



Environment and Social Impact Assessment Report: 600 MW Hybrid Power Project in Jaisalmer, Rajasthan

Executive Summary

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EXECUTIVE SUMMARY

E.1 Project Background

Environmental Resource Management India Private Limited (hereinafter referred as ERM) has been commissioned by Adani Green Energy Limited (hereinafter referred as 'AGEL' or 'Client'), a subsidiary of the Adani Group. ERM is to undertake an Environmental and Social Impact Assessment (ESIA) study of a greenfield 600 MW AC hybrid, Wind (151.2 MW) and Solar (2*300 MW) power project (hereinafter referred as the "project"). The proposed 600 MW hybrid power project is being set up in Jaisalmer district of Rajasthan, India; the same is scheduled for Commissioning in July 2021. The project operates under two (02) SPV's M/s Adani Green Energy Seven Limited (AGE7L) & M/s Adani Green Energy Nine Limited (AGE9L), 100% subsidiaries company of M/s Adani Renewable Energy Park (Gujarat) Limited, which further is a subsidiary of AGEL.

AGEL is currently exploring for fund from international lenders, and this ESIA is prepared to help meet the requirement in terms of providing the lenders, an assessment of the project against international standards.

This report discusses the environmental and social baseline within which the proposed hybrid power project is commissioned and assesses the potential adverse and beneficial impacts that the project could have, along with suitable mitigation measures and an Environmental and Social Management Plan (ESMP) for the project.

E.2 Project Overview

The proposed 600 MW Solar-Wind Hybrid Power Project is located on land ranging from flat to undulating private shrub/waste land, agricultural land and gravel land across 18 villages in Fatehgarh and Pokhran Taluka of Jaisalmer District in the state of Rajasthan. Elevation at project site ranges from 235 m to 330 m above mean sea level.

As observed during ERM site visit, two small rivers (Sukri Nadi and Ghughri Nadi) were observed to traverse through the project area, small rivulets emerging from them are also present which eventually gets lost in sand dunes in their flow path. Multiple small dendritic and semi dendritic channels were also found to be present within the project area. Based on consultation with local community, it is understood that the water channel remains dry throughout the year and only gets water when there is heavy rain in the area, whereas for the ghughri nadi and sukri nadi they are ephemeral in nature. Additionally, in the project area it was observed that multiple small water ponds were observed within the agricultural fields, which were constructed by the owners of the field.

The proposed Project and associated facilities does not fall within 10 km of any Protected Areas such as National Parks, Wildlife Sanctuaries, etc. The nearest Protected Area and Important Bird Area (IBA) is Dessert National Park located at about 60 km west of the site. However, the Project is located in close proximity of the Great Indian Bustard (GIB) habitat known as GIB Arc and the boundary of its proposed Eco sensitive Zone. Rasla enclosures (1 and 2) are situated inside the Study area at approximately 2.8 km north of WTG FTN-266 and about 9.2 km southwest of the solar park boundary. While Guddi enclosure is located at about 15 km east of WTGs FAT-068 and FAT-639.

The project will use the existing gram panchayat road as approach road for the project. The gram panchayat road gets connected to National Highway (NH)-15 which crosses from within the project area. Nearest railway station is the Jaisalmer Railway Station located at an approximate aerial distance of 60 km from the project area. Nearest airport to the site is Jaisalmer Airport, located at an approximate aerial distance of 70 km from the study area.

The total land requirement for the Project is estimated at 2160 acre of land, out of which 1500 acre is for solar plant and 276 acre for WTGs, at 6 acres/WTGs, 286.6 acre for external transmission line and the remaining 98 acres of land is for internal & external access road, and internal transmission line.

The Project will have 72 operating WTGs with a capacity of 2.2 MW each.

E.3 Applicable Reference Framework

The applicable reference framework for undertaking the assignment comprised of the following:

- Applicable local and national environmental and social regulations (including that of the state nodal agency for renewable energy development);
- Position Statements of the Standard Chartered Bank (<https://www.sc.com/en/sustainability/position-statements/our-framework/>);
- IFC Performance Standards on Environmental and Social Sustainability (2012);
- IFC/World Bank EHS General Guidelines;
- IFC/World Bank EHS Guidelines for Power Transmission and Distribution (2007);
- The Equator Principles, 2020; and
- IFC’s Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.

E.3.1 Applicability to IFC Performance Standards

The following IFC Performance Standards are applicable to the Project:

Description	Applicability	Objectives and Applicability to Project
IFC PS 1 - Assessment and Management of Environmental and Social Risks and Impacts	☒	<p>This PS aims to assesses the existing social and environmental management systems of AREPGL, AGE(7)L & AGE(9)L and to identify the gaps with respect to their functioning, existence and implementation of an environmental and social management plan (ESMP), a defined EHS Policy, organization chart with defined roles and responsibilities, risk identification and management procedures as well as processes like stakeholder engagement and grievance management.</p> <p>This ESIA is being conducted as part of the “identification of risks and impacts” requirement under the IFC PS 1. The management plan prescribed in this ESIA report will be implemented for mitigation of impacts identified.</p> <p>The developer, at the corporate level, has also established an Environmental and Social Management System, that will be implemented in conjunction with the management plan presented in this report.</p>
IFC PS 2 - Labour and Working Conditions	☒	<p>This PS is guided by a number of international conventions and instruments on labour and workers’ rights. It recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. The PS covers following themes: human resource policy and management, workers’ organization, non-discrimination and equal opportunity, retrenchment, protecting the workforce and occupational health and safety. This PS helps to assess the status of the employees and workers in AGE(7)L & AGE(9)L as well as any contractors.</p> <p>The project activities will involve hiring of skilled, semi-skilled and unskilled labourers for both solar sites and wind sites during the construction phase. The project will have to develop a human resource policy and ensure non-discrimination and equal</p>

