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AFRICAN DEVELOPMENT BANK GROUP

PROJECT: NOVA SCOTIA POWER DEVELOPMENT LIMITED 80MW SOLAR PHOTOVOLTAIC (PV) PLANT PROJECT IN DUTSE LGA, JIGAWA STATE.

COUNTRY: FEDERAL REPUBLIC OF NIGERIA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY

Date: May 2017

Appraisal Team	Team Leader: : Rhoda Mshana / Kweku Koranteng, Agne Hawaly, Investment Officer, PESR.2 Team Members: F. Oku, Senior Environmental Specialist, SNDI.1 RDGE E. Kahubire, Senior Social Development Specialist SNDI.1 RDGE Divisional Manager: Sector Director: Wale Shonibare Regional Director: Ebrima Faal

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT [ESIA]

SUMMARY

Project Title**: JIGAWA SOLAR PROJECT**	Project Number: **P-NG-FF0-003**
Country: **NIGERIA**	Department: **PESR0**
Division: **PESR2**	Project Category: **1**

1. INTRODUCTION

Nova Scotia Power Development Limited (NSPDL) is planning to develop a ground mounted 80 MWAC Solar Photovoltaic (PV) plant. NSPDL was incorporated in Nigeria under the Companies and Allied Matters Act 1990, on the 12th of September, 2013 with registration number RC 1141701. The company is set up as a Special Purpose Vehicle (SPV) specifically to develop, finance, construct and operate solar parks such as the proposed 80 MWAC solar PV facility in Jigawa State, Nigeria.

The Project will be developed, financed and commissioned by NSPDL, the "Project Company", which will secure revenues under a 20-year "take-or-pay" Power Purchase Agreement ("PPA") with NBET.

This ESIA summary highlights the key assessment and management plans designed by NSPDL to ensure the proposed project complies with both Nigeria and international development partners E&S policy requirements.

2. POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

The ESIA has been carried out in accordance with applicable environmental, social and power sector policies, standards, regulations and legislation in Nigeria as well as relevant international conventions and standards. These include EIA Act No 86 of 1992 (as amended by EIA Act Cap E12 LFN 2004), EIA Sectoral Guidelines for Power Sector, 2013; World Bank Safeguard Policies and Environmental Health & Safety (EHS) Guidelines and IFC Performance Standards on Environmental and Social Sustainability and Equator Principles.

According to the EIA Act No 86 of 1992 (as amended by EIA Act Cap E12 LFN 2004), a full EIA is required for all projects likely to have significant impacts on the environment because of the nature or extent of the activity. The Federal Republic of Nigeria's constitution, the EIA Act, EIA Regulations and various sectoral legislation and regulations are broadly consistent with the Bank's Integrated Safeguards System Policy (ISS).

Some of the key national legislation reviewed and considered in the ESIA studies and found to be consistent with the Bank's ISS Policy include; Land Use Act 1978 (Modified 1990), Labor Act, 1990, The Forest Act (ii) Endangered Species (Control of International Trade and Traffic) Act No. 11 of 1985; Harmful Wastes (Special Criminal Provisions etc.) Act No. 42 of 1988; NESREA[1] Act No. 25, 2007; EIA Procedural Guidelines, 1995; EIA Sectoral Guidelines for

[1] National Environmental Standards and Regulations Enforcement Agency

Power Sector, 2013; Guidelines and Standards for Environmental Pollution Control in Nigeria,1991; National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991 (S.I.No.9); National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991 (S.I.No.15); National Environmental (Sanitation and Wastes Control) Regulations, 2009,(S.I. No.28). National Environmental (Electrical/Electronic Sector) Regulations, 2011(S. I. No. 23), National Environmental (Soil Erosion and Flood Control) Regulations, 2011(S.I. No.12) National Environmental (Noise Standards and Control) Regulations, 2009 (S.I.No. 35), National Environmental (Surface and Ground Water Quality Control) Regulations, 2011 (S.I. No. 22), National Guidelines and Standards for Water Quality in Nigeria, National Policy on Occupational Safety and Health, 2006 Factories Act (CAP F1), 2004,

AfDB's Operational Safeguard Review

The project has been assigned a category 1 by the African Development bank in line with the guidelines within the bank's ESAP for all power generating plants exceeding a generating capacity threshold of 30MW. Consequently Operational Safeguards (OS)1 on Environmental Assessment have been triggered because the component activities have the potential to generate significant environmental and social impacts to identified receptors within its area of influence which if not well managed can lead to disruption of ecosystem services for the community. Operational Safeguard (OS2) has also been triggered because it has economically displaced about 554 persons. OS 4 on Pollution Prevention and Hazardous Substances is triggered since construction will involve use of fuels and possibly some hazardous materials. OS 5 on Labor, Working Conditions, Occupational Health and Safety is applicable since the construction will involve a significant number of construction workers.

3. PROJECT DESCRIPTION AND JUSTIFICATION

The Project: The proposed project will generate and supply additional 80 MWAC of renewable electricity to boost national power supply and specifically provide the Jigawa State and surrounding areas with a carbon free source of electricity to promote economic development in line with NEP[2]. The basic project component will involve:

- *A utility scale solar power plant involving the installation of ground-mounted PV solar modules capable of generating 80 MW AC using fixed tilt system configurations.*
- *The PV modules will convert sunlight to direct current (DC) power. The modules will be connected together to form arrays of panels, which in turn will be connected to inverters to convert the DC power to alternating current (AC) power.*
- *The voltage of the power will be stepped up by a transformer within an on-site substation to the required voltage of the nearby electricity grid.*
- *The generated power from the project site will be evacuated through a dedicated 132 kV overhead transmission line that will connect the solar plant to the Dutse substation located approximately 3.66 northwest of the project site.*
- *Supervisory Control and Data Acquisition (SCADA) System*
- *Associated infrastructure and utilities including*
- *Site security including fencing and CCTV*
- *Buildings, including onsite substation, connection building, control building, guard cabin and spare parts storage*
- *Access road and internal road network*
- *Storm water infrastructure and drainage system*
- *Water supply infrastructure (boreholes)*

[2] National Electric Power Policy

Technical Design Layout of the Project components: Figure 3.1 shows the technical design layout for the project components.

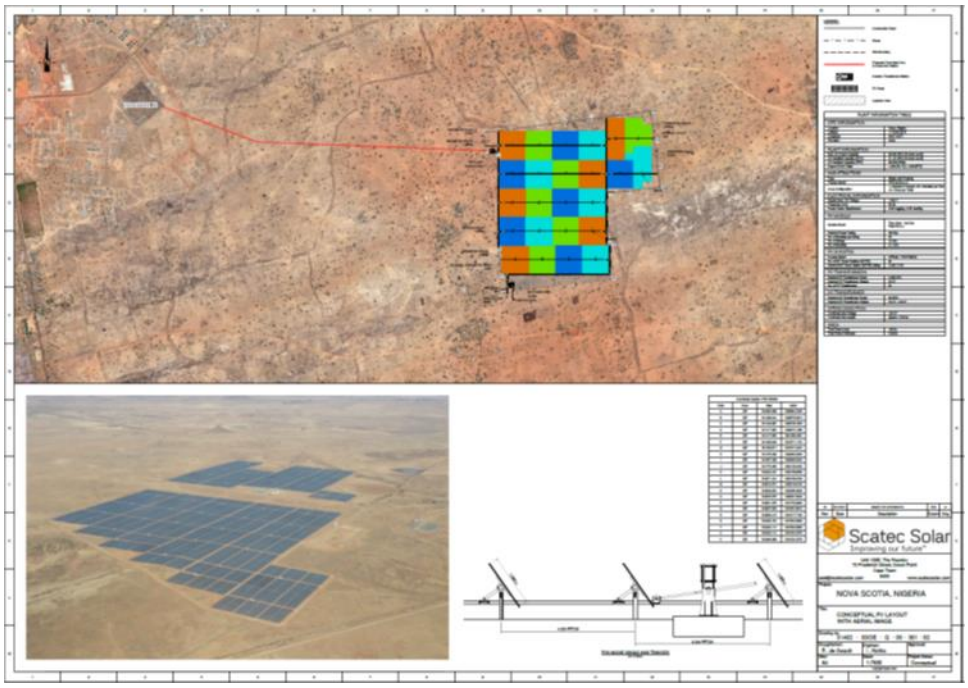


Figure 3.1: Technical Design Layout plan for the project

Project Development: The development of the Solar PV project is broken down into the following phases:

- *Pre-construction:* Including activities such as land acquisition, mobilization of personnel, equipment and materials to site, site preparation and installation of temporary structures for workers.
- *Construction*: Including civil works, electrical works, and equipment installation.
- *Operation*: Plant operation and routine maintenance
- *Decommissioning*: Removal of PV panels and equipment, demolition of structures and evacuation as well as site remediation.

Key Environmental and Social Considerations: The following environmental and social considerations of the project development have been considered within the ESIA;

- *Employment Opportunities and Skills Transfer:* During preconstruction phase, unskilled labor will be sourced from the local community labor pool. During this phase of the project and early stages of construction, a highly-skilled team of solar energy technicians will train potential local employees, preferably from Jigawa State, where possible. During construction, the majority of workers will be hired and managed by the EPC Contractor and other subcontractors. It is envisaged that about 200-300 people will be employed for a duration of approximately 10-12 months. This would include around 20-30 experienced engineers, 10-15 experts and local skilled, semi-skilled and unskilled workers. Overall, the project aims to employ a minimum of 30% (can be up to 60%) of unskilled and skilled labor from the surrounding communities for construction. A total of about 20-30 job opportunities will arise during the operation phase, including skilled and semi-skilled labor (such as electrical and mechanical technicians) and unskilled labor (such as module

cleaners and security personnel) for a duration of approximately 20 years. A Workforce Management Plan will be designed to ensure that NSPDL manages its staff in accordance with the national labor rules, including allowing freedom of association, recognition of trade unions, respect for collective bargaining agreements and protecting worker's rights in terms of the national legislation.

- *Site Security:* A project specific site security plan, procedures, and contract will be established and implemented. The plan will be developed in consultation and partnership with local police authority and local vigilante group(s).
- *Project Health, Safety and Protective Measures:* All works during project implementation and throughout the project life cycle shall conform to NSPDL HSE Policy. The EPC/O&M contractors shall develop a project specific HSE Plan which will guide the activities throughout the phases of project implementation.
- *Water Use and Management:* Total water requirement during the construction phase is estimated at 3,160,000 litres and 55,475,000 litres per year for cleaning and domestic purposes during operations phase. All non-potable water required for use during the construction, operation and maintenance activities of the project will be sourced from groundwater boreholes to be constructed on the project site, while potable water will be sourced outside via tankers and stored on site.
- *Waste Management:* Waste management plan shall be developed and implemented through the entire life cycle of the project. Waste management principles and priorities shall be based on an integrated approach which will involve using a combination of techniques and programs to manage wastes. This approach shall be anchored on the 5Rs of waste management hierarchy of Reduce, Repair, Re-use, Recycle and Recover as the primary drivers while disposal shall be the last option.
- *Waste Water and Drainage:* Waste and storm water will be managed through a combination of open trenches, and ditches and will be led to drain away to the natural environment via gravity. Paved and concreted areas will be sloped to allow for proper drainage.
- *Displacement and Resettlement:* The acquisition of the land for the project site has resulted in economic displacement of about 554 local community farmers. A Livelihood Restoration Plan has been developed to manage this impact to the affected members of the community.

