ESIA study for 77.5 MW DC Solar Power Plant in Saraipalli, District-Mahasamund, Chhattisgarh

Executive Summary

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CleanMax

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EXECUTIVE SUMMARY

E.1 Project Background

Environmental Resource Management (ERM) India Private Limited (hereinafter referred as "ERM") was commissioned by M/s. CleanMax (hereinafter referred to as "CleanMax" or "Client") to undertake Environmental and Social Impact Assessment for a proposed 77.5 MWp solar power Project located in Kena and Ichhapur village in Tehsil Saraipalli, District-Mahasamund in the state of Chhattisgarh, India (hereinafter referred to as "Project").

M/s. CleanMax Terra Private Limited, an SPV of CleanMax Enviro Energy Solutions Private Limited (hereinafter referred to as "Company"), is a company incorporated under the provisions of the Companies Act, 2013 and having its registered office at 33, Ashoka Apartment, Rungtha Lane, Off Napeansea Road, Mumbai-400006.

ERM undertook a site reconnaissance visit of the Project site from 31st January 2024 to 2nd February 2024 (03 days) to obtain data on the environmental conditions for the various identified parameters along with an assessment of socioeconomic conditions, and biodiversity related parameters. Further Environmental baseline data collection was undertaken from 31st January to 9th February 2024.

E.2 Project Overview

The 75MWp solar power plant bearing central geo-coordinates 21°16'32.41" N, 83°02'51.90" E, is proposed to be developed on ~ 105.25 Ha (260.1 acres), a transmission line tower footprint of 0.283 Ha (0.7 acres), and a transmission line right of way (RoW) of 15.94 Ha (39.4 acres) with elevation ranging from ~189 m to ~203 m above mean sea level (amsl). Villages falling within 5 Km radius of the project site are Arjunda, Baidpali, Banhardih, Baitari, Belmundi, Bhothaldih, Chattigirola, Chhindpali, Chhibarra, Dewalbhatha, Girsa, Jalgarh, Jhilmila, Jognipali, Kasdol, Kesratal, Khairjhitaki, Khairmal, Khaparidih, Khamharpali, Kisdi, Kodoguda, Kutela, Madhopali, Nanakpali, Paterapali, Saldih, Salhepali, Saraipatra, Saraipali, Singharpur, Tengnapali. However, as per the aerial imagery of the TL route shared by the project team, the villages impacted include Ichchhapur, Baitari, Bonda NawaPali and Darrabhata. Ichchhapur and Kena village will also be affected by access road and movement of vehicles, localized opportunities for employment in the construction phase (positive impact) and localized stress on common natural resources (e.g., water, power, land availability, etc.).

The nearest river to the location is the Ong River, situated 6 kilometers away. The site is well-connected by road, with State Highway 16 approximately 4.18 kilometers away, National Highway 153 around 3.74 kilometers distant, and Asian Highway 46 roughly 2.12 kilometers from the location. The nearest railway station is Barpali Railway Station, located 70 kilometers away, while the nearest airport is Raigarh Airport, which is 79 kilometers away.

The 5 km study area is categorized majorly by agriculture land. The study area consists of natural habitats (reserve forests, open scrubland) and modified habitats (agriculture lands, open scrubland and water bodies). Agricultural land occupies most of the Study Area (73.31%) and is the dominant habitat type followed by open scrub land (13.11) and waterbody (3.37). The detailed land use category for study area. The predominant vegetation type in the study area is tropical dry deciduous forest, dominated by trees such as Bija (*Pterocarpus marsupium*)

[NT (IUCN v2023-1)], Dhawda (*Anogeissus latifolia*), Haldu (*Adina cordifolia*) [NE (IUCN v2023-1)], Lendia (*Lagerstroemia parviflora*) [LC (IUCN v2023-1)], Dhoban (*Dalbergia paniculata*) [NE (IUCN v2023-1)] etc.

E.3 Applicable Reference Framework

The applicable reference framework for the proposed ESIA study is as follows:

- Applicable national and state legislation, regulations, policies and standards in relation to the planning/pre-construction (land procurement), construction, operation and decommissioning of solar Project and associated facilities in India and relevant to environment, health, safety, labour, land acquisition, stakeholder engagement and indigenous peoples (as relevant);
- In particular, for Chhattisgarh Solar Energy Policy, 2017-2027
- IFC Performance Standards (2012);
- IFC/World Bank General Environmental Health & Safety (EHS) Guidelines (2007);
- IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007);
- IFC/EBRD Workers' Accommodation: Process and Standards;
- IFC's Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets;
- IFC Utility Scale Solar Photovoltaic Power Plants: A Project Developer's Guide (2015).

Where there is a discrepancy between the prevailing environmental and social standards in India on noise limits, health etc. and the corresponding standards published by the IFC/ World Bank General EHS Guidelines, ERM will incorporate the more stringent standards.

E.3.1 Applicability to IFC Performance Standards

The following IFC Performance Standards are applicable to the Project:

TABLE 0.1 IFC PERFORMANCE STANDARDS AND THEIR APPLICABILITY

Description	Applicability	Objectives and Applicability to Project
IFC PS 1 - Assessment and Management of Environmental and Social Risks and Impacts	Yes	This PS aims to assesses the existing social and environmental management systems of Project Company and CleanMax 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. CleanMax has shared the ESIA report with ERM which has been conducted on 15th December 2023 by Ecogenesis Consultancy Private Limited and the ESIA as part of the "identification of risks and impacts" requirement under the IFC PS 1. The management plan prescribed in this ESIA

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		report will be implemented for mitigation of impacts identified.
IFC PS 2 - Labour and Working Conditions	Yes	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 CleanMax as well as any contractors. The Project is in construction phase and during site visit there were approximately 46 skilled, semi-skilled and unskilled labourers at site were employed at the Project site. Similarly, 20-25 employees and worker will be engaged during operation phase. CleanMax has a dedicated contractor management plan and Corporate level HR policies in line with IFC standards. The Project company will ensure that the HR policy in line with Corporate level HR policy is followed.
IFC PS 3 - Resource Efficiency and Pollution Prevention	Yes	PS-3 covers the use of 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 CleanMax intends to minimize pollution related impacts, management plans and systems are in place, and measures it plans to take to conserve and use resources more efficiently. The Project construction activities will lead to increased fugitive dust emissions, especially in the area it is being developed due to the presence of limited vegetation. The Project activities will also lead to increase in ambient noise level during the construction phase which may impact the villages namely Kena (located at a distance of 250m at E direction and Ichhapur (Project location site) in the study area. In addition to this, the Project activities will involve generation of waste. Source of the water will be tanker water from the nearby community which may cause

Description	Applicability	Objectives and Applicability to Project
		significant stress on the existing source of water. Also, wet module cleaning will be opted for solar panels cleaning during operation phase so water will be required for drinking purpose and for cleaning. Therefore, PS 3 is applicable to the Project.
IFC PS 4 - Community Health, Safety and Security	Yes	This PS-4 requires due diligence to anticipate and avoid adverse impacts on the health and safety of the community living near by during the Project life from both routine and non-routine circumstances. It also requires ensuring 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. The Project will involve construction activities that 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. Therefore PS 4 is applicable to the Project.
IFC PS 5 - Land Acquisition and Involuntary Resettlement	To be confirmed	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. **Solar Plant Site:** At the time of site visit, the solar power plant was observed to be in the early part of the planning stage with the CleanMax project team reporting that they were still in the process of shortlisting land parcels. Out of the 89.03 Ha (220 acres) needed for the solar park, consent letters had been signed by 89 land lessors for 45.20 Ha (105.46 acres) and Agreement to lease (ATL) had been signed by 87 land lessors for 44.94 Ha (104.8214 acres). As per the consent letters shared with the ERM team, the land

Description	Applicability	Objectives and Applicability to Project
		will be taken on lease for the solar park for a period of 29 years and 11 months. The land is private agriculture land. Land would be taken on lease only from those willing to lease, without the threat of compulsory acquisition. No physical displacement is expected as there are no residential structures on the required land. It was also reported that the landowners would receive a lease rent at the rate of INR 40,000 / per acre per year. The lease payment can be a viable substitute of the agricultural income (approximately INR 33,000 per acre per year for kharif crops as single cropping was practiced on the shortlisted land parcels reportedly) from the leased land for the landowners. Currently no mitigation/compensation measures are in place for involuntary economic displacement impacts for land users (sharecroppers and agricultural laborers). This is required to be addressed aligned with PS5. It was reported that there was a man-made pond or "Dabri" on one of the shortlisted land parcels along with a solar pump operated tube well. This dabri was used for rainwater harvesting. It was reported by the CleanMax project team, that they will either construct another tubewell for the land lessor on an alternate parcel of land or they would compensate him for the tubewell as per the prevailing market rates. **Transmission line tower footprint and TL RoW:** At the time of site visit, it was reported by the CleanMax project team, that they had hired a second party (M/s Chinmayi Constructions) for procuring land required for TL tower footprint and TL RoW. They were also reported to be responsible for surveying and profiling of the land parcels, negotiating with landowners and compensating them, as well as erection of TL towers and stringing of overhead transmission lines. From our consultation with Mr. Vibhash Agrawal, it was reported that 70 farmers/potential land lessors had been shortlisted for land procurement with whom project disclosures and negotiations were yet to begin. Further, no physical displacement is expected as there are no residential structures on the TL route.
IFC PS 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes	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.

