ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE PROPOSED CONSTRUCTION OF A RENEWABLE PHOTOVOLTAIC SOLAR POWER PLANT, OKAHANDJA, OTJONZONDJUPA REGION, NAMIBIA.

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PROJECT DETAILS

TITLE: Environmental Impact Assessment and Environmental Management Plan for the proposed construction of a renewable photovoltaic solar power plant, Okahandja, Otjonzondjupa Region, Namibia.

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Executive Summary

EUVI ENERGYTECHNOLOGIES cc has been given rights to lease land in the municipal area of farm Portion 11 of Farm Omuramba, N0. 341 in the Otjozondjupa Region. EUVI ENERGYTECHNOLOGIES cc is a Namibian owned company which has a primary focus on sustainable development for the benefit of all Namibians and future generations. The company is proposing to establish a 10 MegaWatts (MW) renewable photovoltaic solar power plant at farm Portion 11 of Farm Omuramba, N0. 341 that will supply electricity to Nampower. The rationale for the development project is based upon the increase in the demand for electricity in the country due to the rapid industrial expansion. The boom in business activities in the country has lead to a demand in electrical services which have grown at a faster rate than expected. The envisaged project is located in the Otjozondjupa Region in the eastern part of Namibia. The plant is to be set up within the farm Portion 11 of Farm Omuramba, N0. 341 itself.

EUVI ENERGYTECHNOLOGIES cc is required to undertake an Environmental Impact Assessment (EIA) for the proposed construction of the renewable photovoltaic solar power plant within the framework of the existing environmental assessment process as described in the Environmental Management Act (2007) and its Regulation (2012), published by the Ministry of Environment and Tourism (MET). As part of the fulfilment of the requirements, EUVI ENERGYTECHNOLOGIES cc has requested Centre for Geosciences Research cc as the Environmental Consultants to undertake the Environmental Impact Assessment (EIA) with respect to the proposed construction of a photovoltaic solar power plant.

The objectives of the EIA include an investigation and assessment of the likely short and long-term positive and negative environmental impacts of the proposed construction of the renewable photovoltaic solar power plant. The EIA also aims at clearly stipulating and determining the legal and regulatory framework and assess the relevance that these legislations will have with regard to the proposed project. The EIA also aims at addressing the public participation process where all Interested and Affected Parties (I&APs) comments/questions and concerns with regard to the proposed project are raised.

1. INTRODUCTION

1.1. Project Background

1.1.1. General Overview

It is well known that power in Namibia is mainly generated and supplied by Namibia Power Corporation (NamPower). Statistics indicate that Namibia has Africa's third highest electrification level at zero percent. The electrical sector in Namibia has the potential to become the driving force behind economic development.

EUVI ENERGYTECHNOLOGIES cc has embarked upon this project of establishing a renewable photovoltaic power plant due to the mere fact that there is a great increase in the need and demand for electricity supply due to the rapid industrial expansion which has taken over the country. EUVI ENERGYTECHNOLOGIES cc feels that through this project they can assist NamPower in executing their plans of increasing the electricity generating capacity and supply in the country.

As stipulated in the Government gazette announcing the commencement of the Environmental Management Act (2007) that an Environmental Impact Assessment be conducted for every energy generation, transmission and storage activities being undertaken. EUVI ENERGYTECHNOLOGIES cc has thus appointed Centre for Geosciences Research cc to carry out the said assessment for the establishment of the photovoltaic solar plant.

1.2. Location of the Project

The envisaged project is located in the Otjozondjupa Region in the central part of Namibia. The plant is to be set up at farm Portion 11 of Farm Omuramba, N0. 341, itself **(Figure 1).** Portion 11 of Farm Omuramba, N0. 341 in Okahandja district is situated 120 km down the C31 motorway from Okahandja town. **(Figure 1).**

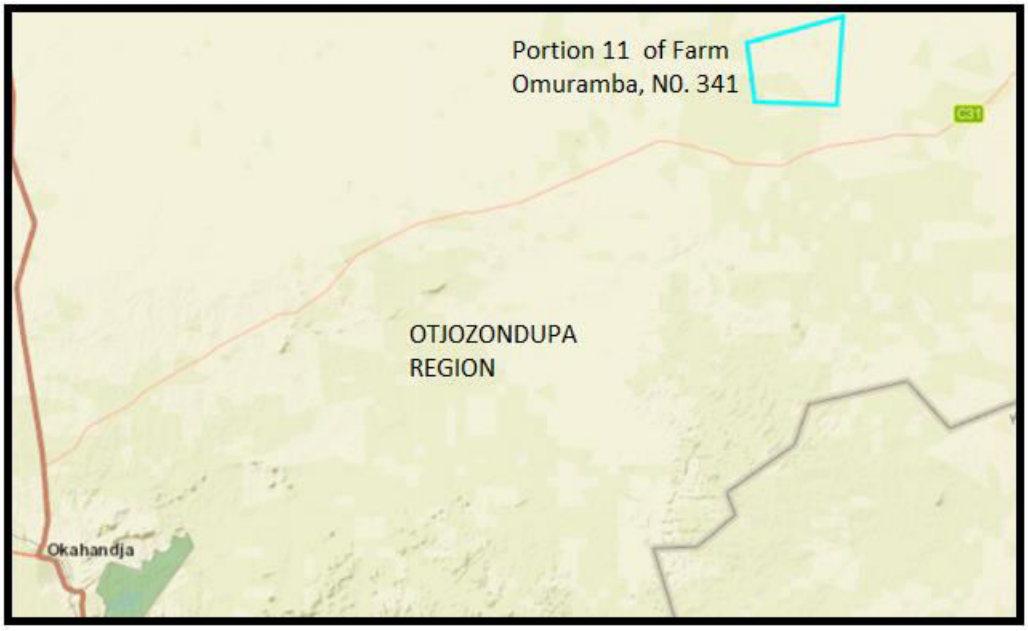

Figure 13: Location of the project area at Portion 11 of Farm Omuramba Okahandja, Otjozondjupa Region (Source: Maps of Namibia, 2012)

1.3. The objectives of the Environmental Assessment Process

The study will involve a process of investigating and assessing the possible long and short–term positive and negative environmental impacts that the proposed establishment of the renewable PV solar power plant at farm Portion 11 of Farm Omuramba, N0. 341 will impose. The objectives of the environmental scoping study are to:

- To prepare a thorough Scoping Environmental Impact Assessment (EIA) report that:
  - Describe the details of the activities to be undertaken for the proposed establishment of the renewable PV solar power plant.
  - Describe the current environmental conditions within the project area based on the available information.
  - Identifies potential positive and negative environmental impacts associated with the proposed project activities.

- To develop an Environmental Management Plan (EMP) based on the outcomes of this study in support of the environmental management of the proposed project.
- To introduce the proposed project to the Government, other stakeholders as well as Interested and Affected Parties (I&APs) to ensure that all key impacts and concerns are incorporated into the final Scoping Environmental Impact Assessment Report.

1.4. Terms of Reference

The term of reference for the proposed project was set out based on the requirement by the Environmental Management Act (2007) and its Regulation (2012) and the Nature Conservation Amendment Act (1996). The steps which were followed are described as follows:

a) a description of all tasks to be undertaken as part of the assessment process, including any specialist to be included if needed:
b) an indication of the stages at which the Environmental Commissioner is to be consulted;
c) a description of the proposed method of assessing the environmental issues and alternatives; and
d) the nature and extent of the public consultation processes to be conducted during the assessment process.

1.5. Scope of the Environmental Impact Assessment

The particular objectives of the EIA in line with the Terms of Reference are to:

- Comply with Namibia`s Environmental Assessment Policy, Environmental Management Act (2007) and its Regulations (2012).
- Confirm the justification of the project and to consider all alternatives that would meet the need.
- Consult all Interested and Affected Parties (I&APs) to ensure that their inputs are taken into account;
- Review the legal and policy framework and their relevant requirements for this project;
- Describe the biological, physical and socio-economic environments of the proposed project.
- Identify and assess impacts related to the construction and operation of the proposed establishment of the renewable PV solar power plant and to propose mitigation strategies
- Compile an Environmental Management Plan for the construction and operation of the proposed establishment of the renewable PV solar power plant.