Justification of the Project:

Project Need: An estimated 50% of Nigeria's population is living without grid connected electricity. Limited grid connectivity is attributed to limited access to infrastructure, ineffective regulation, high technical losses and vandalism, inadequate generation as well as insufficient transmission and distribution facilities hampering economic development and productivity.

Furthermore the project will result in the boost in economic growth at both the local and regional level through set up of industries and subsequent employment opportunities and increased revenue to government via taxes.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

The proposed site for the project known as Dutse-2 is located at a distance of about 5 km from the town of Dutse in Jigawa State, Nigeria. The project area covering approximately 200 hectares of land falls within Latitude 11.6815N and Longitude 9.3858E. The project location

also include the 3.66 km Right of Way (RoW) for the *Transmission Line* (T-line) which will evacuate the generated power to the Dutse substation for onward connection to the national grid. The T-line route falls within Latitude 11.68728N to 11.69109N and Longitude 9.38058E to 9.35066E.

Project Area of Influence: For the ESIA study, a 5 km radius drawn from the centre of the project site has been adopted as the project's Area of Influence which covers all the ancillary components such as power transmission corridors, access roads, borrow pits and disposal areas, construction camps as shown in the Figure 4.1 below has been hosted.

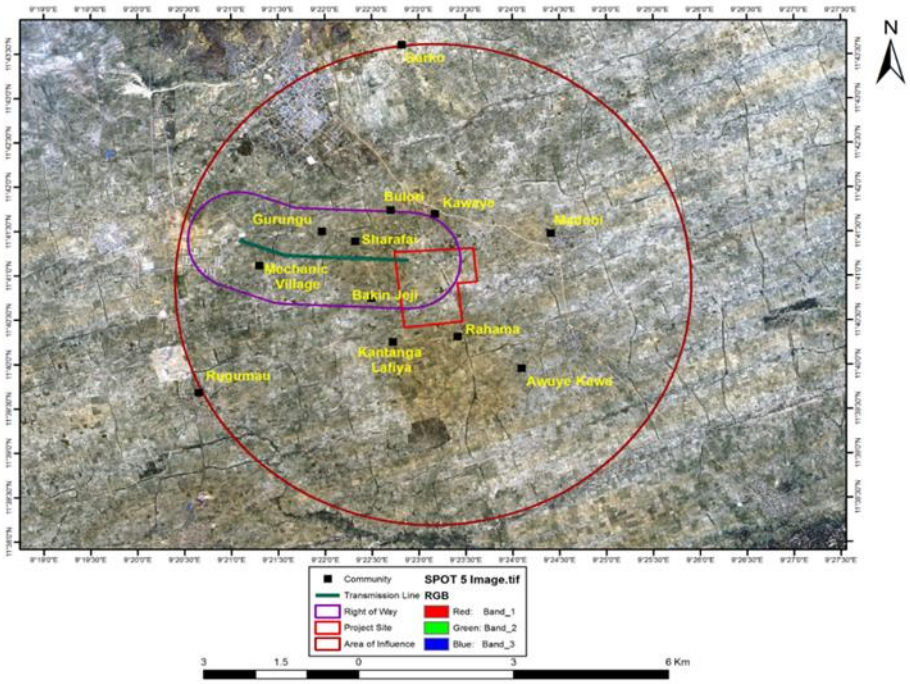


Figure 4.1: The 5km radius depicting the area of influence for the project.

The following environmental and social baseline information of the project's areas of influence have been reviewed as part of the ESIA development process;

Climate and Meteorology: The area is semi-arid characterized by two predominant climatic conditions annually including a very hot and long dry season and a warm, humid and short wet season influenced by two air masses: the tropical maritime or southwest trade winds and tropical continental or north-east trade winds. The former are the moisture laden, rain-bearing winds coming on- shore from the Atlantic Ocean and the latter are the dry, dusty and cold-bearing winds blowing from the Sahara desert associated with the dry season.

Rainfall: The project area is characterized by short wet season with most of the rainfall occurring between May and September. The average annual rainfall ranges from 510mm – 1000mm. that peaks in August with little or no rain at all between October and April.

Temperature: The project area is very hot but the dryness however makes the heat bearable and has two extreme temperatures relative to its tropical position. The maximum daytime temperatures for most of the year are generally under 40°C (104.0 °F). The highest monthly temperature of 36.6 - 39.2°C is experienced between March and May. There is usually the

prevalence of Harmattan, characterized by dust laden winds between November and February when average monthly temperature can be as low as 13.4°C.

Humidity: The average monthly relative humidity for the region ranged from 52.8% to 78.6% during the rainy season (May to September), with its peak usually recorded in the month of August the same month of highest rainfall. Lower values were recorded during the dry season months.

Wind speed and Direction: The average monthly wind speed in the study area ranged from 6.63 to 10.09 Knots with the maximum figure recorded in June. There are some occasional calmness with insignificant wind speed mostly experienced between August and November. There are two major wind directions in the region, namely, the south-west and north-east directions. The northeast wind predominates during the dry season bringing a large amount of dust while the southwest winds are predominant during the wet season. It is expected that these winds will accelerate soiling of the PV panels. Regular operation and maintenance activities will be required to minimize the impacts of soiling on energy yield.

Sunshine: The average range of sunshine hours is between 6.88 hours per day in March to about 8.57 hours per day in November with an approximate average of 7.71sunlight hours for each day. The average annual sunshine in the region is about 2,821hours corresponding to an approximate average of 3000 hours obtainable in the northern part of Nigeria as against an average of 1,500 hours in the South.

Ambient Air Quality: The project area is virtually free of visible heavy industrial activities. The major sources of air pollutants in the area are mostly from light transportation and farming activities. Air quality measurements showed a general trend of acceptable values. Five of the measured parameters CO, PM, VOC, NO_2 and CO_2 were detected in most of the locations sampled, while H_2S and SO_2 were virtually not detected in all the locations. All pollutants detected were however within the FMEnv permissible limits and guideline values recommended by WHO. Proposed project activities may however generate emissions of fugitive dust from site clearing, excavation and movement of earth materials as well as exposure of bare soil and soil piles to wind. Gaseous pollutants may also be generated from exhaust of diesel engines of heavy duty vehicles and earthmoving equipment.

Soil Composition and Quality: The soils are generally sandy at the top, compact at depth with often hard pans. Aeolian deposits from the Sahara desert form substantial part of the soils. The mixing of the sub soil in these deposits has given rise to clayey subsoil, which dominates the area. However, because of the sandy texture, the soil may be prone to erosion when vegetation cover is removed during construction works. The soil particles sizes comprises mainly of sand (the coarse), silt and clay (the smallest) fractions.

Geology: The project site falls within the Chad formation that consist predominantly of recent Aeolian deposits. The rocks underlying this area are made up of 95% ancient crystalline basement complex formations. The basement complex rocks consists mainly of gneiss migmatites schists quartzites and marble but locally granite or syenite and intrusion of amphiobolites and olive rich dykes are found. Sandy beds are formed over impervious clay of the chad formation. The Chad sediments are concealed by sand dunes with no surface outcrops. The soils are generally sandy at the top and compact at depth with often hard pans. The sandy soils are aeolian deposits from the Sahara Desert which form substantial part. The soils in the study area consist of very fine to fine grained silty sand graduating to ferretic hard pan laterite

with occasional gravels. The Aeolian sand is characterized by a loose to medium dense soil but as soon as it is cultivated it forms loose non - cohesive sand.

The depth of aquifers (fed by precipitation and river infiltration) is 25-30 meters for the upper ones and 90-100 meters for the lower ones.

Hydrology and Groundwater: Jigawa State has both surface and subsurface water resources, with its greatest potential based on underground. The drainage basin of the region is determined by the Hadejia river system which flows from the high plateau of northern Nigeria. The Hadejia river meanders for 828 km (about 300 km within Kano and Jigawa states) across the old lake bed with many ox-bow lakes and numerous channels spread over a wide area. The river thus contributes immensely to a very vast underground aquifer in Jigawa State. There are however no surface water bodies in the study area. There are however two main rivers within the Dutse LGA, the Duddurin Gaya and Warwade rivers that are seasonal and more than 10 km away from the proposed project site.

Regarding water quality assessments in the project area, the turbidity level of the groundwater sampled is within acceptable level of 1.0NTU set by FMEnv with no significant health implication attributed to turbidity in drinking water. In terms of water hardness, the values recorded for total hardness in groundwater ranged from 70mg/l - 280mg/l, the maximum value of which is above FMEnv permissible limit and WHO guideline value; total hardness in water is however not associated with any significant health effect. The total suspended solid of the groundwater ranged from 8.70mg/l - 19.9mg/l. The maximum value observed in water collected from hand dug well is above the permissible limit standard prescribed by FMEnv which makes it unsuitable for drinking and use in industrial applications. The high concentration of TSS is consistent with the high turbidity value recorded for the groundwater from the water source. The high value observed may be attributed to shallow depth of the well, poor maintenance and over-usage as it was observed to be the only functioning well in the village.

Phosphate concentrations were 0.50mg/l and 0.65mg/l. These values are below FMEnv permissible value of >5mg/l. BOD concentrations ranged from 8.0 to 12.0mg/l. These values are above FMEnv permissible limit of 0.0mg/l. COD levels of the groundwater ranged from 18.50mg/l - 25.0mg/l. The dissolved Oxygen values recorded were 6.7mg/l and 7.5mg/l respectively. These values are consistent with the high BOD values recorded and are slightly below the FMEnv minimum limit of 6.8mg/l. Recorded calcium concentrations were 28.0mg/l and 110.55mg/l respectively. Manganese levels in the groundwater sources ranged from 0.67 to 2.86mg/l and the recorded levels were above the FMEnv permissible limits and may be attributed to the parental soil material since the soils of the area which were also found to have high levels of manganese. Total Bacterial Count (TBC) and Total Coliform Count (TCC) in the collected groundwater samples ranged from 200 to 300 Cfu/100/ml and 5.0 to 10 Cfu/100/ml respectively. Faecal coliform was detected in all the groundwater samples. These values coupled with the detection of E.coli indicate faecal contamination which could pose harmful health effects. The comparative analysis of wet and dry season's groundwater samples showed little variability as most of the parameters analysed for both seasons were consistent and largely within acceptable FMEnv and WHO limits for drinking water.

