

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION AND OPERATION OF A 10MW MERCHANT SOLAR PHOTOVOLTAIC PLANT ON FARM GERUS, OUTJO- KUNENE REGION -NAMIBIA



ENVIRONMENTAL MANAGEMENT PLAN FINAL

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Acronyms

TERMS	DEFINITION
BID	Background Information Document
EAP	Environmental Assessment Practitioners
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EMP	Environmental Management Plan
GHG	Greenhouse Gasses
ISO	International Organization for Standardization
I&Aps	Interested and Affected Parties
JBIC	Junior Baiano Industrial Consultants
MET: DEA	Ministry of Environment and Tourism's Directorate of Environmental Affairs

1. CHAPTER ONE: BACKGROUND

1.1. INTRODUCTION

(The National Integrated Resource Plan (NIRP) developed by the Namibian Government in 2016 has projected a significant growth in the country's electricity demand and estimates that an investment in the range of N\$90-97 billion (2016) is needed over the next 20 years. Given other sectoral priorities in the country, the Namibian Government cannot meet such a significant investment requirement in a single sector of the economy. Accordingly, private sector investment sources have been deployed through the acceleration of IPPs for the development of the Power Sector in the country (GRN(MME), 2016).

It is beyond this background that, Sino Energy (PTY) LTD intends to spearhead the construction and installation of a 10MW solar power (PV) structures (solar farm) on a 10 ha. piece of land and a powerline in Outjo.

In terms of the Namibian environmental legislation (Environmental Management Act (No. 7 of 2007)) and the Electricity Supply Industry National Policy for Independent Power Producers (IPPS) In Namibia (2017), an EIA is required to obtain an Environmental Clearance Certificate from the Ministry of Environment and Tourism (MET) before the project can proceed.

Furthermore, as per the requirements of the Environmental Management Act No. 7 of 2007, Sino Energy has appointed JBIC to conduct an Environmental Assessment (EA) and develop an Environmental Management Plan (EMP) for the proposed project. This has been followed by an application for Environmental Clearance Certificate (ECC) to the Ministry of Environment and Tourism (MET) : Directorate of Environmental Affairs (DEA).

In this respect, this document forms part of the application to be made to the DEA's office for an Environmental Clearance certificate for the proposed solar farm development and powerline construction, in accordance with the guidelines and statutes of the Environmental Management Act No.7 of 2007 and the environmental impacts regulations (GN 30 in GG 4878 of 6 February 2012)

1.2. PROJECT LOCATION

The project site is located on Gerus Farm In Outjo, Kunene Region: Namibia.

The Locality Map Fig 1) gives a local layout view of the project site:

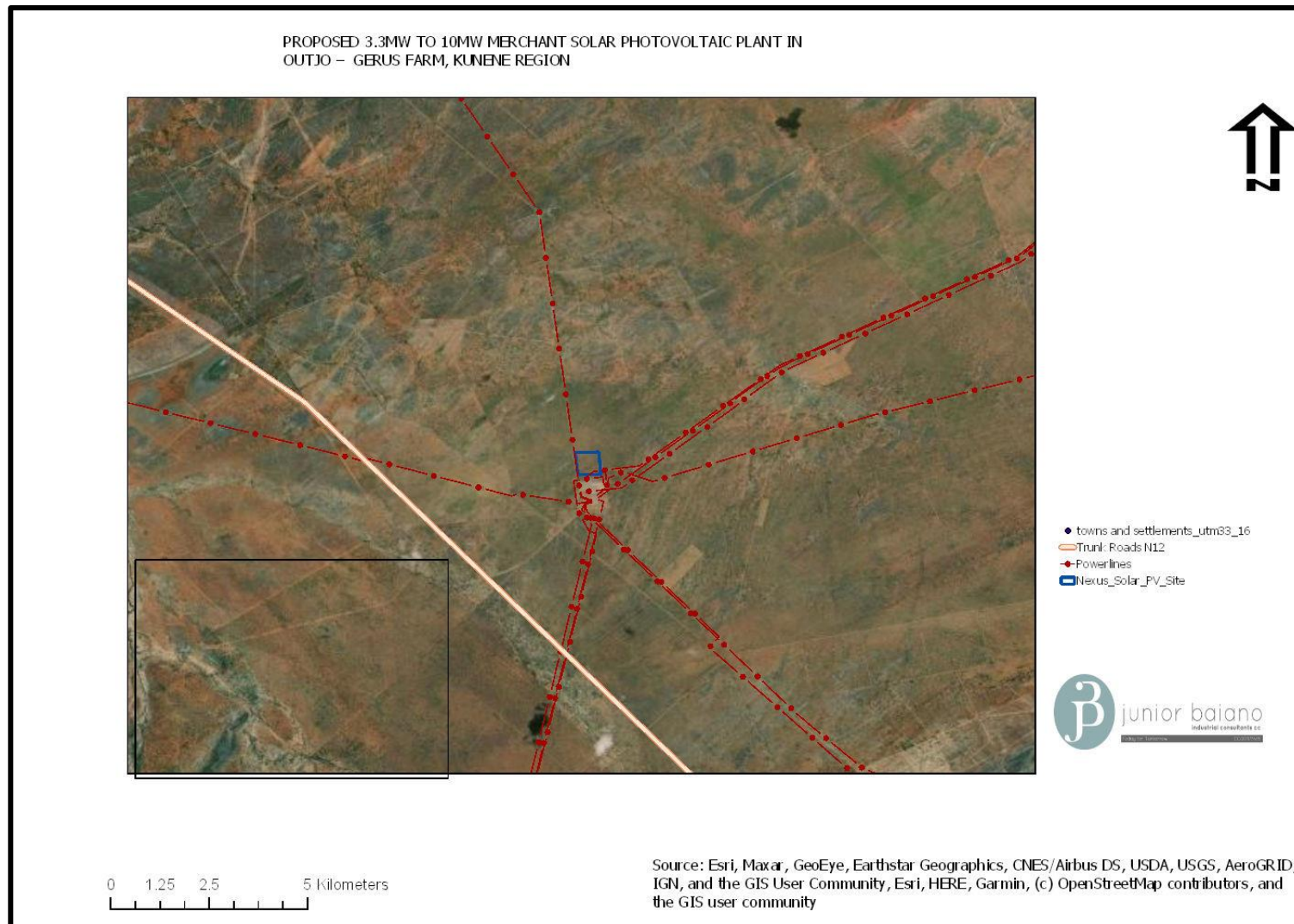


Figure 1: Proposed Project Site

1.3. PROJECT OVERVIEW

Sino Energy intends to construct and operate a Photovoltaic (PV) Solar Power Plant in Outjo, Kunene Region-Namibia. The proposed solar farm entails the construction and operation of a 10 MW PV development, associated infrastructure and services for the provision of renewable electricity to the national power grid.

This project entails the transformation of bare land to accommodate the proposed Solar Power plant, associated infrastructure and services. The infrastructure proposed for the entire Solar Power Plant (project) includes but is not limited to inter alia:

1.4. PV TECHNOLOGY SPECIFIC INFRASTRUCTURE

PV systems produce energy by converting solar irradiation into electricity. A PV system consists of PV panels that encase the solar cells. Solar cells are solid-state semiconductor devices that convert light into direct-current electricity. The top layer of the silicon portion of a solar panel is made from a mixture of this silicon and a small amount of phosphorous, which gives it a negative charge. The inner layer, which constitutes the majority of the panel, is a mix of silicon and a little bit of boron, giving it a positive charge.

The place where these two layers meet creates an electric field called a junction. When light (or photons) hits the solar cell, before it gets to the silicon crystal to make electricity it passes through a glass cover on the panel and an anti-reflective coating, which stops photons from reflecting off of the panel and being lost. The photons are absorbed into the junction, which pushes electrons in the silicon out of the way (See Figure 3). If enough photons are absorbed, the electrons are pushed past the junction and flow freely to an external circuit.

