas, the obtained values are well within the prescribed standards of CPCB for residential area.

Figure 4-18: ANQ Monitoring Results Graphical Interpretation





4.3.3. Surface water Quality

Results of physio chemical analysis of surface water sample collected from village pond from one location namely Reevadi village (SW1) (N 26027'15.48", E 7106'43.79") was studied to have an idea of the quality of surface water in the study area. Analysis were done as per IS: 2296 Class C Specifications and results are presented in the **Table 13,**

Table 13: Surface water Analysis Results

S.No	Parameters/Characteristic	Test Method	Units	Test Results	IS: 2296 Class C Specifications
1.	pH at 25 deg C	IS:3025 part 11 1983	-	7.78	6.5 – 8.5
2.	Colour	IS: 3025 Part 4 1983	Hazen	40	300
3.	Conductivity at 25 deg C	IS: 3025 Part 14 1984	mS/cm	234	--
4.	Temperature at Site	IS: 3025 Part 38 1989	° C	26.1	--
5.	Turbidity	IS: 3025 Part 10 1984	NTU	4.30	--
6.	Dissolved Oxygen	IS: 3025 Part 38 1989	mg/L	4.0	4 min
7.	Chemical Oxygen Demand	IS: 3025 Part 58 2006	mg/L	20	--
8.	Total Suspended Solids	IS: 3025 Part 17 1984	mg/L	2.4	--
9.	Total Dissolved Solids	IS: 3025 Part 16 1984	mg/L	144	1500
10.	BOD (3 days at 27°C)	IS: 3025 Part 44 1993	mg/L	05	< 3.0
11.	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	40	--
12.	Chloride as Cl	IS: 3025 Part 32 1988	mg/L	25	600
13.	Fluorides as F^-	IS: 3025 Part 60 2008	mg/L	0.20	1.5
14.	Sulphate as SO_4^{--}	IS: 3025 Part 24 1986	mg/L	24.7	400
15.	Alkalinity	IS: 3025 Part 23 1986	mg/L	50	--

S.No	Parameters/Characteristic	Test Method	Units	Test Results	IS: 2296 Class C Specifications
16.	Total Nitrogen	IS: 3025 Part 34 1988	mg/L	1.6	--
17.	Cyanides as CN	IS: 3025 Part 27 1986	mg/L	<0.001	0.05
18.	Calcium as Ca	IS: 3025 Part 40 1991	mg/L	8.0	--
19.	Magnesium as Mg	IS: 3025 Part 46 1994	mg/L	4.8	--
20.	Sodium as Na	IS: 3025 Part 45 1993	mg/L	32.6	--
21.	Potassium as K	IS: 3025 Part 45 1993	mg/L	1.5	--
22.	Iron as Fe	IS: 3025 Part 53 2003	mg/L	0.08	50
23.	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001	0.1
24.	Copper as Cu	IS 3025 Part 42 1992	mg/L	0.010	1.5
25.	Arsenic as As	IS: 3025 Part 37 1988	mg/L	<0.02	0.2
26.	Phenolics as C_6H_5OH	IS: 3025 Part 43 1992	mg/L	<0.001	0.005
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	0.05
29.	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.024	15
30.	Total Phosphorus	IS 3025 Part 31 1988	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	0.1
33.	Coli form Organisms	IS: 1622:1981 RA 1996	MPN/100 ml	260	Should not exceed 5000

S.No	Parameters/Characteristic	Test Method	Units	Test Results	IS: 2296 Class C Specifications
34.	Faecal Coliform	IS: 1622:1981 RA 1996	MPN/100 ml	98	--
35.	Pesticides	USEPA	µg/L	<0.001	<0.001

Interpretation of Surface Water Quality Results:

Except for dissolved oxygen (just meets the minimum limits) and BOD, all the other above tested parameters meet the IS: 2296 Class C specifications.

4.3.4. Groundwater Quality

Results of physio chemical analysis of ground water samples from bore well at Harwa village (GW1) (N 26015'32.3", E 71010'53.2") was studied to have an idea of the quality of ground water in the study area. Analysis was done as per standard methods prescribed by IS: 10500:2012 specifications and results are presented in the **Table 14 .**

Table 14: Groundwater Analysis Results

Sr. No	Parameters	Test Method	Units	Test Results	Drinking Water Limits As per IS: 10500:2012	
					Acceptable Limits	Permissible Limits
1.	pH at 25^0C	IS:3025 part 11 1983	--	7.52	6.50 - 8.50	--
2.	Turbidity	IS: 3025 Part 10 1984	NTU	<1.0	1	5
3.	Conductivity at 25^0C	IS: 3025 Part 14 1984	µMho/cm	1646	--	--
4.	Total Suspended Solids	IS: 3025 Part 17 1984	mg/L	<1.0	--	--
5.	Total Dissolved Solids	IS: 3025 Part 16 1984	mg/L	1048	500	2000
6.	Colour	IS: 3025 Part 4 1983	Hazen	<01	5.00	15.00
7.	Taste	IS:3025 part 08 1984	-	Agreeable	Agreeable	--
8.	Odour	IS:3025 part 05 1983	-	Agreeable	Agreeable	--
	CHEMICAL PARAMETERS					

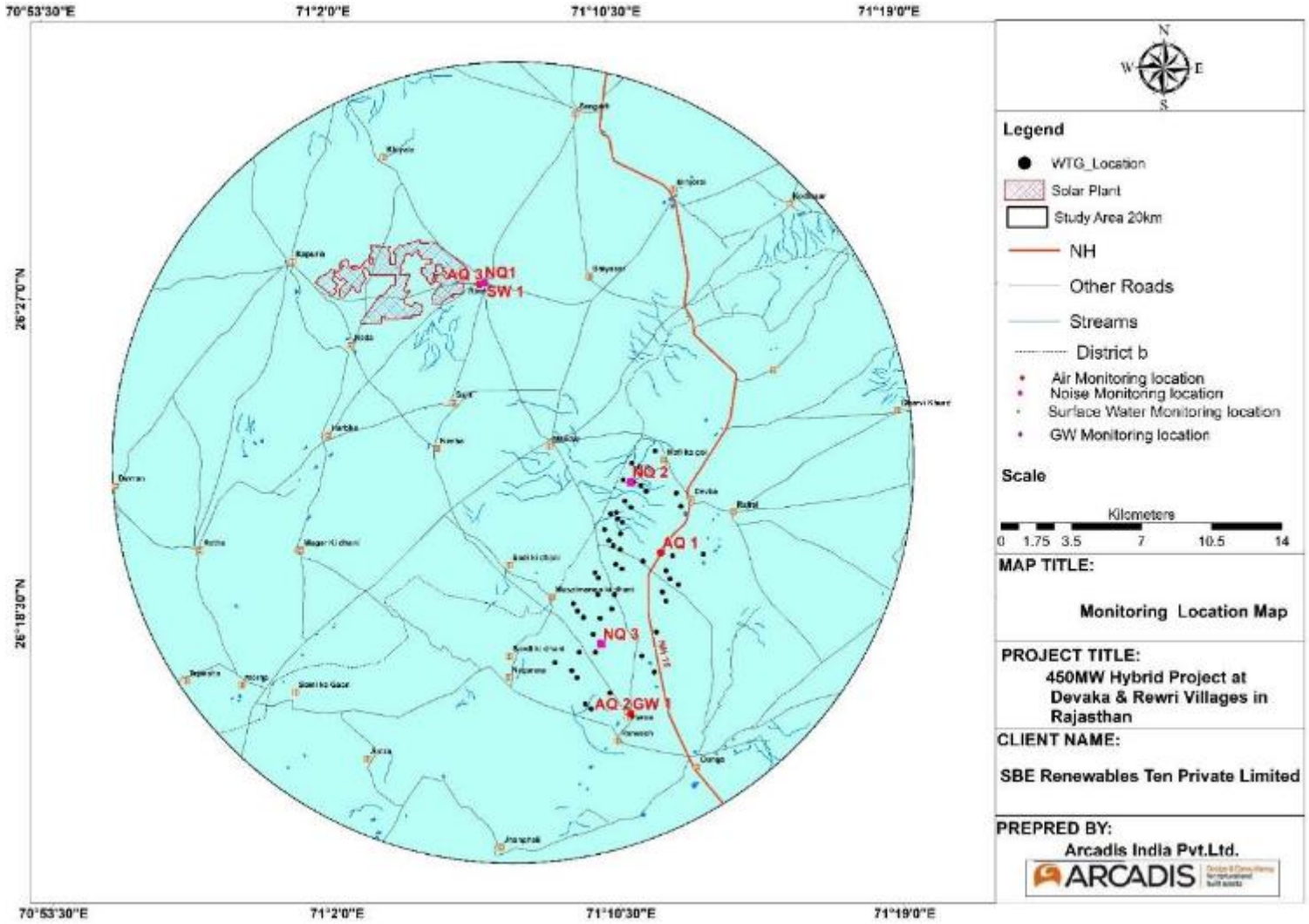
Sr. No	Parameters	Test Method	Units	Test Results	Drinking Water Limits As per IS: 10500:2012	
					Acceptable Limits	Permissible Limits
9.	Total Alkalinity as $CaCO_3$	IS: 3025 Part 23 1986	mg/L	280	200	600
10.	Chlorides as Cl^-	IS: 3025 Part 32 1988	mg/L	200	250	1000
11.	Sulphates as SO_4^{-2}	IS: 3025 Part 24 1986	mg/L	227	200	400
12.	Nitrates as NO_3	IS: 3025 Part 34 1988	mg/L	15.1	45	--
13.	Phosphates as PO_4	IS: 3025 Part 31 1988	mg/L	<0.02	--	--
14.	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009	mg/L	530	200	600
15.	Calcium as Ca	IS: 3025 Part 40 2009	mg/L	120	75	200
16.	Magnesium as Mg	IS: 3025 Part 46 1994	mg/L	55.2	30	100
17.	Sodium as Na	IS: 3025 Part 45 1993	mg/L	129.7	--	--
18.	Potassium as K	IS: 3025 Part 45 1993	mg/L	3.5	--	--
19.	Fluoride as F^-	IS: 3025 Part 60 1993	mg/L	0.90	1	1.5
20.	Iron as Fe	IS: 3025 Part 53 2003	mg/L	0.16	0.3	--
21.	Phenolic Compounds	IS:3025 Part 43 1985	mg/L	<0.001	0.001	0.002
22.	Cyanide as CN^-	IS 3025 Part 27 1986	mg/L	<0.001	0.05	--
23.	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001	0.003	--
24.	Total Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001	0.05	--
25	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.02	0.01	--
26.	Arsenic as As	IS: 3025 Part 37 1988	mg/L	<0.01	0.01	

Sr. No	Parameters	Test Method	Units	Test Results	Drinking Water Limits As per IS: 10500:2012	
					Acceptable Limits	Permissible Limits
27.	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.042	5	15
28.	Manganese as Mn	IS: 3025 Part 59 2006	mg/L	<0.001	0.1	0.3
29.	Copper as Cu	IS 3025 Part 42 1992	mg/L	0.021	0.05	1.5
30.	Nickel as Ni	IS 3025 Part 54 2003	mg/L	<0.001	0.02	--
31.	Boron	IS 3025 Part 57 2005	mg/L	0.010	0.5	1.0
32.	Anionic Detergents	IS 13428 Annex K	mg/L	<0.001	0.20	1.0
33.	Mineral Oil	APHA 23rd Edition 2012	mg/L	<0.001	0.5	--
34.	Aluminium as Al	IS 3025 Part 55 2003	mg/L	<0.001	0.003	0.2
35.	Mercury as Hg	IS 3025 Part 48 1994	mg/L	<0.0002	0.001	--
36.	Pesticides	USEPA	µg/L	<0.001	--	--

Interpretation of Ground Water Quality Results:

- The above tested parameters Village (GW1) sample exceeds the acceptable limit of following parameters: Total Dissolved Solids (1048 mg/l), Total Alkalinity as CaCO3 (280 mg/l), Sulphates as SO4-2 (227 mg/l). Total Hardness as CaCO3 (530 mg/l), Calcium as Ca (120 mg/l), Magnesium as Mg (55.2 mg/l)
- The tested water shows the characteristics of hard water which is caused by a high mineral content.
- Rest all tested parameters meet the Drinking Water Limits as per IS: 10500:2012

Figure 4-19: Environmental Quality Monitoring Location Map



4.4. Ecological Environment

Desktop assessment was carried out to understand the significant risk and impacts to undertake mitigation measures & suggest changes in the project area. Published secondary information was also collected on the same from government officials, journals and residents of the area.

This information will further enable to gauge potential ecological impacts that can be generated from the project activities. Understanding the significant risks and impacts is important to undertake mitigation measures & suggest changes, if the associated risks are huge. Such mitigation measures will help to reduce the impacts and develop ecological monitoring parameters. The project site comprises of dry and barren land with very little vegetation.

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 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 recognized as critically endangered, endangered, threatened etc. as per IUCN Red list and scheduled species as per WPA (1972).
- Identification of areas important for breeding, foraging, 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 (published document) was conducted to determine the land use and land cover, vegetation type (Champion and Seth, 1968), 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 reliable sources like published documents, the ENVIS portal on Wildlife and Protected area in India, wetland atlas, IBA etc. Consultations will be carried out with local people during site visit to understand major flora & fauna in the study area, presence of any IUCN v2020-2 listed threatened species and Schedule I species or other species having conservation value and pressures on forest resource. Literally documentation like “Habitat improvement and conservation breeding of the Great Indian Bustard: An Integrated Approach”. Annual Progress Report II, eBird.com, BirdLife.org, Management Plan of Desert National Park and research paper by Rahmani, A.R., Islam, M.Z. and Kasambe, R.M. (2016) Important Bird and Biodiversity Areas in India: Priority Sites for Conservation (Revised and updated), Indian Bird Conservation Network, Royal Society for the Protection of Birds and Bird Life International (U.K.). Pp. 1992 + xii were referred.

In order to provide representative ecological status for the project a study area is defined for ecological study. As this is a hybrid project, solar project site has no moving part or emission, most of the project related impact (if any) will be confined to the project site only and access roads. Therefore, project development area and 100m around the project site was considered as the “high risk zone” or “core study area”, and 10-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.

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 other published and unpublished documents. Stakeholder consultations (Local People etc.) were also carried out to understand the major flora & fauna in the study area, pressure on forest resources, presence of any Schedule I species.

Secondary data collection was the only component of the baseline survey. Secondary 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 project area was recorded by referring other published and unpublished documents.

Establishing ecological hotspots through Secondary Data Base

A Secondary Data Base review was conducted to determine the presence of any hotspots or sightings around the project area. All with available literature review, research papers and websites with online database of bird observations with real-time data about bird distribution and abundance were used. Through the secondary data base review, it was established that there were no forest areas around the project area and there were no hotspots around the project area as well Figure 4-20).

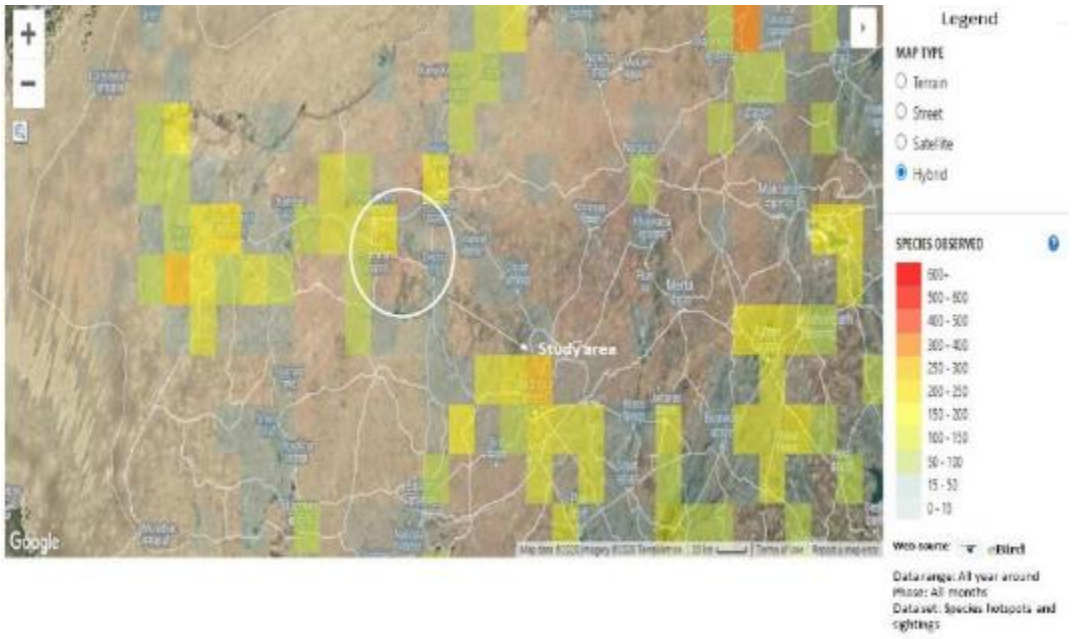


Figure 4-20: Map showing presence of no hotspots and sightings around the project area (total solar- wind)

4.4.2. Habitat Survey

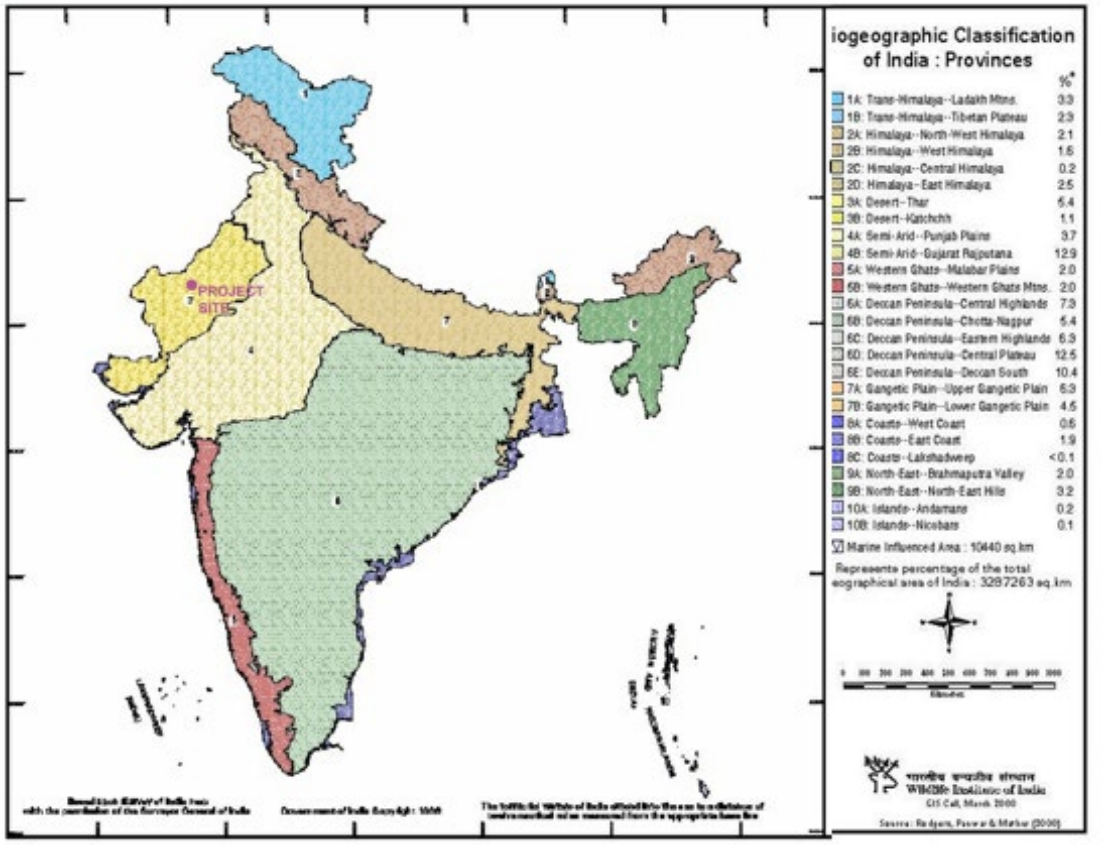
According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the project site falls under the Biogeographic Province – 3-A Desert Thar. The site survey also included understanding of important habitats in the area

The Thar Desert is one of the smallest deserts in the world and occupies nearly 9% of India's geographical area, extending into Pakistan. It covers about 2,00,000 sq. km, out of which 60% of the desert area falls under the State of Rajasthan in India (Krishnan 1977). The Thar Desert is bordered by the Punjab plains to the north and northeast, the Indus River plains to the west, the Rann of Kutch to the south and the Aravalli range to the southeast. The annual rainfall in the desert is very low and occurs from July to September. May and June are the hottest months of the year, with the temperature rising up to 50°C. The months are marked by heatwaves and dust storms with velocities of about 140-150 km/hr (Sharma and Mehra 2009). Winter in the Thar Desert can be considered from October to March. The major part of the Thar Desert is covered by open Grassland or by Grassland interspersed with thorny bushes and trees and dunes (Gupta 1975).

The most common Grass species of this area is *Dicanthium-Lasiurus-Cenchrus* association (Dabadghao and Shankarnarayan 1973). Stabilized dunes are mainly covered by *Calotropis Procera*, *Acacia Senegal, Capparis decidua, Aerva javanica,* and other *Psammophytic sp*. (Shetty 1994). Conservative estimates suggest that nearly 2,000 faunal species are found in the Indian part of the desert. About 68 mammalian fauna are found in the region like the Desert Cat *(Felis sylvetris)*, White-footed Fox Vulpes *(vulpes pusilla)* and Indian Gazelle (*Gazella bennettii)*. The Wild Boar *Sus scrofa* and *Bluebull Boselaphus tragocanelus* numbers have been seen an increase in recent years (Sharma and Mehra 2009). More than 300 avian species are found in the Thar desert, including the Critically Endangered Great Indian Bustard Ardeotis nigriceps (Rahmani and Soni 1997).

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 the purpose of implementation of IFC Performance Standard-6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources). Critical habitats are subsets of Natural habitats. Types of habitats are described in detail in this section below.

Figure 4-21: Location of project area on the Biogeographic Zones.



Types of Habitats in the Study Area

Scrub Land: This type of vegetation is extensively found in non-cultivated lands, particularly revenue lands/grazing land located within the study area. These type of land gets grown by Prosopis Juliflora and local villagers make charcoal by burning the well grown logs of these plants. Tall trees were generally found absent or sparsely distributed. Solid wood thorny trees like *Acacia nilotica, Prosopis juliflora, Morinda tinctoria, Commiphora berryi, Catunaregam spinosa, Azima tetracantha, Opuntia sp, Cassia auriculata, Capparis decidua* (Ker sangri) etc. were commonly observed in the natural scrublands. A plenty of Borassus *flabellifer* (palm tree) were observed along the bunds of the agricultural fields.

In general, type 6A/C2/DS1 – Southern Thorn Scrub forest as per Champion & Seth 1968 is found in the study area. These forests contain spare and stunted growth of species like *Acacia nilotica, Prosopis juliflora, Morinda tinctoria, Commiphora berryi, Catunaregam spinosa, Azima tetracantha, Opuntia sp, Cassia auriculata* and thorny bushes etc along with other ground cover represented by *Calotropis gigantea, Ziziphus sp, Croton bonplandianum, Capparis sepiaria, Cassia auriculata*. Important landuse features in the study area is shown in **Figure 4-2.**

Figure 4-22: Important Land use features in the study area

Agricultural Field: Major agricultural crops include Guar (Cyamopsis tetragonoloba), Bajra (Pennisetum glaucum), Channa (Cicer Arietinum), cumin seeds (Cuminum cyminum), Jowar (Sorghum) etc. Thorny bushes dominated by Prosopis juliflora grow on its own in the abandoned agricultural filed/culturable wastes.

Protected Areas:

- No notified/designated forest area exists within 10 km from project site. DNP is located at 55 km from the land parcel in solar site- Survey No 295 and 70 kms from WTG- SBE. Apart from that solar site is located at the distance of around 72 km from GIB priority while wind farm is located around 90 km from the GIB priority area. Moreover, both the solar and wind site falls in GIB potential area.

Desert National Park:

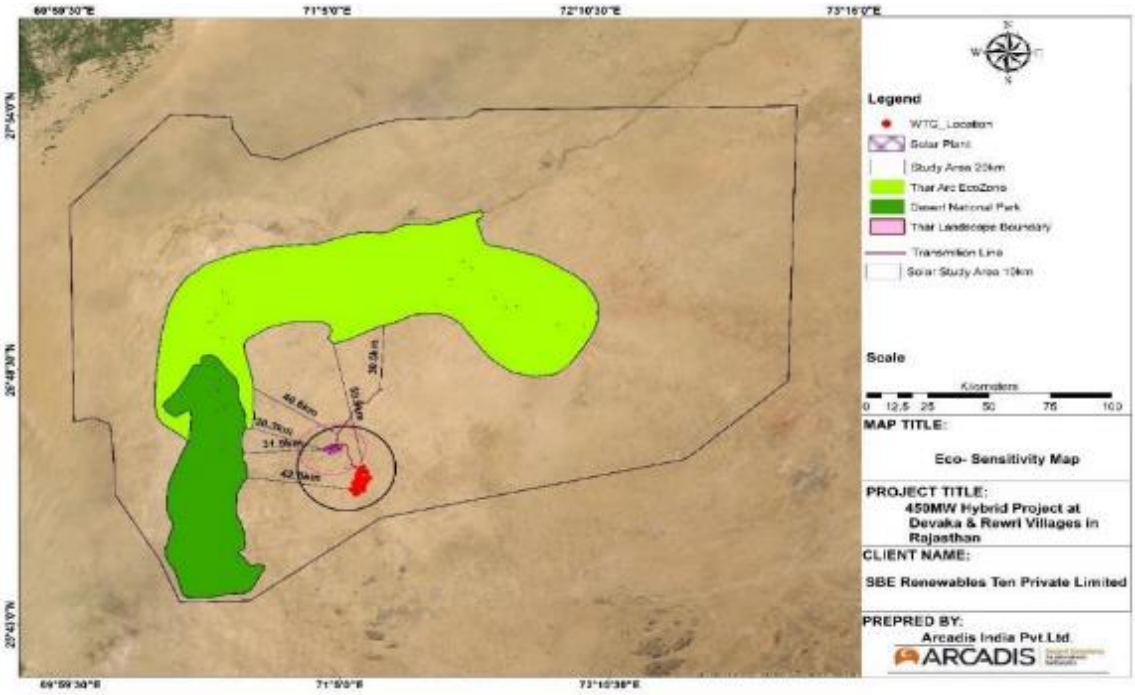
Desert National Park is a beautiful place, located in the Jaisalmer district of the state of Rajasthan. Desert National Park is one of the largest national parks in India. The Desert National Park is also a protected sanctuary.

The Desert protected sanctuary was declared as a National park in 1980. Total area of the National park is about 3162 km2. The desert is a harsh place to sustain life and thus most of the fauna and flora live on the edge. Desert National Park is an excellent example of the desert ecosystem. The landform primarily comprises rocks and compact Salt Lake bottoms, intermediate areas and fixed dunes. Across the landscape of Jaisalmer, altitudes are low, ranging from 210-320 m above mean sea level. The topography of Desert National Park supports sandy, gravelly, rocky, and compact Salt Lake bottoms. Sandy areas dominate the western parts of Jaisalmer district, while gravelly and rocky areas are scattered throughout central, southern and eastern areas. The Desert National Park is barren with several sand dunes and a few hills in the north-western region. The Park forms a vast sandy and undulating terrain.

Its inhabitants include the blackbuck, chinkara, wolf, Indian fox, desert fox, hare and desert cat. Birds like Sandgrouse, Grey Partridge, Blue tailed and green bee-eaters, Drongo, Common and Bush quail and Indian rollers are observed. The park is also home to the Great Indian Bustard which is peril of extinction

Figure 4-23: Forest Office of Jaisalmer

Figure 4-24: Eco-Sensitivity of Project Area



The Project site is located within the same landscape of DNP, GIB potential and priority area. The Project site is situated within the GIB Potential area and in the immediate vicinity of GIB Priority area.

Even though the project is significantly away from the GIB Arc as mentioned by WII, the solar site and wind site may have significant movement of raptors.

Figure 4-25: Topographical Map of Project Area

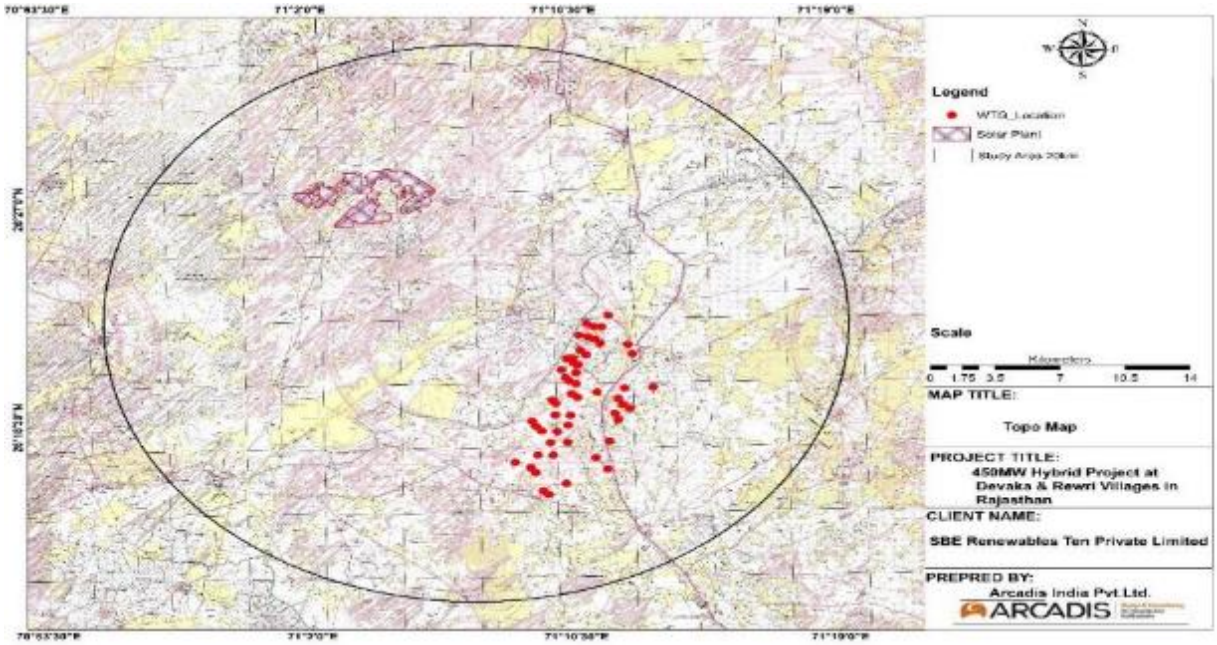


Figure 4-26: Birds recorded at Project site.

Egyptian Vulture

Western Marsh harrier

Variable Wheatear

Short-toed Snake-eagle

Purple Sunbird

Red vented Bulbul

Laughing Dove

Brown Rock Chat

Indian Robbin

Collar Dove

House Sparrow

Red wattled Lapwing

Common Krestrel

Black Drongo

Gargany

Common sandpipper

Common green shank

Grey Francolin

Little Grebe

Shikra

4.5. Socio-Economic Environment

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

Along with site visit, the study was based on primary & secondary data collection from various sources and consultations with various stakeholders. Telephonic Interviews and face to face interaction were also undertaken with Project Proponent, local villagers and government officials. Information and documents were collected from SBE, project site and land details as per requirements. The assessment of socio-economic environment was carried out based on the primary survey like telephonic as well as face to face interaction/consultation with various stakeholders during site visit with the help of framed questionnaire to conduct community consultation (as presented in **APPENDIX C**). Secondary data includes Census 2011, information available on the official website of the district of Barmer and Jaisalmer and other available data on official Government websites.

The socio-economic assessment has been done based on the information's provided by SBE like land details etc. and the outcomes of the consultation with the Revenue officers, SB Energy officials and other community members conducted onsite.

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 2011, district portal website and conducted the 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 villages and communities.

The following methodology was adopted:

- Telephonic and site Consultation with local representatives of project proponent;
- Telephonic Consultation with Land Facilitator;
- Telephonic and personal Consultation with Revenue officer,
- Telephonic Consultation with local sub-registrar office;
- Telephonic and site Consultation with all level stakeholders in the study area villages (e.g. Panchayat Members, landowners, encroachers, vulnerable communities (like SCs, STs, Women, etc.). Village Heads, Teachers, Farmers, Health Worker, ICDS Workers etc.

4.5.3. Demographic Profile

The 526.9 MW Hybrid Power Project is located at 7 villages, out of which 6 villages fall in Sheo taluk of Barmer district(Wind Site) and village Rivdi in Sam block(Solar Site) of Jaisalmer district, Rajasthan. The details of the study area for which socio-economic profiling has been carried is depicted in **Table 18 .**

Table 18: Project Location

Sl. No.	State	District	Mandal/ Taluka	Village
1	Rajasthan	Barmer	Sheo	Mati Ka Gol
2				Manihari
3				Junejon Ki Basti
4				Harwa
				Bhairoopura
6				Deoka
7		Jaisalmer	Sam	Rivdi

Source: (SBE), Primary Consultation and Census 2011

Demographic Profile of the District Barmer

In 2011, Barmer had population of 2,603,751 of which male and female were 1,369,022 and 1,234,729, respectively. Average literacy rate of Barmer were 56.53 of which male and female literacy were 70.86 and 40.63. With regards to Sex Ratio in Barmer, it stood at 902 per 1000 male. The Socio- Economic profile of the Barmer District is presented in **Table 19 .**

Table 19: Socio- Economic profile of the Barmer District

Particulars		Project Influence Area		
General	Area in Sq. m	28387.00		
	No. of Households	4,50,624		
	Sex ratio (Per 1000)	902		
	Child Sex ratio (Per 1000)			
	Density/Km2	92		
Population	Particulars	Male	Female	Total
	Rural	12,73,249	11,48,665	24,21,914
	Urban	95,773	86,064	1,81,837
	Total Population	13,69,022	12,34,729	26,03,751
	Childs Population (0-6)	2,63,356	2,38,166	5,01,522
	Schedule Castes %	16.69	16.84	16.76
	Schedule tribes %	6.76	6.77	6.77
Literacy Rate	Literacy in No.	7,83,461	4,04,861	11,88,322
	Literacy %	70.86	40.63	56.53
Economic Activities	Total Workers %	50.86	41.00	46.18
	Main Workers %	38.45	17.41	28.47
	Marginal Workers %	12.40	23.59	17.41
	Non-Workers %	49.14	59.00	53.82
Category of Workers	Cultivators %	57.45	69.98	62.73
	Agriculture Labour %	8.98	13.86	11.04
	Main Household %	2.47	2.64	2.54
	Other workers %	31.10	13.52	23.70

Source: Census of India 2011

Demographic Profile of the District

In 2011, Jaisalmer had population of 669919 of which male and female were 3,61,708 and 308211, respectively. With regards to Sex Ratio in Jaisalmer, it stood at 852 females per 1000 male. There was total 130463 children under 0-6 years of age. Child Sex Ratio as per census 2011 was 874. The Socio-Economic profile of the Jaisalmer District is presented in **Table 20 .**

Table 20: List of Villages within the Project Area

Particulars		Project Influence Area		
General	Area in sq. m	38401		
	No. of Households	117171		
	Sex ratio (Per 1000)	852		
	Child Sex ratio (Per 1000)	874		
Population	Particulars	Male	Female	Total
	Rural	312447	268447	5,80,894

Particulars		Project Influence Area		
	Urban	49261	39764	89025
	Total Population	3,61,708	308211	669919
	Childs Population (0-6)	69610	60853	130463
	Schedule Castes	52776	46358	99134
	Schedule tribes	22497	19932	42429
Literacy Rate	Literacy in No.	210415	98238	308653
	Literacy %	72.035 %	39.71 %	57.21 %
Economic Activities	Total Workers %	1,82,565 (62.50 %)	106338 (42.98 %)	288903 (53.55 %)
	Main Workers %	137757 (47.16 %)	37626 (15.21 %)	175383.00 (32.51 %)
	Marginal Workers %	44808 (15.34 %)	68712 (27.77 %)	1,13,520 (21.04 %)
	Non-Workers %	179143 (61.32 %)	201873 (81.61 %)	381016 (70.62 %)
Category of Workers	Cultivators %	22265 (7.62 %)	33473 (13.53 %)	55738 (10.33 %)
	Agriculture Labour %	11122 (3.80 %)	18019 (7.28 %)	29141 (5.40 %)
	Main Household %	3444 (1.17 %)	1129 (0.45%)	4477 (0.82 %)
	Other workers %	70012 (23.96 %)	9339 (3.77%)	79351 (14.70%)

Source: Census of India, 2011

Study Area Villages

Demographic Profile

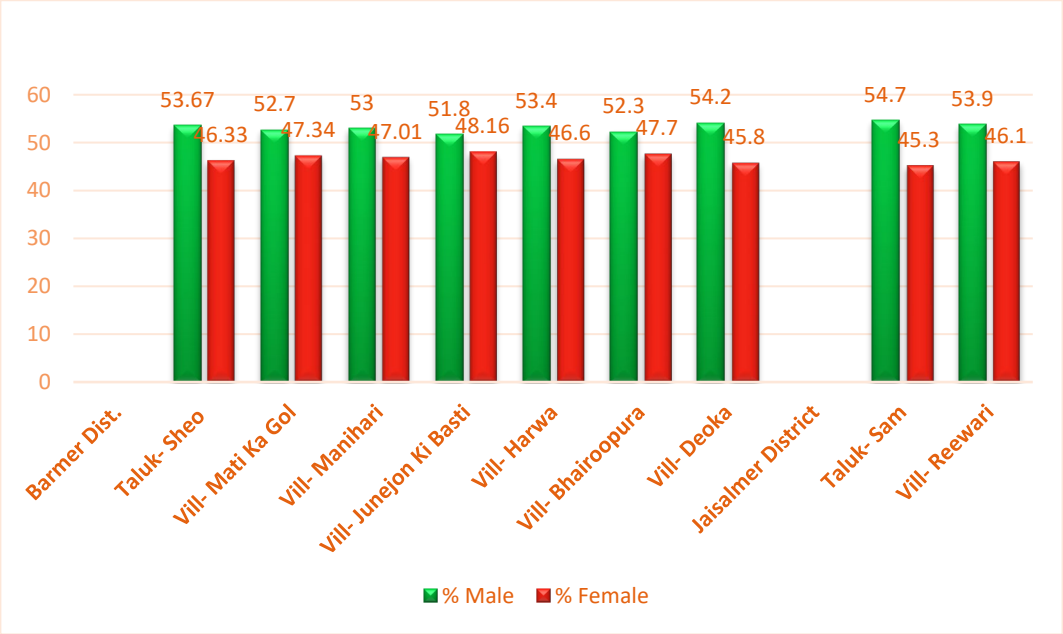
The demographic profile in terms of total population and sex-ratio of the study area villages are discussed in the section below.