Description	Applicability	Objectives and Applicability to Project
<p>IFC PS 3 - Resource Efficiency and Pollution Prevention</p>	<input checked="" type="checkbox"/>	<p>opportunity, protection of the workforce and occupational health and safety. Therefore, PS 2 is applicable to the Project.</p> <p>PS-3 covers the use resources and materials as inputs and wastes that could affect human health. The objective of PS-3 are: to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; to promote more sustainable use of resources, including energy and water, and to reduce project related GHG emissions. Key themes covered under PS-3 are: pollution prevention, resource conservation and energy efficiency, wastes, hazardous materials, emergency preparedness and response, greenhouse emissions, pesticide use and management. This PS will assess how HPD intends to minimize pollution related impacts, what management plans and systems are in place, and what measures it plans to take to conserve and use resources more efficiently.</p> <p>The Project construction activities will lead to increased fugitive dust emissions, especially in the area it is being developed due to the presence of loose sandy soil and limited vegetation. The project activities will also lead to increase in ambient noise level during the construction phase and operation of wind turbines, which may impact the villages or sensitive receptors (identified) in the study area. In addition to this, the project activities will involve generation of waste and may involve abstraction of groundwater. Furthermore, Project will use water during construction phase for civil work and solar module cleaning during operation phase which may pose potential stress on existing common water resources such as water ponds/groundwater/canals etc. Therefore, PS 3 is applicable to the Project.</p>
<p>IFC PS 4 - Community Health, Safety and Security</p>		<p>This PS-4 requires due diligence to anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances. It also requires to ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected Communities. Key areas of compliance screened under PS-4 includes: infrastructure/equipment safety, hazardous material safety, natural resource issues, exposure to disease, emergency preparedness and response, and security personnel requirements. The project would affect the health and safety of the communities adjacent to it during construction phase.</p> <p>The Project activities will involve upgradation of village roads connecting the site and construction activities will lead to stress on the Project access road and on the area in general. Transportation of equipment and increased traffic in the area may lead to accidents and other threats on community health and safety. Furthermore, the Project may pose stress on common water resources such as IGNP canals, water ponds and groundwater due to use of significant amount of water during</p>

Description	Applicability	Objectives and Applicability to Project
<p>IFC PS 5 - Land Acquisition and Involuntary Resettlement</p>	<input type="checkbox"/>	<p>construction and operation phase. Therefore PS 4 is applicable to the project.</p> <p>Not Applicable</p> <p>PS-5 requires project proponents to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use. The key themes covered under this are: compensation and benefits for displaced persons, consultation and grievance mechanism, resettlement planning and implementation, physical displacement, economic displacement. The PS-5 also prescribes private sector responsibility to supplement government actions and bridge the gap between governments assigned entitlements and procedures and the requirements of PS-5.</p> <p>All the land parcels identified/procured are private land procured/ to be procured on lease and the consultation has been done with land owners to take their consent before finalising the lease. The following condition has been fulfilled:</p> <ul style="list-style-type: none"> ■ Land markets for the land is available in the area; ■ The lease agreement took place with the land owner's informed consent; and ■ The lease rent is approximately 35 percent of the prevailing circle rate, as reported by local community; the same agreed by land owners prior to initiating the land leasing process <p>Furthermore, the project has not led to resettlement, physical displacement and economic displacement. Therefore, PS 5 is not applicable to the project.</p>
<p>IFC PS 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources</p>	<input checked="" type="checkbox"/>	<p>PS 6 aims to protect and conserve biodiversity; to maintain the benefits from ecosystem services; and to promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.</p> <p>Project area does not fall within Wildlife Institute of Indian (WII) identified GIB Priority Area. However, the project site is a part of larger landscape identified as GIB Potential Area by WII.</p> <p>The Project being in the close proximity of IUCN Critically Endangered (CR) Great Indian Bustard and Vulture and their habitat and area of good turnover of migratory birds, has possibility to affect these avifaunal species, hence the PS-6 is applicable</p>
<p>IFC PS 7 - Indigenous Peoples</p>	<input type="checkbox"/>	<p>Not Applicable</p> <p>This Performance Standard applies to communities or groups of Indigenous Peoples who maintain a collective attachment, i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. PS-7 endeavour to ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. Key</p>

Description	Applicability	Objectives and Applicability to Project
		<p>themes covered under PS-7 are: avoidance of adverse impacts, consultation and informed participation, impacts on traditional or customary lands under use, relocation of IPs from traditional or customary lands, and cultural resources.</p> <p>As confirmed during community consultations, interview with Patwari and consultation with the Project team, no indigenous peoples will be affected by the project activities and no ST land will be purchased.</p> <p>As per the discussion with project team and the local community, all the land procured for the solar plant and for WTGs is private land and there is no common property resource in the procured land parcels.</p> <p>The project does not envisage adverse impacts on communities of Indigenous peoples. Therefore, PS 7 is not applicable to the project.</p>
<p>IFC PS 8 - Cultural Heritage</p>	<input type="checkbox"/>	<p>Not Applicable</p> <p>For the purposes of PS-8, cultural heritage refers to (i) tangible forms of cultural heritage; (ii) unique natural features or tangible objects that embody cultural values; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes. The requirements of PS-8 apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed.</p> <p>As confirmed during ERM site visit, no cultural heritage will be affected by the project activities. Therefore, PS 8 is not applicable to the project.</p>

E.3.2 Project Categorisation and Justification

The Project has been assessed as **Category A**. The selection of **Category A** is based on the following reasoning:

- The potential habitats for IUCN v2020-2 categorized Critically Endangered (CR) species such as Great Indian Bustard (GIB) (*Ardeotis nigriceps*), White-rumped Vulture (*Gypes bengalensis*), Indian Vulture (*Gyps indicus*) and Red-headed Vulture (*Sarcogyps calvus*) are likely to be present within and in the areas adjacent to the Project site. The GIB Arc, an area with majority of the movement and records of the GIB, is situated immediate vicinity of the Project site. The proposed ESZ of this arc is located at about 5.9 km east of WTG NEW-006. Also a GIB enclosure, which is a GIB Conservation Priority Area and a part of Desert National Park, is situated within the Study area. The consultations with locals confirmed that the movement of two pairs of GIB in this enclosure on annual basis. Also, since the GIB enclosures are located on either sides of the Project site, there is a possibility of inter-enclosure movement of the bird through the Project site.
- Similarly, three Critically Endangered Vulture species have been reported from the landscape of the Project site including Desert National Park (IBA). Consultations confirmed a regular movement and presence of CR Vulture species in larger number near Bhadariya, 20 km north of Project site. Endangered Egyptian Vultures (*Neophron percnopterus*) were also observed inside the Project area and areas along the route of 220 kV transmission line. The Vultures can fly great distances in search of food and thus their movement in the Project area and the areas along the 220 kV transmission line stretch cannot be ruled out

- The impacts of the wind farm development on all these species in this area are likely to be irreversible. Any planned mitigation can only be suggested based on the long term habitat and species monitoring in the wind farm and solar park and surrounding areas. A detailed Critical Habitat Assessment supported by long term bird and bat monitoring of wind farm along with the transmission line alignment is required to ascertain what level of mitigation measures will be required. The impacts anticipated to the biodiversity specifically bird and bats will likely be adverse (resulting in loss of population of species), irreversible (to the already threatened population of vultures and GIBs) from operating wind turbine blades (collision risk) and the electrical transmission infrastructure (electrocution and collision risk).
- **Unprecedented:** Development of solar power projects and wind farms is occurring in large numbers in the last decade and therefore several such projects are located across India. The proposed Project and its surrounding areas consist of a number of upcoming and operational wind and solar projects (Refer **Section 2.1.1**). Hence, the proposed 600 MW wind-solar hybrid Project can therefore not be considered an unprecedented activity.

