

SCALING SOLAR ZAMBIA PROJECT IDC/SP/011/2015



REVISED ENVIRONMENTAL AND SOCIAL IMPACT STATEMENT

FOR THE PROPOSED NGONYE SOLAR PV PLANT UNDER ROUND 1 OF THE SCALING SOLAR ZAMBIA PROJECT

VOLUME 1: NON-TECHNICAL SUMMARY

PREPARED FOR:

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Plot F10723, Lusaka South Multi-Facility
Economic Zone
Chifwema Road, New Kasama,
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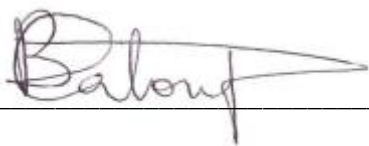
INDUSTRIAL DEVELOPMENT CORPORATION (Z) LIMITED

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NGONYE SOLAR PV PLANT UNDER ROUND 1 SCALING SOLAR ZAMBIA
PROJECT**

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MARCH, 2017



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Introduction

This document provides the Non-Technical Summary (NTS) of the Environmental and Social Impact Statement (ESIS) for the proposed construction and operations of the Ngonye Solar PV Plant under Round 1 of the Scaling Solar – Zambia Project (the Project). The Project is proposed to be situated within the Lusaka South Multi-Facility Economic Zone (LS MFEZ). It has been proposed by the Industrial Development Corporation of Zambia (IDC), an investments holding company wholly owned by the Government of Zambia with registered offices at Plot F10723, Lusaka South Multi-Facility Economic Zone, Chifwema Road, New Kasama, Lusaka, Zambia. The IDC is mandated to play a catalytic role in deepening and supporting Zambia's industrialisation capacity to promote job creation and domestic wealth formation across key economic sectors.

The NTS provides an overview of the key findings of the environmental and social impact assessment (ESIA) study undertaken by Knight Piésold Consulting on behalf of the IDC as part of environmental permitting prior to implementation of the Solar Photovoltaic (PV) Project. It provides a brief description of the project, project rationale and the predicted environmental and social impacts and risks including recommended mitigation and enhancement measures for significant adverse and beneficial impacts.

The main Environmental and Social Impacts Assessment Report, which is the formal report of the ESIA process undertaken by Knight Piesold Consulting, provides detailed information on the project and potential environmental and social impacts and risks anticipated throughout the project development phases (construction, operation and decommission). It includes an assessment of environmental and social impacts in relation to the existing environmental and social baseline conditions and identifies appropriate measures for mitigation and monitoring.

Project Background

Following the severe energy deficit and crisis in Zambia in 2015 on account of low water levels for adequate hydro power generation, His Excellency, Mr. Edgar Chagwa Lungu, President of the Republic of Zambia, in his capacity as Chairman of the Board of the IDC, directed the IDC to target the immediate development and procurement of up to 600 Mega Watts of solar PV power into the national grid as a matter of urgency and priority.

In implementing the directive, the IDC signed a memorandum of understanding ("MOU") on 20 July 2015 with the International Finance Corporation ("IFC"), the private sector arm of the World Bank Group, for advisory and technical services assistance and commenced the immediate development of two solar photo-voltaic (PV) plants with each plant operating up to a capacity of 50 Mega Watts (MW) for an initial total of 100 MW¹ out of the targeted 600 Mega Watts.

In October 2015, the IDC ran a Request for Prequalification (RFQ) for the Pre-qualification of potential Independent Power Producers (IPPs) via a transparent and competitive bidding process. During this process, a total of 48 firms applied, out of which 11 were selected as the successful bidders for the Request for Proposals (RFP) process with detailed final proposals (the bidder with the lowest tariff would be the winner).

These two Solar PV projects have been awarded to two different private developer companies for financing, construction and operation as independent power producers (IPPs) for 25 years. The two project companies will therefore operate two independent photovoltaic power plants and each one will obtain its own environmental permit based on the ESIA for the project site. The two IPPs who have been awarded the two Solar PV Plants projects are NEOEN S.A.S. / First Solar Inc. and Enel Green Power S.p.A. The winning bidders assume majority control in the project companies and IDC will hold 20% as minority shareholder on behalf of the Government.

Prior to developing the Project, IDC is required to conduct an ESIA study in accordance with the Environmental Impact Assessment Regulations, Statutory Instrument No. 28 of 1997, and in compliance with IFC Standards.

¹ Based on site conditions and technology of choice, 80 MW is likely to be the final total capacity for both Solar PV plants.

This document therefore presents the NTS for the proposed Ngonye Solar PV Project, which will be constructed and operated by Enel Green Power S.p.A.

Project Rationale

The power deficit being experienced in the country has negatively affected homes and businesses. Therefore, the provision of up to 100 MW² of solar power into the national grid will contribute to reducing on-going load-shedding and will present an opportunity for the promotion of the use of sustainable renewable energy such as solar energy. The implementation of the proposed Solar PV Project is thus undoubtedly essential for improved quality and security of supply of power for domestic and industrial uses, among other benefits. The Ngonye Solar PV Plant will contribute up to 34 MW towards the initial 100 MW for Round 1 Scaling Solar Zambia Project.

Objective of the Project

The objective of the proposed Ngonye Solar PV Project is to contribute to redressing the current power deficit in Zambia by developing and installing a 34 MW Ngonye Solar PV Plant on Site 1 (Ngonye Site) whose total footprint (52 ha) is partly within the LS MFEZ and partly on 11 ha land owned by the Ministry of Tourism and Arts.

Estimated Project Cost

The estimated investment cost of developing the Ngonye Solar PV Project is USD 43.40 million. Implementation of the Project has been planned to commence once approval has been granted by ZEMA.

Project Screening

The project was screened to assess potential environmental and social risks and impacts associated with the proposed Project's activities and to confirm applicable standard and national regulatory compliance requirements. The project falls under an IFC environmental and social risk Category B Classification for which environmental and social risks and impacts are estimated to be minimal, limited in scope and should be readily mitigated throughout the different stages of the project by effective implementation of an appropriate Environmental and Social Management Plan (ESMP). Under Zambian EIA regulations, and as confirmed by the Zambia Environmental Management Agency (ZEMA) the project requires an ESIA study prior to implementation.

The creation of LS MFEZ for development of industries and other establishments also involved undertaking environmental and social impact assessment studies. The economic zone has been subjected to these studies. Management plans have been developed and are being implemented as part of developing the zone. The project site is therefore located in an area that has already been subjected to a number of environmental and social impact assessment studies

Environmental and Social Impact Assessment Methodology

The ESIA methodology adopted in carrying out the environmental and social impact study is guided by the EIS process as outlined in the Environmental Impact Assessment Regulations, 1997 (Statutory Instrument No. 28 of 1997). It included an approach to environmental and social impact assessment, public consultations and identification and assessment of the impacts. The potential impacts have been assessed using standard methods of assessment and terminology. The impacts have been assessed in terms of their nature, duration, magnitude, likelihood of occurring and their overall significance.

The general approach involved the following:

- Gathering available environmental and social baseline data;
- Analysis of the proposed Project with regard to potential impacts and risks during its implementation;
- Identification of environmental and social mitigation strategies;

² Based on site conditions and technology of choice, 80 MW is likely to be the final capacity for both Solar PV plants.

- Prediction and assessment of the impacts in terms of their nature, duration, magnitude, likelihood of occurring and their overall significance;
- Recommendations for environmental management and monitoring;
- Collation of the above information into the main ESIA Report (Volume 2) and a Non-Technical Summary (Volume 2 – this document).

Legal and Administrative Framework

The Ngonye Solar PV Plant Project will be implemented within the applicable Zambian Environmental and Social legislation and permitting legal and administrative framework. Some of the applicable legislations include the Environmental Management Act No.12 of 2011, Environmental Impact Assessment Regulations, 1997, Statutory Instrument No. 47 of 2010, Public Health Act, Cap 295, Energy Regulation Act, Cap 436, Water Resources Management Act, Cap 198, Road and Traffic Control Act, Cap 464, Local Government Act, Urban and Regional Planning Act, 2015, the Investment Act, National Heritage Conservation Commission Act, Cap 173, Zambia Wildlife Act No. 14 of 2015, Electricity Act No.15 of 1995 and Electricity Amendment Act, 2003, Occupational Health and Safety Act, 2010, Forests Act No. 4 of 2015, Employment Act CAP 268 and Workers' Compensation Act, 1999. The Project will also be implemented in compliance with the IFC's Policy on Environmental and Social Sustainability as well as the Equator Principles.