Table 21: Demographic Profile of the Project Area

Taluk/ Village	Total Population	Male Population	% Male	Female Population	% Female	Sex Ratio
Barmer District						
Taluk- Sheo **(Wind Site)**	2,37,080	1,27, 247	53.67	1,09,833	46.33	863
Village Mati Ka Gol	488	257	52.7	231	47.34	1113
Village Manihari	787	417	53.0	370	47.01	1127
Village Junejon Ki Basti	1223	634	51.8	589	48.16	1076
Village Harwa	1417	757	53.4	660	46.6	1147
Village Bhairoopura	323	169	52.3	154	47.7	1097
Village Deoka	981	532	54.2	449	45.8	1185
Jaisalmer District						
Taluk- Sam**(Solar Site)**	1,89,707	1,03,813	54.7	85,894	45.3	1209
Village Rivdi	1208	651	53.9	557	46.1	2170

Source: Census of India 2011

Figure 4-27: Population Distribution in the study Area



4.5.4. Schedule Caste and Schedule Tribes (SC/ST)

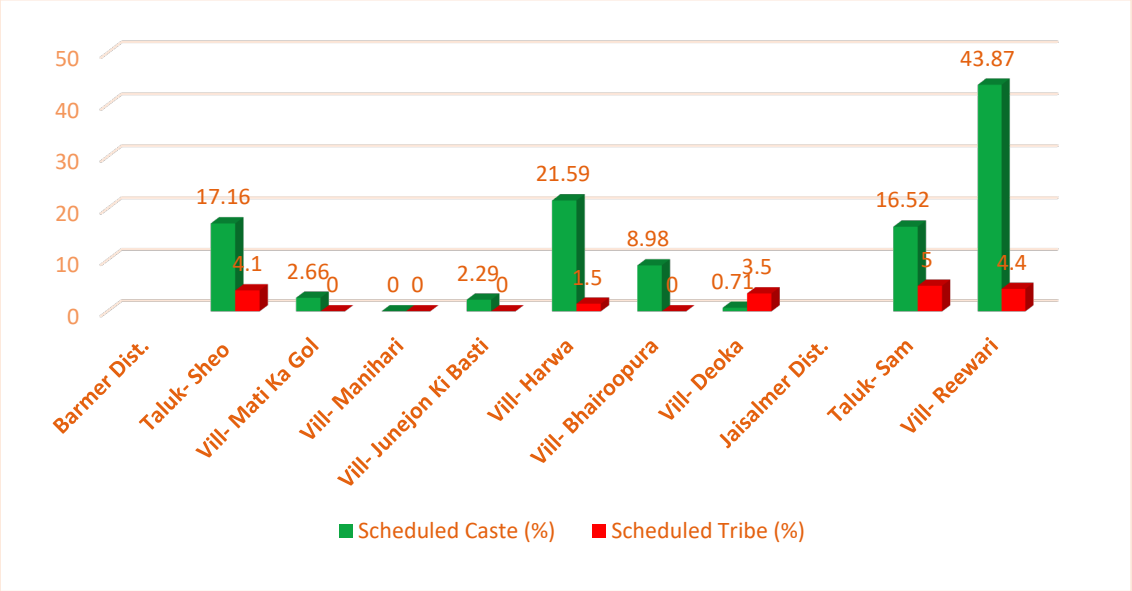
As per census 2011, the study area has sizable no of SC population & and negligible no of ST population. Details of the study area SC & ST population percentage with respect to the total population is appended herein **Table 22.**

Table 22: Study Area SC & ST Percentage

Study Area	Scheduled Caste (No)	Scheduled Caste (%)	Scheduled Tribe (No)	Scheduled Tribe (%)
Barmer District				
Taluk- Sheo **(Wind Site)**	40,679	17.16	9,790	4.1
Village Mati Ka Gol	13	2.66	0	0
Village Manihari	0	0.00	0	0
Village Junejon Ki Basti	28	2.29	0	0
Village Harwa	306	21.59	21	1.5
Village Bhairoopura	29	8.98	0	0.0
Village Deoka	7	0.71	34	3.5
Jaisalmer District				
Taluk- Sam **(Solar Site)**	31,340	16.52	9,413	5.0
Village Rivdi	530	43.87	53	4.4

Source: Census of India, 2011

Figure 4-28: SC & ST Population in the Study Area



4.5.5. Literacy in the Study Area

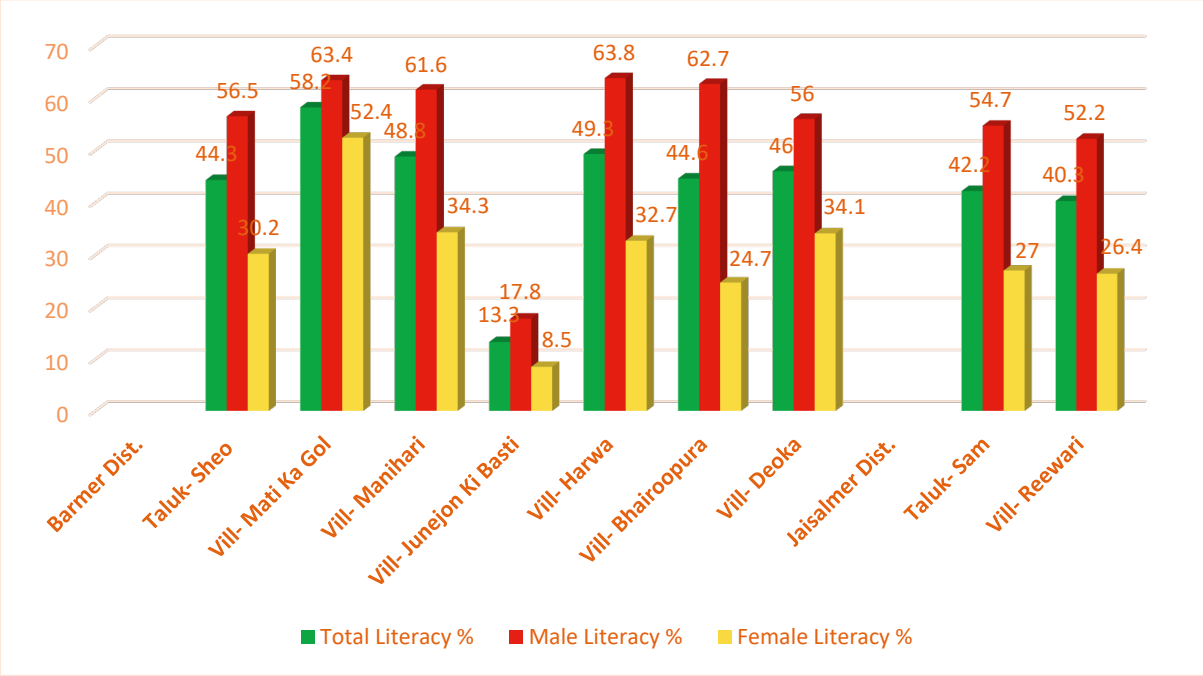
Average literacy rate of Sheo Taluk in 2011 were 44.3 % and Sam Taluk is 42.2 % respectively. As per census 2011 details of the study area literacy scenario is given in **Table 23.**

Table 23: Study Area Literacy Scenario

Study Area	Total Literacy	Male Literacy	Female Literacy	Total Literacy %	Male Literacy %	Female Literacy %
Barmer District						
Taluk- Sheo **(Wind Site)**	1,05,075	71,894	33,181	44.3	56.5	30.2
Village Mati Ka Gol	284	163	121	58.2	63.4	52.4
Village Manihari	384	257	127	48.8	61.6	34.3
Village Junejon Ki Basti	163	113	50	13.3	17.8	8.5
Village Harwa	699	483	216	49.3	63.8	32.7
Village Bhairoopura	144	106	38	44.6	62.7	24.7
Village Deoka	451	298	153	46.0	56.0	34.1
Jaisalmer District						
Taluk- Sam **(Solar Site)**	80,015	56,818	23,197	42.2	54.7	27.0
Village Rivdi	487	340	147	40.3	52.2	26.4

Source: Census of India, 2011

Figure 4-29: Literacy in the Study Area



4.5.6. Workers and Occupation

Study Area Barmer: As per the census 2011 and as verified during site visit and confirmed from local community, majority of population is dependent on agricultural and its allied activities like rearing of animals and it is main source of livelihood. The percentage of cultivators among the total working population of the villages in Barmer in the range of more than 70 percent to 100 percent and in Jaisalmer is 10 percent and rest are agriculture labour. Worker scenario is given in **Table 24 and Table 25.**

Table 24: Study Area working Scenario

Study Area	Total Workers	Total Main Workers	Total Marginal Workers	Total Workers %	Total Main Workers %	Total Marginal Workers %
Barmer District						
Taluk- Sheo	105177	57,544	47,633	44.4	54.7	45.3
Village Mati Ka Gol	244	9	235	50.0	3.7	96.3
Village Manihari	350	347	3	44.5	99.1	0.9
Village Junejon Ki Basti	175	39	136	14.3	22.3	77.7
Village Harwa	740	151	589	52.2	20.4	79.6
Village Bhairoopura	161	123	38	49.8	76.4	23.6
Village Deoka	499	215	284	50.9	43.1	56.9
Jaisalmer District						
Taluk- Sam	83,518	47,362	36,156	44.0	56.7	43.3
Village Rivdi	617	65	552	51.1	10.5	89.5

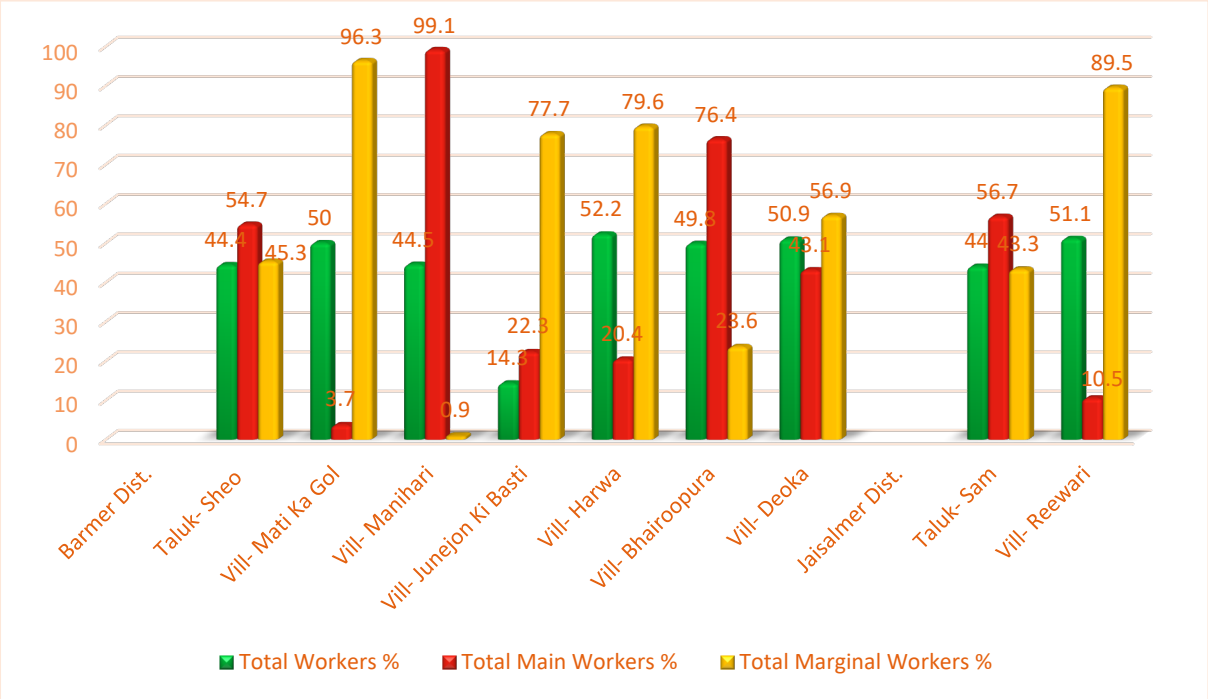
Source: Census of India, 2011

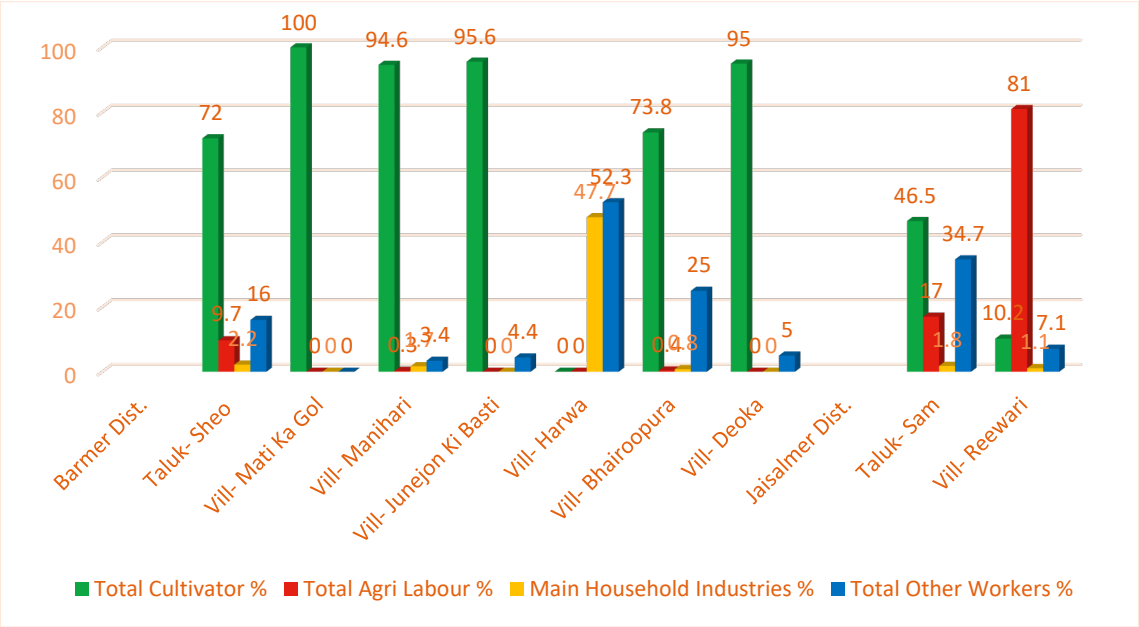
Table 25: Categorization of workers

Village	Total Cultivator %	Total Agri Labour %	Main Household Industries %	Total Other Workers %
Barmer District				
Taluk- Sheo **(Wind Site)**	72	9.7	2.2	16.0
Village Mati Ka Gol	100	0	0	0
Village Manihari	94.6	0.3	1.7	3.4
Village Junejon Ki Basti	95.6	0.0	0.0	4.4
Village Harwa	0	0.0	47.7	52.3
Village Bhairoopura	73.8	0.4	0.8	25.0
Village Deoka	95.0	0	0	5.0
Jaisalmer District				
Taluk- Sam **(Solar Site)**	46.5	17.0	1.8	34.7
Village Rivdi	10.2	81.0	1.1	7.1

Source: Census of India, 2011

Figure 4-30: Status of working population in the Study Area





4.5.7. Wages

As per circular of Labour Department, Govt of Rajasthan, the minimum wage for Contract Labors in all sector is Rs. 249, Rs. 237 and Rs.225 for skilled, semi- skilled and unskilled laborer's respectively w.e.f 1st May 2019.

Table 26: Minimum Wages for Labourers (INR)

Sl. No	CONTRACT LABOUR	BASIC WAGE (INR)
	CATEGORY	PER DAY
1.	Skilled	249.00/day
2.	Semi-Skilled	237.00/day
3.	Unskilled	225.00/day

Source: https://paycheck.in/salary/minimumwages/Rajasthan

4.5.8. Livelihood Resource

Agriculture and cropping pattern: As per Census 2011, more than 80 percent of the working population is directly dependent on agriculture, animal husbandry and labourers in nearby mining area. The agriculture in the area is majorly dependent on rain and large portion of the land remains barren in most part of the year., During site visit, it was noticed that there is no irrigational facility available and there is severe shortage of rainfall and ground water level is also very low which led to loss of agriculture production in the region. In the absence of any other alternative source for livelihood, agriculture and animal husbandry continuing to be the prime livelihood resource. The important crops grown are Jowar, bajra, pulses, jeera and cotton.

4.5.9. Livestock

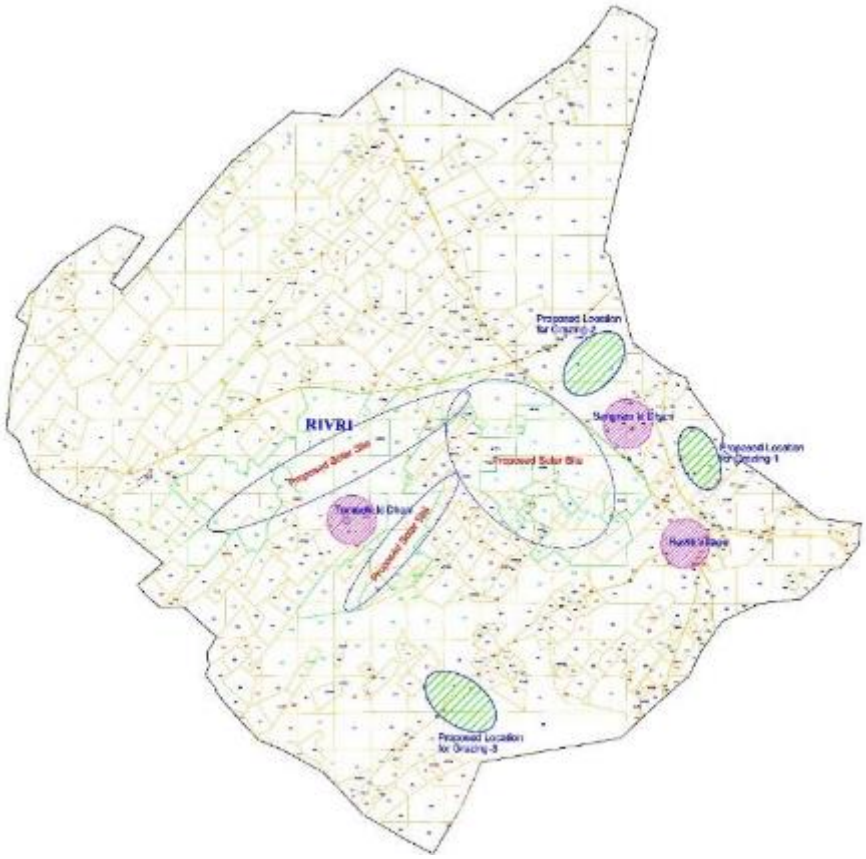
Project area has rich livestock resources especially goat and sheep population. The livestock population of the study area consists mainly of wool and milk producing animals. The village have notable number of livestock population i.e. sheep, goats, cow and buffalo. Gauchar land are available for grazing purpose in most the villages.

Animal Husbandry is commonly practice in the study area

4.5.10. Grazing Land

There is no designated grazing land in Rivdi village. It has been confirmed during consultation with head of Gram Panchayat and community. Grazing cattle are mostly dependent on open land both government as well as private land parcel.

Figure 4-1:Potential Location of Grazing Land



Photographs

4.5.11. Local Employment and Migration

During consultation with the community at the study area village, it was observed that animal husbandry and agriculture are important sources for livelihood. The same pattern of local engagement is for the weaker sections like SCs & STs. Also, the same has been verified with information available from Census 2011. There is no big industry in the region. People have migrated to urban center for better education & job opportunities.

4.5.12. Gender Empowerment Status

The female work participation rate in the area was observed to be lower in comparison to male work participation rate. In study area village, more than 50 % of the total working population are male and 41% of the total working population are female in Barmer district and in Jaisalmer, 62.50 percent are male working population and 43 percent are female engaged in economic activities. the women workforce is mainly concentrated in activities which are unorganized and informal. Household chores are mainly managed by women. Female laborers are engaged mainly in agriculture and animal husbandry.

4.5.13. BPL Families & Vulnerabilities

As reported by the panchayat and community members, a few persons from different vulnerable groups (e.g. BPL, SCs, STs, landless family, orphans & children, old aged/senior citizens, differently abled people, physically handicapped and lone widow, poor migrants etc.) are present in the village. The proposed project has no direct & indirect impact on their land & livelihood.

In Harwa gram panchayat, there are 15 physically handicaps and as per the updated BPL list under Pradhan Mantri awas yojana, there are 197 BPL families. The project proponent may be required to focus on providing livelihood support opportunity to the vulnerable members and implementation of development programs under CSR activity.

4.5.14. Land Holding Pattern

During discussions with the local community in the study area, it was understood that the average land holding size varies between 25-30 bigha (16 to 19 acres) per household in study area villages. As information revealed during telephonic consultation with the community, govt. bore well is the one of sources for irrigation and other source is artificial ponds/wells and through tanker supply. Harwa Panchayat water supply available through tube well.

4.5.15. Irrigation

As per information revealed during consultation with the community, there is no irrigation facility available in the study area. Cultivation is mostly dependent on seasonal rainfall.

4.5.16. Amenities & 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. No major physical and social infrastructure facilities are available in the study area. Communications and transportation facility are very poor.

A review of infrastructure facilities available in the area has been done based on the information given in Barmer and Jaisalmer District Census Handbook, the data of National Informatics Center, for the year 2011 as well as from other resources and site visit undertaken.

Medical Facilities: Study area- village

As observed the health facility in study area villages is inadequate to cater the needs of the population. Harwa, Manihari and Reevadi have public health sub center and people normally go to the nearest Community Health Centre (CHC) at Seo and Sam taluka which is around 7 and 20 km away from the area. ANMs also move into the village for promotion of routine immunisation. Emergency No. 108 is availed for ambulance from Govt. support in times of need. Also, emergency No. 104 is availed for medical assistance. Communicable seasonal diseases like Malaria, dengue is the common disease among the village. As of the last site visit conducted by Arcadis team in the village in January 2021 there were no COVID19 cases in the village or the surrounding area. If they have anyone coming from the city the person self-quarantine in the house for 7 days. In case of any medical need the villagers prefer going to the Government Hospital in Fatehgarh.

Figure 4-31: Medical facility Available at Villages

Primary Health sub-Centre at village Reevadi

Medical Available at Sub Center and No Sitting Arrangement at village Reevadi

Education:

As reported during telephonic consultation with Harwa panchayat head, there are 4 primary schools, 2 Senior Secondary School, 2 Secondary and 1 Upper Primary School in the study area villages. There is one Primary school and one middle high school and one High School in Rewri village of Sam tehsil. College is at Sheo taluka which is about 7 km away. In the school midday meal is provided for students. The schools have separate toilet arrangements for girls and boys. Students normally go to Sheo, Barmer and Sam and Pokhran taluka for availing further higher education.

Figure 4-32: Educational Facility at study area

Rajkiye Aadarsh Uccha Vidhyalaya at Reevadi

Rajkiye Madyamik School at Hadwa

Drinking Water Facility at Reevadi School

Toilet Facility at Reevadi School

Anganwadi Centres (AWC):

"Integrated Child Development Services' is a 100% centrally sponsored scheme under which six services i.e. supplementary nutrition, pre-school education, immunization, health checkup, health and nutrition education and referral services are provided to the children in the age group of 0-6 years, pregnant women & lactating mothers.

As reported during consultation with community and village panchayat head, there is at least one Anganwadi in each village of the study area. It was reported that anganwadi has its own drinking water facility but there is no toilet facility in the anganwadi. On an average, the Anganwadi Centers has enrolment between 20-50 children and 8- 20 mothers. Some of them visit the centers occasionally and few regularly. Water is mostly carried from the nearby school.

Figure 4-33: Anganwadi Center

Consultation at Anganwadi Lawan

Drinking Water Facility:

It was informed by villagers that tube well is present in Harwa gram panchayat and rest of the villages carry water from the old ponds/well or tanka for drinking purpose. Water is also supplied through tanker to different localities. Average rate of the tanker varies from INR 700-1000 per tanker. Borewell is used for irrigation purpose as reported during site visit to both Solar as well as the wind sites)

Figure 4-34: Drinking Water Facility

Water Facility in Harwa Village

Other Physical & Social Infrastructure facilities

Communication and Transportation Facilities: Government bus service are not available in the study area villages but other local transport facilities not inadequate. Auto rickshaw services are available for local movement. Otherwise, people use their self-owned two and/ or four-wheeler.

Cooking fuel source: During consultation, a gradual growth of preferring LPG over fuel wood was reported in the consulted villages. On an average around 30-40% households use LPG and rest 70 % population use firewood, dried biomass, cow dung briquette are the other sources of energy by villagers for cooking and heating.

Sanitation: Most of 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.

Power Supply: Households of all study area villages were observed to have electricity connections. It was told by the local people that electricity is available only for 7-8 hours. Tariffs are being charged for these connections.

4.5.17. Common Property Resources (CPR)

During consultation with Panchayat members and villagers, it was noted that villages have some Common Property Resources (CPR) like community ponds, temples, other ICDS centres, community halls, cremation ground etc. As informed, there is no CPR reported on the proposed site. Neither these sites are used for as pastureland, place of worship or of some religious significance, burial/cremation ground etc. it is also verified during site visit and confirmed from local community including SCs in Reevadi. The same is also reported by the land facilitators and local authority like village panchayat head and land revenue officer. No such informal use has been envisaged for the proposed site.

Figure 4-35: Common Property Resources at Study area Villages

Gram Panchayat Bhawan

Tehsildar Office

Internal village road

Dry Pond

Graveyard at Village Reevadi

Artificial pond used for agricultural purpose

Temple in Village Reevadi

Water Supply System at Hadwa

Rajiv Gandhi Service Center at Reevadi

Community Center at Reevadi

4.5.18. Archaeological Site

As observed during field visit there is no designated archaeological or cultural heritage site within 10 Km radius of the study area village.

4.5.19. Community & Institutional Consultation:

Village profiling and community consultation has been carried out in all the villages located in the proposed project area. Stakeholder consultation included discussion with Harwa & Reevadi village panchayats, Anganwadi, educational institute and community health Centre etc. The list of stakeholders consulted for the proposed project is provided in **Table 27**.

Table 27: Telephonic Consultation with Stakeholders

Stakeholder type	Name & Designation	Department/Address	Date
Project Proponent	Mr. Abhishek (Project Head) Mr. Anil Mishra (Rajasthan Project head)	Representatives SBE Renewables Ten Pvt Ltd	05/06/2020
Land Facilitator	CS Bohra		04/06/2020
Revenue officer	Bheru Singh, Krishana Ram Bhadu	Patwari, Bherupura Hadwa Village & Reevadi Village	02/06/2020
Irrigation Department	Mr. Nakhta Ram	Irrigation Supervisor, Sajit	02/06/2020

Stakeholder type	Name & Designation	Department/Address	Date
Panchayat Members	Mr. Anoop Singh Rathor	Hadwa, Bherupura and Manihari	02/06/2020
Primary Sub Health Centre	Mrs. Anita Singh, ANM Teejo, ANM	Sajit Village & Reevadi Village	02/06/2020
Forest Range office	Mr. Jalan Singh	Forest Guard, Reevadi Village	02/06/2020
Primary School & Secondary School	Mr. Raju Ram Suther Mr. Ridmal Dan	Reevadi & Bhuiyasar Village	02/06/2020
Anganwadi Center	Ms Geeta Devi	Sajit Village	02/06/2020
Villagers	Swender Singh, Sarpanch Aman Singh, Sawai Singh Dilip Singh, Latez Khan Lalit Kumar, Aidaan Khan Mana Ram	Farmers of Reevadi Village	02/06/2020

Source: Primary consultation

Table 28: Stakeholders Consultation Contact details

Name	Designation	Village	Date
kishana Ram Bhadu Phone No: 9784692365	*Patwari*	*Rivdi*	*25-06-20*
Jalam Singh Phone No: 9828484962	*Sarpanch*	*Rivdi*	*25-06-20*
Tarachand Paliwal – general Phone No: 9983450402	villager	Rivdi	26-06-20
Hari Singh – OBC Phone No: 9828490647	villager	Rivdi	26-06-20
Parbat Singh Phone No: 9950138682	villager	Rivdi	26-06-20
Nar Singh Rao- Phone: 8890641519	villager	Rivdi	26-06-20
Bhima Ram- Phone: 7877374950	villager	Rivdi	26-06-20
Satta Ram – ST- Phone: 9571452092	villager	Rivdi	26-06-20
Chala Ram – SC- Phone: 7665295761	villager	Rivdi	26-06-20
Anup Singh- Phone: 8118878433	*Sarpanch*	*Harwa*	*25-06-20*
Fakira Ram – ST- Phone: 9549612494	Villager	Devka	25-06-20
Samda Devi – ST	Villager	Devka	25-06-20
Rasul Khan Phone: 9660117593	Villager	Juneju Ki Dhani	26-06-20

Source: Primary consultation

Table 29: Stakeholders Consultation Contact details

Stakeholder type	Name of the Stakeholders	Village/ Department/ Designation	Date
Surveyor for All WTG Location	• Swai Singh, Jhodhpur Aman Singh, Local leader of Fatehgarh	Maple Energy	10/09/2020
Villagers	• Kasar Khan • Alana • Saukat • Meharban • Shyam Muhammad	Juneji ki Basti/Dhani of Hadwa Panchayat	10/09/2020

Stakeholder type	Name of the Stakeholders	Village/ Department/ Designation	Date
	• Aliyas • Jakur son of Aliyas • Faruk • Alma • Mariyat • Elma • Soda singh • Anwar • Maruawat • Aliyas Yaseen khan		
STs Community	• **Jiva Raj Ram** • **Bhoja ram** • **Hukuma Ram** • **Kamala Devi** **Santu Devi**	**Hadwa Village**	**10/09/2020**
Manganiyars community	• **Moti Khan** • **Chhotu Khan** **Talib Khan**	**Hadwa Village**	**10/09/2020**
SC Community at Hadwa Panchayat house	• **SC Community** • **Sagra Ram-10 Bigha** • **Ina Ram-12 Bigha** • **Dau Ram Jl-18 Bigha** **Nagtu Ram-40 Bigha**	**Hadwa Village**	**10/09/2020**
SC Community at Bherupura Village	• **Mula Ram (30 Bigha)** • **Gyana Ram (50 Bigha)** • **Shiv Lala** • **Hema Ram** **Teja Ram**	**Bherupura Village**	**10/09/2020**
Local Community	• Devgiri Giswami • Kheti Maweshi • Hitesh Giri • Kailash Giri • Sattar Seni • Dhan Dhani • Amrit Giri • **Hera Ram** **Jantu Ram**	Devka Village	10/09/2020
Local Community	• Madan Lala (35 Bigha) • Raju Ram (40-45 Bigha) • Hukium Dan • Vijaya DHan • Bhagirath Dan • Motilal Kumawat • Ramesh Kumaer	Rajada Village	10/09/2020
Meghwal Community(SCs)	• **Raju Ram** • **Kuldeep Ram** • **Uma Ram** • **Gyana Ram (70 Bigha)**	**Sangramo Ki dhani**	**11/09/2020**

Stakeholder type	Name of the Stakeholders	Village/ Department/ Designation	Date
SCs Community	• **Kamachi Ram and his five brothers** • **Arun Lal Ram** • **Pramod**	**Tamachi Ram ki Dhami**	**11/09/2020**
Local Community	• Tarachand Paliwal(50 Bigha) • Hukum Singh(75 Bigha) • Dalpat Singh(75 Bigha) • Rajendra Singh(75 Bigha) • Dinesh Singh(50 Bigha) • Raipal sigh Babu Singh	Reevadi Village	11/09/2020
Local Community	• Ram lal • Pal singh • Lakshan singh • Duraram • **Kasha ram** Naresh Singh	Bhadani Village	11/09/2020
Local Community	• Chain singh(150 Bigha) **Ganga Ram(40 Bigha)**	Bhiyasar Village	11/09/2020
Local Community	• Raja singh(150 Bigha) • Rajendra singh • Kripa Ram(30 Bigha)	Sangur Village	11/09/2020
Local Community	• Angad Lal • Hera singh • Girdhar Barhat • Raju singh	Koda Village	11/09/2020
Local Community	• Kamlesh singh • Balbeer singh • **Daulat Ram** • **Babu Ram** • **Kalu ram**	Unda Village	11/09/2020
Local Community	• Aarab Kahn • Suleman Khan (Panchayat Head) • Khair khan, Mumtaaz, Sabina	Kehro ki dhani	11/09/2020
Local Community	• Allabachay khan • Mubarak Khan • Amin Khan • Narayan Singh • Mungi Lal • Mahangu Lal Madan singh	Devikot Village	11/09/2020
Revenue Officer	• Sugan Singh – 9783804147 • Ram Das Singh (9849130949)	Reevadi Village	11/09/2020

Source: Primary consultation

Consultations were carried out firstly through telephonic and later on physical verification through site visit twice, first in the month of June and then in the month of September at the study area villages including the villages (Reevadi, Devka, Devikiot, Kaharon ki Dhani, Mati ka Gol, Bhadani, Bhiyasar, Kota, Unda and Sangur) where transmission route will pass arranged by project proponent field officers (Details given in **Appendix D**). the consultations were carried out with various stakeholder such as with

the titleholders, non-titleholders, locals, anganwadi workers, primary health center workers, teachers and panchayat members. Discussion was based on a set of questionnaires including project specific negative and positive impacts, socio-economic resource, demographic profile, livelihood dependency of the village and local communities. Needs & expectations of local's along with the project development was also discussed.

During discussion, it was found that the stakeholder's consulted are not fully aware about the upcoming Hybrid solar & wind project. Locals are also not aware that project would involve government revenue land and some government land for transmission line tower, access road, and pooling substation, which would be procured from the Rajasthan Revenue department on lease for approx. 30 years. Land identification has been completed, project boundary has been not clearly demarcated and land lease process has been completed. As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all the locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent. The general perception of locals is positive toward development activities in the region as they see it as an opportunity for direct and indirect employment opportunities. At the same time, locals were also apprehensive on their livelihood as their dependency on government land had been noticed in the form of agriculture activities during monsoon and few showed concerns on the health and safety risk associated with movement of heavy vehicles for transportation of solar/wind equipment's onsite and demanded proper health and safety plan.

Figure 4-36: Stakeholder consultations at project study area during Site Visit

Consultations with Muslim Community at Jhunejo Ki basti

Consultations at Local SCs and Muslim Community at Bhairopura Village

Consultation with female Muslim Community

Consultations at Hadwa with STs Community

Consultations at Hadwa Panchyat Manganiyars community

Consultations at Hadwa with SCs Community

Consultation with Local Community at Hadwa

Consultation with SCs Community at Hadwacha

Consultation with Local Shop Ownwers at Hadwa

Consultations with Muslim Community at Jhunejo Ki basti

Consultations with Private Landowner near Solar Project Site

Consultations with Local Community at Reevadi

Consultations with female at Mati ka Gol

Consultations with female at Devka

Consultation with School teacher at Sangur Village

Consultations at Kheharo ki dhani

Consultation at Devikot Village

Consultations at Kheharo ki dhani with Female

Consultation with Revenue Officer

Consultations with SCs community at Bhiayasar

Figure 4-36: Stakeholder consultations at project study area

Consultation with Sarpanch at Reevadi Village

Consultation with Local Villagers

Consultation with patwari in Rivdi for solar site

Consultation with sarpanch of Harwa for wind site

Consultation with Local villagers

Consultation with ANM Worker at Reevadi

Consultation with Primary School Teacher

Consultation with School Teacher at Reevadi

Meeting with Forest Officer & Irrigation Officer

Meeting with Anganwadi Worker at Reevadi

Consultation with Revenue Officer of Bherupura & Hadwa

Meeting with Local & Sarpanch of Hadwa/ Bherupura/ Manihari

Key Findings of Consultation

Some key findings of different level stakeholder consultation are highlighted below:

Observation on Solar Site:

Solar site: The proposed project is surrounded by two large settlements of Rivdi & Kapuria villageand two small settlements locally called as Dhani (hamlet) Sangram ki Dhani & Tamachi ki Dhani of Rivdi village. It is seen that these settlements especially Sangramo ki dhani and Tamachi ki dhani is falling adjacent to the proposed project boundary.

Since the land leasing/allotment process was underway, it is understood during consultation that the Local communities are not much aware about the proposed project except the involvement local authority such as panchayat and revenue department. Majority of impacted households are from Rivdi village. Apart from agriculture, goat and sheep rearing is another important source of livelihood activity in Sangram Ki Dhani. Majority of households belong to minority community not SC/ST.

Settlement & Structure:

There are 54 structures which are identified on the proposed project land for solar site. Majority of the structures are permanent in nature like underground water tank (18) and few temporary structures like huts used for storage of fodder and food grains(12), cattle shed(20 and common property(2). No residential structure is impacted. Also, two government structures like check dam and borewell are reported at the proposed solar project site.

One family is settled near their private farmland adjacent to the proposed solar boundary and stays with his family member during the farming season. The settler is from Rivdi village and doing farming on his private land. However, there is no adverse impact envisaged.

Grazing & Access issue:

The solar project site, it is seen that local communities are using proposed government land for grazing of their animals. The village road going to Sangram Ki Dhani is not impacted by the proposed project. Currently as per the consultations carried out with the villagers, there will not be any access issues faced by the villagers. The village road going to Sangram Ki Dhani is not impacted by the proposed project. Project proponent will develop alternative approach road to Tamchi Ki Dhani as communicated during site visit.

There is no designated land for grazing in Rivdi village as a result, cattle are dependent on open land for grazing which includes both government as well as private land parcel.

Communities' perception: During consultation it was asked whether they are in favour of any development activities/ projects like solar/wind in their localities. People are overwhelmed for any new project and are willing to sale and lease their private land as expressed their view across small settlements (Dhanis) in Rivdi village. As perceived after discussion, they are looking for other employment opportunities in their surrounding villages.

Observation on wind Site: Site visit and consultations with local communities were carried out in all 7 Villages of WTG Locations and it is seen that WTG locations have been identified on government land. However, the proposed project land is surrounded by private land and agriculture activities are being practiced in Harwa and Devka which happens during monsoon reason (Jun-September). Rest of the year, it is dry land with not much vegetation and no agricultural activities could be undertaken or reported. The region falls under rainfed zone and agricultural activity is fully dependent on monsoon. The land is cultivated in Kharif season only.

Vulnerable community: It was found that vulnerable communities like SCs and STs families have land ownership rights and engaged in agriculture activities. Animal rearing is another main livelihood source across villages in the proposed project sites. Apart from agriculture activities, they are also working as agriculture labours or daily wage labour in nearby villages. The proposed project has no direct & indirect impact on their land & livelihood.

Permanent and temporary structure

A total 23 number of households are impacted by the project. Approx. 29 structures have been impacted due to wind project. Majority of the structures are permanent in nature like residential houses (13) and few temporary structures like huts used for storage of fodder and food grains (12), common property (2), religious place and 1 underground well. Also, two abandoned structures are reported on government land in Devka village.

Communities Perception: It is observed that people are in favour of new project and are willing to sale and lease their private land as expressed their view during consultation across villages so that they might get some employment opportunities. There are few WTG seen at project impacted and project influence area.

Transmission Route: It is reported that the survey for the transmission route has been completed, however, the route finalization is underway. Consultations were carried out in few identified villages like Harwa, Devka, Devikot, Rivdi, Bhiyaasar, Mati ka gol, Sangramon ki dhani, Sanguar and Kair Fakiron ki dhani, Kota and Unda from where transmission route would pass. It was observed that few villages are already having Wind turbine from other developers. Local communities are mostly involved in agricultural and agriculture related allied activities. Animal husbandry is commonly practiced in all communities and it is another Major source of livelihood. Land entitlements are seen across all communities and even marginalized communities are having sizable number of land ownership. On and average, all communities having 10-12 acres (20-22 bigha) of land.

General Perception: During interaction it was understood that local community are positively responding to new development projects in their areas and willing to lease out their land for the same if required in future. Details of the stakeholder's consultations are given in **Appendix E (Table 3).**

Other General observations & finding during consultations:

- SB Energy is the sole authority and responsible for all land related matter for the entire 526.9 MW Hybrid Power Project
- Government Revenue land has been sub leased to SBE for the proposed project.
- Majority of impacted households are from Rivdi village. Apart from agriculture, goat and sheep rearing is another important source of livelihood activity in Sangram Ki Dhani. Majority of households belong to minority community not SC/ST.
- Animal Husbandry & Agriculture is the major livelihood resource of the study area village and also of the surrounding area. Almost 70-80 percent of population is involved in animal husbandry & agriculture, rest are labourers engaged in NAREGA.
- The main crops are jowar, bajra, til along with other crops included black grams and cumin,
- Agriculture is mainly dependent on rainwater and few places bore wells are available.
- Female literacy rate is much lower than male literacy rate in the study area village.
- Sanitation facilities are adequate in the study area villages.
- Scarcity of water is an issue in the study area village, especially potable water.

- Drinking water facility is now adequate in the Harwa village panchayat through tube well. A few scattered manmade wells/ponds are available and mostly used for drinking purpose for domestic animals.
- There is no community health centre available within the study area villages but, local people have to rely on ANM & Local quacks. To avail hospital facility, people generally visit to either Seo community health center (around 7-10 Km) and Barmer (around 20-25 Km) for Govt. and private hospitals.
- Education Facility: Rivdi is having – 1 anganwadi, primary school, Senior secondary school. Schools are almost 2-3 km away from the site. Colleges are there in Jaisalmer and Barmer
- Based on the visual observation during site visit of Arcadis team and people's consultation, land parcels were devoid of settlements, hence, there is no such evidence of physical and economic displacement and resettlement witnessed for this project.
- As per discussion with Sarpanch (village head) 100 -150 ST families living in surrounding villages of wind site & around 8-10 ST families are living in surrounding village of solar site. During site visit, Arcadis held consultations with ST population (locally known as Bhil tribe) residing in Rivdi & Devka village. The consultation revealed that local ST community are not socially secluded. They live with the mainstream population & have access to all common property resources. Also, as reported, no acquisition/leasing of ST land was planned/undertaken for the project. Considering the fact of not taking ST land in project, and no physical and or economical displacement of tribal populations is necessitated, therefore, no adverse negative impacts are envisaged.
- During site visit of Arcadis team, no notified Cultural Heritage site is recorded within the vicinity of the project. However, wind sites traverse through a number of religious common properties such as temples, mosques which though not of archaeological significance but nevertheless are significant to the local community. Kapuria math (temple) is located 15 km (approx.) from solar site

4.5.20. Needs Gap Assessment for CSR Initiatives

Analysis of above socio - economics description and local telephonic consultation in project area villages reveal that majority of the needs and expectations are linked with the fulfilment of basic needs and improvement of some infrastructural facilities at school/ Anganwadi/ health etc. levels.

SBE has its own CSR Policy. CSR initiatives shall be implemented in the project affected villages as per the policy. However, during discussion with villagers, Panchayat Members, anganwadi workers and ANM workers following gaps are identified which is mentioned in Table 29. Needs have been classified as high, medium and low to assess the further take up in the CSR study/initiatives.

Table 29: Key Needs/Gaps Identified

Key Areas	Gaps identified	Suggestions	Needs
Drinking water & Drainage system	• Limited no. of bore well/tube wells are available for drinking purpose in the study area. • There is no fresh/filtered drinking water available in the villages. Fluoride content in water is very high. • There is no drainage facility in the village	• Providing additional drinking water facilities like more tube well and other drinking water facility with RO filters in affected village with help of concerned government dept. • Provision for better drainage facility.	High

Key Areas	Gaps identified	Suggestions	Needs
Education	• Lack of Higher Education facilities • Very low female literacy rate compared to male • Lack of skill development & vocational training in study area village • Lack of basic infrastructure facilities like drinking water, sitting arrangements, sports equipment, library & electricity etc.	• Awareness program regarding female education at village level. This can be linked with vocational training programme in the study area village focussing on Weaker sections specially who belongs to SCs & STs. • Providing computer literacy program at village level • Providing functional Cultural Hall, drinking water facility, borewell, toilet facility, electricity, and tables & chairs	Medium
Health	• Absence of health care facility in study area village which is affecting the basic health of the local people Major diseases are observed – Fluorosis, Malaria, dengue, Body Pain, and other general diseases are common.	• Organizing awareness camp on general health awareness. • Health camps or mobile health clinics can be provided.	High
Agriculture/ Irrigation	• Agriculture is dependent both on rain and irrigation. But the project affected village lacks inadequate irrigation system.	• Rainwater harvesting should be planned wherever possible with the project site to improve groundwater recharge.	Low
Employment opportunities in the area	• Only a few numbers of SHGs (all under Development of women and children in Rural Areas) are reported in the village • Majority of the youth population are unskilled and unemployed. • Labourers are mostly seasonal workers and migrate only for a short while in the nearby towns, either as artist or masons.	• Organizing training/capacity building program for SHGs regarding entrepreneurship and linkages with bank. Separate training programme can be arranged for weaker section of social categories like SCs, STs, PHs etc. • Introduction of processing of dairy and other allied activities related to livestock where preference is given to Weaker sections.	Medium

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
- Site suitability and justification 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.

The project presents an opportunity to utilize the potential for solar and wind 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.

Rajasthan is rich in solar resources and solar energy will complement the conventional sources of energy in a large way. Also, maximum wind energy is generated in Jaisalmer and also in Bikaner and Barmer of western Rajasthan, with many private companies involved in the business. The State of Rajasthan is blessed with about 240 to 300 sunny days with good solar radiation of 5.08 to 5.77 kWh/m2/day. The solar energy potential in Rajasthan is estimated in excess of 18,382 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

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. Solar 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, solar power is not subject to fluctuating fuel prices which drain India’s limited foreign reserves, and in addition, solar power helps in reducing the carbon footprint of the economy.

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.

Table 30: Advantages and Disadvantages of various non-renewable and renewable energy

Source of Energy	Advantages	Disadvantages
Coal	• Relatively cheap form of energy availability in large scale worldwide	• Non-renewable energy source • Large water requirement

Source of Energy	Advantages	Disadvantages
	• Easily transported to power stations • Reliable source of energy with steady output • Coal is available in India	• High emission 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 oil and gas releases 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. • Does not produce significant atmospheric pollutants.	• 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.
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. its construction periods are longer with higher environmental risks from emissions. On the contrary power source from solar energy is most eco-

friendly. It does not have any kind of emissions during operation. Wind power requires high wind zones to be set up and micro siting along with detailed meteorological analysis is required which is very much favourable in Jaisalmer district, site selection for solar power is relatively easier there as well. Both Solar and Wind power energy is a clean power project with no emissions and feasible for the project area keeping in mind the good solar and wind potential in Jaisalmer, Rajasthan throughout the year.

5.3.1. Alternate Routes for Transmission Lines

As discussed with SB Energy official, the route of the transmission line will be selected keeping in mind the following factors

- Transmission line route is planned to avoid any habitations along the route
- No house or community structures are located under the transmission line
- Areas requiring extensive clearing of vegetation have been 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. Tx Line ROW land will be as per 30 m and will be taken up separately, land will be mix with ~60% Govt land and rest private land (Both revenue and private land, but not studied yet). It is reported that the survey for the transmission route has been completed, however, the route finalization is underway. Consultations were carried out in few identified villages like Harwa, Devka, Devikot, Rivdi, Bhiyaasar, Mati ka gol, Sangramon ki dhani, Sanguar and Kair Fakiron ki dhani, Kota and Unda from where transmission route would pass. It was observed that few villages are already having Wind turbine from other developers. Local communities are mostly involved in agricultural, and agriculture related allied activities. Animal husbandry is commonly practiced in all communities, and it is another Major source of livelihood.