The Environmental Assessment procedure as outlined in the Environmental Assessment Policy for Sustainable Development and Environmental Conservation (2008) is shown in **(Figure 2)** below:

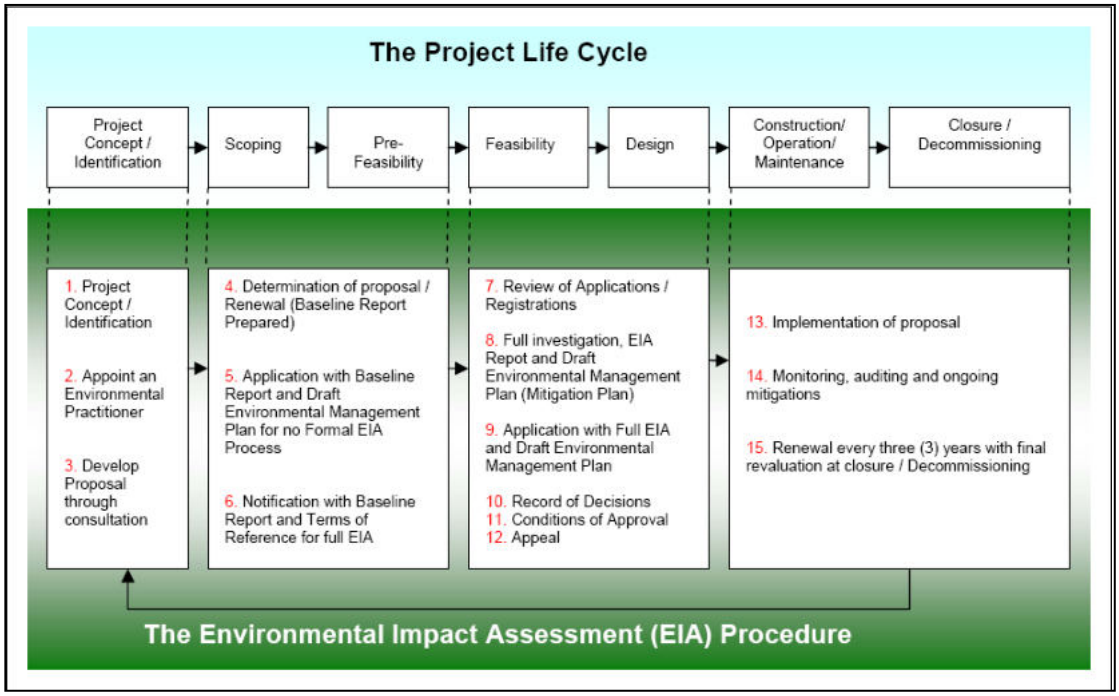

Figure 14: Environmental Assessment process in Namibia (Directorate of Environmental Affairs (DEA, 2008)

2. BACKGROUND TO PHOTOVOLTAIC SOLAR POWER SYSTEMS

2.1. What is a photovoltaic solar power system?

Photovoltaic solar power is generated as a result of converting the sun's radiation energy into electricity that can be used to power electronics and other devices. Photovoltaic technology has gained significant popularity as an alternative energy source, and holds many financial and environmental benefits. Photovoltaics, translated directly from its Greek roots, means literally "light electricity." Although the term has only recently become common knowledge, the technology has been in the works since the 1940s and 1950s. Light energy has long been used to power small electronics such as calculators and wristwatches. However, the potential of photovoltaic technology is now being further exploited, in that it is used to generate electricity for home and commercial usage.

Solar panels, or photovoltaic panels, function to generate electrical energy from solar radiation **(Figure 3).** They are engineered to efficiently absorb radiation, and contain semiconductors to convert the energy. The semiconductors are normally made of silicon, and through a complex molecular interaction, change the energy state of the radiation such that it takes the form of usable electricity. The electricity is then transmitted through the wiring of the panels to power the energy needs of the home.

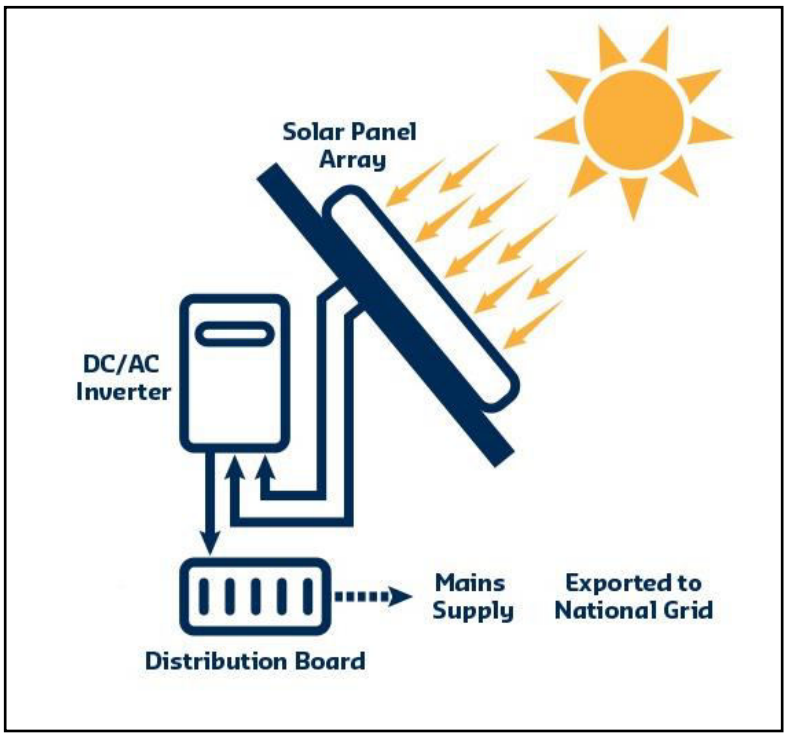

Figure 15: How the PV solar system works (Source: www.markgroup.co.uk)

2.2. Grid connected PV solar power systems

Being grid connected means that a solar photovoltaic system is linked directly to the available electrical grid or utility lines. A connected system comprises a photovoltaic panel or set of panels that directly convert sunlight into electricity. The size of the system dictates how independent from the grid it's possible to be. Grid connected systems need inverters to convert direct current into alternating current usable electricity. The inverter connects to the main electrical supply with a meter showing the number of generated kilowatt hours. Excess electricity can be sold back to the grid. This project is also a grid connected PV solar power system.

2.3. Advantages and disadvantages of PV solar power systems

Advantages

- Photovoltaic (PV) systems provide green, renewable power by exploiting solar energy. We can use photovoltaic (PV) panels as an alternative energy source in place of electricity generated from conventional fossil fuels. Consequently, the more we use PV panels (or other renewable energy technologies) to cover for our energy needs, the more we help reduce our impact to the environment by reducing CO2 emissions into the atmosphere.
- Photovoltaic (PV) panels constitute a reliable, industrially matured, green technology for the exploitation of solar energy. Photovoltaic (PV) companies give valuable warranties for PV panels in terms of both PV panel life span (years of PV life) and PV panels' efficiency levels across time. PV panels can last up to 25 years or more, some with a maximum efficiency loss of 18% only, even after 20 years of operation.
- Unlike wind turbines, Photovoltaic (PV) panels operate autonomous without any noise generation as they do not incorporate any moving mechanical parts. In some cases photovoltaic (PV) panels may be mounted on adjustable rotating basis which is mounted on a fixed pole and allows some movement for better and longer solar tuning – turning the solar panel to follow the sun. Even in this adjustable PV systems, the movements are very moderate, almost negligible, and do not generate any disturbances.

- With respect to operating costs and maintenance costs, Photovoltaic (PV) panels, unlike other renewable energy technologies, require minimum operating or maintenance costs; just performing some regular cleaning of the panel surface is adequate to keep them operating at highest efficiency levels as stated by manufacturers' specs.

Disadvantages

- Perhaps the biggest disadvantage of Photovoltaic (PV) panels is their limited efficiency levels; compared to other renewable energy sources.

- Another disadvantage of Photovoltaic PV panels is that they produce direct electric current which must be converted to alternating current (AC) before it can be used for consumption (either to be transferred to the power grid, or directly for own consumption). To convert DC to AC, PV panel systems use inverters, expensive electronic equipment and with certain technological limitations, adding to the overall system's cost especially at larger power sizes.
- Some toxic substances, such as cadmium and arsenic, are used to create photovoltaic panels. These chemicals have the potential to cause pollution and environmental destruction if they're discarded improperly. Fortunately, they are also somewhat recyclable and their impact can be minimized through reuse and proper handling.

3. PROJECT DESCRIPTION

3.1. General Overview

EUVI ENERGYTECHNOLOGIES cc proposes to construct a PV solar power plant that will produce electricity and supply to private institutions by direct feed and Nampower. The installation site is within the farm Portion 11 of Farm Omuramba, N0. 341 area **(Figure 4)**. The area on which the license is granted provides a surface of about 193,473 Ha, sufficient to accommodate the plant in question. The land on which the supporting structures of the PV modules will be laid is flat and without cumbersome barriers that may prevent the correct installation of the photovoltaic field. There aren't also forests, trees, mountains or tall buildings that may in some way produce shadowing phenomena of the PV modules.

It thus appears that, for the characteristics of the installation site, it is possible to freely choose as regards the orientation and inclination of the modules, as well as for the coefficient of filling of the two areas. This allows optimizing the laying and operating conditions, consequently maximizing the yield of the photovoltaic system. In **(Figure 4)** and **(Figure 8)** the installation site is shown. Farm Portion 11 of Farm Omuramba, N0. 341 is situated at an altitude of 1444m above sea level, and is characterized by a semi-arid climate (hot summers and dry winters).

Figure 16: The installation site for the proposed renewable PV solar power plant at farm Portion 11 of Farm Omuramba, N0. 341, Okahandja district.

