RURAL ELECTRIFICATION AGENCY

ENERGY = EMPOWERMENT = EFFICIENCY

FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

FOR

THE PROPOSED 2.5 MW SOLAR HYBRID POWER PLANT AND ASSOCIATED INFRASTRUCTURE IN FEDERAL UNIVERSITY GASHUA (FUGA), YOBE STATE

UNDER THE FEDERAL GOVERNMENT OF NIGERIA (FGN) ENERGIZING EDUCATION PROGRAMME (EEP) PHASE II

BY

NIGERIA ELECTRIFICATION PROJECT

SUBMITTED TO

THE FEDERAL MINISTRY OF ENVIRONMENT, MABUSHI, ABUJA

DECEMBER 2020

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	-	Alternating Current
ALARP	-	As Low As Reasonably Practicable
AoI	-	Area of Influence
a-S	-	Amorphous silicon
ASTM	-	American Standards for Testing and Materials
B.Sc.	-	Bachelor of Science
BOD	-	Biological Oxygen Demand
Cd	-	Cadmium
CdTe	-	Cadmium telluride
CH_4	-	Methane
CO	-	Carbon monoxide
CoC	-	Code of Conducts
Cr	-	Chromium
CSP	-	Concentrated Solar Power
CSR	-	Corporate Social Responsibility
Cu	-	Copper
DC	-	Direct Current
EA	-	Environmental Assessment
EEP	-	Energizing Education Programme
EHS	-	Environmental, Health and Safety
EIA	-	Environmental Impact Assessment
EMF	-	Electromagnetic Field
EnvAccord	-	Environmental Accord Nigeria Limited
EPC	-	Engineering, Procurement and Construction
EPR	-	Extended Producer Responsibility
ESAs	-	Environmentally Sensitive Areas
ESIA	-	Environmental and Social Impact Assessment
ESMF	-	Environmental and Social Management Framework
ESMP	-	Environmental and Social Management Plan
Fe	-	Iron
FEC	-	Federal Executive Council
FGD	-	Focus Group Discussion
FGN	-	Federal Government of Nigeria
FMEnv	-	Federal Ministry of Environment
FUGA	-	Federal University, Gashua
GBV	-	Gender Based Violence
GHG	-	Greenhouse Gas
GO	-	Grievance Officer
GPS	-	Global Positioning System
GRM	-	Grievance Redress Mechanism
H&S	-	Health and safety

H_2S	-	Hydrogen Sulphide
HR	-	Human Resource
HSE	-	Health, Safety and Environment
IDI	-	In-depth Interview
IEC	-	International Electrotechnical Commission
IGR	-	Internally Generated Revenue
IHR	-	International Health Regulations
ILO	-	International Labour Organisation
IPAN	-	Institute of Public Analysts of Nigeria
ITCZ	-	Inter-Tropical Convergence Zone
IUCN	-	International Union for Conservation of Nature
KII	-	Key Informant Interview
LEMP	-	Labour and Employment Management Plan
LGA	-	Local Government Area
M.Sc.	-	Master of Science
mono-Si	-	Mono-crystalline silicon
MW	-	Megawatt
NAAQS	-	Nigerian Ambient Air Quality Standards
NBS	-	National Bureau of Statistics
NDC	-	Nationally Determined Contributions
NEPP	-	National Electric Power Policy
NERC	-	Nigerian Electricity Regulatory Commission
NESREA	-	National Environmental Standards and Regulations Enforcement Agency
Ni	-	Nickel
NiCd	-	Nickel cadmium
NIMET	-	Nigerian Meteorological Agency
NiNAS	-	Nigeria National Accreditation Service
NO_2	-	Nitrogen dioxide
NPC	-	National Population Commission
OP	-	Operational Policy
OPC	-	Organic Photovoltaic Cells
OHS	-	Occupational Health and Safety
O&M	-	Operations and Maintenance
Pb	-	Lead
PHCN	-	Power Holding Company of Nigeria
PM	-	Particulate Matter
PMT	-	Project Management Team
poly-Si	-	Polycrystalline silicon
PPE	-	Personal Protective Equipment
PV	-	Photovoltaic
QA/QC	-	Quality Assurance and Quality Control
REA	-	Rural Electrification Agency