5.4. Site suitability and justification for the project

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

Basically this is a SECI ISTS Tender which means when SECI had called for bids, whoever wins the bid can select the location of the project in entire India as per their choice; the only limiting factor being that the entire power from both the solar and wind farms has to be evacuated into a common substation. So, eventually, this Developer chose this project location in Rajasthan upon their site working comfort and feasibility where the Site was visibly barren land with very less farming and very less settlers. Land development agreement has been executed with Engineers and Engineers. There is no restriction on location for setting up of these projects, as long as SPV follows all laws and seeks necessary permissions for setting up project and tx line for the project.

5.5. Conclusion

Various factors are considered such as solar and wind resource potential at the project site, favorable environmental and social settings, lowest GHG emissions in the project life cycle. Availability and suitability of solar and wind power potential, land and other allied infrastructure availability and various

government supporting policies. Considering these factors, it can be concluded that the site is the good location for development of Hybrid power project.

6. ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

6.1. Approach & Methodology

Primary impacts are assessed for a radius of 1 km around the project site and secondary impacts are assessed within the study area (10 km radius from project site). Also, 100 m RoW along the tentative transmission line route is also considered for impact assessment. IFC's safeguard policies require that (i) impacts are identified and assessed early in the project cycle; (ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and (iii) affected people are informed and consulted during project preparation and implementation. IFC emphasizes on the use of a screening process as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.

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 31.**

Table 31: Screening Criteria for Environmental and Social Impact Assessment

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

6.1.1. Significance Evaluation Matrix

Significance evaluation matrix as shown in **Table 32** has been used to evaluate the significance of identified potential environmental impacts. This matrix includes criteria as discussed above to analyses the significance of impact. Color 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 32: Impact Significance Matrix

Distribution	Duration	Intensity	Significance
Within Site	Short	Low	LOW
Within Site	Short	Moderate	
Within Site	Medium	Low	

Distribution	Duration	Intensity	Significance
Within Site	Medium	Moderate	
Within site	Long	Low	
Buffer area	Short	Low	
Widespread	Long	Low	
Within Site	Short	High	MODERATE
Within Site	Medium	High	
Within Site	Long	Moderate	
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 33: Aspect Impact Matrix for Construction and Operation Phase

	PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT					
	Aesthetics and Visual impacts	Air Quality	Noise Quality	Topsoil 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	Migrato/y Birds/Avi fauna	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 sub lease/purchase process					L					L						L	M				
Sourcing and transportation of construction material etc.		M	L	L						L							L	P		L	L
Storage and handling of raw material and debris	L	L	L	L																L	
Interaction of migrant labor with locals																	L	P	L	L	
Operation of DG sets		L	L	L																	
Access road construction		M	L	L	L					L							M	P			L
Site Clearance		M	L	L						L					M			P		L	L
Foundation excavation		M	L	M						L								P		L	L
Transformer yard construction		L	L	L																L	L
Substation construction		L	L	L																L	L
Laying of transmission lines																	L		L	L	L
B. Operation Phase																					
Vehicular movement carrying Officials on site during routine inspection, maintenance and operation of Wind - Solar Hybrid Power Project		L	L							L											
Periodic maintenance of all solar modules (washing modules)																		P			L
Maintenance of ancillary facilities such as store, yard, site office																					
Inspection of transmission lines													L								L
Security of Wind - Solar Hybrid Power Project in operation																		P			L
Operation of Wind - Solar Hybrid Power Project													M					P			L
C. Decommissioning Phase																					
Access roads and other components	L	M	L																		
Disconnecting and removal of Inverter Stations, Substation	P			P	M																
Loss of Jobs																		P	M	M	

6.2. Impacts on Physical Environment

6.2.1. Air Quality

Construction Phase:

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

Mitigation Measures:

- Vehicles speed to be restricted to 20-30 km/hr on unpaved road.
- Raw material should be covered with tarpaulin sheet during transportation and in storage area.
- Ensure water sprinkling on unpaved area to minimize the dust emission.
- Fine materials (e.g., sand) should be covered during transportation.
- All the project vehicles shall have PUC. Regularly ensure maintenance of project vehicles during construction and operational phase.
- Turn off the machineries when not in use.

Operational Phase:

During operational phase, there would be minimal vehicular movement about 2-3 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.

6.2.2. Soil Quality

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

Construction Phase:

During construction phase, Loose topsoil is generated due to excavation on project site due to site levelling for erection of module structures towers and access roads. The impact anticipated here is loss of topsoil because of inappropriate storage. However, these activities and associated impacts are limited to be within the project boundary and during construction phase only. Considering the activities limited within the site, short duration of construction phase and low intensity, significance of impact is evaluated as ***Low***. Soil contamination may result due to accidental spillage and inappropriate storage of diesel or used oil during construction phase. 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:

- Though topsoil is very limited in the area, wherever fertile land/ agriculture suitable land exists, Topsoil management is required during site levelling. Use topsoil at the time of plantation and it can be given to nearby agricultural field after taking consent with the landowners/farmers.
- Store hazardous material like diesel and used oil in isolated room and on impervious surface to prevent seepage into project site soil
- Filling and transfer of oil to and from the container shall be on impervious surface
- Care should be taken with regard to possible changes in soil quality due to human activities, such as disposal of waste material and domestic effluents on soil of the surrounding area.
- Broken solar panels should be stored in paved surface and be handed back to manufacturers / authorised recycler within 15 days.

Operational Phase:

During operational phase, project activities such as excavation and usage of chemicals such as diesel and spent oil will be absent except chances of accidental release of used oil from transformer, therefore impact associated with these activities such as topsoil 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 within 15 days.

6.2.3. Noise Quality

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

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 located amongst barren 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) and it can be lower down from 90 dB(A) to 47 dB(A).

The project site is located on barren fields with no continuous noise generating sources in the vicinity of the project site. Majority of the receptors are found to be village settlements and rest house structures with temporary usage (seasonal usage as shelter during agricultural work) located near some of the WTG's.

Workers in close proximity to machines are prone to exposure of high levels of noise of machinery. This will be taken care by providing personal protective equipment like ear plugs/muffs and works will be rotated in shifts to avoid long term noise exposure.

Considering the short duration, localized distribution and low intensity, impact has been assessed as **Low** significance and can be controlled with the recommended mitigation measures:

Mitigation Measures:

- Use DG set with acoustic enclosure.
- Restrict major noise generating activities during night-time 10:00 pm to 6:00 am.
- Regular maintenance of project vehicles.
- Provide personal protective equipment (e.g., Ear plugs, Muffs) job rotation etc., to all workers wherever noise is generated due to machinery operation.
- Use of equipments /machines with inbuilt noise enclosure, wherever possible or provision of special acoustic enclosures for individual noise generating equipment's, wherever possible.
- Low noise equipment shall be used as far as practicable
- The number of equipment operating simultaneously shall be reduced as far as practicable.
- Workers should be prevented from continuous exposure to noise.
- During material movement, honking should be done cautiously to avoid disturbance to locals.
- In case of complaints of higher noise levels and uncomforting received from the inhabitants of nearby settlements possibility of putting noise barriers near to the receptor need to be considered.

Operational Phase:

Any significant noise generating activity during operation of Wind - Solar Hybrid Power Project is absent therefore impact in terms of increment in ambient noise level is not anticipated during the operational phase of the project.

Wind turbines produce noise through a number of different mechanisms, which can be roughly grouped into mechanical and aerodynamic sources. Wind turbines noise could impact on annoyance, sleep and health of the residents at close proximity to the wind turbines. Reconnaissance survey highlighted majority of the receptors to be rest house structures with temporary usage (seasonal usage as shelter during agricultural work). Reconnaissance survey highlighted majority of the receptors to be rest house structures with temporary usage (seasonal usage, Pump house, cattle shade, resting shade as shelter during agricultural work).

- The increment in ambient noise level due to WTG operations during daytime and night time is within permissible limits prescribed for residential area (55 db (A)). However, during night time the increment in ambient noise level due to WTG operations is anticipated to increase up to a range of

0.4 to 4.3 dB(A) and exceeding the permissible limit (45 db (A)) during the operational phase of the project.

- Distances of the identified noise sensitive receptors from the nearest WTGs varies from 137 m to 300 m
- Out of 7 Identified receptors of noise sensitive areas, AH (NR 34), BF (NR 58), AI (NR 35) are village settlements, AW (NR 49) is assumed to be a shed storage area having demarcated boundaries, AO (NR 41) and BB (NR 54) are independent houses, E (NR 5) appears to be a shed of agriculture-storage, where all seems to be permanent structures and for them mitigation measures suggested in this report is to be followed.

In India, there are no specific guidelines for wind power project noise levels. As per IFC's General EHS Guidelines: Environmental, Noise Management Noise, noise impacts should not result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Estimated noise generated during operation phase was calculated using Windpro software. DECIBEL is the module of the Windpro program used, which calculates the noise emission and checks if the noise requirements are met at neighbors and noise-sensitive areas. Furthermore, DECIBEL can calculate and plot noise level curves for the project to enable an assessment of which areas will be prevented from being used for noise-sensitive activities in the future.

The assumptions made for modelling are:

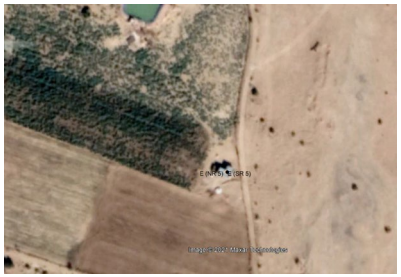
- Noise modelling has been conducted assuming the fixed wind speed range.
- General Ground attenuation factor is considered as 1.0
- WTG plus ambient noise is compared to ambient noise plus margin
- Fixed penalty added to source noise of WTGs with pure tones
- Impact of Cumulative noise is considered at 10m receptor height.
- SB Energy planning to install Senvion S 120 2.1/2.2MW 50 Hz having rotor diameter 120m and hub height 140 m hybrid WTG. Hence Setback distance calculated is 300 m. Modelling has been carried out considering set back distance of 300 m.
- The ambient noise levels measured near WTG locations (SBE 39 and SBE 5) located at Devaka and Harwa village were used as background ambient noise.
- These ambient noise levels at village level were observed to be within permissible limits specified for Residential area as per Noise Pollution (Regulation and Control) Rules, 2000 (without project).
- The increment in ambient noise level due to WTG operations during daytime is within permissible limits prescribed for residential area (55 db (A)). However, during night-time the increment in ambient noise level due to WTG operations is anticipated to increase up to a range of 0.4 to 4.3 dB(A), and exceeding the permissible limit (45 db (A)) during the operational phase of the project.
- Based on the modelling result Out of 7 Identified receptors of noise sensitive areas, AH (NR 34), BF (NR 58), AI (NR 35) are village settlements, AW (NR 49) is assumed to be a shed storage area having demarcated boundaries, AO (NR 41) and BB (NR 54) are independent houses, E (NR 5) appears to be a shed of agriculture-storage, where all seems to be permanent

structures and for them mitigation measures suggested in this report is to be followed. Identification of structures depicted in **Table 34.**

- The background noise levels at WTGs locations without project is expected to be within Residential area as per Noise Pollution (Regulation and Control) Rules, 2000, mainly due to absence of any noise generating residential, commercial, or industrial activity.
- As per the Modelling results It is expected that with WTG operation there will not be any major increment in baseline noise levels near WTG locations and identified receptors considering the maximum background noise and still being well within the specified increment limit of 3 dB(A) for most of the receptors as per IFC's General EHS Guidelines indicates the impact to be of Medium significance. Noise modelling results are depicted in **Table 34**. Noise modelling map is depicted in **Appendix E.**

Table 34: Noise modelling results

NOISE Receptors	Coordinates (Receptors)		Max From WTGs [dB(A)]	WTG Location	Distance (m)	Google earth image
	Easting	Northing				
AH (NR 34)	721310	2913967	45.4	WTG 27 (SBE 65)	262m	
BF (NR 58)	716863	2913647	45.8	WTG 41 (SBE 21)	274m	

AW (NR 49)	718236	2917327	46.3	WTG 38 (SBE 06)	300m	
AO (NR 41)	717058	2912536	47.4	WTG 33 (New 4)	179m	
E (NR 5)	716681	2910258	47.6	WTG 25 (SBE 28)	179m	

AI (NR 35)	721348	2914130	49.0	WTG 27 (SBE 65)	137m	
BB (NR 54)	717838	2917735	49.3	WTG 31 (SBE 05)	153m	

- ***Shadow flicker impact**:* Shadow Flicker Modelling results show that out all the 11 identified receptors will receive shadow for more than 30 hours per year from total 24 WTGs with minimum being 31:53 hours / year to maximum being 121:43 hours / year with distances from WTGs ranging between 179 m to 2.2 km.
- All of these receptors seem to be permanent structures and mitigation measures suggested in the report shall be followed. Identification of structures depicted in **Table 37.** The modelling results is provided in **Appendix. G.**

Mitigation measures:

- Shifting WTGs to few meters out of setback distance 300 m. The same has been verified through modelling.
- Regular maintenance of WTG would be carried out to make sure the parts have been well oiled to reduce friction between parts and generate excess noise.
- All nearby community will be informed about the GRM and the grievance would be addressed on priority bases.
- Plantation would be initiated around the turbine base area to absorb the noise generated by the turbines.
- In case of any complaint related to noise, appropriate measures should be taken to manage the same.

  Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved.

6.2.4. Alteration of Natural Drainage Pattern

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

Construction Phase:

During construction phase, site levelling activities, construction of underground reservoir 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. If it is not carried out, then surface runoff from the site may affect nearby landowners which may cause social agitation.

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

Mitigation Measures:

- Site levelling should be done with minimum alteration in contour level
- Design storm water drainage management system to discharge the surface runoff in the nearby natural drainage
- Do not disturb the natural drainage system

- The exit of runoff from the project site in the adjacent surrounding land area should be restricted

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

Construction 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 purpose such as drinking and washing by the construction workers and staff. Water will be required for domestic purposes by the operations staff. The indicative estimated quantities of water required during the construction and operation phases are presented below.

Phase	Activity	Max. Consumption
Construction	Civil works water requirement (53 WTG @ 60KLD/ WTG)	3180 KLD
	Domestic use – drinking (during peak construction phase) considering 2000 persons @ 110 lpcd	220 KLD
Operation	Domestic use – considering 150 operation and maintenance (O&M) site personals and security guards @ 45 lpcd	6.75 KLD

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

Operational Phase

Water resources: As reported to Arcadis, water will be sourced from safe authorized sources through vendor and supplied by tanker and will be under the scope of the EPC Contractor. Drinking water requirement will be met via local tankers/ approved vendors. As per the categorization by CGWB the Blocks where the project sites are located falls under over exploited category. Hence, impact on the ground water is anticipated to be **High.**

As per Project DPR, water availability for site construction may be delivered by from authorized bore wells outside the plant area but the water quality may need to be assessed by the developer for construction use. In case if Ground water is used then prior approval from the appropriate Government Water supply authority shall be taken. Water can also be made available by tankers and open reservoirs, though the authorized water suppliers. Additionally, plant may also develop its own internal water harvesting system as feasible after the topography study to elevate the ground water level in the area. The Project may have in-house developed semi-automatic module cleaning system which uses compressed air and water for module cleaning. The Project Company is exploring dry (Waterless) cleaning technologies which will be included intermittently with semi-automatic cleaning system currently implemented. It is proposed to develop rainwater harvesting cum storage facilities within site to meet the water requirement of the project as well as for the benefit elevating ground water level.

Water requirement as per MNRE is 5.5 KL per MW of solar for 10 wet cycles in a year which amounts to 55 KL per MW of solar per year or total 23,100 KL per year (or 77 KLD considering 300 days in a year) for the entire solar project.

Mitigation Measures:

- CGWB/CGWA approval needs to obtain in the event of extraction of ground water or installation of bore well water at site as a source of ground water.
- Construct of rainwater harvesting pit to recharge the ground water table.
- Recommended for water less robotic cleaning mechanism of solar panels

6.2.6. Solid/ Hazardous Waste Disposal

Construction Phase:

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

Mitigation Measures

- The excavated material generated will be reused for site filling and levelling operation to the maximum extent possible.
- Ensure contractual obligation that necessitates broken solar panels being accepted by manufacturer
- Use a 2-bin 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 waste handling agency.
- Waste/spent/used oil & bottom sludge 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 sent back to hazardous waste authorized recyclers. 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 a 2- bin 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 sent back to hazardous waste authorized recyclers.

6.2.7. Impact on Land and Land use

Construction Phase

During construction phase, impact on land use is anticipated due to various activities such as site levelling, filling and development of Wind - Solar Hybrid Power Project. Land use classification will change into industrial land use after the development of Wind - Solar Hybrid Power Project. Some impact on natural drainage system is also anticipated. Further, impact will be of long term and permanent in nature, but impact will not be of adverse nature.

Mitigation measures

- 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

Construction Phase

The below aspects of the construction phase can have an impact on ecology

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

The detailed explanation of the ***significant*** impacts is given below.

Destruction and Loss of Vegetation

The site is mainly open scrubby land due to not so fertile soil condition. 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 access route. Only scrubby vegetation can be found in the project site, and the level of impact generated from removal of topsoil (ground cover) can be termed as low as the species are very common and have least conservation value.

The livestock of the area mostly graze on grasses and other ephemeral herbaceous species and the loss of this ground cover will have a minimal impact as it will be for a very short period and the impact is reversible. Hence, impact on ecological environment due to vegetation clearance during construction phase is **"low"** from the project activities.

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. Most of the mammalian species (Chinkara, Desert Fox, Indian Fox and Nilgai) were sometimes spotted around the project site and are listed as Least concern species under IUCN Red List and commonly found all over the region. Temporarily, they may abandon the project activity area during the construction period and migrate to nearby areas. Although the construction activity is of very short duration, activities are limited and confined but the area spread of the project site is large, thus the impact on these mammalian species from construction related activities be termed as '**Moderate'.**

During construction period due to added noise and vehicular movement domestic animals, wild reptiles may temporarily move away from adjacent suitable habitats but may recolonize once the construction phase is over.

Habitat Loss, Disturbance and Modification

Habitat loss due to wind turbines and associated infrastructures viz., turbine bases, substation and access roads is anticipated from such type of project. As the land requirement to setup the wind turbines are relatively low. Earth will be excavated for making roads, etc. and vegetation clearance will result in habitat modification in the study area. Moreover, project area is not a designated or qualifying site of national and international importance for biodiversity. However, due to the presence of wild animals like Chinkara, Nilguy care has to be taken during the movement of vehicles that will be carrying construction material. Hence, from this aspect, the impact is "**Moderate".**

Other 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 very minor and limited to the construction phase only.

Mitigation Measures

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

- Project proponent should plan to build an appropriate level of fencing with lighting as a preventive measure to prevent man animal conflict.
- All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance to faunal population (herpetofauna) in the region.
- If any nests of ground dwelling birds/reptiles are found the Forest Department is to be notified so that the birds don't get displaced.
- Activities generating high noise shall be restricted to daytime 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 fauna within the site.
- Night-time movement of project related vehicles must be restricted along the highway.
- Transportation of construction material shall be restricted to daytime hours in order to minimize noise and disturbance to fauna in the area.

- Temporary barriers be installed around the excavated areas so that the wildlife especially Nilguy and livestock is not trapped in pits.
- General awareness regarding natural resource conservation shall be enhanced through trainings, posters, etc. among the staff and labourers.
- kitchen waste shall be collected and disposed in a manner that it does not attract scavenging animals.
- Awareness activities should also be considered for the local community to abstain from hunting activities.
- The footprints of the construction activities shall be kept to minimum so as to reduce disturbance to flora and fauna.
- Forest department must be informed in case of any wildlife sighting or any incident involving wildlife.
- Pre-clearance biodiversity survey protocol is to be carried out to identify important biodiversity features (e.g., nests, roosts, burrows) prior to construction to be included in construction-phase ESMS.

Operation Phase

Impact

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

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 contact the 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.

Apart from this there could be significant impact on the avifaunal species due to the turbines and transmission lines.

Effect on Flora and Fauna:

It appears that there would be less tall trees in the project area. The proposed project site is not located in any environmentally sensitive area but it a scrubland.

Noise, vibration and emission from vehicles, equipment will occur during construction and pre-construction stages in temporary manner.

The impacts related to above activities are temporary and can be mitigated through following measures:

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

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

Impact on Terrestrial Ecology:

The temporary phase would not result in any adverse impacts on the flora and fauna within or around the proposed project site, provided dust suppression measures and other procedures are followed. The impact is of low significance and temporary in nature.

There is absence of sensitive ecological area (Reserve Forest area) in the core area of project. The removal of herbaceous vegetation from the soil and loosening of the topsoil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimized through adoption of mitigation measures like paving and surface treatment and water sprinkling. Also, recommendations will be provided with list of tree species that can be planted to improve terrestrial ecology and vegetation cover of land.

Impact on Avian Habitat:

Wind turbine operation has few direct and indirect impact on bird and bat communities. Bird and bat mortalities has been reported from various operational wind farms across the country. The impacts during operation phase of wind farm is discussed in the sections below. The impacts of wind farm on the birds and bats identified the main potential hazards as:

- Disturbance & displacement
- Collision mortality
- Loss of habitats resulting from wind turbines and associated infrastructure

Disturbance & displacement

According to Birdlife International's report on effect of wind farm impacts on birds, these effects are variable and species, season and site specific. Disturbance can lead to displacement and exclusion from areas. Human activity during the installation of wind turbine such as movement on access roads may also lead to disturbance.

Noise generating from turbines affect birds and bats from using an area close to these. The effect of birds altering their migration flyways or local flight paths to avoid wind farm is another type of displacement. This effect depends on species, type of bird's movement, flight height, distance to turbines, wind force and wind direction etc. This can be highly variable ranging from a slight check in flight direction, height or speed to significant diversions which may reduce the number of birds using areas beyond wind farm. Some study indicates alteration of flight line whereas some other studies says birds will fly between turbines rows (Christensen et al. 2004, Kahlert et al. 2004a).

Collision and Electrocution risk due to Transmission Lines

The collision mortality and electrocution risk is another impact due to wind power project, especially in area of more bird usage i.e. Important Bird Area (IBA). Direct mortality or lethal injury of birds can result from collision with rotor, towers, nacelles and associated infrastructure such as guy cables, power lines and meteorological masts. Although majority of studies indicates low mortality level from wind turbines (Painter et al. 1999, Erickson et al. 2001). Collision risk depends on a range of factors related to bird species, numbers and behaviour, weather condition, topography and scale of wind farm.

Avian electrocution occurs when a bird's wingspan completes a circuit between energized and/or grounded structures, conductors, hardware, or equipment (Avian Power Line Interaction Committee

2006) and is typically a problem with lower voltage distribution lines where the typical distance between conductors is 2 to 6 feet. Avian electrocution is not an issue with high-voltage transmission lines, because the typical distance between conductors is about 12 feet. Even the largest local birds do not have a sufficient wing span to touch two conductors simultaneously and be electrocuted. Types of transmission lines are provided in Figure 6-1.

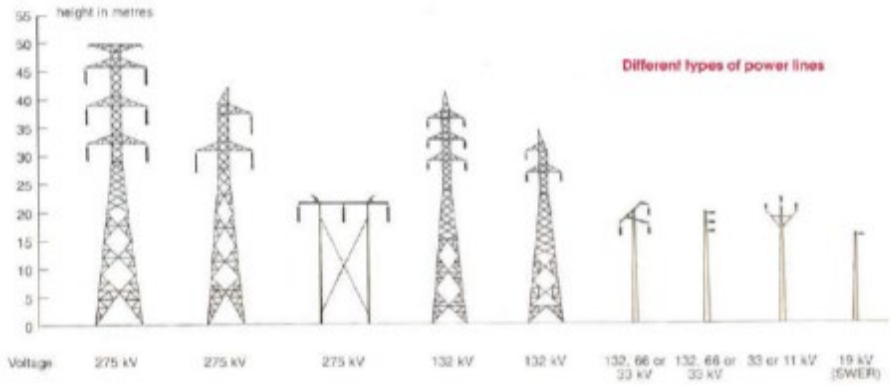


Figure 6-1: types of transmission lines

Caracass Management Plan

The powerline collisions and electrocution are considered as major threats to avian species. Large birds such as cranes and bustards are more susceptible to collisions due to low visibility and height of these structures with respect to the altitude of the flight (Tere and Parasharya 2011). The birds of prey and soaring birds are more vulnerable to collision with power transmission lines (Harness et al. 2013). The Rasla Lake is one of the roosting spots of many migratory birds and hosts Demoiselle Cranes in large numbers every winter. These cranes are known for their toughest migration by crossing Himalayas and spending winter in western Rajasthan (Jain et al. 2005). The basic minimum is to install and maintain bird diverters or reflectors on entire power transmission lines to be laid for the project as per the IFC guidelines. Its efficacy should also be tested. We are providing following preliminary observations. Firm mitigation measures can only be provided after robust, multi season, systematic study.

1. Use of bird diverters or deflectors to make the powerlines more visible.
2. Sufficient spacing between conductors and powerlines to accommodate the wide wingspan of large raptors like Vultures and eagles.
3. Proper insulation of cables closes to poles that are used for perching by the birds.
4. Avoid clustering of powerlines.
5. Pre and post construction monitoring of bird mortality and displacement evaluation along the powerlines and timely intervention, if required. These mitigations are also a part of the mitigation table.

Mitigation Measures

- Vegetation clearing through brush cutting for maintenance activities shall be done manually wherever possible (not applicable in this site, as there is absence of any green vegetation and land in barren)

- Any areas which vegetation cover do not have shall be re-vegetated with locally occurring species and monitored to ensure recovery is taking place.
- Vegetation that needs to be reduced in height shall be mowed or brush-cut to an acceptable height, and not to ground level except where necessary (not applicable in this site, as there is absence of any green vegetation and land in barren)
- General awareness regarding wildlife and natural resource conservation shall be enhanced through trainings, posters, etc. among the staff and labourers.
- Solar panels shall have an anti-reflective coating to minimize the light reflecting off of the panels so that there is very less impact due to glare from the panels.
- Moreover, to minimize effect of “Lake effect”, visual frightening techniques” may be considered to frighten any bird trying to land on panels and prevent birds from landing.
- Fencing and lighting along the project boundary must be properly maintained all through the project lifecycle.
- Above ground wiring, if any should be provided with markers to avoid chances of perching of birds and avoid electrocution;
- Covered conductors, daytime visual markers, visibility enhancement objects such as marker balls, bird deterrents, or diverters shall be installed on any guy wires and transmission lines to enhance visibility of towers/transmission lines for bird. to avoid avian collision;
- Daytime visual markers shall be provided on any guy wires used to support towers to enhance visibility of towers for bird. Visibility enhancement objects such as marker balls, bird deterrents, or diverters shall also be installed along the transmission line to avoid avian collision;
- Use of reflectors and bird flappers to be used at suitable intervals to avoid easy visibility of transmission wires and the risk of electrocution.
- Additionally, installation of insulator capacitors (Jumpers) at the cut point will reduce the risk of electrocution.
- The tip of blades of WTGs should be painted to increase visibility and avoid collision. This is also done for established aircraft navigation path.
- Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors near to the WTGs
- While planning project transmission lines, feasibility should be checked for avoiding water bodies crossings. This can be considered for water bodies that could be important when they turn into suitable habitats.
- Native vegetation must be planted or allowed to grow around the wind-turbines, such that their canopy screens potential prey on the ground from raptors flying overhead.
- Appropriate storm-water management measure shall be implemented to avoid creating ponds which can attract birds and bats for feeding or nesting in the windfarm area
- Training of local staff and security guards for spotting of bird carcass and reporting the same. This will help to ensure the strategic actions when the species are spotted in the region.
- Towers be regularly checked to avoid any nesting in any suitable gaps or platforms.
- Flash lamps on the WTGs should be installed to reduce the collision risks during nights.

- Mandatory shutting down of turbines at specific locations or times during peak migration and breeding season of the birds.
- Strategic placement of wind turbines by avoiding sensitive locations within the designated area such as congregation of vultures around carcass dump sites, or waterbodies as they would be hotspots of winter migratory birds
- Regulate blade speed periodically to reduce collision risks during winter season and monitored by SB Energy technical team
- Fewer but larger turbines may also reduce collision risks (Barclay et al 2007, Smallwood and Karas 2009). Also, the spacing between the turbines can be strategized to reduce risks.
- During construction and post construction monitoring of the birds is essential to identify and address any long-term environmental impacts
- Painting single wind turbine black. A recently published research article provides evidence that painting a single wind turbine blade black reduces collision by 70% and is particularly effective for large birds of prey especially vultures. The paper was published in Ecology and Evolution by researchers from the Norwegian Institute for Nature Research, Norway, and the Lake Ånnsjön Bird Observatory, Duved, Sweden.
- A fatality monitoring program will be implemented in the wind site and certain high-risk sections of the transmission line during the operations phase following Good International Industry Practice. The fatality monitoring will be described in the Operations Phase Monitoring and Management Plan.
- In expertise knowledge, outline and agree on an approach to remove livestock carcasses from the project site and/or modify disposal practices so that they do not attract vultures and other raptors to the wind energy facility. The Carcass Livestock Disposal Program will be described in the Operations Phase Monitoring and Management Plan that will be finalised by client.
- An Operations Phase Biodiversity Management Plan will be developed by client for both the wind and transmission line describing (i) the Fatality Monitoring Program; (ii) the Carcass Livestock Disposal Program; (ii) an Adaptive Management Plan, including quantitative fatality thresholds and reporting requirements; and (iv) a maintenance schedule for the bird flight diverters on the on-site collector lines and on transmission line.
- To establish risk on ecology a detailed and systematic biodiversity study and critical habitat assessment id recommended

Green Belt Development: Greenbelt is recommended as one of the major components of ESIA, to enhance environmental quality attenuation of noise levels, balancing eco-environment, consumption of treated effluent, prevention of soil erosion, and creation of aesthetic environment. An ideal greenbelt always imparts scenic beauty besides providing roosting/perching place for birds and ground surface for naturally available reptiles, other flora and fauna species, to make the area more natural and hazard free. Greenbelt of maximum 2.0 m width can be considered to be developed around the periphery of project boundary with comparatively low height trees & shrubs and no restriction of tree height along the project access road with local species for better survival.

Table 35: Details of Plantation Recommended for Greenbelt

Botanical Name	Local Name	English Name
Acacia auriculiformis A. Cunn. ex Benth.	Bangali baval	Australian wattle

Botanical Name	Local Name	English Name
Acacia nilotica (L.) Willd ex Delile ssp. indica (Benth.) Brenan		Acacia nilotica (L.) Wild ex Delile ssp. Indica (Benth.) Brenan
Aegle marmelos (L.) Corr.	Bili	Bael tree, Golden apple
Ailanthus excelsa Roxb.	Moto Arduso	Tree of Heaven
Albizia lebbeck (L.) Benth.	Kalo saras, Siris, Moti Haradi	Indian walnut and Parrot tree
Albizia procera (Roxb.) Benth.	Gular, Kilai	
Azadirachta indica A. Juss.	Limdo	Neem
Bambusa arundinacea (Retz.) Willd.	Kanti vaans	Bamboo tree
Boswellia serrata Roxb. ex Colebr.	Gugal, Dhupelio, Salai	Incense tree Butea
Butea monosperma (Lamk.) Taub.	Kesudo, Khakharo, Palas	Flame of the forest
Callistemon citrinus (Curtis.) Skeels	Bottle brush	Bottle brush
Cassia auriculata L.	Aval	
Cassia fistula L.	Garmalo	Golden shower
Casuarina equisetifolia L.	Mayurpankhi, Sharu	Beef- wood tree
Commiphora wightii (Arn.) Bhandari	Guggal	
Cordia gharaf (Forsk.) Ehrenb & Asch.	Nani gundi	
Emblica officinalis Gaertn.	Amla	Indian Gooseberry
Eucalyptus globulus Labill.	Nilgiri	Tasmanian blue gum tree
Gliricidia sepium (Jacq.) Kunth ex Walp	Gliricidia	Gliricidia
Gmelina arborea Roxb.	Sevan	Malay- Bushbeech, white teak
Lagerstroemia indica L.	Chinai mendhi	
Madhuca indica J.f.	Mahudo	Mowra butter tree
Manilkara hexandra (Roxb) Dubard.	Rayan	
Melia azedarach L.	Bakan limdo	Persian Lilac
Morus alba L.	Shetur	White mulberry
Parkinsonia aculeata L.	Rambaval	Horse bean tree
Phoenix acaulis Roxb. ex Buch. -Ham.		
Pongamia pinnata (L.) Pierrre	Karanj	Indian beach
Prosopis cineraria (L.) Druce.	Khijdo, Shami	
Prosopis juliflora (Swartz.) DC.	Gando baval	Mesquit
Punica granatum L.	Dadam	Pomegranate
Salvadora oleoides Decne.	Mithijar	
Salvadora persica L.	Piludi	Toothbrush tree
Sapindus emarginatus Vahl.	Aritha	Soap-nut tree
Tamarindus indica L.	Khati amli	Tamarind

Botanical Name	Local Name	English Name
Terminalia arjuna (Roxb. Ex DC) Wight & Arn	Arjun	
Thespesia populnea L.	Paraspiplo, Pardesi bhindi	
Vitex negundo L.	Nagod	Chaste Tree, Vitex
Ziziphus mauritiana Lamk.	Bor, khatibor	The Chinese date

The following measures should be considered in the project design to mitigate the avian species impact due to the project:

Overall Impact Assessment

The overall assessment suggests that the proposed project may lead to significant displacement of habitat for birds and the impact on faunal species. Also, loss of habitat is not anticipated for mammals and other avifauna. Based on above discussion, the impact on ecology during operation phase of the project is envisaged to be High.

Phase of the Project	Risk Assessed
Construction	Moderate
Operation	High

6.2.9. Socio - economic Impact

Key Social 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.

(A) Loss of Land/ Livelihood Conflict

Construction Phase: About 1090.223 Ha. of government revenue lands has been leased by RRECL to SBE for development of proposed 526.9 MW Hybrid Power Project. Transmission Line ROW land will be as per 30 m and will be taken up separately, land will be mix with ~60% Govt land and rest private land (both revenue and private land, but not studied yet). Nature of the proposed project government land is barren and sand dunes are spread around the identified land. The region falls under rainfed zone and agriculture activity is fully dependent on monsoon. The land is cultivated in Kharif season only. Gwar is the major crop cultivated on the land followed by bajara (millet), watermelon, moong, sesame seeds and moth. All agriculture produce is sold in the local market except bajara which is used for household consumption only.

Consultations were carried out with project proponent, land facilitator, land revenue & irrigation department representative as well as with the community including the panchayat members, there is no private land is involved in the project.

Apart from agriculture, goat and sheep rearing is another important source of livelihood activity in Sangram Ki Dhani. Due to proposed project development, there may be restrictions to the easy movement of cattle.

Around 63 structures have been identified on the proposed project land for both solar and wind project. This structure number also includes structures falling within 300 m radius from zero-point location of WTG. Majority of the structures are permanent in nature like underground water tank (*Tanki*), Residential houses and few temporary structures like huts used for storage of fodder and food grains etc.

Since the land has been leased from RRECL and the project proponent is not directly involved in acquisition or leasing of any private land. Compensation toward loss of assets / livelihood pertaining to the proposed government land will in the scope of RRECL. Hence, taking the distribution of impact as within site for short duration and medium intensity, the impact significance can be termed as **'Low**.

Mitigation Measures:

- Stakeholder engagement plan and community development plan should be implemented at project affected village
- It should be ensured that maximum employment is to be provided to marginalised and vulnerable communities like Schedule caste and schedule tribes and the locals as per their capacity and skill set.
- It should be ensured that the villagers/locals are given first preference towards employment followed by the neighbour communities.
- Grievance Redressal Mechanism will be followed onsite, and issues related to livelihood impact related to land to be resolved in coordination with RRECL.
- Complaints/ Concerns from the locals should be timely registered, investigated and resolved as per the GRM.

Operation Phase

There would be no impact on land during operation phase. There would be a requirement 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:

- SBE has their own CSR Policy. CSR initiatives shall be implemented in the project affected village as per the policy.
- Community development plan should be implemented.
- SBE to ensure that benefit may be in the form of financial, employment opportunity, training should be given on priority to the landowners who belongs to tribal category.
- It should be ensured that maximum employment preference is given to the locals as per their capacity and skills useful for project, wherever possible.
- Grievance Redressal Mechanism should be followed onsite.
- Complaints from the locals should be timely registered, investigated and resolved.

(B) 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 ILO guidelines. 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, SBE has laid down policies through which it demonstrates compliance to all of 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. SBE need to monitor the implementation of the policies on regular basis.

Mitigation Measures:

- Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards
- SBE 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
- SBE through its contractors should ensure that labour is being adequately paid by contractors. Also, ensure that wages are being paid as per the requirement of minimum wages act.
- SBE will conduct internal audits as when required to monitor the performance of contractor.
- SBE through the contractor will inform the labour about emergency preparedness plan and communication system to be followed during emergency
- SBE through contractor should ensure that labour receive training on health and safety issues involved in the project.

Operation Phase

Locals are hired as security guards and unskilled job for both the project site. Moreover, there is no direct conflicting issues between the Locals and the Project Proponent

This will enhance the local employment and would be a **Positive Impact**.

(C) Labour Accommodation Offsite

Construction Phase:

There may have some chances of conflict between the migrated labours and the local community arise during staying of migrant labours in the nearby village. 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"**

Considering the sensitiveness associated with the engagement of child, forced labour, SBE has laid down policies through which it demonstrates 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. SBE need to monitor the implementation of the policies on regular basis.

Mitigation Measures:

SBE will monitor and supervise to avoid any conflict between migrated labour and local community.

(D) Social Issues Regarding Right of way and Such Matter

Construction Phase:

It was observed during site visit, the project site is located far distance from any human habitation and 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 condition and the records, information that has been received from the Project Proponent) of the Hybrid power project 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 avoid acquisition of agricultural land;
- 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.

(E) Community Engagement

Construction Phase:

This probable impact is applicable throughout the project life. The project influenced area is home to communities from various castes and religions.

At any stage of the project, preference, and bias towards certain communities over others for labor, business or CSR initiatives could result in communal disharmony. Grievance Redress Mechanism should be developed to effectively deal with the communities' concerns, grievances and keep them adequately informed about the project. In case of an absence of an efficient information disclosure mechanism and grievance redressal mechanism, the stakeholder engagement process is likely to get hindered, consequently, preventing a healthy relationship between the company and local community.

During construction phase, the distribution of impact is buffer area, duration short and intensity moderate, the impact significance can be termed as **Moderate.**

Mitigation Measure:

- To ensure an open and effective communication between the local populations and SBE, a documented grievance redress mechanism must be adopted at the site level for external stakeholders such as the local community.
- Furthermore, the local community must be kept informed of the project and its relevant details, with information disclosure meetings being necessary prior to every major stage of the project.

Operation Phase

During operation phase, very limited employees will be employed on site and limited movement of project employees will take place, mainly for maintenance activities.

The distribution of impact is buffer area, duration long and intensity very low, the impact significance can be termed as **Low**

Mitigation Measures:

- To ensure an open and effective communication between the local populations and SBE, a documented grievance redress mechanism must be adopted at the site level for external stakeholders such as the local community.

6.2.10. Health and Safety Impact

Occupational Health & Safety Hazards for workers

Construction Phase:

Occupational Health and safety hazard associated with project activities (during construction) in Wind - Solar Hybrid Power Projects 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.
- ***Trip and fall hazards:*** The injuries are similar to those discussed under working at height. They occur when workers trip over/fall when debris etc. lies in the walkway/ passages.
- **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. SBE following their Environment, Health and Safety ("EHS") Management Policy and abide by the IFC Principles and Standards will ensure that the dignity and privacy of women is maintained through separate and protected provision for Sanitation Facilities during operation phase of the project as well as in other future projects of SBE.

Also, there can be dissatisfaction among the labourers due to many conflicts/issues unresolved, hence there should be a complaint register onsite. Contractor of SBE should ensure to have regular medical check-up of their hired labourers. SBE and/ or their contractor should ensure to have regular medical check-up of their hired labourers. 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

- ESMS – SBE is having a ESMS Check list for Project Phase as well as operation phase. This check list will be used for ESMS Audit on monthly basis and the same shall be considered during the monthly contractor performance evaluation
- EHS Manual – SBE has a standard contract manual for its Contractors. Based on that contract EHS manual, Contractor prepare and submit their project specific EHS manual which are validated and approved by SBE during the pre-mobilization phase of the project.
- Ensuring the Implementation – The Monthly audits are conducted based on the EHS manual in the name of SAY-DO audit.
- Labour camp Requirement also be mentioned in the EHS manual.

- EHS&S Rev1 EPC Domestic – SBE EHS&S Contract condition for Contractors, SAYDo Format – Monthly SAY-DO Audit format, ESIM Audit Tool are examples of Project ESIM Audit tool during construction and operation phase

- 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
- All work at height to be undertaken during daytime with sufficient sunlight.
- Proper PPEs should be provided to all workers.
- There should periodically training to educate the workers for proper use of PPE's.
- There should be proper monitoring system to ensure that each and every individual labourers are using the PPEs properly.
- 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.
- There should be arrangement for hygienic and 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
- SBE should inform the labour about the Grievance Redressal Mechanism (GRM) by which they can inform about any grievances.
- SBE should ensure that labour receive training on health and safety issues involved in the project.
- SBE should inform the labour about Emergency Preparedness Plan (EPP) and communication system to be followed during emergency situation.
- SBE should involve their EHS person/site EHS representative as mentioned in their Policy.

Operation Phase:

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

- Electrocution/ Electrical Shocks: These may occur when the skin comes in contact with live power lines etc. The severity of the burn depends on voltage, current, time of contact etc.
- Firing due to short-circuit.
- Possible injuries associated with working at height.
- Diseases due to unhygienic condition

The impact significance can be taken as **Moderate**.