3.2. Physiography

3.2.1. Climate

Okahandja district, specifically farm Portion 11 of Farm Omuramba, N0. 341 has a semi-arid climate with hot summers and cool winters (with mild days and chilly nights). The average annual precipitation is 370 mm. High temperatures are very common in the area due to the high sunshine hours in the town **(Figure 5)** and the average annual temperature is 28.3 ºC.

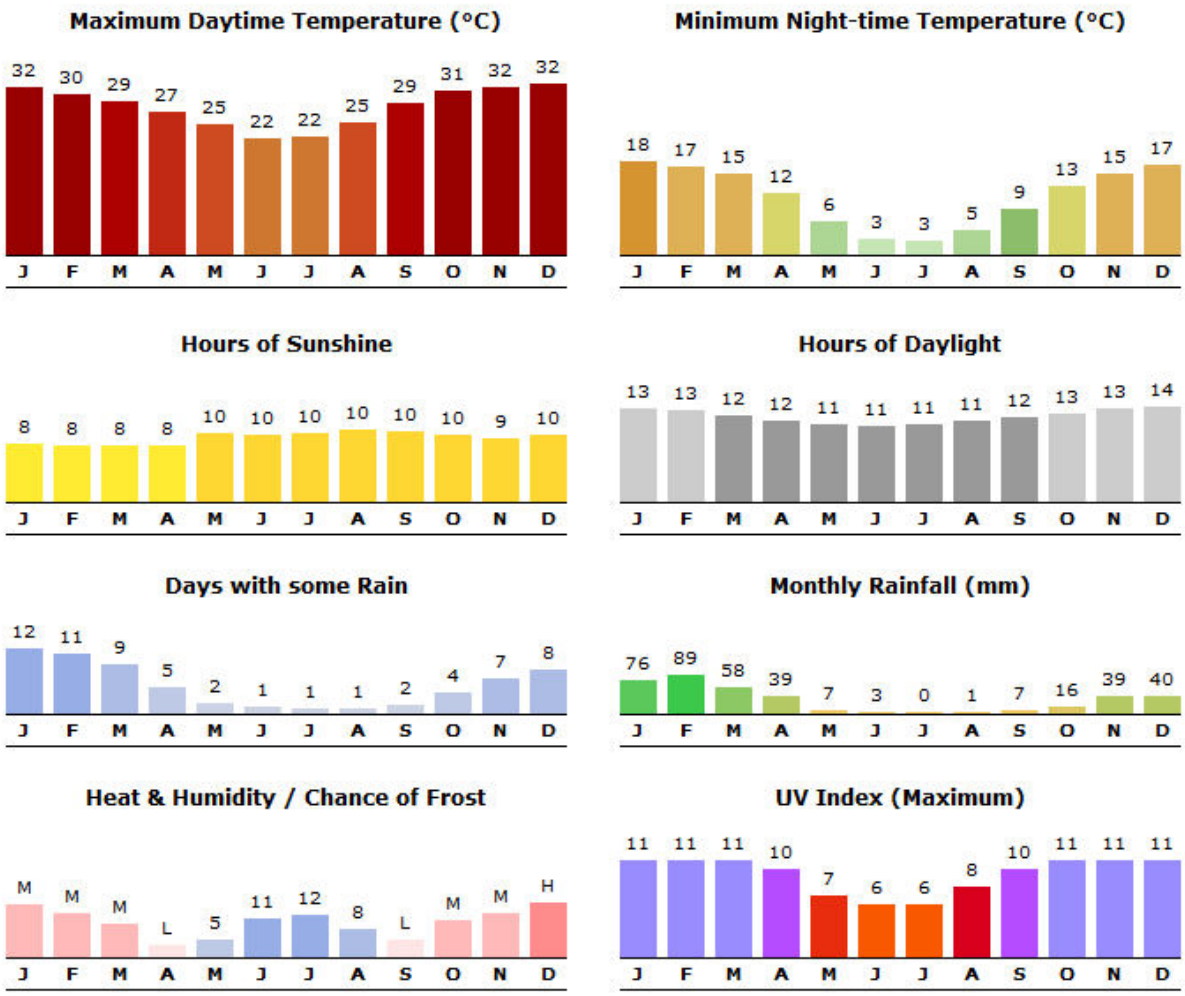

Figure 17: Climate conditions Okahandja District (Source: World Climate Guide)

3.2.2. Geology of the site

Regionally the project area belongs to the Nosib Group which is rather known to be a basal succession formed during the Damara orogen. The Nosib Group is laid down in or marginal to intracontinental rifts and it mainly consists of arenitic rocks like sandstones, quartzites, conglomerates and subordinate schists (Miller, 1992).

The geology in the Okahandja area covering the farm Portion 11 of Farm Omuramba, N0. 341 area is comprised of the Kamtsas Formation which is made up of Kamtsas quartzite (Damara Sequence) and sediments of the Kuibis Subgroup (Nama Group), locally overlain by tillite and shale of the Dwyka Formation (Karoo Sequence) **(Figure 6)**

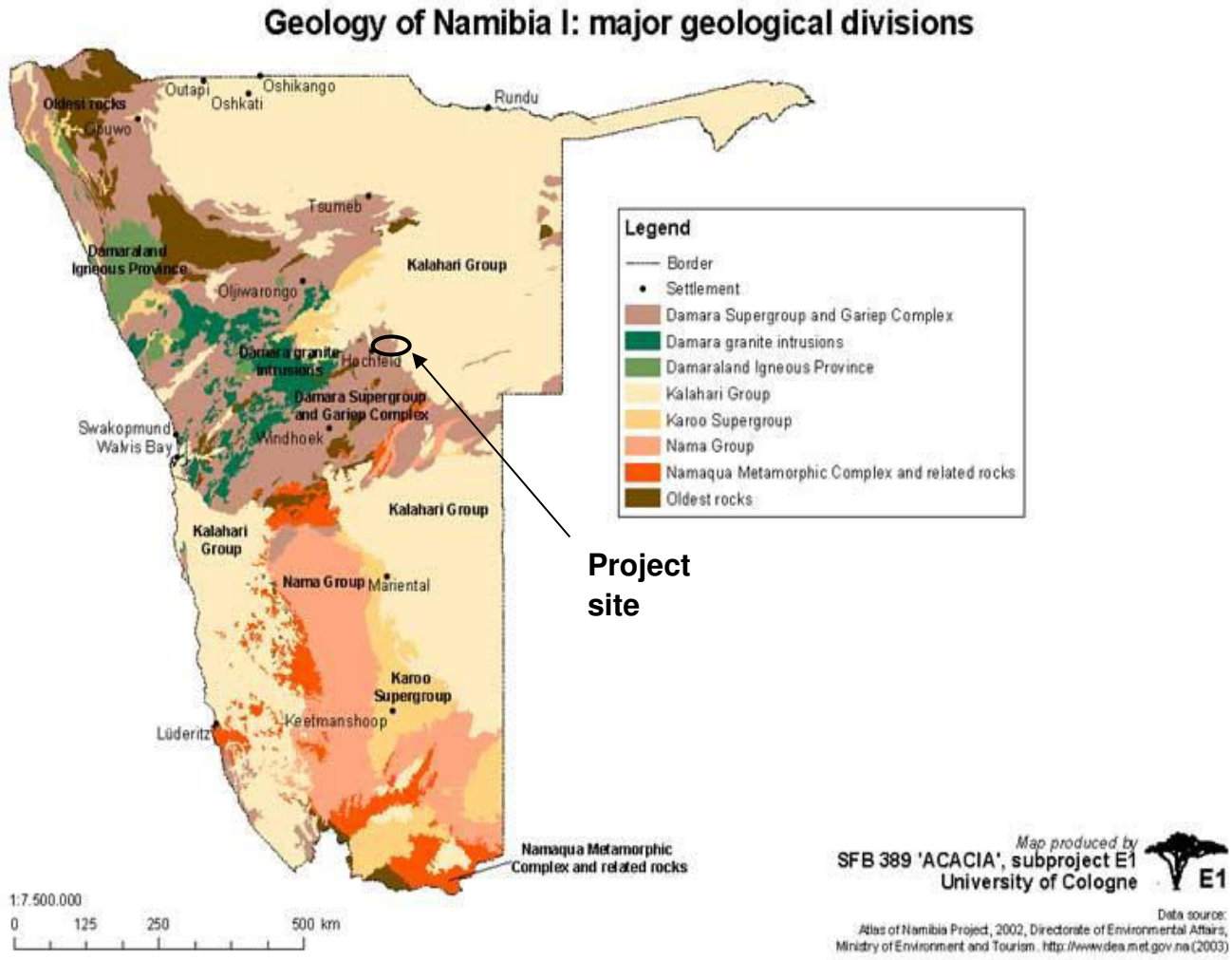

Figure 18: geology of the project area indicating rocks of the Damara Supergroup as well Nama Group rocks

3.3. Rationale for the proposed site

The farm Portion 11 of Farm Omuramba, N0. 341 has been chosen as the proposed locality for the project because of the high average monthly sun hours in Okahandja district **(Figure 7)**. As we know sunshine is a very important aspect of the proposed project. The strength of the sun's ultraviolet (UV) radiation is expressed as a solar UV index. The UV Index for Okahandja is averaged at 12 on a daily basis which is determined to be very high (https://globalsolaratlas.info).