Description	Applicability	Objectives and Applicability to Project
IFC PS 7 - Indigenous Peoples	Yes	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 endeavor 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. Mahasamund district and project area does not fall under a Schedule V area[1] as defined in the Indian Constitution. The landowners who have been registered to lease their land for the project include ST land lessors. Consultations with ST land lessors revealed that the entire population in the villages within which the solar plant and its project components falls, are in the rural category. As per a review of the consent letters and information shared by the CleanMax project team, 15 land lessors in the villages of Ichchhapur and Kena where the solar plant is located and who have consented to lease their land are scheduled tribes belonging to Sawara, Gond, Binjhwar and Agharia sub-castes. It is understood from discussions with the ST land lessors at Kena and Ichchhapur village that agriculture is their main sources of livelihood. However, few of them work as daily wage labourers, agricultural labour at villages or near towns. Consequently, the solar plant is expected to have impact on indigenous peoples and the applicability of PS 7, with the need for FPIC can be triggered, subject to the baseline conditions. The degree of impacts is determined by evaluating (i) the magnitude of the impact on Indigenous Peoples' customary rights of use and access to land and natural resources; socio-economic status; cultural and communal integrity; health, education, livelihood systems, and social security status; or indigenous knowledge; and (ii) the vulnerability of the affected Indigenous Peoples.

[1] The criteria followed for declaring an area as Scheduled Area are preponderance of tribal population, compactness and reasonable size of the area, under-developed nature of the area, and marked disparity in economic standard of the people. Though these criteria are not spelt out in the constitution but have become well established. Constitution of India has established special provisions for fifth scheduled areas.

Description	Applicability	Objectives and Applicability to Project
IFC PS 8 - Cultural Heritage	Applicable	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. As confirmed during ERM site visit, no cultural heritage is likely to be affected by the Project activities, however, since it involves excavation, a Chance Finds process will need to be set up, aligned with PS8. PS8 is provisionally applicable to the Project in the construction stage.

E.3.2 Project Categorization and Justification

Based on the assessment as per IFC categories, the Project has been categorized as **Category B** based on the following reasoning:

- **Potentially limited risks/impacts and reversible**: Environmental, Biological and social impacts of the Project are anticipated during the construction phase and will encompass changes in land-use, increased noise levels, changes in air quality, use and changes in water quality, impacts on terrestrial ecology, occupational health & safety, etc. Further, there is no physical displacement involved in this Project.
- **Unprecedented**: Development of solar power Projects is occurring in large numbers in the last decade and therefore several such Projects are located across India. A solar power Project can therefore not be considered an unprecedented activity.
- **Limited adverse impacts on the baseline**: Solar based energy development is a less polluting source of energy and thus is not likely to lead to any adverse impacts on the baseline environment during the operation phase. In terms of social impacts, the land required is composed of private agricultural land. The site location of the Project does not involve any anticipated settlements and physical displacement.

E.4 Baseline Conditions

E.4.1 Environmental Baseline

The land use is primarily scrub land in the study area (5 km) of solar project contributing majorly falls under Agricultural land i.e., 73 % followed by Open Scrub 13 % and built-up area 5.9%.

According to the Groundwater Yearbook of Chhattisgarh (September 2022), Saraipali Block is in the easternmost part of Mahasamund district, Chhattisgarh, at an elevation of 248 meters above sea level. Mahasamund experiences a tropical savanna climate (Aw) with an average yearly temperature of 35.05ºC, 4.02% higher than India's average. The district primarily receives rainfall from the southwest monsoon, with July and August being the wettest months.

About 95% of the annual rainfall occurs between June and September, totaling around 1044 mm, based on data from 1981 to 2021, and the district has 50-60 rainy days annually.

The proposed solar power plant is situated at an elevation between 189 and 203 meters above mean sea level, with a slight slope from northwest to southeast. The topography varies from flat terrain to slight undulations. Satellite images and an ERM site visit confirmed this elevation range and the undulating nature of the site, as depicted in the digital elevation map.

The district is home to various mineral resources, including gold, tin ore, lead ore, fluorite, beryl, granite, and limestone rocks. The economic viability of extracting these minerals has not yet been fully determined. Limestone is used extensively in small-scale industries for various purposes, and there are numerous granite-based industries in the area.

The district exhibits significant soil variations, primarily characterized by two main types: red and yellow Ultisols, and red gravely/sandy Alfisols. These soils are predominantly found in situ throughout the district. Ultisols are known for their reddish and yellowish hues, while Alfisols typically feature a red, gravelly, or sandy texture. These soil types contribute to the diverse agricultural landscape of the region, influencing crop selection and farming practices. The soil analysis indicates significant characteristics affecting plant growth: with a pH range of 7.52 to 7.22, the soil is strongly alkaline due to high calcium carbonate content, potentially hindering nutrient absorption. Electrical Conductivity (EC) values of 242 and 387 mmhos/cm suggest a low concentration of soluble salts, adequate for germination. However, deficiencies in crucial micronutrients are evident, with iron levels ranging from 7783 to 10342.05 mg/kg, copper levels between 9.08 and 12.24 mg/kg, and zinc levels from 8.05 to 9.79 mg/kg. These deficiencies highlight the need for soil supplementation to ensure optimal plant growth and productivity.

According to the Aquifer Maps and Ground Water Management Plan of Mahasamund District, Chhattisgarh 2018, the Suranginala river flows eastwards and converges with the Ong River, while the Lath Nala and Kholtinala rivers flow northwards and join the Mahanadi River. Acting as the western boundary of the block, the Mahanadi River separates Raipur and Mahasamund districts. Other contributing rivers to the Mahanadi basin include Bag-nainala, Kurarnala, and Hathi Nala. The district boasts 20,626 bore wells or tube wells, 5,093 dug wells, and 4,768 small reservoirs (talabs) utilized for irrigation purposes. Furthermore, 6,654 units of irrigated area are supported by alternate water sources. The net irrigated area accounts for 36% of the total area, with 99,047 units, while the gross irrigated area encompasses 109,195 units. Despite this, satellite imagery from Google Earth indicates the absence of surface water bodies within the study area of the proposed project, though a transmission line traverses the River Bomar.

The computation of groundwater resources in the district, conducted jointly by the Central Ground Water Board and the State Ground & Surface Water Resources and Data Centre (PWD, WRO, and Government of Chhattisgarh), employs the GEC 1997 methodology. In the Saraipali block, the groundwater situation is categorized as safe, with a groundwater development stage of 38.94%. The net groundwater availability is estimated at 84.38 Million Cubic Meters (MCM), with a total groundwater draft for all uses amounting to 32.86 MCM. Looking ahead, the projected groundwater resources for future uses in the Saraipali Block are calculated to be 55.85 MCM.

The groundwater samples from within the Project Area of Interest (AoI) were analyzed against IS: 10500:2012 standards, indicating favorable results. pH levels fell within the alkaline range, turbidity remained below quantifiable limits, and TDS, alkalinity, and hardness were within acceptable levels. Fluoride concentrations were negligible, and no traces of total coliform, E. coli, heavy metals, Trihalomethane, or Pesticide Residue were detected. Consequently, the groundwater is deemed suitable for drinking or domestic purposes during both construction and operation phases, contingent upon conventional treatment. Additionally, it can be used for construction activities with prior governmental approval.

Surface water samples were analyzed against the designated best use classification of the Central Pollution Control Board (CPCB), yielding the following findings. pH levels ranged from 7.46 to 7.2, falling within the acceptable range set by IS 10500 standards. Dissolved Oxygen (DO) levels were measured at 6.80 and 6.60 mg/l, indicative of adequate oxygen content. Turbidity levels were below the quantifiable limit, adhering to the acceptable threshold of 1 NTU. Total Dissolved Solids (TDS) were within the acceptable limit of 500 mg/l but also within the permissible limit of 2000 mg/l. Fluoride concentrations were below detection limits, aligning with permissible limits. Furthermore, no traces of total coliform or E. coli were detected, satisfying IS 10500 standards. Concentrations of heavy metals, Trihalomethane, and Pesticide Residue were within both acceptable and permissible limits as per IS 10500 standards. Consequently, both surface water samples, SW-1 and SW-2, met the criteria for "Class A" classification, indicating their suitability for designated best use.