To convert the Direct Current (DC) to Alternating Current (AC) an inverter will be used. The AC energy can then be used to power anything that uses electricity. In fact, they are just larger versions of the cells used in solar calculators. The front surface of the solar panel is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells and reduce glare back towards the atmosphere. The PV panels are predominantly black in appearance – when viewed directly from the front; however, from close-up, a grid of silver contacts is clearly visible.

The proposed PV developments will entail the following infrastructure –

-The DC current is converted to 230V AC current by inverters, the Voltage is stepped up by Transformer and transmitted over transmission network. Voltage is then stepped down for consumer consumption (230V).

The proposed 5MW solar energy facility would consist of the following:

- Photovoltaic component: numerous rows of PV panels and associated support infrastructure to generate electricity, one (1) 10 MW PV Developments of about 10ha;
- DC-AC current inverters and transformers.
- PV module generate DC current (12V, 24V, 48V)
- Transmission corridor: one overhead 19kV transmission line (500m) located within the transmission corridor to connect the proposed onsite substation to the existing main substation, this will follow an existing powerline servitude in the area, to minimise impacts.
- On-site substation: the on-site substation to collect the electricity produced on site and step it up to the correct voltage to transfer via the transmission line to the existing main central substation.
- Buildings: operation and maintenance buildings to house equipment and a guard cabin for security.
- Additional infrastructure: includes a boundary fence for health, safety and security reasons; water supply infrastructure for groundwater abstraction and storm water infrastructure, if required.

2. CHAPTER TWO: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

2.1. OVERVIEW

The proposed PV plant and transmission line development will have environmental impacts as indicated in the previous chapter. This section describes the Environmental Management Plan (EMP) for impacts associated with the proposed development. The EMP stipulates the management of environmental programs in a systematic, planned and documented manner. The EMP below includes the organizational structure, planning and monitoring for environmental protection at the proposed farm area development and other areas of its influence. The aim is to ensure that the proponent maintains adequate control over the project operations to:

- To prevent negative impacts where possible;
- Reduce or minimise the extent of impact during project life cycle;
- Prevent long term environmental degradation.

2.2. EMP Administration

There is a strong need to clearly outline the roles and responsibilities of all stakeholders to ensure that the EMP is fully implemented. There is also a need for the proponent to appoint an overall responsible person (project manager) to ensure the successful implementation of the EMP as highlighted below:

Table 1: Roles and Responsibilities in EMP Implementation

ROLE	ENVIRONMENTAL RESPONSIBILITIES
Sino Energy Pty (Ltd)	Responsible to enforce EMP implementation to contractors
Environmental Control Officer	Implement, review and update the EMP. <ul style="list-style-type: none"> • Ensure all reporting and monitoring required under EMP is undertaken, documented and distributed as needed • Conduct environmental site training (tool box talks) and inductions with the support of an environmental consultant. • Conducts environmental audit at work site with the support of environmental consultant. • Close out all non-conformances. • Ensure materials being used on site are environmentally friendly and safe.
The Department of Environmental Affairs	Approve the EMP and any amendments to the EMP. <ul style="list-style-type: none"> • Approve reports of environmental issues and non-conformances as issued. • Review and approve environmental reports submitted as part of EMP implementation
Environmental Consultant	Conduct and monitor actions required by the EMP if required <ul style="list-style-type: none"> • Conduct environmental site training (tool box talks) and inductions if assistance is required • Conducts environmental audit at work site • Ensure materials being used on site are environmentally friendly and safe.
Site Engineers	Control and monitor actions required by the EMP. <ul style="list-style-type: none"> • Report all environmental issues to HSE Manager. • Ensure documented procedures are followed and records kept on site. • Ensure any complaints are passed onto the management within 24 hours of receiving the complaint.