An explanation for the high sun radiation in Okahandja can be due to the mere fact that the district is found at a high altitude of up to 1444 m (amsl) and it has been established that there is less atmosphere at higher altitudes to absorb certain radiations especially UV rays therefore implying more sunshine.

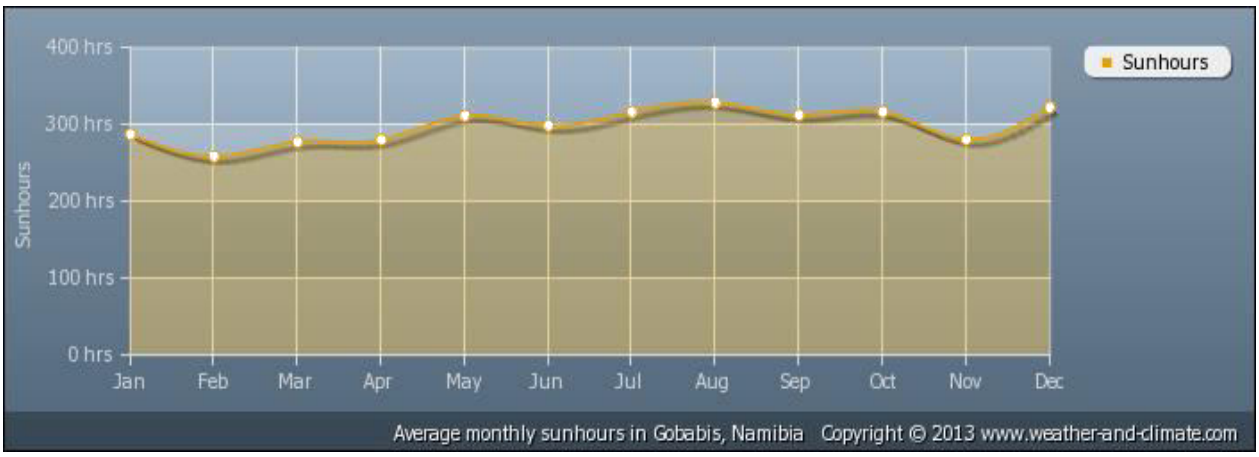

Figure 19: Average monthly sunshine hours in Okahandja district, Otjozondjupa Region (Source: www.weather-and-climate.com)

Figure 20: The site where the proposed PV solar power plant is to be constructed (Source: Google Map)

3.4. Proposed project details

The project consists of several stages: the assessment of the environmental parameters of the installation site, the size of sub-components of the solar PV array, the size of the MV/LV transformers of the various subfields, sizing of MV lines and their parallel until the primary transformer station MV/AV.

The geographic coordinates of Okahandja are 21.548333 17.31667 ; 21.558611 17.534722. This means that the optimal orientation and tilt of the PV system are as follows:
- Orientation 180° to the South, ie 0° to the North;
- 20° tilt.

Considering the composition of the soil and the extremely arid climate, it is easy to assume that the environment is dusty. The dust deposited on PV modules could reduce the yield and, if a regular cleaning is not performed, the reduction may become relevant.

The MW PV solar power system will be made up of subfields that will produce the same amount of solar power each. The subdivision of the PV power plant in various subfields highlights one of the advantages of photovoltaic generators, their modularity. Furthermore, this choice surely advantages the reliability of operation and so productivity of the plant: in fact, in the case of out of service of one of the subfields, the remaining ones continue to operate in an independent way, by limiting the disruption to one part of the facility.

4. LEGAL AND REGULATORY FRAMEWORK

The management and regulation of electricity generating activities falls within the jurisdiction of the Ministry of Mines and Energy (MME), specifically the Electricity Control Board. Environmental regulations are guided and implemented by the Directorate of Environmental Affairs (DEA) within the Ministry of Environment and Tourism (MET) following the guidelines of the Environmental Management Act (No. 7 of 2007).

It is the responsibility of the proponent in this case EUVI ENERGYTECHNOLOGIES cc to have a comprehensive inventory and understanding of all relevant legislations and determine the relevance of these legislations to the proposed project. The interpreted understanding of the legislation provides the background for management and mitigation of all environmental impacts. The Environmental Management Act (2007) requires due process to be followed, essentially that all project related regulatory requirements are identified, scoped (public participation), mitigated and conformed with. The project legal requirements are evaluated in terms of the National legislation, guidelines and policies.

4.1. Namibian Legislation, Guidelines and Policies

4.1.1. The Namibian Constitution

Article 91 defines the function of the Ombudsman and 91 (c) describes the duty to investigate complaints concerning the over-utilisation of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of the ecosystem and failure to protect the beauty and character of Namibia.

Article 95 (l) states that '*the State shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at … maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of natural resources on a sustainable basis for the benefit of all Namibians both present and future; in particular the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian Territory.'*

Article 100 states that '*the land, water and natural resources below and above the surface of the land … shall belong to the State if they are not otherwise lawfully owned.'*

4.2. Legal instruments relevant to this project

There are various legal instruments that are advocates for the effects of electricity generation on the environment. **(Table 1)** below shows the summaries of the legislation that are relevant to this project.

Table 21: Legal instruments relevant to this project.

Topic	Legislation	Provisions	Regulatory Authority
Electricity Generation	Electricity Act 2007	The Electricity Act of 2007 provides the requirements and conditions involved in obtaining licenses for the provision of electricity; also to provide for the powers and obligation of the licensees; and to provide for incidental matters.	Ministry of Mines and Energy
Environmental Impact Assessment	Environmental Management Act of 2007 and EIA regulation of 2012	Provides list of activities that require an environmental assessment, including: Mining and Quarrying. Activities such as exploration or prospecting for minerals or dimension stone, mining for minerals or dimension stone. The Act also provides procedures for adequate public participation during the environmental assessment process for the interested and affected parties to voice and register their opinions and concern about a project.	Ministry of Environment and Tourism
Hazardous Substance such as used oil which (e.g. diesel)	Hazardous Substance Ordinance 14 of 1974	The Act provides for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure thereby in certain circumstances; to provide for the prohibition and control of the importation, sale, use, operation, application, modification, disposal or dumping of such substance; and to provide for matters connected therewith"	Ministry of Health and Social Services
Fauna and flora	The Nature Conservation Ordinance, Ordinance of 1975,	In the course of the Mine's activities, care must be taken to ensure that protected plant species and the eggs of protected and game bird species are not disturbed or destroyed. If such destruction or disturbance is inevitable, a permit must be obtained in this regard from the Minister of Environment and Tourism. For this project, due to it areal extend and location outside	Ministry of Environment and Tourism (MET)

		a protected area a permit will not be required. .	

Topic	Legislation	Provisions	Regulatory Authority
Employees	The Labour Act, 2007 (Act No. 11 of 2007)	The Labour Act gives effect to the constitutional commitment of Article 95 (11), to promote and maintain the welfare of the people. This Act is aimed at establishing a comprehensive labour law for all employees; to entrench fundamental labour rights and protections; to regulate basic terms and conditions of employment; to ensure the health, safety and welfare of employees	Ministry of Labour and social welfare
Archaeological sites	National Heritage Act 27 of 2004 Ministry of Youth	This Act provides provisions for the protection and conservation of places and objects of heritage significance and the registration of such places and objects. The proposed exploration project will ensure that if any archaeological or paleontological objects, as described in the Act, are found in the course of its construction, mining operations or closure that such find be reported to the Ministry immediately. If necessary, the relevant permits must be obtained before disturbing or destroying any heritage.	National Service, Sport and Culture
Desertification	United Nation Convention to Combat Desertification 1992	The convention objective is to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability	United Nation Convention
Biodiversity	Convention on Biological Diversity (CBD) 1992	This convention advocates for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	United Nation Convention

4.2.1. Electricity Act No. 4 of 2007

The Act stipulates the establishment of the Electricity Board and for its powers and functions. It further provides for the requirements and conditions for obtaining licences for the provision of electricity, and for the powers and obligations of licensees and to provide for incidental matters.

The objective of the Act is laid down in its Section 3 which is to exercise control over and regulate the provision, use and consumption of electricity in Namibia through the Electricity Control Board (ECB) as well as to oversee the efficient functioning and development of the electricity industry and security of electricity provision. The Act under its Section 21 states that the applicant has to submit an Environmental Impact Assessment study indicating the extent of any potential damage to or pollution of the environment and the steps proposed to prevent such damage or pollution and to restore the environment generally and in terms of existing environmental legislation. It is for this reason that EUVI ENERGYTECHNOLOGIES cc has appointed Centre for Geosciences Research cc to undertake the EIA study for the proposed renewable solar power plant in Okahandja district's farm Portion 11 of Farm Omuramba, N0. 341.