Limited adverse impacts on the baseline: Solar and Wind based energy development Projects are less polluting source of energy and thus 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 composed of private agricultural and culturable, fallow land waste land. The site location of the project does not involve any anticipated settlements and physical displacement.

E.4 Baseline Conditions

Environmental baseline data was collected through primary surveys as well as secondary sources by literature review and discussions with the concerned stakeholders. The environmental baseline has been assessed covering an area of 5 Km zone (hereinafter referred to as the study area) from the Project boundary. Secondary baseline data collection involved identifying and collecting available published material and documents. Information on various environmental aspects like soil, geology, hydrology, drainage, ecology etc., were collected from different government department, institutions, literature etc. & stakeholder consultations held undertaken during the site visit.

ERM team undertook a site survey on from 2nd July-8th July to understand the site setting and to map environmental sensitivities in the area. The site visit included a walkover of the site with the Adani site team. The rationale of this exercise was to understand the local environmental issues in the area.

For the purpose of establishing the social baseline for the project and undertaking the social impact assessment of the project, a phased participatory approach was adopted. Through this approach an attempt was made to integrate the local understanding and perspective into the impact assessment process and identification of the mitigation measures. The purpose of such an approach was to allow for:

- The triangulation of the information available from secondary sources through the information made available by the local community, both qualitative and quantitative;
- Formulation of the socio-economic baseline on the basis of a combination of primary and secondary qualitative and quantitative data; and
- An understanding to be developed of the local community's perception of the project and its activities and the possible impacts from the same and the desirable mitigation measures.

E.4.1 Environmental Baseline

Climate and Meteorology:

As per the information provided by CGWB in the groundwater brochure for Jaisalmer district (2013), the district experiences arid type of climate. Mean annual rainfall in the district from 2001-2011 has been recorded to be 205.73 mm. Almost 90% of the total annual rainfall was received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September. Additionally, mean annual rainfall from 2001-2011 as per Fatehgarh weather station and

Pokhran weather station where the proposed site fall was recorded to be 280.14 mm 259.25 mm respectively.

M/s. Avon Food Labs Private Limited, an NABL accredited laboratory, was engaged for collection of baseline information on groundwater quality, surface water quality and soil quality. The primary baseline data was collected between 26th June and 27th June 2020. Furthermore, M/s Netel India Private Limited, an NABL accredited laboratory, was engaged for collection of baseline information on ambient air quality and ambient noise quality from 19th-26th August 2020.

Secondary baseline data collection involved identifying and collecting existing published materials and documents. Information on various environment aspects (like geology, hydrology, drainage pattern, ecology etc.), meteorology and socio economic aspects were collected from different institutions, government websites and literatures etc.

Topography:

The project is proposed on terrain with base elevations ranging from 219-338m above mean sea level. The solar plants of 2*300MW are proposed to be located at an elevation of 219-255 amsl. Similarly, majority of the WTG locations are finalised at an elevation ranging between 267-338 amsl. Analysis of digital elevation map for Project shows a trend in elevations increasing towards south with flat to minor undulating terrain with increasing elevations within the Project Aol. These minor undulating terrain can be categorised due to presence of sand dunes in the area.

Geology:

As per Hydrogeological Atlas of Jaisalmer district, Rajasthan (2013), the major part of the district is covered by Alluvium and wind-blown sand. The basement rocks are the metamorphites granites and rhyolites that are unconformably overlaid by dolomitic limestone, shale and sandstone of the Marwar Super Group. Resting over these with are the Jurassic rocks made up of the Lathi, Jaisalmer, Baisakhi and Bhadesar formation. These are followed by rocks of Parewar and Abur formation. Sumer formation consists of unconsolidated highly current bedded reddish, gluconitic sandstone and silty sandstone. Khuiala formation consists of limestone boulder bedded fossiliferous limestone and shales.

Landuse:

Based on the discussion with site representatives and observations from satellite images it is understood that the majority of the current land use of the project site is shrub/waste land followed by agricultural land, and gravel waste land which can be converted to non-agricultural land for industrial development.

Water resources:

Indira Gandhi Nahar Project (IGNP) Canal is the only surface water source for irrigation in the district. According to Indira Gandhi Nahar Department, Government of Rajasthan, the IGNP aims to irrigate the desert land of Western Rajasthan with Himalaya's water and provide drinking water to crores of inhabitants of this area. The canal originates from Harike barrage situated in Punjab. The IGNP canal enters Jaisalmer district near village Nachana and flows towards western direction.

The stage of ground water development in various blocks of Jaisalmer district varies from 60% to 206% which indicates that the scope for ground water development is already exhausted, mainly in Jaisalmer and Sankara blocks. Sankara block (where the proposed site fall) is categorised as **over-exploited** in terms of ground water development, whereas for barmer district the present stage of groundwater development in the district is 114.22%, which indicates that the scope for ground water development is already exhausted.

Soil:

As per the information provided by CGWB in the groundwater brochure for Jaisalmer district (2013), soils of the districts have been classified as Desert soil, sand dunes, red desertic soil, and Saline soil of depressions.

