



Environmental and Social Impact Assessment for the Utility Scale Project in Catete, Luanda Province

Non-Technical Summary



Sun Africa
Renewable energy solutions



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List of Acronyms

CFP	Chance Find Procedure
CGGC	Chinese civil construction services company
CMP	Construction Management Plan
CR	Critically Endangered
EIL	Environmental Installation License
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EPRP	Emergency Preparedness and Response Plan
EWMP	Employment and Workforce Management Plan
GHG	Greenhouse Gas
GM	Grievance Mechanism
HV	High voltage
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
LVEA	Lista Vermelha de Espécies de Angola (Angola's Red List of Species)
LCCP	Local Employment and Procurement Plan
LRP	Livelihood Restoration Plan
MCTA	Ministério da Cultura, Turismo e Ambiente (Ministry of Culture, Tourism and Environment)
MINEA	Ministério de Energia e Águas (Ministry of Energy and Water)
NTS	Non-Technical Summary
PM	Particulate Matter
PV	Solar Photovoltaic
SEP	Stakeholder Engagement Plan
TMP	Traffic Management Plan
VU	Vulnerable
WMP	Waste Management Plan



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1. Introduction

The present document is the Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) for the Utility Scale Project in Catete, Luanda Province. This project comprises a power plant with 104 MWp/77.7 MWac that will be connected via 30/60 kV high voltage (HV) lines to the national electricity grid, to be developed by Sun Africa and constructed by Omatapalo.

The ESIA report was developed to meet the requirements of Executive Decree No. 117/20 of April 22nd, which determines the mandatory environmental impact assessment (EIA) of all projects likely to cause potential environmental and socio-economic impacts. In conformity with the same Decree, projects must be classified according to their category based on a list of specifications and the nature of the project. Per the rules set by Article 9, the proposed project is classified as Category B (Presidential Decree No. 117/20, Appendix II, item 35/a) Hydroelectric power plants; thermal power stations; geothermal installations; photovoltaic, wind and wave energy projects).

The NTS is an integral part of the ESIA and was developed aiming to assess the environment in the project area and surroundings, as well as to briefly present the potential negative and positive impacts resulting from the actions of the project. It is also intended to indicate the measures related to the minimization and maximization of impacts and to define the Environmental and Social Management Plan (ESMP).

The engineering and environmental consulting firm Jonathan T. Motherwell and Associates LLC (dba JTM) performed a gap analysis of the ESIA and this NTS (final draft) on behalf of the developer, Sun Africa LLC, and the EPC Contractor, Omatapalo, Inc. JTM has substantial experience providing world-class environmental & social consultancy services for energy projects worldwide, with particular expertise in projects involving sustainable international financing. The firm's international experience ranges from the United States to Brazil, Peru, Ecuador, Iraq, Kazakhstan, Korea, Indonesia, Papua New Guinea, Ghana, Mozambique, and South Africa.

2. Legal Framework

The current state of the country's electricity supply remains a high-risk factor in Angola's economic instability, as no commercial venture or international business can thrive without a stable and reliable supply of electricity. The energy consumption in Angola is mostly urban and residential.

This Project will serve to improve the reliability and quality of the electricity delivered by the Angolan national grid. The project will improve the efficiency, reliability, and sustainability of its electricity industry. Further, solar power provides a sustainable and clean way to generate electricity, which is aligned with the long-term growth of Angola.

The Ministry of Energy and Water (MINEA) was restructured under Decree No. 223/20 of August 28th. It proposes, formulates, manages, conducts, executes, and controls the Executive policy in the domains of energy, water, and sanitation. The Ministry of Culture, Tourism and Environment (MCTA), established under Presidential Decree No. 162/20 of June 8th, is responsible for formulating, conducting, monitoring, evaluating, and enforcing policies in the fields of culture, tourism, and the environment. This includes the

implementation of strategic programs and projects to promote culture, tourism development, and environmental management.

In case of approval of the ESIA, the MCTA shall issue an Environmental Installation License (EIL) on behalf of the project proponent and indicate in it which mitigation measures should be implemented and the respective environmental management program to be complied with as indicated in Decree No. 117/20 of April 22nd.

The ESIA report also considers the International Finance Corporation (IFC) performance standards and the Equator Principles, which are adopted by the Project.

3. Project Description

The Utility-Scale Project in Catete is illustrated in **Figure 1** and will be located in Icolo e Bengo municipality, in the Catete commune, Luanda Province. The project portfolio consists of both a utility-scale solar photovoltaic (PV) plant and the associated high voltage (HV) interconnection infrastructure (of approximately 2,800 m) necessary to connect to the existing electric grid and RNT substation (see **Figure 2**). This project covers an area of 327 hectares and will have an installed capacity of 104 MWp.

The Project will consist of a ground-mounted solar PV module that employs mono-crystalline silicon PV technology, which will be linked to a single-axis tracking mounting structure. The main components of a solar PV power plant are PV modules, mounting (or tracking) systems, inverters, the balance of the system, transformers, and the delivery station.