Workers	Follow requirements as directed by site engineers. <ul style="list-style-type: none">• Report any potential environmental issues to site engineer/project manager, indicating spilt oil, excess waste, excessive dust generation, dirty water running off the site and other possible non-conformances
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Table 2 : Construction and Operation EMP (C&O EMP)

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
Noise pollution	Noise will be generated through: -Construction of drainage services and water reticulation systems. -Construction of buildings -Moving vehicles. -Installation of PV panels stands -Transmission lines poles construction	- The health of working personnel could be disturbed. - Community residents could be disturbed by the noise. - General annoyance -Driving away of local animals species near the project site	Environmental	6-8 months	- Environmental Control Officer -Site Manger	- A construction interval will be established, used and adhered to. - Workers will be issued earplugs to protect them from excessive noise. - Public will be notified through printed timetable stating planned operational activities. - Construction activities will be conducted during daytime. -Site notices will be erected on, around the site-notifying visitors, and nearby residents of different hazards on site. -No go areas marked as sensitive environments, especially for birds needs to	Construction & Operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						be avoided during construction and operation.	
Dust Generation	Dust will accumulate because of the land preparation, onsite movements of vehicles and machines, wind blowing on loose material during construction and tipping.	<ul style="list-style-type: none"> - Can lead to respiratory illnesses especially to those working in the area. - General air pollution. -Nuisance to nearby residents -The process can also drive away wild animals within the project area surroundings 	Environmental	6-8 months	<ul style="list-style-type: none"> - Environmental Control Officer -Project Manger 	<ul style="list-style-type: none"> - Dust suppression will be done through watering dust sources surfaces. -Transmission pole sites can be wet drilled and minimise dust generation. -Watering down dusty surfaces, -Ensure that protective equipment such as respirators are distributed to employees, and ensure their use. -Site notices to be erected on and around the site to inform visitors and surrounding residents. 	Construction & Operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
<p>Loss of Biodiversity</p>	<p>-Vegetative plants on site will be removed -Habitat destruction for both ground dwelling species and tree dwelling species. -Soil disturbance on and around the site.</p>	<p>-The clearing of vegetation will result in the breaking of the ecosystem processes in the area. -Loss of aesthetic value of the proposed project area. -The few small animals still habiting the place such as small rodents and birds will be forced away. -The ecosystem food chain on and</p>	<p>Environmental</p>	<p>Construction phase</p>	<p>- Environmental Control Officer -Site Manager</p>	<p>- The proposed project area is already disturbed, hence there is little vegetation to be affected by the development. - All the major trees will be preserved and the layout plan will fit into the environment without affecting the trees. - Ground disturbance will only be limited to the boundary area to avoid affecting a large area. -Upon completion of construction activities more trees and lawn will be planted on and around the site to restore the site into a status that is environmentally friendly. -When necessary a permit must be obtained from the</p>	<p>Construction</p>