- **Texture:** The texture of soil samples analysed at four locations (S1, S2, S3 and S4) were found to be Sandy loam. Soil at all sampling locations comprised mostly of sand, with low concentrations of clay and silt;
- **pH:** Generally, soil pH in the range of 6.50-7.00 is considered to be best suited for growing most crops. The pH level in soil samples were observed to be 8.21 (S1), 7.58 (S2), 8.12 (S3) and 8.16 (S4) indicating slightly alkaline to moderately alkaline soil as per standard soil classification;
- **Electrical Conductivity:** EC is used to estimate the soluble salt concentration in soil, and is commonly used as a measure of salinity. The EC value of soil samples were found to be 581 $\mu\text{S/cm}$ (S1), 384 $\mu\text{S/cm}$ (S2), 680 $\mu\text{S/cm}$ (S3) and 354 $\mu\text{S/cm}$ (S4). This indicates low concentration of soluble salts in the soil;
- **Metals:** Iron, copper and zinc are important soil micronutrients considered essential for the normal growth of plants. Deficiencies of micronutrient drastically affect plant growth and metabolism. The level of iron in the soil samples were found 1647.18 mg/kg (S1), 1581.64 mg/kg (S2), 1746.90 mg/kg (S3) and 2074.78 mg/kg (S4). The level of copper in the soil samples were found below limit of quantification at all the sampling locations. The level of zinc in the soil samples were also found to be below limit of quantification except for S4 where the value was 5.18 mg/kg. Therefore, the soil is deficient of metals and micronutrients since copper and zinc (except for S4) does not occur in the soil sampling locations. Furthermore, it is to be noted that high concentration of iron in the soil has led to concentration of other metals being considerably low.

Surface water quality:

All the parameters were observed to be within permissible limit for both the sampling locations except for biological oxygen demand (BOD) for SW 2 (4.2 md/l) which exceeded the permissible limit. Increase in BOD can lead to decrease in dissolved oxygen in the water which may impact the aquatic life.

Ground water quality:

- **pH value:** pH of the groundwater samples were found to be within the range of 6.5 to 8.5;
- **Total Dissolved Solid (TDS):** TDS was observed to be above acceptable limits in GW-1 (3660 mg/l), GW-2 (4048 mg/l) and GW-3 (3224 mg/l). Since the groundwater samples were taken from an area characterised by shrub/waste land and agricultural fields and activities, mixing of soil contaminants (such as Iron) with groundwater through leaching and increase in evaporation due to irrigation activities can lead to high TDS;
- **Calcium:** Calcium content was found to be above permissible limits at GW-1 (288.6 mg/l). Hardness in most groundwater is naturally occurring from weathering of calcium bearing minerals. As can be observed in the previous paragraph, TDS in the groundwater samples was observed to be high. Therefore, high amount of calcium can be expected to occur in the groundwater. Furthermore, presence of limestone¹ also leads to high concentration of calcium in the groundwater as well once dissolved;
- **Chloride:** Chloride content was found to be above permissible limits at GW-1, GW-2 and GW-3. As can be observed in the previously, TDS in the groundwater samples was observed to be high. Therefore, high amount of chloride is bound to occur in the groundwater. Furthermore, high

¹ According to Department of Mines and Geology, Jaisalmer district is endowed with vast resources of cement grade limestone (<http://www.mines.rajasthan.gov.in/dmgcms/page?menuName=7mNDHM7a6IMXQWl3OsFRH0:455611:i3qn6G58v>)

chloride content can be attributed to presence of naturally occurring minerals in Jaisalmer district such as limestone and gypsum

- **Magnesium:** Magnesium was found to be above permissible limits in GW-1 (128.3 mg/l), GW-2 (105.9 mg/l) and GW-3 (189.5 mg/l). As can be observed in the previously, TDS in the groundwater samples was observed to be high. Therefore, high amount of magnesium can be expected to occur in the groundwater. Furthermore, presence of limestone leads to high concentration of magnesium in the groundwater as well once dissolved;
- **Sulphate:** Sulphate content was found to be above permissible limits at GW-1, GW-2 and GW-3. As can be observed in the previously, TDS in the groundwater samples was observed to be high. Therefore, high amount of sulphate can be expected to occur in the groundwater;
- **Total Hardness:** Hardness of water is considered to be an important factor to determine the portability and its domestic usage particularly for washing. Total hardness of water is correlated to the presence of bivalent metallic ions *viz.* **calcium and magnesium**. Total hardness values in the groundwater samples were found to be exceeding permissible limits at GW-1, GW-2 and GW-3 locations. Therefore, the groundwater may not be potable and/or suitable for domestic usage in these locations.
- **Zinc:** Zinc content was found be higher than permissible limit for all the locations.

Noise quality:

The equivalent ambient noise level for day time (Leq day) at all the monitoring locations were observed to be within the prescribed CPCB limits except at location NQ-4 which was exceeding the prescribed corresponding limits for a residential area during the day, and ambient noise level for night time (Leq night) at all the monitoring locations were observed to be exceeding the prescribed CPCB limits. The high noise levels during the night be attributed to high wind speeds during the period, and vehicular movement within the village and from nearby roads.

Air quality:

The analysis of results indicated that the values for PM 10, PM2.5, SO₂, NO₂, and CO were well within the permissible limit as prescribed by NAAQS. This can be attributed to low movement of vehicles in the area and no construction activities conducted in the month of August in the area.

Natural disasters:

- **Earthquake:** As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project is located in an area that is designated as Zone II that corresponds to MSK VI with nontectonic faults. This is classified as a low damage risk zone in terms of earthquake occurrence.
- **Wind/cyclone:** As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site is located in an area that experiences high wind velocities $V_b = 47$ m/s and the zone is classified as high damage risk zone for cyclones.
- **Flood:** As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site falls in an area which is not prone to flooding incidents.
- **Drought:** As per the data released by Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site is located in an area where drought frequency is once in 3 years.

E.4.2 Social Baseline

The core zone for the baseline studies is considered within 2 km radius from the project area, where most of the impacts are anticipated, and the buffer zone is the area in the 5 km radius. The core, the buffer zone and the project footprint together comprise the “Aoi” of the project, which is spread across 34 villages under three tehsils of Jaisalmer district. The concentration of villages is higher in Pokaran tehsil as compared to Fategarh.