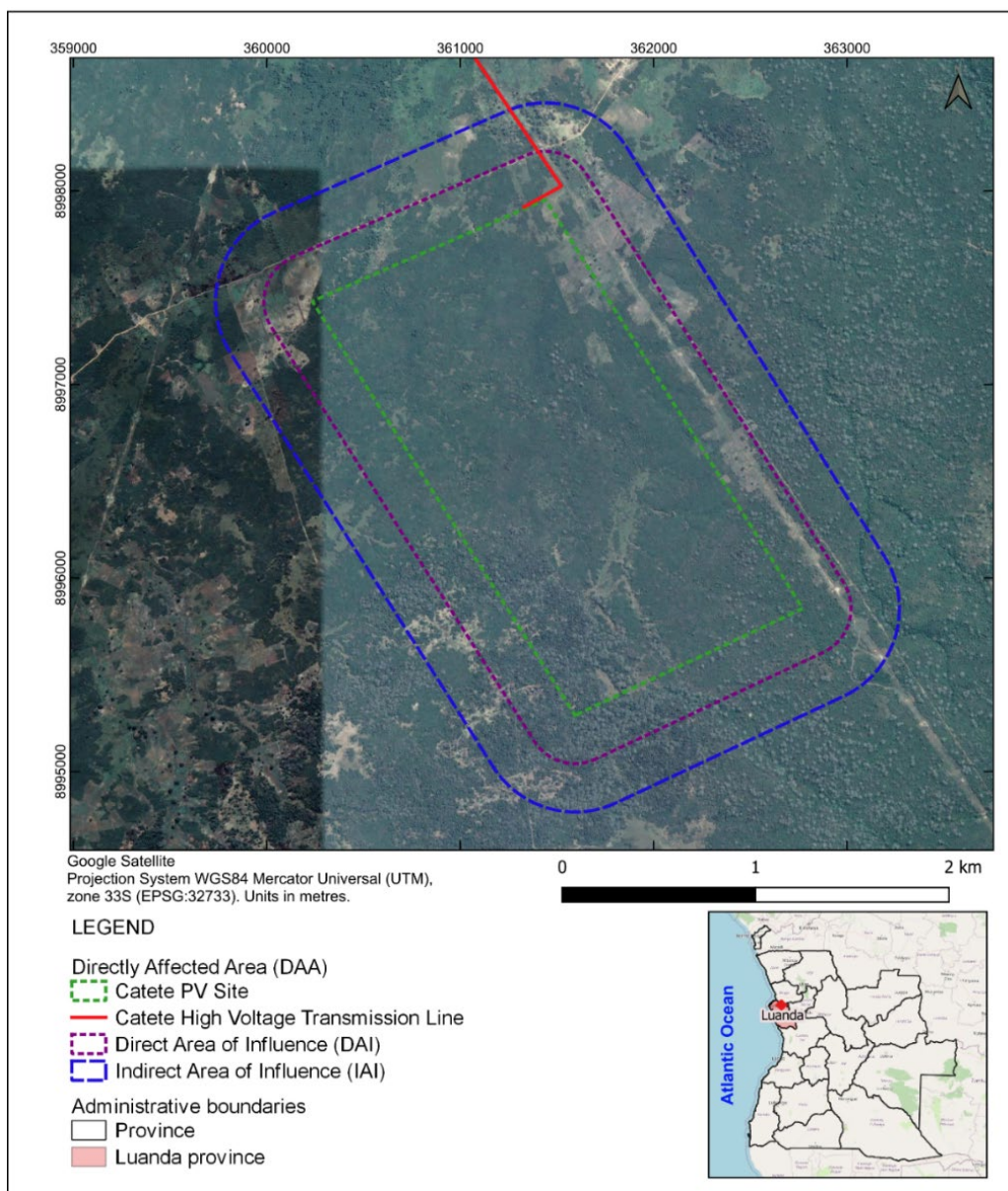


FIGURE 1: PROJECT LOCATION.

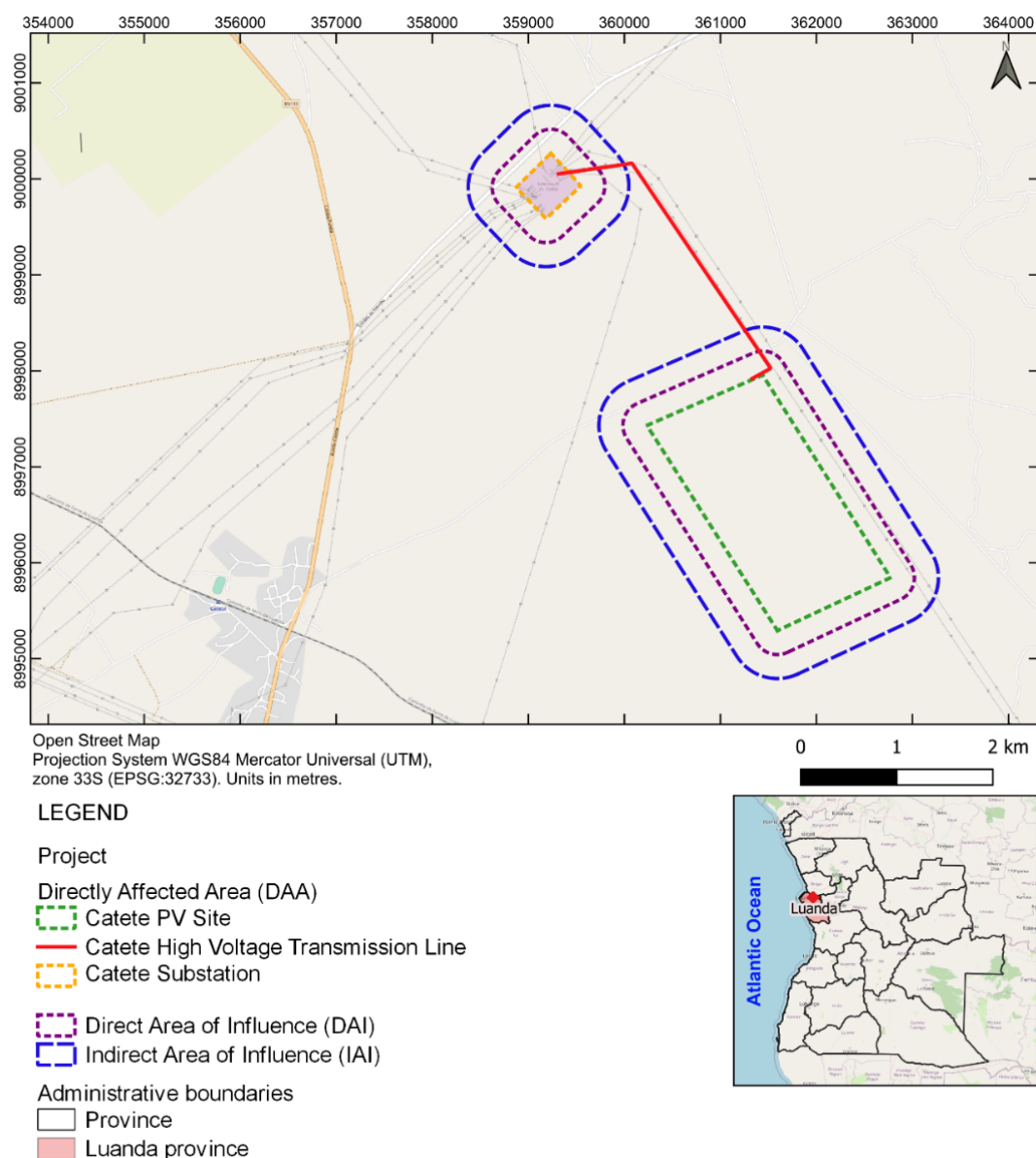


FIGURE 2: PROJECT LAYOUT.