Project Overview

The project proponent for the Ngonye Solar PV Project under Round 1 Scaling Solar Zambia Project is Industrial Development Corporation. The project will be constructed and operated by Enel Green Power S.p.A. It will be operated on a 25 years Power Purchase Agreement (PPA) signed with ZESCO and will consist of a 34 MW Solar PV Plant. Enel Green Power will obtain its own environmental permit for the operation of the Ngonye Solar PV Plant.

The design of the Ngonye Solar PV Plant is expected to have about 106,260 solar modules, 9 conversion units with 36 inverters to be installed at the site. The final designs will confirm the actual numbers of the components. The generated electrical energy will be transferred to an existing substation (which is currently under construction by ZESCO) via a 300 – 350 metres long 33kV underground cable. However, the installation of the underground cable is subject to change depending on final design details.

The total project area at the Ngonye project site is 52 ha. The area that will be developed will consist of the foundations for the conversion units, delivery cabins, Warehouse/Storage areas, Operation & Maintenance room, parking area, roads, and the PV field ground section which will have the installation of the structural posts that support the photo voltaic modules.

The PV system for the proposed Ngonye Solar PV plant will be grid-connected with PV modules mounted on a sun tracking system.

Project Location

The proposed and preferred Project site for the Ngonye Solar PV Plant is partly situated within the LS MFEZ and partly on an additional 11 ha piece of land owned by the Ministry of Tourism and Arts. The 11 ha land falls within the Lusaka National Park area but is outside the physical boundary fence surrounding the national park. The Ministry of Tourism has granted consent to the Ministry of Finance³ to hold title to the additional 11 ha of land. The Ministry of Finance will then lease the land to IDC to facilitate development of the Ngonye Solar PV Project.

³ A letter from the Minister of Finance stating that he has no objection holding title to the land, pursuant to the Minister of Finance (Incorporation) Act, Cap 349 of the Laws of Zambia is presented in Annex 3 of the main ESIA Report (Volume 2) for Ngonye Solar PV Project. A letter from the Ministry of Tourism and Arts to the Office of the Commissioner of Lands indicating that the Ministry of Tourism and Arts has no objection to releasing the portion of land for the Solar PV Project and that the title should be held by the Minister of Finance, pursuant to the Minister of Finance (Incorporation) Act, Cap 349 of the Laws of Zambia is presented in Annex 4 of the main ESIA Report (Volume 2) for the same project. In addition, a copy of the Certificate of Title held by the Minister of Finance for the additional 11 hectares of land is presented in Annex 5 of the main ESIA Report.

The LS MFEZ is located about 15 km to the South and East of the Lusaka Central Business District. There are no human settlements within the Project site. The project site is bordered by the Lusaka National Park to the South and some agricultural holdings to the East.

Main Project Activities

The construction phase of the project works will span a period of about 8-10 months. The phase will comprise ground clearance and levelling on the land at the project site, construction of the plant and staff operations maintenance building, fixing of the module footings and support structures into the ground and mounting of modules onto the support structures within the site, digging of trenches for MV cables installation of inverters conversion units outside in one group along the module blocks and installation of cables and connection of modules to inverters and connection of delivery cabin to the substation.

It is expected that approximately 100 people or more will be on site at the peak of construction activities. The workforce will be reduced to between 5 - 10 people during the operations. During the construction phase site camp facilities will be established near the site.

The operational phase will mainly involve production of electrical energy using solar radiation and project design life is expected to extend for at least 25 years. The decommissioning phase will involve removal from site of used solar modules, associated electrical components and cabling for disposal or recycling. The solar modules will be sent back to the manufacturers for recycling or any certified industrial recycling chain. Site buildings will be demolished, if no alternative use for them will be agreed upon with stakeholders.

All project activities from construction phase through to decommissioning phase will be implemented with a strong focus on managing the occupational health and safety issues of the workers.

Raw materials

The sole source of energy for the project will be the sun (solar irradiance). It will be captured and converted by the solar modules to electric energy for power generation.

Water will be required during the construction phase. It will also be needed for cleaning of the solar modules and within the staff control room or office during the operation phase. The required volume of water during the operation phase will be supplied by the Lusaka South Multi-Facility Economic Zone Limited from the planned central water supply system for the zone.

As an interim measure, private off-site water supply via tankers could be used since on-site groundwater abstraction is not likely as hydrogeological study results suggest the project site has a low groundwater potential to sustain construction and operations of the Solar PV Plant. The approximate volume of water required will be confirmed based on the confirmation of the Solar PV Project Operators/Contractors and taking into account cleaning technology and local climate.

Project Alternatives

The feasible alternatives considered for this Project relate to project technology, project location and no project alternative.

Solar energy is the main source of renewable energy because of the local climate, which provides long sunshine hours (annual average of 7 hours / day). For Lusaka, the modelled average yearly sum of direct and diffuse radiation received on horizontal plane is estimated to be 5.80 kWh/m². Solar PV technology, using solar energy as a raw material is, therefore, the preferred option for the proposed Solar PV Project. In addition, the selected technology is associated with very low noise levels and ease of installation.

The PV system preferred for the proposed Ngonye Solar PV Plant is the Grid-connected PV with PV modules installed on a sun-tracking system. Sun-tracking systems have more complex mounting structures associated with high cost of mounting and maintaining them but increase the average total annual irradiation.

Site selection was based on the initial desktop review of technical environmental, commercial and legal information. The LS MFEZ has been selected because it is owned by IDC (LS MFEZ Limited is a

subsidiary of the IDC); it has the necessary infrastructure; the fiscal incentives offered will reduce the tariffs; its proximity to the load centre for electricity; and availability of existing background data on the proposed Project site as result of on-going development works. The site is in Lusaka where the yearly average Global Horizontal Irradiation (sum of direct and diffuse radiation received on a horizontal plane) is estimated to be 5.80 kWh/m². This provides high potential for PV power generation.

Under the “No Project Alternative”, any potential adverse environmental and social impacts and risks associated with the project would not occur. However, the disadvantages associated with the no project scenario include increased power deficit and load shedding, lost opportunity to promote renewable energy, loss of employment opportunities for the local people who could have been employed during the construction and operation phases of the project, loss of government revenue through reduced taxes, and loss of business for suppliers and contractors.

Environmental and Social Setting of the project area

Topography

The project site has a relatively flat topography controlled by the underlying calcareous rocks of the Lusaka Limestone, which are easily weathered by mineral dissolution and leaching processes. It varies between 1315 and 1330 metres above mean sea level. The South eastern part of the site and generally the entire South to Southwest is relatively high in elevation than the north-north eastern side. The general slope at the project site is towards the northeast and this forms a general drainage direction of rainfall water surface runoff. It also slopes slightly towards the southwest.

Some sink holes (swallow holes) and low depressions characterize the surface topography of the project site. The sink holes have been observed on the eastern side of the immediate project site with one observed along the eastern side of the tarred road leading to the Lusaka South National Park. The sinkholes (swallow holes) may be indicators of larger cavities (caverns) located below the rock/soil contact or some underground streams.

The rock outcrops and subsurface pinnacles also form the surface and subsurface features of the project site.

Climate

The climate of the Project area is characterized by three distinct seasons: cool dry season from mid-April to August; hot and dry season from September to October; a rainy season from November to April. The area receives annual rainfall in the region of 500 mm to 1000 mm with the mean annual rainfall being in the order of 800 mm. Moderate temperatures with mean monthly temperatures ranging between about 15°C in the cold season to about 30°C in the hot season are experienced in the area. Prevailing easterly winds dominate the area during the dry season with fresh winds experienced in the months of July and August. Mean wind speed recorded in the area ranges from 4 km/hour to 9 km/hour. Extreme wind events in the area are associated with thunderstorms and transient, short-term “dust devils” and may reach 112 km/h. Sunlight hours per day range from 5 hours to 9 hours in August with an annual average of 7 hours per day.