RH	-	Relative Humidity
SEA	-	Sexual Exploitation and Abuse
SEP	-	Stakeholder Engagement Plan
SL	-	Screen Line
SMEs	-	Small Medium Enterprises
SO_2	-	Sulphur dioxide
SOP	-	Standard Operating Procedure
TDS	-	Total Dissolved Solids
TMP	-	Traffic Management Plan
TOC	-	Total Organic Carbon
TSP	-	Total Suspended Particulate
V	-	Vanadium
VOC	-	Volatile Organic Compounds
VRFB	-	Vanadium Redox Flow Battery
WBG	-	World Bank Group
WHO	-	World Health Organisation
WMP	-	Waste Management Plan
Zn	-	Zinc

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ACKNOWLEDGEMENTS

The Rural Electrification Agency will like to thank the ESIA Consultant – Environmental Accord Nigeria Limited for their commitment to the success of the ESIA study. We also thank the World Bank, Federal Ministry of Environment, the Yobe State Ministry of Environment, Management of Federal University, Gashua and other stakeholders including the local communities in the Project area for their valuable contributions and support.

EXECUTIVE SUMMARY

1.0 INTRODUCTION

This report documents the Environmental and Social Impact Assessment (ESIA) study for the proposed 2.5 MW solar-hybrid power plant and associated infrastructure in Federal University, Gashua (FUGA), Yobe State, under the Federal Government's Energizing Education Programme (EEP) Phase II.

The EEP is one of the key components of the Nigeria Electrification Project (NEP). NEP is a Federal Government initiative that is private sector driven and seeks to provide electricity access to off grid communities across the country through renewable power sources. NEP is being implemented by the Rural Electrification Agency (REA) in collaboration with the World Bank.

The objective of the EEP is to provide dedicated, clean and reliable power supply to Federal Universities and affiliated Teaching Hospitals across the country. The scope of the EEP includes provision of off-grid, dedicated and independent power plant, rehabilitation of existing electricity distribution infrastructure, and provision of street lighting (for illumination and improved security) as well as a world class renewable energy training centre for each of the beneficiary universities. FUGA is one of the beneficiary universities under the EEP Phase II.

In compliance with the relevant requirements of the Federal Ministry of Environment (FMEnv.) and other relevant regulatory agencies in Nigeria, as well as the applicable requirements of the World Bank Safeguard Policies, the ESIA of the proposed Project in FUGA has been conducted.

The ESIA study covers the entire life cycle of the Project (i.e. pre-construction, construction, commissioning, operation, decommissioning, and closure) and it involves key issues identification, baseline environmental and socio-economic data gathering, stakeholder consultation, identification and evaluation of impacts, development of mitigation measures and environmental and social management plan.

The applicable legal and institutional framework to the proposed Project includes, but not necessarily limited to the following:

- EIA Act CAP E12 LFN 2004
- National Policy on the Environment, 1989 (revised in 1999 and 2017)
- World Bank Safeguard Policies on Environmental Assessment
- National Environmental (Energy Sector) Regulations, 2014

- National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991, S.I.9
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991, S. I. 15
- National Environmental (Sanitation and Wastes Control) Regulations, 2009
- National Environmental (Noise Standards and Control) Regulations, 2009
- Yobe State Ministry of Environment Laws on Environmental Protection
- Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal
- The United Nations Framework Convention on Climate Change
- Declaration of the United Nations Conference on Human Environment
- International Labour Organisation (ILO): ILO-OSH 2001 - Guidelines on Occupational Safety and Health (OSH) Management Systems

2.0 PROJECT JUSTIFICATION

Need for the Project and Benefits

The Project is justified primarily based on the need for power for Nigeria's federal universities as an essential element for research and educational development. The EEP is also part of measures in ensuring that Nigeria achieves its carbon emission targets (20 % - 30 % carbon emission reduction by the year 2030) as contained in its Nationally Determined Contributions (NDC), under the Paris Agreement.