Mitigation Measures:

- 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.
- Drinking water needs during the construction phase will be met via local tankers/approve vendors. In operational phase, packaged drinking water will be made available for the drinking purpose.
- SBE will implement Environmental Social Management System (ESMS). Following that an Emergency Preparedness Plan to deal with health and safety issues during project life cycle of a Wind - Solar Hybrid Power Project will be built. SBE have a documented EHS manual for construction contractors. It will it be ensured that the contractors implement these procedures through regular compliance audit of contractors and sub-contractors conducted at Site.
- SBE emphasize the consultation of non-managerial workers to fulfil the legal and other requirements, assigning roles and responsibilities, applicable controls for outsourcing, procurement and contractors, achieving objectives, training needs, monitoring and measurement, identifying hazards and assessing risks, communication, effective implementation, investigating incidents and nonconformities, determining corrective action. It is clearly mention in ESMS that Developer is committed to communicate its relevant EHS requirement(s) to external providers, including contractors; SB Energy's procurement process has defined and applied EHS criteria for the selection of contractors. The contractors must meet the requirement of EHS management system as per the laid EHS terms and conditions at the time of awarding contracts to the contractor.
- SBE will ensure that they abide by the policy of safeguarding all issues regarding the health and safety of the workers who are working under the Projects.
- Emergency Preparedness and Plan for On-Site Emergencies: the plan has defined nature of emergencies that can be encountered during operation of a solar farm. Requirements of an Emergency Control Centre (ECC), firefighting facilities and medical facilities has also been detailed out. Roles and Responsibilities of personnel at site, communication channel to be followed, and procedures for different emergencies have also been detailed. SBE 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.

(C) Community Health & Safety

Construction Phase:

During construction phase, various project components such as transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction require land clearing, levelling, excavation, grading activities, vehicle movement, DG set operation will take place. This will result in an increased level of dust and particulate matter emissions, as well as high traffic load, which in turn will directly and temporarily impact the local community. If improperly managed, there is a risk of nuisance and health effects. The village roads going to Sangram Ki Dhani and Kapuria are not impacted by the proposed project. Project proponent will develop alternative approach road to Tamchi Ki Dhani as

communicated during site visit as a result there will not be any impact on access road to Mata ka Mandir at Tamachi ki Dhani. Taking the distribution of impact as within site, duration as short and intensity as low, the impact can be considered as "**Low".**

Mitigation Measures

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

Operation Phase

- **Traffic Movement**: In operational phase, very few (2-3 nos.) of vehicles will be required for commuting from home to site office. Therefore, impact associated with movement of project vehicles is not anticipated. Besides, there may be impact due to restriction in public access but considering (as informed during interaction) SBE Energy Projects Private Limited will construct strengthen existing roads within the village connecting the main roads and between places with different Project sites.
- **Risk of Electrocution**: Risk of Electrocution is anticipated in the operational phase of the project, which could be mitigated through boundary wall and restricted entry in project site.
- Taking all these points in consideration, with distribution buffer area, duration short and intensity low, the significance of impact can be taken as **Low**.

According to IFC EHS guidelines, community health and safety hazards specific to wind energy facilities primarily include the following during the operation phase:

- Shadow flicker;
- Blade throw;
- Electromagnetic interference and radiation; and
- Public access

Shadow Flicker:

Shadow flicker refers to the shadows that a wind turbine casts over structures and observers at times of the day, when the sun is directly behind the turbine rotor from an observer's position. The shadow flicker effects usually during periods after sunrise and before sunset. During intervals of sunshine, wind turbine generators will cast a shadow on surrounding areas as the rotor blades pass in front of the sun, causing a flickering effect while the rotor is in motion. The light effect caused when the sun is positioned behind a rotating wind turbine has been described as shadow flicker. With the sun in the background, large moving shadows can be produced which some people may find distasteful. The **Table** below shows the approximate sensitivity to shadow flicker at different RPM for three blade turbines, according to Stankovik et. al.

Table 36: Shadow Flicker Sensitivity

Flicker Rate (Hertz)	Human Perception	Equivalent RPM Rate for a 3-Bladed Turbine
< 2.5	Negligible Effect	<50

Flicker Rate (Hertz)	Human Perception	Equivalent RPM Rate for a 3-Bladed Turbine
2.5 - 3	May Affect 0.25% of the Population	50-60
3 - 10	Effect is Perceptible	<200
10 - 25	Greatest Sensitivity	200-500
>50	Continuous Light Source	1000

Source: Stankovik et al., 2009,

Larger turbines generally operate between 18 and 45 RPM, while smaller turbines generally operate below 150 RPM (Stankovik et al., 2009, p.96). So, the effect is expected to be negligible.

It has been stated that "*Flicker effects have been proven to occur only within ten rotor diameters of a turbine*". The greater the distance between the turbines and the observer the less noticeable the shadow flicker will be (Office of the Deputy Prime Minister, 2004, p.177)[1].

Modelling was undertaken using Wind Pro, for shadow flickering using real case scenario. The sensitive WTG locations resulted from the analysis of worst-case scenario outcome will then be used as input in real scenario approach. The outcome of real scenario approach will be in the form of expected hours of shadow flickering on identified receptors. To run the real case scenario for shadow flickering following data have been used in software:

- Annual operational hours estimated for WTGs
- Sunshine hours of project site/nearby location

The real case scenario result will be then analyzed with respect to cumulative impacted receptors and sensitive locations of WTGs. The maximum no. of hours (more than 30 hrs./year[2]) of shadow flickering occurrence in real scenario will be considered as **significant cumulative impact on the receptors**. The locations of WTGs contributing the significant cumulative impact will be identified and mitigation measures will be delineated for such locations.

SHADOW FLICKERING MODELLING RESULTS AS PER WTG LOCATIONS IDENTIFIED DURING January 2022.

SB Energy planning to install Senvion S 120 2.1/2.2MW 50 Hz having rotor diameter 120m and hub height 140 m hybrid WTG. Hence Setback distance calculated is 300 m. Modelling has been carried out considering set back distance of 300 m.

Shadow Flicker Modelling results show that out all the 11 identified receptors will receive shadow for more than 30 hours per year from total 24 WTGs with minimum being 31:53 hours / year to maximum being 121:43 hours / year with distances from WTGs ranging between 179 m to 2.2 km.

All of these receptors seem to be permanent structures and mitigation measures suggested in the report shall be followed. Identification of structures depicted in **Table 37.** The modelling results is provided in **Appendix. G.**

[1] *The Real Truth about Wind Energy, A Literature Review on Wind Turbines in Ontario, June 10, 2011, SIERRA Club Canada.*

[2] *Dutch standards of 30 hrs/year was used in analysis of significant impact. In, India shadow flickering standards are not available*

Table 37: Shadow Flickering Modelling Results Detailing the Shadow Hours Received at the Receptors wrt the Nearest WTG Locations

Shadow Receptors	Coordinates Shadow Receptor		Shadow hours per year (h/year)	Impacting WTGs	Distance (m)
	Easting	Northing			
AJ (SR36)	721058	2914461	31:53	WTG 13 (SBE62)	1.1km
				WTG 27 (SBE65)	514m
AC (SR 29)	722407	2912899	41:49	WTG 21 (SBE52)	437m
AF (SR 32)	722136	2913893	43:36	WTG 34 (SBE77)	499m
BD (SR 56)	720710	2916716	51:54	WTG 28 (SBE63)	377m
AG (SR 33)	721763	2914228	54:23	WTG 13 (SBE62)	1.7km
				WTG 24 (SBE60)	2.2km
				WTG 27 (SBE65)	289m
AN (SR 40)	715852	2911307	57:21	WTG 5 (SBE25)	649m
				WTG 6 (SBE26)	453m
				WTG 45 (SBE86)	1.1km
AS (SR 45)	717624	2914052	58:29	WTG 9 (SBE56)	1.8km
				WTG 24 (SBE60)	2.1km
				WTG 32 (SBE20)	768m
				WTG 41 (SBE21)	568m
BB (SR 54)	717838	2917735	58:41	WTG 31 (SBE05)	153m
				WTG 36 (SBE07)	906m

				WTG 38 (SBE06)	540m
E (SR 5)	716681	2910258	75:50	WTG 14 (SBE32)	671m
				WTG 25 (SBE28)	179m
				WTG 43 (SBE29)	2.2km
AO (SR 41)	717058	2912536	79:09	WTG 2 (SBE24)	2.2km
				WTG 29 (SBE57)	912m
				WTG 33 (NEW4)	184m
				WTG 44 (SBE48)	2.0km
P (SR 16)	722169	2909645	121:43	WTG 50 (SBE46)	271m

Mitigation Measures

- Ensuring effective work permit system for critical activities such as electrical work.
- Shifting WTG's to few meters out of setback distance 300 m.
- The impact of shadow flicker received by the structure will further be reduced if there is closed wall/opaque structure where in the light/shadow would not penetrate/directly affect the receptor. The source of shadow flicker would be through window's, open roof and doors.
- Provide curtain and blinds in households with open roof, and windows, doors facing WTGs.
- Boundary Wall and restricted entry in project site
- Prepare emergency communication system and emergency preparedness plan should be framed.
- It is recommended that SBE Renewables Ten Pvt. Ltd should formulate a complaint resolution procedure for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. SBE Renewables Ten Pvt Ltd will ensure that appropriate and timely action is taken in case of receipt of such complaints.
- Undertake plantation to hide shadow flicker near receptors (households) identified with significant impact.
- There is no structures impacted by noise or shadow flicker belong to SC/ST communities

(D) Impact on Cultural/Archaeological Site

Any archaeological monuments or sites as per the Archaeological Survey of India does not exist in project site, hence **No impact** is envisaged both during construction and operation phase.

(F) Corporate Social Responsibility

Construction Phase

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

SBE have 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 lays down the areas of intervention, principles, and mechanisms for undertaking various programs in accordance with Section 135 of the Companies Act 2013. As per their CSR Policy, SBE 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 Anganwadi Centres by facilitating them with provisions of exclusive Drinking Water, sitting arrangement, power supply and toilet facilities for them in project area villages;

- Facilitating the local schools by providing them with amenities like chairs, benches, fresh drinking water etc.;
- Facilitating in development and creation of health infrastructure in the project area villages, where it is found to be an 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 may 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. Cumulative Impacts

SBE has been allotted approximately 1090.223 Ha. of government revenue land by RRECL on sublease basis for Hybrid power project. The project would be established on unused, fallow and barren land. Agricultural practice was observed in the surrounding area, and this agricultural practice is based on bore well (ground water) and rainfall. Also, the land is barren in nature during the site visit.

There are following projects around the SB Hybrid project:

- 700 MW hybrid power project – overlap with same study area as the SBE hybrid project
- 380 MW solar power project at Neemba village - 10 km south of solar site and 10 km west of wind site
- 250 MW solar power project at Bhinajpura village – 40 km east of wind site
- 390 MW hybrid power project – 35 km north east of wind site
- 600 MW hybrid power project – 30 km north east of wind site

As land acquisition is involved in the project, there are possibilities of impacts on the landowners. With a continuous increase in both numbers and sizes of such PV developments cumulative concerns are likely to increase in the near future. Land and access to pasture land may also be impacted considering the large trench of land being leased for the project. Safety concerns also needs to be addressed cumulatively, whereas simultaneous construction may result in deterioration of environment and safety concern.

For total 526.9 MW Hybrid power project, water will be required for construction phase and only for domestic use during operation phase. Water for the entire project will be provided by authorized local vendors for which necessary approvals will be obtained.

The project also has a positive impact in terms of employment generation for the local people during entire project lifecycle. One of the cumulative effects is solar reflections known as Glint and Glare. Glare impacts can be minimized by the inherent design qualities of the PV panels, which reduces reflectivity and the potential for visual discomfort or impairment.

Cumulative impacts associated with decommissioning of the proposed project would include the removal of all project components, including Gen-tie Line structures and wiring, as well as all towers, wiring, PV panels, and inverter structures. Decommissioning would temporarily impact the proposed project's contribution to local and regional cumulative impacts on visual resources. 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.

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 Gen-tie 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 baseline land uses or agricultural use, in accordance with the Agricultural Reclamation Plan. Visual recovery from land disturbance of closure and decommissioning would likely occur within a few years to allow for regrowth of vegetation. 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.

The potential cumulative impacts identified for the project has been highlighted in the following sub sections:

- Socio-economic Impact on Land.
- Impact on Migrant Workers: SBE and its contractor has decided to engage local people during construction as much as possible (unskilled and semi-skilled) to minimize migration of labour from far off places. This will not have any stress on the local and moreover provide job opportunities to the local population.
- Impact on Infrastructure: The road connectivity in the area is good therefore transportation of turbine components will not lead to any disturbances to the habitations. There will be no disturbance to habitations as the turbines are erected on isolated plateaus.
- Impact on Aesthetic Value: Multiple projects, including several utility-scale production facilities, are proposed around the proposed project. These have the potential to result in cumulative impacts to aesthetics, land use, community health and safety due to increased traffic, labour influx, fugitive emissions during construction, stress on water resources, biodiversity, noise and shadow flicker when considered together with the proposed project. After construction of the project, the existing visual character of the area would be altered as well as its surroundings. The proposed project is not located in a designated scenic vista, nor has an important visual resources. None of the roadways abutting or surrounding the project sites are designated or proposed scenic roadways. In addition, the sites would not be visible from any designated scenic resources or scenic highways. No historic structures or significant scenic resources exist on the proposed project sites. Accordingly, no significant cumulative impact would result from the proposed project's incremental impact on a scenic vista, or damage to scenic resources.
- Impact on air quality, water quality and soil characteristics: During operation of the project no fuel of any kind will be burnt. Therefore, the impact on air quality is not considered. However, there will be increased traffic movement which will case air pollution to some extent. There is no wastewater generation from the wind turbine. The domestic wastewater may be generated from office of the O&M team. Septic tanks with soak pits should be provided to treat sewage during operation phase. There is no significant solid waste generation during operation phase. Therefore, the impact on soil is not envisaged.

- Impact on Noise: The noise from existing surroundings has been captured in the baseline recorded for the project. The baseline noise levels in the area are thus within the prescribed CPCB standards of 55 dB (A) and 45 B (A) during the day and night time respectively at all locations. It is to be noted that ambient noise levels depend on various factors such as the exact number of vehicles/equipment being used at the construction site, number of hours of operation, etc. Due to unavailability of such information, the cumulative noise levels from simultaneous use of construction vehicles and equipment is difficult to ascertain. However, the construction activities will be temporary in nature and will not last for more than 15-20 days for a particular turbine site.
- Impact on Biodiversity -The project area also has other wind power plants developed by other SPVs. Good wind profile of the area is expected to attract development of some more wind farms in the area. Establishment of number of wind farm in the area is expected to have direct impact on birds and bat in the area. Due to increase in number of wind farms in the area, cumulative impacts on birds and bat need to be ascertained with the help of seasonal bird and bat studies
- Cumulative Shadow Flicker Impact: Since the area has a good wind resource potential there are few more wind power projects in the area; there exists the potential for cumulative shadow flicker impacts.

Mitigation Measures

- To curb with the low ground water resources in the area Sourcing of water tanker from authorized/ registered vendors/ tankers should be considered by EPC contractor.
- Wherever feasible client can support the rainwater harvesting/ water conservation initiatives in nearby villages. Building of catchment area to store water during extreme drought seasons.
- Follow applicable national norms and international guidelines for Wind & Solar project development, wherever feasible.

Table 38: Overall Project Risk Assessment

Environment and Social Parameters	Impact During Construction Phase	Impact during Operation Phase
Livelihood	High	No impact
Laying of Transmission Lines	Moderate	Low
Employment generation	(Positive) High	(Positive) Moderate
Air Quality	Moderate	Low
Noise Quality	Low	Low
Ground Water Quality and Quantity	Moderate	Low
Surface Water Quality and Quantity	Low	No impact
Soil Contamination	Moderate	Low
Topsoil Loss	Low	No impact
Impact on Wildlife other than avifauna	Moderate	Moderate
Impact on avifauna	Low	Moderate
Visual Effects	Low impact	Moderate
Occupational Health and Safety	Moderate	Moderate
Unnatural Events like Earthquake, floods etc.	Low	Low

6.4. Conclusion

The proposed 526.9 MW Hybrid Power Project will have minor as well as short term impact during construction phase. Minor impact due to generation of dust and fugitive emissions are expected during

construction phase only. Minor impact is expected on resource utilization like land and socio-economic conditions of project area villages. Land for the proposed project is totally government land which is being leased for the period of 30 years. Rest of the impacts on environment and social parameters is assessed to be minor during construction and operation phase of the proposed project.

Overall impact anticipated due to generation of noise and shadow flicker from the operating WTGs is anticipated as Low and moderate respectively. WTG locations which were at proximity to water bodies (WTGs SBE-47, NEW5, SBE-49 and SBE-61) which were prone to collision of birds due to proximity of a seasonal water body (holding water in season) along with an Agricultural Plot holding water (locally called as Khadin) were dropped from consideration.

The project also has a positive impact in terms of employment generation for the local people during entire project lifecycle. The impacts identified both during construction and operation phase can be minimized and mitigated by adopting suitable mitigation measures as suggested in the ESIA report. Based on the conclusion drawn from the ESIA study the kind of impacts of the project on environment, resources, biodiversity, labours and community, this project is expected to have limited adverse environment and social impacts which can be mitigated by adopting suitable mitigating measures.

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.

SBE 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 & Management Plan, presented below. 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

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

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

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

7.2. Monitoring

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

The monitoring process should cover all stakeholders including contractors, labourers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. SBE 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 must be established to ensure updating and recording of requirements specified in ESMP. Responsibilities must be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained, and that document control is ensured. The following records should be maintained at site:

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

Table 38: Environment Management Plan

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
CONSTRUCTION PHASE							
A	**Physical Environmental Management Plan**						
1	**LANDSCAPE AND VISUAL**	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	**LOW**	• Ensure the construction site is left in an orderly state at the end of each workday • 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 SBE's Personnel
2	**WATER RESOURCES AND QUALITY**	• Possibility of contaminated runoff from the site entering ground though very limited. • Domestic water runoff from the portable toilets into the ground water can lead to degradation of water quality.	**MODERATE**	• During construction phase, water is being sourced from tanker through vendor as reported. • Construct rainwater harvesting pit to recharge the ground water • Periodic monitoring shall be carried out to ensure that the wastewater is not finding its way into ground or surface water. • Conserve water at all project locations and ancillary facilities and if possible, recycle and reuse water utilizing every opportunity. • Approval/NOC from competent authority (CGWB/CGWA) will be	**LOW**	Maximum efforts should be made to reuse and recycle water to reduce water consumption.	Project Developer/ Contractor under the supervision of SBE's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				obtained if bore well is installed for ground water extraction • Paved impervious surface and secondary containment to be used for fuel storage tanks • Adequate drainage of road based on road width, surface material, compaction and maintenance • Leak-proof holding tanks for sanitary wastewater to protect the shallow ground water level. • Wastewater holding tanks / septic tank to be located at more than 500 m away from bore wells or any other underground water holding tanks.			
3	**AIR QUALITY**	• Fugitive Dust due to movement of project vehicles and site clearance • Emission from Diesel Generators	**MODERATE**	• Vehicles speed to be restricted to 20-30 km/hr. on unpaved road. This will reduce dust emission • Raw material should be covered with tarpaulin sheet during transportation and in storage area • Practices water sprinkling wherever required on unpaved area but ensure use of tanker water purchased form authorized vendor only • All the project vehicles shall have valid PUC certificate • Ensure regular maintenance of project vehicles during	**LOW**	Six monthly monitoring for air quality	Project Developer/ Contractor under the supervision of SBE's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				construction and operational phase • Turn off the DG sets & machineries which are not in use • DG sets preferably should be 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.			
4	**SOIL QUALITY**	Topsoil Loss (though topsoil is very less due to the arid and desertic land in the project area)	**LOW**	• Though topsoil is very limited in the area, wherever fertile land/ agriculture suitable land exists, Topsoil management is required during site levelling. • Provide appropriate storage of topsoil in an isolated and covered area if any. • Allow only covered transportation of topsoil within project site. • Use topsoil at the time of plantation on the approach road. • Re-vegetation shall be done in the area after the completion of construction, in order to reduce the risk of soil erosion	**LOW**	• The workforce shall be sensitized to handling and storage of hazardous substances viz. fuel oil, machine oil/fluid etc. • The workers engaged in handling hazardous substances shall be briefed about the possible hazards and the need to prevent contamination.	Project Developer/ Contractor under the supervision of SBE's Personnel
		Soil Contamination		• In case of any accidental spill, the soil will be cut and stored			

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				securely for disposal with hazardous waste. • Store hazardous material (like used oil) in isolated room with impervious surface. • Filling and transfer of oil to and from the container shall be on impervious surface. • Waste disposal grounds that are in use by the local people should be identified and permission from local administration for use of the same needs to be obtained for disposing domestic wastes.			
5	**NOISE LEVEL**	• Disturbance to habitants • Vehicular noise from heavy vehicles utilized to deliver construction materials and solar plant parts • Noise from DG sets • Construction noise from using mobile equipment, and concrete mixing	**Moderate**	• Regular maintenance of construction machinery and equipment shall be carried out to ensure noise emissions are maintained at design levels. • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures. • Keep stationary source of noise such as DG sets (during construction phase) at farthest point from the settlements • Restrict major noise generating activities during night time 10:00 pm to 6:00 am	**LOW**	Noise emissions of construction equipment adhere to emission norms as set out by MoEF&CC/ CPCB to ensure the compliance.	Project Developer/ Contractor under the supervision of SBE's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• 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 unavoidable, drivers should be informed to restrict speed at those locations. • Diesel generator sets, if used; will adhere to noise standards of MoEF&CC.			
6	**SOLID WASTE**	Contamination of land	**MODERATE**	• Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". • Domestic and construction waste like recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of SBE's Personnel
7	**CHANGE IN LOCAL TOPOGRAPHY**	Alteration in natural drainage pattern	**MODERATE**	• Don't allow the considerable alteration of contour level	**LOW**	The drainage patterns of the area will be maintained.	SBE design team

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• 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 wherever required • 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.			
B	**Ecological Environmental Management Plan**						
9	**ECOLOGY**	• The construction activities will lead to loss of vegetation resulting in displacement of terrestrial species • Disturbance to local livestock population	**MODERATE**	• All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance to human as well as faunal population in the region. • Activities generating high noise shall be restricted to day time and will be mitigated to minimize the noise level outside the site boundary. • Recovery of ground story (mostly grasses and herbs) vegetation	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of SBE's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		• Man -Animal conflict		under the PV panels and in other places that do not need to remain cleared shall be encouraged to grow. • Movement of construction and transport vehicles shall be restricted to dedicated paths to minimize any harm to small mammals/reptiles within the site. • Transportation of construction material shall be restricted to day time hours in order to minimize noise and disturbance to fauna in the area. • General awareness training regarding wildlife shall be enhanced through putting signage, posters, among the staff and labourers. • Waste shall be collected in a manner that it does not attract wild animals. • Temporary barriers shall be installed on excavated areas. • The footprints of the construction activities shall be kept to minimum to reduce disturbance to flora and fauna. • Planting native, fast growing trees on access roads and/or in nearby barren areas/ schools/ Panchayat office which may also give an alternate habitat to the faunal species especially the bird species			

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				and maintain the ecological balance. • The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area around WTG. • The crane staging area, intervening areas, overhead clearance for suspended turbine components should be planned in such a way that minimum tree felling is required; • Contractors should ensure that labour colonies are not set up in the regions where faunal species are commonly found. • Sign boards on the roadside should be installed and strict regulations on speed limits should be imposed to control the road kills of animals during transportation of materials			
C	**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. SBE will include clause or provisions related with non-engagement of forced and child labour, gender equity, non-discrimination on employment	**LOW**	Periodic EHS audits should be conducted to monitor the vendor practices • Construction contractors should adhere to social obligations, labour laws and	Developer/Contractor under the supervision of SBE personnel Project

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				and opportunity and freedom to express their view in contractor's agreement and HR policy • SBE 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 • SBE shall include clause to ensure access of necessary basic amenities and facilities such as drinking water, kitchen, toilet and crèches (for female workers children) • SBE shall conduct internal audits as when required to monitor the performance of contractor. • SBE through the contractor inform the labour about emergency preparedness plan and communication system to be followed during emergency • SBE through contractor should ensure that labour receive training on health and safety issues involved in the project. • IFC guidance note on "Labour and working condition" shall be followed by project developers and contractors. • SBE shall prepare Labour engagement plan in line with IFC guidance manual and include in contractors agreement.		international commitments • SBE through contract agreement, should ensure that the contractor should provide the migrant workers adequate information on expected social behavior and hygiene practices to be followed at site • Water usage should be monitored and controlled to minimize the wastewater generation • SBE to ensure that all site personnel and migrant labourers avoid using any community infrastructure facilities like water bodies, electricity etc., without prior permission from the Panchayats	

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
2	**LABOUR ACCOMMODATION** **(Inside or outside the plant premises)**		**MODERATE**	• As reported by SBE, the labours will be engaged by sub-contractor for construction purpose. Unskilled labors will be hired locally, and the technical work will be undertaken by the skilled personnel who will stay in rented accommodation nearby to the site area village. As reported by SBE, two labour camps will be established near the site. • The camp will have all the basic physical and social infrastructure facility and as per the national guidelines.	**LOW**	• SBE through contract agreement, should ensure that proper health and safety measures should be taken, (to provide the basic amenities) for the labors those who will be staying in labour camp and nearby villages)	
3	**LAND LEASE**	• Loss of Land/ Livelihood/ • Obstruction to places of relevance/ • Manhandling Natural Resources of Utility	**MODERATE**	• Project will be set up on government revenue land parcel measuring approximately 1090.223 Ha.. Land allotted to SBE is on sub lease basis. • Process of Land leasing – Since this is entirely Revenue Land, SBE are required to make an application to RRECL which then recommends for allotment of the said project land to District Collector for allotment. After obtaining necessary NOCs and approvals from relevant govt. departments allotment order is issued by District collector and lease deed is signed. • It should be ensured that maximum employment is given	**LOW**	• GRM Registers and SEP Documentations	• Developer/ Contractor under the supervision of SBE 's Personnel • Social Management team for grievance handling

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				to the locals w.r.t their capacity and skills. • 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 leasing 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.			
4	**IMPACT ON INDIGENOUS PEOPLE**	• 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	Low	• Though very few Bhil tribal populations are residing in the study area villages however, no tribal land and livelihood are getting impacted because of the project. • They are hopeful that the project will bring employment opportunities for them	**LOW**	• GRM Registers • Employment Records • CSR Programs implemented.	SBE

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		and use of village resources					
5	**IMPACT ON ARCHEOLOGICALLY IMPORTANT SITES**		**No Impact**	• There is no archaeological important site in the study area.	**No Impact**	Chance Find Procedures and Records	SBE
4	**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 Panchayat 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 SBE 's Personnel / PRI representatives
5	**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 • All work at height to be undertaken during daytime with sufficient sunlight • Proper PPEs should be provided to workers handling welding,	**LOW**	• The labour 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 programmed • An accident reporting and	Contractor under the supervision of SBE 's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				electricity and related components. • 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		monitoring record should be maintained	
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 then will be delivered to approved vendors for disposal or reuse.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer
2	**SOLID WASTE MANAGEMENT**	Contamination of land	**MODERATE**	• Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". The waste generated should be disposed as per The Municipal Solid Wastes (Management and Handling)	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				Rules, 2000. as amended till 2016. • 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.			
3	**GROUNDWATER ABSTRACTION**	Ground water depletion if extracted during operation phase (permission must be obtained from statutory authority).	**MODERATE**	• Ensure optimal usage of water viz., storage and reuse water. • Rain water harvesting to be practiced.	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer
4	**WASTEWATER MANAGEMENT PLAN**	Degradation of ground and surface water quality	**MODERATE**	• Ensure that construction of septic tanks during operation a phase. • 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
5	**ECOLOGY & BIODIVERSITY**	Impact to the local avifauna	**MODERATE**	• Project proponent should follow all the directions of regulatory agencies as prescribed from time to time by the Federal Government/state government / court orders.	**MODERATE to LOW**	Periodic avian surveys should be carried out along with consultations with the stakeholders in the nearby areas	S B Energy

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• As WLPA, 1972 Any accidental death due to species listed in the schedule will lead to legal action against the responsible party irrespective of the location where the incident occurred. • The power pole configuration should be designed to minimize avian electrocution risk • Bird diverter should be installed in transmission line which the client will be complying with respect to the sensitive areas • Flash lamps on the WTGs should be installed to reduce collision risk to birds & bats at night		Detailed biodiversity study and critical habitat assessment for further study id recommended.	
6	**AMBIENT NOISE LEVELS**	• Noise generation due to operation of wind turbines. • Wind turbines produce noise through mechanical and aerodynamic sources.	**Moderate**	• Wind turbines should be designed in accordance with the international acoustic design standards • Proper and regular maintenance of the WTG's • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved. • Operating turbines in reduced noise mode.	**Low**	Undertake ambient noise level monitoring on in order to understand the increase in noise levels due to the project operation	SB Energy

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Building natural barriers like plants/usage of appropriate noise barriers around potentially affected structures, if complaints on the same are received • Shifting WTG's to few meters out of setback distance 270m . • Regular maintenance of WTG would be carried out to make sure the parts have been well oiled to reduce friction between parts and generate excess noise. • All nearby community will be informed about the GRM and the grievance would be addressed on priority bases. • Plantation would be initiated around the turbine base area to absorb the noise generated by the turbines. • In case of any complaint related to noise, appropriate measures should be taken to manage the same.			

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
7	**SHADOW FLICKER AND BLADE THROW HAZARD**	• Disturbance to nearby community due to shadow flickering caused by wind turbines • Injury due to accidental blade throw	**Moderate**	• During site selection of the project, measures are taken to select the WTGs location at least 300 m from all the temporary and/or permanent structures. However, if the settlements are located within the narrow bands (200m), each dweller will be informed about possible negative impacts i.e. noise, shadow flicker, blade throw etc. If the owner is willing to relocate, the structure will be dismantled with agreement and appropriate compensation will be provided as per local/national regulations and in line with IFC PS' physical and/or economic displacement requirements. • Regularly maintain the wind turbine. • The impact of shadow flicker received by the structure will further be reduced if there is closed wall/opaque structure where in the light/shadow would not penetrate/directly affect the receptor. The source of shadow flicker would be through window's, open roof and doors. • It is recommended that SBE Renewables Ten Projects Pvt Ltd should formulate a complaint resolution procedure for the local community so that	**Low**	Necessary procedure will be followed, and records will be maintained for consultations, essential documents, compensation benefits etc.	S B Energy

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				any issues or concerns associated with shadow flicker are reported to the site staff. • SBE Renewables Ten Projects Pvt Ltd will ensure that appropriate and timely action is taken in case of receipt of such complaints. • Usage of curtain and blinds in households/structures with open roof, and windows, doors facing WTGs would cut out the impact of shadow flicker. • Landscape features, such as trees could also be used to prevent or limit the potential for shadow flicker. • Micro siting can be reconsideration, if feasible. • Use warning signs to alert the public of risk.			
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 • Improvement of the physical & social infrastructure facilities in the study area villages • Opportunities for contributing to the economic and developmental	**Low**	CSR Activities should be documented Should be conducted continuously through the project cycle. Should be conducted continuously through the project cycle.	SBE's Personnel SBE's Personnel SBE's Personnel

SN	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				needs of villagers through skill training will be explored.			
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 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's / SBE's 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 SBE assess in the environmental performance and identify gaps or non-conformance (if any) ensuring immediate actions to bring it into compliance. To ensure the same, the following environmental parameters will be monitored. The Environment Monitoring Program is depicted in **Table-39.**

Table-39: Environment Monitoring Program

A. Environmental Quality Monitoring Program

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
A.	**CONSTRUCTION & OPERATION PHASE**			
A1	Ambient Air Quality	Monitoring of PM_{10}, $PM_{2.5}$, SO_2, NOx, CO		Once during construction phase
A2	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)		Once during construction phase and other during operation phase near permanent receptors close to WTG
A3	Ground Water quality	IS 10500 parameters		Once during construction phase
A4	Surface Water quality	IS 10500 parameters		Once during construction phase
A5	Soil Quality	Soil parameters viz. pH, SAR, Water holding capacity, Conductivity, Organic Carbon, NPK		Once during construction phase

7.5. Environmental Management Plans

The ESMP is comprised of some site-specific management plans viz. Emergency Preparedness and Response Plan, Waste Management Plan, Storm Water Management Plan, Environmental Monitoring Plan, Road Safety and Traffic Management Plan and Occupation Health and Safety Management Plan for this Hybrid power project. The management plans will be executed through Environmental Social Management System.

7.5.1. Emergency Preparedness and Response Plan

Purpose

SBE, should develop a site-specific Emergency Management Plan for implementation at the entire project location, In the event of an emergency 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 SBE & 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 large section of construction workers due to contaminated drinking water, unhygienic conditions that have developed at workplace.
- Protests by the local community or other stakeholders at any point of the project lifecycle due to grievances.
- Serious injury or death of employee or sub-contracted worker at work, due to non-work-related illness or work-related accident.
- Onset of any natural disaster like earthquake.

Emergency Management

The following steps 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 an agreement 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.
- Regular liaising with the police, Gram Panchayats, 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 2-3 professionals during operation of the project; should be formed to combat any emergency situation and ensure safety of the life and property at site. For this purpose, 2-3 personnel employed in the plant during operation phase 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 SBE & 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 project sites 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. Though the possibility of flooding is rare due to drought prone area.

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 & Wind Plants (e.g., unauthorized entry to the Plants). Any public rights of way located within and close to the Solar & Wind 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 or there are no rights of way across the site, consider fencing the solar energy facility site to prohibit public access to the site.
- Provide fencing of an appropriate standard around the sub-station with anti-climb paint and warning signs.
- Post information boards about public safety hazards and emergency contact information.

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

Electromagnetic Interference and Radiation: Wind turbines could potentially cause electromagnetic interference with telecommunication systems (e.g., microwave, television, and radio). This interference could be caused by path obstruction, shadowing, reflection, scattering, or re-radiation. The nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver, characteristics of the rotor blades, signal frequency receiver characteristics, and radio wave

propagation characteristics in the local atmosphere. Suitable mitigation measures to enhance the quality of the television signal and lower the impact of wind turbine on telecommunication need to be adopted.

Public Access: Safety issues may arise with public access to wind turbines (e.g., unauthorized climbing of the turbine) or to the wind energy facility substation. Any public rights of way located within and close to the wind energy facility site should be identified prior to construction to establish any measures that may be required to ensure the safety of their users. Prevention and control measures to manage public accesses include:

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

Blade Throw: A failure of the rotor blade can result in the "throwing" of a rotor blade, or part thereof, which may affect public safety. The overall risk of blade throw is extremely low. Blade throw risk management strategies include:

- Establish setback distances between turbines and populated locations. The IFC EHS Guidelines for Wind Energy (August 7, 2015) recommends the minimum setback distance is 1.5 x turbine height (tower + rotor radius),[3] although modelling suggests that the theoretical blade throw distance can vary with the size, shape, weight, and speed of the blades, and the height of the turbine. It is therefore recommended that the minimum setback distances required to meet noise and shadow flicker limits be maintained with respect to sensitive residential receptors to provide further protection
- Minimize the probability of a blade failure by selecting wind turbines that have been subject to independent design verification/certification (e.g., IEC 61400-1), and surveillance of manufacturing quality.
- Ensure that lightning protection systems are properly installed and maintained.
- Carry out periodic blade inspections and repair any defects that could affect blade integrity.
- Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.

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

[3] *https://www.ifc.org/wps/wcm/connect/2c410700497a7933b04cf1ef20a40540/FINAL_Aug+2015_Wind+Energy_EHS+Guideline.pdf?MOD=AJPERES*

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. The focus of the plan is primarily on communication with the community areas where there are likely interactions between the community and the Contractors. The community liaison plan would concentrate on the following aspects

Communication with the Community: As mandated in the Performance Standards of IFC, SBE had already disclosed the project details prior to lease of land parcels from the villagers to make the community aware of the important features of the project.

7.5.3. Waste Management Plan

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

- Minimize the potential to cause harm to human health and the environment.
- Comply with Indian environmental regulation and guidelines following the IFC Performance Standards.
- Reduce operational costs and reduce any potential liabilities which may arise from waste handling operations.

This plan also ensures that every waste stream and solid waste materials from the main plant site and bracketed facilities will be managed effectively.

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

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

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 main plant to the nearby natural drainage channels, surface water bodies, public and private properties though the possibility of heavy rain is very rare in this climatic zone.

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 Wind - Solar Hybrid Power Project site will be directly discharged into any nallah/water body.
- Rainwater collected from the project site will be used to recharge the ground water through onsite rainwater 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 on the project site. 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.

Responsibility: SBE would take responsibility for construction of the road before the existing road is diverted / closed for use by villagers. SBE (through the implementing agency/contractors) should start the process of dialogue with the community to decide on the alignment of the road and also fix up the likely timeline for the construction.

SBE 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 SBE and/ or their contractors should have an agreement with the Gram Panchayats for the sharing of the resource. In case of damage to community property SBE including its contractors should ensure that it is repaired or replaced to the satisfaction of the community at the earliest. SBE should maintain documentation of all incidents of damages to the community property. All cost for repair/replacement should be borne by SBE.

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

7.5.6. Occupation Health and Safety Management Plan

The Occupational Health and Safety (OHS) of the employee and contractual labours will be maintained at the work sites during both construction and operation phase. The OHS Management measures 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 workplaces 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. SBE needs to ensure it through its contractors.
- Sufficient light and ventilation will be provided for workers working in confined space.
- Periodic health check-up camps for workers onsite will be organized to ensure prevention of occupational health hazards.
- Work/Construction signage all along construction area.
- Health and Safety training for all workers and awareness.
- 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 solar PV panel components 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 (GRM)

SBE should incorporate a GRM Policy mentioning the procedures for lodging of grievances, processing of grievances, resolving grievances and closing of grievances. Following the GRM Policy in the ESMS of SBE and the IFC guidelines issues raised through grievance redressal system should be addressed with remedial measures on site. Grievance redressal framework for onsite implementation should also be formulated for the purpose.

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.

SBE will follow their grievance mechanism to ensure that grievances from affected communities are addressed and necessary mechanisms exist for catering to external communications from others. If the client anticipates ongoing 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 client will inform the affected communities about the mechanism in the course of its community engagement process. The decision on the grievance would be communicated to the aggrieved person within a timeframe.

7.5.8. Community Development Plan under CSR

SBE have their own CSR Policy. Following the guidelines of MNRE of Govt. of India and Companies Act, 2013 it is mandatory to undertake developmental activity for the community of the project affected area. The same has been suggested in Environmental Management Plan**.**

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 crore or more; or
- net profit of Rs.5 crore or more

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, SBE has developed 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 lays down the areas of intervention, principles and mechanisms for undertaking various programs in accordance with Section 135 of the Companies Act 2013.

SBE should take some initiatives for Community Development Plan under their CSR Policy in the project affected village as suggested below:

- Employment opportunities to the people who are losing their lands in a manner that is affecting their livelihood resource in project area villages;
- Creating provisions for employment opportunities to the people who are skilled and semi- skilled in project area villages;
- Supporting the Anganwadi Centres by facilitating them with provisions of exclusive drinking water, sitting arrangement, power supply and toilet facilities for them in project area villages;
- Facilitating the village schools by providing them with amenities like chairs, benches, drinking water facilities, sports goods etc.;
- Facilitating in development and creation of health infrastructure in the study area villages
- 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.

Under their CSR Policy, SBE should create provisions for the abovementioned matters and/ or any other pertinent issues. Recommendation under CSR Policy.

7.5.9. Road Safety and Traffic Management Plan

Scope and Purpose

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

During Construction Phase

The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.
- Any road diversions and closures will be informed in advance to the project vehicles accessing the above route. Usage of horns by project vehicles will be restricted near sensitive receptors viz. schools, settlements etc. Though, no such chances are seen so far. Because, the project location is absolutely located in isolation.
- 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.
- The SBE / 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 25 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.
- SBE 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.

7.5.10. Ecological Management Plan

Construction phase

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

- Project proponent should plan to build an appropriate level of fencing with lighting as a preventive measure to prevent man animal conflict
- All project activities shall be undertaken with appropriate noise mitigation measures to avoid disturbance to faunal population (herpetofauna) in the region.
- Activities generating high noise shall be restricted to daytime 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 fauna within the site.
- Night-time movement of project related vehicles must be restricted along the highway.
- Transportation of construction material shall be restricted to daytime hours in order to minimize noise and disturbance to fauna in the area.
- General awareness regarding natural resource conservation shall be enhanced through trainings, posters, etc. among the staff and labourers.
- kitchen waste shall be collected and disposed in a manner that it does not attract scavenging animals.
- Temporary barriers shall be installed on excavated areas.
- The footprints of the construction activities shall be kept to minimum so as to reduce disturbance to flora and fauna.
- Forest department must be informed in case of any wildlife sighting or any incident involving wildlife.
- If any nests of ground dwelling birds are found the Forest Department is to be notified so that the birds don't get displaced.

- Pre-clearance biodiversity survey protocol is to be carried out to identify important biodiversity features (e.g., nests, roosts, burrows) prior to construction to be included in construction-phase ESMS.

Operational phase

- Vegetation clearing through brush cutting for maintenance activities shall be done manually wherever possible (not applicable in this site, as there is absence of any green vegetation and land is barren)
- Any areas without vegetation cover shall be re-vegetated with locally occurring species and monitored to ensure recovery is taking place.
- Vegetation that needs to be reduced in height shall be mowed or brush-cut to an acceptable height, and not to ground level except where necessary (not applicable in this site, as there is absence of any green vegetation and land is barren)
- General awareness regarding wildlife and natural resource conservation shall be enhanced through trainings, posters, etc. among the staff and labourers.
- Solar panels shall have an anti-reflective coating to minimize the light reflecting off of the panels so that there is very less impact due to glare from the panels.
- Moreover, to minimize “Lake effect”, visual frightening techniques may be considered to frighten any bird trying to land on panels and prevent birds from landing.
- Fencing and lighting along the project boundary must be properly maintained all through the project lifecycle.
- All transmission lines need to have bird reflectors due to the movement of Raptors in the area.
- Project proponent should follow all the directions of regulatory agencies as prescribed from time to time by the Federal Government/state government / court orders.
- As WLPA, 1972 Any accidental death due to species listed in the schedule will lead to legal action against the responsible party irrespective of the location where the incident occurred.
- The power pole configuration should be designed to minimize avian electrocution risk
- Flash lamps on the WTGs should be installed to reduce collision risk to birds & bats at night
- Strategic placement of wind turbines by avoiding sensitive locations within the designated area such as congregation of vultures around carcass dump sites, or waterbodies as they would be hotspots of winter migratory birds.
- Regulate blade speed periodically to reduce collision risks during winter season and monitored by SB Energy technical team
- Fewer but larger turbines may also reduce collision risks (Barclay et al 2007, Smallwood and Karas 2009). Also, the spacing between the turbines can be strategized to reduce risks.
- During construction and post construction monitoring of the birds is essential to identify and address any long-term environmental impacts
- Painting single wind turbine black. A recently published research article provides evidence that painting a single wind turbine blade black reduces collision by 70% and is particularly effective for large birds of prey especially vultures. The paper was published in Ecology and Evolution

by researchers from the Norwegian Institute for Nature Research, Norway, and the Lake Ånnsjön Bird Observatory, Duved, Sweden.