Geology and Soils

Local Geology

The project area lies completely within the calcareous formation of the Lusaka Limestone and Dolomites. The rocks are part of the Chunga-Goma formations. The localized geology is an intercalation of clear white crystalline limestone, dark grey dolomitic shale and siltstone and grey dolomite. The rocks are gently folded with dips averaging 40° with dip directions of 058° (North East). There are some joints with vertical dips and geotechnical studies undertaken on site indicate the presence of one major inferred fault. Rock exposures are very prominent in the central and western sides of the project site while the eastern side is covered by thicker soil cover and only sporadic outcrops are observed.

Structural Geology

The major structural feature in the project area is the gentle dipping of the rocks, which generally dip on average 40°/058°. Some localized joints are visible and the two common ones are one striking North-South with a vertical dip and the other one with a vertical dip as well but striking North East –South West.

Geotechnical aspects of the project area

The geology of the project area is predominantly calcareous, gently folded and geomorphically flat. This has implications in terms of geotechnical aspects. Some of the aspects include the following:

- The soil cover has varying thickness due to in-situ leaching. This presents a challenge in determining the stable depth for foundations.
- There are some floating rock gobbles, which could give false rock base during foundation exploration drilling.
- Presence of swallow holes is an indication of presence of larger caverns at depth or presence of underground streams. These can pose challenges in stability of surface structures in both short and long terms.
- The flat nature of the area has implications in creating an efficient drainage system within the area.
- The irregular subsurface weathered profile might present some serious challenges to foundation designs for heavy structures (in excess of 10 Tonnes weights).
- Uncertainties in drill logs due to irregular weathering profiles are a geotechnical challenge that requires serious consideration during foundation design and at construction stage.

The project site has karstic weathering features that include swallow holes (sink holes) and cavities. These features present a challenge to construction works on site. Suitable design and construction techniques should be considered taking into account foundation requirements for the proposed Solar PV plant. In addition, small undulating sub-surface pinnacle topography exists across the entire project area resulting in the variation of depth to the bedrock across the area.

The presence of sinkholes, cavities and rock pinnacles in the sub-surface provides significant evidence that there are problematic karstic weathering features at the project site. Therefore, the planned development should proceed with caution due to the risk posed by the karstic terrain identified on site. This risk will be required to be mitigated through suitable design and construction techniques. Detailed investigations should be carried out to understand further the site characteristics necessary for design.

The cavities noted in the diamond drilled boreholes on site were further investigated by carrying out ground penetration radar surveys. The preliminary results of the survey carried out as part detailed sub-surface mapping of the project site indicate void type of anomalies picked at depths ranging from 1.9m to 24.3m. A detailed ground penetration survey has been done to confirm the presence of void type anomalies and have been incorporated in the design of the project

Soils

The soils at the proposed project site are ferruginous and are composed of silt, sand and gravel. The typical soil profile is composed of three layers – a humus layer followed by clayey silt sand then sand gravel (laterite). The layers are of varying thickness. Weathered rock of varying thickness controlled by the solubility of the parent rock is found below the laterite layer.

Hydrology and Hydrogeology

Surface Water

The project area lies on the Lusaka Plateau. It lies at the watershed divide for the Chilongolo and Kafue Gorge sub catchments. The project site is divided into five sub catchments. The southern parts of the project area are drained by sub catchments which pour into the Kafue Gorge Sub catchment while runoff

from the Northern and Eastern part of project area are drained by sub catchments that pour into the Chilongolo sub-catchment.

There are no permanent surface water features or open water courses at the Project site. The site is characterised by small valleys and depressions where rainfall runoff flows through. Most of the rainfall that is not lost through evapotranspiration drains into fissures and grikes or infiltrates through the lateritic overburden to recharge groundwater.

Surface rainfall runoff within the LS-MFEZ follows intense storms and travels for short distances until it is absorbed into the soil horizon. It flows to the north and east into the Chalimbana and Chongwe Rivers, and to the south into the Funswe and Chisuko Rivers that discharge into the Kafue and Zambezi Rivers, respectively. The base flow for these rivers is derived from the Lusaka Dolomite and discharges usually at the contact with the Cheta and Chunga Formations. There is no distinct surface drainage within several kilometres of the LS-MFEZ boundaries and any flow in these directions will be sub-surface through the soil horizon and the underlying geological structures. Surface runoff flow follows the same direction within the immediate project site.

Groundwater

The project area is located on the groundwater water divide and a recharge zone for the karst aquifer (Lusaka Dolomite Aquifer) that supplies Lusaka City zone with groundwater. It is underlain by the calcareous dolomite formation of the Lusaka Dolomite belonging to the Upper Division of the Katanga system. This geological formation (Lusaka Dolomite) has high recharge potential for groundwater. The area is also characterised by shallow groundwater tables, abundant surface karst features (karst morphology and sinkholes) that facilitates good permeability of the unsaturated zone.

Within the immediate surroundings and outside the project area, there are boreholes whose average estimated yields ranges from 0.2 l/s to 8 l/s. The long term sustainability of these yields is however not ascertained. Within the boundary of the project site, there are no existing boreholes. Available resistivity and magnetic survey data generated at surveyed areas at the project site suggests that the site is considered to be less favourable for occurrence of groundwater. The site has low groundwater potential.

The general groundwater flow direction in the project area is generally towards the northwest.

Ambient Air Quality

Dust monitoring undertaken around the proposed project site boundary by Knight Piesold Zambia in April 2016 shows that average PM10 concentrations at the site range from 6 $\mu\text{g}/\text{m}^3$ to 12.8 $\mu\text{g}/\text{m}^3$ while average PM2.5 concentrations range from 6.8 $\mu\text{g}/\text{m}^3$ to 14.0 $\mu\text{g}/\text{m}^3$ for a 24hr averaging period. The results for both PM10 and PM2.5 are all below IFC Ambient Air Quality Guidelines (50 $\mu\text{g}/\text{m}^3$ for PM10 and 25 $\mu\text{g}/\text{m}^3$ for PM2.5 for averaging period of 24hr) and the Zambian Emission Limits for Ambient Air Pollutants. The project incremental impacts of dust are unlikely to change the background levels through the life of the project.

The baseline data on gaseous air pollutants has been gathered through review of Environmental and Social Impact Assessment studies that have been conducted within the LS MFEZ. A review of JICA shows that sulphur dioxide levels ranged from 0.37 $\mu\text{g}/\text{m}^3$ to 0.43 $\mu\text{g}/\text{m}^3$ while NO_x (as NO₂) was 0.21 $\mu\text{g}/\text{m}^3$. There are currently no industries within the zone that emit sulphur emissions. Without a source of sulphur dioxide in the area the baseline concentration of gaseous air pollutants are still considered to be low as found in the baseline study done by JICA. Baseline concentrations of NO_x and NO₂ are not expected to be high as there are no sources that include large fossil fuel combustion units, heavy traffic especially diesel vehicles. There are currently no operational industries likely to emit air pollutants.

Land Use

The proposed Project site partly falls within the LS MFEZ, which is Statutory Land owned by LS MFEZ Limited and partly falls within an 11 ha piece of land, which is part of the Lusaka National Park and owned by the Ministry of Tourism and Arts. The 11 ha piece of land is additional land required for the project and is physically outside the boundary fence for the National Park. The LS MFEZ is currently zoned for industrial and commercial development. Although the LS-MFEZ certificate of title for the entire MFEZ is

zoned for agricultural purposes, Statutory Instrument No.47 of 2010, which designates the area as a multi-facility economic zone, overrides the zoning.