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
		around the area will be broken.				<p>Directorate of Forestry before removing a major tree species (In this respect, a permit is not necessary to be obtained for land clearance for MAWF)</p> <ul style="list-style-type: none"> - All protected species must not be removed must be clearly marked and such areas fenced off. - Utilise existing tracks and roads where possible. - During vegetation clearing avoid killing and/or hunting of animals. 	
Avian Impacts	-Avifauna electrocution or hitting on transmission line infrastructure	-High fatalities of avifauna in the project environment -Birds may affect transmission line	Environmental Infrastructure	Project life time	- Environmental Control Officer	-Use aircraft warning spheres across deep valleys in forested areas -Investigate the implementation	Operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
		<p>infrastructure to nesting construction on powerline.</p>				<p>of warning spheres in areas where pilots have recommended them.</p> <ul style="list-style-type: none"> - Bird diverters will be installed on the transmission line in the event that the transmission line is reconducted, or if the static wire or aviation markers are replaced. -BDs will be spaced between the aerial marker balls to increase visibility of the shield wire. - If available, light emitting BDs will be installed to improve low light visibility; Puget Sound Energy is working with Tyco Electronics in South Africa to develop BDs that store solar 	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						energy and emit visible light during low light conditions.	
Greenhouse gas emissions	Green House Gasses (GHGs) emissions will be produced from the following activities: <ul style="list-style-type: none"> Fuels combustion for transport (construction vehicles and equipment) Ground excavation releases phosphorus found underground and releases particulate 	-Global climate change - Air pollution	Environmental	Construction phase	- Environmental Control Officer -Project Manager -Department of Environmental Affairs.	-Adopt the use of ethanol blended fuels wherever necessary. -Design an operation system that cuts on fuel consumption. - Use of solar energy system during construction for lighting and other minor energy needs.	Construction & Operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
	matter into the atmosphere.						
Waste Generation	Construction and operation is associated with a lot of raw material and activities that results in pollution	<p>-Chemical pollution from oil spills resulting from the handling of various machineries used during the construction phase</p> <p>-Construction rubble, empty packaging containers/bags and materials remnants.</p> <p>-Construction workers can also pollute the</p>	Environmental	Construction phase	<p>- Environmental Control Officer</p> <p>-Project Manger</p>	<p>- Ensure that all waste from construction activities is stored and contained in designated containers and transported to Outjo waste disposal site.</p> <p>-Bulky waste such as building rubbles must be collected and disposed of for landfilling.</p> <p>-Hazardous waste storage bin will be on site and an independent hazardous waste transporting company will be contracted to collected hazardous waste storage bin whenever it is full.</p> <p>-Visual inspections monitoring</p>	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
		surrounding environs if they are not provided with adequate toilet facilities and a waste management system for domestic waste.				-All waste will be managed by proponent and the developer will ensure that domestic waste handling facilities such as labelled dustbins will be available. -Waste separation will be provided for to allow for recycling of recyclable materials i.e. glass, hazardous waste, paper, bio-degradable waste.	
Hydrocarbons release into the environment	There will be no storage of oils and fuel on site, however there is risk of spillage of hydrocarbons from vehicles and machinery operations, maintenance through leakages and spillages	-Washing away of contaminated soils by rains into nearby rivers -Pollution of soil and affecting small living organisms	Environmental	Construction Phase	- Environmental Control Officer -Project Manager -Department of	-Implement a maintenance programme to ensure all vehicles, machinery and equipment are and remain in proper working order -Vehicle maintenance should be	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
	which may result in environmental contamination	habituating the soil -Result in possible groundwater pollution. -Possible fire risk on and around the site			Environmental Affairs.	Conducted in designated areas only, preferably off-site. -If maintenance is to be conducted on site, these areas should be designed to contain spillages i.e. maintenance site must be bunded and paved and the use of chemicals must be controlled. - Spillages are to be removed from site by a specialist waste removal contractor such a rent a drum. -Waste oil, fuels and other chemicals from drip trays on stationery vehicles and machinery will be disposed of as hazardous waste at a licensed facility by a	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						<p>specialist hazardous waste handler.</p> <p>-Oil residue will be treated with oil absorbent material such as Drizit or bio-remediation and removed to an approved waste disposal site</p> <p>-Spill kits will be easily accessible and workers will be trained in the use thereof.</p> <p>-Staff and contractors will be trained in the handling and storage of oils, fuels, chemicals and other hazardous substances</p> <p>-No bins containing organic solvents such as paint and thinners shall be cleaned on site, unless containers for</p>	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						liquid waste disposal are provided on site.	
Safety and Health risks	Construction related Safety and Health hazards	-Injuries to workers such as Occupational dermatitis, slips and fall of humans and objects, musculoskeletal disorders, etc.	Health and safety	Construction phase	HSE Officer	- Equip workers with Personal Protective Equipment (PPE), provide trainings on how to effectively use the PPE. -Provide platforms for briefings and meetings about possible safety and health hazards in the work place. -Provide site signs warning and informing about different hazards on site.	Construction and operation
	Electrical hazards	-Fatalities and fires	Health and safety	Construction and operation	HSE Officer	-Employees should be trained on electrical safety before working on site. -Safety representative with training on electrical hazards emergency management should be station on site always during construction.	Construction and Operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						-Safety signs during construction and operation should be put on site, no go areas should be labelled, PPE specifications should be clear to maintenance personnel.	
Population Influx	The project will bring in skilled and unskilled workforce into Outjo.	-There is potential for cultural systems conflict between locals and new people in the area -Potential for rife prostitution and spread of HIV/AIDS and other STDs	Socio-economic	Construction phase	- Environmental Control Officer -Project Manger	-Train and brief employees to respect local cultures and leaders, -Engage on massive sexual health training and awareness and providing contraceptives such as condoms, as well as provide means counselling for those that are affected by HIV/AIDS and other STDs,	Construction