Regional Vegetation: The project area falls within the Sudan Savannah vegetation belt of Nigeria characterized by relatively long dry season lasting 5-7months resulting in less woody species compared to the Forest belt or even the Guinea Savannah. Thus the regional vegetation

is a mixture of grasses and low growing shrubs and trees. The region is currently experiencing desert encroachment which is greatly exacerbated by human activities such as over cultivation, overgrazing, etc.

Site Specific Vegetation: The terrestrial plant life in the project area is typically a mixture of herbaceous flora especially of members of the grass family- the Poaceae and low growing woody species, with the herbaceous species being more abundant. Common grasses are *Setara pallid-fusca, Chloris gayana, Digitaria exilis and Eragrostis atrovirents.common woody species in the area.* The predominant habitat within the project site and the entire study area is the modified habitat. The indigenous natural vegetation has over the years been largely converted by agricultural related practices such as farming and grazing. Although, there are fallow fields with shrubs and scattered woody vegetation particularly outside the boundaries of the project site, there are however no critical habitat on the project site and the entire project area. Vegetation of ecological and conservation importance were typically rare as vegetation were predominantly composed of scattered trees, cultivated farmlands and grasses.

Wildlife Resources: The project area is not situated in a main conservation or protected area. Most of the animal species recorded in the project area have not been evaluated or are of least concern according to the IUCN Red List of threatened species. However, three animal species listed as threatened by the Endangered Species (Control of International Trade & Traffic) Act No. 11 of 1985, were identified. These included Heros (*Ardea sp*), Family Ardeidae; Bosc's monitor lizard (*Varamus eamthematicus*), Family Varanidae; and Black kite (*Milvus migrans*), Family Falconidae. It was also observed that every other fauna species in the study area are threatened by habitat destruction and poaching.

Ecosystem Services: The project area host plant species that provide provisioning services and are of economic importance. The woody species in the area provide wood which is a versatile raw material with a variety of uses in many labor-intensive industries such as sawmills, ply mills, industrial/residential construction, and furniture manufacture. More importantly, for the host community, wood forms the principal cooking fuel. The availability of fuel wood is a key factor in the life of the people. Plant species of *Acacia albida* and *Piliostigma reticulatum* form good fodder, fuel wood *and* industrial raw material. Other non-wood components of the natural vegetation that are critical for survival in the project area which are rare in the project area including

- Leaves and barks of trees such as *Azadirachta indica* (Neem tree) for the treatment of malaria. Herbaceous species found in the area for instance
- *Senna obtusifolia* have also been found to provide good remedy for the treatment of ailments like typhoid.
- The seed of *Parkia biglobosa* is used to prepare a local seasoning (*dawadawa*) which is still a veritable delicacy for most rural communities.
- Similarly, Shea butter a major ingredient in most creams and soap is derived from the Shea butter tree (*Vitellaria paradoxa*). The bark of Acacia *senegal* produces gum arabic which is used in the manufacture of writing ink, hair glazing cream, mucilages for pharmaceuticals, and glues in plywood industries.

Apart from the recreational benefits provided by natural vegetation in general, members of the host communities have spiritual/religious attachments to some species in the study area. For instance, the fruit of the Date palm, Phoenix dactylifera. This plant, belonging to the family

Arecaceae has a lot of traditional and cultural significance. It has been in cultivation since 6000BC. It was mentioned more than 50 times in the Bible and more than 20 times in the Quran.

Many members of the host community depend on wild animals as their main source of animal protein. Apart from their aesthetic value and source of protein, the skin of some of the species are raw materials for the hide and skin Industries. These are: Black cobra, *Naja melanoleuca*; Green mamba, *Dendraspis* sp; and Puff adder, *Bitis arientans.*

Land Use: Within the proposed project site, the predominant land use classes are farmland and fallow field. Farmland covers an estimated 86.49 ha, representing 43% of the total area covered by the proposed project site. Fallow field covers an estimated area of 83.039 ha, representing 41% of the total proposed project site area. Built-up area constitutes the least land use area covered within the project site at 0.01% of the proposed project site area. The predominant land cover within the study area is fallow field, which covers about 46% of the total area. This is followed by farmland, representing approximately 35% of the total area. The least land cover type observed in the area is water body, which covers an estimated 0.02% of the study area.

Administrative Set-up: The Emir is Head/Chairman of the Dutse emirate council and is supported by Councilors, District Heads, Village Heads and Ward Heads. Ward Heads adjudicate on cultural and civil matters that are within their ward purviews. This includes hearing and settling of disputes and non-criminal cases. Issues that are not satisfactorily resolved at the ward level is taken to the Barden Kude (Village Head). In the event that any matter is beyond the Barden Kude, or parties disagree with the judgment of the Barden Kude, the matter goes to the Hakimi (District Head). It is only when a case is not resolved by the district head that it goes to the Emir and his cabinet Counselors.

Demographic Characteristics: The total population of the project area and its area of influence is estimated at 5,180. The ratio of male to female respondents is 73:31. This representation can be adjudged to be reasonably gender fair on the consideration that females in the project area are culturally restrained from public accessibility. Majority of the persons in the project area are between 20 and 44 years old with 97% of the respondents being married while 3% are single. Early marriages are common in the project area and 46% of the married men have more than one wife, while 54% are monogamists. The proportion of persons with two wives is 36%; those with three wives are 6% while those with four wives constitute 4%. On average there are 6 children per household. The key demographic characteristics are summarized as below;

89 vulnerable persons were recorded in the project area including 52 males and 37 females. The category of vulnerability includes those above 60 years old, orphans, unemployed and persons physically disabled. During payment of compensation or provision of employment, members of the vulnerable group may be disadvantaged to access the opportunities due to their respective vulnerability conditions; but special attention can be paid to them to ensure that they have equal access/benefit with others that are not vulnerable.

Muslims dominate the project area and the people are known for respect for elders which is enshrined in their culture. The predominant language spoken is Hausa. The women dress in Hijab. The staple food of the people of the project area are 'Tuwo' (corn millet), and 'Tuwon-Shinkafa' (rice millet). These foods are accompanied with Hausa soup delicacies such as

Miyan-kubewa and *Miyan-taushe*. Eid-el-Fitr and Eid-el-Kabir and the Gani (Durbar) celebrations are the widely religious and cultural celebrations witnessed in the study area.

Regarding level of educational attainment those with primary education are highest in number and account for 34% of the respondents. This is followed by the proportion of people with Islamic education which stands at 28%, and secondary education (10%). Those without any form of education are about 25% while the proportion of persons that have attained tertiary education is 3%.

Given the rural agrarian nature of the communities within the project area, most people within the active work force group engage in one form of agro-based activity or the other to fend for themselves and families. The common beliefs however is that those in farm based occupations are unemployed. This perception may have been based on the account of low income associated with farm based activities in the localities or on the fact that many of those in agro-based employment engaged in it for lack of alternative and therefore, do not have job satisfaction. Assessment of unemployment statistics in these local rural areas therefore is fraught with the challenges of definition of scope. In one definition, all the persons such as artisans, farm owners and farm based laborers might be catalogued as employed since they work and earn a living from their activities. On the other hand, some farmers and laborers without constant job/activities or those without job satisfaction can be graded as unemployed. Based on the later definition, the population of the unemployed in these communities is as high as one-third of its population.

Aside crop farming as the primary occupation in the project area, livestock rearing also features prominently. For example, many households own livestock such as cow, goat, poultry and sheep. Ownership of cow accounted for about 50% of the livestock even though the herd of cow owned is small (about 1 to 3 cows). At least, 30% of the households own or rear goats with some having as many as 10 to 16 in stock. Those who have poultry are many but, they are mostly at subsistence level as the average number of chicken owned per household ranged from 3 to 16 only.

Whereas farming is the main source of livelihoods, production is low and income from farming activities appear to be quite unsustainable for many households, and justifies the assumption that majority of the people of the project area are living in extreme poverty. Household income is generally low in the project area with about 38% of the people earning less than N15, 000 per month while about 24% earn between N15, 000 to N29, 000. In cumulative terms, about 62% of households in the project area earn less than N30, 000 per month. Given the average number of persons in a household as eight (children plus husband and wife) the average disposable income per head for each household is N3,625 per month or N120 per day or equivalently USD 0.6. The proportion of people who earn between N100, 000 and N300, 000 per month is only about 4%. The low income scenario is connected with the undeveloped and subsistence based agricultural practices, characterized by poor market accessibility, poor intra community and farm access road, lack of processing and storage facilities, lack of credit facilities as well as unavailability of power/electricity.

Social Infrastructure: Only three primary schools are serving the five communities in the project area and their environs. The situation of the primary schools is even worsened by their

dilapidated conditions and dearth of learning facilities. There are no healthcare facilities in the project area; the nearest health facility to the people is the General Hospital in Dutse town which is located about 5 km away in Dutse town. Although taxis and tricycles are used for transportation within Dutse town, the same cannot be said about the villages situated within the project area. Due to poor access to road network, vehicles do not find their ways into the project area and therefore constrains the people and their goods to be conveyed by motor-cycle and cow carts. Cost of transport from the project area (about 3.4km) to Dutse town by motor cycle is N100 and cost even higher on wet days. The project will construct one access road that the community can use to ease their travel constraints. As shown on the map below the access road will as much as possible use existing roads and paths as a means to minimize impact on land use. The access road construction will mostly consist in upgrades that will result in road quality improvement for the surrounding community.

Communication: The entire project area has a good telecommunication coverage network. Available network providers in the area are MTN, Globacom, Airtel and Etisalat.

Access to Water: Available to the communities of the project area are a few hand pump-boreholes but no pipe borne water. About 50% of the people of the area depend on shallow hand dug wells water for drinking, 44% depend on borehole while water vendors service 6% of the population mainly of those within the Mechanized settlements. Many villagers do trek long distances spanning about 30 to 50 minutes to fetch water. This poses some difficulty to the people against the backdrop that most families are large and require more number of trekking trips to fetch water that will be enough for their daily water consumption needs. The project will not impact on any water source during construction and operation.

Markets: The Emirate is exceptionally well endowed with major agricultural and livestock markets principally (Shuwarin, Sara, and Kiyawa) holding on Mondays, Tuesdays, and Fridays, respectively. They are conveniently situated along the major roads passing through the Emirate. The project is not expected to disrupt the operation of these markets.