4.2.2. Environmental Legislation

4.2.2.1. Environmental Management Act No. 7 of 2007

The Environmental Management Act No. 7 of 2007 is an important tool in terms of environmental protection. The Act requires adherence to the principle of optimal sustainable yield in the exploitation of all natural resources. The Act gives effect to Article 95 (l) of the Namibian Constitution by establishing general principles for the management of the environment and natural resources. It promotes the coordinated and integrated management of the environment The Act promotes inter-generational equity in the utilisation of all natural resources. Environmental impact assessments and consultations with communities and relevant regional and local authorities are provided for, to monitor the development of projects that potentially have an impact on the environment. According to the Act, Namibia's cultural and natural heritage is required to be protected and respected for the benefit of present and future generations. In order to promote the sustainable management of the environment and the use of natural resources, the Act has established a bundle of principles for decision-making on matters affecting the environment. The

objective of the Act is laid down in its Section 2, which is to prevent and mitigate, on the basis of the principles set out in section 3, the significant effects of activities on the environment.

4.2.2.2. Environmental Impact Assessment Regulations No. 30 of 2012 of the Environmental Management of 2007

Environmental Impact Assessment Regulations No. 30 of 2012 of the Environmental Management Act No. 7 of 2007 lists activities which may not be undertaken without environmental clearance certificate and hence are subject to an environmental assessment process. It is for these reasons that an environmental assessment should be undertaken to identify the fatal flaws associated with the various activities to be undertaken. The act also provides procedures for adequate public participation during the environmental assessment process for the interested and affected parties to voice and register their opinions and concern about a project.

4.2.3. Legislations on Biodiversity

4.2.3.1. Nature Conservation Ordinance 4 of 1975 (as amended 1996)

The Nature Conservation Ordinance deals with conservation by providing for the declaration of protected habitats as national parks and reserves, and for the protection of scheduled species wherever they occur. The Ordinance also applies to the manufacture, sale, use, disposal and dumping of hazardous substances, as well as their import and export and is administered by the Minister of Health and Social Welfare. Its primary purpose is to prevent hazardous substances from causing injury, ill-health or the death of human beings.

4.2.3.2. United Nation Convention to Combat Desertification (1992)

The convention objective is to forge a global partnership to reverse and prevent desertification/ land degradation and to mitigate the effects of drought in the affected areas in order to support poverty reduction and environmental sustainability.

4.2.3.3. Convention on Biological Diversity (CBD) (1992)

This convention advocates for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

4.2.4. National Heritage Act No. 27 of 2004

The Heritage Act of 2004 makes provision for the developer to identify and assess any archaeological and historical sites of significance. The existence of any such sites should be reported to the Monuments Council as soon as possible. The Council may serve notice that prohibits any activities as prescribed within a specified distance of an identified heritage/archaeology site.

4.2.4.1. Cradle to Grave Responsibility

This principle provides that those who manufacture potentially harmful products should be liable for their safe production, use and disposal and that those who initiate potentially polluting activities should be liable for their commissioning, operation and decommissioning.

4.2.4.2. Precautionary Principle

There are numerous versions of the precautionary principle. At its simplest it provides that if there is any doubt about the effects of a potentially polluting activity, a cautious approach should be adopted.

4.2.4.3. The Polluter Pays Principle

A person who generates waste or causes pollution should, in theory, pay the full costs of its treatment or of the harm, which it causes to the environment.

4.2.4.4. Public Participation and Access to Information

In the context of environmental management, citizens should have access to information and the right to participate in decisions making.

4.2.5. Legislations for health and safety

4.2.5.1. Regulations for the Health and Safety of Employees at Work of the Labour Act of 2007 (amended 2011)

The Regulations relating to Health and Safety at the Workplace in terms of the Labour Act No. 11 of 2007 came into force on 31 July 1997. These regulations prescribe conditions at the workplace, and *inter alia* deal with the following:

- Welfare and facilities at work-places, including lighting, floor space, ventilation, sanitary and washing facilities, usage and storage of volatile flammable substances, fire precautions, etc.
- Safety of machinery.
- Hazardous Substances including precautionary measures related to their transport, labelling, storage, and handling. Exposure limits, monitoring requirements, and record keeping are also covered.
- Physical hazards including noise, vibration, ionizing radiation, non-ionizing radiation, thermal requirements, illumination, windows and ventilation.
- Requirements for protective equipment.
- Emergency arrangements.
- Electrical safety

5. AFFECTED ENVIRONMENT

5.1. Socio-Economic Environment

According to (Namibian Statistics Agency, 2011) the population size of the country had increased from 1.8 million in 2001 to 2.1 million in 2011. There had also been an increase in the population density from 2.1% in 2001 to 2.6% in 2011. These statistics are a clear indication there is a demand in electricity usage due to the increase in population size.

In terms of housing conditions in the country households with electricity for lighting were found to be 42% and those that use wood/charcoal for cooking were 52%. This gives an indication that there is a definite need for electricity generation projects in order to cater for the demands of the population in the country; this also in turn contributes to the development towards vision 2030.

It is also stated in the (Namibian Statistics Agency, 2011) report that the households of the Otjozondjupa region depend on wages and salaries, farming, business or non-farming activities, pension and cash remittance as their main source of income. About 49 % of the population depends on wages and salaries. Therefore this project will serve as a great opportunity to contribute to these wages and salaries of those seeking temporary and permanent employment through the activities of the proposed PV solar power plant in Okahandja District. Only a small percentage depends on cash remittance and business or non-business activities, which is the lowest dependency in the area adding up to 6 % and 7% respectively, in the year 2011. The dependency of the residents on pension only adds up 13% of the total population.

5.2. Biophysical Environment

5.2.1. Biodiversity (Fauna and Flora)

A desktop study (literature review) was conducted on the flora and the vertebrate fauna expected to occur in the Okahandja around farm Portion 11 of Farm Omuramba, N0. 341 area (Otjozondjupa Region) in central Namibia. An extensive literature review of the plant species as well as the reptiles, amphibians, mammals and birds expected to occur in the general Okahandja district around farm Portion 11 of Farm Omuramba, N0. 341 area was conducted using as many relevant literature as possible.

Flora

The project area belongs to the thornbush savanna according (Mendelsohn, 2012) **(Figure 10)**. The thornbush savanna (300-400 mm rainfall) of the central Kalahari is an open savanna with *Acacia erioloba* as the dominant tree **(Figure 9).** Common shrubs include *Acacia hebeclada, Ziziphus mucronata, Tarconanthus camphoratus, Grewia flava, Ozoroa paniculosa* and *Rhus ciliata*. There is a good grass cover but of course, unpalatable grasses such as *Eragrostis pallens* and *Aristida stipitata. Schmidtia kalahariensis* is an indicator of veld deterioration.

Figure 21: Vegetation in the surrounding of proposed area

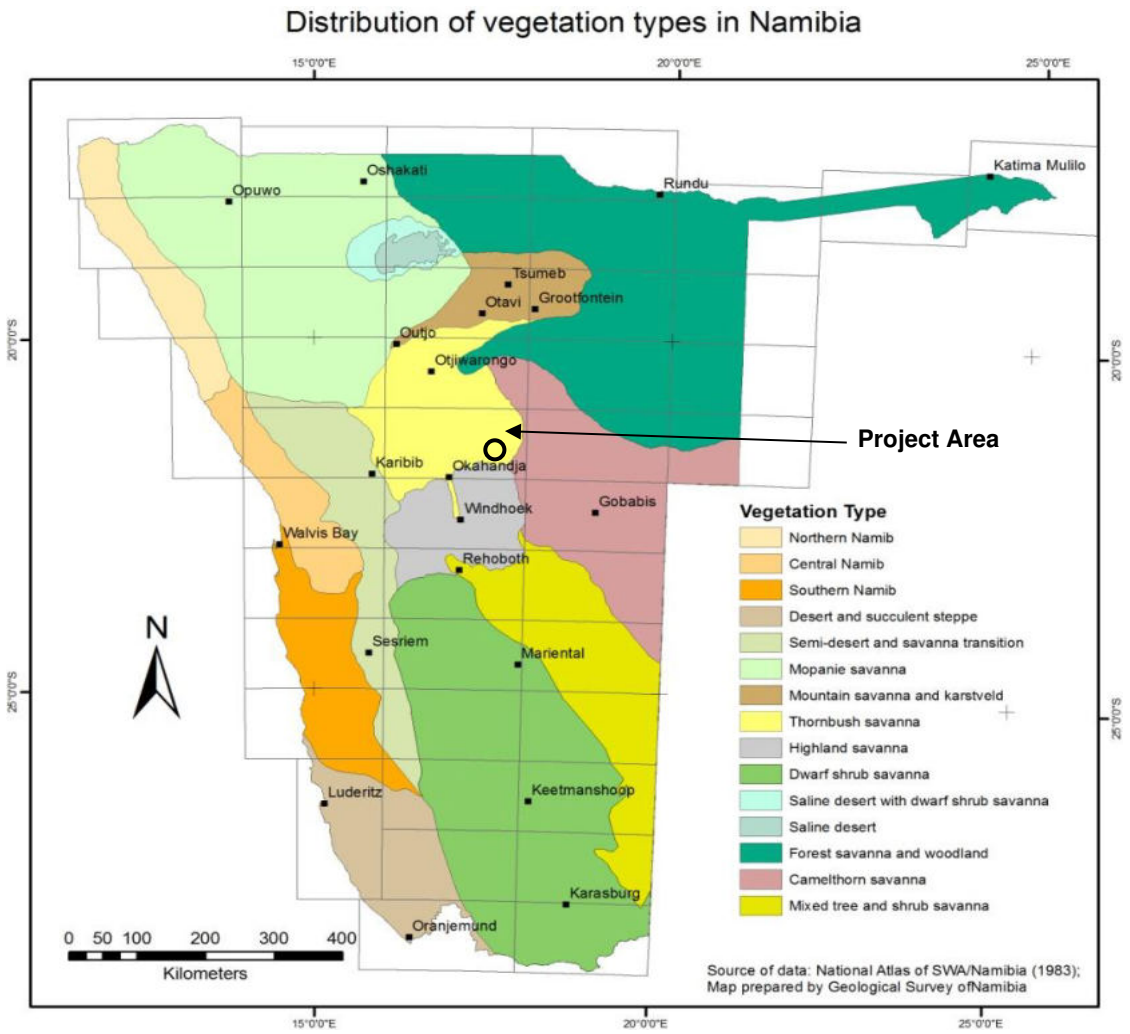

Figure 22: Vegetation in the project area (Source: National Atlas of Namibia)