- A fatality monitoring program will be implemented in the wind site and certain high-risk sections of the transmission line during the operations phase following Good International Industry Practice. The fatality monitoring will be described in the Operations Phase Monitoring and Management Plan.
- In consultation with the communities, outline and agree on an approach to remove livestock carcasses from the project site and/or modify disposal practices so that they do not attract vultures and other raptors to the wind energy facility. The Carcass Livestock Disposal Program will be described in the Operations Phase Monitoring and Management Plan that will be finalised by client.
- An Operations Phase Biodiversity Management Plan will be developed by client for both the wind and transmission line describing (i) the Fatality Monitoring Program; (ii) the Carcass Livestock Disposal Program; (ii) an Adaptive Management Plan, including quantitative fatality thresholds and reporting requirements; and (iv) a maintenance schedule for the bird flight diverters on the on-site collector lines and on transmission line.

For selection of the optimum route, the following points should be taken into consideration:

- The route of the transmission lines avoids or minimizes passage through human habitations.
- No monument of cultural or historical importance is affected by the route of the transmission line.
- Ensuring that the route of transmission line does not create any threat to the survival of any community with special reference to tribal community.
- Ensuring that the proposed route of transmission line does not affect any public utility services like playgrounds, schools, other similar establishments.
- Shortest possible length and favorable ground profile.
- Avoidance of reserve forest zones which are quite significant in area in this project; also avoidance of any archaeological and other sensitive areas and unstable ground feature.
- Minimizing no. of crossing of major rivers / railway lines, national and state highways;
- Avoidance of rocky stretches and areas reserved for planned and future development.
- Restricted areas such as civil and military air field should be avoided.
- Routing should be kept away from large habitations, densely populated areas, reserve forests and hydrocarbon pipelines to the extent possible.
- Forests should be avoided to the maximum extent possible. When it is not possible, a route is selected in consultation with the Divisional Secretaries that causes minimum damage to existing plantation/forest resources.

7.5.11. Management Plans for Addressing Climate Change Risk Assessment & Human Rights in adherence to Equator Principles 4

The Management Approach of AGEL has been with an aim to demonstrate the ability of large-scale Hybrid (solar – wind) power to improve the electricity supply and stability of the Government of India national grid, and substitute for fossil-fuel generation in the future. AGEL's renewable power generation will increase the percentage of clean energy supply in line with the Indian's Government's stated greenhouse gas (GHG) emissions reduction targets and Equator Principles 4.

AGEL (Adani Green Energy Limited) optimize energy consumption and in turn, reduce the GHG emissions Initiatives through adhering to ISO 50001, ISO14001 and by using diesel only for DG sets and onsite vehicles, electricity from grid for non-generating hours, refrigerants, fire extinguishers and SF6. They have detailed GHG inventory is done as per ISO 14064 and assured through external party. AGEL is also committed to take up many energy efficiency initiatives and use efficient technologies such as LEDs, energy star rated equipment and through reducing line losses.

Additionally, AGEL is a signatory to the Science Based Targets Initiative (SBTi) where they signed MOU with CDP for 'The Science Based Targets Initiative Incubator Project' (SBTiIP) to advance from commitment stage to target development stage, Signatory to United Nations Global Compact (UNGC) where they have submitted first Communication on Progress (COP) for FY21, TCFD supporter and reports to CDP since 2020. AGEL is also adhering to UN Sustainable Development Goals where they are a signatory to UN Energy Compact in line with SDG 7 (Affordable and Clean Energy)

AGEL has their own Integrated Management System Policy, which includes climate change and human rights aspects. AGEL's HR Policy is in alignment to UNGC (United Nations Global Compact) and their sustainability governance is in compliance with IFC PS and UNGC Principles.

AGEL is certified with:

- QMS Quality Management System (ISO 9001:2015)
- Environmental Management System (ISO 14001:2015)
- Occupational Health and Safety Management System (OH&SMS, ISO45001:2018)
- **Energy Management System (ISO50001:2018)**
- Asset Management System (ISO55001:2014)

AGEL's certifications that are in process:

- Information Security (ISO27001:2013)
- **Disaster Management IT (ISO22031:2019)**
- Business Continuity (ISO27031:2011)
- **Social Accountability (SA 8000)**
- **Social Responsibility (ISO: 26001)**

The project has been assessed for climate change risks where the project can be classified as low risk from future climate change impacts considering the number of adaptative and mitigating measures highlighted above. The project is located in a region which has cry and desertic topography; may be at risk from high temperatures, future water stress and change in solar radiation affecting solar power potential. While climate change impacts are not anticipated to be significant over the design life of 25 years of the renewable energy (hybrid solar and wind), project outputs sensitive to climate change were assessed by AGEL along with climate change risk response (mitigation) measures. AGEL has adopted adequate engineering design of their project site, all weather road pavement, high design standard

transmission line as well as regular maintenance of roads. Climate change is projected to influence water availability. Regions like the project Site that are already dry may suffer further if future precipitation is projected to decrease. Therefore, AGEL commits that generating clean electricity with no emissions and virtually negligible water consumption in comparison to business as usual, they are enabling customers to decouple their own business growth from environmental impacts. At AGEL, their focus on decarbonizing – with a net-zero 2050 goal for carbon emissions – continues as they are deploying significant amounts of renewables – investments.

Complying with GRI (Global Reporting Initiatives), under Climate Change, AGEL is adhering to KPIs GRI 302-1, 2, 3, 4, 5, GRI 305-1, 2, 3, 4 which have the ESG Goals and Targets of:

- Best assessment score company in Electric Utility sector in India on Carbon Disclosure Project (CDP) by 2021
- Company with energy intensity reduction target in line with NDC (Govt of India) or SBTi (Science Based Targets) by 2022
- Carbon Calculator on AGEL website by 2023
- Carbon passbook for employees and AGEL quarterly carbon mission due to business by 2022.

AGEL has carried out a climate risk assessment and scenario planning in line with TCFD recommendations for all its operations sites. Opportunities were also assessed from climate-related risks and is discussed in the climate change section of AGEL "Sustainability Report FY2021" and it suffices the requirements of Equator Principles 4.

AGEL has taken approved climate target by SBTi within two years of commitment submitted in May 2020. Climate Change Risk is seen as a Business Risk in AGEL. As an electric utility company, AGEL is exposed to physical and transition risks associated with climate change. Water availability, extreme heat, wind speed and lighting are a few change conditions that hold relevance to AGEL's business operations for this Hybrid project site. A Screening Level Natural Hazard and Climate Change Physical Risk Assessment for proposed hybrid power project was conducted by AGEL through external consultant in order to meet the requirements of undertakings against International standards. The risk assessment reviewed the EP4 requirements, national level plans and commitments towards climate change followed by evaluation of natural hazards under baseline and climate change conditions.

Mitigation Measures adopted by AGEL at an organizational level, includes multi-faceted approach which focuses on lowering emissions, sequestering more than the project emit, and climate-proofing their operations and supply chains. AGEL's Operational Excellence Framework is designed to be resilient to future shocks. It is supported by ENOC to enable Business Continuity and seamless Project Management at all of their operational sites.

For monitoring Carbon Emissions, AGEL has identified the use of fossil fuels and grid electricity as significant contributors to their emissions, which is why monitoring their emissions is a critical component of AGEL's environmental protection efforts and climate change risk mitigation and they actively seek opportunities to implement energy-efficient technologies in their operations. In this Hybrid Project the emissions are expected to be quite less than 1,00,000 MT CO2e as reported by AGEL. Moreover, for their entire operations of clean energy generation they have been able to avoid 14,600,000 tons of CO^2 e. Given the nature of their operations, their emissions are limited and minimal. They do however track and assess their emissions, both direct and indirect. Their direct emissions (Scope 1 emissions) arise from diesel used in the generator sets and vehicles, refill of SF6 from their circuit breakers and refill of refrigerants. Their consumption of small amount of electricity purchased (during the non-generating hours of both solar plant and wind farms) from the grid, accounts for their Scope 2 emissions, while the largest contributions to Scope 3 emissions include capital goods,

upstream transportation and operations of their contractors (use of vehicles and construction machinery, especially during the project construction phase). They have established key performance indicators (KPIs) as stated above, to reduce GHG emissions in the next five years. They don't use any ozone depleting substances (ODS). Refrigerants used are non-ODS type (R-22). As part of the journey, FY 2019-20 GHG emission calculations (developed as a part of the Annual Integrated Report development) and estimated emissions till Dec. 2020 were published. Based on the base year emissions, science-based targets (SBT) were developed jointly with WRI India. The carbon tax adopted as internal carbon price in AGEL is being used to calculate financial viability of emission reduction initiatives on a regular basis.

Management Plans for Addressing Human Rights in adherence to Equator Principles 4

SBE Renewables Ten Pvt. Ltd., part of Adani Group is committed to upholding of fundamental human rights in line with the legitimate role of business. Maintaining a diverse workforce for the energy sector to thrive, diversity is essential. The company has a human right policy made with consultation of all stakeholders and has a committee which presides it.

Group's approach related to human rights were incorporated to its business policies and compliance in line with internationally recognized laws, as mentioned in the International Bill of Human Rights and The International Labour Organization's Declaration on Fundamental Principles and Rights at work including eradication of child or forced labour and harassment or intimidation in the workplace. Also, group have addressed the International Labour Organization's eight fundamental conventions through our employee and supplier Code of Conduct, policies and vendor evaluation criteria. Being a signatory to the UNGC, all of our significant investment agreements such as services order for manpower supply and EPC contracts contains human right clauses respecting human rights by appropriate measures to avoid child labour, forced labour, minimum wage and all the applicable regulations. All acquisitions, mergers and investment decisions take human rights related clauses into consideration.

Equal opportunities were given to all employees and to all eligible applicants for employment in the company. Policies on human capital management aim to eliminate discrimination at the workplace. Company is against unfair discrimination on any ground including race, caste, religion, colour, ancestry, marital status, gender, sexual orientation, age, nationality, ethnic origin, disability or any category protected by applicable law. Induction programmes are structured to highlight awareness on Human Rights for new employees and refresher trainings. All operations and value chain partners protect, upkeep and abide by the applicable regulations protecting human rights. All security personnel, including those supplied by third party, are trained in human rights policies, identification and prevention of child labour.

Concluding remarks on Compliance with Equator Principles 4

As described above, the project developer has required systems and process in line with the requirement of the Equator Principles July 2020 (EP4) to address the risks associated to the climate change and human rights. Alongside the baseline of environmental physical parameters are already studied in detail in this ESIA report. The proposed project is in compliance with the EP4 requirements and will be adhering to the existing systems and procedures in line with EP4 requirement.

7.5.12. Stakeholder Engagement Plan (SEP)

SBE shall develop broad level Stakeholder Engagement Plan to guide stakeholder engagement across the lifecycle of the project, demonstrating Company's commitment towards its stakeholders while also

addressing the requirements of the International Finance Corporation (IFC) Performance Standards (PSs). SEP is the process of developing appropriate management strategies to effectively engage stakeholders throughout the lifecycle of the project, based on the analysis of their needs, interests and potential impact on project success. This plan provides details on the general principles for SBE stakeholder engagement which shall be used for implementing, monitoring and evaluating stakeholder engagement activities. The main objectives of the SEP are to:

- Enable management to develop effective stakeholder management strategies for the proposed project to build longer term relationships so as to ensure smooth functioning of the projects;
- To define and standardize the processes that the projects will use to communicate with respective stakeholders;
- To ensure regular and timely sharing of information with project teams to spruce up their understanding and skills of engaging with the stakeholders;
- Ensuring coordination in approach and message to be shared with the community regarding the company and the projects;
- To assess the efficiency of the communication process in meeting the objectives of the Stakeholder Engagement Plan and ensuring the project's 'Social License to Operate'

Stakeholder Identification, Mapping & Analysis

"Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. Effective stakeholder mapping is done by identifying the people/groups that have stakes/ interests in the Project either directly or indirectly and the way both can mutually benefit from each other.

Categorization of Stakeholders

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders** (land sellers, local labourers, sub-contractors and Gram panchayat), those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders as in the following table.**

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	Sub-contractors Contractual Labourers Landowners, land users, agricultural Labourers (if applicable) Local Communities where project is located Project Affected Families Agricultural Labours Vulnerable Community (if any)	Local community outside the immediate impact zone of the project Non-government organizations, interest groups or other civil society groups
Institutional Stakeholders	Project Developer Project investors /Lender	District schools/colleges

	Gram Panchayat	Village Institutions (schools, health Anganwadi etc.)
Government Bodies	Regulatory Authorities. Gram Panchayats/Gram Shaba Relevant government bodies and other regulators	District Administration
Other Groups		Other industries/projects Other external influences

Overall Stakeholder Engagement Strategy

The overall stakeholder strategy will be cognizant of the requirement of the various stakeholders and the level at which communication is presently being undertaken by the project.

Table 40: Stakeholder Engagement Strategy

Sl. No.	Particular	Responsibility
1	Regulatory Authorities	The regulatory authorities will be coordinated directly by SBE legal team via OEMs/developers, or project-based team. These consultations are in relation to the Power purchase agreement, power evacuation arrangements; Consent to establish related permits, revenue land allotment, or other requirements required for the wind power projects. The copy of the permits and communication will be made available to SBE at various levels. SBE team at the corporate level will be responsible for driving the timely fulfilment of the project level regulatory compliances. After completion, a copy of the relevant permits and compliances will be provided to the corporate team from all the projects, for records.
2	Community around the project	The project liaison officer of each site will be solely responsible for interaction with the community members residing near each project, through village meetings and other platforms. The minutes of the meetings will be shared with the respective site in-charge as well as the corporate liaising team in standard reporting formats in pre-decided time intervals.
3	NGOs, Civil Society, Political leaders and Media	SBE ESG head along with the developers CSR team will be accountable for any communication with local NGOs, civil society members, political leaders and media. The details of any such communication concerning the projects will be made available to the SBE corporate team in the form of stakeholder engagement records. Nobody apart from designated the SBE corporate liaising in-charge will be responsible for communication with the above-mentioned stakeholder.

Organizational Structure & Roles and Responsibilities

During the construction stage, owing to the interplay of the various actors involved, it is important to have a system in place which ensures that the community as one of the key stakeholders is aware about the Stakeholder engagement as well as the communication protocol including the grievance mechanism.

Engagement Methods

The methods of communication can be either verbal or written, based on the purpose of communication and the target stakeholder group. Some of the key methods of communication are as follows:

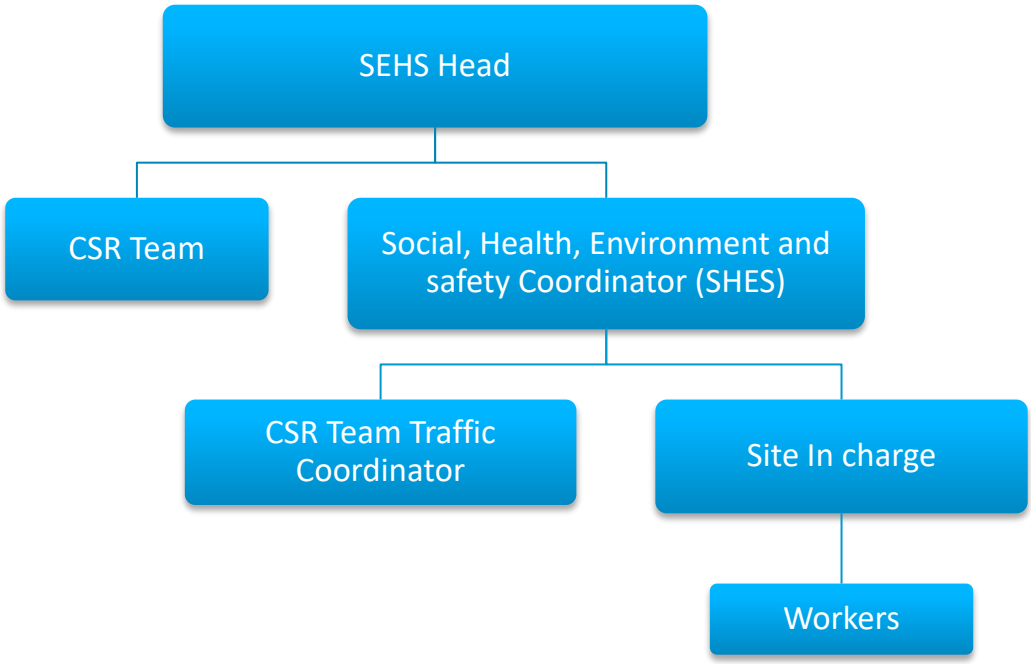
Meetings and Discussions: Meetings and discussions are an essential component of any communication exercise. The corporate CSR team of SBE will have regular interface with their

counterparts in the project to review the current engagement with local community. These discussions are will be to communicate specific information to the target stakeholders and allow for the collective opinion of the groups to be captured and assessed.

Reports and Notices: Information disclosure is an important process of communication with the local stakeholders and is part of the applicable reference framework for the project. A mandatory communication from the corporate team will guide project teams for the forthcoming meetings in each project. The process of disclosure of information to the communities at the project will involve the provisioning of information in an accessible manner (a manner which allows for easy understanding, such as in the local language) to the various stakeholders in a project. There will be visits of the designated members of corporate team at regular intervals to each project.

7.5.13. Provisions for ESMP Implementation

Environmental and social management plan will not be successful without a proper designated team and financial support for the same. The proposed team for environmental & social management plan is as follows:



Adequate budgetary provision will be made by the SBE for execution of environmental management plan.

8. CONCLUSION AND RECOMMENDATION

The ESIA study based on the conclusion drawn from the IFC performance standards, Equator Principles and World Bank Group's EHS Guidelines and applicable sector guidelines with respect to the intensity of impacts due to project activities on environment, resources, biodiversity, labours and community, the project is expected to have limited adverse environment and social impacts, which can be mitigated by adopting suitable mitigating measures.

- **Potentially limited risks/impacts and reversible:** Environmental and social impacts of the project are anticipated during the construction phase and will encompass changes in land-use, increased noise levels, changes in air quality, use and changes in water quality, impacts on terrestrial ecology, occupational health & safety, etc. Further, there is no physical displacement. Thus, most of these impacts are limited to the project sites and their immediate vicinity and can be minimized through application of mitigation measures as proposed in the ESMP.
- **Unprecedented:** Development of Hybrid power projects is occurring in large numbers in the last decade and therefore several such projects are located across India. A Hybrid power project can therefore not be considered an unprecedented activity.
- **Limited adverse impacts on the baseline:** Solar based energy development is a non-polluting source of energy and thus is not likely to lead to any adverse impacts on the baseline environment during the operation phase. In terms of social impacts, the land required is private agricultural land; but the site location of the project does not involve any anticipated settlements and physical displacement.
- **Solar Site:** It is found that a total 58 number farmers involved in agriculture and allied activities in proposed government land and this was the common practice by local community and same was highlighted during consultation. Approx. 34 structures have been identified on the proposed project land for solar and wind project. site. Majority of the structures are permanent in nature like underground water tank (tanki) and few temporary structures like huts used for storage of fodder and food grains. No residential structure is impacted. Also, two government structures like check dam and borewell are reported at the proposed project site.
- **Wind site:** A total 48 survey numbers of government land are identified for WTG locations for wind energy project is spread over seven villages Bherupura, Devka, Manihari, Junejo Ki Dhani, Manihari, Harwa and Mat ka Gol under Shiv Taluka of Barmer district. A total 23 number of households are impacted by the project. Around 29 structures have been impacted due to wind project. Majority of the structures are permanent in nature like residential houses and few temporary structures like huts used for storage of fodder and food grains. Also, two abandoned structures are reported on government land in Devka village.
- Considering that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land.
- **Noise:** In India, there are no specific guidelines for wind power project noise levels. As per IFC's General EHS Guidelines: Environmental, Noise Management Noise, noise impacts should not result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.
- Estimated noise generated during operation phase was calculated using Windpro software. These ambient noise levels at village level were observed to be within permissible limits specified for Residential area as per Noise Pollution (Regulation and Control) Rules, 2000 (without project), However the increment in ambient noise level due to WTG operations is anticipated to increase up to a range of 0.4 to 4.3 dB(A), in night time during the operational phase of the project.

- Distances of the identified noise sensitive receptors from the nearest WTGs varies from 137 m to 300 m
- Out of 7 Identified receptors of noise sensitive areas, AH (NR 34), BF (NR 58), AI (NR 35) are village settlements, AW (NR 49) is assumed to be a shed storage area having demarcated boundaries, AO (NR 41) and BB (NR 54) are independent houses, E (NR 5) appears to be a shed of agriculture-storage, where all seems to be permanent structures and for them mitigation measures suggested in this report is to be followed.
- **Shadow Flicker:** Shadow Flicker Modelling results show that out all the 11 identified receptors will receive shadow for more than 30 hours per year from total 24 WTGs with minimum being 31:53 hours / year to maximum being 121:43 hours / year with distances from WTGs ranging between 179 m to 2.2 km.
- All of these receptors seem to be permanent structures and mitigation measures suggested in the report shall be followed.

- **Ecology:** The project area is plain land with sparse vegetation as reported. Chinkara, Nilgai, Indian Peafowl are present in the Landscape. Therefore, there is a possibility of mortality of birds due to collision with the WTGs. The client shall be emphasizing to minimize the adverse impact through adequate mitigation measures during operation phase. Mitigation like daytime visual markers, visibility enhancement objects such as marker balls, bird deterrents, or diverters shall be installed on wires and transmission lines to enhance visibility of towers/transmission lines for bird to avoid avian collision.
- **Caracass Management Plan:** the powerline collisions and electrocution are considered as major threats to avian species. Large birds such as cranes and bustards are more susceptible to collisions due to low visibility and height of these structures with respect to the altitude of the flight (Tere and Parasharya 2011). The birds of prey and soaring birds are more vulnerable to collision with power transmission lines (Harness et al. 2013). The Rasla Lake is one of the roosting spots of many migratory birds and hosts Demoiselle Cranes in large numbers every winter. These cranes are known for their toughest migration by crossing Himalayas and spending winter in western Rajasthan (Jain et al. 2005). The basic minimum is to install and maintain bird diverters or reflectors on entire power transmission lines to be laid for the project as per the IFC guidelines. Its efficacy should also be tested. We are providing following preliminary observations. Firm mitigation measures can only be provided after robust, multi season, systematic study.
  1. Use of bird diverters or deflectors to make the powerlines more visible.
  2. Sufficient spacing between conductors and powerlines to accommodate the wide wingspan of large raptors like Vultures and eagles.
  3. Proper insulation of cables closes to poles that are used for perching by the birds.
  4. Avoid clustering of powerlines.
  5. Pre and post construction monitoring of bird mortality and displacement evaluation along the powerlines and timely intervention, if required. These mitigations are also a part of the mitigation table.

- The project will improve the socio-economic conditions of the surrounding areas. Job opportunity will improve significantly in the project area and its surrounding. The project will create many jobs to the local population both during construction and operation phase with corresponding increase in income. Other associated business activities like transport, hotels, consumer goods etc., will also be benefited.

- To conclude, with the proper implementation of the Environmental and Social Management Plans (ESMP) and undertaking the recommendations, the proposed project should be in comply with the IFC Performance Standards, other lender(s) requirements.

8.1. Impacts Assessment

ESIA was focused on interactions between the Project activities and various resources/receptors that could result in significant impacts. During construction and operation phase of the project environmental management plan shall be followed mentioned in **Table 41.** The table below presents the outcomes of the comprehensive assessment of identified impacts as a result of the various phases of the Project.

Table 41: Impact Assessment Summary

Impact Description	Significance	
	Without mitigation	With mitigation
Construction phase		
Landscape and visual	Low	No impact
Water resources and quality	High	Moderate
Air quality	Moderate	Low
Soil quality	Low	Low
Noise level	Moderate	Low
Solid waste	Moderate	Low
Change in local topography	Moderate	Low
Ecology	Moderate	Low
Engagement of local and migrant labour	Moderate	Low
Labour accommodation	Moderate	Low
Land lease	Low	Low
Impact on indigenous people	Low	Low
Impact on archeologically important sites	No impact	No impact
Community engagement	Moderate	Low
Occupational health and safety	Moderate	Low
Operation phase		
Hazardous waste management	Moderate	Low
Solid waste management	Moderate	Low
Groundwater abstraction	High	Moderate

Wastewater management plan	Moderate	Low
Ecology & biodiversity	Moderate	Moderate
Corporate social responsibility	Moderate	Low
Occupational health and safety of workers	Moderate	Low

8.2. Level of compliance and gap with Applicable IFC Standards

A gap assessment against the requirements of IFC environmental and social performance standards has been made, to determine to what extent the findings related to the project management systems and performances are aligned with the intended requirement of the IFC reference framework.

ESIA identifies the sustainability of the project in construction phase which more precisely helps to the proponent towards project's viability with respect to the environment & social aspects. During execution phase of the project ESDD shall be conducted which will mainly emphasizes to finding the gaps of ESMP/ESAP as recommended in ESIA report. During construction/operation phases Identified gaps /deviation of the recommendation along with principles/performance standards can be highlighted.

In this section, IFC performance standard, compliance to all environmental, health, safety and social regulation together with all sub-requirements are presented next to a gap assessment, recommendations and references to the actions in the Environmental & Social Action Plan (ESAP).

Table 42: Environmental and Social Action plan

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
Performance Standards						
1.	Performance Standard (PS) - 1 Assessment and Management of Environmental and Social Risks and Impacts	Applicable	The project will have environmental and social impacts due to generation of onsite air emissions, noise, domestic wastes from site office and rest rooms, and generation of hazardous wastes from the construction site.	SBE is required to fulfil the following requirements: • Environmental and social action plan; • Identification of risks and impacts; • Management program; • Organizational capacity and competency; • Training for security and safety workers; • Emergency preparedness and response; • Stakeholder engagement/ grievance redressal; and Monitoring, reporting and review.	SBE and its contractors	To be Followed during construction and operation phase

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
2.	PS 2: Labour and Working Conditions	Applicable	As reported about 2000 labourers are estimated to be deployed in the peak construction phase. The contractor's workforce will comprise of skilled, semi-skilled and unskilled labours, which may be sourced from the nearby village settlements depending on their skills and capabilities.	The worker accommodation standards as laid down by ILO is presented in Error! Not a valid result for table. of the document. IFC guidance note on "Labour and working condition" shall be followed by project developers and contractors. SBE shall prepare Labour engagement plan in line with IFC guidance manual and include in contractors agreement. The company, as a part of oversight procedures will need regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met at all the project sites. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system at all the said project sites	SBE and its contractors	To be Followed during construction and operation phase
3.	PS 3: Resource Efficiency & Pollution Prevention	Applicable	The project involves use of resources like land and water. Improper handling of broken and damage solar panel, other waste may result contamination.	Recommendations given in Table 3 -2 and Table 7-1 shall be followed in order to reduction in pollution.	SBE and its contractors	To be Followed during construction and operation phase
4.	PS 4: Community Health, Safety and Security	Applicable	Heavy vehicles would use the existing village roads. several staff will remain involved during the operation period. The generated electrical energy will be transmitted through high voltage power line, thereby exposing the	SBE and contractors will ensure proper stakeholder consultations, grievance redressal mechanism, communication to workers and other stakeholders to avoid any conflict between migrant labour and local community. Construction of boundary wall may result in restriction of access/ increased	SBE and its contractors	To be Followed during construction and operation phase

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
			staff and community to electrical injury cannot be ignored. For Solar plant, SBE shall deploy 15-20 person and EPC shall deploy Appx. 200 personals as security guard For Wind: Dove Resources Private Limited, Will deploy as per site requirements	distances from common property. Interaction of community with project staff especially security staff would occur.		
5.	PS 5: Land Acquisition and Involuntary Resettlement	Applicable	As reported, the proposed project is falling in government revenue land. Since the project developer is not involved in land acquisition and no physical or economic displacement anticipated for this project.	GRM and SEP as developed as part of ESIA / ESMS to be implemented to address the grievances if any related to lease of Government.	SBE	To be Followed during land lease, construction and operation phase
6.	PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Applicable	The project area is not located within any notified ecologically sensitive area As WLPA, 1972 Any accidental death due to species listed in the schedule will lead to legal action against the responsible party irrespective of the location where the incident occurred.	– The power pole configuration should be designed to minimize avian electrocution risk – Bird diverter should be installed in transmission line which the client will be complying with respect to the sensitive areas – Follow the DOs & DON'Ts as applicable, attached in Appendix – Mandatory shutting down of turbines at specific locations or times during peak migration and breeding season of the birds – Strategic placement of wind turbines by avoiding sensitive locations within the designated area such as	SBE and its contractors	To be Followed during construction and operation phase

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
				congregation of vultures around carcass dump sites, or waterbodies as they would be hotspots of winter migratory birds – Regulate blade speed periodically to reduce collision risks during winter season and monitored by SB Energy technical team – Fewer but larger turbines may also reduce collision risks (Barclay et al 2007, Smallwood and Karas 2009). Also, the spacing between the turbines can be strategized to reduce risks. – During construction and post construction monitoring of the birds is essential to identify and address any long-term environmental impacts. – Painting single wind turbine black. A recently published research article provides evidence that painting a single wind turbine blade black reduces collision by 70% and is particularly effective for large birds of prey especially vultures. The paper was published in Ecology and Evolution by researchers from the Norwegian Institute for Nature Research, Norway, and the Lake Ånnsjön Bird Observatory, Duved, Sweden.		

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
				– Detailed biodiversity assesmnet and criticle habiat assesmnet is recommended to establish exact biodiversity risk at the project site. – A fatality monitoring program will be implemented in the wind site and certain high-risk sections of the transmission line during the operations phase following Good International Industry Practice. The fatality monitoring will be described in the Operations Phase Monitoring and Management Plan. – In consultation with the communities, outline and agree on an approach to remove livestock carcasses from the project site and/or modify disposal practices so that they do not attract vultures and other raptors to the wind energy facility. The Carcass Livestock Disposal Program will be described in the Operations Phase Monitoring and Management Plan that will be finalised by client. – An Operations Phase Biodiversity Management Plan will be developed by client for both the wind and transmission line describing (i) the Fatality Monitoring Program; (ii) the Carcass Livestock Disposal Program; (ii) an Adaptive Management Plan, including		

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
				quantitative fatality thresholds and reporting requirements; and (iv) a maintenance schedule for the bird flight diverters on the on-site collector lines and on transmission line. –		
7.	PS 7: Indigenous Peoples	Not Applicable	No impact on tribal community has been envisaged for the proposed hybrid project. **No Bhil community/Indigenous People have their land in the proposed solar site or wind site, so PS 7 is not applicable.**	Engage local tribal people in the construction & development of the project to the extent feasible where skills are matched	SBE	To be Followed during construction and operation phase
8.	PS 8: Cultural Heritage	Not Applicable	As reported during consultations, there is no designated archaeological or cultural heritage site within 10 Km radius of the study area village. Project proponent will develop alternative approach road to Tamchi Ki Dhani in Rivdi village as communicated during site visit as a result there will not be any impact on access road to Mata ji ka Mandir at Tamachi Ki Dhani. The temple is not a cultural heritage, so PS 8 is not applicable.	Chance find procedure could be formulated under PS 8 in case of discovery of any artefacts and/ or settlement in the future at proximity of the project area.	-	-
		Environmental, Health, Safety and Social Regulations				

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
9.	Consent to Establish from Rajasthan Pollution Control Board (RSPCB) under Water (Prevention & Control of Pollution) Act, 1974 and the Air (Prevention & Control of Pollution) Act. 1981	Not Applicable	-	As per CPCB notification No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016 Hybrid power project falls in White category and therefore white category industries do not require to obtain consent of the board, an intimation to the RSPCB shall suffice (APPENDIX A).	SBE	To be Followed before operation phase
10.	Hazardous Waste authorization as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	Applicable to make agreement with CPCB/ SPCB authorized Haz waste recycler for proper disposal and management.	Required For storage, transfer & recycling of transformer waste/used oil.	Agreement with Authorized vendor shall be made. During construction phase EPC contractor will be responsible and during operations, it will be under O&M contractor scope	SBE and its contractors	To be Followed during construction and operation phase
11.	NOC from Village Panchayat	Applicable	In process	NOC from Gram Panchayat shall be obtained if applicable; with Govt land allotment and NOC issued by DC for lease signing, GP NOC may not be required	SBE	To be obtained before construction phase

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
12.	Factory License under factories act 1948	Applicable	Need to be obtained	With reference to the factories act 1948, the same is applicable because this solar plant generating, transforming, or transmitting electrical energy and more than 10 workers are employed/working at site.	SBE and its contractors	Do to obtained during Commissioning Phase.
13.	Power Purchase agreement	Applicable	Obtained	-	SBE	To be Followed during construction and operation phase
14.	Approval for extraction of ground water	If required needs to be obtained	If required needs to be obtained	Central Ground Water Board (CWGB) approval for extraction of groundwater requires to be obtained in case project proponent intends to install bore wells/dug wells for ground water extraction during construction and operation phase As reported by SBE, water required for construction and operation phase will be met by vendor from the safe and approved sources.	SBE and its contractors	To be Followed before construction and operation phase
15.	Land Lease	Applicable	Completed	As reported by Proponent, for Solar Project in village Rivdi, 2060 Acres govt. land allotted, mutated and possession already taken for @ 100% land, while for Wind Project, 634 Acres govt. land allotted, where possession already taken for all the	SBE	To be completed 100% before construction phase

Sr. No	Requirement	Applicability	Status/ Observations	Recommendations	Responsibility	Timeline
				locations. Reportedly for Transmission line and substation (PSS), recently excavation has been started on almost all govt. land and If there is some private land, an agreement has been done. Lease deeds for the entire land has been executed through revenue department with the project proponent.		

Brief Assessment of Project:

- **Location of project site w.r.t ecologically sensitive area**: The project area is not located within any notified ecologically sensitive area

- Project proponent should follow all the directions of regulatory agencies as prescribed from time to time by the Federal Government/state government / court orders.

- **Source of Pollution**: The Hybrid power project is based on clean technology and is not likely to cause any significant pollution. Further, the project will help to reduce GHG emissions.
- **Resettlement:** The issue of resettlement and rehabilitation need to be further quantify as the proposed project land involved few temporary structures and standing crops noticed during site visit
- **Project Benefit**: The produced electricity will be evacuated to the state electricity grid and will help to cater the energy requirement
- **CSR plan**: The CSR plan focused on community development will be implemented by the SBE.

The project will have number of positive impacts which are:

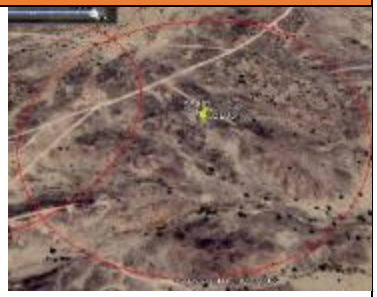
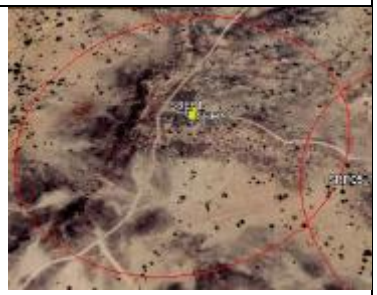
- Agriculture in the area is majorly dependent on rain and large portion of the land remains barren most part of the year; The project will generate more employment to local community.
- Various CSR activities will be implemented in the study area village.
- During the construction phase, local populations often supply manpower for services such as those of drivers, vehicle vendors, contractors, watchmen etc.

Complaints received through Grievance Redressal Mechanism (GRM) procedures shall be addressed by SBE in line with the procedure formulated in ESMS. This will overcome public inconvenience during the proposed project activities. Based on the environmental and social assessment and surveys conducted for

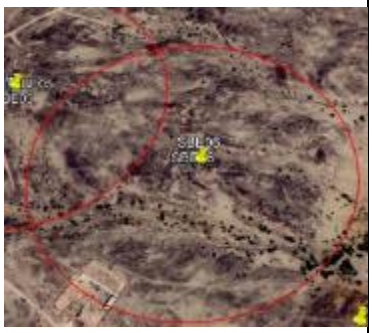
the project, the potential adverse environmental impacts can be mitigated to an acceptable level by implementing adequate mitigation measures identified in the ESMP, whereas project will improve the socio-economic conditions of the surrounding areas.

APPENDIX A: WTG PROFILING

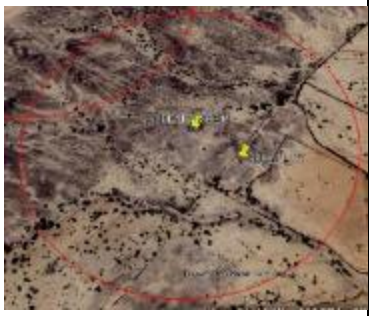
Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE01	719078	2919317	286	Barren	undulated	Matika Gol	203	-	-	-	-	-	10	-		
	SBE02	718303	2918516	304	Barren	undulated	Devka	-	-	-	-	-	-	10	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE03	718713	2918491	297	Barren	undulated	Devka	N/A	346	-	316	-	-	25	-		
	SBE04	717483	2917871	322	Barren	undulated	Devka	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE05	717990	2917759	318	Barren	undulated	Devka	-	132 - RRB 400	-	-	-	-	-	-	 	
	SBE06	718361	2917600	304	Barren	hillock, undulated	Devka	-	267	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													 

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE09	720135	2917217	269	Barren	Flat	Devka	390	-	-	450 Elevated water tank	-	-	-	400		
	SBE10	717562	2916811	313	Barren	hillock	Devka	-	-	-	-	-	-	-	-	 	

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE11	717871	2916504	307	Barren	Flat	Devka	N/A	**105**	-	-	-	**-**	-	-	 	

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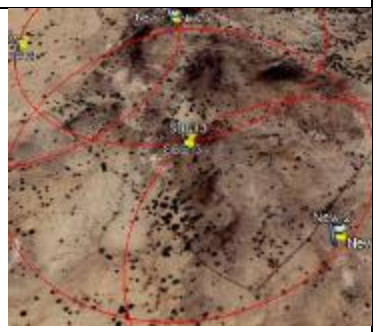
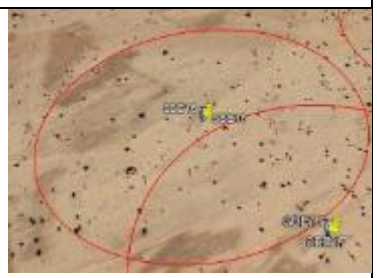
	Location	Easting	Northing	Elevation (m)													
	SBE12	716854	2916185	306	Barren	undulated	Devka	-	-	-	-	-	-	-	-		
	SBE13	717203	2915944	319	Barren	hillock	Devka	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
																	
	SBE16	716771	2914847	306	Barren	Flat	Bherupura	-	-	-	-	-	-	-	-		
	SBE17	716990	2914594	301	Barren	Flat	Bherupura	450	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE18	717339	2914403	285	Barren	Flat	Bherupura	600	**198**	-	-	-	-	-	-		
	SBE19	718470	2913813	274	Barren	Flat	Bherupura	300	-	-	-	-	-	-	578		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE20	717113	2913662	279	Barren	Flat	Bherupura	-	-	-	-	-	-	-	-		
	SBE21	717421	2913430	280	Barren	Flat	Bherupura	-	270	-	-	**52**	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE24	714991	2911701	300	Barren	undulated	Bherupura	-	-	-	-	-	-	-	-		
	SBE25	715203	2911325	294	Barren	undulated	Bherupura	-	340	330	-	-	-	-	-		
	SBE26	715505	2911015	295	Barren	undulated	Bherupura	-	310	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE27	716324	2910963	268	Barren	Flat	Bherupura	240	360	-	-	-	-	-	-		
	SBE28	716895	2910198	277	Barren	undulated	Bherupura	350	-	-	**240**	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE31	715295	2909278	279	Barren	Flat	Hadwa	-	-	-	260	-	-	-	-		
	SBE32	715985	2910171	295	Barren	undulated	Bherupura	560	520	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE33	716107	2909265	287	Barren	Flat	Bherupura	400	-	-	-	-	-	-	-		
	SBE37	714917	2908360	271	Barren	Flat	Hadwa	-	306	-	-	-	-	-	-		

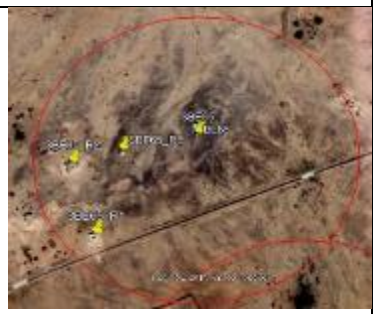
Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE39	715183	2908005	272	Barren	Flat	Hadwa	120 (Single phase supply line)	273	-	-	-	-	-	-		
	SBE40	715890	2906447	287	Barren	undulated	Hadwa	450	267	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE42	716825	2907233	263	Barren	Flat	Hadwa	435	-	-	-	-	-	-	-		
	SBE43	719040	2908281	273	Barren	undulated	Manihari	55 (11kv line)	379	-	-	-	-	-	264		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE44	718414	2909089	275	Barren	undulated	Manihari	263	-	-	-	-	-	-	750		
	SBE55	716078	2913232	281	Barren	Flat	Bherupura	-	-	-	**125**	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE56	716249	2912987	304	Barren	Flat	Bherupura	400	560	-	-	-	-	-	-		
	SBE58	716915	2911433	289	Barren	Flat	Bherupura	320	-	-	-	-	-	-	-		

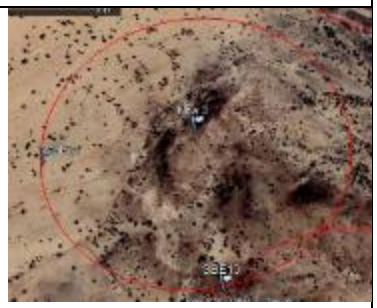
Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE60	719621	2913340	291	Barren	undulated	Junejo ki dhani	550	398	-	-	-	-	-	-		
	SBE62	719949	2914086	293	Barren	Flat	Junejo ki dhani	430	450	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE63	720365	2916562	278	Barren	undulated	Devka	217	-	-	-	-	-	-	400		
	SBE65	721480	2914167	292	Barren	undulated	Junejo ki dhani		145 (west), 296 (east)	-	165	-	-	160	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE67	717912	2918710	301	Barren	undulated	Devka	-	-	-	-	-	-	-	-		
	SBE68	715590	2906694	281	Barren	undulated	Hadwa	120(11kV line)	217	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE081	719145	2910278	281	Barren	undulated	Manihari	-	373	-	-	-	-	-	225		

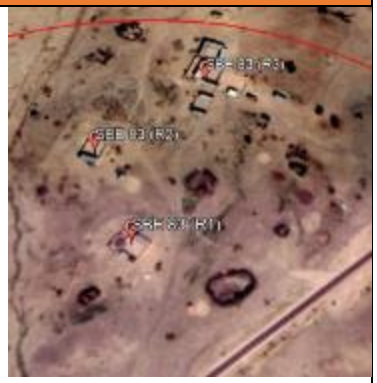
Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	NEW6	717344	2915191	326	Barren	undulated	Devka	-	-	-	-	-	-	-	-		
	NEW4	717041	2912137	276	Barren	Flat	Bherupura	420	-	-	-	-	-	-	-		

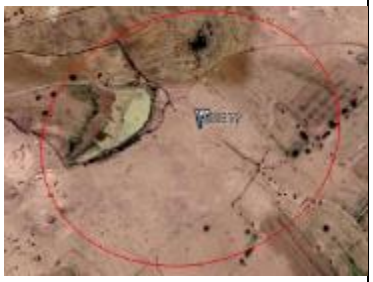
Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	new 2	717446	2915761	327	Barren	undulated	Devka	-	-	-	-	-	-	-	-		
	new3	717140	2916244	325	Barren	hillock	Devka	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE70	714586	2908648	272	Barren	hillock	Hadva	-	-	-	-	-	-	-	-		
	SBE71	716567	2905772	255	Barren	Undulated	Hadva	-	-	-	-	-	-	112	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE 75	722466	2915851	267	Barren	Undulated	Rajdal	-	-	-	-	-	-	-	-		
	SBE 76	723266	2915219	262	Barren	Undulated	Rajdal	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE82	721922	2917326	264	Barren	Undulated	Devka	-	-	-	-	-	-	-	-		
	SBE83	720553	2913594	294	Barren	Undulated	Junejo ki dhani	-	120	-	-	-	-	20	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)												 	

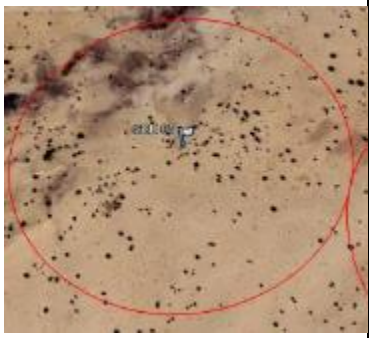
Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE77	721696	2913657	274	Barren	flat	Junejo ki dhani	-	-	-	-	-	-	-	-		
	SBE52	721890	2912660	271	Vegetation	flat	Junejo ki dhani	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE51	722165	2911070	277	Vegetation	Flat	Manihari	-	-	-	-	-	-	-	-		
	SBE45	719272.	2909739	267	Vegetation	flat	Manihari	-	-	-	-	-	-	-	270		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
																	
	SBE 46	721907	2909382	272	Vegetation	Flat	Manihari	-	180	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE50	721165	2910795	268	Vegetation	flat	Manihari	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE78	719606	2911001	274	Vegetation	flat	Manihari	-	-	-	-	-	-	-	-		
	SBE84	715191	2910009	274	vegetation	undulated	Bherupura	-	-	-	-	-	-	-	-		

Sr.No.	WTG Locations				Land Cover	Topography	Name of the Village	Distance from EHV (m)	Receptor (m)	Water Body (m)	Water tank (m)	Underground water tank (m)	Religious Structure (m)	Village Road (m)	National Highway (m)	Site photograph	Google earth Image (300m radius)
	Location	Easting	Northing	Elevation (m)													
	SBE85	716970	2916964	313	Ban	undulated	Devka	-	-	-	-	-	-	-	-		

APPENDIX B: 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 5, 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.