For the PV park location, three initial sites were considered for developing the project and its substation's surrounding areas. During the selection process, aspects such as steep mountain slopes, solar resources, available areas, land use, local regulations, accessibility, grid connection, water availability, etc., were considered. Size limitations, physical constraints, and potential physical and/or economic resettlement were also reasons for these two sites to be screened out.

For the pre-selected sites, the following criteria was used to assess the benefits: Availability of land for unrestricted and fit-for-purpose development of the Project; Larger footprint to store equipment and materials; Topography of the area to facilitate ground leveling; Water availability for the operation phase; Long-term economic benefits arising from the development and integration of the Project into the local industry; and Access to the local workforce (during the construction and operation phases).

Technical requirements such as production efficiency, maintenance requirements, safety issues, proximity to the grid network for power transport, and the transmission line route were also considered for the site selection. In parallel, contact with local authorities were established to verify the existence of settlements and economic activities within the selected site for validation. Additionally, drone imagery was carried out to identify environmental and social sensitivities inside the site. At every level of potential site assessment, the project proponents sought to avoid areas that would be acutely impacted by potential negative impacts of the project and to select a site that would necessitate as few minimization, mitigation, and compensation efforts as feasible.

4. Environmental and Social Baseline

The present section provides a description of the current environmental and social baseline of the proposed area, based on bibliographic research (previous studies on the area including Holísticos reports) and site visits. The following elements are presented: physical (climate, air quality and noise, geology and geomorphology, hydrology); biological (flora and fauna); and socio-economic conditions. A field survey was conducted on the 4th and 10th August, 2022.

Climate

In Angola, the climate in the area is generally tropical and two (2) seasons are identified: the rainy season and the dry season (Cacimbo). Luanda province, according to the Köppen climatic classification, has a dry steppe climate, very hot, and the study area is integrated in the semi-arid region of the province of Luanda. The average daily high temperature in Luanda for the rainy season is above 29°C, with March being the hottest month (average high of 30°C and low of 25°C). In the dry season, the average daily high temperature is below 26°C. The coldest month in Luanda is July, with an average low of 20°C and a high of 26°C.

Geology and Geomorfology

The project area is in the Cuanza Sedimentary Basin, which is related to the evolution of the Angolan Continental Margin, the opening of the South Atlantic. Stratigraphically the formations of the Cuanza Basin were deposited discordantly on the Crystalline Punch and in different environments, they comprise sediments of post-Cambrian age to the Quaternary. The area of the Project is formed by sedimentary rocks of different ages, in this case Lower Miocene from the Neogenic System, Cenozoic Era.

Pedology

From a geological point of view, the province of Luanda is in an area that is predominantly composed of quartz deposits (Pleistocene) and marls, clays and limestones (Oligo-Miocene). The pedological unit in incidence of the Cuanza Terrestrial Basin is associated with the soil regionally known as "Quelo" or "Mussequê", a regional term meaning sandy soil. According to the Generic Characteristics of the soils, the project area is composed by Luvisol, an argic horizon, a subsurface zone with higher clay content than the material above it. This typically arises as clay is washed downward by water and accumulates at greater depth.

Hydrology

The Project area is in the Bengo River Basin and, in addition to this watercourse, comprises two lagoons, the Quilunda lagoon and the Lalama lagoon. Due to the lack of food of the Bengo River (Quilunda Lagoon) and the lack of good operational management of the Quiminha Dam in Lalama Lagoon, they have suffered a great reduction in their water levels, a fact that has caused the disappearance of several aquatic species as well as the emergence of great difficulties in the development of agricultural activities in the Bengo Valley.

Air Quality

Solar energy has enormous potential to mitigate climate change by directly reducing emissions, including Greenhouse Gas (GHG) emissions. By knowing the air quality data, it is possible to determine the degree of control and the technological, human, and financial resources required to mitigate the impacts of air pollution on the environment and human health. There is no air quality legislation in Angola. In this context, the International Finance Corporation (IFC) guidelines and best practices were used as applicable to the project (see **Table 1**).

TABLE 1: IFC GUIDELINES FOR AIR EMISSIONS AND AMBIENT AIR QUALITY.

Pollutant	Averaging time	Air quality guidelines
PM_{2.5} (mg/m³)	Year average	0.035
	24-hours	0.075

Source: IFC, 2007.

Spot air quality measurements were taken on the 10th of August 2022. The measurements were taken for one (1) hour at four (4) different locations, using a Haz-Dust equipment (Particulate matter-PM monitor) model EPAM-5000 properly calibrated with a Hold Peak HP-866B Pro Anemometer. From the results obtained (see **Table 2**), it appears that the maximum values for all points sampled are above the permissible threshold (24 hours averaging time) defined by the Air Quality Guidelines (IFC Air Emissions and Ambient Air Quality). However, it is necessary to emphasize the traffic in the vicinity of the sampled areas, especially for P2 and P3. P2 is located along the transmission line, and there is occasional traffic of people heading to the farms, and P4 corresponds to the village of Calumbunze de Baixo, which, in addition to the traffic of people and transport assigned to the village, is also an access route to Sacrifício village.

TABLE 1: PARTICULATE MATTER (PM_{2.5}) MEASUREMENT RESULTS.

Ref	GPS Coordinates	Temp. (°C)	Wind Direction	Wind (m/s) *		Parameters (mg/m³)			
				Max	Min	Max	Min	TWA	STEL
Day Time									
P1	9°03'40.2"S 13°44'23.6"E	29.4		2.2	1.1	0.100	0.002	0.025	0.042
P2	9°5'8"S 13°45'24"E	31.5	NE	2.6	1.6	1.762	0.002	0.020	0.043
P3	9°4'21"S 13°42'55"E	39.9	EW	3	1.1	1.816	0.002	0.044	0.092

Key: STEL - Short-Term Exposure Limit; TWA - Time-Weighted Average.

Noise

In Angola, there is no guidance on noise levels during the exploratory or operational preparation phase. However, IFC's Environment, Health, and Safety (EHS) guidelines provide criteria and guidelines that have been adopted in this project. Table 1.7.1 of IFC's EHS guidelines is shown in **Table 3**, taken directly from the IFC document.

TABLE 3: NOISE LEVELS ACCORDING TO IFC GUIDELINES ON EHS

Receptor	Established Noise Levels – 1-hour LAeq, dB(A)	
	Daytime (07:00 – 22:00)	Night-time (22:00 – 07:00)
Residential, industrial and educational zones	55	45
Industrial, commercial	70	70

For sound data, five (5) field measurements were made on 10th of August 2022, performed during daytime for fifteen (15) minutes each using a noise measurement equipment consisting of a Brüel & Kjær. This equipment was fitted with a Brüel & Kjær preamplifier model ZC 0026 and a Brüel & Kjær 4191 microphone. The results of the measurements are shown in **Table 4**.