The equivalent ambient noise levels during the daytime (Leq day) at monitoring locations N1, N2, N3, and N4 were recorded at 54.4, 52.0, 51.8, and 50.9 dB(A) respectively, all of which fall within the CPCB daytime limit of 55 dB(A). Similarly, the noise levels during nighttime (Leq night) at the same locations were measured at 44.1, 42.9, 41.7, and 43.7 dB(A) respectively, which also comply with the prescribed CPCB limits. Overall, the ambient noise levels recorded at all monitoring locations satisfy both daytime and nighttime standards set by the CPCB.

Particulate matter (PM10) and (PM2.5), Sulphur Dioxide (SO2), Nitrogen Oxide (NOx), and Carbon Monoxide (CO) concentrations were observed to be within the prescribed limits at all four locations of the project site. This indicates compliance with regulatory standards for air quality, reflecting a favorable environmental condition in terms of these pollutants across the project area.

Based on data from the Building Materials & Technology Promotion Council (BMTPC) and Disaster Management Authority of Chhattisgarh, the project site is situated in Zone II for earthquakes, indicating low damage risk (MSK VI). Regarding wind and cyclones, the area experiences high velocities (Vb= 44 m/s), categorized as a moderate damage risk zone. However, the site is not prone to flooding incidents. In terms of drought vulnerability, Mahasamund district has a moderate index of 0.4, signifying moderate drought susceptibility. While earthquakes, floods, wind/cyclones, and drought can pose significant risks, the project location's low earthquake and flood risk, coupled with moderate wind/cyclone and drought vulnerability, indicate manageable disaster potential.

E.4.2 Social Baseline

Chhattisgarh has a total population of 2.56 crore (Census, 2011) and has a geographical area of 1.35 lakh sq. km. The population density of the state is 189 persons per sq. km. in 2011 (as compared to 154 persons per sq. km in 2001).

Chhattisgarh has 5 administrative divisions, 27 districts, 96 sub-divisions, 154 tehsils, 68 sub-tehsils, 146 development blocks, 14 towns, and 20529 villages.

About 23.2% of the population of Chhattisgarh is urban while the remaining 76.8% is rural. The state has a higher sex ratio as compared to India; 991 females per 1000 males as compared to India's sex ratio, which stands at 943 (Census, 2011).

As per the District Census Handbook, 2011, Mahasamund district has a total population of 10.3 lakh persons and a population density of 216 persons per sq. km. The district has 5 tehsils (Basna, Saraipali, Mahasamund, Pithora and Bagbahra) and 545 Gram Panchayats.

All residents in the Study Area fall within the rural category. According to Census 2011, the study area (solar plant, proposed transmission line route and GSS) specifically comprises a SC population of 14.1 %, while the Area of Influence (AoI) encompasses a slightly higher SC population at 15.9%. The ST population is 22.6% in the study area while its is 24.7% in the AoI.

Insights from consultations reveal that the livelihoods of Scheduled Caste (SC) individuals closely mirror those of the general community. However, only 10% of SC population own land, leading to a higher reliance on agricultural and wage labor. SC individuals mainly work as cultivators during the cropping season and shift to roles like daily wage laborers or construction workers during the non-cropping season. Some SC households are also involved in poultry farming. Site visits indicate that SC communities reside alongside general caste communities in main settlement areas, and they prefer local employment over migration to other states.

Chhattisgarh has 30.62% Scheduled Tribes out of the total population. Chhattisgarh stands at the eighth place after Mizoram, Lakshadweep, Nagaland, Meghalaya, Andhra Pradesh, Dadar and Nagar Haveli and Manipur from the point of tribal population.

The settlement pattern in villages of the study area has a low degree of nucleation with no reported delineations between dominant caste groups and marginalized groups like SC and ST communities, living in scattered communities in the villages.

The study area comprises the solar plant, project components, and existing GSS across five villages: Ichchapur, Kena, Baitari, Bonda Nawapali, and Darrabhata. Consent has been obtained for 45.20 Ha (105.46 acres) out of the required 89.03 Ha (220 acres) for land acquisition. It encompasses 1416 households with 5866 rural residents, boasting a sex ratio of 1007 females per 1000 males, slightly below the district's rate but surpassing the state's. Total literacy is 65.9%, with female literacy at 62.2%. SC population percentage is 14.1%, and ST population is 22.6%, both higher than district figures but lower than state averages.

The female literacy rate for the study area is reported as 62.2%, slightly lower than the AoI's rate of 67.2% but higher than the national female literacy rate of 60.24%. Meanwhile, male literacy rates for both the study area (85.5%) and AoI (86.3%) exceed their female counterparts but are lower than the national male literacy rate of 80.27%. However, this data

is from 2011, and consultations with Gram Panchayat members and land lessors reveal a growing trend among the younger generation to pursue non-farm-based occupations, leading to increased college education completion and graduate-level attainment.

The data shows that 82% of the land in the study area and 77% in the AoI falls under Net Sown Area, while 1% of the study area as well as the AoI are current fallows. Apart from land under cultivation, nearly 2% of the land in the Study Area and 4% of the AoI consists of barren and uncultivable land area.

The study area predominantly comprises private agricultural land, where rain-fed farming is prevalent, leading to a single cropping system focused on Kharif crops such as paddy and groundnut. The pre-monsoon phase is crucial for sowing, while post-monsoon months mark the harvest period, resulting in seasonal shifts in labor dynamics. During winter months, many agricultural laborers transition to daily wage labor due to reduced agricultural activity. Consultations revealed that agriculture has become more water-intensive over the years, with declining land productivity annually. Consequently, many landowners expressed a desire to lease out their land parcels.

The livelihood of people in the study area is primarily based on agriculture and allied activities, such as livestock rearing. Census data from 2011 highlights a high dependence on farm-based livelihoods, with 36% of total workers engaged in cultivation and 56% working as agricultural laborers. Additionally, 84% of the land is under cultivation, indicating a heavy reliance on agriculture. However, recent trends suggest a shift away from farm-based livelihoods, with individuals pursuing opportunities in daily wage labor, small businesses, teaching, government services, and urban migration. Consultations with local communities reveal that younger generations are increasingly disinterested in farming, favoring non-farm occupations. Improved access to education is cited as a key factor driving this transition away from traditional agricultural livelihoods.

The WPR in the Study Area and the AoI combined is 45%. Non-workers constitute 55% of that population and include children and the elderly, in addition to the unemployed. Most of workers other than farmers or agricultural labourers are either engaged in daily wage labour during non-cropping season while some of them migrate to nearby villages and districts for daily wage work.

During consultations with female land lessors and Anganwadi workers, it was noted that the productive roles of women remain consistent across caste and religious groups in the study area. Women are responsible for managing household chores alongside agricultural labor during the cropping season, regardless of social background. The average age of marriage for women is reported to be between 18-20 years old. Typically, women in the study area complete middle school before dropping out to assist with household and farm work. During the agricultural off-season, they often work as daily wage laborers on nearby construction sites to support their families. Unfortunately, it was reported that women are paid lower wages than men for the same nature, amount, and duration of work, with contractors attributing this disparity to perceived lower efficiency among women.

During consultations with Gram Panchayat members, it was found that most households in the study villages lack borewells, relying on ponds, lakes, and tubewells for agricultural water needs. Tap water connections are scarce, with households depending on common taps supplied

by Gram Panchayats. However, the upcoming Har Ghar Nal Yojana scheme is expected to increase tap water connections. Community toilets were absent according to the 2011 census handbook, but after initiatives like the Swachh Bharat Mission, toilets are now present in every household, reducing open defecation issues.

The data underscores a notable scarcity of senior secondary and higher educational institutions in the study area as well as the AoI, evident by the absence of arts and science colleges, engineering and medical colleges, management institutes, polytechnics, and vocational training centres. Conversely, the study area and AoI exhibit a comparatively robust primary and middle school education landscape, hosting forty primary schools, twenty middle schools, five secondary schools, and two senior secondary schools.

During consultations with Gram Panchayat members, it was noted that a majority of people in the study area are graduates, although individuals from SC and ST communities often discontinue their education after middle school due to financial constraints. The nearest college, Ravi Shankar University in Saraipali, is approximately 10 km away from the solar plant site, with students relying on autos, government buses, and personal vehicles to commute. Despite their education, women across all social groups primarily assume the role of housewives and tend to avoid seeking formal employment outside of agriculture and daily wage labor. They often engage in agricultural labor alongside their domestic responsibilities, with the average age of marriage reported to be 22-23 for women and 23-25 for men in the study area.