Fauna

There is numerous wildlife and fauna as per say within the area of the proposed PV solar power plant which is the farm Portion 11 of Farm Omuramba, N0. 341 itself. Nevertheless, the surrounding areas in general are sustained by livestock animals such as cattle, sheep, goats, horses etc. and wildlife such as, cheetahs, leopards, caracal, eagles, meercats, mongoose, zebras, baboons, African wild dogs, springboks etc **(Figure 11).**

Figure 23: Small stock animals such as sheep and wildlife such as hyenas in the surroundings.

5.2.2. Groundwater and surface water hydrogeology

The hydrology of Namibia is characterized by the semi-arid to arid climate, and has very limited occurrences of surface water.

The project area is hydrogeological situated within the Hochfeld-Dordabis Area **(Figure 12),** which stretches from east of Windhoek to the eastern borders of Namibia. The area mainly includes the sandvelds between the Kalahari basins of northern Otjozondjupa-Epukiro and the Stampriet artesian basin (Christelis and Struchmier, 2001).

Both alluvial and fractured aquifers occur in the area. The alluvial aquifers are mainly found along the riverbeds. The north-eastern side of Okahandja has porous aquifers consisting of the Kalahari sediments overlying the quartzites. The secondary fractured aquifers in the area are generally hosted in the faults and other secondary structures and are more prevalent in competent rocks like the sandstones and quartzites. The fractured aquifers in the basement rocks and the porous aquifers from the saturated Kalahari sediments are some of the aquifers supplying water to the surrounding farms including the farm Portion 11 of Farm Omuramba, N0. 341 area. The fractured aquifers in the area have relatively moderate to high yields and receive fairly regular recharge (Christelis and Struchmier, 2001).

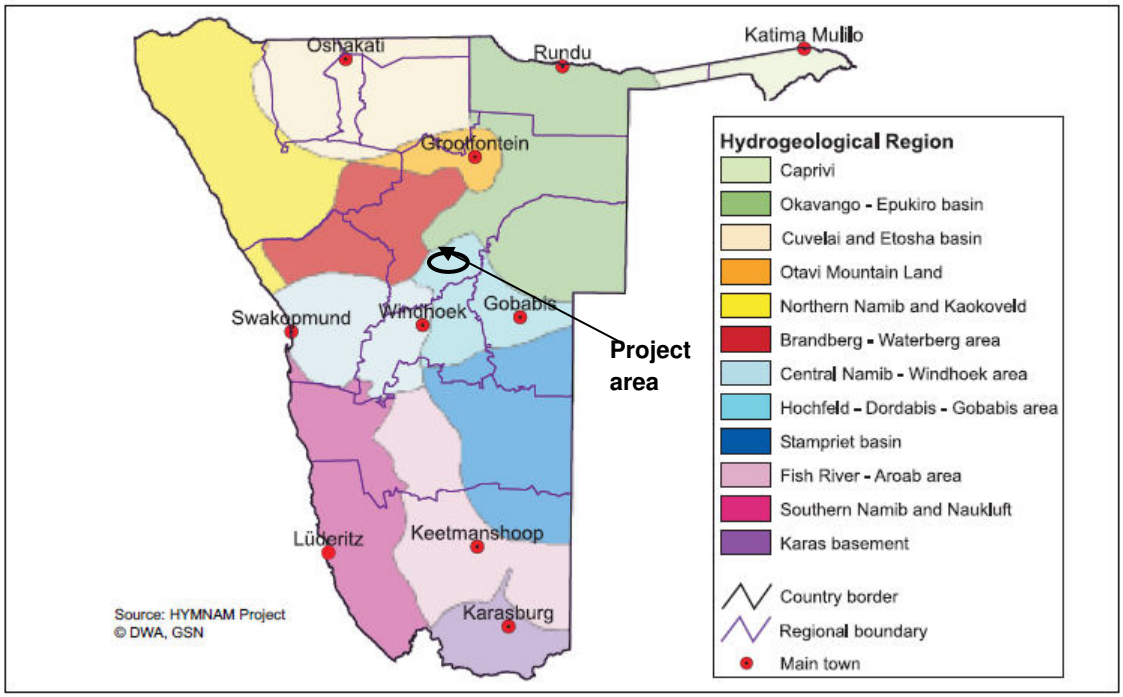

Figure 24: Hydrogeological Regions of Namibia (Christelis and Struchmier, 2001).

5.3. Potential impacts identified

Social impacts of the activities of the project are likely to be minimal and tend to be positive. A clear understanding of these impacts may help communities understand and anticipate the effects of the project. One of the major possible impacts of the project is the generation of electricity which is a very important impact that will benefit many people in the long-run. The following is the summary of the likely positive and negative impacts for this project:

5.3.1. Positive Impacts

- Power generation
- Employment creation during construction and operation
- Increase in income levels
- Increase in training and skills development opportunities
- VAT payment
- Reduction of Carbon Dioxide gas emissions into the atmosphere
- No air, water, noise pollution

5.3.2. Negative Impacts

- Visual impacts
- Solid waste: wires, drill bites, & human waste (Temporal)
- Disturbance of the Fauna and Flora during construction (Minimal)
- Possible land disturbance (Minimal).

- Solar panels contain toxic substances such as (cadmium and arsenic) which can get into the environment, harmful substances.

6. PUBLIC CONSULTATION PROCESS

6.1. Legal and policy requirement

6.1.1. Environmental Management Act (2007) and it EIA regulations (2012)

Public consultation is a crucial part of the EIA process. This provides an opportunity to stakeholders or interested member of the public to find out more about what is being proposed, and to raise any issues or concerns. The Environmental Management Act 2007 and its EIA regulations of 2012 are the key documents governing environmental impact assessment in Namibia.

One of the key objectives of the Act is to prevent and mitigate the significant effects of activities on the environment by:

"Ensuring that there are opportunities for timeous participation of interested and affected parties throughout the assessment process; and ensuring that the findings of an assessment are taken into account before any decision is made in respect of activities."

The key principle of the Environmental Management Act 2007 advocates for public participation. The principles states that *"the participation of all interested and affected parties must be promoted and decisions must take into account, the interest, needs and values of interested and affected parties*".

Section 21 of the EIA Regulations outlines procedure on public participation process as follows:

"(2).The person conducting a public consultation process must give notice to all potential interested and affected parties of the application which is subjected to public consultation by:

a) Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is or is to be undertaken;

b) Giving written notice to:

i. The owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site;

ii. The local authority council, regional council and traditional authority, as the case may be, in which the site or alternative site is situated;

iii. Any other organ of state having jurisdiction in respect of any aspect of the activity; and

c) Advertising the application once a week for two consecutive weeks in at least two newspapers circulated widely in Namibia.

(3) A notice, notice board or advertisement referred to in sub regulation (2) must -

a) Give details of the application which is subjected to public consultation; and

b) State:

i. That the application is to be submitted to the Environmental Commissioner in terms of these regulations;

ii. The nature and location of the activity to which the application relates;

iii. Where further information on the application or activity can he obtained: and

c) The manner in which and the person to whom representations in respect of the application may be made.

(6) When complying with this regulation, the person conducting the public consultation process must ensure that **a)** information containing all relevant facts in respect of the application is made available to potential interested and affected parties; and **b)** consultation by potential interested and affected parties is facilitated in such a manner that all potential interested and affected parties are provided with a reasonable opportunity to comment on the application.

28. For the purpose of the Act and these regulations a notice is given to a person or a person is informed of a decision, if a document to that effect is:

(a) Delivered personally to that person;

(b) Sent by registered post to the persons last known address;

(c) Left with an adult individual apparently residing at or occupying or employed at the person's last known address; or

(d) In the case of a business-

(i) Delivered to the public officer of the business;

(ii) Left with an adult individual apparently residing at or occupying or employed at its registered address;

(iii) Sent by registered post addressed to the business or its public officer at their last known addresses; or

(iv) Transmitted by means of a facsimile transmission to the person concerned at the registered office of the business.