The immediate project site is currently an open space with tall grass, shrubs and regenerating trees. The landscape at the site has been affected by human activities such as charcoal burning, firewood collection and farming. The southern end of the project site forms the boundary with the Lusaka National Park while a NRB Pharma Zambia, a pharmaceutical company, and LS MFEZ Offices are located on the northern end of the site. Within the Lusaka National Park boundary fence, there is a 200 metre buffer zone maintained by the Department of National Parks and Wildlife under the Ministry of Tourism and Arts.

The ZESCO substation, which will facilitate the transfer of generated electrical energy from the Solar PV plant into the national grid is under construction and is located immediately to the North of the proposed project site. Other industries are also planned to be established within the economic zone. The neighbouring properties on the eastern end of the project site are smallholdings and large farms where individual farming activities such as poultry, pig rearing and crop production are practised. The neighbouring properties close to the site boundary are located within 40-100 metres while the distance between the properties and the ZESCO substation under construction at the site is over 800 metres. There are also a number of business entities and private game ranches.

Biodiversity

Flora

The immediate project site is a modified ecosystem which is characterised with some tall grass and some regrowth vegetation arising from previous disturbances such as shifting cultivation and charcoal production. The vegetation is mainly of regrowth nature with species of Miombo woodland dominating. The dominant species namely *Bauhinia petersiana*, *Diplorynchus condylocarpon*, *Combretum molle* and *Albizia antunesiana* are Chipya Ecological group, which is composed of species that grow in habitats where dry season fires are intense. The proposed project area is a modified habitat that is in its early stage of the woodland recovery from previous disturbances. The available baseline gathered shows that the proposed Project site does not have flora of biological importance.

Fauna

The proposed project area has a variety of fauna species namely; mammals, reptiles and avifauna. The commonest spotted mammals over the project area are Common duicker, Greater Cane Rat, Scrub hare, Cape hare, African civet, Tree Squirrel, African wild cat, African savanna hare, and Southern Giant Pouched Rat. The animals observed over the proposed project area are mainly of Least Concern (IUCN Red List Database). Reptiles observed across the project area include Flap-necked chameleon, Black-necked spitting Cobra, Nile monitor lizard, Southern African python, Twig snake, Puff adder and Spotted bush snake. The species are neither rare nor endangered. They are mainly of least concern.

The bird species observed at the site are mainly in the Least Concern or Unknown category under the IUCN Red List Database. None of the species fall under either the threatened or the endangered category.

Therefore, project site has no flora and fauna species that can be classified as rare, threatened or endemic to the area or that are of special scientific value.

Archaeology and cultural heritage

There are no known sites of archaeological, cultural or historical value near or within the vicinity of the project site. Transect walks at the site and interviews with traditional leadership in surrounding village communities of Mahopo, Shantumbu, Kakote, Mwachilenga, Chisompola and other key stakeholders at institutions in the vicinity of the project site confirmed that the proposed site does not host any known archaeological and cultural heritage resources of significance. The site was never used for culturally important activities such as burial, shrines, or any intangible heritage processes.

Noise and vibrations

Noise

Construction works and occasional traffic movement of vehicles along the tarred access roads leading to the substation and the Lusaka National Park are considered the only major sources of noise at the site. Baseline noise levels recorded at selected points along the Project site boundary ranged between 32.4 Leq dBA to 50 Leq dBA with the highest level of 50 Leq dBA recorded when there was intrusive noise from a bulldozer that was clearing land near the ZESCO substation that was under construction. The noise levels recorded around the boundary of the proposed solar plant reflect the typical values that are obtainable in a quiet place and are within the IFC Noise Levels Guideline Limits for day (70 Leq dBA) and night (70 Leq dBA) time for industrial and commercial receptors.

Vibration

Baseline vibration readings collected at identified points on and near project site beacons and receptor areas of interest show that vibration levels ranged from 0.03 to 0.20 mm/s peak. These readings were very low on and around the project site despite on-going construction activities at the ZESCO substation. Vibration-sensitive areas identified at the site are agricultural smallholdings located on the eastern boundary of the project site. The nearest buildings close to the site boundary are located within 40 – 100 metres. Off-site vibrations are therefore not anticipated to adversely affect identified vibration sensitive receptors.

Traffic and Road Infrastructure

The project site is serviced by newly constructed roads provided as part of the wider LS MFEZ development. The site is located along Chifwema Road, off Leopards Hill Road. The roads leading to the site and those within the LS-MFEZ are all tarred. Current road traffic volume on access road and internal roads are low but this is expected to increase at the peak of multiple construction and operation activities within the zone.

The surroundings of the proposed project site are well covered and served by the local radio and television network. The site has good reception for the three mobile cell networks (Airtel, MTN and CellZ).

Socio-economic conditions of the project area

The population in the immediate vicinity surrounding the LS-MFEZ includes residents of Shantumbu and Mahopo Villages, Leopards Hills, Chalala and New Kasama residents and the farming community in New Kasama bordering the eastern end of the proposed project site.

Socio-cultural and economic activities

Shantumbu Village

Shantumbu village is one of the areas whose population is in the vicinity surrounding the LS MFEZ. The village is headed by a Headman and falls under the traditional leadership of Chieftainess Mukamambo Nkomeshya of the Soli people. Land within the village is under customary tenure. The village is predominantly inhabited by the Soli speaking tribe while other ethnic groups like Lenje, Tonga and Bemba are also found. The Soli people practice the 'Chikwela Makumbi' tradition ceremony held in October at Chieftainess Mukamambo Nkomeshya's palace in Chongwe. There are no people in Shantumbu Village who can be referred to as indigenous people.

A large majority of households in the village are subsistence farmers growing maize as the main crop while other crops grown are beans, sweet potatoes and groundnuts. Charcoal production and livestock is also practised. Other livelihood activities among local residents are artisanal quarrying of building material and some employment opportunities at the four quarrying and mining companies located in the area.

Shantumbu Primary School, originally established in 1958, is the only education facility in Shantumbu Village with a total pupil enrolment of 610 with 22 serving teachers. It has pupils attending Grades One to Nine classes. The pupils proceeding to Grade 10 attend senior secondary school in Lilayi, which is 4 km

away or Kamwala located about 12 km away. Absenteeism is a common problem among pupils and many of them drop out of school due to long distances they have to walk to attend school.

The people in Shantumbu Village have access to basic preventive and curative services offered at Chisankane Rural Health Centre. The centre serves 22 villages with a catchment population of 9,732 people.

Water supply in the area is from boreholes and shallow wells. The school and the clinic are supplied with water from boreholes installed within their respective premises. In terms sanitation services, many households in Shantumbu Village use pit latrines.

Mahopo Village

Mahopo village has an estimated 370 households. The village character of the settlement is slowly being transformed with the construction of permanent house structures of brick and mortar with iron roofing. Livelihood and economic activities for some residents of Mahopo Village includes formal employment with the majority of them being employed as casual workers in the surrounding farms. Others are involved in trading in vegetables, eggs, chickens and other farm produce sourced from the surrounding farms, and in artisanal mining for crushed stones and slate for construction.

Mahopo Settlement is served by Mahopo Community School, which is a 1 X 3 Classroom Block School constructed with the assistance of the Japanese Embassy in Zambia. The school has a total pupil enrolment of 500 pupils in Grades One to Five with 5 teachers. Pupils proceeding to Grade 6 and above attend nearby schools in Chilenje and Kamwala South located 6km away. The school has no library facility.

Mahopo settlement has a new clinic constructed in 2016. The clinic has not been commissioned into operation.

Water supply within Mahopo Settlement is currently from 6 boreholes located within the area. With regard to sanitation services provision, new houses that are being constructed have individual toilets served by soak-aways while the older village type houses have pit latrines.

Chalala Residential Area

Chalala area is a medium cost residential area located about 6 km to northwest of the proposed project site. The area is characterized by a high density of middle-income housing estates. Water supply and sanitation services are from individual boreholes and septic tanks. Livelihood activities among the residents are through formal employment in the civil service and private business enterprises. One of the Lusaka inner roads that terminate on the north-western boundary of LS MFEZ passes alongside the eastern and northern extents of Chalala Residential Area.