The potential Project benefits include, amongst others:

- Stimulation of academic and research activities within the University as a result of access to constant and reliable power supply, thereby promoting educational advancement.
- Reduction in fossil fuel consumption by the University thereby leading to reduction in carbon emissions and improvement in eco-balance.
- Significant reduction in the cost of power generation by the University through diesel-fuelled generators. .
- Increase in social interactions within the University. There will be enhanced security in the University as a result of more streetlights for illumination which would help keep off opportunistic crimes and gender-based violence.
- Enhancement of learning in renewable energy leading to certification as a result of training centre to be provided as part of the Project.
- Improvement in livelihood enhancing activities within the University.
- Direct and indirect employment opportunities during Project development and operation.
- Increase in local and regional economy through award of contracts and purchase of supplies for Project development.

- Increase in financial and technical collaborations between the FGN, the University, REA, World Bank and other relevant Ministries, Departments and Agencies (MDAs).
- The project will contribute to Nigeria's nationally determined contributions for the Paris agreement to cut carbon emission by 20 % - 30 % by 2030.

Envisaged Sustainability of the Project

Technical Sustainability: The Project development shall be handled by qualified and experienced EPC contractor (to be selected by REA through a competitive process) according to pre-established standards and procedures. The design and construction phase of the Project shall be overseen by qualified engineers from REA and the Department of Works and Physical Planning in FUGA. Upon completion of the construction phase, an O&M contractor will be engaged to operate and maintain the Project, in conjunction with the team from FUGA's Works and Physical Planning Department.

Environmental Sustainability: The environmental sustainability measures for the Project include the use of renewable source of energy (solar) for electricity generation (with negligible greenhouse gas emissions compared to fossil fuelled power plants). In addition, the establishment of REA Project Management Unit (PMU) which includes experienced Environmental and Social Safeguards Specialists to oversee the implementation of the Project will contribute to environmental sustainability of the Project.

Economic Sustainability: The proposed Project is part of the FGN's EEP initiative, a component of NEP. NEP is being funded by the World Bank with Three Hundred and Fifty Million US Dollars ($350,000,000) loan, of which One Hundred and Five Million US Dollars ($105,000,000) is allocated for projects under the EEP. The proposed Project in FUGA, as part of the EEP Phase II, will be financed from the NEP fund. Upon completion, the Project will significantly reduce the use of diesel generators in the University thereby saving costs on diesel fuel and generator maintenance, amongst others. Also, monthly expenditures to the local power distribution company for power consumption from the national grid would be saved. Part of such savings will be used for the maintenance of the Project facilities in the long run.

Social Sustainability: Stakeholder consultation has been carried out as part of the ESIA process in ensuring that all relevant stakeholders are presented with the opportunity to provide input into the Project at the early stage. This has also assisted in laying a good foundation for building relationship with the stakeholders. In addition, initial stakeholder engagement activities carried out during the ESIA have been presented in the report. A Stakeholder Engagement Plan (SEP) shall be developed to ensure continuous engagement with relevant stakeholders throughout

the Project life cycle. In addition, a grievance redress mechanism (GRM) has been developed by REA for the Project.

Project Alternatives

Within the context of the Solar Project, various alternatives were considered based on environmental, economic and operational factors. These included solar technology types, PV module types, and battery type alternatives. The preferred option is the use of mono/polycrystalline silicon PV panels and Lithium ion batteries for the Project.