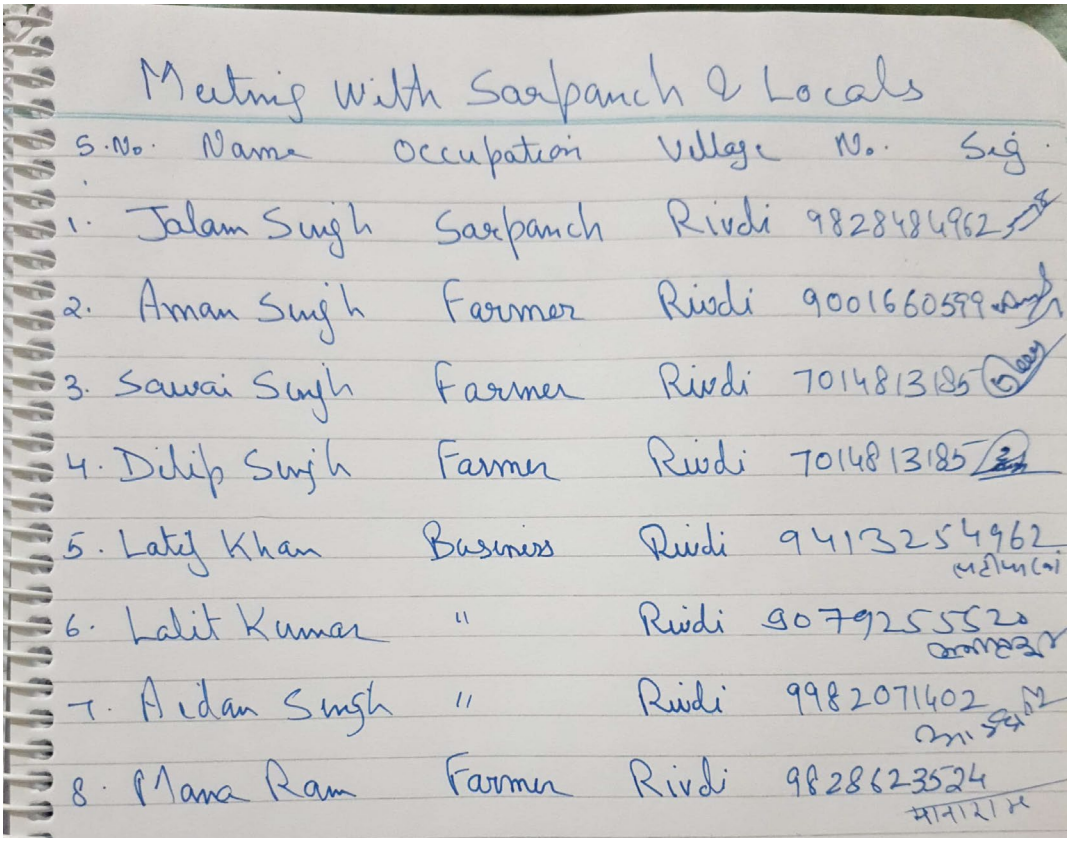
APPENDIX C: SAMPLE QUESTIONAIRE FOR COMMUNITY CONSULTATION

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 %***	***Labor %***	***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***	

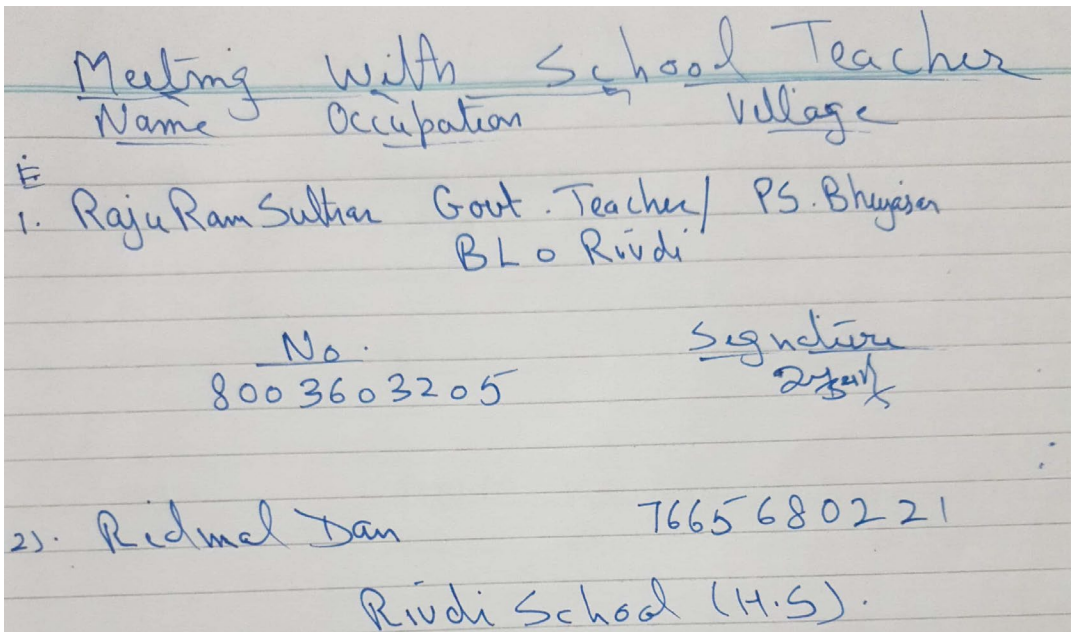
Major rituals and festivals	***Name***	***Period***	***Name***	***Period***	
Fishing area		***Name of the***			
Forest	***Wood***	***Timber***	***NTFP***	***Others***	
Any Vulnerable Groups like- landless/homeless- people, Women headed HH, Orphans etc.					
Any program related to child / women health 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 D: ATTENDANCE SHEET OF STAKEHOLDERS CONSULTATION



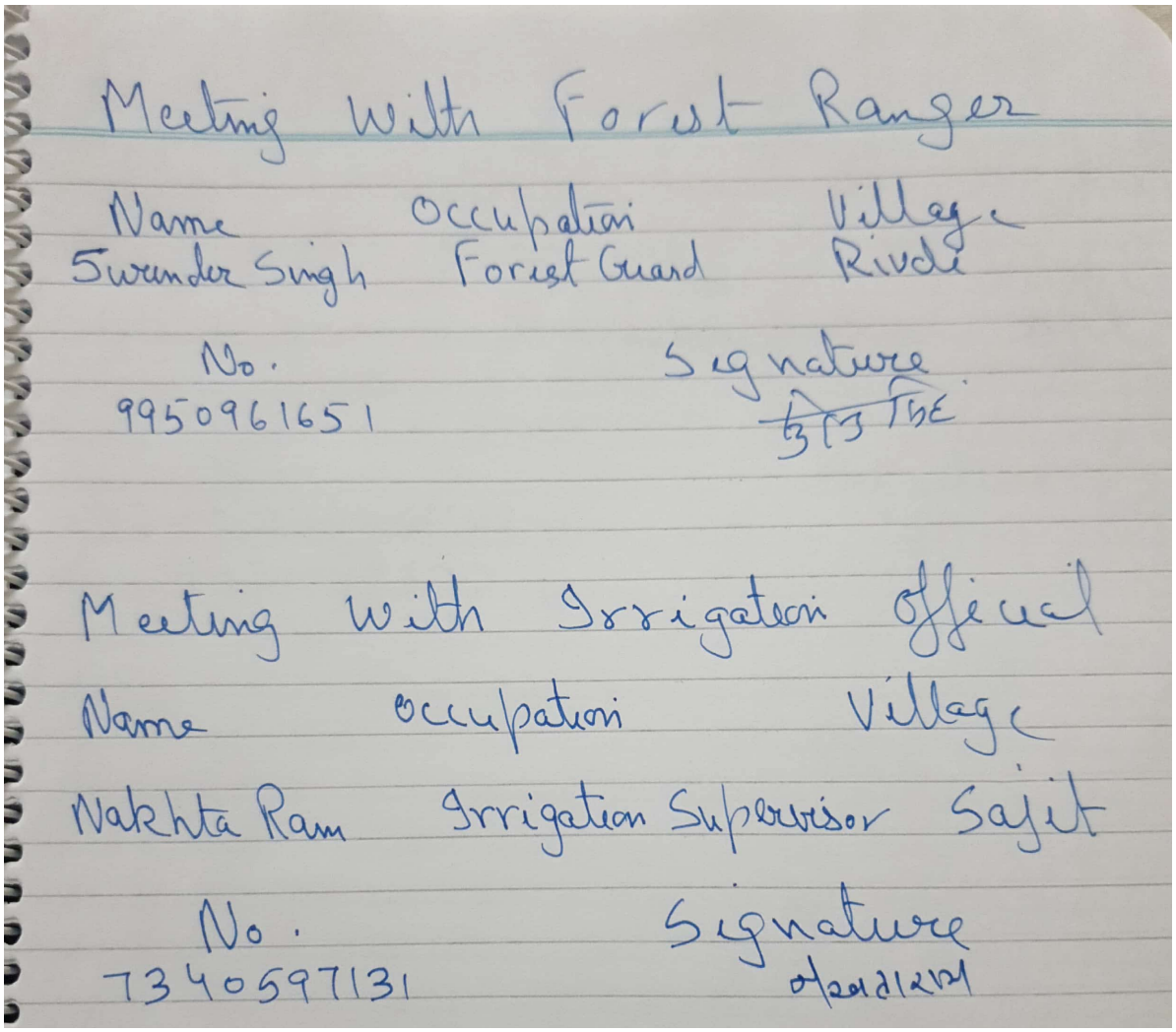
Meeting with Sarpanch & Locals

S.No.	Name	Occupation	Village	No.	Sig.
1.	Jalam Singh	Sarpanch	Rivdi	9828484962	
2.	Aman Singh	Farmer	Rivdi	9001660599	
3.	Sawai Singh	Farmer	Rivdi	7014813185	
4.	Dilip Singh	Farmer	Rivdi	7014813185	
5.	Latif Khan	Business	Rivdi	9413254962	
6.	Lalit Kumar	"	Rivdi	9079255520	
7.	Aidan Singh	"	Rivdi	9982071402	
8.	Mana Ram	Farmer	Rivdi	9828623524	



Meeting with School Teacher

Name	Occupation	Village	
1. Raju Ram Suthar	Govt. Teacher/ BLO	PS. Bhuyasar Rivdi	
	No. 800360320 5		Signature
2). Ridmal Dan		7665680221	
	Rivdi School (H.S).		



Meeting with Forest Ranger

Name	Occupation	Village
Surender Singh	Forest Guard	Rivdi

No.
9950961651

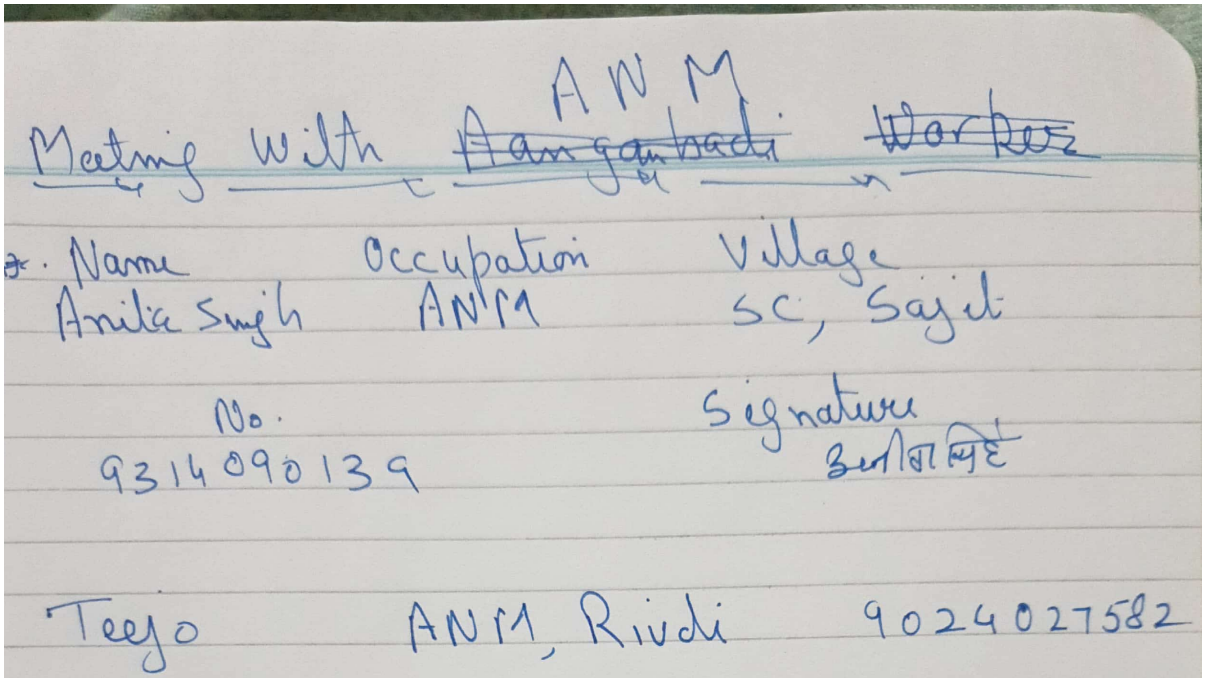
Signature

Meeting with Irrigation Official

Name	Occupation	Village
Nakhta Ram	Irrigation Supervisor	Sajit

No.
7340597131

Signature



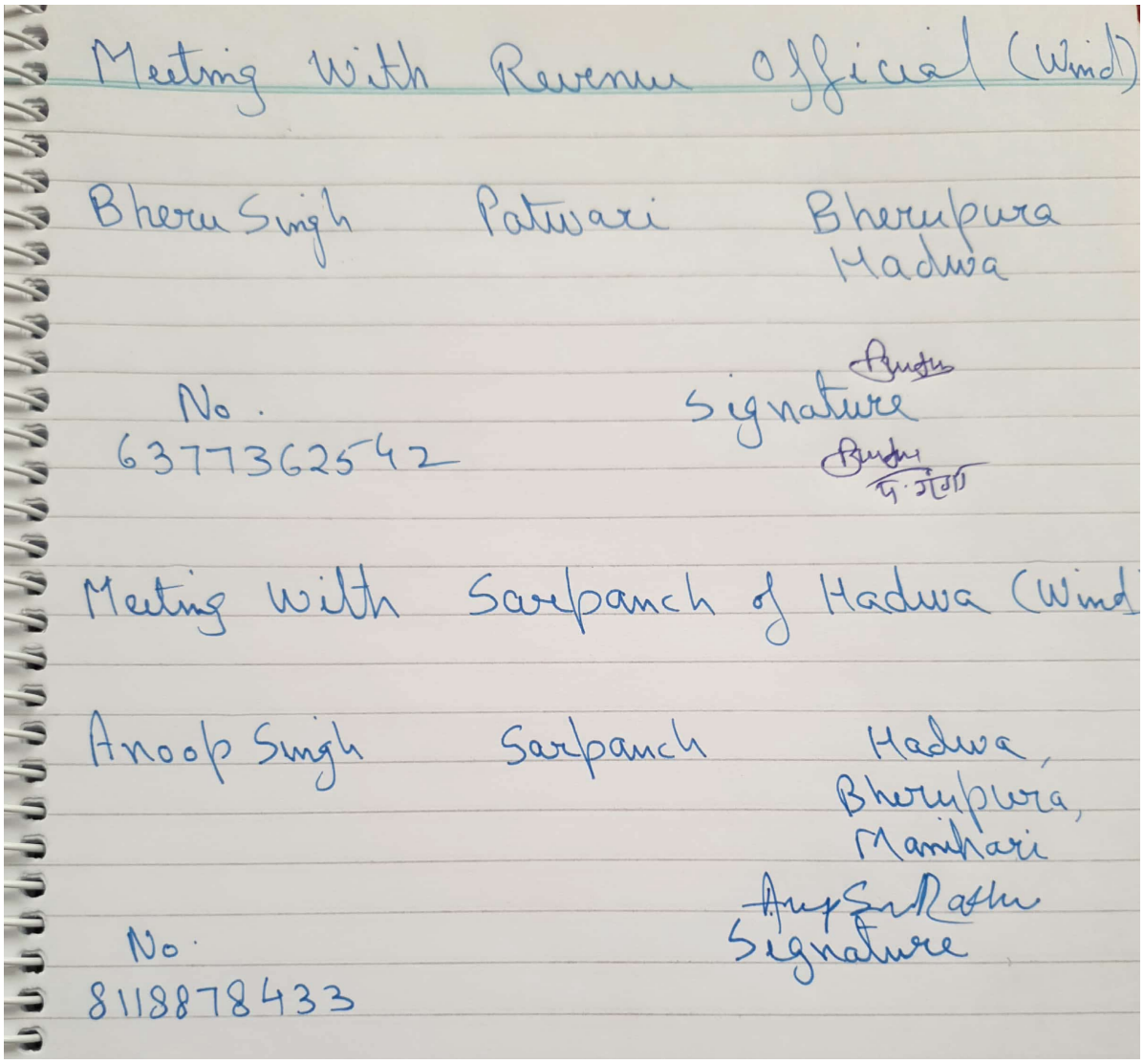
Meeting with ~~Aanganbadi~~ ANM ~~Worker~~

	Name	Occupation	Village
*	Anita Singh	ANM	SC, Sajit

No.
9314090139

Signature

Teejo ANM, Rivdi 9024027582



Meeting with Revenue Official (Wind)

Bheru Singh	Patwari	Bherupura Hadwa

No.
6377362542

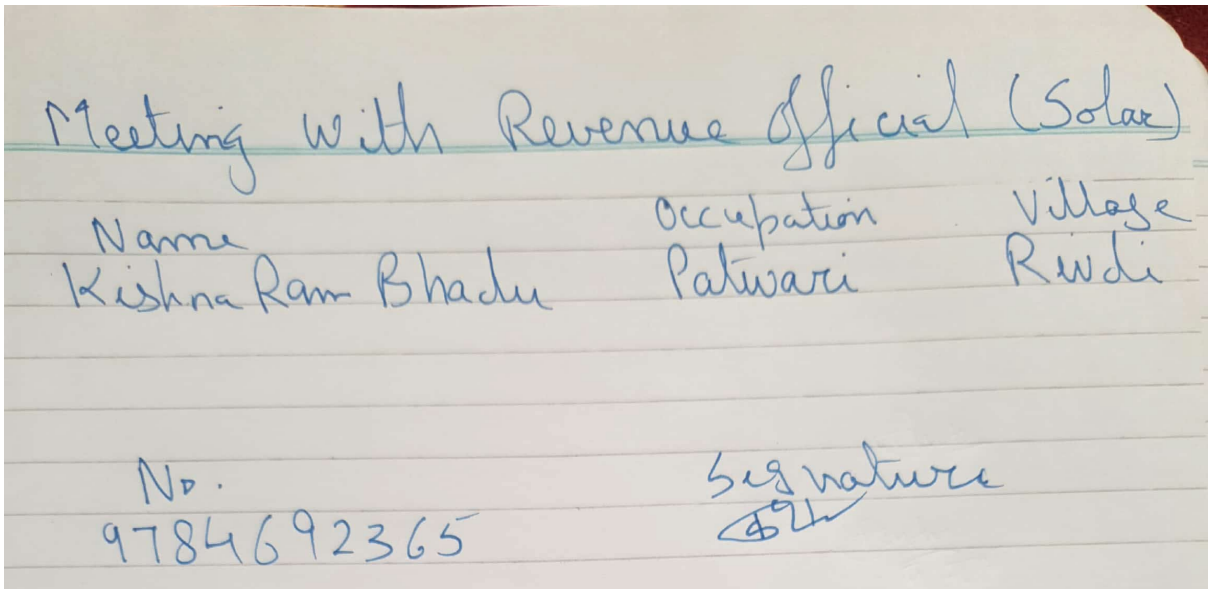
Signature

Meeting with Sarpanch of Hadwa (Wind)

Anoop Singh	Sarpanch	Hadwa, Bherupura, Manihari

No.
8118878433

Signature

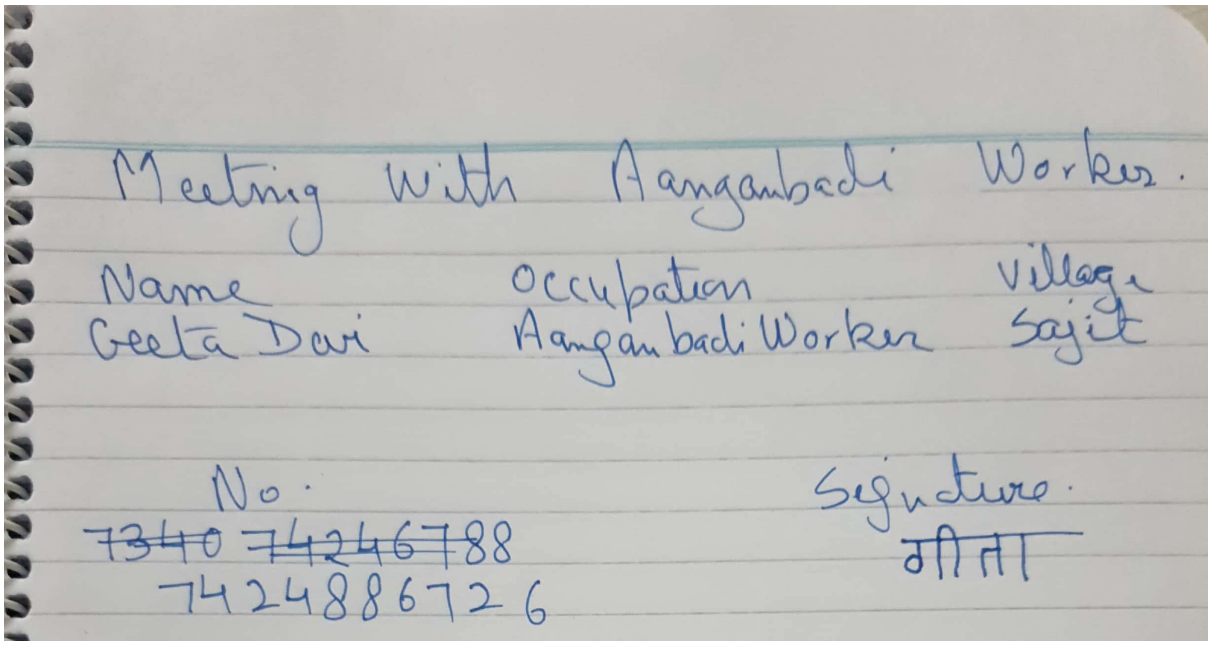


Meeting with Revenue Official (Solar)

Name	Occupation	Village
Kishna Ram Bhadu	Patwari	Rindi

No.
9784692365

Signature



Meeting with Aangambadi Workers.

Name	Occupation	Village
Geeta Devi	Aangambadi Worker	Sajit

No.	Signature.
~~7340 7424 6788~~ 7424886726	~~जीत~~

APPENDIX E: SUMMARY OF STAKEHOLDERS CONSULTATION

Table 1: Summery of Consultation through Tele/Video Conferencing

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
Project Proponent SBE	• Representatives SBE Renewables Ten Pvt Ltd	• Mr. Abhishek (Project Head) • Mr. Anil Mishra (Rajasthan Project head)	• Telephonic interaction	• The background of the 526.9 MW Hybrid Power Project • One of the first Hybrid project by SECI. • The project was awarded in Jan 2019 and thereon it took seventh months for PSA and it got amended in October - November 2019. After that PPA was signed in December 2019. 7 May 2021 has been given the timeline for commissioning of project. Considering the covid-19 crisis Ministry of Renewable Energy has given a general guideline to extend the date for commissioning for the period of lockdown plus 30 more days for remobilisations. August 2021 would be the timeline for commissioning of project. • Foundation work for wind project will start during July and august 2020 and it will get operation by November December. • The construction work for Solar project will start a bit late in next year Jan-Feb, 2021and commissioning will be in July & August 2021. • Transmission line work is under Kintech scope of work and it will a mix of government & private land. As reported by SBE, there is no hurdle/challenge in land leasing for transmission line. There is no plantation, any vegetation and no agriculture activities on the proposed land. • Kintech will start working on transmission line which is 30 km from wind PSS to Solar PSS and 50 km from solar PSS to PGCIL GSS • NOC from Gram Panchayat is under process as reported. • All the project land is on lease basis for 30 years and it is revenue land. •
Land Facilitator	• Engineer and Engineer Pvt Limited	• Mr. Jigar Saha	• Telephonic Interaction	• Proposed project is falling on Government Land which is approx. 2700 Acres • Land is allotted on lease basis to SBE for 30 Year • DLC rate is Rs. 30000 per bigha and @ 5% yearly increment • There is no private land procured for the land. • The 526.9 MW Hybrid project are divided as 420 MW for solar project and 105 MW for wind project are mostly continuous land.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
				• As per the government land categorization, it is waste land and as per government norm it is allotted for Renewable Energy Project. • There is no encroachment and settlement on the land. No CPRs are reported on the land. It's basically sand dunes which is locally called as Barani land. there is no dependency of local on the revenue land at present.
Irrigation Department, Jaisalmer	Irrigation Dept. Officer	• Mr. Naksha Ram Ji	• Telephonic Interaction	• There is severe shortage of water • No government schemes for irrigation in the area • Main source of irrigation is old pond/well • Drip irrigation mechanism is not practised in the region • Main food crops are jwar, bajara, mung and til
Panchayat Members	Harwa Gram Panchayat	• Dhapo Kanwar(Panchayat Head) • Mr. Anoop Singh Rathor (Panchayat Secretary)	• Telephonic Interaction	• 5 villages falling in Harwa Panchayat namely Hadwecha, Harwa, Bheroopura, Manihari and Check Harwa. • Village is resided by 200 swarna caste mainly Brahmin & Rajputs households, 300 OBCs households and 250-300 and 50 households of SCs & STs respectively. • There are 150 muslim Voters are there in Harwa village. • 30% houses are pacca and 70 % are kuccha houses. • 70 % of the families have moved to Dhani or on farms land and set up a house there with their cattle. • Hadwa & Hadwecha is only connected with pucca road rest of the villages are only having kuccha road. • NO irrigation facilities available in the village • Agriculture and animal husbandry are the main source of livelihood of people. Almost 90 % of the locals are dependent on animal husbandry like cows, sheep, goats etc. • Average per family land holding size is 25 bigha. • Gochar land is available in all the Harwa GP villages except Bheroopura.. • As reported village has a primary health centre facility and anganwadi center in Hadwa village. • Most of the households in the village has toilet facilities • 70 % Villagers use firewood, Cow dung, and biogas as a fuel for cooking purpose and around 30 % families are using LPG.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
				• Tubewell is the main source of water for drinking purpose • Village has two schools one is primary school and one secondary school. • Power supply is available only for 7- 8 hrs • There are 5 schools in Hadwa Panchayat, 2 primary schools in Harwa and Manihari, 1 senior secondary school in Hadwecha, I senior school and primary school in Harwa and 1 upper primary in Manihari. • Separate toilet facilities are available in all schools as reported during consulation • For higher education parents send their children to Seo town which is 7 Km from Harwa. • No community toilets available in the village. • Transport and communication facilities are poor, and no government buses run. Locals use personal vehicle or taxies available for commutation. • Village secretary have expressed his view to have a separate schools for girls, skill development program for women and young girls, provisions for another tubewell, road in Hadwa, community hall for villagers and separate hall for local artists and employment opportunities for youth.
Circle Office, Land procurement	Bhairoopura, Patwari	• Bhairo Singh, Patwari	• Telephonic Interaction	• The region is unirrigated and mostly barren land are there. And no irrigation facilities available. • Locals are mostly dependent on Barani food crops • Many Solar projects are coming in the area and providing job opportunities to local youth. • Per hectare production is very less as compared to land holding per households • Location is good for solar & wind projects are people are happy to give their land for power plants • Explained the land leasing process for lease of land. source of drinking water is personal tubewell/wells. • Government has provided pipeline facility to few households for supply of drinking water. Few use tankers and personal tubewell for domestic purpose.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
Primary Health sub Centre	Sajid Health Center	• Ms. Anita Singh (ANM)	• Telephonic Interaction	• As informed by ANM no sufficient medicines are available in the centre. • Health centre has 6 rooms and no bed available. • Electricity and water supply are not available in the centre. • Routine check-up and immunization happens in the centre. • As of now Malaria was the major disease reported in the area. • Average 10-15 patients visit the health centre daily. • Major area of concern is labour room and storage room unavailability.
Land revenue department	Reevadi Village, Seo Tehsil	• Krishan Ram Bhadu	• Telephonic conversation	• Land leasing process is in initial stage. Survey of the land has been completed. There are no mining activities on the land. It's a continuous land and its mostly barren land and no irrigation facility. • Sangad is the main source for water supply in nearby areas. • No legal cases and pending grievances reported yet. • Land is barren and non- agriculture. • No legal and any local grievances yet reported from the villagers. • Currently land identification & land procurement process is going on. • Land is free of any encroachments.
Forest Range office	Forest Guard, Barmer	• Mr. Jalan Singh	• Telephonic Interaction	• The area where the project is proposed is a 'banjar' (Fallow) land. • The project area and nearby area is devoid of any vegetation and has sparse vegetation. • There are a very few wild animals seen in the area-mainly Dessert fox, Chinkara and Nilguy. But these animals are rarely seen. • He mentioned that the Desert National Park is located about 45kms from the project site and there are no Great Indian bustard enclosures around the project and in the immediate vicinity of the project. • There is no forest land located nearest to the project site.
Primary School & Secondary School	Harwa Village	• Mr. Prakash Palivani (Principle)	• Telephonic mostInteraction	• Government senior secondary school, Harwa village. • Project area is located around 3km from the school. • Toilet, drinking water, electricity facilities are available.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
				• School buses are not available. Students commute to school with bicycle or by walking. • Playground is available but it needs to be developed properly. • Major area of concern is RO maintenance, Insufficient Chair and table.
Anganwadi Center	Reevadi Village	• Ms Geeta (Assistant) • Meena (AASHA worker) • Puja (Worker)	• Telephonic Interaction	• This village has 1 anganwadi centre. • There are 4 rooms with boundary wall but no toilet facilities • Around 100 kids and 50 women are enrolled. • Health check-up is carried out by ANM 2 times in a month for kids and pregnant women. • Major area of concern is no electricity, no sitting arrangements and water supply is through nearby tanka. • No major engagement activities for women in the village • They wanted some for skill development programs or provide Sewing machine for them • Demanded Swings and TV for kids in anganwadi
Villagers	Reevadi Village	• Jalan Singh, Sarpanch • Aman Singh • Sawai Singh • Dilip Singh • Latez Khan • Lalit Kumar • Aidaan Khan • Mana Ram	• Telephonic Interaction	• Village is resided by mix of communities like Swarn castes like Brahmin, Rajput, OBCs and STs & SCs communities. • Animal Husbandry and agriculture as the main source of livelihood. • As reported village has a primary health centre facility. • Most of the households have toilet facilities • LPG is used as a fuel for cooking food. • Village has two primary schools and one secondary school. • Tubewell is used for drinking purpose. • Electricity is available 6-7 hrs • Villagers are aware about the project. • People are looking forward for the employment generation due to this project.

Table 2: Summery of Consultation During Site visit in June

Stakeholders Consultations during Site Visit
Consultation with patwari • kishana Ram Bhadu - Patwari – Phone: 9784692365 • The project is spread over in an area of approx. 2100 Acre. • It is proposed on govt waste land. Villagers are aware of the project and they are happy about it.

- The land had been taken on lease basis from govt for a period of 30 years, which can extendable by another 10 years if required.
- No cultural heritage site or temples are there within 10km radius. There is a temple named Kapooria Math temple that is about 15-20km away from the site and it comes under Kapooria village.
- There is no temple or common property resources inside the site or its periphery.
- Rivdi is having 1 crematorium and 1 graveyard.
- There is a water reservoir which is situated within 2km distance from the site.
- There is no grazing land. There are no encroachers in the site.
- The land allotment by revenue department is yet to be done and land demarcation is to be done after the allotment.
- Engineer and Engineer Pvt Limited is handling the land allotment process, which is SB's professional facilitator for land, substation, boundary and transmission line.
- Education Facility: Rivdi is having – 1 anganwadi, primary school, Senior secondary school. Schools are almost 2-3 km away from the site. Colleges are there in Jaisalmer and Barmner.
- SC: there are 100 SC families and their caste is Meghwal.
- ST: there are 8-10 families and they are basically Bhil tribes who are mostly engaged as daily labours and agricultures.
- Few STs stay with the mainstream population. There is no as such discrimination between them.
- Health Centre: There is one Sub Centre which is having only ANM and doesn't have any doctor. PHC is in Fathegadh which is 15km away from Rivdi. Better hospital facilities are there in Jaisalmer and Barmer.
- There is a small stone cutting firm in Fathegarh with only 4-5 workers.
- Women: 50% women are into household work only and rest into agriculture and labour.
- Literacy rate is low.
- Vegetables such as Bajra and gawar are cultivated. Agriculture is rain fed.
- Fatehgarh is having 0.5 MW solar plant which is 14/ 15 km away from the Rivdi plant.
- Villagers are mostly involved in agriculture.
- Job preference will be given to locals.
- water in the area is said to be heavy, not good for usage. water is supplied to houses as per govt water supply yojana which is from Indira Gandhi canal. Electricity is also available via govt supply scheme.
- Mostly villagers' own cow, sheep, goat. only 5% owns camel which are Raika caste- Devashi- OBC.

Consultation with Sarpanch

- Jalam Singh- Sarpanch – Phone: 9828484962
- Voters- 2500, SC- 20%, ST- 7%
- Agriculture is based on rainfall; production is very low. Mostly bajra n gawar are grown.
- about the site which is fully on govt land; private land exists in between govt land.
- The land type is govt waste land.
- Rivdi is having 1 crematorium and 1 graveyard.
- The locals are aware of the project and the awareness about the same was given through gram sabha in presence of SBE contractors.
- wild animal is very rare.
- DNP is approx. distance is 30 km from the land parcel in solar site- Survey No 295 and 45 kms from WTG-SBE 37
- NOC to be provided by collector from DNP & DDP prior to allotment of govt land for any project.
- GIB habitation has been found around 40 km from the solar site.
- GIB arc- institute of Dehradun has made a study about the movement of the GIB. as reported the allotted land doesn't fall under their movement area.

Consultation with Villagers

- Tarachand Paliwal – General caste – Phone: 9983450402

Grocery store owner, as well as into agriculture. He agrees to have a solar plant in the area.

- Hari Singh – OBC – Phone: 9828490647, he is into agriculture.
- Parbat Singh, Phone: 9950138682, he is into agriculture.
- Nar Singh Rao, Phone: 8890641519, he is into agriculture.

- Bhima Ram, Phone: 7877374950, he is into agriculture.
- Satta Ram – ST- Phone: 9571452092, he is into agriculture.
- Chala Ram – SC- Phone: 7665295761, he is into agriculture.
- As observed and reported there is no discrimination with SC & ST people. They get along with the main stream people as observed and reported
- It was reported that 70% women are into agriculture and 30% are household.
- Literacy rate is very low 40-45% girls and boys are going to school.
- Schools are not having benches, electricity, toilets and supply water connection is there in school.
- There is a pond in Rivdi which also used by the villagers for drinking and other purpose.
- There are approx. 150 houses in the village.

WIND SITE (Consultation with Sarpanch)

- Anup Singh- Sarpanch – Phone: 8118878433
- It is proposed on govt waste land. Villagers are aware of the project and they are happy about it.
- He is looking forward to employment for the villagers and different kind of CSR development in the area.
- SC population 25%, ST population (5-10) %

SC is meghwal, ST is Bheel

ST-100 families for all villages. There is no discrimination. They stay with mainstream people.

- Education Facility: Devka – Middle school

Rajdal – Senior Secondary School

Mattika gol – Primary School

Hadvecha – Senior Secondary

Hadwa – Senior School

Behrupura – Primary School

Menihari – Upper Primary School

Junejuki Dhani – Primary School

For higher studies people goes to Shew College in Barmer district which is 65km from Harwa.

10^{th}, 11^{th} and 12^{th} have benches but others are not having; midday meal kitchen facility is there but in poor condition; senior secondary school is having RO but others are not having RO facility; wash rooms are there but still few more washrooms are required; manihari is having less no.of class rooms; electricity is there.

Harwa panchayat is having senior school, senior secondary, primary and middle school.

- Anganwadi – behrupura – there is anganwadi but dedicated building is not there.

Manihari – 2 anganwadis – one anganwadi is having dedicated building whereas another is not having a dedicated building.

Rest all villages are having one anganwadi each.

- Health Facility: Harwa/ Harvecha/ Devka/ Manihari/ Rajdal is having sub centres with ANM and there is no doctor; Gunga is having PHC which is 7km away from Harwa; for better treatment people travel to hospitals in Barmer.
- Harwa and Harvecha is having supply water facility; in rest of the villages water is provited through tankers; Rs 500 for 4000lts.
- Almost all villages are having 100% toilet facilities.
- Drainage is mostly open.
- All villagers are into agriculture, 80% of the women are into agriculture and few in sewing.
- Vegetables such as Bajra and gawar are cultivated. Agriculture is rain fed.
- Temple: There is one Surya mandir in Devka.
- Behrupura/ Harwa/ Harvecha is having 1 crematorium and 1 graveyard in Harwa

Devka/ Rajdal/ Matti Ka Gol – having crematorium in Rajdal Juneju Ki Dhani is having 1 graveyard.
Consultation with ST • Fakira Ram – Phone: 9549612494; bheel caste- Devka Village • 10 members in family • He is labour by occupation. • He is aware of the project. • There is no discrimination, children are allowed in school, they are allowed in hospital and temples without any discrimination. • Access are commonly used by all.
Consultation with Women • Samda Devi – ST – Devka Village • She is into household work and agricultural work as well • Girl child goes to school no discrimination is there.
Consultation with Villager • Rasul Khan – Village – Juneju Ki Dhani – Phone: 9660117593. • He is aware of the project and happy about it. • He is into agriculture. • There are 4 members in the family. • he is having 75 acres of land which is waste land.