Electricity Access: The communities in the project area are not connected to the national grid and therefore, lack access to electricity. The use of hurricane lamp is prominent as a means of household energy while other sources of household energy are private generators and use of touch light. Firewood is used for cooking in all households in the project area. The project is not expected to have in impact on woodlots that would limit the community's access to biomass. When asked if they will be willing to pay for electricity bills when the service is provided, the people affirmed their willingness to pay with about 45% of them willing to pay on the average N500 monthly.

Solid waste management: is poorly handled and is characterized by open dump, disposal in nearby bush and by burning. Poor solid waste management is an environmental concern as it causes air pollution and could contaminate surface and underground water which could have far reaching adverse health impacts on the population in the area. The project has in place a solid waste management plan from which the community can benchmark and apply to their environs. Pit latrine coverage is over 85% of the population, about 6% make use of water closet, 4% use ventilated pit latrine and bush respectively. Pit latrine and use of nearby bush around the farms were however observed as the means of passing human feces. The direct

consequences of these methods of human waste disposal are not considered to be safe as they could increase the risk of transfer of pathogens between feces and food by flies.

Cultural Heritage: There are no distinct cultural heritages or archeological monuments peculiar to the villages within the project area. However, memorable artifacts in the LGA (Dutse) include the Sawaba Monument and the Dutse Rock.

Community Health Status: The common sicknesses and diseases in the project area include cholera, cough, catarrh, diarrhea, dysentery and pneumonia. Others are malaria, skin rashes and typhoid. The most common with high risk of re-occurrence are malaria, which is the leading cause of morbidity amongst households in the project area.34% of the households have visited hospitals as many as 3 to 4 times in a month for treatment of one or more sicknesses such as malaria, typhoid, skin rashes, cough and catarrh. The nearest health facility to the people of the area is the General Hospital in Dutse town (5 km away).

To remedy these concerns the respondents requested the following from project sponsor or government:

- Provision of medical facility and personnel such as health care centre in their communities;
- Supply of infrastructure such as water, electricity and road. The demand for electricity ranked high, followed by water and road.
- Reduction in poverty level through employment creation and livelihood support that will boost their income in order to better improve on their nutrition.

5. PROJECT ALTERNATIVES

The ESIA considered project alternate analyses for both site location and technical design as follows;

Site Alternatives: Two possible sites were initially identified and assessed for the proposed 80 MWAC solar PV power project in Dutse, Jigawa State. The two sites are: (i) Dutse-3 & Dutse-4 and (ii) Dutse-2 respectively. Dutse-2 site was considered more viable and was chosen as the preferred site because it is a single parcel of land likely to pose fewer environmental and social concerns as opposed to two separate sites which may have larger environmental, social and economic footprints.

Solar Technology Alternatives: The preferred solar technology for the proposed solar plant is the PV system. The PV technology is widely exploited around the world much more than the CSP technologies as it is cheaper and much favored by investors. In addition, the associated environmental risks and impacts with the PV systems are lesser and easier to manage than those of the CSP technologies. Limited access to water in the project area does not favor the application of the Parabolic Trough and Power Tower which require cooling and the surface structures for the CSP systems that are highly reflective may cause significant visual intrusions in the form of glint and glare to inhabitants of affected communities as well as greater disruption to natural landscape and aesthetics.

Photovoltaic Panel Technology Alternatives: Poly-Si cells also tend to be slightly more sensitive to higher temperatures than mono-Si. However, their lower pricing in comparison to mono-Si modules and higher efficiency in comparison to thin-film technology make them by

far the most commonly used solar PV module technology in the market today and thus the preferred technology of choice for the proposed project.

Transmission Line Route Alternatives: A 3.6 km transmission line is required, whereas two options were analyzed, Option 2 that includes an introduction of a small angle point at AP2 to avoid Bakinjeji settlement and to allow the transmission line enter the proposed solar power plant project site was selected as the preferred option.

6. POTENTIAL IMPACTS

The following potential positive and negative environmental and social impacts are anticipated throughout the different project development phases as summarized in Table 6.1 below;

Table 6.1: Potential Environmental and Social impacts

PROJECT PHASES	ENVIRONMENTAL	SOCIAL
POSITIVE IMPACTS		
Pre-construction	__	• Employment of local labor.
Construction	__	• Opening up of access roads to adjoining settlements and remote areas to enhance easy movement of people & their farm produce. • Job creation via direct engagement by NSPDL and indirect employment through economic vendor activities e.g. food selling. • Stimulation of local socioeconomic activities. • Improved livelihood and poverty reduction. • Acquisition of new skills and development of human capacity.
Operation	• Reduction of overall emissions of GHGs as a result of cost effective and renewable source of energy generation. • Avoidance of fossil fuel utilization and reduced GHGs and other pollutant gas emissions. • Promotion of clean energy as an alternative energy source and the establishment of Cleaner Development Mechanism (CDM).	• Creation of employment and business opportunities. • Creation of tourist attraction and recreational resources. • Technology transfer and training of project staff on solar power plant management, operation and maintenance. • Generation of renewable electricity to boost national power supply. • Increased revenue generation to government through permits and taxes. • Savings on cost of diesel for pumping & distributing water to citizens by the Jigawa State ministry of water resources. • Increase power transmission to homes and industries. • Reduction in power outages.
Decommissioning	• Soil stabilization and regeneration • Restoration of flora and fauna habitat	• Increase in land availability for agriculture and other purposes.
NEGATIVE IMPACTS		
Pre-construction	• Deterioration of local air quality due to the release of fugitive dusts & gaseous pollutant emissions • Noise disturbances from equipment & truck traffic. • Loss of vegetation/habitat fragmentation. • Predisposition of soil to erosion • Generation of various waste streams associated with packaging of the equipment	• Loss/depletion of farm land. • Loss of land based livelihood and exacerbated poverty. • Loss of economic trees including medicinal herbs. • Grievance & conflicts over land resettlement & compensation. • Loss of ecosystem provisioning services e.g. economic trees • Traffic congestion & increased risk of RTA and Injuries. • Risk of security breaches and threat to lives and properties. • Risks of exposure to occupational health and safety hazards, accidents and injuries • Management of community of expectations

PROJECT PHASES	ENVIRONMENTAL	SOCIAL
Construction	• Deterioration of local air quality. • Noise disturbances. • Soil erosion • Pollutant release and potential soil and groundwater contamination. • Generation of hazardous wastes. • Generation of packaging wastes	• Change in land use pattern (land conversion/transformation) from agro-forestry to industrial use. • Increased traffic and attendant risk of RTA and Injuries. • Risk of communicable & vector-borne diseases such as STDs including HIV/AIDS, malaria. • Threat to community safety and security. • Increase demand on existing health & sanitation infrastructure • Increased social vices/crimes and dilution of indigenous culture, norms and traditions in nearby communities • Risk of worker exposure to OHS hazards, accidents and injuries.
Operation	• Generation of industrial/ hazardous wastes • Soil contamination form leachates of hazardous wastes. • Potential for fire outbreak due to failure of electrical installations • Pollution and hazardous substances management.	• Risk of electrocution. • Visual intrusion and disruption to aesthetics. • Risk of worker exposure to OHS hazards, accidents and injuries.
Decommissioning	• Air quality deterioration • Generation of industrial and hazardous waste. • Soil contamination from indiscriminate dumping of wastes.	• Traffic Congestion and increased risk of RTA and Injuries. • Risks of occupational accidents and injuries to workers. • Loss of employment

Climate Change

The project will boost electricity generation in Nigeria and reduce dependency on hydrocarbon and other non-renewable sources which will result in significant reduction of emission of GHGs in two major ways:

- Generation of the 80 MWAC electricity from the sun will not lead to emission of GHGs and thus offsetting emission which would have otherwise been emitted from the generation of equivalent amount of electricity from other sources such as hydrocarbon, coal amongst others.
- The electricity generated will be utilized by households and businesses who would have otherwise continued their reliance on off-grid petroleum powered generators contributing significantly to the release of GHGs and climate change
- The project will result in overall less water intake compared to its fossil fuel equivalent
- The project will also reduce the need for finite resources dependence for Nigeria

7. ENVIRONMENTAL MANAGEMENT PLAN (ESMP)

The ESIA has developed an ESMP to manage the residual environmental and social impacts associated with the project development works following identification and analysis of all the identified potential environmental and social impacts. The ESMP contains mitigation measures developed in line with the hierarchy of mitigation with their associated cost, names of the responsible implementing units/agencies, monitoring regimes for the adopted performance indicators and evaluation to assess both compliance and performance as summarized in Table 7.1 overleaf;

Table 7.1: Environmental and Social Management Plan (ESMP)

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
A	***PRE-CONSTRUCTION PHASE:*** **LAND ACQUISITION**										
1	**Impact on Land Owners/Users** Loss/depletion of farm land	Satisfactory compensation implementation Social justice and sustainability	• Develop and implement a Resettlement Action and Livelihood Restoration Plan to compensate affected persons and/or communities. • Avoid forced eviction of farmers from their farmlands. • Ensure all issues relating to compensation are handled in a transparent, consistent and equitable manner. • Ensure adequate engagement with affected persons and communities throughout the process of land acquisition. • Ensure disclosure of relevant information and participation of affected communities and persons continue through implementation, monitoring and evaluation of compensation payments. • Ensure affected land owners are adequately compensated for loss of land and economic crops at full replacement cost. • Provide alternative income earning opportunities such as credit facilities, training or employment opportunities to assist affected persons. • Provide opportunities to affected persons and communities to derive appropriate development benefits such as employment, from the project. • Establish a grievance mechanism to receive and address specific concerns about compensation.	Developed RALRP Evidence of stakeholders Engagement. Grievances and conflicts. Alternative livelihood. New skills acquired No of employed locals	• Increase in direct and indirect jobs. • No of people trained. • No of benefitting locals. • No of complaints received • No of grievances received/ resolved	• Visual Observation • Survey • Participation records/ minute of meetings	Host communities	Quarterly	NSPDL	FMEnv Jigawa State Ministry of Lands Invest Jigawa Dutse LGA	700,000
2	Loss of land based livelihood.										
3	Loss of economic trees including medicinal herbs.										
4	Grievance and conflicts over land resettlement & compensation.										
5	Exacerbated poverty condition due to loss of access to land (means of livelihood).										
6	**MOBILIZATION OF PERSONNEL, MATERIALS AND EQUIPMENT TO SITE**										
	Impact on Air Quality & Noise Level Deterioration of local air quality due to the release of fugitive dusts and gaseous pollutant emissions from heavy duty vehicles.	To minimize fugitive dust and exhaust emissions	• Implement dust suppression techniques such as, use of (i) water suppression for control of loose soil materials on unpaved surfaces and (ii) covered trucks for transporting loose materials that may generate dust. • Ensure emissions from road and off-road vehicles comply with specified national standards. • Conduct regular visual inspection of dust pollution and ensure appropriate intervention if dust levels are high • Pave access roads with gravel to minimize release	Gaseous pollutants such as SO_2, NO_2, CO_2, CO, VOCs, H_2S, TSP. Vehicular emission • Evidence of dust control	FMEnv air pollutants permissible limit	In-situ Air Quality Measurement	Access Road Air quality sampling points (See Chapter 4)	Daily	EPC Contractor	FMEnv JSME JISEPA	1,000,000 for monitoring activities during pre-Construction phase. 1,000,000 for Air