The equivalent continuous noise level for sampled areas is mostly below the allowed threshold (less than 55 dB). For P4, this value is approximate (53.4) and for P5 it was exceeded (59.1). The maximum noise level (peak) was above 70 dB. However, the sound gradient of the sampled points is due to the observations verified during the sampling. In P1 the removal of trees was the main cause of excessive noise, and P4 corresponds to the village of Calumbunze de Baixo, where the traffic of vehicles and people was intense, and P4 is located on the side of a road. The noise level can be considered intermittent (when observations during sampling are considered).

TABLE 2: RESULT OF NOISE MEASUREMENTS

Points	Coordinates	Observation	Parameters [dB(A)]			
			LAeq	LCpeak	LAFmin	LAFmax
P1	9°03'40.2"S 13°44'23.6"E	Traffic, tree removal, birds	37.3	82.7	23.5	55.2
P2	9°3'40.07"S 13°44'26.14"E	Motorcycles (used as taxis), electric current from the transmission line	36.6	70.5	26.8	54.1
P3	9°5'8"S 13°45'24"E	Occasional conversation, wind	35.2	71.9	23.6	52.7
P4	9°4'21"S 13°42'55"E	Occasional conversation, traffic of people and transports	53.4	94.0	26.3	75.5
P5	9°2'31.48"S 13°43'1.92"E	Traffic of people and transports	59.1	116.6	40.0	92.0

Flora and Vegetation

The survey indicated that the edaphoclimatic characteristics (aridity and grayish-brown soils) and the proximity to the coast provide the development of a natural vegetation of the steppic shrub savanna. The arboreal stratum is dominated by *Adansonia digitata* (baobab) associated with *Sterculia setigera* (Muxixe),

Euphorbia conspicua (Quissona) and *Acacia (Senegalia) nigrescens*. The shrub stratum is almost completely dominated by *Dichrostachys cinerea*, which is widely disseminated in the area, and forms an almost impenetrable tree population, associated with *Gymnosopia senegalensis*, *Hosmundia opposita*, *Neuracanthus scaber*, among others in the shrub stratum. The dense and medium-sized herbaceous stratum consists of species like *Andropogon gayanus*, *Hyparrhenia dissoluta*, etc.

There are areas with scarce arboreal and shrub coverage which denote the land occupancy for agricultural activity, resulting in the elimination of trees and shrubs and the consequent savannization of the area. Despite the harsh conditions of the area, the remaining natural vegetation shows a certain degree of xerophytes allowing it to persist and resist the edaphoclimatic adversity, such as the scarcity of humidity and nutrients in the soil, the fires, etc. Such adaptations cover the deep root system, early development, modification of leaves into spines, leaf senescence, among others. After drying, the herbaceous stratum fuels the seasonal fires in the dry season.

Baobab trees (*Adansonia digitata*) are a threatened species according to the Angolan Red List of Species (*Lista Vermelha de Espécies de Angola-LVEA*); the main cause for its status is deforestation for urbanization purposes.



FIGURE 3: PANORAMIC OVERVIEW OF CATETE' S PV PARK WITH BAOBAB TREES.

Fauna

The area can present a rich **avifauna** according to studies in surroundings areas (i.e Quiminha Dam). *Platysteira albifrons* is listed as endemic/vulnerable specie in LVEA and Near threatened (NT) in IUCN. *Cercropis abyssinica*, *Pternistis afer*, and *Uraeginthus angolensis* were some of the species recorded in the area during the site visit.

Regarding other faunal groups, the most common species for this type of habitat includes mammals: elephants, rhinoceros, buffalos, lions, leopards, hyenas, ungulates, hippopotamus, wild dogs; reptiles (lizards, snakes); and insects. Previous studies indicate the absence of large mammals, a rarity of medium-sized mammals, and some small mammals due to the anthropic pressure that the area has suffered, namely hunting and charcoal production, agriculture, inert exploitation, occupation of land and construction, and effective human presence. According to reports from local inhabitants, occasionally wild boars (*Potamochoerus porcus*), cane rats (*Trynomys sp.*), hares (*Lepus sp.*), and small predators such as genets (*Genetta genetta*), servals (*Felis serval*), ratels (*Mellivora capensis*), jackals (*Canis adustus*), and Vervet monkeys (*Cercopithecus aethiops pygerythrus*) can also be observed. No records were made during the site visit.

Environmental Sensitive Areas

Of the fourteen protected areas recognized by Angolan law, only Quiçama National Park and Nature Reserve Bird Island are in Luanda Province; however, these are far from the project area. There are no conservation areas in the municipality of Icolo e Bengo.

Socioeconomic Environment

More details on the socioeconomic environment at the provincial and municipal levels are described in the ESIA report; therefore, this section presents information about the socioeconomic environment of the sensitive receptors in the project area.

Calumbunze de Baixo and Sacrificio were identified as sensitive receptors due to their proximity to the project area and the possibility that they may be affected during the different phases of the project (**Figure 4**). Calumbunze de Baixo is located Northwest of the PV site (Access Road 1 to the site) and Sacrificio village is located Northeast of the project's concession area.