The healthcare infrastructure in India, including Chhattisgarh, typically follows a three-tier system. In the study area, there is one primary health sub-centre, while the AoI villages have five primary health sub-centres, one dispensary, four non-government outpatient medical facilities, and four non-government medicine shops. However, there are no hospitals, maternity and child welfare centers, or TB clinics in either the study area or the AoI villages.

According to the 2011 Census, households in Mahasamund district heavily rely on electricity for lighting, ranking 8th among the state's districts in terms of this percentage. Consultations revealed that in the study area, households predominantly use electricity for domestic and agricultural purposes, particularly for running motor pumps. Additionally, the majority of households have LPG connections, with occasional use of firewood for cooking. Electricity connections for irrigation purposes are supplied for 20 hours per day, and power outages are rare, occurring only in cases of electrical faults, which are promptly addressed within 20-30 minutes.

During consultations with female land lessors and Anganwadi workers, it was found that women's roles remain consistent across caste and religious groups in the study area. Regardless of social background, women are responsible for managing household chores and participating in agricultural labor during the cropping season. The average age of marriage for women is reported to be 18-20 years old. Typically, women complete middle school before dropping out to assist their families with household and farm work. During the agricultural off-season, they often work as daily wage laborers on nearby construction sites to support their families. Unfortunately, women are paid lower wages than men for the same nature, amount, and duration of work, with contractors citing perceived lower efficiency as the reason for this disparity. It was noted that women in the study area are responsible for feeding and cleaning livestock, preparing dung cakes, and milking, among other tasks, but they are not responsible

for grazing livestock outside the household premises. Male members of the household typically handle livestock grazing on specific government-owned land parcels, which are commonly used by the community for grazing and are scattered across various parts of the villages. Regardless of their social group, women are not only responsible for household chores but also actively engaged in agricultural work in the fields and livestock rearing alongside men.

The exposure of women beyond the boundaries of their villages was found to be limited. In consultations with landowners, two female landowners who had participated, reported that while they were aware of the solar Project for which they had consented to lease their land, they did not personally attend the Gram Sabha sessions organized by CleanMax to inform landowners about the Project. Instead, they indicated that they had sent their husbands and sons to represent them at these sessions, who later conveyed the information to them. Despite being the sole owners of their land parcels, these women expressed reliance on male family members for any decisions regarding their land parcels.

It was also reported by the Anganwadi workers and the female land lessors that almost all adult women in the study area have bank accounts as significant proportion of them are beneficiaries of the "Mahtari Vandan Yojana[2]" of the Chhattisgarh state government wherein married women are eligible to receive INR 1000 every month as financial support in their personal bank accounts.

E.4.3 Ecology baseline

A rapid ecological survey was conducted from 30th January to 1st February 2024 to establish an ecological baseline and identify any sensitive ecological receptors within the study area of the Project.

In addition to primary surveys during the site visit for the E&S Scoping, previous ERM experience in the landscape was also referred to especially for avifaunal species. Also, secondary data for the Project site was collected from the Chhattisgarh Forest Department published data[3] of Gomarda Wildlife Sanctuary (~14km from Project site) and available published scientific literature[4][5][6].

The Project site location and immediate surroundings was also run for IUCN listed threatened species (CR, EN, and VU Species). Databases such as IBAT (Integrated Biodiversity Assessment tools), and crowdsourcing platforms such as ebird, iNaturalist, GBIF (Global Biodiversity Information Facility) to understand the presence and absence of the potential Critical Habitat (CH) trigger species and their habitat values.

[2] In pursuit of promoting economic self-reliance among women in the state and enhancing their health, nutrition, and overall empowerment, the Council of Ministers has resolved to introduce the "Mahtari Vandan Yojana" across Chhattisgarh. Under this initiative, eligible married women will receive monthly financial assistance of Rs 1000, aiming to combat discrimination, inequality, and societal unawareness towards women while fostering their active role within families.

[3] Fauna of Gomarda Wildlife Sanctuary, Chhattisgarh. (n.d.). Chhattisgarh Forest Department. http://www.forest.cg.gov.in/WildLife//media/Gomarda%20WLS%20New.pdf

[4] Pandey, A. & Govt. L. P. P. College Sarangarh, Raigarh, Chhattisgarh, India. (2015). Study of Mammal Biodiversity of Gomarda Wildlife Sanctuary. Indian J.L.Sci. (Vol. 5, Issue 1, pp. 115–116). http://www.ijls.in/upload/413514378Microsoft%20Word%20-%20Paper%2027.pdf

[5] BirdLife Data Zone. (n.d.-e). https://datazone.birdlife.org/site/factsheet/gomarda-wildlife-sanctuary-iba-india

[6] Longhorned Beetles from Gomarda Wildlife Sanctuary, Chhattisgarh, India (Coleoptera: Cerambycidae). https://docplayer.net/20674306-Longhorned-beetles-from-gomarda-wildlife-sanctuary-chhattisgarh-india-coleoptera-cerambycidae.html

Professional judgement was used to determine if species identified from the above sources were found in the study area of the Project. Desk-based assessment was also used to identify habitat contiguity, habitats of conservation significance (e.g. Protected Areas) and potential hotspots for migratory and congregatory species (e.g. waterbodies).

The varius habitats within the study area were identified using Google Earth Pro to determine the types and extent of habitats in the 5 km radius of the Project site. These habitats were marked and visited during the site reconnaissance to identify the quality and level of disturbance at these habitat locations.

The floral diversity of the study area was recorded by visual observation during the site visit in the 5km study area. The road transects routes, point counts and waterbody surveys were used to populate the floral diversity across different habitat type. It was further populated basis discussions with the focal communities/ stakeholders and review of scientific publications available in the public domain.

Amphibians are often restricted to natural and constructed ponds during the warmest times of the day[7]. All the natural and manmade waterbodies, although limited in number in the Project area, were visited during the warmest times of the day to determine the presence of amphibians along the shaded ledges of the water body. Amphibian searches were paired with waterbody surveys.

Reptile presence was determined using intensive time-constrained search method[8,9]. The method targets rocks and logs located around water bodies or recently dried streams, hedges and along the trunks of higher vegetation. Visual searches also led to the revelation of basking reptiles in the morning and evening. Lizards were recorded during the day as and when opportunistically encountered.

Any avifaunal species that was identified by visual sighting or hearing bird calls were recorded. Birds were identified along motorable roads, around water bodies, and in clumps of higher vegetation during the hottest parts of the day. Binoculars and standard field guides were used for avifaunal identification. Among all faunal groups, special emphasis was given to avian fauna, as transmission line infrastructure may threaten avian fauna due to electrocution or collision. Detailed methodologies for avifaunal surveys are provided below:

56 waterbodies in the study area were visited during early morning and evening hours to monitor the bird activity. Special attention was paid towards recording migratory species. It is to be noted that 38 out of the 56 waterbodies were dry and the remaining 18 waterbodies were used for irrigation and domestic purposes.

Consultations were undertaken with local communities in the core and buffer zone of the Project site to determine presence of Vultures, human-wildlife conflict and large congregation

[7] Knutson et. al. 2004. Agricultural ponds support amphibian populations. Ecological Applications. 14 (3): 669-684

[8] Welsh, H.H., jr. 1987. Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In. Multiple – Use Management of Califirnia's hardwood resources. T.R. Plumb, N.H. Pillisbury (eds. Gen. Tech. Regional Environmental Planning. PSW – 100) US Department of Agriculture, Forest Service

[9] Welsh, H.H. Jr. and Lind, A. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and southwestern Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech. Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service

of migratory species. As part of the consultations, images of the above species were shown to the community members in the study area to determine if there have been any sightings in the last decade. The information from village consultations was supplemented through discussions with the District Forest Officer of Saraipalli Division.

According to the WWF Terrestrial Ecoregions classification of the world the study area falls under tropical and subtropical dry broadleaf forest [10]. It is part of biome category 11: Tropical Dry Zone under the Indomalayan realm and Indian-subcontinent bioregion.

According to Biogeographic Zones of India the landscape of Mahasamund district is classified as 6: Deccan Peninsula[11] The altitude of landscape ranges between 215 m and 550m. The topography of the area is gently undulating with boulders and rocks.

There are no key biodiversity areas (KBAs), protected areas (PAs), important bird areas (IBAs) in the 5 km Study area. The closest protected area is Gomarda Wildlife Sanctuary ~14km from the site, which is also an important bird area and ~10 km from the transmission line route.