Leopards Hill & New Kasama Residential Areas

Leopards Hill and New Kasama residential areas are located on and around Leopards Hill Road, one of the main roads leading to the project site. The areas have mixed land use types comprising smallholding and large farms with plush residences. They are inhabited by affluent Zambians and different nationalities, mainly expatriate personnel. There are a number of business entities and large farms in these areas with notable ones being Zambezi Private Game Reserve, Bangweulu Taxidermy, Leopards Hill Polocrosse Club, Veterinary Surgery, J Lazy J Ranch Stables & Sanctuary, Kyindu Ranch and Trees 4 Zambia.

Trading activities on stalls (locally known as *Tuntamba*) along the Chifwema Road leading to the project site is also noticeable. The stalls numbering 20 are located on a farm bordering the LS-MFEZ. Goods sold in these stalls include farm produce such as eggs, vegetables; foodstuffs such as cooking oil, sugar, bread and second-hand clothing.

Education facilities in the project area include the American International School of Lusaka (AIS), Naledi School and State Lodge Primary School. The AIS and Naledi School are private education facility located along Leopards Hill Road opposite each other while State Lodge Primary School is government education facility located about 6 km from the LS MFEZ. It is accessed by pupils from surrounding farm areas of New Kasama / Leopards Hill Road area, and the State Lodge Police Camp.

Chifwema Settlement

Chifwema Settlement falls under Kafue District and is located about 18 km from the LS-MFEZ. The population in the area is mainly involved in subsistence farming. The main food crop grown is maize. It is likely that some of the unskilled workforce will be drawn from this settlement.

The education facilities within the settlement include Nachitete and Chifwema Primary Schools. The Nachitete Community School is a single block facility located in the precincts of a mosque while Chifwema Primary School is a 1 x 2 classroom block facility with 2 staff houses. The School runs Grades One to Nine classes and has an enrolled population of 603 pupils. Water supply to the school is from a borehole and tank provided by ZAMTEL in partnership with Huawei.

Chifwema Settlement has two health centres - the Andy Health Centre at Chifwema, which is currently not operational as it has not been handed over to the Ministry of Health, which is responsible for providing staff to run the health facility. Nachitete is another health centre within the settlement.

Historical Land Use and Resettlement issues at LS MFEZ

There are no human settlements at the project site. Resettlement issues arose at the time of creating the LS MFEZ and they were handled by the Disaster Management and Mitigation Unit (DMMU), a government agency, and other government institutions. The available information on resettlement issues is presented in the main ESIA Report (Volume 2). The proposed Solar PV Project will not result in physical and economical displacement of people. In addition, the proposed Project is not responsible for resettlement impacts that arose during the creation of the LS MFEZ. This is because the resettlement was not as a consequence of the proposed Solar PV Project but as a result of the creation of the LS MFEZ.

Impact Identification and Assessment

The potential environmental and social impacts of the proposed Project have been predicted and evaluated using standard methods and based on the analysis of the Project components and the environmental and social baseline conditions of the project area. The significance of the impacts has been classified as major, moderate, minor or negligible; either beneficial (positive) or adverse (negative) and the following impact significance terminology have been applied:

- Major beneficial or adverse impact – where the project would cause a significant improvement of or deterioration to the existing environment;
- Moderate beneficial or adverse impact – where the project would cause a noticeable improvement of or deterioration to the existing environment;
- Minor positive or negative impact – where the project would cause a barely perceptible improvement of or deterioration to the existing environment; and
- Negligible – no discernible improvement of or deterioration to the existing environment.

Mitigation and enhancement measures aimed at reducing potential adverse impacts and at enhancing beneficial impacts have been proposed.

Summary of Environmental and Social Impacts and Mitigation Measures

The potential environmental and social impacts associated with the proposed Solar PV Project as detailed in main ESIA Report (Volume 2) are summarised in this section. The impacts that have been assessed relate to the following:

- Landscape and visual amenity;
- Soils and Geology
- Water Resources
- Archaeology and Cultural Heritage
- Traffic and Road Infrastructure
- Socio-economic

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- Air Quality
 - Noise and Vibration
 - Land Use
 - Biodiversity
 - Community Health and Safety
 - Occupational Health and Safety
 - Deforestation and Climate Change
 - Cumulative impacts

Appropriate mitigation and enhancement measures to address significant impacts and risks have been included, where necessary.

Landscape and visual amenity

The proposed site is generally flat and is characterised by dolomite rock outcrops in places. It is surrounded by agriculture holdings on the East and the Lusaka National Park on the South.

The potential impact associated with the project on landscape and visual amenity is the creation of visual intrusion and disruption to aesthetic quality as well as light reflectivity from the solar module surfaces arising from the clearing of the project site (construction phase) and installation of solar PV modules (operation phase). The significance of the potential impacts on landscape and visual amenity relating to visual intrusion and disruption of aesthetics arising from site clearing and installation of solar PV modules are considered to be minor negative while the overall significance of the impact of the project on aviation in terms of reflectivity is also considered to be minor negative.

The potential landscape and visual impacts associated with the project will be mitigated by using low visual reflective solar modules with anti-reflective coating (ARC) that reduces reflectance from the solar PV modules and by using low level solar module mount design system (2-3 metres) that will not disrupt the aesthetic view of the project /surrounding areas. In addition, visual intrusion and disruption of aesthetic quality will be mitigated by leaving a perimeter buffer of trees and grass vegetation along the boundaries to screen sensitive viewing areas such as sides of the road to the Lusaka National Park entrance and the area along the eastern boundary area where there are some agriculture holdings.

Soils and Geology

The proposed project will not, in geological terms, have any direct or indirect impacts to the geological environment of the project. However, there are a few geological situations related to secondary negative impacts and risk that may arise to the Project at construction phase (short term) and operation phase of the project (long term). The significant short term impacts and risks relate to the following:

- Irregular soil profile at the project site that may cause foundation construction challenges.
- Floating rock boulders in subsoil that may impact negatively on foundation designs.
- Noise from rock blasting – noise to the environment during construction. Rammed piles (with or without pre-drilling), with possible use of concrete when required, will also be used.

The significant long term (operations) secondary impacts and risks relate to the following:

- Rock weathering - may cause infrastructure instability over a long period of time.
- Sinkholes – risk of these occurring later after construction can lead to stability problems.
- Floating rock boulders in sub soil - risk from continued weathering of rock may pose infrastructure instability.
- Underground caverns in base rock formation - if not picked during investigation can cause a risk to the stability of infrastructure foundations.
- Underground stream in subsurface - Limestone rock formations have the potential to undermine structure foundations.

The risks presented by irregular soil profile at the project site, floating rock boulders in subsoil, development of sinkholes on site, which can lead to infrastructure instability have been assessed as major negative. In addition, underground caverns in base rock formation and underground streams in the subsurface have the potential to undermine structure foundations and the significance of the risks are considered to be major negative.

Mitigation measures for identified risks relating to irregular soil profiles, development of sinkholes, and floating rock boulders in the subsoil, include carrying out detailed surface mapping and subsurface ground penetration surveys, as well as undertaking specific and detailed geotechnical investigations for foundation design. Identification of weathering zones that could result in unstable surface structure foundations should be undertaken by carrying out detailed borehole drilling and logging at specific sites. Flooding risks that present a threat to electrical equipment mounted close to the ground will be mitigated by construction of an effective storm water drainage network in and around the project area. The drainage system for the proposed project will be integrated into the plans for the LS MFEZ drainage system, which includes internal catchment areas and pond systems. The Solar PV Project will not, however, have full responsibility for the LS MFEZ internal catchment areas and pond systems. The drainage network should channel increased surface runoff to designated catchment areas. An effective drainage network will also minimise soil erosion over exposed surface and will minimise the risk of erosion of the support structures and foundations.

Water Resources

The potential impacts and risks associated with the proposed project relate to increase in surface runoff during the rainy season or storm rainfall than infiltration into the ground resulting in reduced recharge of groundwater aquifer, and flooding risks due to surge in groundwater table.