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
Land use change	-The existing environment will drastically change from a dormant piece of land to a PV plant.	-The area will no longer be suitable for agriculture. -Sudden change in landscape appearances may be unfavourable to the conservatives.	-Social -Terrestrial environment	Permanent	- Environmental Control Officer -Project Manger	-The development should blend into the existing area through designing and colour coding. -Green designing will bring life to the site and blend with surrounding areas.	Construction and operation
Resources consumption	The construction industry can be resource intensive, i.e. water resources.	-The project can result in a strain on available water resources, however also generating clean energy/electricity.	-Socio-economic	Construction phase.	- Environmental Control Officer -Project Manger	-Water saving should be ensured by the site manager i.e. repairing leakages, opening taps only when water is required and recycling of water on site.	
Flooding and Storm Water	-The area is prone to flooding, just like most flat areas in Northern Namibia.	-Enhance the chances of flood occurrences	Environmental	Increased storm water flow	-Site Engineer -ECO	-Standard storm water drainage will be part of the water reticulation designs indicating the storm water deposit areas.	Operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
	<p>-The soil is clay-loamy, which gives a low infiltration rate</p>					<ul style="list-style-type: none"> - During construction all access tracks and the compound area will be constructed using permeable granular materials. - Vehicular movements will be restricted to the access tracks and designated areas where possible to avoid or limit soil compaction, which could have a detrimental impact on infiltration rates. -The ground conditions are sandy hence the use of vehicles on-site is unlikely to create muddy conditions, which may in-turn increase suspended solids levels in surface water run-off. -All run-off is likely to dissipate naturally to ground, 	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						<p>however standard storm drains are going to be installed around the project area to avoid water flowing into nearby properties.</p> <p>- During operation the following design features will reduce the risks from surface water run-off from solar panels by promoting dispersion and infiltration:</p> <ul style="list-style-type: none"> • The gap between panels will be sufficient (typically 20 mm) to allow drainage to ground rather than onto adjacent panels. • The ground surface around and between the frames will be maintained as grass to ensure that 	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						<p>bare soil areas are minimised.</p> <ul style="list-style-type: none"> • The vegetated gap between rows of frames will be of greater width than that of each row of solar panels. • Groundcover vegetation will be maintained in good condition in those areas receiving runoff from solar panels. • The surface gradient is generally less than 10% across the site and therefore run-off is expected to remain dispersed and unlikely to form channels. • Broad grass strips around the edge of the array will 	

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
						also act to impede drainage of surface water to field margins.	
Positive Impacts							
Employment creation	The development provides an opportunity of outsourcing work	- Improves disposable income to those employed and their immediate families.	Socio-economic	Project life time	-Project Manger	- Work with local leadership (councillor) on acquiring non-skilled labour from the residents.	Construction and operation
Business linkages	-Raw materials acquiring and contracting companies provide an opportunity for businesses.	-Local suppliers will be presented with an opportunity to empower their businesses. -Construction workers can be provided with accommodation, food and services	-Socio-economic	Construction phase	-Project Manger	-The proponent will outsource most of its materials and services from Outjo	Construction and operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
		from the local community increasing business activities.					
Infrastructure development	The development presents a unique opportunity for infrastructure development in Northern Namibia area.	-Existing roads will be upgraded which will benefit the local community. -Development of the facilities will also pave way for future developers to grow interests in the area and result in ripple effects and quick growing of the area.	-Socio-economic	Construction phase	-Project manager	-Development such as road upgrading will not only be limited up until the project site, but it will be extended to service other the connecting roads when there is need.	Construction and operation