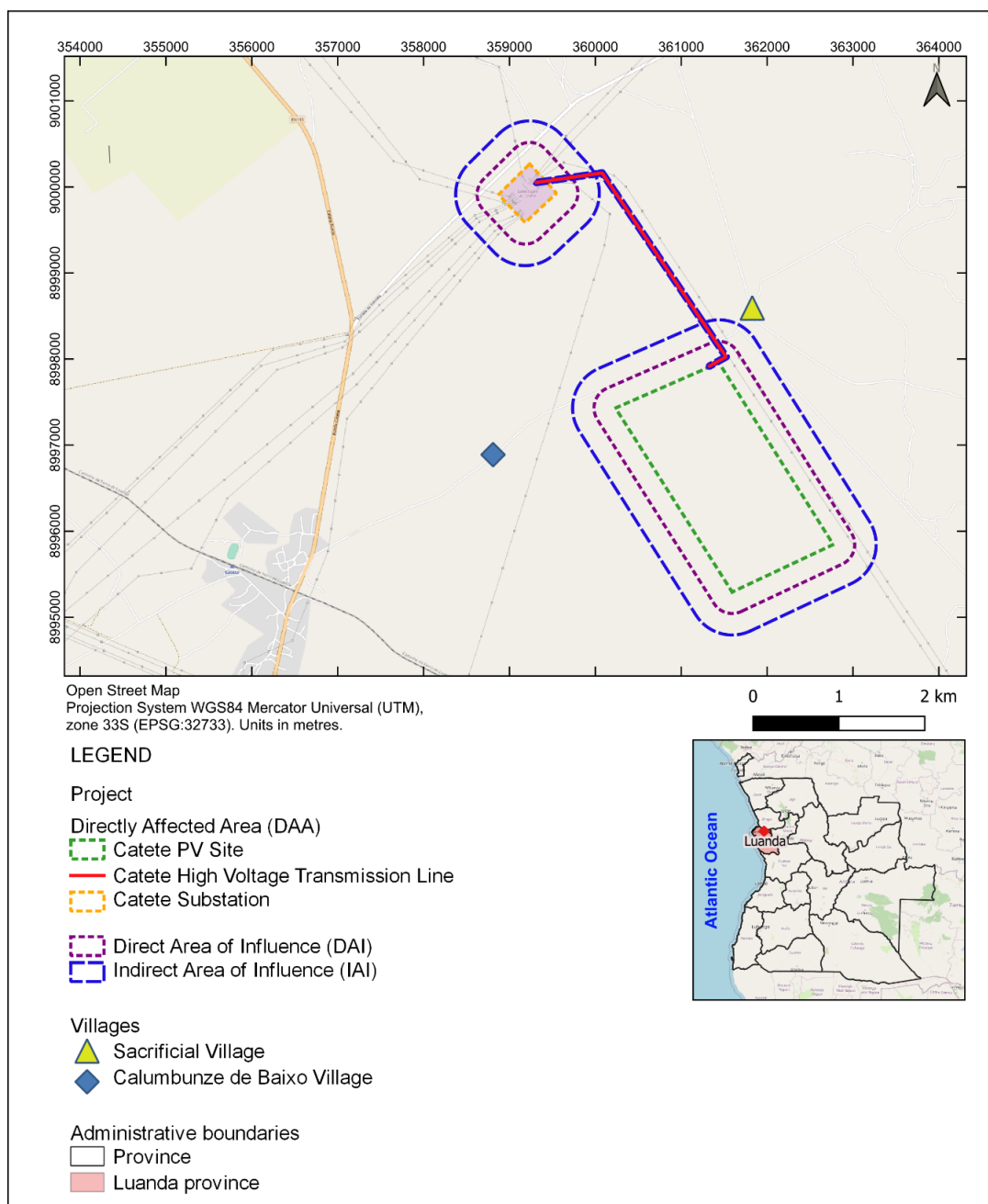


FIGURE 4: SENSITIVE RECEPTORS IN PROJECT'S AREA.

In addition to these, the following activities were identified as being underway in the vicinity of the site:

- Agriculture subsistence activity;
- Deforestation / firewood collection;
- Charcoal production.

Regarding the activities carried out in the vicinity area of the project, special attention should be given to agricultural fields. Plots of land cover approximately 16 hectares (about 5% of the 327 hectares of project area) (**Figure 5**). From the analysis of the drone imagery, they all are abandoned/fallow fields. During the

visit, the coordinator from Calumbunze de Baixo informed the survey team about the possibility of agricultural activity by the people in the project's concession area. However, due to the information on the danger of mines and high risk that they were still present, the team had to refrain from inspecting the area. Based on these findings, an inventory will be required after demining and prior to construction to identify the land users and negotiate cash compensation (and maybe alternative land). A Livelihood Restoration Plan (LRP) will be needed and active community engagement throughout the process is essential to mitigate the loss of crops and permanent loss of agriculture land (as proposed in the Stakeholder Engagement Plan developed for the project).