The significance of the risk of erosion of solar PV structures and foundations that could arise from increase in surface runoff during rainy season or storm rainfall, and the flood risks that could arise as a result of an a surge in groundwater table have been assessed as minor negative. Reduced groundwater recharge that could potentially arise as a result of construction works has been assessed as moderate.

Small quantities of fuel and oil will be stored on site during the construction and operation phases of the project. The oil will be used in a couple of small transformers that will be installed on site. The quantities of fuel and oils that is expected to be stored on site will be limited and thus the proposed Solar PV Plant is not expected to generate on site significant quantities of used oil from transformers and other maintenance works. Vehicle maintenance and service will be carried out at designated service stations or workshops away from the project site.

Accidental spillage of fuels and oils onto the ground may potentially occur during their storage and handling with potential contamination of groundwater should surface runoff contaminated with oil spillages be indirectly released, through seepage, into the groundwater aquifer. The overall significance of the impact is considered to be moderate. It is unlikely that the impact will occur because of the proposed mitigation measures coupled with limited quantities that will be stored on site. With implementation of the mitigation measures, the overall significance of the impact is considered to be negligible. In order to mitigate potential increase in surface runoff and flood risks, the Storm Water Management Plan should be developed and implemented. A storm water drainage system should be properly designed and constructed to convey the surface runoff away from the project area into a catchment area that will hold runoff and allow it to filter slowly into the ground. This will also contribute to recharging of the groundwater aquifer. The surface drainage system should also be designed and constructed to avoid erosion of support structures and foundations.

Though limited quantities of fuels and oils will be stored on site, the potential for groundwater contamination that could arise will be mitigated by implementing the following measures:

- Appropriate procedures for storage and handling of fuels and oils should be adopted to avoid spillages of fuels and oils onto the ground. These included the following: Fuel tanks must be bunded to contain possible spills and to prevent the infiltration of fuel into the ground; The fuel tanks used for the storage of fuel must be designed and installed in accordance with relevant Oil Industry standards; The tanks must be constructed to conform to the requirements of all relevant legislation,

which includes the Environmental Management (Licensing) Regulations, 2013; use of all generators on site must include the use of drip trays.

- Secondary containment structures, made of impervious and chemically inert material and capable of containing the larger of 110 percent of the largest storage vessel should be constructed for storage of fuels, oils and other hazardous substances. All products (fuels, oils) shall be stored in a bund area that can carry 10% more than the product's capacity.
- Handling, storage and disposal of hazardous substances (used transformer oils) should be carried out in accordance with the World Bank General Environmental Health and Safety Guidelines (Hazardous Materials Management) and the applicable Zambian Environmental Management (Licensing) Regulations, 2013.
- Dedicated secured storage areas for fuels, oils and other hazardous materials should be provided as part of the design. Mainly diesel, to a maximum volume of 30 cubic metres, will be stored. All fuel stored on site will be above ground level and the storage areas shall be secured. The storage areas and containers shall be clearly marked and labelled for the content stored within. Drip trays, a thin concrete slab or a facility with PVC lining shall be in place to prevent soil and water pollution.
- All products shall be used in an open well-ventilated area and according to manufacturer's specifications.
- MSDS Hazard list and First aid treatment notices shall be prominently displayed.
- Training on handling, storage and disposal of hazardous waste should be provided as part of the overall environmental management of the site. Only trained personnel shall be allowed to work and handle the chemicals.
- Uncontrolled dumping of any toxic or hazardous waste, including used transformer oils from a couple of transformers to be installed on site should be avoided.
- Uncontrolled dumping or littering of any waste within the project area and areas adjacent to the project site should be avoided.

Air Quality

Dust emissions are likely to be generated during construction works relating to site clearance and levelling of the proposed project site area, transportation of plant components to site, construction of infrastructure onsite including internal roads. The significance of impacts associated with dust emissions during the project development phases has been assessed to range from minor to moderate negative as the project would cause mainly a barely perceptible deterioration in the existing ambient air quality.

The significance of the impacts associated with the emissions of exhaust gases including CO, NO_x during use of heavy equipment on site has also been assessed as minor negative.

Some mitigation measures to reduce exposure to dust and fugitive dust generation will include provision of Personal Protective Equipment such as dust masks to all the workers that might be exposed to dust emissions, and where dust emissions will arise from unpaved roads and any other exposed surfaces as a result of proposed project related activities, water should be applied on the surfaces to reduce or suppress any fugitive dust emissions. Construction equipment and vehicles used for transportation of plant equipment should be adequately maintained and inspected to minimise exhaust emissions.

Noise and Vibration

The site clearing and levelling will involve the use of heavy equipment. The machinery will include bulldozers, frontend loaders and tipper trucks. The use of such equipment will generate some noise. The noise generated though high in decibel terms is reduced to normal permissible daytime values at distances not so far from the working area. The significance of noise disturbance on noise sensitive receptors during the construction phase is considered to be minor negative. During the operation phase, the significance of noise disturbance is considered to range from negligible to moderate with potential noticeable change in noise levels likely to be caused by inverters.

Construction works such as ground breaking and excavations have the potential to create vibrations. Considering the nature of the expected earthworks being relatively minor, it is unlikely that the vibration impacts (disturbance to humans, animals in the nearby Lusaka National Park or damage to structures) upon the surrounding receptors will be significant. Where any vibration impacts area likely to occur during the construction and operation, the impacts will be site specific and temporary in nature and the significance of the impacts is assessed as being negligible.

The following measures will be considered, where appropriate, and will be implemented throughout the construction phase:

- Provision of adequate PPE such as ear plugs to site workers likely to be exposed to high noise levels;
- Where appropriate, bored piling techniques will be considered in preference to impact piling to minimise vibration impacts;
- The presence of 200 metres buffer zone within the National Park from the park boundary fence will minimise potential noise disturbance on wildlife;
- The movement of heavy vehicles during the night will be avoided wherever practical.
- The contractor and their sub – contractors will, at all times, carry out all work in such a manner as to keep any disturbance from vibration to a minimum especially when working in close proximity to receptor areas.
- Operators of vibrating hand- held machinery will be provided with appropriate PPE (e.g. protective gloves) and be given suitable breaks from using such equipment to reduce the impacts of vibration.

Land Use

The project site is partly within the LS MFEZ designated for industrial and commercial development and partly within the Lusaka National Park area (11 ha additional land for the project) owned by the Ministry of Tourism and Arts. The 11 ha piece of additional land is located outside the physical boundary fence for the National Park and is currently not used as a park. The land at the site in its current state is degraded because of previous human activities such as charcoal burning. The land immediately to the South of the project site is a protected Lusaka National Park which is progressively developing into a forest. The project area within the LS MFEZ is already zoned as a multi-facility economic zone and mostly for commercial and industrial purposes. Implementation of the project on the project site is expected to be seen as a landmark energy project both locally and nationally which will in turn attract more investment in the LS MFEZ.

The impacts associated with use of the land for the project will be negative, direct and localised in extent. The frequency of the impact will be once-off and it will certainly occur since the land will be cleared to pave way for construction of the solar plant. Considering the project footprint (52 ha) and the current state of the land, the magnitude of the potential impact is considered to be low. The land is a recharge area for the Lusaka Dolomite Aquifer. Therefore, the sensitivity of the receptor is considered to be high. The significance of the impact is assessed as moderate negative as the project will cause a noticeable deterioration to the existing environment.

The additional 11 ha land required for project development is currently not used as part of the National Park. The area is physically located outside the National Park fence boundary and extends along the southern boundary of the LS MFEZ.

The impacts associated with the change in land use of the additional 11 ha from being part of the Lusaka National Park to development of a solar PV Plant will be negative, direct and long-term in nature as the change will continue for the life of the project. The change will be on-site as this will be limited to the boundaries of the project site. The resource sensitivity or value of the additional land is considered to be low having been previously subjected to human activities such as charcoal burning and is not currently being used as a park. The magnitude of the impact of the change in land use is assessed to be low. The overall significance of the impact is considered to be minor as the proposed project would cause a barely perceptible deterioration to the existing national park.