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
			of dust. • Implement routine preventative maintenance including tune-ups on all heavy equipment to meet the manufacturer's specification in order to ensure efficient combustion and minimal emissions. • Ensure speed limits are reduced and enforced especially on unpaved roads to minimize airborne fugitive dusts. • Train drivers/ workers on proper operation of vehicles and equipment to include fuel efficiency and anti-idling techniques. • Limit soil disturbance activities and travel on unpaved roads during periods of high wind. • Reroute access roads away from immediate outskirt of communities as much as possible.	measures • Vehicle maintenance records • Vehicular speed limit • Drivers' training records						Quality In-Situ Equipment
7	Noise disturbances from equipment and truck traffic.	To reduce potential noise impacts on affected communities, workers and wildlife	• Restrict all haulage and noise generating activities to working hours during the day when noise is better tolerated. • Select and use (where feasible) vehicles and equipment with lower sound power levels. • Install suitable mufflers on engine exhausts & compressor. • Ensure the maintenance of all equipment in accordance to manufacturer's specifications. • Ensure vehicle travelling within and around project area are operated in accordance with speed limits to reduce noise levels. • Develop a mechanism to record and respond to noise complaints. • Provide and enforce the usage of hearing protection devices (ear plugs/muffs) for workers exposed to noise levels >90 dB(A) for a duration of more than 8 hours per day. • Institute a Hearing Protection Program for workers in work areas with noise in excess of 85 dB(A).	• No of Complaints from affected communities • Working hours • Vehicle / equipment maintenance records • No of workers trained • Usage of ear plugs/ muffs	• Noise Levels (Not to exceed 90dB(A) for 8 hours working period	• In-Situ Measurement of noise level	Along access Roads Noise level sampling points (See Chapter 4)	Daily	EPC Contractor	FMEnv JSME JISEPA	600,000 for Noise Level In-Situ Equipment
	Impacts on Affected Communities (Pedestrians, Motorcyclists – Community Health, Safety & Security)		• Ensure regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents such as those caused by equipment malfunction or premature failure.	• Vehicles maintenance records. • Drivers'	No of speed limit violations. No of signal violations.	• Visual Observation • Interview	Along access roads Project site	Montly	EPC Contractor	FRSC Police	500,000 for monitoring activities during

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
8	Traffic Congestion & increased risk of RTA and Injuries (Traffic Safety).	To minimize potential impacts of traffic congestion and risk of RTAs	• Engage drivers with appropriate class of driving license and at least three years of driving experience. • Train drivers on defensive driving techniques, haulage safety and pedestrian safety. • Develop and implement a Traffic Management Plan (TMP) and safe traffic control measures shall include: - Establishment and strict enforcement of speed limits; - Employment of appropriate road safety signage and on-site trained flag-men with high-visibility vests to direct traffic and warn of dangerous conditions; and - Minimization of movement at peak hours of the day. • Ensure coordination with emergency agencies to ensure that appropriate first aid is provided in the event of accidents. • Where possible, use locally sourced materials to minimize transport distances.	license. • TMP submitted. • Records of Drivers' Training •Speed control measures	No of congestion occurrences & queue lengths					pre-construction
9	Risk of injuries to pedestrians and motorcyclists from collision with moving heavy duty vehicles (Pedestrian Safety).										
12	Employment of local labour.	To enhance positive impacts of job creation and improve standard of living in the affected communities	• Develop and implement a Labour and Employment Plan (LEMP) in line with international employment guidelines and IFC Performance standard 2: Labour and Working Condistions. The Plan should detail percentages and numbers of workforce to be sourced from the local areas and various demographics. • Notify community's representatives and Dutse LGA of the specific jobs and skills required for the project prior to commencement of recruitment. • Initiate training and skills development programs prior to the commencement of construction to ensure members of local workforce are up-skilled and can be employed on the project or other industrial developments in the area. • Ensure construction jobs are targeted to the local people. • Train members of nearby communities to enable them find employment opportunities within the proposed solar project and other industrial developments in the area.	•Developed LEMP. •No of employed locals •Evidence of job notification in affected communities and Dutse LGA. •No of locals trained.	National Labour Laws. Proportion of community members with improved income. No of employed persons.	Interview Records	Site office Affected communities	Periodic	EPC Contractor	Federal Ministy of Labour (FML) Dutse LGA	300,000

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
			• Promote the fair treatment, non-discrimination, and equal opportunity of workers. • Protect workers, including vulnerable categories of workers such as women and migrant workers. • Promote safe, healthy working conditions & the health of workers. • Provide a grievance mechanism for workers to freely raise workplace concerns. • Prohibit employment of minors. • Avoid the use of forced labor.								
13	Respiratory and eye related problems from exposure to fugitive dusts and gaseous emissions.	To minimize fugitive dust and exhaust emissions	• See A6 • Provide and enforce usage of appropriate PPE.	Gaseous pollutants such as SO2, NO2, CO2, CO, VOCs, H2S, TSP	FMEnv air pollutants permissible limit	• In situ • Complaint records	Affected communities Project site Access roads	Periodic	EPC Contractor	FMEnv JSME	—
14	Risks of accidents and struck-by injuries from the movement of vehicles	To promote safe and healthy working conditions as well as protect the health of workers	• Plan and segregate the location of vehicles traffic, machine operation and walking areas. • Control vehicle traffic through the use of one-way traffic routes. • Establish speed limits and use on-site trained flagmen with high visibility vests or outer clothing covering to direct traffic. • Ensure mobile equipment is outfitted with audible reverse alarms. • Provide & enforce usage of appropriate PPE.	• Speed limits • Presence of flagmen • Audio reverse alarms on vehicles • Usage of PPE	No of speed limit and signal violations.	Visual observation HSE Records	Access roads and project site	Weekly	EPC Contractor	FML	—
15	**SITE PREPARATION AND CLEARING**										
	Impact on Air Quality & Noise Level Deterioration of local air quality due to release of fugitive dusts & gaseous pollutant emissions from land clearing activities & heavy duty vehicles.	See A6	See A6	See A6	See A6	See A6	See A6	See A6	See A6	See A6	--
16	Noise disturbances from operation of machineries and motorized equipment.	See A7	See A7	See A7	See A7	See A7	See A7	See A7	See A7	See A7	--
17	Impacts on Ecology and Biodiversity	To Protect and conserve	• Avoid the removal of natural vegetation and Trees to the extent possible, especially species of	Clearly defined	Available number and	Biodiversity survey	Project site and	Periodic	EPC Contractor	FMEnv JSME	--

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
	Loss of vegetation/ habitat and natural carbon sequestration from vegetation clearing	biodiversity and promote sustainable management of all living natural resources.	Acacia senegal and Phoenix dactylifera which mostly occur in isolation. • Restrict removal of natural vegetation to construction site only. • Clearly define work areas to avoid unnecessary disturbance of areas outside development footprint. • Retain all short (<18 cm) native vegetation to the maximum extent possible. • Retain native root structure to facilitate recovery of vegetation cover, retain soil stability and minimize erosion. • Compensate for economic trees at full replacement cost. • Revegetate temporary disturbed areas with native species immediately following the completion of construction activities to ensure all temporary use areas are restored. • Develop and implement a project specific Integrated Vegetation Management Plan (IVMP) to revegetate part of the solar array area. • To the extent possible schedule vegetation clearing to occur outside of bird breeding season. • Implement soil conservation measures such as stockpiling topsoil or gravel for the remediation of disturbed areas. • Avoid the use of herbicides on site.	boundaries of protected areas	diversity of plant species within baseline conditions		adjoining areas				
18	Loss of ecosystem provisioning services such as fuel wood & economic trees										
19	Predisposition to soil erosion due to the removal of vegetal cover and exposure of soil surfaces to rain and wind.	To prevent soil erosion									
20	**Social Impact** Employment of Labour	See A12	See A12	See A12	See A12	See A12	See A12	See A12	See A12	See A12	--
21	**Impacts on Occupational Health and Safety** Respiratory and eye related problems for workers due to exposure to fugitive dusts and gaseous emissions.	To promote safe and healthy working conditions as well as the health of workers	• See A6 • Provide and enforce usage of appropriate PPE.	See A6	See A6	See A6	See A6	See A6	See A6	See A6	--
22	Risks of worker exposure to noise emanating from machineries and associated safety concerns from poor communication		• Develop and implement project specific OHS Plan. The OHSP will inter-alia entail: • Provision of health and safety orientation training and hazard specific training; • OHS responsibilities;	• OHS Plan developed • Compliance • with OHS Plan.	• Increase/ decrease in Lost Time Injuries (LTI).	• Visual observation • Interview. • HSE Records	Project site	Monthly	EPC Contractor	FML	--

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
23	Risks of worker exposure to poisonous plants & dangerous animals e.g. snakes		• Site health and safety rules and instructions; • Safe work practices; • Incident/Accident reporting; • Emergency contingency plan; • Provision and enforcement of use of PPE. • Implementation of explicit plans regarding initial response, triage, communication and transportation of casualties in the event of medical emergencies; • Prohibition of drug & alcohol use by workers while on the job; • Provision and training of first aiders at site.	• No of workers trained • No of accidents & injuries	• First Aid care. • No of near misses. • % of workers trained.						
24	Risks of accidents and struck-by injuries from the movement heavy duty vehicles										
B	***CONSTRUCTION PHASE:* CONSTRUCTION/ IMPROVEMENT OF INTERNAL AND EXTERNAL ACCESS ROADS**										
1	**Impact on Air Quality & Noise Level** Deterioration of local air quality due to the release of dust from exposed soil surfaces and exhaust emissions from equipment and vehicles.	See A6	See A6	See A6	See A6	See A6	See A6	See A6	See A6	FMEnv JSME JISEPA	1,000,000 for monitoring activities during construction phase
5	Job creation and increased business	See A12	• Ensure local and regional procurement targets are included in the project's LEMP • Include requirements for local employment in the contract establish with EPC/O&M Contractors and require that the contractor recruits in accordance with the NSPDL's recruitment policy and request for proposal (RFP) documents. • Also see A12	See A12	See A12	See A12	See A12	See A12	See A12	FML Invest Jigawa Dutse LGA	300,000
7	Risk of communicable diseases such as STDs including HIV/AIDS from influx of temporary construction workers.	To avoid negative impacts on the health and safety of workers & Affected Community	• Institution of HIV prevention program to include peer education, condom distribution & Voluntary Counseling and Testing (VCT). • Undertaking health awareness and education initiatives on STIs amongst workers and in affected communities.	Level of Awareness and Education No of new STI cases	Level of awareness and knowledge of preventive measures. % of STI cases among workforce and communities	Visual observation Records Interview	Project site Affected communities Health care centres Site clinic	Quarterly	NSPDL EPC Contractor	FMoH JSMoH Dutse LGA	500,000
	ERECTION OF TOWERS AND INSTALLATION OF OVERHEAD HV TRANSMISSION POWER LINES										