The core zone of the AOI comprises of 18 villages while the buffer zone has 16 villages. Village wise predominant land use is as provided in the table below:

Village Name	Total Geographical Area	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area	Net Area Sown
Loona Kalan	1561.69	0	166.99	188	287	0	18.7	208	24	669
Naya Khara	613	0	30	0	25	0	208	45	25	280
Achalpura	2530	0	1	7	7	0	550	0	0	1965
Neran	6259	0	757	9	729	0	2667	644	623	830
Naya Sanawara	4980	0	15	0	0	0	10	1584	386	2985
Dawara	9087.45	0	156.72	0	101.17	0	5398.17	0	0	3431.39
Sanawara	8552.04	0	64.04	74	663	0	958	0	2130	4663
Sadrasar	2295	0	21	28	3	0	414	496	222	1111
Amarsar	1503.31	0	0.16	23.35	42.75	0	0	304.15	24.05	1108.85
Motisar	2488	0	8	564	107	0	312	137	89	1271
Madhopura	5996	0	16	20	247	0	1257	1368	23	3065
Madasar	3860	0	41	12	385	0	655	2049	143	575
Lakhasar	2056	0	550	4	7	0	468	242	240	545
Sankra	5114	0	45	23	671	0	39	540	591	3205
Khetasar	4623	0	6	19	20	0	58	507	7	4006
Khuhra	3192	0	12	11	811	0	530	69	278	1481
Achla	1215.31	0	12.01	19.51	297.63	0	375.59	0	0	510.57
Bhainsara	6180.52	0	16.94	937.79	838.7	0	0	2162.9	94.99	2129.2
Core Total	72106.32	0	1918.86	1939.65	5242.25	0	13918.46	10356.05	4900.04	33831.01
Buffer Total	54573.13	813	1951.78	1697.87	2742.56	0	22928.22	3671.71	1227.79	19540.2
Aol	126679.45	813	3870.64	3637.52	7984.81	0	36846.68	14027.76	6127.83	53371.21

- The core zone has 3,712 households supporting a population of 22,520 individuals. The average size of the households is six across the core and buffer zone. The Sex Ratio in the Aol is 867 females per thousand males, which is higher than the district sex ratio of 842 (and very less than the national sex ratio of 933).
- The buffer zone comprises of 2,155 households supporting a population of 12,739 individuals. The buffer zone exhibits a sex ratio of 819 females per 1000 males, which is lower than the district figure of 852 females per 1000 males;
- The 100 percent of the population in the Aol falls in the rural category. The SC population in the core and buffer zone distributed to 11.27 percent and 7.39 percent, respectively;
- The total working population in the Aol is 43.07%. Out of the total working population, 47.78% is categorised as main workers (i.e. those who have worked for a period of 6 months); and remaining 52.22% are marginal workers (i.e. those who have not worked for a period of 6 months). The proportion of cultivators and agricultural labourers is 78.89%. Being a low-rainfall, arid region, the agricultural productivity is relatively lower than other parts of the state of Rajasthan. There is a significant proportion of population as other workers (18.74%), those engaged in some economic activity, but are not cultivators or agricultural labourers or in household industry;
- Within the study area, the number of the Govt. primary school is 35 which is comparatively more in number than the number of secondary schools (5) and senior secondary schools (2) in the AOI;
- As per the consultation with the local community, the level of educational attainment and status among male and female are similar until primary level (as every village have a primary school), post which, the level of education among the female started to decline. The main reason for the decline among the level of education among female is the culmination of the absence of educational infrastructure at the village level accompanied by a lack of transportation facilities.

E.4.3 Ecology Baseline

Based on the primary survey, consultations with community and the forest officials and secondary literature, it was observed that the potential habitats for IUCN v. 2020-2 categorized Critically Endangered (CR) Great Indian Bustard (GIB) (*Ardeotis nigriceps*) are present in the areas adjacent to the Project site and habitats for CR/EN Vulture species inside the Project site. According to a study carried out by Wildlife Institute of India (WII), this landscape has been divided into GIB Priority Area and GIB Potential Area considering the need of conservation efforts. The Project site is located outside the GIB Priority Area. However the entire site falls within the GIB Potential Area.

The key impacts identified include electrocution hazards and collision with transmission infrastructure and hazards from the rotating turbine blades. The impacts due to transmission infrastructure have been assessed as Critical, while due to operational turbines as Major. Since no WTG is located within the GIB priority area, the impact due to turbines may be reduced to moderate with the help of embedded controls such as maintaining a minimum set back distance of 500 m from GIB enclosures and all the water bodies, etc. Also, the embedded controls adopted by the Client such as installation of bird diverters on 33 kV and 220 kV transmission lines in all the areas, installation of suspended insulators, etc. will reduce the electrocution and collision impacts to major.

The vegetation clearance activity may also have critical ecological impacts which may further be reduced to some extent by avoiding the clearance of old mature trees in the Project area.

A long-term monitoring of entire Project site and the transmission line alignment is crucial which will help build a stronger baseline, understand the movement of migratory species and areas with the presence of EN, CR species such as GIB and Vultures in this landscape. This will help identify the high risk areas of the transmission line stretch and Project site. The mitigation measures can be revised based on the outcomes of the study to further reduce the impacts.

E.5 Stakeholder Engagement

According to the discussions undertaken with the local community and the project team, it is understood that the engagement by the project proponent with the local community was restricted to negotiations with landowners. These negotiations through the land aggregator are being undertaken with the identified landowners, with the help of the intermediaries in the area. According to the consultation with the local community, these meetings provided a basic understanding of the project and the purpose of the land procurement.

The key concerns and expectations that were raised during the stakeholder consultation process have been summarised below:

- **Key feedback received from local community regarding project :** It was informed during the consultation with the community that there is a drastic shift from agriculture based economy to non-agriculture based economy due to lack of irrigation facilities and decline in crop yield. There was a positive outlook towards the solar projects in the area. Although the area has witnessed development of various solar and wind projects in the past 5-10 years, the community desired more such projects in the vicinity. They expect to receive benefits from the project in terms of employment and development of infrastructure and the overall community. In addition they also demanded preference to the local community in contractor and employment opportunities from the project;
- **Key feedback received from identified land lessors who were consulted during the ERM site visit:** It was informed that the private landowners are willing to lease out their land due to the low productivity of the agricultural land, dependency on monsoons and lack of irrigation facilities. The compensation received after leasing out their land will be used for livelihood earning and starting of alternative livelihood option then farming. The major concern of the stakeholder group till now is related to availability of employment opportunities that the project will generate; and
- **Community Development activities:** The local communities were of the opinion that apart from the economic opportunities, the local community should also benefit from the project in terms of community development activities. Some of the key areas for development activities identified included medical infrastructure, access to middle and higher schools, and trainings for youth within the village. This can be done by collaborating with local NGOs working on these areas.