India has 7 UNESCO Heritage Sites for Natural Significance[12]. The nearest natural heritage site is Sundarbans National Park[13] (criteria ix[14], x[15]) located approximately 568 km east of the Project site.

Chhattissgarh does not have any Biosphere reserves. The nearest Biosphere Reserve is Achanakmar Amarkantak[16] located approximately 167 km north-west of the Project site.

India has 80 Ramsar sites as of January 2024[17]. The nearest Ramsar Site is Hirakund Reservoir[18], located approximately 80 km northeast of the Project site.

There are no protected areas in the AoI. Nearest protected area is Gomarda Wildlife Sanctuary[19], located about ~14 km northeast of the Project site. The ESZ of Gomarda Wildlife Santuary is defined[20] and is ~10 km from the closest section of the trasnmission line route and ~12 km from the solar plant boundary.

The 5 km study area is categorized majorly by agriculture land. The study area consists of natural habitats (reserve forests, open scrubland) and modified habitats (agriculture lands, open scrubland and water bodies). Agricultural land occupies most of the Study Area (73.31%) and is the dominant habitat type followed by open scrub land (13.11) and waterbody (3.37).

The predominant vegetation type in the study area is tropical dry deciduous forest, dominated by trees such as Bija (*Pterocarpus marsupium*) [NT (IUCN v2023-1)], Dhawda (*Anogeissus*

[10] Olson, D. M., Dinerstein, E., Wikramanayake, E. D., Burgess, N. D., Powell, G. V. N., Underwood, E. C., D'Amico, J. A., Itoua, I., Strand, H. E., Morrison, J. C., Loucks, C. J., Allnutt, T. F., Ricketts, T. H., Kura, Y., Lamoreux, J. F., Wettengel, W. W., Hedao, P., Kassem, K. R. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. Bioscience 51(11):933-938

[11] Rodgers, W.A. and Panwar, S.H. (1988) Biogeographical classification of India. New Forest, Dehra Dun, India.

12 UNESCO World Heritage Centre. India - UNESCO World Heritage Convention. https://whc.unesco.org/en/statesparties/in

[13] UNESCO World Heritage Centre. The Sundarbans. https://whc.unesco.org/en/list/798/

[14] Criteria ix: to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

[15] Criteria x: to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

[16] Achanakmar-Amarkantak Biosphere Reserve, India. UNESCO. https://en.unesco.org/biosphere/aspac/achanakmar-amarkantak

[17] RAMSAR Wetland Sites (wiienvis.nic.in)

[18] Hirakud Reservoir | Ramsar Sites Information Service. https://rsis.ramsar.org/ris/2494

[19] Wildlife Sanctuaries (wiienvis.nic.in)

[20] THE GAZETTE OF INDIA. (2016). THE GAZETTE OF INDIA : EXTRAORDINARY [PART II—SEC. 3(ii)]. In THE GAZETTE OF INDIA : EXTRAORDINARY. https://moef.gov.in/wp-content/uploads/2017/06/Gomarda%20Wildlife%20Sanctuary%2C%20Chhatisgarh.pdf

latifolia), Haldu (*Adina cordifolia*) [NE (IUCN v2023-1)], Lendia (*Lagerstroemia parviflora*) [LC (IUCN v2023-1)], Dhoban (*Dalbergia paniculata*) [NE (IUCN v2023-1)] etc.

The floral assessment was undertaken in the available habitats within the solar power plant area and 5 km buffer areas. The prominent tree species found in the study area are Tendu (*Diospyros melanoxylon*) [NE (IUCN v2023.1)], Mahua (*Madhuca longifolia*) [NE (IUCN v2023.1)], Sal (*Shorea robusta*) [LC (IUCN v2023.1)], Bija (*Pterocarpus marsupium*) [NT (IUCN v2023.1)], Dhawda (*Anogeissus latifolia*) [NE (IUCN v2023.1)], Haldu (*Haldina cordifolia*) [NE (IUCN v2023.1)], Lendia (*Lagerstroemia parviflora*) [LC (IUCN v2023.1)], Dhoban (*Dalbergia lanceolaria*) [LC (IUCN v2023.1)], Bamboo (*Dendrocalamus strictus*) [LC (IUCN v2023.1)], Saja (*Terminalia tomentosa*) [NE (IUCN v2023.1)] , Shisham (*Dalbergia sissoo*) [LC (IUCN v2023.1)], Semal (*Bombax ceiba*) [LC (IUCN v2023.1)], Salai (*Boswellia serrata*) [LC (IUCN v2023.1)], Amla (*Phyllanthus emblica*) [LC (IUCN v2023.1)] , Kulu (*Sterculia urens*) [NE (IUCN v2023.1)], Amaltas (*Cassia fistula*) [LC (IUCN v2023.1)] and Ber (*Ziziphus mauritiana*) [LC (IUCN v2023.1)].

A total of thirty-five (33) floral species belonging to twenty (20) families were observed in the study area. Fabaceae was the most dominating family in the area with 6 species. None of the species identified in the region is endangered.

A total of 147 species are reported from the study area and surrounding landscape[21]. During the primary survey 76 species were observed. The project site and study area are highly modified agriculture land habitat. No IUCN threatened species (CR, EN and VU) were observed during the primary survey. One near-threatened species namely, Alexandrine Parakeet (*Psittacula eupatria*) [NT (IUCN v2023-1)] was observed.

As for the reported species, one critically endangered Indian vulture (*Gyps indicus*), two IUCN vulnerable (VU) species: Common Pochard (*Aythya ferina*) and River Tern (*Sterna aurantia*) and three IUCN near-threatened species: Asian Woolly-necked Stork (*Ciconia episcopus*), Black-tailed Godwit (*Limosa limosa*) and Ferruginous Duck (*Aythya nyroca*) have been reported. All the other reported species have been classified as least concern as per the latest IUCN Red List (Online Version 2023-1). The IUCN CR Indian Vulture is reported from Shisupal Cliffs[22] located at ~4km southeast from the project site and ~5.5km from the transmission line route infrastructure. According to the latest population estimates 10-12 individuals[23] of the species are inhabiting the cliffs.

According to the Wildlife (Protection) Amendment Act, 2022 fourteen (13) Schedule I species are reported. Two Schedule I species were observed during the primary survey namely, Booted Eagle (*Hieraaetus pennatus*) [LC (IUCN v2021-1)] and Chrested serpent Eagle (*Spilornis cheela*) [LC (IUCN v2021-1)].

Thirty-three (33) migratory species are reported from study area. Two migratory species were observed during the primary survey namely Indian pitta (*Pitta brachyura*) and Booted Eagle

[21] Fauna of Gomarda Wildlife Sanctuary, Chhattisgarh. (2016). Wildlife Institute of India and Madhya Pradesh Forest Department. https://www.forest.cg.gov.in/WildLife//media/Gomarda%20WLS%20New.pdf
[22] Bharos, A. M. K., 1, Bux, F., 2, & TCRP. (2018). Avifauna of Kalidarha dam and Shishupal Cliff in Mahasamund district, Chhattisgarh, India. In Asian Journal of Conservation Biology (pp. 119–124) [Journal-article]. https://www.ajcb.in/journals/short_others_dec_2018/AJCB-Vol7-No2-%20Bharos-Bux.pdf
[23] Arjun, M. S., Panda, B. P., Arun, P., & Bharos, A. M. K. (2023). Status of ornithological works from the state of Chhattisgarh, India, and conservation implications: A review. Journal for Nature Conservation, 75, 126471. https://doi.org/10.1016/j.jnc.2023.126471

(*Hieraaetus pennatus*). 56 waterbodies were visited in the study area, 38 waterbodies were dry and the remaining 18 waterbodies were used for irrigation and domestic purposes. Most of the waterbodies with water were degraded and saw increased eutrophication, in addition wetland birds were not observed in these waterbodies except for 2 or 3 individuals of Little cormorants *(Microcarbo niger*) [LC (UCN v2023-1)], Grey-headed swamphen (*Porphyrio poliocephalus)* [LC (UCN v2023-1)], Little egret (*Egretta garzetta)* [LC (UCN v2023-1)], and White-breasted waterhen (*Amaurornis phoenicurus)* [LC (UCN v2023-1)]. The waterbodies are therefore not expected to provide suitable habitat for large scale congregation of both migratory and residential wetland associated avian fauna.

India lies along the Central Asian Flyway, a global migratory pathway that connects the Palearctic (Europe and Northern Asia) to the Indian subcontinent. The birds that utilize this flyway congregate at key water bodies around India.

