



Environment and Social Impact Assessment Report: 700 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 700 MW AC hybrid (510 MW Wind, 250 MW & 350MW Solar) power project (hereinafter referred as the "project"). The proposed 700 MW hybrid power project is being set up in Jaisalmer and Barmer district of Rajasthan, India; the scheduled commercial operation date is 10th August, 2021. The project operates under the SPV M/s RSEPL Hybrid One Limited (RHPOL or HPD¹), a 100% subsidiary company of M/s Adani Green Energy Limited (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 700 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 47 villages in Fatehgarh, Jaisalmer and Pokhran Taluka of Jaisalmer District, and Sheo Taluka in Barmer District in the state of Rajasthan. Elevation at project site ranges from 240 m to 333 m above mean sea level.

As observed during ERM site visit, a dry seasonal water channel of 2 km length and 6 feet deep was observed to traverse between the two land parcels of the 250MW solar plant. The 250 MW & 350 MW solar plants are falling within the AREPRL Fatehgarh Solar Park Land. 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. 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.

There are no Protected Areas (PA) or Important Bird Area (IBA) within 5 km radius of the Project site. However, Desert National Park is situated at a distance of 25.1 km west of the Project site. It must also be noted that Rasla enclosures (1 and 2) are situated inside the Study area at approximately 2.4 km southeast from the boundary of 350 MW Solar Project. Also, 220 kV transmission line alignment passes from a distance of 2.9 km southeast of Rasla enclosure.

The given Hybrid project comprises of two solar sites of 350 MW and 250 MW; and one 510 MW wind site. As per the information shared by land team of RHPOL and separate consultations held with engaged aggregators, it has been informed that approximately 2911 Acres of Government land will be taken on lease for both the Solar sites and approximately 526.5 Acres of land will be taken on lease for wind site, which will have 232 WTGs in total.

The total land requirement for the hybrid project comprising of both the solar parks and 232 WTG locations is estimated at 4437.5 Acres (as per the estimate given by the land team of RHPOL), out of which 3561 Acres of government land identified for 350 MW & 250 MW solar parks falls within 2500 hectares of government land, which has been granted to AREPRL. Separate lease agreements shall

¹ As mentioned in the PPA dated 7th July 2020 (

be further carried out between AREPRL and AEML, for taking ~3561 Acres out of total 2500 hectares (allotted to ARERPL by Govt of Rajasthan) of land on lease and for the remaining 350 Acres of private land, separate lease agreements shall be carried out with identified private land lessors of the nearby villages, however no details pertaining to number of private and lessors identified and current status of the lease agreements were shared with ERM. Similarly for 232 WTGs, approximately 526.5 Acres of land will be taken on lease for 29 years and 11 months.

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 AGEL and RHPOL 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</p>

Description	Applicability	Objectives and Applicability to Project
		<p>PS helps to assess the status of the employees and workers in RHPOL as well as any contractors.</p> <p>The project activities will involve hiring of approximately 1900 skilled, semi-skilled and unskilled labourers for both solar sites during the construction phase and approximately 1410 construction labourers will be required for wind project. The project will have to develop a human resource policy and ensure non-discrimination and equal opportunity, protection of the workforce and occupational health and safety. Therefore, PS 2 is applicable to the Project.</p>
<p>IFC PS 3 - Resource Efficiency and Pollution Prevention</p>	<input checked="" type="checkbox"/>	<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 RHPOL 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>

Description	Applicability	Objectives and Applicability to Project
		<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 canal due to use of significant amount of water during construction and operation phase. Therefore PS 4 is applicable to the project.</p>
<p>IFC PS 5 - Land Acquisition and Involuntary Resettlement</p>	<input checked="" type="checkbox"/>	<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> <ul style="list-style-type: none"> ■ In the hybrid project the total land required for both the solar parks and 232 WTG locations is 4437.5 Acres. For solar parks both Govt land and private land leasing is involved. In the case of Government land, it was reported by RHPOL land team, that the Govt. of Rajasthan has already allotted 2500 ha of Govt. land to AREPRL. The total land required for 700 MW solar park is 3911 Acres. Further 3561 Acres of land out of total 2500 ha. will be leased to RHPOL by AREPRL and remaining 350 Acres of land shall be taken on lease from identified private land lessors of the nearby area, however no details pertaining to the same has been shared with ERM. The team of RHPOL informed that there are no litigations and land users on this government land, which shall be leased for two solar projects; however no detailed study pertaining to the same has been carried out and shared with ERM. ERM understands that there could be a possibility of economic displacement on government land, which may be informal but recognised by the IFC PS, also there might be informal title-holders on this revenue land. ■ For WTG locations, private land shall be taken on lease for 29 years 11 months. This land-lease process will be carried out on the basis of mutual negotiations and consultations with private land owners and aggregators appointed by RHPOL. After agreeing to market rate, an official MoU followed by Lease-Deed agreement shall be carried out. ■ ERM understands that this entire process of land leasing of private land shall be carried out in keeping with Section 7 of PS5 (however it does not trigger willing buyer- willing seller"); where mutual negotiations, consultations and compensation/ lease amount shall be given as per current market rate.