Table 3: Summery of Consultation During Site visit in September

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
Surveyor for All WTG Location	Maple Energy	• Swai Singh, Jhodhpur • Aman Singh, Local leader near Fatehgarh	• Face to Face Interaction	• Discussion on the sensitive receptors on the following WTG locations. • Initially Survey was carried out for 69 WTG locations and it later on finalized on 51 locations. • House near proposed SBE 65 Location is at the distance of 250 meters and it can be further readjusted 50 meters away from the current proposed location. • SBE 5 Location: The current structure belongs to Vestas. The land was given to Vestas for RRB wind project and later on the project got stalled and the land further transferred to government. • SBE 18: there is temporary structure, and it is at a distance of 260 meter from the proposed SBE 18 locations. • SBE 39: structure is at 272-275-meter distance.
Villagers	Juneji ki Basti/Dhani	• Kasar Khan • Alana • Saukat	• Face to Face Interaction	• 39 WTC location is falling in Junejo ki basti hamlet and houses seen near the location is occupied by Sindhi muslim population. Around 40 families are settled near 30 WTC location. Majority of the

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
	of Hadwa Panchayat	• Meharban • Shyam Muhammad • Aliyas • Jakur son of Aliyas • Faruk • Alma • MAriyat • Elma • Soda singh • Anwar • Maruawat • Aliyas • Yaseen khan		people possess 5-10 bigha of land and land is not usable for cultivation and animal rearing is the main occupation. Every family on an average keep 20-25 goat and sheep and it is an important source of livelihood for local community. • During the dry season, few of families of migrant to other locations like Panjab other places for fodder of their animals. • There is lack of irrigation facilities and agriculture is mainly rainfed.there are 4 tubewell in thehamlet. • Jwar and Bajara is main staple food for the locals, the community is residing in the hamlet from the last 26 year. • Children from the Jhunejo ki basti hamlet go to Negrda for basic education • For the health facility women go to Ganga
Villagers	Hadwa Village	• Jiva Raj Ram • Bhoja ram • Hukuma Ram • Kamala Devi • Santu Devi	• Face to Face Interaction	• There was one tribal family residing in Hadwa village which is now divided in 5 households after the division of the family among five brothers. They have got colonies under Indira Awas Yojana and mostly working as laborer. There is no toilet facility in their houses and source of drinking water is Panchayat Tubewell. JIva Ram own 30 bigha which will be equally distributed among his five sons. Women are involved in households' cores and provide support as agriculture labour and engaged in construction works. There is a secondary school in Hadwa and a community hall for both communities. For health facility, UP swasthya Kendra is available and local communities have great faith in Baba ki samathi as religious place.
Manganiyars community	Hadwa Village	• Moti Khan • Chhotu Khan • Talib Khan	• Face to Face Interaction	• Manganiyars is a tribal community with a strong musical tradition (classical folk music). The Manganiyar is hereditary communities who make livings as musical performers. There are 40 families in the community and few of them are internationally recognized.
SC Community at Hadwa Panchayat house	Hadwa Village	• SC Community • Sagra Ram-10 Bigha • Ina Ram-12 Bigha • Dau Ram JI-18 Bigha • Nagtu Ram-40 Bigha	• Face to Face Interaction	• There are 50 families of SC communities in Hadwa Village and Most of the SCs community possess on an average 10-20 Bigha of private land. They are mostly growing Jawar, Bajara, Mung and till. Agriculture is totally rain fed and there is no irrigation facility for the small farmers. Tanker is used for drinking purpose and per tanker cost is Rs. 300-400. They are self-sufficient. As reported their dependency on government land is minimal. Mostly working as agriculture labours and other construction work nearby villages. Majority of

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
				families own sheeps, goats and cow for meeting their personal need. • There is severe water shortage in the area and only 75% houses having sanitation facility as a result swaccha Bharat Mission.
SC Community at Bherupura Village	Bherupura Village	• Mula Ram (30 Bigha) • Gyana Ram (50 Bigha) • Shiv Lala • Hema Ram • Teja Ram	• Face to Face Interaction	• They are mostly involved in agriculture activities and animal rearing. • Jwar, bajara, Mungfali and till is main crops grown by the farmers. • They produce for personal consumption and rest sell it to the market. They use modern mode Woman is also involved in agriculture activities and animal rearing. technology for agriculture and they are progressive farmer in the area.
Local Community	Devka Village	• Devgiri Giswami • Kheti Maweshi • Hitesh Giri • Kailash Giri • Sattar Seni • Dhan Dhani • Amrit Giri • Hera Ram • Jantu Ram	• Face to Face Interaction	• Devka is having OBC, SCs And STs population. Main source of occupation is agriculture and animal rearing. Jwar, bajara, Mungfali and till is main crops grown by the farmers. • Local community are also involved in small business-like shops, restaurants, repair work etc. • Dewaka is having primary and secondary school and for higher study children go to Rajda for senior secondary education. • Local community is using government vacant land for grazing and few of them are also cultivating on government land • There are three ST families are residing in the village and they are involved in agriculture and animal rearing practices. On an average the families have 40-50 bigha of land and they are self-sufficient as reported during consultations. They are also working as agriculture labour in the village. • There are many ponds and tanks are available in the village. Sanitation facility is comparatively good in the village as compared to other villages where WTG locations are falling. • Few of the private landowners using tubewell for irrigation purpose.
Local Community	Rajada Village	• Madan Lala (35 Bigha) • Raju Ram (40-45 Bigha) • Hukium Dan • Vijaya DHan • Bhagirath Dan • Motilal Kumawat	• Face to Face Interaction	• Rajada is having 700 population with 270 Households. Out of that 400 is OBC population, 60 muslim Families, 5 STs and no SCs population. Mainly Prajapati, Thakur general, suther and nair community is reported in the village. Thakurs are mainly Pakistani migrants who came to India in 1971. Main source of occupation is agriculture and animal rearing. Jwar, bajara, jeera gwar,mot, Mungfali and till is main crops grown by the farmers. Few of the private landowners using tubewell for irrigation purpose.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
		• Ramesh Kumaer • Ram Das Singh (9849130949)		• Local community is using government vacant land for grazing and few of them are also cultivating on government land. • There are Five ST families are residing in the village and they are involved in agriculture and animal rearing practices. On an average the families have 15-20 bigha of land and they are self-sufficient as reported during consultations. They are also working as agriculture labour in the village. • There are 5 ponds and tanks are available in the village. 70 percent houses having Sanitation facility. There three temples in the village and not located near WTG Location. Cremation Ground is far away from the project location. Grazing land is not near proposed project wind location. • Rajada is having all primary and secondary school. • Water level varies from 300-500 There is shortage of drinking water, health facility and veterinary doctor in the village and nearby villages. • There is fear of langoor, Cheetah, pig, Nilgay and foxes in the village and they destroy the crops.
Local Community	Sangramo Ki dhani	• Raju Ram • Kuldeep Ram • Uma Ram • Gyana Ram (70 Bigha) •	• Face to Face Interaction	• There are five hamlets in Reevadi village, Tamacho ki Dhani, Lekhmaniyon ki dhani, Bhilon ki dhani, Badal khan ki dhani and Jam ki dhani in Revadi revenue village. There are 400 households in Sangramo Ki dhani. Approx. 40 percent are land less farmers who are engaged as daily wage labourers. There is shortage of irrigation facility and few are having borewell in their land and majority dependent on Canal water. As reported, 80 percent are SCs and 10 percent are STs people in the village.as seen during site visit, people are engaged in agriculture and its allied activities. Animal rearing is commonly practiced in all hamlets and it is an important source of livelihood of the locals. Some are also involved in doing small business like carpenter, small shop owners, running restaurant etc.
Local Community	Tamachi Ram ki Dhami	• Kamachi Ram and his five brothers • Arun Lal Ram • Pramod •	• Face to Face Interaction	• There are 15 families residing in the hamlet and majority is SCs population. Mainly engaged in agriculture and animal husbandry. Main crops grown are Bajara/ Gwar. There is huge shortage of water and even source of drinking water is not fit for drinking purpose. The floride content is very high in water available and ground water level varies from 550-600 m.
Local Community	Reevadi Village	• Tarachand Paliwal(50 Bigha) • Hukum Singh(75 Bigha)	• Face to Face Interaction	• Majority are titleholders of the land and also involved in domestication of animal. Locals are involved in doing agriculture activities on government land during monsoon season. There are 30-40 personal tubewell in the area and because of that two seasonal crops are grown by

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
		• Dalpat Singh(75 Bigha) • Rajendra Singh(75 Bigha) • Dinesh Singh(50 Bigha) • Raipal sigh • Babu Singh		the rich farmers. Main crops cultivated during winter are Cumin seeds, Sarso and gwar, Bajara, til, and groundnut. Per bigha production is 1 quintal depending on the good rainfall.
Local Community	Bhadani Village	• Ram lal • Pal singh • Lakshan singh • Duraram • Kasha ram • Naresh Singh	• Face to Face Interaction	• There are 350 Rajput family, 90 Bhil and 100 Meghwal community is residing in the village. All these community own land and average land holding size of the Rajput community is 50-60 Bigha, for Meghwal, 20-25 bigha and for Bhil 20-30 Bigha as reported during interaction with local communities. Main occupation of the local communities are agriculture and animal rearing. Few of the locals are involved in business and few are government service employee. •
Local Community	Bhiyasar Village	• Chain singh(150 Bigha) • Ganga Ram(40 Bigha)	• Face to Face Interaction	• There are 60 Rajput family, 50 Meghwal community (SCs) is residing in the village. All these community own land and average land holding size of the Rajput community is 50-60 Bigha, for Meghwal, 30-40 bigha as reported during interaction with local communities. Main occupation of the local communities are agriculture and animal rearing. Few of the locals are involved in business and few are government service employee.
Local Community	Sangur Village	• Raja singh(150 Bigha) • Rajendra singh • Kripa ram(30 Bigha)	• Face to Face Interaction	• It's a big Village and very progressive in the area. The village has given many administrative officers like IAS/IPS/ IRS/tehsildar at top positions and people are mostly engaged in productive work. There are 350 families belong to OBC category, 80 Meghwal community (SCs), 50 STs and 10 muslim community is residing in the village. All these community own land and average land holding size of the OBC community is 50-60 Bigha, for Meghwal 30-40 bigha and STs approx.20-40 land holdings as reported during interaction with local communities. Main occupation of the local communities are agriculture and animal rearing. Few of the locals are involved in business and few are government service employee like teacher, professor and patwari etc. there us one middle and one senior school is there in the village. 20 percent of the SCs are landowners and doing cultivation and self-sufficient.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
				• Agriculture and animal rearing are main occupation, and many are doing cultivation on government land. The main crops grown in the region during winter are Cumin seed, Isabhgol, arnadi and sarso and during summer jawar, Bajara and gwar. • Majority of the houses having personal toilet facilities and open defecation is not seen as reported now. Grazing land are there is the village and 40 percent of the total village land belong to Rajasthan State Government. There are 3-4 pondd and cremation ground is found in the village. 2 tanks are developed by government for agriculture purpose. • As reported, Ground water level is varying from 350-450 ft.
Local Community	Koda Village	• Angad Lal • Hera singh • Girdhar Barhat • Raju singh	• Face to Face Interaction	• There are 100 families belong to OBC category, 10 Bhil community (STs), is residing in the village. All these community own land and average land holding size of the OBC community is 50-60 Bigha, and STs approx.20-40 Bigha land holdings as reported during interaction with local communities. • Main occupation of the local communities are agriculture and animal rearing. many are doing cultivation on government. The main crops grown in the region during winter are Cumin seed, Isabhgol, arnadi and sarso and during summer jawar, Bajara and gwar. • Few of the locals are involved in business and few are government service employee like IAS, IRS teacher, professor and patwari etc. Around 20 percent of the population are engaged in service sector and mostly government service. • Majority of the houses having personal toilet facilities and open defecation is not seen as reported now. Grazing land are there is the village and 30 percent of the total village land belong to Rajasthan State Government and 70 percent owned by private landowners. There are 3-4 ponds and cremation ground are found in the village. • There are many wind farms seen in the village.
Local Community	Unda Village	• Kamlesh singh • Balbeer singh • Daulat Ram • Babu Ram • Kalu ram •	• Face to Face Interaction	• 60 percent family belong to general category mainly Rajputs, 20 percent OBC and 20 percent meghwal community (SCs), has occupied the village. All these community own land and average land holding size of the general community is 200 Bigha, and SCs approx.40-50 Bigha land holdings as reported during interaction with local communities. • Main occupation of the local communities are agriculture and animal rearing. many are doing cultivation on government land. The main crops

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
				grown in the region during winter are Cumin seed, isabhgol, arnadi and sarso and during summer jawar, bajara and gwar. • Majority of the houses having personal toilet facilities as reported now. Grazing land are there is the village and 50 percent of the total village land belong to Rajasthan State Government and 50 percent owned by private landowners. There are 2 ponds, 5 temples and cremation ground are found in the village. • There are many wind farms seen in the village.
Local Community	Kehro ki dhani	• Aarab Kahn • Suleman Khan(Panchayat Head) • Khair khan •	• Face to Face Interaction	• There are 40 muslim sindhi families is residing in the village. This community own land and average land holding size of the muslim community is 20-30 Bigha as reported during interaction with local communities. Main occupation of the local communities are agriculture and animal rearing. 25 percent are engaged in agriculture activities and rest are in animal husbandry. On an average every family owns on an average 30-40 goats, sheeps and cattle. Few of the locals are involved in business and few are employee in government service.
Local Community	Devikot Village	• Allabachay khan • Mubarak Khan • Amin Khan • Narayan Singh • Mungi Lal • Mahangu Lal • Madan singh	• Face to Face Interaction	• The population of Devikot is 1400 and 400 households. There are 100 families belong to general, 250 muslims, 10-15 Bhil community (STs), 20 ate SCs community is residing in the village. • Main occupation of the local communities are agriculture and animal rearing. The main crops grown in the region during winter are Cumin seed, Isabhgol, arnadi and sarso and during summer jawar, Bajara and gwar. • Few of the locals are involved in business and few are government service employee like administrators, teacher, bankers etc. Around 20 percent of the population are engaged in service sector and mostly government service. • Majority of the houses having personal toilet facilities and open defecation is also seen as reported now. Grazing land are there is the village and 20 percent of the total village land belong to Rajasthan State Government and 80 percent owned by private landowners. There are 3-4 ponds and cremation ground are found in the village. There is small marketplace seen at Devikot, it is located at State highway and looks like a small town. Unemployment is a serious issue in Deveikot and more than 100 families are landless and cultivating on private land of others. • There are many wind farms seen in the village.

Stakeholder Group	Village/ Department/ Designation	Name	Methodology	Findings
Revenue Officer	Reevadi Village	• Sugan Singh • 9783804147	• Face to Face Interaction	• With the good rainfall, per bigha 1 quintal is an average production of bajara and jwar. As confirmed, 25 -30 thousand circle rate per bigha.

Source: Primary Survey

APPENDIX F: PHOTO PLATES OF THE CONSULTATIONS

Settlement of muslim Community at a distance of 250 WTG Location at Junejo ki basti

General Topography of Junejo ki dhani as it is not fit for agriculture activities

Health Center at Manihari

Jwar cultivation at Manihari

Approach Road to Devka Village

Consultation with local community at Devka

Consultation with female stakeholders at Devka

Consultation with female stakeholders at Manihari

Few structures near WTG Location 39

Consultation with Manganiyars community

Structure near WTG location 39

Cultivation of Bajara at Hadwa

Consultations at Devka

Stucture at Devka where WTG location Proposed

Approach road to Hadwa Village

Consultations at Jhunejo Ki Dhani

Standing crops at project Site

Consultation with Private owners of Land near the project Boundary

Access Road to Proposed Soar Project Site at Reevadi Village

Approach Road surronding Project Solar Site

Standing Crops at Proposed Solar Project Location of Reevadi Village

Consultation at Reevadi Village

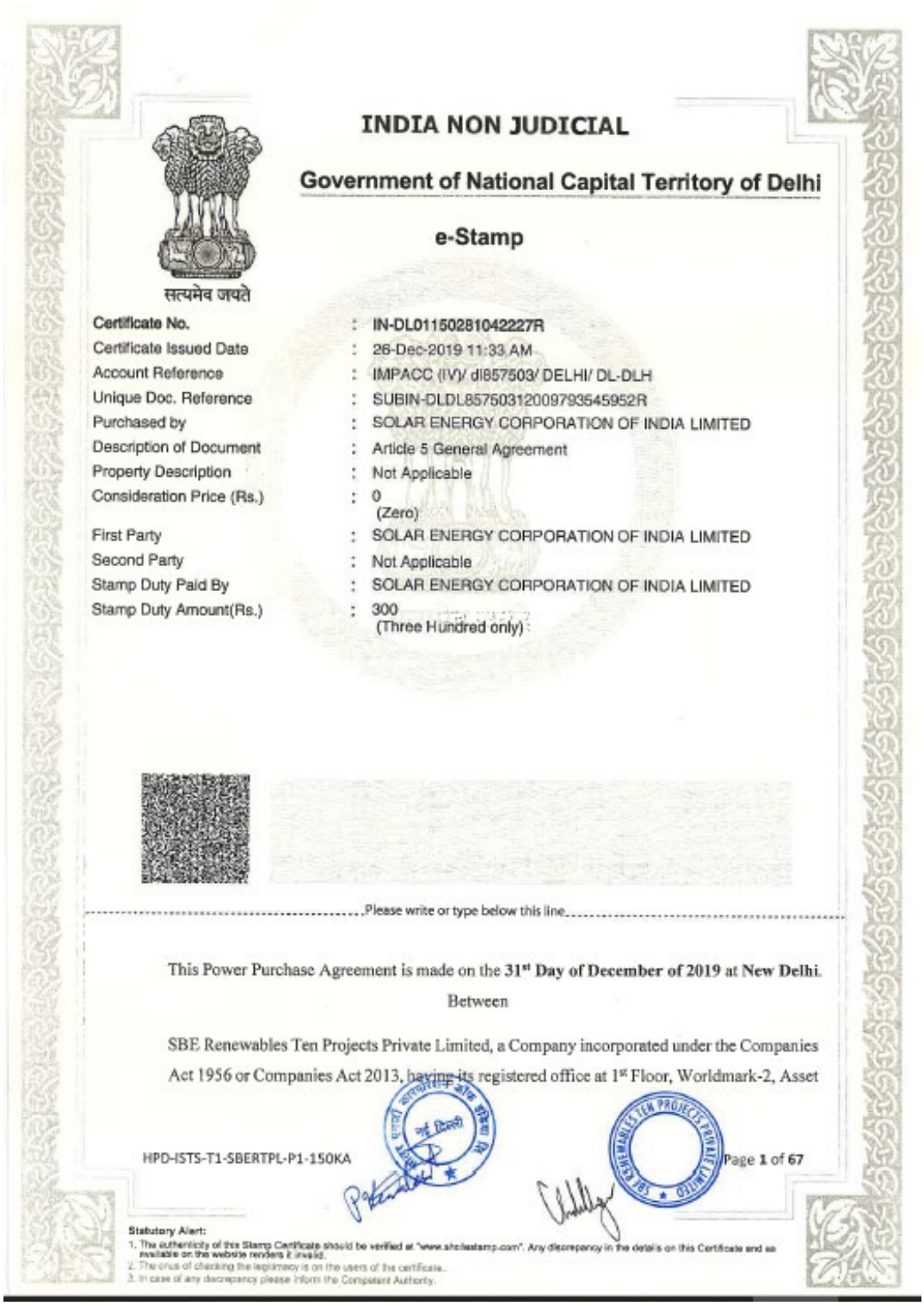
Temporary structure at Solar Site

Grazing at Solar Site at Reevadi Village

Temporary structure at near Solar Site

Temporary structure at Solar Site

APPENDIX G: POWER PURCHASE AGREEMENT (SAMPLE)



सत्यमेव जयते

INDIA NON JUDICIAL

Government of National Capital Territory of Delhi

e-Stamp

Certificate No.	:	IN-DL01150281042227R
Certificate Issued Date	:	26-Dec-2019 11:33 AM
Account Reference	:	IMPACC (IV)/ dl857503/ DELHI/ DL-DLH
Unique Doc. Reference	:	SUBIN-DLDL85750312009793545952R
Purchased by	:	SOLAR ENERGY CORPORATION OF INDIA LIMITED
Description of Document	:	Article 5 General Agreement
Property Description	:	Not Applicable
Consideration Price (Rs.)	:	0 (Zero)
First Party	:	SOLAR ENERGY CORPORATION OF INDIA LIMITED
Second Party	:	Not Applicable
Stamp Duty Paid By	:	SOLAR ENERGY CORPORATION OF INDIA LIMITED
Stamp Duty Amount(Rs.)	:	300 (Three Hundred only)

Please write or type below this line

This Power Purchase Agreement is made on the **31st Day of December of 2019** at **New Delhi**.

Between

SBE Renewables Ten Projects Private Limited, a Company incorporated under the Companies Act 1956 or Companies Act 2013, having its registered office at 1st Floor, Worldmark-2, Asset

HPD-ISTS-T1-SBERTPL-P1-150KA

Page **1** of **67**

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.

APPENDIX H: DRAFT LAND LEASE COPY (BARMER/ JAISALMER)

LEASE DEED

This Lease Deed made on the _____ day of _____ 20__

Between

_____ having its Registered office at _____ through its Authorised Signatory Sh._____ s/o Sh._____ r/o _____ (hereinafter called the "Lessee" which expression shall, unless excluded by or repugnant to the context, includes his / its, heirs, successors, executors, administrators and assigns) of the **First Part** AND **The Governor of the State of Rajasthan** (hereinafter called the "Lessor" which expression shall, unless excluded by or repugnant to the context, includes his successors in office and permitted assigns) through the Collector, District _____ of the **Second Part** , in pursuance of allotment sanction accorded by the State Govt. vide Letter No. _____ dated:_____ and Allotment Order No. _____ dated: _____of District Collector, _____

Whereas the "Lessor" has agreed to grant and the "Lessee" has agreed to accept plot of land admeasuring _____ Hectares situated at Village _____, Tehsil _____, District _____, Rajasthan

S.No.	Village Name	Khasra No.	Total Land (Area in Bigha)	Type of Land	Alloted Area (in Hectares)
Total Area Allotted					

and more particularly described in the above schedule hereto (hereinafter called the plot) on lease on the condition hereinafter appearing:

NOW THIS INDENTURE WITNESS AS FOLLOWS:

1. That the "Lessor" agrees to let the said plot and the "Lessee" has agreed to occupy the said plot for a period of 30 years on lease for the purpose of setting-up setting up Solar Park for establishment of Solar Plants based on Renewable Energy Sources for which the "Lessee" had applied under the provisions of the Rajasthan Land Revenue (Allotment of Land for setting up of Power Plant based on Renewable Energy Sources) Rules, 2007 and Amended Rules,2007 Notification No.F-6(28)Rev.6/2014/9 Jaipur dated. 04/08/2014 of the Revenue Department (Group 6), Rajasthan, Jaipur.

2. That the possession of the said plot is hereby delivered/has been delivered to the "Lessee" on and with effect from _____ vide Letter No._____ of Tehsildar, _____, Distt._____

3. That the "Lessee" hereby covenants with the "Lessor" as under

(I).The Land has been allotted on lease hold basis for a period of 30 Years from the date of allotment

(II).The Lessee shall have an option to renew the said lease for a further period of ten (10) years after expiry of the present term of lease.

(III).The premium to be charged for the allotment of government land for setting up and developing Solar Park shall be equivalent to the DLC of the same class of agricultural land in the vicinity and shall be determined accordingly.

(Iv).The Lessee shall set up on the said plot, all infrastructure facilities required for _____ Solar plant for which land has been leased to him by the Lessor within a period of 2 Years and in case of his failure to do so, the said plot shall revert to the Lessor unless the stipulated period is extended by the State Government on valid grounds.

(v).Lease rent payable of the land allotted for setting up of Solar park for establishment of solar power plants shall be paid annually.

(vi).Annual Rent shall be charged at the rate of 5% (Five Percent) per annum of the premium as specified in sub rule (3) for 2 years from the date of allotment which shall be enhanced thereafter for every year at the rate of 5% (Five percent) per annum of the previous year.

(vii).The Lessee may sub lease the leased land or part thereof for setting up and developing Solar Park for Solar Plant/Solar Power Plant/Solar PV Power Plant/Solar Thermal Power Plant/Solar Farm purpose after taking prior permission of the District Collector on recommendation of RREC. The Transferee shall pay 50% (Fifty percent) additional lease rent annually to Lessor.

(viii).The Lessee, during the period of lease, may assign his interest in the said plot, to any financial institution for the purpose of taking loan for establishing or developing the Renewable Energy Power Plant/Solar Park. Such assignment shall be subject to First Charge of the Government.

(ix).The Lessee may levy and recover such lease rent and other charges as may be determined by it, in respect of the lands sub leased by it.

(x).The periods of the sub leases shall be determined by the Lessee but such period shall not exceed 30 years in all, in any case.

(xi).The land shall revert to the Government free of all encumbrances and without payment of any compensation, in case the Lessee or any of its sub lessees use it for any purpose other than Solar Plant/Solar Power Plant/Solar PV Power Plant/Solar Thermal Power Plant/Solar Farm, including essential welfare and supporting services or commit breach of any other condition of the lease or sub leases

(xii).The Sub Lessees of the Lessee shall continue to be governed by all other terms & conditions prescribed in these rules and any other analogous rules that may be promulgated or orders that may be issued, in this behalf by State Government.

(xiii).The rent as aforesaid excludes all kinds of taxes/fee/duty which the Municipal Board, Panchayat or any Civil Body has imposed or may impose during the period of lease in respect of the said plot and the "Lessee" agrees to pay such tax / fee / duty to the authorities concerned directly.

(xiv). In case any default is made by the Lessee or Sub Lessee in respect of any of the aforesaid terms & conditions, the lease shall stand terminated and the said plot of land shall revert to the Lessor and Lessee or Sub –Lessee shall not be entitled to any compensation for premature termination of the lease or sub lease.

(xv).The Lessee agrees to pay annual lease rent of _____ for first two years, and the said amount of rent has already been deposited with Lessor as per details below:

S.No.	Challan No.	Date	Amount	Particulars
1				**Lease Rent for First Year**

Note: Payable Lease Rent is _____ - per year for the first two years from the date of allotment which shall be enhanced thereafter for every year at the rate of 5% (Five percent) per annum of the previous year.

Provided that in case the "Lessee" has assigned or mortgaged its leasehold right hereby demised in favor of any institution or institutions for the purposes of availing of financial assistance, the "Lessor" shall, before exercising its rights to determine the lease of the said plot, give notice thereof to the assignee or mortgagee, as the case may be, and in case default is not rectified either by the Company or by assignee or the mortgagee within a period of 3 (three) months from the date of the receipt of the notice, the said plot or land shall revert to the "Lessor".

The "Lessee" shall have to remove there from at its cost, all the buildings and structure constructed by him/it thereon. In case of his/its failure to do so, the Lessor shall have a right to dispose the said structures or buildings in any way he/it likes and

to refund the proceeds to the "Lessee" after recovering the entire sum due to him/it from the Lessee.

(xvi) The "Lessee" shall abide by all the terms and conditions prescribed in the Lease Deed and direction issued by the State Government and RREC from time to time.

(xvii) The "Lessee" shall adhere to the policy for promoting generation of electricity through Non-Conventional Energy Sources.

(xviii) The "Lessee" shall abide by all the provisions of the Rajasthan Land Revenue (Allotment of Land for setting up of Power Plant based on Renewable Energy Sources) Rules, 2007 and Amended Rules,2007 Notification No.F-6(28)Rev.6/2014/9 Jaipur dated. 04/08/2014 of the Revenue Department (Group 6), Rajasthan, Jaipur as amended from time to time.

4. The cost and expenses incidental to the preparation and execution and registration of this lease including stamp duty shall be borne and paid by the "Lessee".

In witness whereof the parties hereto have set their respective hands on the dates mentioned against their signatures.

1. Witness	**1. Signed for and on behalf of** **The Governor of Rajasthan (Lessor)**
2. Witness	**2. For _____ (Lessee).** **Authorized Signatory**

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APPENDIX I: SHADOW FLICKER MODELLING

Project:
450mw Solar and wind

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:40/3.4.388

SHADOW - Main Result

Calculation: 105MW Jaisalmer

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [JODHPUR]

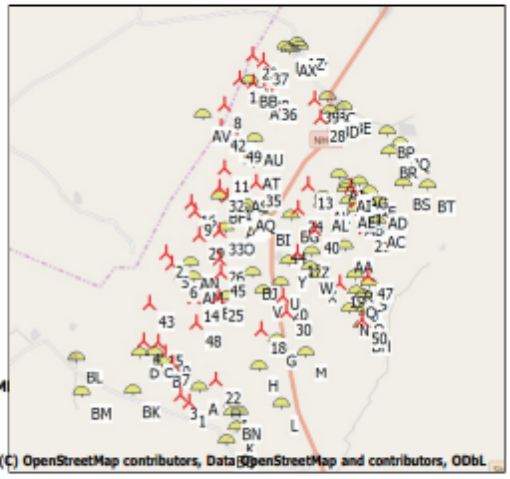
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8.71	9.25	8.52	9.17	10.09	8.60	6.53	6.37	8.38	9.44	9.14	8.61

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
497	703	609	403	299	256	440	1,938	2,226	812	331	240	8,754

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: 450mw Solar and wind_EM
Obstacles used in calculation
Eye height for map: 1.5 m
Grid resolution: 1.0 m

All coordinates are in
UTM (north)-WGS84 Zone: 42



Scale 1:200,000
New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	715,890	2,906,447	275.5	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
2	714,991	2,911,701	285.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
3	715,590	2,906,694	272.8	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
4	714,245	2,908,612	273.3	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
5	715,203	2,911,325	280.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
6	715,505	2,911,015	284.9	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
7	715,287	2,907,852	264.8	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
8	716,970	2,916,964	313.1	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
9	715,987	2,913,175	273.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
10	715,009	2,908,196	269.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
11	716,993	2,914,755	294.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
12	717,483	2,917,871	316.1	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
13	719,967	2,914,219	283.9	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
14	716,016	2,910,162	283.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
15	714,766	2,908,583	271.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
16	715,872	2,913,491	275.1	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
17	719,619	2,911,831	281.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
18	718,414	2,909,089	268.7	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
19	721,145	2,910,766	270.9	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
20	719,145	2,910,278	272.7	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
21	722,006	2,912,723	268.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
22	716,809	2,907,238	260.1	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
23	717,912	2,918,710	293.5	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
24	719,621	2,913,340	287.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
25	716,856	2,910,216	271.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
26	716,890	2,911,552	275.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
27	721,480	2,914,167	283.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
28	720,365	2,916,562	270.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
29	716,161	2,912,369	276.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
30	719,272	2,909,739	267.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
31	717,990	2,917,759	309.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
32	716,856	2,914,044	283.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
33	716,875	2,912,511	272.9	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
34	721,696	2,913,657	274.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
35	718,152	2,914,254	274.1	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1

To be continued on next page...

Project:
450mw Solar and wind

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:40/3.4.388

SHADOW - Main Result

Calculation: 105MW Jaisalmer

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
36	718,632	2,917,298	286.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
37	718,303	2,918,516	295.5	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
38	718,361	2,917,600	293.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
39	720,135	2,917,217	268.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
40	720,236	2,912,644	284.1	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
41	717,131	2,913,769	279.2	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
42	716,854	2,916,185	304.9	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
43	714,449	2,909,934	279.2	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
44	719,059	2,912,258	283.5	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
45	716,923	2,911,063	270.6	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
46	717,204	2,915,931	322.9	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
47	722,128	2,911,040	276.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
48	716,104	2,909,286	278.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
49	717,446	2,915,761	311.0	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1
50	721,957	2,909,474	275.4	Suzlon S120-2.1 2100 120.0 !-! hu...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	2,500	2.1

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Degrees from south cw	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]	[°]		[m]
A	716,228	2,906,865	263.2	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
B	714,910	2,907,768	263.6	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
C	714,631	2,908,130	267.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
D	714,133	2,908,061	262.7	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
E	716,681	2,910,258	270.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
F	717,147	2,910,128	266.7	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
G	718,972	2,908,648	267.4	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
H	718,338	2,907,704	256.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
I	717,426	2,906,301	254.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
J	717,690	2,906,046	256.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
K	717,620	2,905,523	252.5	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
L	719,181	2,906,359	253.3	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
M	719,992	2,908,194	257.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
N	721,503	2,909,767	272.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
O	722,023	2,909,777	274.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
P	722,169	2,909,645	271.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
Q	721,755	2,910,397	274.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
R	721,678	2,910,942	275.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
S	722,189	2,910,680	276.3	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
T	721,991	2,910,250	276.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
U	719,055	2,910,655	272.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
V	718,440	2,910,377	269.7	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
W	720,063	2,911,204	274.5	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
X	720,379	2,910,917	270.3	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
Y	719,315	2,911,393	275.6	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
Z	720,127	2,911,767	275.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AA	721,291	2,911,989	267.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AB	721,662	2,913,284	271.7	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AC	722,407	2,912,899	273.4	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AD	722,482	2,913,536	270.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AE	721,397	2,913,541	278.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AF	722,136	2,913,893	276.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AG	721,763	2,914,228	280.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AH	721,310	2,913,967	282.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AI	721,348	2,914,130	285.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AJ	721,058	2,914,461	277.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AK	720,530	2,913,716	292.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AL	720,473	2,913,450	300.6	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AM	715,967	2,910,800	273.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AN	715,852	2,911,307	272.4	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AO	717,058	2,912,536	273.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AP	717,662	2,913,263	271.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AQ	717,784	2,913,408	273.7	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0

To be continued on next page...

Project:
450mw Solar and wind

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Calculated:
07-01-2022 12:40/3.4.388

SHADOW - Main Result

Calculation: 105MW Jaisalmer

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Degrees from south cw	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]	[°]		[m]
AR	717,481	2,913,103	272.4	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AS	717,624	2,914,052	276.6	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AT	718,014	2,914,859	277.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AU	718,066	2,915,690	283.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AV	716,218	2,916,507	301.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AW	718,236	2,917,327	296.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AX	719,239	2,918,823	272.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AY	719,589	2,918,957	269.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
AZ	719,501	2,919,068	270.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BA	719,083	2,918,948	285.5	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BB	717,838	2,917,735	309.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BC	720,609	2,917,207	275.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BD	720,710	2,916,716	277.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BE	721,177	2,916,858	268.4	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BF	716,863	2,913,647	278.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BG	719,365	2,913,001	285.2	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BH	721,962	2,909,205	272.4	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BI	718,514	2,912,896	273.2	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BJ	718,061	2,910,971	268.1	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BK	713,907	2,906,713	263.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BL	711,890	2,907,905	267.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BM	712,100	2,906,662	273.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BN	717,432	2,906,028	253.5	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BO	717,250	2,905,069	252.6	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BP	722,738	2,916,026	264.2	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BQ	723,176	2,915,635	262.8	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BR	722,836	2,915,324	266.9	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BS	723,336	2,914,215	263.0	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0
BT	724,180	2,914,152	258.3	1.0	1.0	1.0	0.0	90.0	Fixed direction	2.0

Calculation Results

Shadow receptor

No.	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	28:31	54	0:41	14:39
B	3:10	21	0:12	1:11
C	35:48	66	0:43	13:40
D	9:26	31	0:24	3:40
E	224:52	152	2:28	75:50
F	3:47	29	0:12	1:30
G	0:00	0	0:00	0:00
H	5:39	26	0:18	3:07
I	0:00	0	0:00	0:00
J	0:00	0	0:00	0:00
K	0:00	0	0:00	0:00
L	0:00	0	0:00	0:00
M	0:00	0	0:00	0:00
N	73:06	106	0:53	27:30
O	0:00	0	0:00	0:00
P	189:05	149	1:30	121:43
Q	0:00	0	0:00	0:00
R	40:44	65	0:48	22:18
S	0:00	0	0:00	0:00
T	0:00	0	0:00	0:00
U	1:42	16	0:09	0:51
V	29:05	49	0:55	11:20
W	16:20	60	0:25	6:18
X	35:37	101	0:35	16:52
Y	4:52	36	0:13	1:58
Z	3:09	24	0:11	1:12
AA	4:30	21	0:17	1:56
AB	8:07	36	0:19	4:51

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Projects
450mw Solar and wind

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SHADOW - Main Result

Calculation: 105MW Jaisalmer

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
AC	71:50	101	1:01	41:49
AD	2:11	20	0:09	1:16
AE	3:47	19	0:16	1:41
AF	70:59	104	0:55	43:36
AG	119:58	132	1:32	54:23
AH	50:57	88	0:53	19:40
AI	52:22	100	1:13	22:14
AJ	81:28	121	0:56	31:53
AK	26:38	76	0:29	13:44
AL	25:33	105	0:32	10:57
AM	14:31	48	0:28	8:19
AN	97:11	153	1:02	57:21
AO	188:31	181	1:44	79:09
AP	12:50	58	0:17	6:59
AQ	7:10	36	0:17	3:03
AR	28:10	60	0:36	14:44
AS	100:44	155	0:58	58:29
AT	15:05	55	0:27	6:22
AU	0:00	0	0:00	0:00
AV	53:51	102	0:40	20:27
AW	68:23	125	1:05	27:27
AX	31:52	125	0:28	17:21
AY	17:52	84	0:21	9:54
AZ	20:36	91	0:22	12:02
BA	45:20	119	0:33	26:50
BB	151:37	222	1:30	58:41
BC	21:14	46	0:46	8:21
BD	88:52	101	1:09	51:54
BE	19:34	46	0:32	11:13
BF	44:21	119	0:30	25:15
BG	20:22	52	0:31	7:47
BH	0:00	0	0:00	0:00
BI	8:50	35	0:26	4:05
BJ	11:44	56	0:18	7:11
BK	6:12	36	0:16	2:28
BL	0:00	0	0:00	0:00
BM	0:00	0	0:00	0:00
BN	0:00	0	0:00	0:00
BO	0:00	0	0:00	0:00
BP	0:00	0	0:00	0:00
BQ	0:00	0	0:00	0:00
BR	0:00	0	0:00	0:00
BS	8:32	43	0:17	4:15
BT	0:00	0	0:00	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (60)	3:02	1:12
2	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (61)	2:52	1:41
3	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (62)	31:41	15:55
4	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (63)	0:00	0:00
5	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (64)	9:08	3:36
6	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (65)	76:49	49:39
7	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (66)	42:58	16:29
8	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (67)	8:02	4:23
9	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (68)	44:57	26:10
10	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (69)	0:00	0:00
11	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (70)	11:46	5:04
12	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (71)	14:28	8:51
13	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (72)	16:01	7:29
14	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (73)	32:37	14:53
15	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (74)	0:00	0:00

To be continued on next page...

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450mw Solar and wind

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SHADOW - Main Result

Calculation: 105MW Jaisalmer

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No.	Name	Worst case [h/year]	Expected [h/year]
16	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (75)	16:26	8:01
17	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (76)	4:30	1:56
18	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (77)	0:00	0:00
19	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (78)	78:30	36:42
20	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (79)	39:24	18:21
21	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (80)	78:20	44:09
22	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (81)	11:05	5:10
23	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (82)	20:06	9:30
24	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (83)	50:24	25:39
25	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (84)	213:52	72:24
26	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (85)	0:00	0:00
27	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (86)	237:03	99:13
28	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (87)	107:16	61:50
29	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (88)	34:01	18:46
30	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (89)	3:25	1:22
31	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (90)	73:50	28:40
32	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (91)	12:13	4:57
33	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (92)	172:16	71:31
34	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (93)	131:27	66:59
35	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (94)	0:00	0:00
36	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (95)	90:34	34:31
37	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (96)	61:49	37:03
38	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (97)	43:24	15:47
39	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (98)	23:55	9:24
40	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (99)	36:43	16:21
41	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (100)	70:53	43:57
42	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (101)	49:13	18:44
43	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (102)	13:54	8:17
44	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (103)	13:35	5:10
45	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (104)	12:23	4:51
46	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (105)	20:31	7:43
47	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (106)	5:35	2:10
48	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (107)	0:00	0:00
49	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (108)	2:43	1:01
50	Suzlon S120-2.1 2100 120.0 !-! hub: 140.0 m (TOT: 200.0 m) (109)	260:57	148:42

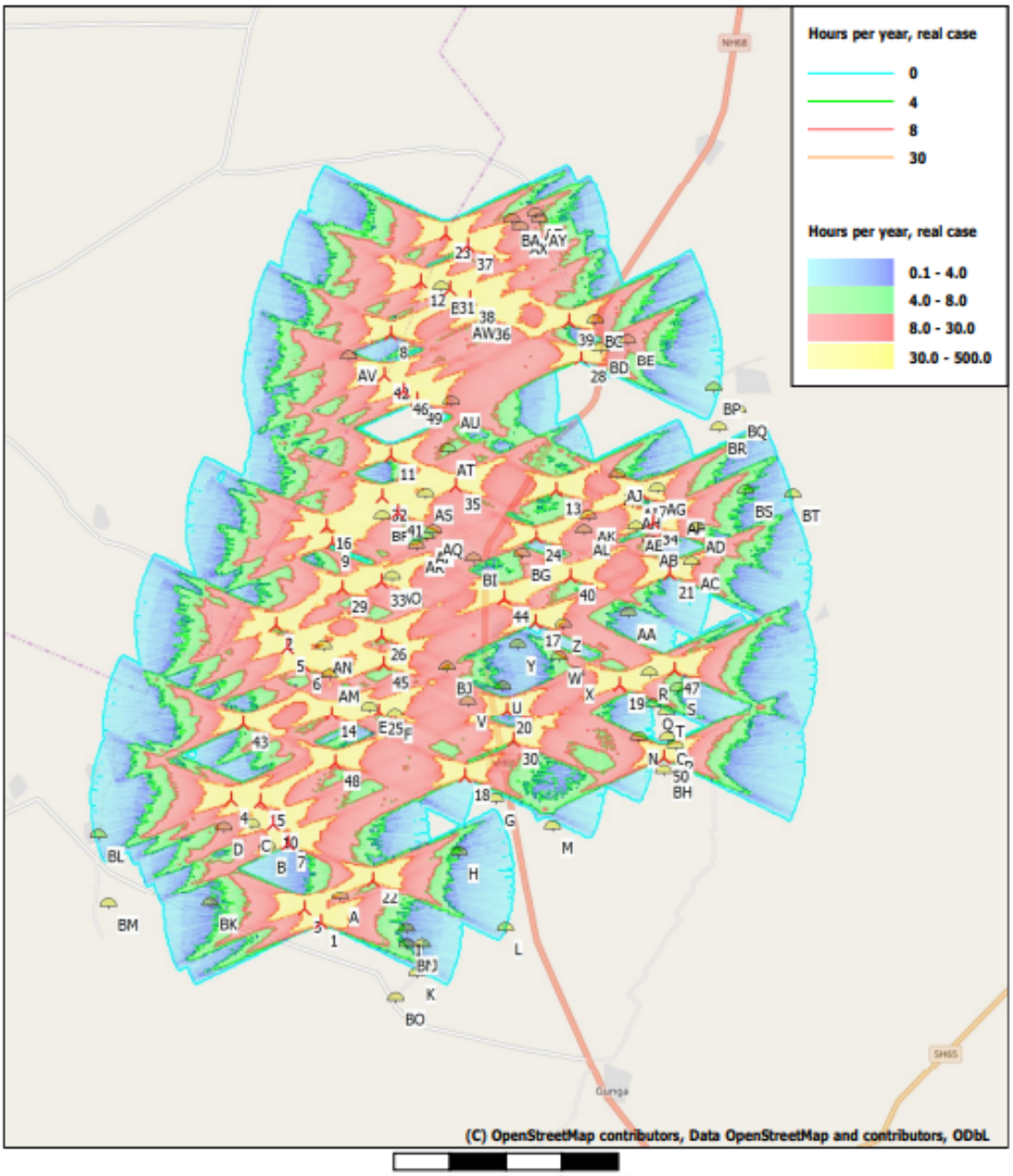
Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

Project:
450mw Solar and wind

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:40/3.4.388

SHADOW - Map

Calculation: 105MW Jaisalmer



Map: EMD OpenStreetMap , Print scale 1:100,000, Map center UTM (north)-WGS84 Zone: 42 East: 718,920 North: 2,912,460

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: 450mw Solar and wind_EMDGrid_0.wpg (1)

APPENDIX J: NOISE MODELLING

Project:
450mw Solar and wind

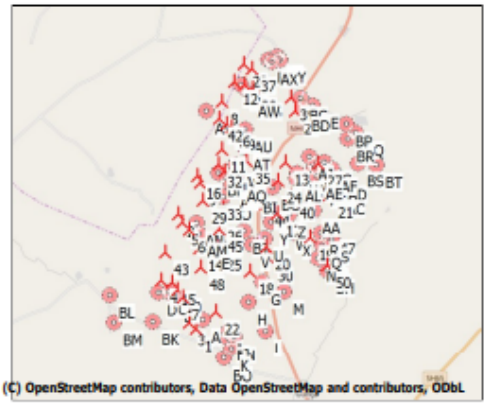
Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:07/3.4.388

DECIBEL - Main Result

Calculation: 105MW Wind Jaisalmer

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
3.0 m/s - 18.0 m/s, step 1.0 m/s
Ground attenuation:
General, Ground factor: 1.0
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
Model: 5.0 dB(A)
Height above ground level, when no value in NSA object:
0.0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0.0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)

All coordinates are in
UTM (north)-WGS84 Zone: 42



Scale 1:250,000
New WTG
Noise sensitive area

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	WTG type Manufact.	WTG type Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Noise data Name	First wind speed	LwaRef	Last wind speed	LwaRef
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	[m/s]	[dB(A)]
1	715,890	2,906,447	275.5	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
2	714,991	2,911,701	285.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
3	715,590	2,906,694	272.8	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
4	714,245	2,908,612	273.3	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
5	715,203	2,911,325	280.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
6	715,505	2,911,015	284.9	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
7	715,287	2,907,852	264.8	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
8	716,970	2,916,964	313.1	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
9	715,987	2,913,175	273.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
10	715,009	2,908,196	269.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
11	716,993	2,914,755	294.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
12	717,483	2,917,871	316.1	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
13	719,967	2,914,219	283.9	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
14	716,016	2,910,162	283.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
15	714,766	2,908,583	271.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
16	715,872	2,913,491	275.1	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
17	719,619	2,911,831	281.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
18	718,414	2,909,089	268.7	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
19	721,145	2,910,766	270.9	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
20	719,145	2,910,278	272.7	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
21	722,006	2,912,723	268.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
22	716,809	2,907,238	260.1	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
23	717,912	2,918,710	293.5	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
24	719,621	2,913,340	287.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
25	716,856	2,910,216	271.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
26	716,890	2,911,552	275.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
27	721,480	2,914,167	283.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
28	720,365	2,916,562	270.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
29	716,161	2,912,369	276.4	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
30	719,272	2,909,739	267.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
31	717,990	2,917,759	309.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
32	716,856	2,914,044	283.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
33	716,875	2,912,511	272.9	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
34	721,696	2,913,657	274.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
35	718,151	2,914,254	274.1	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
36	718,632	2,917,298	286.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
37	718,303	2,918,516	295.5	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
38	718,361	2,917,600	293.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
39	720,135	2,917,217	268.0	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
40	720,236	2,912,644	284.1	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
41	717,131	2,913,769	279.2	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
42	716,854	2,916,185	304.9	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
43	714,449	2,909,934	279.2	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
44	719,059	2,912,258	283.5	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
45	716,923	2,911,063	270.6	Suzlon S120-2.1 2100 12...	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h

To be continued on next page...