Thirty-one (31) species of mammals are reported from the Mahasamund district**Error! Bookmark not defined.**. Twenty-five (25) of the recorded species are classified as least concern as per the latest IUCN Red List (Online Version 2023-1). One (01) species is classified as near threatened- Striped Hyaena (*Hyaena hyaena*) and five (05) are classified as Vulnerable - Four horned Antelope (*Tetracerus quadricornis*), Gaur (*Bos frontalis*), Leopard (*Panthera pardus*), Sambar (*Rusa unicolor*), Sloth Bear (*Melursus ursinus*). Fifteen (15) of the thirty-one species reported are protected and categorized under Schedule I as per the Wildlife (Protection) Amendment Act, 2022.

Most of these species are recorded from the forested habitat of the Gomarda Wildlife Sanctuary. The project site is disjunct from ecologically sensitive areas as lands intervening the sanctuary, reserve forests and the proposed Project site host large tracts of agricultural lands. The RFs are isolated from the Gomarda WLS and are unlikely to act as dispersal routes, passages or corridors for faunal species of the WLS. Though presence from the project site and study area cannot be ruled out as species like Indian Grey Wolf (*Canis lupus pallipes*) [LC (IUCN v2023-1)], Leopard (*Panthera pardus*) [VU (IUCN v2023-1)], Bengal Fox (*Vulpes bengalensis*) [LC (IUCN v2023-1)], Golden Jackal (*Canis aureus*) [LC (IUCN v2023-1)] use scrublands, grasslands, and agriculture land as habitat. The community consultations confirmed presence of Leopard and Golden Jackel from the study area.

Three species namely, Five-striped palm squirrel (*Funambulus pennanti*), Black-naped hare (*Lepus nigricollis)* and Chital (*Axis axis)* were observed during the primary survey.

32 species of herpetofauna are reported from the Mahasamund district**Error! Bookmark not defined.**. The Common Garden Lizard, (*Calotes versicolor*) [LC (IUCN 2023-1)] was encountered during the survey. Other herpetofauna such as frogs and geckos were not encountered as night surveys were not performed.

In addition to the primary survey, the Forest Department document on Fauna of Gomarda Wildlife Sanctuary**Error! Bookmark not defined.** was reviewed to understand the distribution of herpetofauna in the study area, based on the types of habitats available within it.

8 species of amphibians belonging to 8 genera under 4 families are reported from the study area and adjoining landscape based on published literature**Error! Bookmark not defined.**. No amphibians were encountered during the primary survey. These species are expected to occur in the study area as there are many seasonal and perennial waterbodies in the study area.

24 species of reptiles are reported from the study area and adjoining landscape based on secondary data. The Common Garden Lizard (*Calotes versicolor*) [LC (IUCN 2023-1)] was encountered during the survey.

E.5 Stakeholder Engagement

The key groups that were consulted during the ESIA study process were: land lessors, agricultural labourers working on the leased land and land lessors from the Project villages, local elected representatives (Gram Panchayat members), government officials (Anganwadi worker), on-site laborers, land aggregator and the CleanMax land team.

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

- **Key feedback received from local community in the study area:** It was informed during the consultation with the community that there is a lack of irrigation facilities and decline in crop yield. There was a positive outlook towards the solar Projects in the area. 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 4 land lessor who were consulted during the site visit:** It was informed that the lessors are willing to lease their land parcels due to the low productivity, dependency on monsoons and lack of irrigation facilities. The amount received after leasing their land was going to be re-invested to build houses or to fund their children's wedding or their education. The major concern of the stakeholder group till now is related to availability of employment opportunities that the Project will generate.
- **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 such as setting up of community bore wells at different locations in the study area, setting up of streetlights and a wifi zone.

E.6 Key Identified Impacts

E.6.1 Planning phase

Impact due to land procurement (long term lease) on title-holders- The 77.5 MWp solar power plant requires 89 hectares of land, with approximately half of the required land already secured through signed agreements with 89 land lessors. Most land lessors, predominantly engaged in agriculture, opt to lease their land due to its low productivity. Post-decommissioning, the land will be returned in its original state. No physical displacement is anticipated, but a man-made pond on one parcel will be addressed by the project team, either through alternative arrangements or compensation.

Impact of land procurement on Land users (agriculture labourers and Sharecroppers on leased land)- Consultations and secondary census data analysis reveal that agricultural labor (56%) and cultivation (36%) are the primary occupations in the Study Area, with average wages ranging from INR 200-300 per day. Due to the rainfed nature of agriculture, a single cropping system is practiced. However, during the land lease process, agricultural laborers dependent on project land may have faced economic displacement, as documented by the ERM team. Despite being absorbed by land lessors on alternate lands, the transition may have temporarily

affected their income and financial capacity. Notably, no separate project disclosure session was conducted for non-title holders by the CleanMax project team.

Impact due to transmission line land procurement (Right of Way Agreement) on title holders- The power generated by the solar plant will be transmitted via a 33 kV internal line to the 132/33 kV solar Farm Pooling substation within the plant. From there, a 132 kV overhead line, approximately 5.6 km in length, will connect to the existing CSPTCL substation at Darrabhata village. Land will be required for 25 transmission line towers, covering approximately 0.28 Ha, and for the Transmission line Right of Way (RoW), totaling 15.94 Ha with a width of 14m. The procurement of land for towers and RoW is managed by a second party, Chinmayi Constructions, responsible for surveying, negotiations, compensation, tower erection, and line stringing. Compensation is offered based on prevailing circle rates for "right to use," with alternative guidelines from the Ministry of Power applied if needed, ensuring fair compensation for landowners.

Impact due to transmission line land procurement (Right of Way Agreement) on Non-title holders-During our consultation with Mr. Vibhash Agrawal of M/s Chinmayi Constructions, it reported that there are currently no compensatory arrangements in place for agricultural laborers working on the land parcels shortlisted for the TL RoW and TL Tower footprint. Also given the initial phase pf the land procurement process, an estimate regarding the number of agricultural laborers dependent on the shortlisted land parcels for their livelihoods could not be confirmed from the consultation. However, it was also reported that these laborers would be absorbed into alternate land holdings owned by the potential land lessors and hence would face no loss of livelihood.

Impact on Women- The lack of separate meetings arranged for women landowners and agricultural laborers during the initial stages of the land procurement process suggests a gap in gender inclusivity in the Project's engagement efforts. Women, comprising a significant portion of land lessors, were not adequately briefed about the solar power plant, relying instead on information relayed by male family members. This oversight may have implications for gender equity and participation in decision-making processes related to the Project. Therefore, the receptor sensitivity and impact magnitude are assessed as medium, highlighting the need for improved gender-inclusive engagement strategies.

E.6.2 Construction phase

Change in Land-use- The total study area covers approximately 105.25 hectares, consisting mainly of open scrub land and agricultural areas, including the footprint of the transmission line towers (0.283 hectares) and the Transmission Line Right of Way (15.95 hectares). The 132 kV external transmission line will connect to the Darrabhata Saraipalli Grid Substation at Saraipalli, covering approximately 6 kilometers of land. The establishment of the solar plant will involve converting cultivable land to industrial use for a long term period of 29 years, with temporary changes during the construction phase lasting approximately 4-6 months.

Impact on topography and drainage- The Project area features predominantly flat topography with minimal undulations and no water bodies running through the site. Solar projects typically don't require extensive levelling, and since the proposed Project and access roads are situated on mostly flat terrain, receptor sensitivity is deemed low. Although some slight alterations to the topography may occur due to excavation work for the solar site, transmission line

locations, and access roads, these are expected to be minimal, resulting in a small impact magnitude. Any land clearing and levelling activities will be localized to the immediate vicinity of the Project components, further supporting the assessment of a small impact magnitude.

Impact on Soil Environment- During the construction phase, soil compaction and erosion are anticipated due to vehicular movement and excavation activities. The sandy soil prevalent in the Project area is inherently loose, making it susceptible to erosion. Sandy soil lacks cohesion, making it prone to erosion from rainfall and runoff. Consequently, construction activities may disturb the soil surface, removing vegetation and exposing it to erosion. However, sandy soil also facilitates better percolation and lower runoff. Given that the Project is located in a drought-prone area, the impacts of soil compaction are expected to be minimal. Overall, the resource sensitivity is assessed as low to medium, and the impact magnitude is deemed small to medium.

Waste Generation and Soil Contamination- During the construction phase, various types of waste will be generated onsite, including concrete, steel cuttings, packaging materials, and municipal solid waste such as food waste and plastics. A small portion of this waste will be hazardous, including waste fuel and oils. Improper management of solid waste could lead to soil quality impacts. Furthermore, soil contamination may occur due to leaks and spills of oil, lubricants, or fuel from heavy equipment, as well as improper handling of chemical storage and wastewater. These spills could have long-term consequences on soil quality if not addressed appropriately.