E.6 Key Identified Impacts

E.6.1 Impacts associated with construction phase

E.6.1.1 Environmental impacts:

- **Change in Land Use:** Based on review of the land use in the Project AoI, it was observed that majority of land use-land cover includes shrub/waste land (83.54%) followed by agricultural land (11.53%) and gravel waste land (4.93%). As observed during ERM site visit and discussion with site team, both WTGs and solar power plant will be located on private shrub/waste land, agricultural land and gravel waste land. Additionally, the external transmission line connecting the pooling substation will pass through shrub/waste land, and agricultural land. There is no major dependency for grazing on the land leased for the project. Since, majority of the land is shrub/waste land where no agricultural activities are taking place, thus, receptor sensitivity is assessed as low. Furthermore, it is understood that pooling substation, storage yard and site office will be developed on private shrub/waste land. The project activities such as strengthening the access road, installation of solar modules and WTGs and proposed internal and external transmission towers are expected to alter the land use of the area throughout the project life cycle.

- **Topography:** The Project area exhibits flat topography with minor undulations. Two small rivers (Sukhri Nadi and Ghughri Nadi) pass through the proposed project site. Few small water channels observed within the Project area were mostly dry throughout the year except for monsoon season. Since the proposed project, along with the access road, is mostly on a flat terrain the receptor sensitivity has been assessed to be low. The topography may be altered slightly due to the strengthening of approach roads, excavation work at the WTG sites and solar site, internal and external transmission line locations and PSS and SCADA. Clearing and levelling of land would be done prior to any civil work, although these changes are envisaged to be small and restricted to the immediate vicinity of the Project components. The impact magnitude has therefore been assessed as small considering the footprint of the Project.
- **Soil environment:** During the construction phase, the top soil will be susceptible to soil erosion to some extent due to site clearance activities. The region is characterised by red desertic soil and sandy soil which is loose in nature and thus soil erosion can occur easily in the Project area. The scale of site clearance will be small at WTG footprint, but since there are 72 turbines in the project the scale of site clearance will be moderate. At different parcels of land and in solar plant area and the pooling substations, excavated loose soil would be susceptible to erosion. The removal of stabilised top soil would result in slope destabilisation and increase in soil erosion. As for soil compaction, the strengthening of internal access roads and excavation and collection of soil will lead to soil compaction, thus increasing surface run-off and decreasing the percolation rate of the soil. However, since the Project is being developed in a drought prone area the impacts arising from soil compaction will be minimal. Therefore, the overall resource/receptor sensitivity is assessed as low to medium and the impact magnitude is assessed to be small to medium.
- **Waste generation:** General construction waste generated onsite will comprise of concrete, steel cuttings/filings, packaging paper or plastic etc. Municipal solid wastes consisting of food waste, plastic, the construction workforce will also generate glass and waste paper. A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease and waste oil containing rags.
- **Water resource consumption:** Water is a prime requirement for the execution of civil works, especially with regard to preparation of raw materials like concrete etc. for civil works associated with the Project (i.e. WTG foundation solar PV module installation, casting, construction of proposed site office, SCADA room). Source of water for the construction phase will be from IGNP canal, it can be sourced from Mohangarh pumping station. Based on estimates shared by AGE(7)L & AGE(9)L, approximately 145 KLD water will be required during peak time of construction phase for civil work and approximately 315 KLD water will be required for domestic purpose. The project IGNP canal is used for irrigation purpose, drinking purpose and also used by other power producers for sourcing water. Therefore, the receptor sensitivity is assessed to be high. However, since the construction phase of the Project will almost a year (~ 10-12 months), therefore, magnitude of impact is assessed as large;
- **Air Quality:** Air quality in the study area will be impacted in the form of fugitive dust emissions from construction/installation activities, vehicular emissions and exhaust emissions from DG sets. However, the construction activities are going to occur for almost a year (~10-12 months); The significance of impact is assessed to be moderate;
- **Ambient Noise:** The hybrid Project is spread across a larger area ~4240 acres (area required for transmission towers and the PSS have not been included in the area mentioned). The air quality impacts would be confined to 500 m of the construction activity area includes material storage area, villages located near to access routes etc. and will not have any long term impact on the ambient air quality of the area. However, the Project study area is characterised by presence of loose sandy soil and is prone to soil erosion, coupled with the fact that construction activities will involve increase in the number of vehicles entering the region. State Highways will be utilised along with village roads for transportation of construction materials. Villages along the state

highways and village roads in the Project AoI will be impacted due to increased emissions. Therefore, the receptor sensitivity is assessed as medium. Since the construction related activities will last for almost a year (i.e. 10-12 months), the impact magnitude is assessed to be medium.

- **Occupational and Community Health and Safety:** The construction phase activities such as the erection of the WTGs, installation of solar modules, construction of the transmission line and substations and movement of material and personnel may result in impacts on the health and safety of the workers and community. These activities will involve the use of heavy machinery and live transmission power lines. Furthermore, the movement of material and personnel via the access roads may result in injuries to workers or local community and their livestock due to accidents; The project is expected to follow corporate level OHS procedures established by AGEL. The SOPs cover aspects related to a) recognition and reporting of Incidents, Illness and safety hazards, b) use of personal protective equipment, c) training and development needs, d) transportation safety, and handling hazardous materials, and e) emergency response plan. Therefore, the significance of impact is expected to be minor to negligible;