Description	Applicability	Objectives and Applicability to Project
<p>IFC PS 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources</p>	<input checked="" type="checkbox"/>	<p>Since PS 5 is applicable for both government and private land leasing process; hence PS5 is applicable for this project.</p> <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>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 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>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.</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 (*Gyps bengalensis*) and Indian Vulture (*Gyps indicus*) and Red-headed Vulture (*Sarcogyps calvus*) are likely to be present within and in the areas adjacent to the wind farm. 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 18.4 km north of 250 MW Solar Project and 25.6 km west of WTG FS478. Also one GIB enclosure, which is also a GIB Conservation Priority Area and a part of Desert National Park, is situated at about 2.4 km southeast from the boundary of 350MW Solar Project. Also, 220 kV transmission line alignment passes from about 2.9 km from Rasla GIB enclosure. The consultations with locals confirmed that the movement of two pairs of GIB in this enclosure on annual basis.
- The Solar Park and 220 kV transmission line alignment entirely cover either sides of Rasla GIB enclosure. The inter-enclosure movement of GIB through the Solar Project sites and along the transmission line cannot be ruled out. These components may pose a serious risk of collision to GIBs present in the landscape.
- 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, 27 km north of Project site. Endangered Egyptian Vulture (*Neophron percnopterus*) were also observed inside the Project area. The Vultures can fly great distances in search of food and thus their movement in the Wind farm and Solar park 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)
- **Potentially limited risks/impacts and reversible:** Environmental and social impacts of the Project are anticipated during the operation, construction and decommissioning phase and will encompass changes in land-use, increased noise levels, changes in air quality, use and changes in water availability and quality, occupational health & safety, etc. Most of these impacts are limited to the Project site and their immediate vicinity and can be minimized through application of mitigation measures as proposed in the ESMP;
- **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. Hence, the proposed 700 MW wind-solar hybrid Project can therefore not be considered an unprecedented activity; and
- **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 shrub/waste land, agricultural land and gravel waste land. The site location of the project does not involve any anticipated settlements and physical displacement.

Additionally, given the guidelines of 30 hours or less per year is considered acceptable, the operation of the wind turbines theoretically results in shadow flicker impact on the structures and settlements present in vicinity. The results show that theoretical shadow flicker impact in real case scenario occur at 7 receptors with higher than 120 shadow hours per year, 51 receptor with shadow impact between 120 shadow hours per year to 60 hours per year, 33 receptor with shadow impact between 60 shadow hours per year to 30 hours per year and from a total of 345 receptors identified within the Project area.

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. Netel India Pvt Ltd, an NABL accredited laboratory, was engaged for collection of baseline information on groundwater quality, The primary baseline data was collected between 19th August and 26th August 2020. The primary baseline data was collected for aspects including Ground water quality (5 locations), surface water quality (2 locations), soil quality (5 locations), Ambient Noise (5 locations), and ambint air quality (5 locations).

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 solar plants of 350MW & 250MW are proposed to be located at an elevation of 246-272 amsl and 245-255amsl respectively. Similarly, majority of the WTG locations are finalised at an elevation ranging between 260-304 amsl. Analysis of digital elevation map for Project shows a trend in elevations ranging from 213-363 metres above mean sea level which is indicative of flat, yet increasing elevations within the Project Aol, which contributes to undulating nature.

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, glauconitic sandstone and silty sandstone. Khuiala formation consists of limestone boulder bedded fossiliferous limestone and shales.

As per Hydrogeological Atlas of Barmer district, Rajasthan (2013), most part of the district is covered by desert sand and sand dunes. The rock formation occupies the area in patches. The Malani igneous suits of rocks are most extensive & are oldest in the area, consist of volcanic rocks, rhyolites granites & associated intrusive like basic dykes aplites & quartz veins. Besides these igneous rocks other rocks exposed in the area are sandstone belonging to Lathi, Fatehgarh & Mandai formation, Akli & Kapurdi formations constituted by bentonite.

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 with few portion of agricultural land and gravel waste that will be converted to non-agricultural land for industrial development.