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
27	Risks of fall from working at height and other related occupational accidents and injuries to workers.	To promote safe and healthy working conditions as well as the health of workers	• Develop and implement project specific OHS Plan. (See A22-24). Specifically: - Training of workers on proper use of scaffolds and ladders. - Usage of fall prevention and protection devices, including safety belt, full body harnesses, shock absorbing lanyards or self-retracting inertia and other fall arrest devices attached to fixed anchor point or horizontal life-lines to protect workers. - Provision of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall.	• See A22-24 • No of workers trained • Availability of fall prevention and protection devices	See A22-24	Visual observation Interview	Project site & Along RoW	Monthly	EPC Contractor	FML TCN	300,000
C	***OPERATION PHASE:* OPERATION OF PV PANELS AND OTHER ASSOCIATED COMPONENTS**										
5	**Social Impact** Creation of employment and business opportunities	To enhance positive impacts of job creation and improve standard of living in the Jigawa State and Nigeria	• Ensure maintenance jobs are targeted to the local people. • Ensure technology transfer by training indigenous people on solar plant management, operation and maintenance • Also see A12	No of employed locals. No of locals trained.	Applicable National Labour Regulations and Laws.	Interview Records	Site office	Periodic	O&M Contractor	FML	300,000
6	Technology transfer and training of project staff on solar power plant management, operation and maintenance.										
7	Increased revenue generation to government through permits and taxes										
8	Savings on cost of diesel for pumping & distributing water to citizens by the Jigawa State government ministry of water resources.										
10	Visual intrusion and disruption to aesthetics especially due to reflective surfaces of PV panels.		• Ensure selection of solar panel backs that are colour-treated to minimize visual contrast with natural landscape setting. • Ensure coatings and painting on selected PV panels and associated infrastructures have little or no reflectivity. • Retain natural vegetation wherever possible within the solar plant.	No of complaints	PV technology conforming with international standards	Records Interview	Solar Plant	Annually	O&M Contractor	Dutse LGA	100,000
11	**Impact on Community Infrastructure and OHS** Potential for fire outbreak due to failure of electrical installations	To prevent fire outbreak	• Ensure solar plant is designed and constructed in full compliance with Nigeria's building codes, Fire Service regulations, other applicable emergency and legal/insurance requirements, and in accordance with an internationally accepted life and fire safety (L&FS) standard. • Use fire resistant materials.	Evidence of fire safety and protection equipment	No of fire incidences	Visual inspection Interview	Solar Plant	Annually	O&M Contractor	Fire Service	300,000

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
			• Install appropriate fire safety & protection system & equipment. • Train workers on fire prevention techniques and the use of different fire extinguishing agents and equipment • Ensure routine inspection and prompt repair of any malfunctioning electrical installations. • Develop and implement Emergency Response and Contingency Plan to respond to on-site emergency issues	No of workers trained Developed Emergency Plans							
	ROUTINE MAINTENANCE AND SERVICING										
17	Impact on Soil and Land Generation of industrial/ hazardous wastes (insulating oils e.g. polychlorinated biphenyls (PCBs), liquid petroleum fuels, waste water, cleaning agents and solvents, damaged panels, transformers, batteries, herbicides for weed control, etc.) during routine maintenance. Risk of worker exposure to hazardous chemicals.	See B16	• Develop and Implement a site-specific Waste Management Plan (WMP) that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring. • Establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling and finally disposal of wastes. • Ensure the WMP address all solid and liquid waste likely to be generated during the implementation of the project • Implement feasible waste prevention, reduction, reuse, recovery and recycling measures. • Identify and implement pollution prevention opportunities such as use of material substitution for less hazardous alternatives, recycling and waste minimization. • Minimize hazardous waste generation by segregating hazardous from nonhazardous wastes. • Create waste collection areas with clearly marked facilities such as colour code bins and provide equipment for handling waste. • Ensure that hazardous wastes are stored in properly labelled closed containers placed away from direct sunlight, wind and rain and provide secondary containment with 110% of storage containers.	See C17	See C17	See C17	See C17	Periodic	O&M Contractor	FMEnv NESREA JSME	500,000

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
			• Ensure hazardous materials and waste storage areas are formally designated and access restricted to authorized persons. • Ensure proper disposal/treatment of waste by government								
D	***DECOMMISSIONING PHASE:* REMOVAL OF PV PANELS AND EQUIPMENT, DEMOLITION OF STRUCTURES AND EVACUATION**										
1	**Impact on Air Quality** Air quality deterioration from the release of dust during demolition activities and exhaust emissions from vehicular equipment.	See B1	See B1	See B1	See B1	See B1	See B1	Weekly	O&M Contractor	FMEnv JSME JISEPA	500,000
4	**Impact on Community/ Worker's Health & Safety** Traffic Congestion and increased risk of RTA and Injuries (Traffic Safety).	See A8	See A8	See A8	See A8	See A8	See A8	Weekly	O&M Contractor	FRSC	200,000
	SITE REMEDIATION INCLUDING LEVELLING, FILLING AND RE-VEGETATION										
6	Soil stabilization and regeneration	To restore the site to pre-project conditions	• Develop and implement a site reclamation plan to ensure that the site is rehabilitated and restored to a stable state. • Re-contour/grade site to blend with natural topography • Re-vegetate all exposed soil surfaces with indigenous plant species. • Install erosion control structures to prevent erosion and run-offs in order to allow planted vegetation to grow to a self-sustaining state.	Developed site reclamation Plan % vegetal cover Evidence of erosion control structures	Plant distribution and diversity in Adjoining farmlands	Visual observation	Solar plant	periodic	O&M Contractor	FMEnv JSME JISEPA	500,000
7	Increase in land availability for agriculture and other purposes										
8	Restoration of flora and fauna habitat										
9	**Social Impact** Loss of employment	Acquisition of new skills and development of human capacity especially by locals employed to work during construction.	• Carry out an analysis of alternatives to retrenchment e.g. employee capacity building programs; long-term maintenance works etc. prior to implementing any collective dismissals after construction. • Develop and implement a retrenchment plan to reduce the adverse impacts of retrenchment on workers. • Ensure compliance with all legal and contractual agreement with public authorities, workers and their organization.	Acquisition of new skills and development of human capacity especially by locals employed to work during construction.	Acquisition of new skills and development of human capacity especially by locals employed to work during construction.	Acquisition of new skills and development of human capacity especially by locals employed to work during construction.	Acquisition of new skills and development of human capacity especially by locals employed to work during construction.	Acquisition of new skills and development of human capacity especially by locals employed to work during construction.	O&M Contractor	FML	300,000

S/N	Significant Associated and Potential Impacts	Desired Outcome	Enhancement/Mitigation Measures	Parameters to be Measured	Performance Indicator	Method of Measurement	Sampling Location	Frequency of Monitoring	Responsibility		Monitoring Cost (N)
									Implementation	Supervision	
			• Ensure all workers receive notice of dismissal and severance payments mandated by law and collective agreements in a timely manner. • Provide a grievance mechanism for workers to raise workplace concerns.								
	Monitoring Cost									**8,900,000.00**	

8. ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM

The ESMP incorporates thematic plans that will be prepared by NSPDL and EPC/O&M contractors to address specific potential environmental and social impacts. NSPDL shall develop a RALRP[3] while the EPC/O&M Contractors will be required as part of contractual requirements to develop site-specific ESMPs detailing how the management actions contained in this ESMP will be implemented. The contractors will also be required to develop environmental and social management plans as it relate to their construction and operational activities. Such management programs shall include the following:

- Waste Management Plan
- Spill Prevention and Emergency Response Plan
- Traffic Management Plan
- Erosion Control Plan
- Integrated Vegetation Management Plan
- Occupational Health and Safety Plan
- Security Plan
- Labor and Employment Plan
- Emergence Response Management Plan

Implementation Mechanism: The ESMP implementation and monitoring is anticipated to require increased resources during the first three years after construction start, including the following profiles and physical needs:

- Community Liaison Officer (CLO) in charge of communication with communities, socializing with the project, selection of local employees for training, etc.
- Compliance officer in charge of supervision of specific projects, grievance management, reporting to the lenders, etc.
- E&S officer in charge of local government affairs, produce materials for CLO(s), supervise Livelihood Restoration Programme consultant(s), etc.
- Vehicles, community office, travels, materials & events, telecommunications, etc.

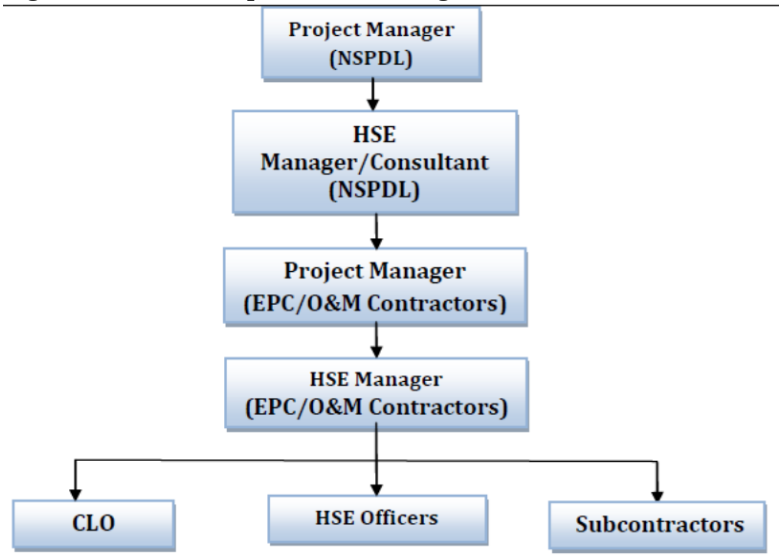
ESMP Implementation Arrangement: The selected EPC and O&M contractors shall provide adequate human and financial resources on an ongoing basis to achieve effective implementation of the ESMP and assure continuous improvement of environmental performance. The environmental and social management personnel will comprise of the following; NSPDL Project Manager (PM) and HSE Manager/Consultant as well as the EPC/O&M contractor's Project Managers, HSE Manager, HSE Officers, Community Liaison Officers and subcontractors as detailed out in Figure 8.1 overleaf. The duties of the personnel shall be as follows;

- The Project Manager shall be responsible for the implementation of the ESMP and ensuring that the environmental and social requirements are satisfied.
- The Health Safety and Environment Manager/ Consultant with appropriate training and experience shall be employed by NSPDL for the duration of the construction phase of the project.
- The Contractor shall appoint a Project Manager who shall be responsible for onsite implementation of the ESMP. The EPC Contractor's PM is answerable to the NSPDL PM through the HSE Manager/ Consultant for all Health Safety and Environment issues related to the construction of the project.