E.6.1.2 Socio-economic impacts

- **Community health and safety:** The construction phase activities such as the erection of the WTGs, construction of the transmission line and substations and movement of material and personnel may result in impacts on the health and safety of the community. These activities will involve the use of heavy machinery and live transmission power lines. Furthermore, the movement of material and personnel via the access roads may result in injuries to people or livestock due to accidents;
- **In-migration of workers:** The in-migration of workers from outside the area will result into increased risk of conflict and social unrest due to cultural differences between the labourers and local community. Similarly, the in-migration may also lead to spread of communicable diseases due to contact and interaction between the labourer and the local community. Moreover, lack of proper sanitation or waste management facilities may also resulted in outbreak and transmission diseases. The in-migration will also resulted in increased pressure on basic facility such as water etc. Such pressure and demand may lead to inflation and increased prices of food items and basic commodities. As this impact is restricted to the construction phase the impact, magnitude is assessed as minor. However, post implementation of mitigation measures the impact significance is assessed to be negligible.
- **Impact on landholding and agricultural income:** As reported during the consultation, due to lack of irrigation facilities and dependence on rainfall, considerable section of the working population, working as agricultural labourers in the study area has reduced. Reportedly, none of the landowner consulted and the local community in the area practice sharecropping. Majority of the households are working as other works and cultivators. Therefore, sale of land is not expected to have significant impact on the agriculture labourers. The impact significance is envisaged to be minor, however, post implementation on mitigation measures the impact significance is assessed as negligible to minor.
- **Impact on employment opportunities:** The construction phase activities of the project including construction of access road, civil works, foundation activities, site clearance and security will involve semi-skilled and unskilled workers. According to the information available, the preference will be given to the local workers to be employed as a contractual workforce. It is understood that the establishment of the solar and wind power project in the area shall result in a shift of preferences of the local community from agriculture and livestock rearing for income. With the locals, preferring to be employed by the solar & wind power projects during the construction and operation phase, as drivers and security personnel. The local community is likely to benefit from the economic opportunities to be created from civil works during construction phase including, self-employment options for individuals possessing vocational or technical training skills like

electricians, welders, fitters etc; and, contracting opportunities for locals possessing tractors, dumper trucks or other vehicles which would be needed to carry away excavated soil and other material. The significance of the impact is assessed as positive.

- **Labour rights and welfare:** The projects will employ skilled, semi-skilled and unskilled workers, across the project lifecycle, which will include contractual and regular employees and local and migrant workers. The regular skilled workers are likely to be comprised of migrant workers, from different districts and states in the country, depending upon the need for technical expertise. The overall impact significance of the labour rights and welfare during the operation phase is assessed as minor.

E.6.1.3 Ecological impacts:

- **Vegetation Clearance:** For various activities such as excavation for the erection of WTGs and construction of ancillary facilities, construction of solar plant infrastructure, storage yards, access/internal roads, will cause loss of habitat and loss of connectivity of wildlife.
- **Laying of Approach Roads:** Approach roads are constructed to connect the WTGs and Solar project with the main access roads in the area. These are used during construction phase as well as in operational phase for maintenance activities. Following ecological concerns should be considered during the construction of approach roads.
 - Vegetation loss, Habitat continuity
 - Roadkills
 - Habitat disturbance

E.6.2 Operational Phase

Following are the key impacts identified during the operational phase:

- **Soil Environment:** During operation phase, the waste generated from Project will include domestic solid wastes at SCADA building and substation and hazardous wastes like waste oil from DG sets and transformers, and oil containing jutes and rags. The quantity of hazardous waste generated will be much lesser than the quantity generated during the construction stage. Therefore, the receptor sensitivity and impact magnitude is assessed as low and small. The hazardous waste generated will have to be through an approved vendors (which is yet to be identified) in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended. The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and oil spill control kit will be used for cleaning small spills and leaks. During operation phase, the quantity of municipal waste and hazardous waste generated is less and probability of the hazardous waste generation is only during maintenance work and therefore occasional. The waste generated would be routed through proper collection and containment;
- **Water Environment:** During O&M phase, water will be primarily required at the solar plant for module cleaning. The Project intends to implement both dry cleaning and wet module cleaning at site. Reportedly, there will be 24 module cleaning cycle per year comprising of 16 cycles of dry cleaning and 8 cycles of wet cleaning (2 dry cleaning followed by 1 wet cleaning) Water for operation phase will be sourced from IGNP canal. As per secondary research it is understood that the Indira Gandhi Nahar Department has reserved 0.87 MAF (1200 cusec) of water for drinking, energy projects, and other industries. It is understood that Water Resources Department will allocate required quantity of water from IGNP canal/ the nearest available source for cleaning of solar panels and auxiliary consumption for Solar PV Power Plants subject to the availability of water. Power Producer is expected to intimate estimated water requirement to RREC along with source of water, which AGE(7)L & AGE(9)L is yet to complete. Approximately 10,642 KL water

will be required per year for wet module cleaning. For domestic purpose approximately 5.4 KLD water will be required considering 40 manpower deployed at site during operation phase. Since the Project is considering wet module cleaning as well as dry module cleaning. Furthermore, there will be only 16 dry cleaning cycles and only 8 wet cleaning cycles per year therefore, receptor sensitivity and impact magnitude is assessed to be medium;

- **Water quality:** During operation phase, wastewater generation is expected to be from solar module cleaning. Additionally, sewage would be generated from substation and SCADA building, these will be of almost negligible quantity. Therefore, the receptor/resource sensitivity, which may be the groundwater and nearby surface water body, is assessed as medium as a two small rivers are found to pass from the project area with multiple small dendritic and sub dendritic channels present within the project area. The rivers have little flow and water round the year whereas the dendritic and sub dendritic channels are seasonal and are filled in the monsoon season, hence the impact magnitude is assessed to be small;
- **Noise generation:** There will be no noise generated from the solar power plant during operation phase. However, the emanation of noise from the operation of WTGs is of the following two types: (a) mechanical noise, from interaction of turbine components; and (b) aerodynamic noise, produced by the flow of air over blades. Mechanical sounds originate from the relative motion of mechanical components and the dynamic response among them.
- **Shadow Flickering:** Given the guidelines of 30 hours or less per year is considered to be acceptable, the operation of the wind farm theoretically results in shadow flicker impacts that could be considered as significant for the purposes of this study. The results show that theoretical shadow flickers impact in the real case scenario occur with 2 receptors with higher than 120 shadow hours per year, 1 receptor with shadow impact between 120 shadow hours per year to 60 hours per year, 13 receptors with shadow impact between 60 shadow hours per year to 30 hours per year and from a total of 153 receptors identified within the Project area;
- **Economy and Employment:** Depending upon the skill requirement, the local community should be given preference for employment, especially in semi-skilled and unskilled work. Especially as a security personnel for WTGs. The sourcing of local labour wherever possible should be made obligatory for the sub-contractors and in all major procurement activities; and
- **Hazards associated with Turbine Blades and Transmission Line Infrastructure:** The entire landscape of the Project site harbours several threatened bird species. Furthermore, 13 species protected under Schedule I of Indian Wildlife Protection Act 1972 have been reported from this landscape. Following impacts have been identified to these faunal species present in the landscape:
 - Electrical hazards to birds; and
 - Risk of collision with transmission lines.
 - Collision risk to bird and bat species.