The presence of the protected Lusaka National Park located immediately South of the project site will mitigate the change in land use of an 11 ha piece of land. The Lusaka National Park will continue to play its role of conserving wildlife resources and its other important role as recharge area and as a positive barrier to negative influences on the overall economic zone.

Biodiversity

The proposed project site is located in an area that has a modified habitat and which is in an early stage of the woodland recovery from previous disturbances. Project activities at the proposed site will include clearing vegetation to pave way for installation of solar project infrastructure. The activities will result in removal of tree species, loss of vegetation and wildlife habitats. The baseline flora and fauna conditions established indicate that there are no flora or fauna species at the project site classified as rare, threatened or endemic to the project area or of special scientific value. The predicted impacts will be negative, direct and localised in nature. The overall significance of the impacts of the project on flora and fauna during the construction phase is considered to be minor negative while the overall significance of the impacts on flora and fauna during the operation phase is considered to be negligible. The significance of the potential impacts anticipated on birds as result of reflective surfaces of solar modules is considered to be minor negative.

Clearing of vegetation will only be confined to areas where the solar infrastructure will be installed to minimise loss of vegetation and wildlife habitats while low reflective surface modules coated with anti-reflective coating to minimise potential impacts on birds will be used.

The other likely ecological impact is on movement of burrowing and nocturnal animals through and across the project site during the operation phase. However, this may be minimal as most of these animals will not be able to move into the project area due to the restriction arising from the erected wire fence around Lusaka National Park and from the fence that will be erected during project development phases. In the case of burrowing animals, those that may be noted during the operation phase will be removed and the burrows filled.

Archaeology and Cultural Heritage

The archaeological and cultural heritage impact assessment survey results have indicated that there are no known archaeological and cultural heritage sites at the proposed project site. However, construction works may expose, unearth or remove unknown subterranean and chance surface archaeological finds. The potential impacts associated with the occurrence of underground and chance surface archaeological finds are related to damage to archaeological finds that may be exposed or unearthed during construction works.

In an event that archaeological finds of cultural significance are found during the construction and operation phases of the Solar Power Project, National Heritage Conservation Commission (NHCC) - East Central Regional office should be contacted as a matter of urgency for specialist advice and intervention.

Traffic and Road Infrastructure

The Lusaka South Multi-Facility Economic Zone is serviced by a network of roads, which includes Leopards Hill Road and the newly constructed inner ring roads. Access to the economic zone and the project site is either through the Lusaka Inner Link Road that terminates on the LS MFEZ north-western boundary or through Chifwema Road, which branches off the Leopards Hill Road (D152). Tared access roads have been constructed within the economic zone and traffic volume on the access roads and internal roads of the project area is currently low. However, traffic volume is expected to increase as the economic zone is being developed.

For transportation of construction material to the project site, it is expected that inner ring roads joining the Kafue Road will be used mainly. This is expected to increase traffic volume on the roads leading to the economic zone. The potential impacts associated with increased traffic volume are increased traffic congestion and decreased road safety. The traffic congestion as a result of the proposed project is likely to occur principally during the construction phase. They will be regional in extent and their frequency will be once off (construction phase). The magnitude of the impact is considered to be low while the

sensitivity of the potential receptors is considered to be high. The overall significance of the impacts associated with the project in relation to traffic congestion is considered to be moderate.

Decrease in road safety as a result of increase in traffic volume during construction phase may potentially cause traffic-related injuries and fatalities among members of the public including construction workers. Traffic safety management within the economic zone should be enhanced. Appropriate road safety measures such as putting up appropriate signage and undertaking road safety training for workers and other stakeholders within the zone should be implemented.

Socio-economic

A socio-economic impact assessment survey was undertaken in areas surrounding the LS MFEZ. These are Mahopo and Shantumbu Villages, Leopards Hills, Chalala and New Kasama residents and the farming community in New Kasama bordering the eastern end of the proposed project site.

The social baseline survey identified negative social conditions in Shantumbu, Mahopo and Chifwema settlements relating to limited sources of livelihood activities, inadequate schools and associated facilities such as library facilities, learning facilities and teaching materials, inadequate health facilities; and inadequate water supply and sanitation services. In addition, the Mphande Forest Community, where some households moved from Lusaka South Local Forest No. 26 have been resettled, is not a planned settlement. The settlement does not have basic facilities such as clean drinking water, education facilities, health services, proper access roads. The local community members do not have title to land on which they have been resettled.

The baseline social conditions within the identified settlements around the project area are considered to be negative and the conditions are likely to further deteriorate in the long term if there is no community support rendered. The magnitude of the deterioration in the social conditions likely to arise if no community support is rendered will be experienced at both local (project area and adjacent settlement) and regional (district) scales.

It is recommended that a Community Development Plan should be developed and implemented by the Operators/Contractors of the Ngonye Solar PV Plant. The CDP will include community projects aimed at improving living conditions in identified settlements. Such projects could include provision of adequate schools and associated facilities (education services) such as library facilities, learning facilities, learning materials and play parks for children, provision of adequate water supply and sanitation services, provision of adequate health facilities, and provision of any other community help necessary to improve the living conditions in identified settlements. These community development activities can be undertaken in conjunction with a non-state actor (such as World Vision Zambia) already operating in the respective settlements.

The value of the benefits or services that will be provided through implementation of highlighted possible community projects will be high. In addition, the magnitude of the beneficial impacts that will arise through improving the social baseline conditions in identified settlements are also considered to be high.

The significance of the beneficial impacts that could arise through implementation of the recommended community support to the identified communities of Shantumbu, Mahopo and Mphande is considered to be major. This is because implementation of Community Development Plan through which community support will be rendered will result in a significant improvement to the living conditions and livelihoods in the identified settlements besides strengthening stakeholder engagement and relationships beneficial for long-term positive Solar PV project outcome.

The positive social impacts anticipated during the construction phase of the project include increased employment opportunities, increased contribution to the construction sector and national economy, capacity building and technology transfer, and increase in revenue to the local authority and government. The significance of the impacts is considered to be major beneficial as the project will cause a major improvement in the socio-economic conditions of the existing environment. The benefits of employment opportunities should be maximized by ensuring that the Contractor employs members of the local community, where possible. Benefits associated with increased contribution to the construction sector and national economy should be enhanced by ensuring that, where possible, locally produced raw

materials and services are procured from local contractors. The project offers potential in capacity building and technology transfer to local contractors, skilled manpower and unskilled workers. Collaboration between the project developers and their skilled work force will foster transfer of skills and will also build additional local capacity. In order to enhance this benefit locally skilled specialists and experts should be used to benefit from technology and skills transfer.

The beneficial socio-economic impacts associated with the operation phase are similar to the construction phase. In addition, since the proposed scaling solar project with its attendant solar farm will be the first of its kind in Zambia, the project offers great potential for tourism. This benefit can be enhanced by constructing an education centre and recreational facilities. These facilities will provide educational talks about renewable energy and conduct tours around the solar farm. This could be packaged together with entry into Lusaka National Park.

The potential negative social impacts of the project relate to impacts of traffic on road safety, particularly during the construction phase, influx of population at construction site, impacts on public safety, potential upsurge of sexually transmitted infections (STIs) and Human Immuno-deficiency Virus (HIV) / Acquired Immune Deficiency Syndrome (AIDS). The significance of the impacts is considered to range from moderate to major adverse. Appropriate mitigation measures such as development and implementation of HIV Policy to curb risk social behaviour and enforcement of by-laws by respective local authorities to prevent unplanned settlements will be implemented.

Community Health and Safety

The potential impacts predicted on public health and safety that may potentially arise from the proposed project relate to outbreak of water borne diseases arising from lack of or inadequate provision of good water and sanitation facilities on site to workers and increased safety and security risks through an unauthorised access to construction site. Security risk will form one of the major risks during construction and operational phases of the project. In addition, safety risks resulting from unauthorised persons inadvertently venturing onto the construction site is likely to occur. The location of the site within the zoned MFEZ site, which is subject to security measures, is not completely fenced on the eastern side. This presents considerable security and safe risks. The significance of the predicted impacts and risks on community health and safety is considered to be moderate adverse. The mitigation measures recommended to prevent outbreaks of diseases are provision of good water supply and sanitation facilities among workers while security risks will be minimised by enclosing the project site within a security perimeter and placing caution signs around the site to prevent occurrence of accidents. The actions of security shall be done within the confines of the law and respect of human rights.