The area is barren, undulating with its famous sand dunes. There are no perennial rivers streams in the district and it lies in the watershed area of Barmer basin. Small nallas are purely seasonal and ephemeral with the result that there is lack of effective discharge in the event of heavy precipitation.

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. The Sheo block (where the project site is located), fall under "Overexploited" category.

Soil:

As per the information provided by CGWB in the groundwater brochure for Jaisalmer district (2013) and Barmer 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, S4 & S5) 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 8.34 (S1), 8.48 (S2), 8.46 (S3), 8.78(S4) and 8.59 (S5) indicating moderately alkaline to strongly 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 221.4 μ S/cm (S1), 224 μ S/cm (S2), 179.1 μ S/cm (S3), 192.1 μ S/cm (S4), and 217.4 μ S/cm (S5). 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 13670 mg/kg (S1), 8099 mg/kg (S2), 7649 mg/kg (S3), 6617 mg/kg (S4) and 9695 mg/kg (S5). The level of copper in the soil samples were found to be 6.21mg/kg (S1), 2.05mg/kg (S2), 1.61mg/kg (S3), 0.95 mg/kg (S4) and 3.72mg/kg (S5) at the sampling locations. The level of zinc in the soil samples were also found to 29.70 mg/kg (S1), 13.90mg/kg (S2), 11.90 mg/kg (S3), 10.70 mg/kg (S4) and 14.70 mg/kg (S5). Therefore, the soil is deficient of metals and micronutrients since copper and zinc occur in the soil at very low concentrations at 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 (2079mg/l) and GW-2 (2395mg/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 & Chloride:** Calcium & Chloride content were found to be within permissible limits for all the samples.
- **Magnesium:** Magnesium was found within permissible limits for all the GW samples.
- **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 within permissible limits at all locations. This is because

- **Zinc:** Zinc content was found be higher than permissible limit for all the locations.
- **Lead:** Lead content was found be higher than permissible limit for all the locations.
- **Total Coliform and Faecal Coliform:** Total Coliform and Faecal Coliform are found to be present in GW2 and GW5 sample. Presence of Total coliforms include bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste, whereas Faecal coliforms are the group of the total coliforms that are considered to be present specifically in the gut and feces of warm-blooded animals. Presence of total coliform and faecal coliform renders the ground water to not potable for domestic use.

Noise quality:

The equivalent ambient noise level for day time (Leq day) and night time (Leq night) at all the monitoring locations were observed to be within the prescribed CPCB limits except at location NQ-6 which was exceeding the prescribed corresponding limits for a residential area during the day as well as at night. The high noise levels at NQ-6 can be attributed to high wind speeds during the period, and vehicular movement.

Air quality:

The analysis of results indicated that all the parameters for particulate matter were within the permissible limit of 100 and 60 prescribed by NAAQS. The other parameters were observed to be within the NAAQS limit. 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 a 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 53 villages under four tehsils of Jaisalmer and Barmer district. The concentration of villages is higher in Fatehgarh tehsil as compared to Pokaran.

The core zone of the AOI comprises of 47 villages while the buffer zone has 06 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 & Uncultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc.	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area	Net Area Sown
Rasla	6235.68	0	78.52	2.75	1046.84	0	3569.77	0	0	1537.8
Neran	6259	0	757	9	729	0	2667	644	623	830
Dawara	9087.45	0	156.72	0	101.17	0	5398.17	0	0	3431.39
Amarsar	1503.31	0	0.16	23.35	42.75	0	0	304.15	24.05	1108.85
Chitrori	571	0	0	23	0	0	0	0	165	383
Lakhmana	3128.19	0	94.5	7.1	71.53	0	1663.2	14.07	353.25	924.54
Devalpura	2356.23	0	35	494	63	0	0	902.23	163	699
Dholiya	5627.81	0	82	62	262.81	0	1946	0	0	3275
Pancha	1973.24	0	204.28	13.96	433.09	0	499.44	0	0	822.47
Kanasar	889	0	0	0	11	0	167	99	17	595
Kapuriya	3197.31	0	366.72	214.8	32.48	0	1361.21	0	0	1222.1
Kathora	1851.4	27.52	14.6	57.77	0	1192.07	0	157.04	402.4	0
Khyala	2384.97	0	100.2	87.86	65.98	0	1702.95	40.22	101.87	285.89
Laxmansar	1636.43	0	30.18	0	0	0	577.07	16.02	73.04	940.12
Sandhuwa	1004.4	0	14.8	62.1	37.8	0	277.5	0	5.6	606.6
Khelana	3156.69	0	0.16	603.82	1352.45	0	253.17	35.19	156.7	755.2
Mandai	6123.94	0	1415.27	351.89	287.93	0	1880.97	0	257.99	1929.89
Masooriya	3055	0	44	61	0	0	2	714	213	2021
Hariyasar	3940.6	0	54	122.6	129	0	80	468	766	2321
Bhinajpura	948.13	0	3.27	192.75	0	0	287.69	78.2	37.12	349.1
Mehron Ki Dhani	2816.4	0	84.4	300.9	65.4	0	559.3	0	78.6	1727.8
Neemba	3829.89	0	46.95	103.98	499.94	0	821.97	55.89	0	2301.16
Pabnasar	2807.02	0	27.12	0	38.08	0	1265.01	120.04	152.65	1204.12
Kalyanpura	1040	0	103	0	0	0	489	37	61	350
Pratappura	2475	0	0	0	79	0	7	415	222	1752
Rampuraiya	976.94	0	0	34.27	31.09	0	421.11	47.1	105.95	337.42
Ramdeora	7585	170	180	132	5496	0	0	745	862	0
Bonada	3554.12	0	11.02	220	362.01	0	69.02	1732.03	114.01	1046.03
Roopsar	3083	53.5	1.5	0	0	0	930.5	420.5	361	1316
Rawri Chak	2767.96	0	203.25	93.05	43.97	0	1273.92	228.89	0	924.88