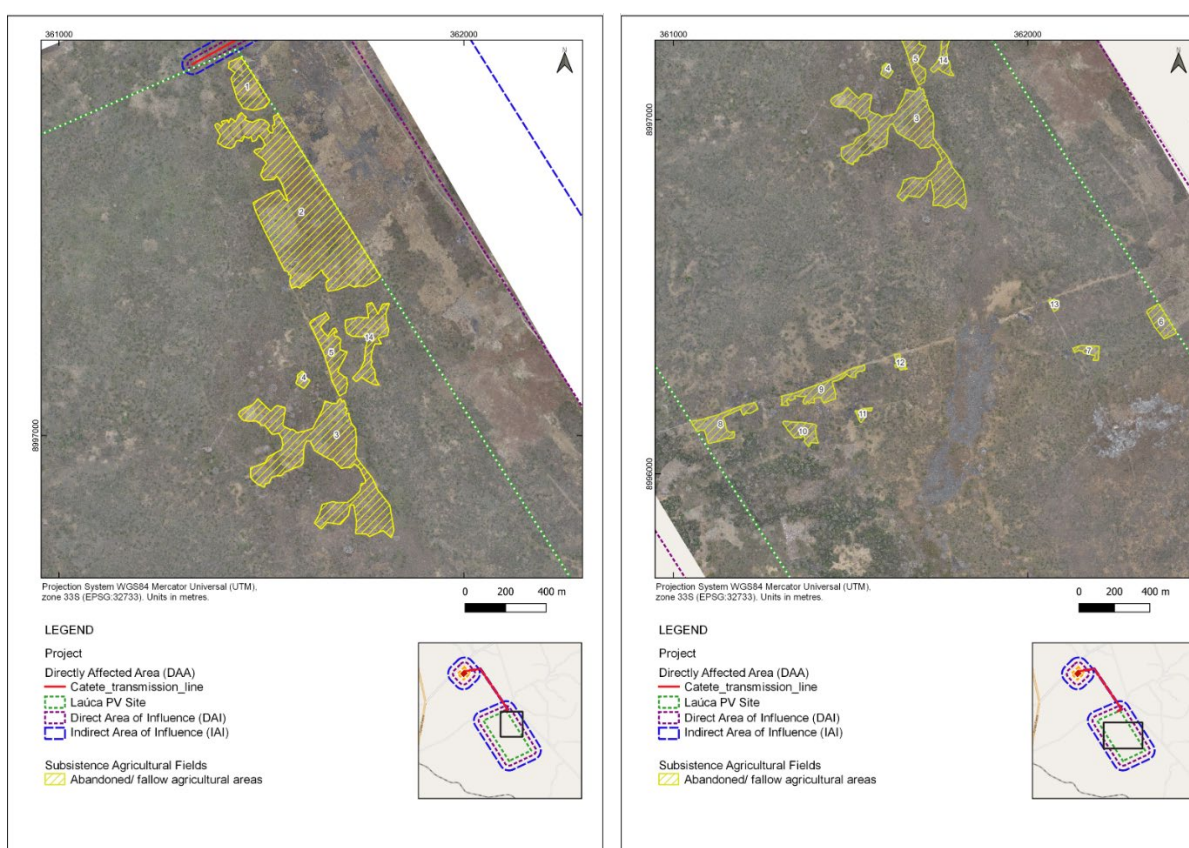


FIGURE 5: MAP OF THE AGRICULTURE FIELDS INSIDE THE PROJECT SITE AREA

No interviews were carried out in the village of Sacrifício, however some information was obtained during the interviews in the village of Calumbunze de Baixo, since people from Sacrifício were in Calumbunze for resettlement.

The Calumbunze de Baixo village is under the direction of the coordinator as established by the Government. Currently available demographic data is limited and based on numbers provided by the coordinator: approximately 200 inhabitants.

Due to the distance (approximately 8 km from the village of Calumbunze de Baixo), inhabitants of the village of Sacrifício have moved to the village of Calumbunze as the latter has fewer inhabitants and is closer to the rest of the municipality. By the time of the survey, Calumbunze de Baixo had already received

approximately 120 people. According to the village coordinator, the village has few inhabitants because the young people migrate and there is a high mortality rate, so most of the population is over 45 years.

Living conditions in the villages are precarious due to the lack of basic infrastructure. There are no Health services in Calumbunze de Baixo or Sacrifício villages. People from both villages must go to the health post in the village of Calumbunze de Cima or to the Municipal Hospital of Catete. There are no schools. The children go to primary school in Calumbunze de Cima. For other classes, there is availability only at the headquarters or in the capital Luanda.

The houses are mostly wood-to-pike and sheet roof, though block houses and sheet roof can also be found to a lesser extent (**Figure 6**). Calumbunze de Baixo has piped water and three fountains, but there is no electricity, no sanitation, and no treatment of domestic waste. As for latrines, most families relieve themselves in the open air. Regarding transportation, there are so-called moto-taxis that circulate in the villages and some cars. The inhabitants have access to these on the detour that gives access to the route to the villages. However, due to costs, many people travel the distance on foot.



FIGURE 6: MAIN LIVING CONDITIONS AT THE VILLAGES.

The main economic activities in the village of Calumbunze de Baixo include agriculture and charcoal production, both for consumption and for sale. In addition to these, some people manage to carry out other jobs at the headquarters or even in the capital. During the interviews with the community, they expressed what are considered the main problems in the villages: medical services, education, lack of employment, electricity, and better access to water.

5. Assessment of the Potential Impacts and Mitigation Measures

The scope of the ESIA report considers the environmental and social impacts that could potentially result from Project activities (e.g., pre-construction and mobilization, construction and installation, operation, and decommissioning) under the direct control of the Consortium responsible for the activities (Sun Africa LLC, Omatapalo Inc. and Omatapalo – Engenharia & Construções, S.A.) and its sub-contractors. Sun Africa is

leading the necessary development activities of the project and Omatapalo is leading the Engineering, Procurement, and Construction services.

The ESIA report describes what will happen by predicting the magnitude of impacts and quantifying these to the extent practicable. The term ‘magnitude’ is used as shorthand to encompass all the dimensions of the predicted impact, including: the nature of the change (what is affected and how); its size, scale, or intensity; its geographical extent and distribution; its direction (positive or negative); its duration, frequency, reversibility, etc.; and where relevant, the probability of the impact occurring as a result of accidental or unplanned events.

The evaluation of the information on the magnitude of the impacts was made explaining what this means in terms of its importance to society and the environment. The evaluation of impacts presented here is based on the judgment of the ESIA team, informed by reference to Angolan legal standards, government policy, Sun Africa’s standards, and current good practice. Where standards are not available or provide insufficient information on their own to allow grading of significance, significance has been evaluated taking into account the magnitude of the impact and the value or sensitivity of the affected resource or receptor.

Table 5 presents a summary of the impacts on environmental resources and receptors assessed in this chapter, including their significance before, and following the recommended mitigation measures.

6. Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) will provide the means for ensuring that all proposed mitigation measures and Project commitments are tabulated into actionable items that can be assigned ownership. The ESMP is a dynamic document, subject to review and calibration as part of an ongoing environmental management and improvement program, and provides a framework for verifying that proposed mitigation measures (which are commitments made by the Consortium and its subcontractors) are taken forward into the planning and implementation of the Project pre-construction and construction phases.

In addition to the Project ESMP, the Consortium will develop issue-specific management plans to address areas related to environmental impact and environmental management. These plans include but are not limited to the following: Stakeholder Engagement Plan (SEP) and Grievance Mechanism (GM); Construction Management Plan (CMP); Waste Management Plan (WMP); Traffic Management Plan (TMP); Chance Find Procedure (CFP); Emergency Preparedness and Response Plan (EPRP); Employment and Workforce Management Plan (EWMP), Local Employment and Procurement Plan (LCCP) and the Livelihood Restoration Plan (LRP).

The plan set out in **Table 5** below specifies all the measures that the Consortium currently proposes to adopt in relation to impacts identified in the ESIA, along with the timing and responsibility for implementing the measure.

TABLE 5: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
Soil And Geology (low value)				
Loss or physical damage to soil resources through site preparation/construction	<ul style="list-style-type: none"> The area of land allocation should be defined in the CMP, in order to avoid the allocation 	Estimates of soil volume or area of cultivable soil lost completed	Omatapalo	During site preparation and