Impact on Water Environment- The proposed Project site falls within the SAFE category according to the CGWB report of Mahasamund district (2018) and the Groundwater Yearbook of Chhattisgarh State (September 2022). While no borewell or well is present at the site, water tanker water from nearby villages is being used for construction and RO packaged water for drinking purposes. The sandy soil type of the area allows for high percolation into the subsoil and groundwater, resulting in medium receptor sensitivity. Accidental spillage of chemicals and fuel during construction activities may contaminate groundwater, causing measurable changes in both water quality and quantity. Therefore, the magnitude of impact on water quality and quantity is assessed to be medium.

Impact on air quality- During the initial phases of construction, baseline data was collected to assess existing environmental and socio-economic conditions as well as potential impacts of Project activities. The Project area spans approximately 89 hectares, with air quality impacts confined to a 500-meter radius around construction zones and material storage areas, and nearby villages like Kena and Ichhapur. The area's loamy sandy soil prone to erosion, combined with increased vehicle traffic during construction, will lead to short-term air quality changes (~4-6 months). However, ambient air quality in the study area complies with national standards. Sources of air quality impacts during construction include fugitive dust emissions, vehicular emissions, machinery exhaust, and diesel generator emissions. Despite fugitive dust being the primary emission source, its short-term nature categorizes impact magnitude as small.

Impact on Ambient noise- During the construction phase, noise sources include construction activities, operation of DG sets, vehicle movement, and increased anthropogenic activity in the area. Construction is expected to last 4-6 months and will occur during daytime hours. Noise levels from various construction equipment were estimated based on assumptions due to

limited specific information. It's assumed that only one of each type of equipment will be operational at any given time. Re-assessment of noise levels may be necessary if actual equipment inventory and sound power levels differ from assumptions.

Impact on Occupational, Health and Safety- The Project will require a significant workforce during construction, with potential impacts on occupational health and safety. Activities such as working at heights, operation of heavy machinery, digging for cable laying, and working with live electrical components pose risks that need to be managed. These concerns persist throughout the Project's life cycle, including construction, operation, and decommissioning stages. Proper measures for fire safety, structural safety, and emergency situations are essential to mitigate these risks effectively.

Impacts on Landscape and visual impacts- During the construction phase, the visual landscape of the area will undergo significant change due to the installation of PV modules and associated structures. However, it's important to note that this solar power Project is the only one in the vicinity, with no other installations within a 5 km radius. The Project area, primarily unirrigated agricultural land in a rural setting, will see the temporary presence of various equipment and infrastructure such as ground-mounted structures, PV modules, transformers, inverters, transmission line towers, cranes, and transportation vehicles. While these changes will be noticeable in the immediate vicinity, their significance will diminish with increasing distance from the development.

Impact from influx of Migrant Labour- The Project will employ skilled, semi-skilled, and unskilled workers from different areas, including local and migrant laborers. Skilled workers, likely migrant workers, will be needed during the construction phase for tasks such as steelwork for solar PV panels. Local workers may fulfill unskilled labor needs, but only temporarily. Labor accommodation will be arranged by contractors, often in rented residential buildings in Kena. This influx of labor, especially migrants, may impact the local community, potentially leading to resentment due to competition for jobs and resources. Therefore, the impact magnitude is assessed as medium, with medium receptor sensitivity due to the community's reliance on agriculture and limited local skills for construction work.

Impact on Women-Potential impacts on women during construction phase include gender bias in job access, favoring males. This observation was substantiated during the site visit, wherein the ERM team did not witness any women engaged as a laborer or working at the Project office on-site. Finally, women and girls are disproportionately at risk in terms of safety (gender-based violence, harassment, curtailed movement, reduced access to resources), with arrival of migrant laborers in the construction phase and their accommodation being planned in the study area.

Impacts on Community, Health and Safety- The construction phase activities, including the erection of solar panels and transmission lines, may pose risks to the health and safety of the community. Movement of material and personnel could lead to accidents, causing injuries to people or livestock. The presence of migrant labor and construction of accommodation facilities may generate waste and wastewater, potentially leading to unhygienic conditions and waterborne diseases. Lack of waste disposal systems at the Project site and labor camps could contribute to airborne diseases. Structural safety of Project infrastructure, fire safety, and management of emergencies are also concerns. Increased number of workers and operation of

machinery pose risks of fire hazards and contamination of soil. Additionally, waste generation during construction could expose the community to health risks.

Impact on Economy and Employment- During the peak construction period of 4-6 months, the Project is expected to employ approximately 100-150 workers, providing employment opportunities for unskilled and semi-skilled labor from the local community. Various civil works such as construction of solar PV module mounting area, transformer yard, internal roads, and transmission lines will create job opportunities. Locals with vehicles like tractors or dumper trucks may also find contracting opportunities for transporting materials. Indirect employment opportunities may arise from the establishment of small shops and repair outlets. Skilled labor brought in from other states may further stimulate economic activity, benefiting local vendors and businesses.

Stress on Community Resources- During the construction phase, water requirements for civil work and construction, estimated at approximately 50-60 liters per day, will be met using water tankers. These tankers will source water from borewells belonging to specific households in the Project villages, with the Project team compensating these households monetarily. This arrangement may potentially affect the groundwater table in the area. Additionally, transportation of heavy machinery and materials may cause wear and tear on community roads, leading to premature damages. Considering the high sensitivity of these resources, the impact magnitude on community resources during the construction phase has been assessed as medium.

Ecological Impacts- During the construction phase, activities such as road construction, walling, and installation of solar modules will generate noise and vibrations, impacting the surrounding areas. This continuous movement of vehicles and people will disturb local fauna, hindering their natural activities like foraging and breeding. Additionally, vegetation clearance and soil preparation will alter soil properties, potentially affecting local flora and ground-dwelling fauna. While fauna may adjust to the disturbance, they could relocate, leading to changes in species composition. Moreover, increased human activity may raise the risk of human-wildlife conflict, including hunting and road kills, especially if proper facilities are lacking for laborers.

E.6.3 Operational phase

Impact on Soil Environment- During the operation and maintenance (O&M) phase, soil compaction and erosion are expected to be infrequent due to occasional vehicle movement for maintenance activities only. As a result, the impact magnitude of soil compaction and erosion during this phase is assessed to be small.

Impact on Waste generation and Soil Contamination- During the operation phase, the Project generates domestic solid waste at MCR room and substation, along with hazardous waste such as waste oil, lubricants, and oil-containing jutes and rags, as well as broken modules during maintenance activities. While any leak or spill of hazardous waste could contaminate the soil and groundwater, the quantity of hazardous waste generated is significantly lower compared to the construction phase. As a result, the receptor sensitivity is assessed as low, and the impact magnitude is considered small during the operation phase.

Impacts on Water Environment- During the operation phase, the water requirement for domestic purposes, including cleaning of modules, is estimated to be approximately 60-70 KLD

for about 20-25 employees and workers. This water will be sourced from the nearest village via tankers and from an RO plant or drinking water supply. Wet cleaning technologies will be adopted for module cleaning to minimize water usage. Additionally, sewage generated from the MCR room will be of negligible quantity. As the Project area falls under the safe category for groundwater, the receptor sensitivity is assessed as medium. Given the use of wet cleaning technologies and minimal wastewater generation, the impact magnitude is assessed as medium.

Impact on Landscape and Visual Impacts- The primary components of the Project include PV modules arranged horizontally, with a maximum height of 2 meters above ground level. The site will be enclosed by a boundary wall approximately 2 meters high to maintain inconspicuousness. Although the site currently lacks permanent structures, the introduction of PV modules will permanently alter the landscape, potentially affecting nearby habitations and passersby visually.

Impact on Economy and Enployment- During the operations phase, the requirement for unskilled and semi-skilled labour is expected to reduce to 15-20 respectively. The services for which labour will be required will include maintenance work of the facility, providing 24-hour security, bush and undergrowth cleaning and housekeeping activities. As per consultation with the Project team robotic dry brushing method of cleaning is most likely to be used for cleaning the solar PV modules in order to improve efficiency and reduce water consumption.

Collision and Electrocution- The impact of transmission lines on biodiversity, particularly bird mortality due to collision and electrocution, is well-documented and represents a significant anthropogenic threat to avian populations. Studies have shown that power line collision mortality can have substantial population-level effects, potentially contributing to declines in species such as cranes and diurnal raptors. Inappropriately routed or designed transmission lines can exacerbate these impacts, particularly for migratory and soaring birds. Electrocution risk arises when birds perch or nest on transmission lines, exposing them to uninsulated electrical components. Reduced visibility of lines during both day and night increases the likelihood of collision. While internal transmission lines within solar projects may mitigate some risks due to restricted access for birds, seasonal waterbodies in the study area may attract migratory and resident birds, further heightening the risk of collision and electrocution.