E.6.3 Cumulative Impacts

During ERM site visit and based on discussion with site representative, the following projects were observed to be operational within 10 km of the proposed 600 MW hybrid Project.

- A 39.9 MW wind power plant developed by Suzlon and owned by Orange Renewable Power Private Limited is located near Bhainsara Village and other surrounding villages, few of the turbines are located approximately within a distance of 600m-1km from the turbine location of proposed 600MW project ;
- A 100 MW wind power project developed by Siemens Gamesa and owned by National Aluminium Company Limited (NALCO) located approximately 5 kms of the proposed project, few of the turbines are located at a distance of 1.5-2.5 kms from the proposed project. ;

- In addition to the above, AGEL is planning to develop a 390 MW and 700 MW solar and wind hybrid power project located within the 5 km radius of the Proposed 600 MW project.
- There are other upcoming wind power projects to be developed by Renew and Eden Renewables (capacities not known) within 5-10 km of the proposed project site.

The cumulative impact significance will not go beyond moderate for environmental and social impacts since hybrid power projects are projects with very low dependence on natural resources and are being developed to enhance the renewable energy sources in the country. Maximum dependence and impacts of solar and wind power projects on natural resources and the ambient environment are during the construction phase, which lasts for a short duration. As for ecology impacts, the Project site falls inside the Central Asian and West Asian-East African Flyways and supports the turnover high numbers of migratory birds in winter. The Project site is situated in close proximity to GIB habitat and there is a likelihood of the movement of GIB and Vultures inside the Project site. The existing windfarms and some future projects coming in this landscape may lead to an increased risk to these avifaunal species. Also siting of wind and solar parks in the natural habitats thereby affecting the thorny scrub vegetation and grasslands.

E.7 Key Mitigation Measures Identified

Following are the key mitigation measure identified for the Project:

- Ensure hazardous waste containers are properly labelled and stored onsite provided with impervious surface, shed and secondary containment system awaiting handling and disposal by an authorised vendor (authorised by the RSPCB and as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended);
- The construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, metal cuttings wastes as per the Construction and Demolition Waste Management rules 2016;
- Spill, leakage and clearance plan to be adopted for immediate cleaning of spills and leaks;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage will be strictly restricted.
- Prepare and implement water conservation scheme e.g., rainwater harvesting at the project site. A regular inspection for identification of water leakage and preventing water wastage.
- For construction uses, the low quality water will be blended with fresh water. Construction Labour deputed onsite to be sensitized about water conservation and encouraged for optimal use of water;
- All workers (regular and contracted) should be provided with training on Health and Safety policies in place with appropriate refresher courses throughout the life cycle of the Project;
- As part of the stakeholder engagement and information disclosure process, the community shall be provided with an understanding of the activities to be undertaken and the precautions taken for safety. Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities;
- Project should ensure a monthly monitoring and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in terms of resources, migrant workers, child labour and forced labour, health and safety, payment of wages etc.;
- Depending upon the skill requirement, the local community should be given preference for employment, especially in semi-skilled and unskilled work;

- Contracting opportunities for locals possessing tractors, dumper trucks or other vehicles which would be needed to carry away excavated soil and other material. Creation of indirect employment for local community through establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc.;
- Measure to reduce the risk of prevalence of diseases should be developed, including screening of workers, undertaking health awareness amongst the workers, implementation of vector control programs, avoiding the presence of unsanitary conditions and better facilities in the project site, such as safe drinking water, proper waste collection and disposal etc.;
- Revegetation with native species of the cleared vegetation at shall be undertaken in order to provide a vegetation cover for the movement of smaller mammals;
- Unnecessary disturbance of neighbouring vegetation due to off-road vehicular movement, fuelwood procurement, needless expansion of labour camp and destruction of floral resources should be prohibited;
- The construction of approach roads for the Project should be carried out in a phased manner by focusing on clusters of WTGs at a given time to allow impacted fauna to adjust to the disturbed areas;
- When grasses or small shrubs are removed for access road construction, replanting of native species should be implemented after the construction phase Residual impact significance;
- Construction and transportation activities must be avoided at night (6:00 pm to 6:00 am), if possible. In case nighttime construction and transportation activities cannot be avoided, the following measures must be taken;
- A detailed and long term monitoring of bird and bat species (covering migratory as well as breeding season) within the Project study area should be undertaken for at least two years which may help understand the presence of threatened species inside the Project area and their movement. This will further help in assessing the site specific impacts and updating the mitigations measures;
- A minimum distance of 1000 m is recommended between turbines and habitats visited by bird species of conservation significance. It includes resting/roosting and feeding sites;
- Formulation of a traffic management plan for night time equipment transportation to avoid any potential accidents during night travel and ensure community health and safety while using village roads and state highways;
- Areas, where construction activities are being undertaken, shall be properly lighted, so as to ensure occupational health & safety and avoid any potential accident/incidents that could harm the Project workers;
- Cattle Carcass Management should be implemented as a precautionary measure for vulture presence in the area;
- Bird carcass monitoring should be commissioned in operation and maintenance phase, in which all bird carcasses found in the wind farm should be recorded and photographed with details about the distance from the closest wind turbine generator and the name of the wind turbine generator for at least two years; and
- Periodic bird mortality counts should be undertaken for the first two years of the wind farm operation to determine if there is any risk of CR and EN and migratory bird species collision from the wind farm. The mitigation measures should be revised based on the results of the monitoring.

E.8 Conclusion

The proposed project is a green energy project that will comprise of 72 operating WTGs and 1,900,462 solar PV modules to generate 751.2 MW power through wind (151.2 MW) and solar

(600MW) energy. Impacts due to proposed power project are short term, generally limited to construction phase and operation phase have negligible to critical environmental, ecological and social impacts. The Project and its key components such as access road, project office building, and transmission lines are likely to have potential environmental impacts on baseline parameters such as land use, water, ambient air quality, noise quality in the immediate vicinity of Project during the construction phase. The project is also likely have potential impact on water during operation phase due to cleaning of modules. Additionally, there will be impact due to noise and shadow flickers effect on the receptors present within the proposed Project area. Critically endangered species have been identified in the region. A detailed Critical Habitat Assessment supported by long term bird and bat monitoring of wind farm along with the transmission line alignment will be required to ascertain what level of mitigation measures will be required. The social impacts from the project are assessed to be generally beneficial in terms of local employment and overall local area development.

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