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>of areas that will not be intervened;</p> <ul style="list-style-type: none"> • Manage soil stripping, stockpiling, handling, re-spreading and re-vegetation in a manner that minimizes degradation in soil quality and maximizes the potential for successful vegetation growth; • Protect soils outside the construction footprint by minimizing the movement of vehicles and equipment outside designated areas; • Accelerated erosion from storm events during construction shall be minimized through managing storm water runoff (e.g. velocity control measures); • Contour temporary and permanent access roads / laydown areas so as to minimize surface water runoff and erosion; • Spread mulch generated from indigenous vegetation across exposed soils after construction, and • The area affected by an accidental spill (the affected portion of the soil) must be secured in spill containment kits, and be forwarded to an environmentally adequate final destination. 	by visual monitoring		construction phases
Contamination from discharges and spills during construction and operation	<ul style="list-style-type: none"> • Install secondary containment for storage of hazardous materials. • Place containers carrying hazardous materials above ground where possible. • Implement spill detection system. • Enforce speed restrictions on vehicles on access roads. 	To keep a log of spill events (volume, substance, and potential cause). Keep a record of the actions implemented to prevent the occurrence of spills.	Omatapalo	During site preparation and construction phases
Habitats and Flora and Fauna (high value species of conservation interest; medium value forest; low value savannah grassland and species of low conservation interest)				
Loss and disturbance of habitats during site preparation,	<ul style="list-style-type: none"> • No mitigation recommended. UXO clearance to be conducted before any work onsite; 	Monitor contractor's management of	Omatapalo	Site preparation

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
construction and operation	<ul style="list-style-type: none"> Conduct clearing in a controlled way to reduce the potential for fire to spread outside the Project area, in the PV park; Vegetation that does not grow high enough to cause interference with the transmission line, or cause a fire hazards, should not be trimmed or cut unless it is growing in the road access area to the PV park; Vegetation clearing will be kept to the absolute minimum and should not extend beyond the corridor or PV site; All areas disturbed by construction activities shall be landscaped and rehabilitated. 	<p>the removed vegetation in order to prevent potential fires caused by dried vegetation.</p> <p>Visual inspection on a daily basis.</p> <p>Road kill assessment performed on a weekly basis.</p> <p>Wildlife interaction record to be updated permanently</p>		and construction
Disturbance of/harm to wildlife from site preparation, construction and physical presence of the Project	<ul style="list-style-type: none"> Roll out a TMP to optimize Project vehicle use in terms of traffic levels and frequency. Construction activities shall not interfere with or cause fatalities to animals; No interference with livestock shall occur without the owner's permission; The breeding sites of wild bird species must be taken into consideration in the CMP and be kept intact, and disturbance to breeding birds avoided. Special care shall be taken where nestlings or fledglings are present; Alien invasive vegetation should be removed immediately and disposed of at a licensed waste disposal facility. The area should be quarantined, and monitoring efforts should be increased; Use of low emission, directional lighting where possible. 	<p>Implement the TMP and assess vehicle use, traffic flow, safety records and maintenance logs.</p> <p>Visual inspection on a daily basis.</p> <p>Road kill assessment performed on a weekly basis.</p>	Omatapalo	Weekly during site preparation and construction
Injury or mortality to wildlife from Project traffic	<ul style="list-style-type: none"> Roll out a TMP to optimize Project vehicle use in terms of traffic levels and frequency. 	Manage vehicles trips, including destination and load, per logistics plan to optimize routes	Omatapalo	Daily during site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
		and day trips of vehicles.		
Impacts to habitats and species from unplanned hazardous spills	<ul style="list-style-type: none"> Develop and implement an emergency response program. 	<p>Number of incidents.</p> <p>Record of the actions implemented to prevent the occurrence of spills.</p>	Omatapalo	Daily during site preparation and construction
Water Resources (low/medium value)				
Drawdown of the water table resulting from Project water consumption	<ul style="list-style-type: none"> Reduce the quantity of water used as part of Project activities through leveraging results of groundwater study; Activities shall be conducted > 100 m away from water bodies; Ensure adequate siting of portable toilets on site and appropriate on going management of these facilities. 	<p>Visual verification and audit reports.</p> <p>Daily inspection of onsite facilities.</p>	Omatapalo	Site preparation and construction
Groundwater contamination from early survey works and accidental spills	<ul style="list-style-type: none"> Implement a spill mitigation plan, including measures to prevent, prepare for and respond to unplanned events; Domestic wastewater shall be treated and disposed of in accordance with an approved waste management plan; Use bounding, drains/gullies and interceptors (with oil-water separators) around liquid storage, fueling, construction vehicle parking and maintenance areas. 	<p>Number of incidents</p> <p>Record of the actions implemented to prevent the occurrence of spills.</p>	Omatapalo	Site preparation and construction
Dust Emissions and Noise				
Emissions affecting the local air quality	<ul style="list-style-type: none"> Removal of vegetation shall be scheduled in the CMP only when soil stripping is required and there is time for exposed surfaces to be revegetated or stabilized as soon as possible. No vegetation burning will be allowed; Excavation, handling and transport of erodible materials shall be avoided under high wind conditions; Where possible, soil stock piles should be located in sheltered 	Visual inspection on a daily basis	Omatapalo	Daily during site Site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>area where they are not exposed to wind.</p> <ul style="list-style-type: none"> Vehicle speeds shall not exceed 40 km/h along dust roads or 20 km/h along unconsolidated and vegetated areas; Appropriate dust suppression methods should be used when dust generation is unavoidable, e.g. dampening with water (in prolonged periods of dry weather). 			
Noise nuisance generated due to construction activities	<ul style="list-style-type: none"> Working hours for significant noise generating construction work (including works required to upgrade existing access roads or pavements), will be daytime only; Siting noisy equipment as far away as possible from noise sensitive receptors (particularly near settlements), and use of barriers (e.g. site huts, acoustic sheds or partitions) to reduce the level of construction noise at sensitive receptors wherever possible; Where practicable noisy equipment will be orientated to face away from the nearest noise sensitive receptors; Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practicable; Where practicable, stationary equipment will be located in an acoustically treated enclosure. 	Routine visual site inspections endure good practice is being adhered to.	Omatapalo	Daily during site preparation and construction
Noise nuisance generated due to vehicle movement on site and access to the PV site and transmission line	<ul style="list-style-type: none"> Identify transportation routes off site that will avoid existing communities, where possible. Normal working hours will be loading/ unloading activities will be restricted to day-time (06:00 to 18:00 hours). Unloading activity may be done after day-time (06:00 -18:00) occasionally when unavoidable situations occur but only at the PV site. 	Routine visual site inspections endure good practice is being adhered to, and as part of internal procedures	Omatapalo	Daily during site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<ul style="list-style-type: none"> Implement TMP to optimize the operation of truck transportation. 			
Infrastructure and Services				
Road deterioration due to increased traffic caused by the movement of workers and materials to and from the Project site	<ul style="list-style-type: none"> Inform local government and communities about planned traffic increase and associated safety measures to be utilized. Develop and implement a SEP that incorporates measures to address critical stakeholder concerns, engagement and communication protocols in the event of incidents involving local population, feedback mechanism. Ensure procedures are in place for dealing with claims in the event of an incident. 	Routine visual site inspections ensure good practice is being adhered to, and as part of internal procedures	Omatapalo	Daily during site preparation and construction
Land Acquisition				
Potential impacts on community subsistence agriculture leading to loss of crops and arable land	<ul style="list-style-type: none"> Develop and implement a livelihood restoration plan; Develop and implement a GM; and Contract a professional community liaison officer who will ensure in compliance with national law and IFC requirements on land acquisition and will manage all grievances. 	Number of Grievances	Omatapalo	Site preparation and before construction
Community Health and Safety				
Potential impacts on community safety, in particular, road accidents, and trespass on the working site potentially resulting in accidents leading to injuries and fatalities	<ul style="list-style-type: none"> Provide access to health care for those injured by its activities Ensure that signs are put up around work fronts, road and construction site advising people of the risks associated with trespass. Undertake a program of SEP to inform local communities of the risks of trespassing onto sites, the meaning of signs, and the dangers of playing on or near equipment (towers) or entering fenced areas (PV parks). Special attention to be paid in schools and markets along the transmission routes and in areas where towers will be built close to residential or school areas. 	Number and type of incidents identified through Assessments and Audits	Omatapalo	Site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<ul style="list-style-type: none"> Omatapalo will develop EPRP in cooperation with local emergency authorities and local hospitals. 			
Inadequate waste management	<ul style="list-style-type: none"> Omatapalo will prevent (or at least minimize) the potential for community exposure to hazardous materials, including both accidental and planned releases, and the transport of hazardous wastes and materials. If there is a potential for life-threatening hazards, operations may need to be modified, or substances causing the hazard substituted or eliminated. Omatapalo also needs to have systems in place to control the safety of deliveries of raw materials and the transportation and disposal of wastes in compliance with the WMP. 	Number and type of incidents identified through Assessments and Audits	Omatapalo	Site preparation and construction
Impact from workers presence and potential interaction with local populations	<ul style="list-style-type: none"> Ensure that all workers are housed in accommodation camps rather than in the local settlements in order to minimize interaction with local communities and related health and safety impacts. Ensure all workers undergo pre-employment screening and regular health screening including voluntary screening for Sexually Transmitted Diseases (STDs). Ensure all workers including subcontractors receive education around transmission routes and symptoms of communicable diseases of concern and STDs. Omatapalo will develop a Worker Code of Conduct with guidelines on worker-community interactions and will provide training on the worker code of conduct to all employees including subcontractors as part of the induction process. 	<p>Number and type of breaches identified through Assessments and Audits</p> <p>Number of trainings provided / delivered</p>	Omatapalo	Site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
Disturbance to population and workers from Project associated noise	<ul style="list-style-type: none"> Post warnings of the proposed construction activities and maintain surveillance throughout the construction works. Publicly communicate activities to inform and keep local communities aware and updated on Project's activities; Notify relevant authorities, associations and population groups of Project phases, activities, CMP, timing, truck routes, etc. 	Number of grievances received, pending and closed out (per month, year, area/city)	Omatapalo	Site preparation and construction
Road Accidents and Security				
Road conditions	<ul style="list-style-type: none"> Develop and implement a TMP, assess local road conditions and be responsible for road maintenance during Project construction to minimize traffic risks associated with roads deteriorated from Project activities, particularly the erection of the towers. 	Number and type of non-compliances identified through Assessments and Audits	Omatapalo	Site preparation, construction, and commissioning
Site trespass and Accidents	<ul style="list-style-type: none"> Erect signs around work fronts and construction site warning of risks associated with trespassing, particularly in the PV park. All signs will be in local Portuguese. Erect fencing around facilities to minimize the risk of trespassing. Fencing will be checked weekly to ensure that it is in good condition and to look for any signs of entry. 	Number and type of incidents identified through Assessments and Audits	Omatapalo	Site preparation, construction and commissioning
Public Security	<ul style="list-style-type: none"> Project security systems will comply with Angolan laws and regulations; Communicate the construction times and plan to the communities existent in the proposed project area, particularly along the transmission line; Access to GM will be provided to ensure complaints are received and addressed; Omatapalo and subcontractors will conduct a reasonable investigation to ensure that hired security personnel are not involved in past abuses; 	Number of grievances received, pending and closed out (per month, year, area/city)	Omatapalo	Site preparation, construction and commissioning