Project:
450mw Solar and wind

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:07/3.4.388

DECIBEL - Main Result

Calculation: 105MW Wind Jaisalmer

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	First wind speed	LwaRef	Last wind speed	LwaRef
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	[m/s]	[dB(A)]
46	717,204	2,915,931	322.9	Suzlon S120-2.1 2100 12....	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
47	722,128	2,911,040	276.0	Suzlon S120-2.1 2100 12....	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
48	716,104	2,909,286	278.0	Suzlon S120-2.1 2100 12....	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
49	717,446	2,915,761	311.0	Suzlon S120-2.1 2100 12....	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h
50	721,957	2,909,474	275.4	Suzlon S120-2.1 2100 12....	No	Suzlon	S120-2.1-2,100	2,100	120.0	140.0	USER	Runtime input	3.0	98.2	18.0	110.5 h

h) Generic octave distribution used

Calculation Results

Sound level

Noise sensitive area No.	Name	Easting	Northing	Z	Immission height	Demands Min Noise	Sound level Max From WTGs	Distance to noise demand	Demands fulfilled ? Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
A	Noise sensitive point: User defined (1)	716,228	2,906,865	263.2	0.0	45.0	41.1	251	Yes
B	Noise sensitive point: User defined (2)	714,910	2,907,768	263.6	0.0	45.0	43.9	55	Yes
C	Noise sensitive point: User defined (3)	714,631	2,908,130	267.1	0.0	45.0	44.3	43	Yes
D	Noise sensitive point: User defined (4)	714,133	2,908,061	262.7	0.0	45.0	40.0	291	Yes
E	Noise sensitive point: User defined (5)	716,681	2,910,258	270.0	0.0	45.0	47.6	-110	No
F	Noise sensitive point: User defined (6)	717,147	2,910,128	266.7	0.0	45.0	43.9	46	Yes
G	Noise sensitive point: User defined (7)	718,972	2,908,648	267.4	0.0	45.0	36.8	463	Yes
H	Noise sensitive point: User defined (8)	718,338	2,907,704	256.9	0.0	45.0	32.9	1,143	Yes
I	Noise sensitive point: User defined (9)	717,426	2,906,301	254.9	0.0	45.0	33.2	877	Yes
J	Noise sensitive point: User defined (10)	717,690	2,906,046	256.9	0.0	45.0	31.4	1,237	Yes
K	Noise sensitive point: User defined (11)	717,620	2,905,523	252.5	0.0	45.0	30.1	1,657	Yes
L	Noise sensitive point: User defined (12)	719,181	2,906,359	253.3	0.0	45.0	28.9	2,287	Yes
M	Noise sensitive point: User defined (13)	719,992	2,908,194	257.0	0.0	45.0	31.7	1,449	Yes
N	Noise sensitive point: User defined (14)	721,503	2,909,767	272.8	0.0	45.0	38.8	300	Yes
O	Noise sensitive point: User defined (15)	722,023	2,909,777	274.8	0.0	45.0	43.1	73	Yes
P	Noise sensitive point: User defined (16)	722,169	2,909,645	271.9	0.0	45.0	44.1	31	Yes
Q	Noise sensitive point: User defined (17)	721,755	2,910,397	274.9	0.0	45.0	38.6	474	Yes
R	Noise sensitive point: User defined (18)	721,678	2,910,942	275.1	0.0	45.0	41.5	201	Yes
S	Noise sensitive point: User defined (19)	722,189	2,910,680	276.3	0.0	45.0	42.0	123	Yes
T	Noise sensitive point: User defined (20)	721,991	2,910,250	276.8	0.0	45.0	37.8	530	Yes
U	Noise sensitive point: User defined (21)	719,055	2,910,655	272.9	0.0	45.0	42.0	131	Yes
V	Noise sensitive point: User defined (22)	718,440	2,910,377	269.7	0.0	45.0	38.2	444	Yes
W	Noise sensitive point: User defined (23)	720,063	2,911,204	274.5	0.0	45.0	37.7	513	Yes
X	Noise sensitive point: User defined (24)	720,379	2,910,917	270.3	0.0	45.0	37.3	533	Yes
Y	Noise sensitive point: User defined (25)	719,315	2,911,393	275.6	0.0	45.0	40.0	278	Yes
Z	Noise sensitive point: User defined (26)	720,127	2,911,767	275.9	0.0	45.0	40.3	250	Yes
AA	Noise sensitive point: User defined (27)	721,291	2,911,989	267.9	0.0	45.0	36.6	777	Yes
AB	Noise sensitive point: User defined (28)	721,662	2,913,284	271.7	0.0	45.0	42.7	111	Yes
AC	Noise sensitive point: User defined (29)	722,407	2,912,899	273.4	0.0	45.0	40.5	195	Yes
AD	Noise sensitive point: User defined (30)	722,482	2,913,536	270.0	0.0	45.0	36.9	541	Yes
AE	Noise sensitive point: User defined (31)	721,397	2,913,541	278.0	0.0	45.0	43.8	52	Yes
AF	Noise sensitive point: User defined (32)	722,136	2,913,893	276.8	0.0	45.0	40.3	235	Yes
AG	Noise sensitive point: User defined (33)	721,763	2,914,228	280.0	0.0	45.0	44.4	22	Yes
AH	Noise sensitive point: User defined (34)	721,310	2,913,967	282.0	0.0	45.0	45.4	-14	No
AI	Noise sensitive point: User defined (35)	721,348	2,914,130	285.0	0.0	45.0	49.0	-123	No
AJ	Noise sensitive point: User defined (36)	721,058	2,914,461	277.1	0.0	45.0	39.7	267	Yes
AK	Noise sensitive point: User defined (37)	720,530	2,913,716	292.0	0.0	45.0	38.7	504	Yes
AL	Noise sensitive point: User defined (38)	720,473	2,913,450	300.6	0.0	45.0	38.8	578	Yes
AM	Noise sensitive point: User defined (39)	715,967	2,910,800	273.1	0.0	45.0	42.1	232	Yes
AN	Noise sensitive point: User defined (40)	715,852	2,911,307	272.4	0.0	45.0	42.6	160	Yes
AO	Noise sensitive point: User defined (41)	717,058	2,912,536	273.0	0.0	45.0	47.4	-79	No
AP	Noise sensitive point: User defined (42)	717,662	2,913,263	271.1	0.0	45.0	39.1	464	Yes
AQ	Noise sensitive point: User defined (43)	717,784	2,913,408	273.7	0.0	45.0	39.1	469	Yes
AR	Noise sensitive point: User defined (44)	717,481	2,913,103	272.4	0.0	45.0	39.3	473	Yes
AS	Noise sensitive point: User defined (45)	717,624	2,914,052	276.6	0.0	45.0	41.9	269	Yes
AT	Noise sensitive point: User defined (46)	718,014	2,914,859	277.9	0.0	45.0	39.6	367	Yes
AU	Noise sensitive point: User defined (47)	718,066	2,915,690	283.0	0.0	45.0	39.4	349	Yes
AV	Noise sensitive point: User defined (48)	716,218	2,916,507	301.9	0.0	45.0	38.4	447	Yes
AW	Noise sensitive point: User defined (49)	718,236	2,917,327	296.8	0.0	45.0	46.3	-74	No
AX	Noise sensitive point: User defined (50)	719,239	2,918,823	272.9	0.0	45.0	35.5	724	Yes

To be continued on next page...

Project:
450mw Solar and wind

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:07/3.4.388

DECIBEL - Main Result

Calculation: 105MW Wind Jaisalmer

...continued from previous page

Noise sensitive area No.	Name	Easting	Northing	Z	Immission height	Demands Min Noise	Sound level Max From WTGs	Distance to noise demand	Demands fulfilled ? Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
AY	Noise sensitive point: User defined (51)	719,589	2,918,957	269.8	0.0	45.0	33.4	1,097	Yes
AZ	Noise sensitive point: User defined (52)	719,501	2,919,068	270.0	0.0	45.0	33.4	1,052	Yes
BA	Noise sensitive point: User defined (53)	719,083	2,918,948	285.5	0.0	45.0	36.0	622	Yes
BB	Noise sensitive point: User defined (54)	717,838	2,917,735	309.0	0.0	45.0	49.3	-249	No
BC	Noise sensitive point: User defined (55)	720,609	2,917,207	275.8	0.0	45.0	40.6	211	Yes
BD	Noise sensitive point: User defined (56)	720,710	2,916,716	277.0	0.0	45.0	42.0	123	Yes
BE	Noise sensitive point: User defined (57)	721,177	2,916,858	268.4	0.0	45.0	35.3	608	Yes
BF	Noise sensitive point: User defined (58)	716,863	2,913,647	278.8	0.0	45.0	45.8	-39	No
BG	Noise sensitive point: User defined (59)	719,365	2,913,001	285.2	0.0	45.0	41.9	166	Yes
BH	Noise sensitive point: User defined (60)	721,962	2,909,205	272.4	0.0	45.0	44.1	32	Yes
BI	Noise sensitive point: User defined (61)	718,514	2,912,896	273.2	0.0	45.0	37.8	588	Yes
BJ	Noise sensitive point: User defined (62)	718,061	2,910,971	268.1	0.0	45.0	37.0	863	Yes
BK	Noise sensitive point: User defined (63)	713,907	2,906,713	263.9	0.0	45.0	32.4	1,428	Yes
BL	Noise sensitive point: User defined (64)	711,890	2,907,905	267.0	0.0	45.0	28.4	2,198	Yes
BM	Noise sensitive point: User defined (65)	712,100	2,906,662	273.0	0.0	45.0	27.6	2,641	Yes
BN	Noise sensitive point: User defined (66)	717,432	2,906,028	253.5	0.0	45.0	32.1	1,120	Yes
BO	Noise sensitive point: User defined (67)	717,250	2,905,069	252.6	0.0	45.0	29.5	1,683	Yes
BP	Noise sensitive point: User defined (68)	722,738	2,916,026	264.2	0.0	45.0	29.8	1,997	Yes
BQ	Noise sensitive point: User defined (69)	723,176	2,915,635	262.8	0.0	45.0	29.4	1,991	Yes
BR	Noise sensitive point: User defined (70)	722,836	2,915,324	266.9	0.0	45.0	30.7	1,531	Yes
BS	Noise sensitive point: User defined (71)	723,336	2,914,215	263.0	0.0	45.0	31.0	1,475	Yes
BT	Noise sensitive point: User defined (72)	724,180	2,914,152	258.3	0.0	45.0	28.5	2,274	Yes

Distances (m)

	WTG																				
NSA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	537	4992	661	2643	4577	4213	1364	10127	6315	1805	7927	11078	8250	3304	2256	6636	6014	3119	6277	4490	8228	691
B	1644	3934	1271	1075	3569	3301	386	9424	5513	440	7291	10426	8197	2637	828	5804	6219	3745	6918	4923	8655	1971
C	2102	3590	1727	618	3246	3015	713	9139	5225	384	7034	10150	8097	2460	473	5503	6212	3903	7028	4999	8689	2354
D	2386	3740	1998	562	3435	3257	1173	9344	5440	886	7279	10366	8483	2821	820	5701	6656	4403	7516	5480	9150	2800
E	3892	2222	3727	2940	1823	1399	2780	6713	2999	2654	4508	7656	5147	672	2544	3333	3333	2090	4493	2464	5868	3022
F	3889	2669	3770	3274	2283	1866	2939	6838	3260	2881	4630	7750	4969	1131	2838	3597	3002	1639	4049	2004	5509	2910
G	3787	5017	3906	4727	4623	4198	3770	8554	5423	3989	6420	9343	5659	3321	4207	5751	3248	712	3035	1639	5081	2582
H	2752	5213	2928	4192	4789	4357	3054	9360	5955	3365	7178	10203	6715	3381	3678	6290	4321	1387	4154	2697	6216	1598
I	1543	5924	1878	3932	5494	5090	2642	10673	7023	3071	8465	11570	8316	4110	3505	7356	5949	2958	5811	4332	7888	1122
J	1844	6266	2198	4296	5836	5428	3006	10942	7330	3437	8737	11827	8485	4444	3871	7664	6098	3128	5850	4475	7951	1482
K	1961	6714	2343	4575	6285	5885	3296	11460	7825	3737	9254	12349	9008	4909	4184	8158	6618	3654	6318	4994	8431	1897
L	3292	6789	3607	5426	6363	5932	4170	10833	7528	4559	8677	11637	7900	4948	4944	7863	5490	2836	4825	3920	6963	2530
M	4458	6108	4650	5762	5721	5300	4717	9276	6391	4983	7214	9997	6025	4436	5240	6711	3656	1814	2819	2250	4957	3323
N	6521	6793	6664	7349	6490	6126	6504	8505	6484	6681	6724	9046	4709	5501	6840	6751	2794	3162	1061	2412	2999	5332
O	6978	7290	7133	7864	6993	6634	7005	8785	6926	7190	7076	9280	4894	6019	7354	7185	3162	3674	1322	2921	2946	5799
P	7046	7467	7210	7991	7166	6803	7112	8978	7119	7305	7274	9467	5077	6175	7479	7379	3359	3796	1518	3089	3083	5875
Q	7071	6888	7191	7719	6617	6280	6951	8125	6402	7096	6455	8609	4220	5744	7220	6647	2573	3588	713	2613	2340	5869
R	7328	6730	7423	7789	6486	6173	7099	7644	6113	7212	6041	8100	3697	5715	7303	6341	2243	3753	561	2618	1811	6117
S	7589	7271	7710	8209	7016	6693	7459	8169	6686	7598	6604	8594	4179	6195	7714	6915	2816	4097	1048	3071	2051	6387
T	7189	7149	7323	7917	6873	6531	7120	8384	6679	7278	6729	8855	4456	5976	7415	6925	2851	3761	991	2846	2473	5994
U	5265	4197	5263	5226	3910	3569	4696	6645	3971	4735	4590	7386	3679	3079	4763	4264	1304	1692	2093	387	3603	4089
V	4685	3695	4657	4551	3373	3004	4040	6749	3721	4066	4611	7555	4134	2434	4089	4036	1872	1288	2733	712	4268	3538
W	6328	5097	6353	6370	4862	4562	5835	6538	4528	5882	4694	7149	3016	4179	5910	4775	768	2682	1167	1304	2466	5131
X	6335	5445	6385	6553	5192	4875	5943	6942	4939	6020	5118	7533	3328	4428	6079	5191	1189	2684	781	1390	2431	5126
Y	6016	4334	5996	5782	4112	3828	5363	6044	3775	5363	4086	6732	2900	3521	5347	4031	533	2474	1935	1128	3002	4852
Z	6801	5137	6806	6675	4944	4683	6226	6081	4373	6241	4330	6652	2457	4414	6236	4591	512	3179	1428	1784	2108	5615
AA	7738	6306	7780	7813	6124	5867	7291	6589	5435	7338	5111	7007	2593	5582	7360	5623	1679	4085	1232	2744	1025	6531
AB	8948	6856	8961	8766	6750	6562	8376	5963	5676	8376	4895	6205	1936	6452	8346	5794	2507	5306	2571	3921	658	7753
AC	9171	7512	9218	9219	7374	7154	8727	6788	6426	8766	5723	6997	2774	6952	8776	6562	2985	5519	2478	4184	438	7961
AD	9680	7713	9711	9597	7607	7419	9169	6491	6505	9185	5623	6617	2606	7293	9169	6610	3332	6027	3076	4664	942	8476
AE	8980	6665	8978	8686	6579	6411	8348	5596	5423	8329	4569	5837	1583	6354	8280	5525	2467	5359	2786	3964	1019	7796
AF	9719	7474	9730	9495	7394	7229	9133	6010	6191	9124	5215	6122	2194	7168	9084	6277	3254	6077	3280	4692	1177	8525
AG	9749	7228	9740	9384	7174	7035	9088	5519	5871	9056	4799	5621	1796	7040	8990	5937	3216	6134	3517	4739	1525	8568
AH	9269	6713	9252	8865	6654	6512	8583	5274	5381	8544	4388	5467	1366	6519	8474	5459	2724	5672	3205	4277	1425	8095
AI	9424	6805	9404	8994	6754	6621	8726	5215	5445	8683	4399	5379	1384	6646	8607	5513	2876	5832	3370	4437	1553	8252
AJ	9536	6666	9499	8980	6642	6536	8774	4793	5232	8709	4076	4940	1118	6626	8611	5276	2998	5988	3696	4600	1980	8381
AK	8624	5895	8586	8097	5840	5705	7867	4819	4576	7808	3687	5152	755	5746	7719	4664	2094	5088	3014	3707	1779	7471
AL	8370	5755	8336	7887	5683	5533	7631	4962	4495	7581	3717	5337	920	5539	7501	4601	1831	4823	2767	3439	1697	7213
AM	4354	1328	4124	2785	927	509	3026	6245	2375	2775	4086	7231	5262	640	2522	2692	3795	2986	5178	3221	6338	3661

To be continued on next page...

Project:
450mw Solar and wind

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:07/3.4.388

DECIBEL - Main Result

Calculation: 105MW Wind Jaisalmer

...continued from previous page

	WTG																					
NSA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
AN	4861	946	4621	3138	649	453	3501	5766	1873	3223	3632	6763	5041	1157	2933	2184	3804	3389	5321	3451	6315	4180
AO	6200	2230	6024	4829	2216	2174	5008	4428	1247	4800	2220	5351	3360	2593	4570	1523	2656	3704	4454	3075	4951	5304
AP	7042	3094	6888	5771	3131	3115	5909	3765	1677	5719	1635	4612	2496	3511	5503	1804	2425	4241	4286	3333	4378	6085
AQ	7214	3273	7063	5960	3317	3305	6091	3648	1812	5905	1563	4474	2329	3696	5691	1914	2419	4364	4275	3413	4277	6246
AR	6844	2858	6682	5536	2890	2875	5691	3895	1496	5495	1723	4768	2725	3286	5273	1656	2487	4121	4346	3278	4541	5903
AS	7800	3530	7634	6404	3647	3703	6626	2985	1857	6413	945	3822	2349	4209	6171	1840	2985	5025	4816	4069	4579	6863
AT	8676	4372	8517	7296	4516	4591	7519	2350	2636	7309	1027	3058	2055	5104	7067	2542	3427	5784	5153	4719	4527	7716
AU	9496	5037	9331	8044	5220	5331	8316	1680	3263	8094	1423	2257	2404	5896	7836	3106	4160	6610	5808	5519	4933	8545
AV	10066	4961	9834	8138	5281	5539	8705	880	3340	8399	1916	1860	4393	6349	8056	3036	5783	7737	7566	6883	6916	9288
AW	11130	6495	10958	9586	6725	6878	9924	1317	4722	9685	2857	929	3558	7501	9408	4506	5668	8240	7177	7108	5951	10190
AX	12821	8292	12666	11367	8515	8655	11661	2933	6517	11438	4647	1997	4661	9241	11174	6306	7002	9769	8279	8545	6698	11837
AY	13045	8590	12898	11643	8802	8930	11909	3290	6812	11695	4939	2369	4753	9493	11440	6609	7126	9937	8337	8690	6686	12044
AZ	13128	8638	12978	11703	8856	8990	11982	3292	6862	11764	4990	2347	4872	9564	11505	6654	7238	10038	8463	8797	6822	12133
BA	12902	8322	12742	11412	8554	8702	11727	2899	6551	11498	4685	1929	4810	9306	11228	6332	7137	9881	8437	8670	6877	11928
BB	11455	6672	11267	9805	6930	7113	10207	1161	4921	9950	3097	381	4110	7789	9654	4677	6167	8665	7714	7570	6518	10547
BC	11750	7866	11650	10695	7989	8025	10763	3647	6134	10610	4369	3195	3057	8410	10417	6021	5467	8410	6464	7082	4697	10669
BD	11344	7606	11254	10367	7706	7719	10391	3748	5903	10251	4202	3427	2605	8061	10073	5814	5005	7965	5966	6626	4198	10249
BE	11677	8054	11598	10773	8143	8143	10761	4208	6364	10634	4683	3830	2903	8454	10468	6283	5263	8246	6092	6887	4218	10565
BF	7265	2700	7069	5675	2854	2962	6005	3319	995	5758	1116	4269	3157	3586	5481	1003	3301	4815	5161	4069	5226	6409
BG	7418	4563	7350	6744	4487	4341	6568	4631	3383	6486	2950	5221	1359	4390	6377	3528	1197	4026	2857	2732	2655	6304
BH	6669	7405	6849	7740	7084	6706	6811	9227	7174	7026	7450	9755	5397	6023	7223	7447	3520	3550	1762	3015	3519	5516
BI	6962	3720	6857	6048	3665	3549	5988	4351	2542	5863	2402	5081	1965	3703	5714	2708	1535	3808	3385	2693	3496	5909
BJ	5018	3155	4940	4486	2879	2556	4174	6091	3026	4125	3931	6924	3766	2199	4069	3337	1780	1915	3091	1287	4317	3938
BK	2001	5104	1683	1929	4791	4589	1789	10699	6788	1848	8614	11717	9647	4043	2058	7057	7669	5095	8295	6336	10085	2949
BL	4258	4902	3893	2459	4762	4769	3398	10386	6675	3133	8542	11428	10252	4703	2955	6860	8669	6631	9687	7633	11205	4964
BM	3796	5810	3490	2899	5601	5527	3402	11395	7585	3289	9457	12435	10909	5252	3286	7802	9125	6765	9933	7919	11613	4744
BN	1598	6176	1959	4103	5747	5347	2816	10946	7292	3251	8738	11843	8575	4370	3693	7625	6202	3215	6020	4583	8109	1361
BO	1936	7006	2323	4646	6582	6197	3405	11898	8204	3847	9689	12804	9545	5240	4303	8534	7165	4185	6901	5543	9011	2213
BP	11775	8873	11755	11274	8881	8799	11060	5844	7328	11002	5884	5570	3308	8920	10906	7319	5227	8174	5496	6778	3383	10601
BQ	11726	9081	11725	11362	9063	8955	11082	6347	7598	11047	6245	6117	3508	9012	10975	7612	5208	8095	5275	6704	3138	10538
BR	11272	8642	11269	10903	8618	8504	10622	6091	7179	10587	5871	5928	3075	8554	10516	7202	4749	7644	4862	6252	2731	10086
BS	10760	8715	10796	10678	8631	8459	10260	6934	7422	10274	6366	6901	3369	8367	10254	7499	4415	7106	4086	5750	1998	9554
BT	11318	9510	11376	11375	9412	9225	10898	7739	8251	10935	7212	7660	4213	9087	10938	8334	5118	7673	4547	6353	2602	10106

	WTG																					
NSA	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
A	11965	7310	3410	4734	8995	10543	5505	4187	11036	7207	5683	8720	7636	10707	11835	10945	11065	7033	6963	9341	3548	6091
B	11347	7297	3127	4271	9171	10349	4768	4786	10455	6571	5134	8985	7251	10231	11271	10420	10798	7221	6399	8639	2215	6113
C	11078	7215	3050	4101	9130	10197	4507	4912	10199	6319	4923	8971	7065	10003	11016	10179	10624	7197	6169	8357	1814	6054
D	11299	7615	3472	4448	9553	10540	4761	5406	10437	6573	5227	9408	7383	10274	11256	10434	10948	7632	6447	8567	1899	6471
E	8542	4260	180	1311	6190	7302	2174	2643	7615	3790	2262	6059	4259	7306	8416	7532	7769	4282	3540	5930	2255	3108
F	8616	4055	304	1447	5924	7194	2448	2161	7678	3927	2399	5758	4247	7322	8467	7570	7693	3984	3641	6064	2704	2863
G	10118	4737	2634	3574	6062	8036	4664	1132	9164	5796	4396	5702	5666	8657	9891	8973	8648	4191	5442	7829	4702	3611
H	11014	5780	2916	4111	7186	9087	5148	2239	10061	6511	5024	6835	6552	9598	10812	9896	9681	5292	6184	8610	4483	4611
I	12418	7373	3956	5278	8849	10673	6198	3902	11472	7764	6234	8505	7986	11063	12246	11338	11247	6937	7474	9901	4697	6177
J	12666	7546	4253	5564	8962	10851	6505	4018	11717	8042	6516	8601	8221	11292	12485	11574	11436	7073	7743	10174	5062	6361
K	13191	8069	4755	6073	9467	11376	7000	4529	12242	8555	7028	9099	8748	11819	13011	12100	11962	7587	8261	10690	5433	6887
L	12416	6995	4504	5676	8140	10272	6726	3382	11462	8029	6570	7720	7962	10953	12189	11271	10900	6373	7689	10098	5931	5901
M	10720	5160	3731	4571	6156	8377	5666	1705	9772	6638	5325	5723	6333	9205	10459	9547	9024	4457	6266	8585	5809	4170
N	9637	4038	4668	4946	4400	6890	5942	2231	8730	6315	5380	3895	5600	8060	9316	8440	7575	3144	5927	7925	7056	3490
O	9833	4297	5185	5431	4423	6984	6409	2751	8943	6701	5828	3894	5918	8250	9497	8637	7676	3378	6314	8232	7575	3865
P	10015	4488	5343	5613	4574	7149	6597	2898	9127	6898	6020	4040	6114	8431	9677	8820	7841	3568	6511	8427	7725	4062
Q	9158	3635	4902	5000	3780	6320	5931	2569	8269	6107	5318	3261	5278	7575	8822	7963	7010	2712	5723	7584	7321	3276
R	8633	3160	4876	4827	3231	5772	5699	2690	7751	5734	5053	2715	4838	7049	8292	7439	6462	2231	5354	7125	7299	2931
S	9098	3698	5354	5371	3559	6159	6261	3065	8231	6306	5621	3018	5392	7514	8747	7909	6852	2770	5927	7666	7776	3506
T	9392	3895	5135	5265	3951	6518	6203	2767	8509	6385	5594	3420	5547	7808	9052	8198	7210	2969	6001	7850	7549	3554
U	8136	2744	2243	2344	4268	6051	3364	941	7184	4040	2863	3998	3711	6657	7897	6980	6651	2313	3661	5952	4662	1603
V	8350	3189	1592	1945	4858	6477	3027	1048	7396	3994	2646	4621	3888	6924	8140	7223	7047	2892	3636	6021	4016	1980
W	7808	2181	3356	3192	3284	5366	4072	1665	6875	4284	3446	2946	3599	6259	7521	6618	6013	1450	3896	5925	5756	1456
X	8174	2539	3592	3547	3432	5645	4461	1616	7247	4711	3850	3040	4012	6616	7878	6981	6305	1733	4323	6339	6011	1882
Y	7450	1971	2726	2430	3519	5275	3301	1655	6502	3615	2683	3286	3088	5944	7194	6280	5881	1554	3227	5387	5080	902
Z	7288	1652	3620	3244	2755	4801	4012	2201	6362	3986	3336	2456	3176	5729	6991	6094	5450	884	3604	5498	5967	1176
AA	7522	2148	4776	4422	2186	4666	5144	3023	6647	4888	4446	1717	3871	5938	7178	6330	5354	1242	4525	6107	7144	2248
AB	6595	2042	5702	5077	901	3525	5577	4276	5788	4866	4849	374	3641	5029	6217	5433	4219	1563	4557	5615	7953	2798
AC	7346	2821	6165	5679	1571	4194	6268	4451	6567	5668	5545	1039	4465	5797	6956	6202	4879	2186	5347	6452	8492	3409
AD	6903	2868	6533	5934	1184	3693	6428	4972	6166	5649	5700	795	4389	5383	6501	5788	4366	2417	5356	6220	8804	3654
AE	6235	1788	5628	4926	632	3193	5366	4355	5423	4569	4638	321	3323	4665	5859	5069	3887	1467	4272	5257	7829	2667
AF	6407	2575	6434	5745	711	3203	6167	5046	5669	5283	5440	500	4001	4886	6006	5291	3880	2274	5007	5758	8647	3485
AG	5909	2319	6339	5560	290	2721	5903	5134	5168	4911	5181	575	3611	4385	5510	4790	3404	2200	4655	5285	8482	3346
AH	5835	1801	5823	5036	263	2762	5391	4693	5040	4455	4668	495	3171	4274	5453	4679	3456	1704	4184	4978	7958	2826
AI	5726	1899	5958	5149	137	2623	5477	4857	4944	4492	4757	587	3198	4173	5339	4579	3317	1856	4232	4941	8074	2957
AJ	5287	1823	5973	5083	514	2212	5325	5049	4504	4223	4616	1027	2914	3733	4902	4138	2906	1995	3988	4544	8011	2975

To be continued on next page...

Project:
450mw Solar and wind

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Calculated:
07-01-2022 12:07/3.4.388

DECIBEL - Main Result

Calculation: 105MW Wind Jaisalmer

...continued from previous page

	WTG																					
NSA	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
AK	5638	984	5075	4235	1051	2850	4572	4172	4774	3689	3849	1167	2438	4054	5291	4448	3523	1112	3400	4428	7162	2072
AL	5850	859	4852	4055	1236	3113	4446	3901	4973	3666	3719	1240	2456	4265	5511	4656	3782	841	3357	4536	6975	1850
AM	8145	4450	1064	1190	6460	7248	1581	3471	7247	3363	1937	6402	4087	7023	8061	7209	7651	4650	3189	5457	1748	3418
AN	7684	4283	1483	1067	6313	6927	1106	3763	6797	2915	1580	6299	3738	6604	7614	6775	7299	4584	2774	4980	1963	3345
AO	6232	2686	2329	999	4713	5210	913	3567	5305	1521	185	4771	2036	5015	6108	5228	5601	3180	1235	3654	3685	2020
AP	5453	1961	3152	1877	3924	4265	1747	3874	4508	1122	1088	4053	1106	4150	5292	4393	4664	2648	733	3032	4626	1721
AQ	5304	1838	3324	2060	3773	4076	1927	3959	4356	1125	1277	3920	923	3982	5135	4232	4476	2568	747	2929	4816	1717
AR	5623	2153	2954	1660	4138	4503	1511	3811	4684	1130	848	4251	1332	4350	5475	4582	4896	2793	753	3145	4386	1790
AS	4667	2120	3912	2606	3857	3716	2230	4617	3725	768	1714	4091	565	3399	4515	3624	4040	2967	569	2268	5200	2297
AT	3852	2211	4785	3493	3534	2903	3104	5272	2900	1416	2610	3873	621	2516	3668	2763	3171	3137	1403	1762	6080	2803
AU	3024	2818	5606	4302	3739	2459	3829	6072	2070	2043	3395	4161	1439	1705	2836	1932	2572	3740	2137	1309	6798	3573
AV	2779	4649	6324	5001	5759	4148	4139	7426	2170	2545	4050	6176	2970	2540	2895	2406	3981	5574	2887	713	6807	5112
AW	1420	4221	7244	5930	4529	2262	5375	7659	497	3562	5005	5044	3075	397	1190	300	1902	5092	3726	1793	8307	5136
AX	1332	5496	8931	7641	5167	2526	7150	9084	1641	5340	6740	5720	4696	1641	985	1505	1839	6259	5476	3556	10097	6567
AY	1695	5617	9158	7881	5150	2517	7426	9223	1997	5621	6993	5703	4917	1915	1359	1830	1823	6346	5740	3894	10384	6719
AZ	1629	5730	9239	7957	5286	2651	7486	9332	2000	5678	7064	5839	5000	1972	1320	1859	1957	6466	5805	3914	10438	6825
BA	1195	5633	9011	7714	5348	2708	7199	9211	1615	5386	6805	5901	4785	1710	892	1529	2025	6408	5534	3550	10135	6690
BB	978	4743	7583	6255	5098	2786	5622	8123	154	3819	5312	5613	3495	906	909	540	2354	5627	4028	1836	8505	5611
BC	3087	3992	7935	6769	3163	690	6572	7587	2676	4908	6000	3713	3842	1979	2651	2282	474	4579	4891	3891	9531	5186
BD	3435	3547	7557	6423	2663	377	6292	7124	2913	4689	5691	3214	3550	2157	3005	2509	762	4100	4636	3892	9230	4754
BE	3753	3847	7924	6821	2708	864	6731	7370	3312	5156	6116	3243	3991	2582	3318	2912	1102	4318	5090	4375	9654	5064
BF	5171	2775	3431	2095	4647	4557	1458	4591	4264	397	1136	4833	1425	4057	5078	4227	4843	3519	295	2538	4429	2599
BG	5891	425	3749	2868	2415	3699	3266	3263	4953	2718	2538	2421	1744	4359	5617	4708	4286	941	2363	4055	5794	803
BH	10332	4752	5205	5589	4986	7529	6608	2743	9432	7035	6067	4460	6326	8752	10005	9135	8218	3848	6646	8650	7548	4213
BI	5845	1193	3151	2108	3227	4107	2411	3247	4891	2017	1684	3272	1405	4404	5624	4706	4615	1740	1635	3684	5030	839
BJ	7740	2836	1422	1307	4680	6047	2358	1728	6788	3300	1943	4520	3284	6352	7549	6636	6581	2744	2948	5352	3758	1629
BK	12648	8750	4579	5684	10626	11777	6088	6160	11776	7902	6513	10435	8654	11592	12595	11763	12211	8674	7758	9920	3266	7569
BL	12370	9450	5477	6189	11453	12115	6178	7607	11589	7896	6787	11369	8918	11562	12398	11656	12438	9598	7865	9654	3266	8387
BM	13377	10058	5938	6845	12013	12897	7005	7805	12564	8782	7551	11875	9709	12482	13379	12603	13266	10099	8708	10644	4028	8930
BN	12691	7633	4228	5551	9090	10935	6467	4142	11745	8037	6507	8740	8258	11334	12519	11609	11511	7186	7747	10174	4915	6439
BO	13657	8604	5162	6493	10033	11908	7381	5089	12712	8984	7451	9671	9229	12307	13488	12580	12486	8142	8701	11123	5614	7413
BP	5522	4115	8268	7363	2245	2433	7525	7179	5055	6207	6836	2588	4917	4299	5087	4652	2863	4207	6044	5886	10287	5266
BQ	6097	4231	8325	7496	2243	2960	7738	7071	5604	6517	7033	2470	5210	4839	5661	5201	3428	4194	6326	6346	10424	5325
BR	5976	3778	7865	7042	1783	2764	7300	6626	5424	6116	6592	2020	4805	4645	5544	5021	3299	3734	5914	6044	9970	4865
BS	7044	3816	7614	6974	1856	3786	7408	6045	6414	6482	6681	1732	5184	5624	6620	6017	4388	3475	6221	6774	9864	4703
BT	7750	4631	8315	7740	2700	4512	8215	6600	7164	7325	7487	2533	6029	6378	7320	6764	5075	4222	7059	7603	10606	5460

	WTG					
NSA	45	46	47	48	49	50
A	4256	9119	7228	2425	8979	6295
B	3861	8479	7925	1931	8386	7250
C	3723	8215	8042	1873	8134	7449
D	4098	8448	8532	2321	8382	7951
E	841	5697	5503	1130	5556	5334
F	961	5803	5064	1340	5641	4855
G	3167	7495	3960	2938	7275	3097
H	3645	8305	5049	2737	8106	4029
I	4788	9633	6676	3265	9460	5531
J	5076	9897	6681	3608	9718	5474
K	5584	10417	7125	4057	10240	5867
L	5218	9774	5532	4247	9561	4173
M	4201	8224	3559	4038	7984	2346
N	4760	7515	1418	5420	7238	541
O	5259	7816	1267	5939	7533	310
P	5434	8010	1396	6075	7727	272
Q	4878	7165	744	5759	6880	945
R	4756	6701	461	5815	6414	1494
S	5280	7241	365	6243	6951	1228
T	5133	7429	802	5966	7144	776
U	2171	5592	3097	3253	5354	3133
V	1665	5690	3747	2578	5475	3631
W	3144	5524	2071	4400	5255	2565
X	3459	5935	1753	4576	5663	2138
Y	2414	5005	2836	3840	4751	3266
Z	3281	5088	2129	4727	4810	2934
AA	4465	5678	1266	5849	5386	2602
AB	5234	5184	2292	6847	4890	3822
AC	5783	6022	1880	7265	5727	3455
AD	6084	5796	2521	7664	5506	4096

To be continued on next page...

Project:
450mw Solar and wind

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Lala Ram / lala.ram@arcadis.com
Calculated:
07-01-2022 12:07/3.4.388

DECIBEL - Main Result

Calculation: 105MW Wind Jaisalmer

...continued from previous page

	WTG					
NSA	45	46	47	48	49	50
AE	5114	4827	2605	6791	4532	4105
AF	5932	5337	2853	7590	5049	4422
AG	5783	4867	3209	7513	4581	4758
AH	5261	4552	3039	7001	4260	4539
AI	5384	4518	3187	7138	4229	4695
AJ	5352	4125	3585	7164	3839	5068
AK	4478	3996	3117	6263	3700	4476
AL	4278	4104	2924	6036	3808	4244
AM	991	5278	6166	1521	5176	6135
AN	1099	4817	6282	2037	4730	6375
AO	1480	3398	5286	3388	3248	5777
AP	2321	2707	4989	4271	2507	5728
AQ	2498	2589	4947	4451	2378	5735
AR	2115	2842	5084	4058	2658	5762
AS	3070	1925	5418	5003	1718	6303
AT	3950	1344	5613	5891	1066	6674
AU	4766	895	6175	6698	624	7334
AV	5490	1142	8051	7222	1437	9078
AW	6401	1736	7394	8319	1754	8690
AX	8098	3536	8302	10039	3548	9736
AY	8331	3852	8314	10279	3847	9774
AZ	8410	3889	8447	10355	3894	9904
BA	8175	3554	8473	10111	3583	9900
BB	6734	1912	7951	8625	2012	9231
BC	7165	3636	6352	9113	3478	7850
BD	6804	3592	5851	8742	3400	7349
BE	7189	4079	5895	9114	3889	7425
BF	2585	2309	5875	4427	2193	6585
BG	3118	3641	3388	4943	3362	4377
BH	5371	8239	1843	5859	7961	269
BI	2427	3306	4063	4341	3057	4854
BJ	1141	5033	4068	2582	4829	4174
BK	5293	9790	9290	3383	9715	8510
BL	5942	9626	10707	4435	9622	10189
BM	6529	10582	10942	4788	10554	10251
BN	5061	9906	6869	3518	9733	5688
BO	6003	10862	7710	4370	10694	6447
BP	7645	5535	5023	9457	5299	6598
BQ	7746	5979	4713	9504	5731	6280
BR	7289	5665	4342	9044	5408	5916
BS	7145	6367	3397	8751	6089	4937
BT	7887	7199	3728	9429	6923	5179

APPENDIX K: DO'S AND DON'T'S FOR WILDLIFE

DOs

- The developer should intimate the District Forest Officer about the project activity prior to the starting of the project.
- Awareness programs should be conducted for all contractors and their workers regarding the presence of the species in the region and their conservation status.
- The presence of the Indian Blue Bull, Indian Dessert Fox need to be managed both during the construction and operation phase of the project
- The movement of vehicles through access road (day and nighttime) needs to be monitored constantly for presence of Chinkara herds in and around the road.
- Signage's showing the Indian Blue Bull should be placed within the project site and near to the approach roads for generating awareness amongst the vehicle drivers and labors.
- Signages prohibiting the hunting or killing of the Indian Blue Bull should also be placed in and around the project site.
- The construction area location needs to be temporally barricaded to prevent the grazing animals from entering the area while the work is on.
- If pits are dug on the ground for any project activity it should be suitably barricaded and closed permanently after construction so that the animals are prevented from falling in the pit.
- If the construction site is close to any water pit or water channel then special precautions should be taken to keep the Indian Blue Bull away from the construction site as they may visit the water source for drinking.
- The area around the construction site should not be used for any other purposes other than the work specified both during and operation phase of the project.
- The equipment with associated facilities like generator, cables and transformer should be properly fenced to prevent accidental electrocution of the Nilgai and Chinkara.
- About 50 m around the project site should be kept free of grasses and shrubs to keep the grazing animals away from nearing the project boundary.
- During operation phase the security guards should be periodically trained regarding the management of the Indian Blue Bull.
- Record should be maintained about the presence of the Indian Blue Bull, Indian Dessert Fox in and around the project area in all seasons during operation phase.

Don'ts

- Hunting or killing of wild animals is totally prohibited under Wildlife Protection Act
- No construction activity should start without an awareness program regarding the presence of the Indian Blue Bull and their management.
- The workers should not be allowed to throw stones or wood or any other weapon to ward off the Indian Blue Bull from the site.
- DG sets without acoustic cover should not be used during project construction phase.
- No pits should be left uncovered near the project boundary or within the project site during construction and operation phase of the project.
- Fencing of the area should be properly insulated so that electrocution can be avoided.
- No electric cables should be loosely hanged or left above the ground during operation phase of the project.
- Construction activity should preferably continue during daytime and should not be allowed during night time.

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