Village Name	Total Geographical Area	Forest Area	Area under Non-Agricultural Uses	Barren & Uncultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc.	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area	Net Area Sown
Sangram Singh Ki Dhani	657.26	0	4.9	196.7	63.9	0	109.98	31.99	0	249.79
Mehreri	1073.84	0	26.12	0	44.1	0	512.01	74.09	27.34	390.18
Bhelani	4205.4	0	1133.4	10.8	110.4	0	1479	48.05	96.1	1327.65
Unda	4557.82	509.1	97.8	0	97.78	0	2325.7	0	69.15	1458.29
Nagana	725.35	0	19.06	0	8.04	0	407.12	7.11	11.01	273.01
Bhakhrani	2241.5	0	110.12	213.1	58.69	0	1006.15	0	27.2	826.24
Seetorai	3461.69	0	101.07	6.03	156.08	0	2203.42	0	152.05	843.04
Sumliyai	2464.93	0	200.47	135.86	69.89	0	1203.98	69.89	194.88	589.96
Sanjeet	2439.51	0	40.52	42.48	41.45	0	1480.26	25.8	176.8	632.2
Harbha	3211.7	0	180.17	19.7	718.1	0	1106.33	0	0	1187.4
Kodiyasar	5806.4	408.6	101.4	0	83.4	0	2782.55	0	242.4	2188.05
Loona Kalan	1561.69	0	166.99	188	287	0	18.7	208	24	669
Bhiyasar	5048.44	207.4	690.8	212.6	125.2	0	1255.14	255.6	184.4	2117.3
Dharwi Khurd	1743	0	186	130	273	0	68	74	98	914
Ratkuriya	1264.65	0	44.65	79	39	0	52	78	42	930
Kanasar	4078.46	399	143	400	141	0	32	40	110.46	2813
Pabu Mali	1974.57	0	60.57	14	0	0	87	154	93	1566
Core	142381.32	1775.12	7415.66	4922.22	13599.35	1192.07	44299.31	8340.1	6865.02	53972.47
Buffer	158963.94	1842.12	8652.92	6670.3	14188.22	1192.07	48415.68	8992.1	7608.87	61401.66
Aol	301345.26	3617.24	16068.58	11592.52	27787.57	2384.14	92714.99	17332.2	14473.89	115374.13

- The core zone has 8,573 households supporting a population of 50,510 individuals. The average size of the households is 6 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 852 (and very less than the national sex ratio of 933).
- The buffer zone comprises of 935 households supporting a population of 5,564 individuals. The buffer zone exhibits a sex ratio of 837 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 13.64 percent and 19.64 percent, respectively;
- The total working population in the Aol is 42.77%. Out of the total working population, 48.70% is categorised as main workers (i.e. those who have worked for a period of 6 months); and remaining 51.30% are marginal workers (i.e. those who have not worked for a period of 6 months). The proportion of cultivators and agricultural labourers is 72.18%. 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 (26.10%), 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 46 which is comparatively more in number than the number of secondary schools (9) and senior secondary schools (4) 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, 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 (WTG locations) is located outside the GIB Priority Area. However the entire site falls within the GIB Potential Area and boundary of 350 MW solar park falls in the immediate vicinity of GIB Priority Area (approx. 70 m) and 2.4 km from the GIB enclosure.