6.2. Consultation process followed during the EIA process

Communication with stakeholders about the proposed small scale surface mining project was facilitated through the following ways

- Identification of stakeholders
- Newspaper adverts
- Written notices
- Notice boards
- Information documents
- Stakeholder meetings
- Reasonable opportunity for the public to register and comment on the project

7. VISUAL IMPACT ASSESSMENT

Visual impacts are a subset of landscape impacts. Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effect with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (i.e. views) caused by the intervention and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the scene as perceived by people visiting, working or living in the area.

This approach reflects the layman's concerns, which normally are:

• Will I be able to see the new development?

• What will it look like?

• Will the development affect views in the area and if so how?

Landscape and visual impacts do not necessarily coincide. Landscape impacts can occur with the absence of visual impacts, for instance where a development is wholly screened from available public views, but nonetheless results in a loss of landscape elements and landscape character within a localized area (the site and its immediate surrounds).

7.1 Intensity of Visual Impact

The intensity of visual impact is determined using visual intrusion, visibility and visual exposure criteria (Hull and Bishop, 1988), qualified by the sensitivity of viewers (visual receptors) towards the proposed development. The intensity of visual impact is therefore concerned with:

• The overall impact on the visual amenity, which can range from degradation through to

enhancement;

• The direct impacts of the mine upon views of the landscape through intrusion or

obstruction;

• The reactions of viewers who may be affected.

7.2 Significance of Visual Impact

The significance of impact was determined based on the Hacking method of determination of the significance of impacts. This method also complies with the method provided in the EIA guideline document.

Significance = consequence x probability

Consequence is a function of severity, spatial extent and duration

Severity, based on

• Intensity of impact (will the impact be of High, Moderate or Low intensity?) and

Scale/ spatial extent of impact

• Will the impact affect the national, regional or local environment, or only that of the site?

Occurrence duration, based on

• Duration of occurrence (how long may it last).

7.3 Methodology

The following method was used:

• Site visit. A field survey was undertaken and the study area scrutinized to the extent that the receiving environment could be documented and adequately described;

• Project components. The physical characteristics of the project components were described and illustrated;

• Describe and map the landscape character of the study area. The description of the landscape focused on the nature and character of the landscape rather than the response of a viewer;

• Describe the quality of the landscape. Aesthetic appeal is described using recognized contemporary research in perceptual psychology as the basis;

• Describe the sense of place of the study area as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations associated with the historic/current use of the land;

• Illustrate, in very basic simulations, the proposed project overlaid onto panoramas of the landscape, as seen from nearby sensitive viewing points to give the reviewer an idea of the scale and location of the proposed project within their landscape context;

• Determine precise visual intrusion (contrast) of the proposed project by simulating its physical appearance from sensitive viewing areas;

• Determine the visibility of the proposed project by conducting detailed view shed analyses;

• Rate the impact on the visual environment and sense of place of the proposed mine based on a professional opinion and the method described below; and

• Suggest measures that could mitigate the negative impacts of the proposed mining project.

7.5 Description of the project

Construction Phase

Construction activities are those activities which will take place during the establishment and construction of the renewable photovoltaic solar power plant.

The following activities will occur during the construction phase:

• Site clearing;

• Topsoil stripping;

• Development of a construction camp and associated facilities;

• Construction of permanent access routes within the site;

• Construction of a photovoltaic power plant;

• Obtaining borrow material for construction;

• Power supply for construction;

• Water supply for construction

The following facilities will be developed during the construction phase:

• Workshop and maintenance area;

• Stores for storing and handling fuel, lubricants, solvents, paints and construction materials;

• Contractors lay-down area/s;

• Mobile site offices;

• A canteen;

• A temporary waste collection and storage area;

• A wash bay for washing equipment and vehicles;

• A parking area for cars and equipment;

• Change houses.

Operational Phase

The operational phase will consist of the following facilities:

• Renewable power plant;

• Workshops and associated structures such as stores, changing rooms, etc;

7.6 Visual Receptors

Views

The proposed project site is located within the boundaries of farm Portion 11 of Farm Omuramba, N0. 341 in Okahandja district. The project site is surrounded by the farms. The south, east and west of the project site is surrounded mainly by vegetation.

Sensitive Viewer Locations

As previously mentioned the proposed study area is located just inside the farm Portion 11 of Farm Omuramba, N0. 341. The project itself will be erected close to the substation with a capacity of 11Kv close to the gravel road and therefore the most sensitive viewers will be the residents living in the area surrounding farms and road users of the C31 road users.

Non - Sensitive Viewer Locations

The least sensitive receptors are likely to be people engaged in activities that focuses on their work or activity and who therefore may be potentially less susceptible to changes in their views (Institute of Environmental Assessment & The Landscape Institute, 1996).

Visibility

In determining the visibility of the project, the worst-case scenario i.e. visibility of the project's features at a variety of heights and locations, was used. To do this, vantage points were assigned at offsets equivalent to the height above ground level of the proposed project. The 'zone of potential influence' (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was established at 10km. Over 10km the impact of the proposed renewable photovoltaic solar power plant is insignificant due to the diminishing effect of distance and atmospheric conditions (haze) on visibility.

A viewshed analysis was undertaken for the solar panels (with a maximum height of 131m for the m) as this would be mounting the most visible feature of the power plant (solar panels).The viewshed analysis for the renewable photovoltaic solar power plant project indicates that the project will be highly visible from approximately 70 - 80% of the 'zone of potential influence' which are the residential area in the surrounding farm area and the C31 road users.

7.7 Mitigation Measures

In considering mitigating measures there are three rules that were considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management / maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been considered:

• Mitigation measures should be designed to suit the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness.

• It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective.

Mitigation measures would relate mostly to 'good housing keeping issues and will not be sufficient to significantly reduce the impact of the proposed construction of a renewable photovoltaic solar power plant. To this end we nevertheless propose that the following activities be implemented.

Earthworks

• Re-vegetate the area; grow palm trees around the renewable photovoltaic solar power plant at a distance of 50 m away from the power plant.

• Dust suppression techniques should be in place at all times during the construction/ start-up, the decommissioning and closure phases.

• A professional Landscape Architect should assist with the final design of the power plant.

8. IMPACT ASSESSMENT

The purpose of this section is to assess and identify the potential positive and negative environmental impacts associated with the proposed development of a renewable photovoltaic (PV) solar power plant and to provide possible mitigation measures that are expected from construction, operational and decommissioning activities of the project. The following summarises some impacts identified, following the site investigation visit and from comments received from I&APs:

- Destruction of flora and displacement
- Visual impacts
- Health impacts
- Cumulative impacts
- Power generation
- Reduction of Carbon Dioxide gas emissions into the atmosphere
- Possible land disturbance
- Heritage impacts
- Noise impacts

These identified impacts will be assessed and evaluated in different phases of the development. Mitigation measures are also proposed for different impacts. Such assessment is also a requirement in term of Section 26(1) (g) and (26) (i) (iii) of the Environmental Assessment Regulations (MET, 2009).

8.1 Proposed Development Environmental Impact Evaluation

There are three different phases that are associated with the proposed development. Firstly the construction has to take place before construction can commence. In the construction section the different stages of the development as well as their potential impacts will be discussed. Impacts which may arise during the operation phase as well as potential decommissioning related impacts will also be discussed. Possible mitigation measures are also put forward for the potential impacts identified.

8.2 Classification of potential impacts

An appraisal of the type of effect of the proposed Renewable Photovoltaic (PV) Solar Power Plant would have on the affected environment; rate as either positive (beneficial on the environment), neutral (no impact on the environment), or negative (adverse impact on at a cost of the environment).

Table 22: Classification of potential impacts

Term	Definition
Positive Impact	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Neutral Impact	No impact on the environment
Negative Impact	An impact that is considered to represent an adverse change from the baseline , or introduces a new undesirable factor

Consequences of the impact are calculated as the average sum of the ratings of severity, duration and extent of the environmental impact. Likelihood considers the frequency of the activity together with the probability of an environmental impact occurring. The following assessment methodology will be used to examine each impact identified, see table.

Table 23: Criteria for impact evaluation (DEAT, 2006)

Rating of Severity											
Impact Type		**Extent**		**Duration**		**Intensity**		**Probability**		**Significance**	
		Immediate	I					Low	LP		
Positive	POS	Local	L	Short-Term	ST	Low	L	Probable	P	**Low**	L
No Impact	NO	Regional	R	Medium-Term	MT	Medium	M	High	HP	**Medium**	M
Negative	NEG	National	N	Long-Term	LT	High	H	Definite	D	**High**	H

.3 Impacts Associated with Construction Phase

Potential effects on the environment and their mitigation measures during construction are:

Dust Pollution – These are expected to be site specific, short-termed and will most probably pose a negligible nuisance and heath threat to those residing nearby. The construction of the proposed facility will have impact on the surrounding air quality. Dust suppression during the construction process is advised if dust becomes an issue.