3.0 PROJECT DESCRIPTION

An approximately 12.5 ha of land within the FUGA campus has been allocated for the proposed solar power plant and the training centre. The Project site lies geographically within Latitude 12.88172°N - 12.87680°N and Longitude 11.01232°E - 11.01727°E. The proposed Project site is one of the undeveloped land areas within the University campus reserved for future development projects. There are no physical structures on the site. In addition, there is no local community encroachment (i.e. farms, residential buildings, and firewood / fruit gathering) within the site. The nearest community to the Project site is Low-Cost community, situated about 1.2 km away from the University.

The proposed solar power plant will involve the use of PV technology for power generation. PV panels will be installed on the site using piling foundations and the power generated will be evacuated via an 11 kV underground armoured cable to the existing power house (also the switch yard) and distributed within the University. The exact number of the panels is yet to be finalized. However, based on the review of similar solar power projects, about 6,600 PV panels (for example, JKM340PP-72H-V) would be required to generate a power capacity of 2.5 MW.

Storage facilities will be constructed for batteries and inverters to be installed for the Project. Power distribution within the University will be via the existing power infrastructure (mostly wooden poles and overhead cables), which will be rehabilitated where required. Additional streetlights will be installed within the University while existing streetlights will be retrofitted for energy efficiency purposes and powered by the proposed Project.

The pre-construction phase activities for the Project will include site clearing, and mobilization of equipment and construction materials to site. The construction phase activities will include civil, mechanical and electrical works; installation of PV panels and associated components such as mounting structures, inverters, batteries, and switchgear. The exact number of PV panels, batteries and inverters to be installed is yet to be finalized. Also, the construction of renewable energy training

centre as well as installation of additional streetlights will be carried out during the construction phase.

Following the construction phase, the facility will be tested and commissioned before operational phase. Activities during the operational phase will include power generation and distribution, and routine maintenance such as periodic cleaning of the PV panels.

The envisaged life span of the power plant is 25 years which could be extended with proper and regular maintenance. In the event of decommissioning, the PV panels and associated infrastructure will be removed from the Project site and recycled as appropriate. The site will be rehabilitated with native plant species afterwards.

It is estimated that about 300 people would be employed during the construction phase. Occupational health and safety (OHS) plans shall be developed and maintained by all contractors involved in the implementation of the proposed Project. The contractors shall provide OHS training which will include hazard awareness, safe work practices and emergency preparedness. Worker activities will be managed through appropriate planning and the application of Permit-to-Work system, Job Hazard/Safety Analysis, Personal Protective Equipment (PPE) requirements and other safety-based protocols.

It is the goal of REA that the proposed Project is designed, developed and operated in a sustainable manner. Thus, effective waste management practices that comply with the relevant local requirements and international best practices shall be implemented during all phases of the proposed Project. To achieve this, all contractors engaged during the lifecycle of the Project will put in place and comply with a site waste management plan. The potential waste streams associated with the proposed project phases include:

A. Pre-construction and construction phase: cleared vegetation, excavated soil, general refuse, garbage, inert construction materials, metal scraps, concrete waste, food waste, and used packaging materials.
B. Operational phase: paper waste, food packaging, e-wastes (damaged/discarded batteries, panels, inverters, cables, equipment, etc.).

In line with NEP ESMF, the University shall be encouraged to prepare e-waste management plans that account for safe end-of-life disposal of equipment from the solar power plant. The Extended Producer Responsibility program (EPR) will be implemented for solar panels, inverters, batteries and other electrical components to be installed for the Project.

The proposed Project is planned to be commissioned in the fourth quarter (Q4) of 2021.

4.0 DESCRIPTION OF THE ENVIRONMENT

The description of environmental conditions of the Project's area of influence is based on desktop studies and field investigations. Field sampling was conducted from August 15 to 17, 2019 by a team of environmental and social specialists.

A 1 km radius from the centre of the Project site was selected as the spatial boundary for biophysical sampling while a 2km radius was selected for socio-economic survey. The rationale for the spatial boundary was based on the consideration of potential environmental and social aspects of the proposed Project as well as observations noted during the reconnaissance survey.