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:** Impact on land use is expected to be mainly from clearing of vegetation from land prior to construction activities. The potential for alteration of land use of the proposed site is minor as there is no major dependency for grazing on the land leased for the project and majority of the land is shrub/waste land where no agricultural activities are taking place. Structures, albeit of temporary nature, which will support project activities during the construction stage such as storage yards, etc. will have an impact on the immediate vicinity of the construction area. The construction phase is expected to last approximately 6-8 months, following which the temporary structures will be dismantled from their respective locations with the returning of land to its acceptable pre-construction state. However, site access roads, internal roads, transmission

lines and permanent structures such as WTGs, solar modules, site office and the pooling substation will remain until the end of the Project life cycle (i.e. 25 years). Hence, the change in land use due to project development has been classified as medium.

- **Topography:** The Project area exhibits flat topography with minor undulations. There are no major water bodies that pass through the proposed Project site. The water channels observed within the Project area are mostly dry. Since the proposed project, along with the access road, is mostly on a flat terrain, the impact is assessed to be minor;

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:** There will be clearance of vegetation that covers the top soil, site levelling and grading during the construction phase. These activities will largely affect the top layers of the soil and loss of top soil quality is envisaged but the effects can be reversed over time.
- **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:** Based on estimates shared by RHPOL, approximately 195 KLD water will be required during peak time of construction phase for civil work and approximately 405 KLD water will be required for domestic purpose with a peak manpower requirement of 3000.. 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. The significance of impact is therefore considered to be moderate;
- **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:** Noise quality in the study area will be impacted in the form of noise from heavy vehicular traffic movement, increased workforce and construction/demolition and from D.G. sets. However, construction work is expected to last for approximately 6-8 months and construction activities will be restricted to daytime. The overall impact significance is expected to be minor to moderate.
- **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;

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 among 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 land owner 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 to 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 can 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. The hazardous waste generated will be disposed through approved vendors. 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. The significance of impact has been assessed as minor;
- **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 cycles 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. AGEL has already received access to its other project (390 MW & 600MW Hybrid power project) proposed in the same region. The impact significance therefore assessed to be moderate;
- **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 low and impact magnitude is assessed to be medium. Post implementation of mitigation measures the impact significance is assessed to be minor;
- **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 at 7 receptors with higher than 120 shadow hours per year, 51 receptor with shadow impact between 120 shadow hours per year to

60 hours per year, 33 receptor with shadow impact between 60 shadow hours per year to 30 hours per year and from a total of 345 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 IUCN 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 390 MW hybrid Project.

- A 50.4 MW wind power plant 24 turbine and developed and owned by Mytrah Private Limited² located approximately 6-8 km from the proposed site
- A 39.9 MW wind power plant developed by Orange with 15 turbines located in Bhesada³, Rajasthan 5 km from the nearest turbine of the proposed project
- A 51.2 MW wind power plant developed by Renew Power with 24 turbines located in Fatehgarh Taluka⁴, Rajasthan 5 km from the nearest turbine of the proposed project
- A 50 MW wind power project developed by Siemens Gamesa located near Devikot and owned by National Aluminium Company Limited (NALCO)⁵ located within 5 km of the proposed project; The nearest turbine is located approximately 2 kms from the project site.
- As reported by site representative, there are upcoming wind power projects to be developed by Renew and Eden Renewables (capacities not known) within 10-15 km of the proposed project site.
- AGEL also plans to develop 600MW and 390 MW solar and wind hybrid power project within 10 km of the proposed project.
- One solar power plant of 50MW capacity was observed (26°29'44.08"N, 71°40'36.64"E) at a distance of 4 kms from turbine FS265 in the proposed site vicinity. Information on developer and owner is not available for the solar project.

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

² https://www.thewindpower.net/operator_en_3699_mytrah.php

³ <http://orangerenewable.net/>

⁴ <https://renewpower.in/newroom/sites-project-locator/>

⁵ <https://nalcoindia.com/business/operation/wind-power-plants/>

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 GPCB 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 232 operating WTGs and 1,891,290 solar PV modules to generate 1,110 MW power through wind (510.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.

It is important for RHPOL to implement the suggested mitigation measure to minimize the impacts over the environment, social and ecological resources in order to mitigate overall impact significance.

The Environmental and Social Management Plan (ESMP) and specific management plans describes mitigation measures for impacts specific to project activities and also discuss implementation mechanism. To conclude, the implementation of ESMP will help RHPOL in complying with national/ state regulatory framework as well as to meet IFC / EDF reference framework requirements.

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