Impact	Description	Effects	Class	Time frame	Responsibility	Action	Phase
Climate smart energy	The project is towards clean energy production and is highly beneficial to the country and the continent at large.	-Alternative clean energy generation	-Socio-economic - Environmental	Operation phase	-Project manager	-It is recommended that the project once it takes off, a second phase development be implemented.	Operation

2.3. ENVIRONMENTAL MONITORING PLAN

Monitoring component is very important for identifying successfulness of mitigation measures formulated for the significant impacts identified. The monitoring works will identify impacts that have not been foreseen and give enough time to analyse the situation and formulate measures to minimise impact. Survey records and results must be maintained for these monitoring and inspections, highlighting any problems and the measures taken to address it.

Prior to site preparation and construction activities, the main contractor should present an environmental management plan (including, *inter alia*, location of construction camp and toilet facilities, location of material storage areas, solid waste management plan, dust control measures, activity schedule, etc.) for review and approval by the DEA, the environmental monitor and the project manager. The entity selected to carry out environmental monitoring of the construction works should then prepare an environmental monitoring programme based on the above, the requirements of the EIA, and conditions of the development permit. The major elements of the environmental impact monitoring programme to be implemented during the construction phase of the project are as follows:

- Site clearance to ensure that trees marked for protection are left untouched and that large areas of soil are not left exposed and uncovered for extended periods of time.
- Site drainage and surface runoff, especially during and shortly after major rainfall events, to ensure there is no flooding, ponding and runoff of surface water
Compliance of construction works with site management and landscape plans.
- Ensure transportation of earth materials is done by covered trucks and from approved sites.
- The contractor must immediately and completely clean up spills of materials in public areas.
- Solid waste disposal practices to ensure appropriate on-site management and final disposal at approved dump.
- Electrical safety training and signage is highly recommended and important for this development, thus high priority should be placed on electrical safety.
- **An ECO should be contracted to conduct quarterly reports before the triennial renewal period.**

3. CHAPTER THREE: CONCLUSION AND RECOMMENDATIONS

3.1. Conclusion

Arising from the analysis by the consultants, the proposed project is going to create permanent land cover/use change on the proposed project site. It is a dry shrub savannah environment that is going to be converted into a light industrial area and the document has thus provided adequate mitigation measures for the identified impacts for sustainable land development. Because land must develop, but with land development there should not be environmental degradation, thus the EMP provides for the sustainable land development of the energy generating facility.

3.2. Recommendations

To alleviate any negative impacts that may emanate from the construction and operation phases of the land development and its affiliate development, relevant and cost-effective management and mitigation measures will be put in place.

The following recommendations are proposed:

a) Waste Management Recommendations

Solid and liquid waste shall be generated during the project lifespan and must be managed in such a way that it does not impact on the environment.

- The waste water reticulation system should be regularly monitored and maintained in good working conditions and odours managed to make the facility environmentally friendly.
- Provision of colour coded dust bins at all erven to ensure that recyclable material is recovered.

b) Environment Management Plan Recommendations

To ensure a healthy and safe environment in the proposed site and its environs, a plan for environmental management has to be instituted through monitoring. This involves the collection and analysis of relevant environmental data of the site including:

- Health & Security provision for workers
- Firefighting equipment that is strategically placed for easy access
- Devoted maintenance status of drainage facilities (drainage lines)
- Ensuring that only efficient taps are installed to conserve water.
- Quantification on amount of waste generated and its management to obtain information for continued improvement in handling and disposal

- Observation on socio-economic & demographic characteristics of the project's life cycle and identification of unexpected environmental impact
- Formulation of counter-measures to mitigate against the observed unexpected negative impacts and comparing them with actual impacts

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