Table 24: Impact associated with dust pollution

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Dust	NEG	I	ST	L	P	L	L

Noise Impact – Earthmoving equipment will be utilised during the construction phase and noise may thus be generated. Construction workers should be equipped with ear protection equipment. Residential properties nearby (<150m) the site may be impacted. Construction should be limited to working hours only (07H00- 19H00).

Table 25: Impact associated with noise pollution

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Noise	NEG	I	ST	L	P	L	L

Safety and Security – Should a construction camp be necessary, it should be located in such a way that it does not pose a risk to the public. Equipment housed on site must be placed in a way that does not encourage criminal activities. For safety and security reasons it is recommended that the entire site (construction site and camp) be fenced-off and security personnel be employed to safeguard the premises and to avert criminal activates. Relevant safety signs should be clearly displayed.

For safety reasons children should also be kept from making the site a playground and their access should be prevented.

Table 26: Impact associated with safety and security

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Safety and Security	NEG	I	ST	L	P	M	L

Generation of Waste – In the form of human waste, litter, building rubble and other material to be disposed off. Waste must be disposed of at an appropriately classified waste disposal site. Waste handling procedures must be cleared with the town council and the construction contractor should be informed about this.

Table 27: Impact associated with waste generation

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Generation of waste	NEG	I	ST	L	P	M	L

Groundwater Contamination – Leakages from equipment and machinery might occur during the construction phase. Chemicals used during construction e.g. paint and paint remover is also posing a risk. Care must be taken to avoid contamination of soil and groundwater.

Proper toilet facilities should be installed at the construction site and at the camping site or alternative arrangements made. The contractor shall ensure that there is no spillage when the toilets are cleaned or during normal operation and that the contents are properly removed from site. Fuel (diesel and petrol) and oil containers shall be in good condition and placed in a bunded area or on plastic sheeting covered with sand (temporary bunding).

Table 28: Impact associated with groundwater contamination

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Groundwater Contamination	NEG	I	ST	L	P	L	L

Health and Safety – During construction, earthmoving equipment will be used on site. This increases the possibility of injuries and the responsible contractor must ensure that all staff members are briefed about the potential risks of injuries on site. The contractor is further advised to ensure that adequate emergency facilities are available on site. All Health and Safety standards specified in the Labour Act should be complied with. Health and Safety Regulations pertaining to personal protective clothing, first aid kits being

available on site, warning signs, etc. is very important and should be adhered to. Specific areas of concern are:

- Manual handling of equipment, heavy loads and repetitive work.
- Working at heights (falling/drowning)
- High noise - can lead to hearing deficiencies
- Exposure to chemicals (paints etc.)
- Adequate measures must be brought in place to ensure safety of staff on site, and includes:
- Proper training of operators;
- First aid treatment;
- Medical assistance;
- Emergency treatment;
- Protective clothing;
- Ventilation and protective equipment;
- Install mechanical lifting aids - rotate work tasks - reduce repetitive activities;
- Reduce noise exposure - isolate noisy equipment, rotate tasks, make use of protective equipment;
- Working at height - permit to work system

Table 29: Impact associated with health and safety occupational

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Health and Safety - Occupational	NEG	I	ST	L	D	M	L

Increased Informal Settlement and Associated Problems – Lack of proper housing may encourage informal settlements. Unskilled migrant workers are expected to choose cheaper housing options and thus opt for informal housing options. This can be mitigated by giving employment preference to locals that can proof normal residence in the area.

Table 30: Impact associated with increased informal settlement and associated problems

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Increased informal settlement and associated problems	NEG	L	ST	L	P	M	L

Increased Spread of HIV/ AIDS – The spending power of locals and expatriates working for the developer and/or its contractors are likely to increase, and this might be a perfect opportunity for sex workers to explore. Migrant labourers from other regions and

expatriates are normally vulnerable and may use the services rendered by the sex workers. A key initiative should be to educate workers.

Table 31: Impact associated with spreading of diseases such as HIV/AIDS

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Increased spread of HIV/ AIDS	NEG	N	ST	M	P	M	L

Increased Influx to farm– More job opportunities may attract more non-local job seekers. This may lead to an increase housing demand with potential stimulation of property values and economic activities through increased spending in area. This impact can be seen as

both positive and negative. It is still advised to give employment preference to locals that can proof normal residence in the area.

Table 32: Impact associated with flux at farm Portion 11 of Farm Omuramba, N0. 341

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Increased influx to the farm	POS/NEG	N	ST	L	P	M	L

Heritage Impacts – There are no known heritage areas or artefacts deemed to be impacted by the construction.

During construction, the contractor might come across archaeological features or objects that possess cultural values. If archaeological remains or objects with cultural values (e.g. Pottery, bones, shells, ancient clothing or weapons, ancient cutlery, graves etc) are uncovered at the exploration camp or surrounding, it should be barricaded off and the relevant authorities should be contacted immediately.

Table 33: Impact associated with heritage aspects

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Heritage Aspects	NEG	I	ST	L	LP	L	L

Stimulation of Skills Transfer – As the construction and operation of the development requires specialised work and skills it can be expected that experts will be training locals in certain skills during development and operation.

Table 34: Impact associated with stimulation of skills transfer

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Stimulation of skills transfer	POS	N	ST	M	P	L	L

Employment Creation – Various employment opportunities will be created during all phases of the development, ranging from highly skilled to unskilled. The creation of unskilled posts is of special interests as this is a major demand locally. Preference should be given to local residence and to Namibian Citizens. During the construction phase it is estimated that at least +-100 people will be recruited.

Table 35: Impact associated with employment creation

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Employment creation	POS	L	ST	M	D	M	M

As discussed in the different sections, impacts are expected to be low to medium, short lived and site specific. An Environmental Management Plan (EMP) will ensure that the impacts of the construction work is minimised and includes measures to reduce the identified impacts during construction of the facility while ensuring that vehicles and pedestrian traffic are suitably protected to avoid accidents and injuries.

It is further advised that traffic signs and barricades be installed along the excavations to ensure public safety. Landscaping and re-vegetation of cleared areas will reduce visual impacts, growing palm trees around the PV solar power plant at a distance of 50 m away from the power plant will help reduce visual impacts.

The appointed contractor should be made aware of the content and environmental requirements of this report so as to plan the construction phase accordingly.

8.4 Impacts Associated with Operational Phase

Visual Impacts – The operation of the photovoltaic renewable power plant can cause some serious visual impacts as the community is not used to seeing steel frames with solar panels. Refer to chapter 6 for detailed description.

Health Impacts – The operations of the renewable photovoltaic solar power plant can cause serious health and safety risks to workers on site. Occupational exposures are normally related to dermal contact with fuels and inhalation of fuel vapours during handling

of such products. For this reason adequate measures must be brought in place to ensure safety of staff on site, and includes:

- Proper training of operators;
- First aid treatment;
- Medical assistance;
- Emergency treatment;
- Protective clothing, footwear, gloves and belts; safety goggles and shields;
- Manuals and training regarding the correct handling of materials and packages should be in place and updated as new or updated material safety data sheets becomes available; and
- Monitoring should be carried out on a regular basis, including accident reports.

Table 36: Impact associated with health aspects

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Health Impacts	NEG	I	LT	L	LP	H	L

Economic Impacts – Creation of new employment opportunities. This is deemed to be a positive impact. It is not clear how many new, permanent employment positions will be created but it is expected to be about 20-30 people.

Table 37: Impact associated with economic aspects

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Economic Impacts	POS	R	LT	L	P	M	M

Stimulation of Economic Development – The development of the new renewable photovoltaic solar power plant at farm Portion 11 of Farm Omuramba, N0. 341 is expected to enhance the economic development at the settlement. The construction of the solar power plant is expected to boost development confidence of the area.

Heritage Impacts – There are no known heritage areas or artefacts deemed to be impacted by the operational phase.

Table 38: Impact of heritage significance

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Heritage Impacts	NEG	I	ST	L	LP	L	L

Ecological Impacts – No known conservation worthy vegetation are present on the proposed facility. Limited impact on the flora can be expected, as very little vegetation exists at the site.

Table 39: Impact of ecological significance

Identified Impact	Impact Type	Extent	Duration	Intensity	Probability	Significance	
						Unmitigated	Mitigated
Ecological Impacts	NEG	I	ST	L	LP	L	L

8.5 Impacts Associated with Decommissioning Phase

The decommissioning phase of the renewable photovoltaic power plant is difficult to visualise at this point in time. However impacts associated with this phase will be similar to that of the construction phase, besides possible pollution emanating from the presence of toxic substances such as cadmium and arsenic in the solar panels.

During the decommissioning phase the solar panels to be removed should be handled properly and/ recycled. Guidelines for the solar panel removal must be followed to reduce the risk of toxic substances spillage and groundwater contamination. Rubble and waste will be created, as structures are dismantled. These should be contained and disposed of at an approved waste facility and not dumped in the surrounding areas. These should be done in recognition with the Okahandja Town Council's waste management regulations and guidelines.

9. REFERENCES

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