E.6.4 Decommissioning phase

Impact on Soil Environment- The decommissioning phase of the project is expected to impact the soil in several ways. Increased vehicular and workforce movement, dismantling of plant components, and removal of internal electric lines may lead to soil compaction. Waste generated during decommissioning, including dismantled plant components and demolition debris, poses a risk of soil contamination, although this is considered to be minimal. Receptor sensitivity to these impacts is assessed as medium. Removal of grounded structures and demolition of various components may affect the top layers of soil and lead to loss of topsoil quality, but these effects can be mitigated over time. Additionally, the large number of laborers during decommissioning is expected to generate significant domestic waste, particularly at labor camps, contributing to the medium impact magnitude.

Impact on Water Environment- Water during the decommissioning phase will be consumed by labourers and will be required for civil work such as demolition and dismantling, Site grading

and leveling, Excavation and backfilling, Erosion and sediment control, Revegetation and landscaping, Infrastructure removal and restoration. The water demand is expected to be met through procurement of water tankers from community. Also, there is a potential for contamination of groundwater water resources resulting from improper management of sewage and accidental spills/leaks at the storage areas. Therefore, the receptor sensitivity is assessed to be **medium.**

Impact on Air Quality- During the decommissioning phase, air quality will be impacted by various sources, including dust emissions from demolition activities such as dismantling of solar panels and transmission towers, as well as increased vehicular movement for transporting dismantled materials. Additionally, emissions from emergency power diesel generators used during decommissioning activities will contribute to air pollution. Receptor sensitivity to these impacts is assessed as medium. However, since the demolition activities are expected to occur for a relatively short period, the impact magnitude has been assessed as small.

Impact on Noise- During decommissioning phase of the Project, noise will generated from dismantling of structure, movement of vehicles carrying dismantled structure and equipment. The area would then be an Industrial area and therefore the receptor sensitivity is assessed to be **low to medium.** Impact magnitude is considered to be **small** considering the decommissioning period to last for small duration.

Impact and Economy and Employment- During the decommissioning phase, social impacts may arise from the loss of jobs and associated income for households directly affected by the project closure. However, the impact is expected to be limited due to the relatively small number of permanent employees affected, mainly security guards. Additionally, improper disposal of construction waste and debris from dismantling activities may lead to soil contamination and discontentment within the project villages. Despite these potential impacts, the overall magnitude is considered small given the short duration of the decommissioning period.

E.7 Climate Change screening

Baseline: Water Stress (High) and Extreme Heat (32.52°C) are identified as high-risk hazards for the site; whereas, Cyclone (90 knots) is identified as medium-risk hazard.

For the site under consideration, the mean of daily maximum temperature during Baseline is 32.52°C, whereas the maximum of daily maximum temperature is around 48.14°C.

Furthermore, no riverine or coastal flood as well as landslide risk is identified for the assessed site.

Future Scenarios: For both scenarios (SSP 2-4.5 and SSP 5-8.5) and across two-time horizons (2030 and 2050), the risk allied with water stress will remain high for the site under-consideration.

Extreme heat is projected to increase by 0.42°C in SSP2-4.5 and 0.45°C in SSP5-8.5 for the site in 2030. Further, extreme heat is projected to rise by 1.14°C in SSP2-4.5 and 1.51°C in SSP5-8.5 for the site in 2050. Cyclone risk is projected to increase significantly (6%-9%) in both the scenarios across the time horizons (2030 and 2050).

E.8 Mitigation Measures and ESMP

For the purpose of providing site specific mitigation measures to mitigate key identified impacts from the Project, an ESMP has been developed. The ESMP specifies the standards and controls required to manage and monitor environmental and social impacts during construction operation and Decommissioning phases. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment. This is in accordance to IFC Performance Standards 1, which emphasizes the importance of managing social and environmental performance throughout the lifecycle of the Project.

E.8.1 Roles and Responsibilities

The responsibility for implementing the Environmental and Social Management System (ESMS) rests with the ESMS Implementation Committee, composed of key stakeholders at both corporate and Project/site levels. At the corporate level, the committee includes the Chief Operating Officer (COO) - Projects, tasked with overseeing ESMS implementation and ensuring alignment with organizational goals. Additionally, the Head of Execution - Solar & Wind Farm leads ESMS activities related to Projects, while the Head of Health, Safety, and Environment (HSE) integrates health, safety, and environmental considerations into the ESMS framework. At the Project/site level, the committee consists of the Site-In Charge, responsible for on-site leadership and adherence to ESMS procedures. The HSE Manager oversees health, safety, and environmental initiatives, while the Administrative Officer supports ESMS implementation through administrative coordination and communication facilitation.

E.8.2 Inspection, Monitoring and Audit

CleanMax Energy Solutions (CMES) is committed to actively monitoring and evaluating the effectiveness of its Environmental and Social Management System (ESMS) throughout all phases of its Projects and facilities. This involves engaging with diverse stakeholders, including contractors, laborers, suppliers, and local communities impacted by Project activities. Rigorous inspection and monitoring will be conducted during both construction and operation phases to ensure ESMS compliance. Regular inspection, auditing, and monitoring processes, as outlined in CMES's manual, will be carried out to ensure adherence to applicable frameworks, including risk assessment checklists and action plans. Both internal teams and external agencies or experts will conduct inspections and audits, with comprehensive documentation of all processes and findings. Contractors will be required to implement corrective actions based on inspection and audit outcomes within their respective areas of operation.

E.8.3 Reporting and Documentation

CleanMax shall establish and implemented documentation and record-keeping system to ensure the updating and recording of requirements specified in the ESMS. Relevant personnel will be assigned responsibilities to maintain the ESMS documentation system and ensure document control, including access and distribution to identified individuals. This will involve the following documents:

- Master Environment Management System document
- Legal Register
- Operation control procedures
- Work instructions

- Incident reports
- Emergency preparedness and response procedures
- Training records
- Monitoring reports
- Auditing reports
- Complaints register and issues attended/closed

E.8.3.1 External Reporting and Documentation

CleanMax Energy Solutions (CMES) will provide transparent reporting on environmental and social impacts, aligning with shareholder agreements and investor expectations. Reports will detail project impacts, highlight instances of non-compliance, and evaluate ESMS effectiveness.

E.8.3.2 Internal Reporting and Communication

CleanMax will establish an internal reporting system to monitor ESMS objectives regularly. Findings from inspections, audits, and other asset-level information will be communicated back to the ESMS Manager and corporate committee by the HSE representative or designated staff. This communication will follow specific ESMS requirements discussed within the ESMS Committee, facilitating feedback and input from asset-level stakeholders.

E.8.4 Documentation

The ESMP acts as an environment and social management tool which needs to be periodically reviewed to address changes in the organization, process or regulatory requirements.

Following a review, the Site in-charge in coordination with personnel delegated EHS will be responsible for making the amendments in the ESMP and seeking approval from the designated approval authority. The amended ESMP will be communicated to all the staff on the Project.

E.8.5 Training Programme and Capacity Building

Training is needed for effective implementation of ESMP. The training programme will ensure that all concerned members of the team understand the following aspects:

- Purpose of management plan for the Project activities;
- Requirements of the management plan and specific action plans;
- Understanding the sensitive environmental and social features within and surrounding the Project areas; and
- Aware of the potential risks from the Project activities.

E.8.6 Purpose of the ESMP

CleanMax recognizes the importance of training for the effective implementation of its Environmental and Social Management Plan (ESMP). The training program will ensure that all team members understand the purpose and requirements of the management plan, as well as sensitive environmental and social features and potential risks associated with Project activities. The Head of HSE at CleanMax will oversee the identification and delivery of

environmental, health, and safety induction training, along with job-specific training for construction and operation personnel. Additionally, general environmental awareness will be promoted among the Project team to encourage environmentally sound practices and compliance with regulations. Contractors and subcontractors will also receive training to ensure a consistent level of awareness and commitment to environmental stewardship.

E.9 Conclusion

The Project is a green energy Project proposing to generate 77.5MWp power through solar energy by CleanMax. The Project and its key components such as solar plant area, site office building, external transmission lines, internal transmission line, etc. are likely to have had environmental impacts on baseline parameters, such as on land use (conversion from agricultural to industrial land), ambient air quality and noise quality, especially during the construction phase. The social impacts from the Project are assessed to be beneficial in terms of local employment and overall local area development.

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