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<ul style="list-style-type: none"> Omatapalo and subcontractors will also check that security personnel are adequately trained in the use of force (and where applicable, firearms), to show appropriate conduct toward workers and communities, and require them to act within the applicable law. 			
Unplanned Events				
Risk during stringing activities	<ul style="list-style-type: none"> Omatapalo will follow the method statement for overhead stringing particularly along the urban and peri-urban areas; the activities will be managed by experienced Supervisors. Stringing activities near wires and other electrical utilities will be done after proper shutdown of the line/utilities with prior information and permission. 	<p>Number and type of incidents identified through Assessments and Audits</p> <p>Number of trainings provided / delivered</p>	Omatapalo	Site preparation, construction and commissioning

7. Final Remarks

Solar power facilities like those proposed for the Luanda Province Photovoltaic Project reduce the environmental impacts of combustion used in fossil fuel power generation. Further, the development, construction, and operation of the proposed solar facilities are expected to create both direct and indirect employment and bring additional income to the region.


An aspect that needs to be considered is the existence of subsistence agricultural activity in some parts of the site. Interviewed people from Calumbunze village indicated the possibility that they farm in the area. Before construction, as part of the Stakeholder Engagement Plan (SEP) and after the demining process, there will be a need to undertake an inventory of the land users of the area and to develop a Livelihood Restoration Plan (LRP) to be able to provide cash compensation and arable land for the current subsistence farmers as well as other ecosystem services such as firewood collection and charcoal production.

Impacts on resources associated with site construction, operation, and decommissioning (i.e., soil and geology, air quality, noise, habitats and terrestrial flora/fauna, water resources, infrastructure, and community health) range from not significant to moderate/minor. Particular attention is to be given to sites located near environmental and social sensitive receptors. The Consortium and its contractors will implement the mitigation measures and monitoring programs outlined in the ESMP to address the minimal impacts identified. As such, the Project is ready to move forward with the proposed mitigation measures in place, and, as a result, any residual impacts can be mitigated during planning and construction and managed throughout operation and, ultimately, decommissioning.




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