The environmental and social condition of the Project's AoI is summarized as follows:

Climate and Meteorology: Yobe State is located in the hot, dry tropical climate zone of North-east, Nigeria. Based on the review of long term (1990 - 2017) climatic data of the study area obtained from the Nigerian Meteorological Agency (NiMet), rainfall generally occurs from April to October with a peak period in August (358.1 mm). The monthly temperature is relatively high and stable all year with the highest value of 39.22^{0}C in the month of April. Wind speed variability is more pronounced from May to June when speeds could exceed an average of 10.16 m/s. The average monthly sunshine hours is approximately 7.70 hours.

Geology and Hydrogeology: The geology of Yobe State principally comprises crystalline and sedimentary rocks, underlain by basement complex rocks. The crystalline rocks are represented by older granites found in pockets of places in the southern part of the State. Another crystalline rock formation of younger age is located in the north-western tip of the state in the Machina area. The Project site falls in the north-western part of the State.

Air Quality and Noise: A total of 8 locations were sampled in the study area (4 locations within the Project site, 2 within the 1km AoI, and 2 at buffer/control points). The concentrations of air quality parameters recorded in the study area complied generally with the National Ambient Air Quality Standards and the World Health Organization (WHO) Air Quality Guidelines. The noise levels recorded within the Project site were also within acceptable limits (World Bank limit of 55 dB(A) for educational institution and FMEnv limit of 90 dB(A). In summary, the ambient air quality and noise within the Project site and the surrounding environment is considered to be satisfactory.

Soil Quality: The dominant soil type within the Project site is clay based on the grain size analysis. No heavy metal and hydrocarbon pollution was recorded in the soil samples collected from the Project site. The concentrations of Iron in the soil samples obtained from the Project site ranged from 76.11 mg/kg to 118.2 mg/kg in the topsoil and 83.42 mg/kg to 144.88 mg/kg in subsoil. Zinc concentrations ranged from 0.01 mg/kg to 0.95 mg/kg in topsoil and 0.01 mg/kg to 0.46 mg/kg in subsoil samples from the study area, below the prescribed limit (10-50 mg/kg) for unpolluted soil. Mercury, Chromium, Lead and Nickel were undetected in the soil samples from the Project site and AoI.

Groundwater Quality: Groundwater samples were collected from two (2) different boreholes in the study area (one close to the Project site and one from the nearby local community). The concentrations of parameters analyzed in the groundwater samples were generally within the FMEnv and WHO limits for substances and characteristics affecting the acceptability of groundwater for domestic use.

Terrestrial Flora: The natural ecosystem of the Project site was observed to have been substantially modified by human activities (mainly development activities within the University). Based on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species classification, no endangered species were recorded within the Project site. The plants species noted include Red Acaia (*Acacia seyel*), Desert date (*Balanite aegyptiaca*), Geron darli grass (*Setaria pallide fusca*), and White Acacia (*Faidherbia albida*).

Terrestrial Fauna: The fauna species observed at the Project site were generally few and restricted to small invertebrates such as earthworms, insects, grasshoppers, butterflies, spiders. Also, vertebrates such as lizards (*Agama agama*) and birds (Sun lark, Black Kite) were sighted within the Project site. Based on the IUCN classification, no threatened or endangered fauna species were observed in the Project and AoI.

Socio-economic and Health: The identified local community in the Project's AoI is Low Cost community, located about 1.2 km away from the University. The socio-economic characteristics of the community based on information gathered through focus group discussions, key informant interviews, direct observations, and surveys are summarized as follows:

- Low Cost community is relatively homogenous in terms of ethnicity and language.
- The community has an estimated population of 2,000 residents.
- About 75.50 % of respondents within the community are married while 24.50% are single.