[3] Resettlement Action and Livelihood Restoration Plan

- The Contractor shall appoint a suitably qualified Health Safety and Environment Manager who shall be responsible for the coordination of all HSE activities of the contractor.
- The Contractor's Health Safety and Environment Officers shall be answerable to the Health Safety and Environment Manager. The Health Safety and Environment Officers shall be deployed to the project site to perform the following functions regarding the implementation of the ESMP.
- The Community Liaison Officers shall be the main contact between affected community representatives and the EPC Contractors and assist in resolving all disputes between EPC contractors and the affected communities in line with the agreed grievance handling procedure.

Figure 8.1: ESMP Implementation Organizational Structure



Training and Competency: NSPDL shall ensure that all persons that have roles to play in the implementation of the ESMP and management system are competent on the basis of appropriate education, training or experience. To this end, NSPDL shall ensure that EPC and O&M contractors identify the training needs for their employees at each relevant function and level, with direct responsibilities for ESMP implementation. Consequently, the EPC and O&M contractors shall be required to develop training plans to include project specific training programs, with respect to the different aspects of the ESMP implementation against significant potential environmental and social impacts of the project, management and monitoring actions, regulatory requirements and specific roles and responsibilities. This is to ensure that they are fully aware of the relevant aspects of the ESMP and are able to fulfill their roles and functions. The details of the planned training programme are shown in the Table 8.1 overleaf.

Table 8.1: Proposed ESMP Training

Capacity Building Activity	Proposed Topics	Objectives	Target Audience	Duration	Estimated Budget (N)
Module 1: Training on Environmental and Social Management Plan Implementation	• Overview of Environmental Impact Assessment • Overview of Potential Impacts of Project • Environmental Pollution & Control • Environmental and Social Management Plan • Basic Environmental Management • Environmental Performance Monitoring – Monitoring Mitigation Measures in ESMP • Environmental Reporting	To enhance competence in environmental sustainability and regulatory practice	NSPDL representatives, relevant staff of FMEnv (EA Dept), JSME, JISEPA, other relevant MDAs, LGA departments, EPC Contractors, NGOs, CBOs.	5 days	5,000,000
Module 2: Training on Construction HSE	• Introduction to Construction HSE • Overview of Health and Safety Hazards in Construction • Incidents: Causation, Investigation & Reporting • Excavation Safety • Construction Site Inspection • Personal Protective Equipment	To promote safe & healthy working conditions as well as the health of workers and regulators who may be involved in monitoring during project implementation	NSPDL representatives, relevant staff of FMEnv (EA Dept), JSME, JISEPA, other relevant MDAs, LGA departments, EPC Contractors, NGOs, CBOs.	5 days	3,000,000
	TOTAL			**10 days**	**8,000,000**

Institutional Arrangements: For this ESMP, the Federal Ministry of Environment (FMEnv) through the EA Department and relevant agencies will play the role of lead environmental regulator, overseeing compliance requirements, granting consent and also monitoring or providing supervisory oversight for the project.

- The Jigawa State Ministry of Environment (JSME) will be the environmental compliance overseer at the state level. In addition to other statutory functions,
- JSME shall ensure that all project activities comply with the State environmental laws and requirements and perform regular compliance monitoring and periodic inspection of all the stages of the project.

Other institutions and stakeholders that will be involved in the implementation of the ESMP are as follows;

Table 8.2: Key Stakeholder Groups within the Stakeholder Engagement Plan

S/N	CATEGORY	ROLES & RESPONSIBILITIES
1.	Federal Ministry of Environment	• Lead role - provision of advice on screening, scoping, review of draft ESMP report (in liaison with State Ministry of Environment), receiving comments from stakeholders, public hearing of the project proposals, and convening a technical decision-making panel, environmental and social liability investigations, monitoring and evaluation process and criteria.
2.	TCN	• Coordination of electricity transmission and connection to grid. • Collaboration with EPC/O&M contractors to ensure the implementation of the ESMP especially with regards to the transmission line component of the project. • Supervision of all HSE activities related to the transmission line during construction and operation phase.
3.	Jigawa State Ministry of Environment	• Environmental compliance overseer at the State level • Review of draft ESMP report (in liaison with Federal Ministry of Environment) • Site assessment and monitoring of ESMP implementation.
4.	State Government MDAs (Ministry of Lands, Housing, Urban Development and Regional Planning, etc.,	• Compliance overseer at State Level, on matters of land acquisition and compensation and other resettlement issues, • Other MDAs come in as and when relevant areas or resources under their jurisdiction or management are likely to be affected by or implicated projects. • They participate in the EA processes and in project decision-making that helps prevent or minimize impacts and to mitigate them. These institutions may also be required to issue a consent or approval for an aspect of a project; allow an area to be included in a project; or

		allow impact to a certain extent or impose restrictions or conditions, monitoring responsibility or supervisory oversight.
5.	JISEPA	• Inspection of project premises in order to ensure strict compliance with sanitation and waste management standards in the state. • Collaboration with other MDAs at the State and Federal level, NGOs and Donor Agencies in environmental protection and management especially in areas of waste recycling etc.
6.	Local Government	• Provision of oversight function across subproject in LGAs for ESMP compliance. • Monitoring of activities related to public health, sanitation, waste management amongst others.
7.	Affected Community	• Promote environmental awareness. • Review environmental and social performance report made available by NSPDL. • Provide comments, advice and/or complaints on issues of nonconformity. • Attend public meetings organized by NSPDL to disseminate information and receive feedback.
8.	CDA	• Ensure community participation by mobilizing, sensitizing community members;
9.	NGOs/CSOs	• Assisting in their respective ways to ensure effective response actions, • Conducting scientific researches alongside government groups to evolve and devise sustainable environmental strategies and techniques.
10.	Others/General Public	• Identify issues that could derail the project and support project impacts and mitigation measures, Awareness campaigns.

Estimated Budget for ESMP Implementation

To effectively implement the mitigation and monitoring measures recommended in the ESMP, a total estimated cost of N 43,900,000 has been budget as in Table 8.3 below. The cost of mitigation by the EPC Contractor shall be included in the contract as part of the project implementation cost.

Table 8.3: Estimated Budget for ESMP Implementation

#	ITEM	RESPONSIBILITIES	ESTIMATED COST
1	mitigation	EPC Contractor	To be included in contract cost
		NSPDL (Land Acquisition related cost)	27,000,000.00
2	Monitoring	FMEnv, JSME, JISEPA, FRSC, Police etc	8, 900,000.00
3	Capacity Building	EPC Contractor	8,000,000.00
Grand Total			**N 43,900,000.00**

Communication and Stakeholder Engagement: As a demonstration of its commitment to dealing with project related issues in a positive and proactive manner, NSPDL shall ensure that the EPC contractor, implement and maintain procedures for internal and external communications on environmental and social management issues.

Effective internal communication mechanisms for information dissemination between levels and functions within the organizations shall be implemented. The mechanism shall encourage information to flow top-down, bottom-up and across functional lines amongst those responsible for the implementation of the ESMP. Those with specific role within NSPDL for the ESMP include the Project Manager and HSE Manager/Consultant while those of EPC/O&M contractors include the Project Manager, HSE Manager, HSE Officers and CLO.

NSPDL shall also implement proactive, two-way communication with external parties to report on environmental and social performance and progress and to solicit, receive, document and respond to feedback from the public. Audience for external communication shall include the regulators such as FMEnv, JSME etc, affected communities and other stakeholders. Appropriate approach and strategy that fits the interest of each identified external parties shall be adopted as agreed between the parties.

The NSPDL's PM shall be responsible for external communications on environmental and social concerns of the project through the HSE Manager. Methods of communication may

include meetings, periodic reports, press releases etc. Procedure for external communications shall specifically include measures to (i) receive and register external communications such as complaints, advice, and other specific information regarding the environmental and social concerns of the project from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. NSPDL shall make public available periodic reports on the environmental and social sustainability of the project.

For effective external communication, a project specific Stakeholder's Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) have been designed for the project. It is envisaged that under this project, grievances may result due to one or a mix of the following factors:

- Failure to identify all affected land owners and categories of affected persons and communities.
- Non-payment of compensation.
- Inadequate compensation or valuation of assets
- Delay in disbursement of entitlement.
- Dispute about ownership of land or asset
- Non-participation or engagement of affected persons and communities in compensation negotiation.
- Implementation of project before or without resolving resettlement matters.

At the moment, all the concerned villages within the project area have common cultural practises that govern the way civil cases and grievances including land disputes are resolved. Ward Heads adjudicate on cultural and civil matters that are within their ward purviews. This includes hearing and settling of disputes and non-criminal cases. Issues that are not satisfactorily resolved at the ward level are taken to the Barden Kude (Village Head). In the event that any matter is beyond the Barden Kude, or parties disagree with the judgement of the Barden Kude, the matter goes to the Hakimi (District Head). It is only when a case is not resolved by the District Head that it goes to the Emir and his cabinet counsellors. The stated local grievance redress does not in any way impede the right of dissatisfied parties in any case from seeking for redress through judicial means.

A functional GRC shall be constituted by NSPDL in collaboration with the Dutse local government and the local community. NSPDL will have the responsibility of spearheading the constitution of this committee whose duty is to monitor and review the progress of implementation of the compensation of the affected people and to carry out post implementation social audits. The composition of the committee will include the following: (i.) All the Village Heads (Barden Kude) from the five affected villages; (ii). A representative of the Hakimi (District Head) and (iii) two representatives each from project affected persons in each of the 5 village. The implementation plan for grievance handling is highlighted in the Table 8.4 below.

Table 8.4: Grievance Redress Mechanism

#	Process	Description	Completion Time frame	Responsible Agency/Person
1	Receipt of complaint	Document date of receipt, name of complainant, village, nature of complaint, inform NSPDL/EPC/ O&M	1day	Secretary to GRC at project level
2	Acknowledgement of grievance	By letter, email, phone	1-3 days	Secretary to GRC at project level

#	Process	Description	Completion Time frame	Responsible Agency/Person
3	Screen and Establish the Merit of the Grievance	Visit the site; listen to the complainant/community; assess the merit	7-14 days	GRC and the aggrieved affected person or his/her representative
4	Implement and monitor a redress action	Where complaint is justified, carry out compensation redress	21-30 days	NSPDL/EPC/O&M contractors.
5	Extra intervention for a dissatisfied scenario	Review the redress steps and conclusions, provide intervention solution	2-4 weeks of receiving status report	District head
6	Judicial adjudication	Take complaint to court of law	No fixed time	Complainant
7	Funding of grievance process	GRC logistics and training, redress compensation	No fixed time	NSPDL/EPC/O&M contractors.