Occupational Health and Safety

The construction works will involve activities and procedures with potential risk to the occupational health and safety of workers and personnel. The activities and procedures that can expose workers to potential risks such as accidents or injury illness include movement of machinery around the site, blasting or rock breaking, work in dusty environment and work in trenches. The significance of the potential impacts has been assessed as major adverse as the project would cause a significant deterioration of the occupational health and safety of workers at the project site. Strict adherence to health and safety measures and procedures will minimise (or eliminate) risks of accidents, injury or hazardous developments occurrences. Some of the mitigation measures to minimise risks will include establishment and implementation of a Health and Safety Policy to guide construction and operations of the facility, conducting all construction and operational activities in accordance with the provisions of the Occupational Health and Safety Act, No. 36 of 2010 and international best practice such as the IFC Performance Standard 4 on Community Health, Safety, and Security and the associated World Bank Environmental, Health and Safety Guidelines (General EHS Guidelines: Occupational Health and Safety).

Deforestation and Climate Change

Construction activities of the proposed project will involve clearing of existing vegetation cover which has already been disturbed. The site is a modified habitat that is in its early stage of woodland recovery from previous disturbances. Deforestation of the site will occur and the impact will be direct and negative. The extent of the impact will be on-site as the clearing will be limited to the boundaries of the project site. The

magnitude of the impact is considered to be low and the sensitivity of the resource in terms of its value is considered to be low having been degraded through previous human activities. The overall significance of the impact is therefore considered to be minor negative. Clearing vegetation at the project site will however be confined to the project boundaries.

The proposed project is a clean and renewable source of energy for power supply generating far less to no CO₂/MWh as compared to the conventional / fossil-fuel power plant that produces significant CO₂ per MWh generated. A bituminous coal plant, for example, produces 938,000 kg CO₂/MWh while natural gas produces 54700kg CO₂/MWh to generate 100MWh equivalent power of the proposed Scaling Solar project. Therefore, the project is not likely to contribute to significant Greenhouse Gases (GHG) emissions that contribute to negative effects of human-induced climate change. The significance of the proposed project on climate change is major positive since it will use a clean and renewable source of energy that will not generate Green House Gases (GHG).

Cumulative impacts

Cumulative impacts are impacts arising from the combination of multiple impacts from existing projects, the project and/or future projects. The industrial and commercial developments that have been earmarked to be carried out at LS MFEZ will result in cumulative impacts associated with the project. These impacts relate to the following:

- Impacts on recharge of the aquifer: other developments within the LS MFEZ would reduce infiltration and groundwater recharge subsequently affecting water supply in Lusaka and base flow into rivers and streams draining out of the Lusaka Dolomite Aquifer. Appropriate mitigation measures for the broader LS MFEZ have been highlighted in the Strategic Environmental Assessment Report for LS MFEZ (ZEMA, 2014).
- Aquifer contamination may arise as a result of other developments that may potentially and indirectly release into the groundwater raw sewage, agricultural products, wastewater, hydrocarbons effluent and leakages.
- Noise and vibration impacts are likely to increase in the short term during the construction works. These will be short term and localised in nature and are reversible.
- Ambient air quality is likely to reduce in the short term (dust emission during construction) to long term (gaseous pollutants emission during operation) because of future developments to do with manufacturing industries that will be established in the economic zone.
- Solid waste conditions will cumulatively increase as the LS MFEZ is developed. The proposed project will also contribute to generation of solid waste throughout its development phases. This will cumulatively contribute to waste generation within the LS MFEZ with the potential impact of overwhelming planned centralised waste management facilities at the site.
- Traffic congestion and its associated negative effects will increase along the access roads to economic zone (Leopards Hill Road and Inner Ring Roads) as construction and operations of facilities in the LS MFEZ peaks up. These will negatively and cumulatively result in reduced road safety along the access roads and may also negatively affect the zone and its expected economic multiplier effects.
- Cumulative positive socio-economic impacts relating to employment opportunities, capacity building and skills transfer for skilled and unskilled workers will arise and will be incremental as the economic zone is developed.

Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) has been developed to ensure compliance with the requirements of the Zambian regulatory requirements as well as IFC Environmental and Social Sustainability policies, guidelines, standards and other requirements. The plan has incorporated mitigation measures, which have been defined in line with the predicted potential environmental and social impacts and risks. This has been done in order to avoid or minimise potential adverse

environmental and social impacts and risks, and to enhance benefits arising from project development phases.

With regard to implementation of the ESMP, IDC will have senior management commitment to ensure that the level of environmental and social performance identified in the ESMP for the proposed project is achieved while the Contractor will play a central role in achieving the level of performance required. The Contractor will implement the ESMP as part of the day to day management of the Contract and operational procedures. The Contractor will be required to report to IDC on environmental, health and safety issues pertaining to the construction and operations of the Ngonye Solar PV Plant.

The ESMP includes commitments for capacity building and technology transfer to ensure consistent and acceptable environmental and social performance during the development phases of the Project. The necessary skills and information required to achieve the required level of performance will be provided to local specialists by the Contractor to transfer skills and technology to the locals and to build national capacity.

The Contractor will undertake environmental auditing and inspections of all its operations to ensure that environmental monitoring activities undertaken at the project site are accurate and relevant to meeting the environmental management objectives of the proposed Project. External audits will also be conducted by independent external auditors such as ZEMA, Energy Registration Board and IFC. The environmental audits and reporting shall be conducted in compliance with IFC requirements as well as applicable Zambian environmental regulatory requirements.

Decommissioning and Closure Plan

The project life is expected to extend for a period of at least 25 years. The decision to decommission the Ngonye Solar PV plant will be influenced by economic sustainability and technological changes / advances. As these factors dictate, a specific closure concept and plan will be developed.

In general decommissioning and closure principles require that a project is decommissioned and the site rehabilitated in a socially responsible manner that reflects sound environmental management practices. The decommissioning and closure phase of a project should be implemented to achieve the following objectives: protection of public health and safety, reduction or prevention of environmental degradation, and allowing continued productive use of the project site, similar to its original use or to an acceptable alternative use.

In respect of the proposed Ngonye Solar PV Plant, the main activities during the decommissioning phase will be removal from site of used solar modules, associated electrical components and cabling for disposal or recycling and demolition of site buildings. The solar modules will be sent to the manufacturer for recycling or any certified industrial recycling chain. The buildings may not be demolished if alternative use for them is agreed upon with other stakeholders.

Most of the impacts associated with construction phase activities are similar to impacts associated with the decommissioning phase. A detailed decommissioning plan will include measures to mitigate any significant adverse impacts and to enhance beneficial ones. The plan will include responsibilities and roles to manage the impacts in a sound and environmentally sustainable manner.

Summary and Conclusion

This Non-Technical Summary of the Environmental and Social Impact Statement (ESIS) for the proposed construction and operations of the Ngonye Solar PV Plant has provided an overview of the key findings of the environmental and social impact assessment (ESIA) study undertaken for the proposed project. The summary has provided a brief description of the project, project rationale and the predicted environmental and social impacts and risks including recommended mitigation and enhancement measures for significant adverse and beneficial impacts likely to arise as a result of the proposed Project activities.

Implementation of the measures will be monitored to assess their effectiveness and to adjust them where appropriate. With the effective implementation of the proposed mitigation measures summarised herein and consolidated in the Environmental and Social Management Plan (ESMP) presented in the main ESIA Report (Volume 2), the construction and operation of the proposed Ngonye Solar PV Plant is not likely to

result in adverse environmental and social impacts and risks. The project will not only contribute to redressing the power deficit currently being faced by Zambia but it will also promote the use of renewable energy technologies to generate clean and sustainable energy with the subsequent creation of employment opportunities and associated multiplier effects. In addition, the project will stimulate economic growth and development in Zambia.