Monitoring of Corrective Actions: As part of the ESMP implementation, a project specific monitoring plan has been designed. This plan establishes environmental and social action plans with well-defined desired outcomes and actions to address all significant impacts identified for the proposed project.

Internal monitoring shall be carried out at two levels. The first level of monitoring shall be carried out by the EPC Contractor on an ongoing basis as specified in the monitoring plan. The second level of monitoring shall be carried out by NSPDL. NSPDL shall require supervision and monitoring of its own works in order to ensure that the mitigation measures and actions specified in the monitoring plan and as bound by the contract is satisfactorily implemented. This shall be the main duties of the HSE Manager. Monitoring by the HSE Manager shall be carried out by regular site visits and inspection of EPC contractor's regular monitoring reports.

External monitoring and supervision will be done by FMEnv, JSME, other relevant MDAs, financial institutions and affected communities as may be required. These institutions will check reports received periodically from the NSPDL and carry out inspections and/or audits on their own. Using the monitoring indicators specified in the monitoring plan, each party will seek to measure the project's progress, in a manner that highlights the various objectives in line with national and international environmental and social requirements.

Reporting is essential for conveying information from the monitoring activities. The following reporting procedures have been developed in order to ensure that NSPDL is able to receive feedback from the implementation of the ESMP on an ongoing basis and to take rapid corrective actions if there are issues of non-conformance:

- Monthly Progress and Monitoring Report: to be prepared by the EPC Contractor's HSE manager, providing relevant information on all monitoring activities, and on any specific events, as the case may be. These reports are to be made available to NSPDL and FMEnv/JSME at their request.
- Quarterly Reports: to be prepared by the EPC Contractor, summarizing all observations of the period. Reports will also be made available to NSPDL and FMEnv/JSME accordingly.
- Quarterly Report by NSPDL: based on the EPC Contractor's reports and on own activities. The report shall be made available to FMEnv/JSME and financial institutions upon request.
- Additional Reports according to specific conditions. Most importantly, separate reports will have to be prepared in the case of incidents irrespective of whether or not these give rise to "accidents" involving actual injury, fatality, serious environmental impact

or other serious damage. The procedure for investigating and reporting these incidents shall be included in the OHS Plan for the project.

Auditing: Audit for the proposed project shall be carried out at two levels, namely internal and external audit.

- **Internal Audit:** This shall be undertaken by NSPDL (O&M contractor during operation phase) to ensure there is absolute compliance with its HSE Policy, all the requirements of this EIA/ESMP, all applicable national laws, relevant international policies, guidelines and conventions. The procedure for conducting ESMP audits shall be developed by the NSPDL HSE Manager.
- **External Audit:** This shall be undertaken by the O&M contractor. The frequency of external audit shall be determined by regulators and may likely be carried out every three years once the solar plant commences operation in fulfilment of the law.

Management and Revision of the ESMP: The ESMP is designed to be a dynamic and flexible plan that shall be subject to periodic review by top management to improve overall environmental and social performance of the project.

9. DECOMISSIONING PLAN

At the planned end of the current 20yr life of the project or end of life of any of the project components, NSPDL through the O&M contractor shall develop a comprehensive abandonment, decommissioning and remediation plan that is specific to the project taking into account the most cost-effective and practicable methods, environmental considerations, legal requirements and industry practices at that time. In addition, the plan shall contain an adaptive management component that allows for the incorporation of lessons learned from monitoring data during the operation of the facility. This plan will be submitted to the FMEnv and other relevant regulatory agencies for approval, at least 2 years prior to scheduled abandonment and decommissioning. Decommissioning shall only commence after the approval of the decommissioning plan by the regulatory Agencies.

The plan shall specify all activities that will be undertaken during the decommissioning and abandonment of the project which shall include the following:

- Stakeholders Consultation
- Dismantling and removal of PV panels and other equipment
- Demolition of buildings and structures
- Site remediation/re-establishment of vegetation in order to restore the environment back to pre-project state as practicable possible.
- Assessment of residual impacts, if any.

10. PUBLIC CONSULTATION AND DISCLOSURE

Public participation formed an integral part of the full ESIA process and the consultation of Interested and Affected parties (I&AP's) is key to ensuring adherence to the legal requirements.

Different forms of consultation were employed to engage with the identified I &AP during both the ESIA Scoping and development phases. This included focus group discussion and in-depth interviews sessions as summarized in Table 10.1 below;

Table 10.1 Types of Stakeholder consultations held with key I&Aps

S/N	Focus Group Discussion			
	Stakeholder Group	**Community/venue**	**Date**	
1	-Katangar-Lafia Youth Association - Farmers/Village Members	Katangar-Lafia	9th September,	
2	- Hunters group - Farmers/Village Members	Bulori	10th - 11th September, 2015	
3.	- Farmers/Village Members - Rahama Self Help Group	Rahama	12th September, 2015	
4.	- Kawaye Youth - Farmers/Village Members	Kawaye	13th - 14th September, 2015	
5.	- Farmers/Village Members	Sharafai	14th - 15th September, 2015	
6.	- Farmers/Village Members	Bakin-Jeji	15th - 16th September, 2015	
7.	- Mechanics	Mechanic Village	16th September, 2015	
	In-depth Interview Sessions			
	Village Head	**Community**	**Date**	
1.	Hamza Yusuf	Bakin-Jeji	9th September, 2015	
2.	Inuwa Umaru	Katangar-Lafia	9th September, 2015	
3.	Balarabe Mohamed (Chairman)	Mechanic Village	9th September, 2015	
4.	Mallam Ali Bulori	Bulori	10th September, 2015	
5.	Mohammed Shuaibu	Rahama	12th September, 2015	
6.	Bello Ahmed Sahad	Kawaye	13th September, 2015	
7.	Mallam Alhassan Bello	Sharafai	14th September, 2015	
	Stakeholder Workshops			
	Stakeholder Group	**Activity**	**Venue**	**Date**
1.	Major stakeholders (see table 4.27)	Scoping Workshop	Conference Hall, Dutse State Library	8th September, 2015
2.	Major stakeholders (see table 4.27)	Public Consultation	Conference Hall, Dutse State Library	28th October, 2015

The stakeholders were informed about the proposed project and the intention of the proponent to carry out an ESIA to ensure the environmental and socio-economic sustainability of the proposed project, and to identify major issues of concerns from stakeholders. They were given opportunity to express their concerns and share their views with regards to perception of the proposed project, as well as make contributions towards the development and sustainability of the proposed project. Issues regarding compensation and resettlement were also discussed, as this was a flash point in the discussions. The stakeholders' questions were attended to while remarks and concerns were noted and documented as summarized in Table 10.2 below;

Table 10.2 Highlights of Issues and concerns at Stakeholder Scoping Workshops

Major Concerns and Questions			
Issues	**Description of Concerns**	**By Whom**	**Responses**
Compensation	• Local communities are expectant of compensation they might receive. • Who will pay compensation; the State or the project proponent? • Do not want third parties /community leaders to receive compensation for or on their behalf	Ibrahim Abduhamadu, land owner from Bakin Jeji, and Yahaya Buba also a land owner from Bulori	The ESIA socioeconomic expert responded that the project sponsor will pay compensation, and that it will follow a transparent process and best practice in addressing the issue of land compensation. He assured the people that they will not be short changed and that there will not be elite capture of any ones entitlement
Project Life Cycle	• After 25 years of project life cycle what will be the future of the communities in terms of energy/electricity supply?	Farm Owner	The MD, NSPDL answered that after 25 years, only the panels will be replaced to continue to generate energy as far as the government is desirous with the sustainability of the project
Harmattan Season	• How will the solar panels function at harmattan period?	Bello Ahmed, village head, Kawaye	The MD, informed that harmattan weather will not significantly affect energy supply because the energy stored in the panels can sustain the Solar system for 2 months

Major Concerns and Questions			
Issues	**Description of Concerns**	**By Whom**	**Responses**
Employment	• Want the project proponent to engage their unemployed youths during implementation stage	Affirmed by many of the village representatives	The proponent welcomed the suggestion and informed that it is in their policy to work with locals during construction and operation stages of the project
Mechanic Settlement	• The present location is a new layout allocated to the auto-mechanic service operators by Jigawa State Government and what will be their fate if the solar power project will result to their displacement?	Balarabe Mohd, Chairman, Nigerian Automobile Technician Association	The automobile people were assured that, if it is confirmed that their land is within the 30 meter radius for the transmission right of way, NSPDL will liaise with the state government to ensure that they are resettled before displacement. They promised to carry the Auto mechanic people along in the process

11. CONCLUSION

The ESIA study for the proposed 80 MWAC solar PV plant near the town of Dutse, Jigawa State has been carried out in line with the EIA Act Cap E12 LFN 2004, EIA Sectoral Guidelines for Power Sector, 2013 as well as other relevant national and international standards including the IFC Performance Standards on Environmental and Social Sustainability and Equator Principles. The overall goal of the ESIA is to identify and assess the potential environmental and social impacts of the proposed project, evaluate alternatives and propose appropriate measures to mitigate the significant adverse effects and enhance potential benefits in order to ensure that the proposed project is environmentally and socially sustainable.

This ESIA has identified a series of measures to enhance potential positive impacts of the proposed project as well as technically and financially feasible measures to address negative impacts largely through the application of appropriate mitigation measures, sound engineering design, good construction practices, effective maintenance and adequate supervision and enforcement during the project life cycle. In addition, a comprehensive ESMP has also been developed using the hierarchy of mitigation to manage any residual environmental and social impacts throughout the development phases of the project.

In consideration of the above therefore, there is no major environmental or social issue to impede the implementation of the proposed development of solar PV project, which is expected to generate and supply additional 80 MWAC of renewable electricity to boost national power supply and specifically provide the Jigawa State and surrounding areas with carbon free source of electricity to promote economic development. The immense benefits that will be derived from the proposed projects are significantly greater than the short-term environmental effects. NSPDL has further committed to mobilize the funds that will be required to enforce the ESMP operational controls to mitigate negative impacts as well as enhance positive impacts.

REFERENCES AND CONTACTS

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For more information, please contact:

For AfDB

- Felix Oku, Senior Environmentalist, Email: f.oku@afdb.org
- Edith Birungi Kahubire, Senior Social Development Specialist: E.Kahubire@afdb.org
- Hawaly Agne, Consultant: H.Agne@afdb.org