- Islam is the most prevalent religion in the community.
- Trading and seasonal agricultural activities are the common livelihood activities in the community.
- Majority of the houses within the community are connected to the national grid for electricity supply. Although a few residents stated that they have privately owned generators as backup source of electricity.
- Public and private boreholes are found within the community as well as water vendors who supply water to markets.
- Women in the community perform majorly domestic roles as they are usually restricted and are not allowed to take leadership positions or make autonomous decisions. This may be attributed to the patriarchal nature and culture of the community.
- Based on interviews with community leadership and respondents in the community, there are no direct livelihood activities or ecosystem services obtained from the Project site.
- Members of the community were positively disposed to the proposed Project. They believe that the Project will improve the economic values of the communities, impact positively on entrepreneurship and create job opportunity for community members.

Stakeholder Engagement

Stakeholder engagement was conducted as part of the ESIA for the proposed project. This included a review of the legal and administrative framework, stakeholder identification and analysis, and initial consultation with stakeholders. Comments and issues raised by relevant stakeholders consulted during the ESIA study were provided in the report. The consultations were conducted between August 9 to 17, 2019 with the following:

- Yobe State Ministry of Environment
- Yobe State Environmental Protection Agency
- Yobe State Ministry of Women Affairs and Social Development
- Yobe State Ministry of Youth and Sports
- FUGA Vice Chancellor
- FUGA Director of Works
- FUGA Student Union Government President
- Bade Local Government representative
- Ward Leader of Low-Cost community

The consultations served to provide stakeholders with information about the proposed Project and to gather information important to the ESIA. Consultation with the identified stakeholders (regulators and potentially affected communities) showed general acceptance of the proposed Project.

5.0 ASSOCIATED AND POTENTIAL RISKS AND IMPACTS

The potential environmental and social (E&S) risks and impacts associated with the proposed Project were identified and ranked across each phase of the Project development. In the pre-construction phase, the significant impacts identified are: increase in traffic including potential for road accident and soil degradation as a result of site clearing. For construction phase, the potential impacts identified include: soil degradation, decrease in ambient air quality, increased noise emission, gender-based violence (GBV) risks, community health and safety impacts due to influx of workers and construction activities, and occupational health and safety hazards. During the commissioning phase, the proposed Project is presumed to have minor noise impact and OHS hazards which may arise from injuries and electrocution. The operational phase will have significant risks such as electric shock and injuries to workers, GBV risks, and work-related issues (poor working conditions and discrimination). The decommissioning phase will have significant impacts on the soil and road traffic of the Project area.

Some of the potential positive impacts associated with the proposed Project include: employment opportunity, promotion of clean energy source, reduction of GHG emissions, and skill acquisition and transfer of knowledge through training and retraining.

6.0 MITIGATION MEASURES

Recommended mitigation measures required to complement those incorporated in the Project design for the identified negative impacts were proffered while enhancement measures for the positive impacts were similarly presented and documented in the ESIA report.

The summary of the recommended mitigation measures for the identified significant negative impacts is provided as follows:

<u>Pre-construction Phase</u>

The proffered mitigation measures for the potential impacts associated with the pre-construction phase of the Project include, amongst others:

- The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.
- Soil conservation measures shall be implemented such as stockpiling topsoil in layers or for the remediation of disturbed areas.
- Disturbed areas will be rehabilitated with native plants to prevent erosion.
- Site clearing equipment / machinery shall be operated and maintained under optimum fuel-efficient conditions.

- Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).
- A traffic management plan (TMP) shall be developed and implemented by the EPC Contractor.
- Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.
- Drivers' competency shall be assessed and where required; appropriate training shall be provided. This will include training on safe driving measures such as adherence to speed limits (of less than 10 km/h) in the Project area.
- Provision of adequate PPE especially gloves, safety boots, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.
- Unregistered labourers and touts shall not be patronised for off-loading materials.
- The site shall be secured with perimeter fencing and/or security.

Construction Phase

Some of the mitigation measures for the potential impacts associated with the construction phase of the Project include:

- Excavation works shall not be executed under aggressive weather conditions.
- Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint.
- Construction machinery shall be turned off when not in use.
- Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.
- Employment of workers for construction activities shall be open and fair.
- The GBV Action Plan for EEP shall be implemented for the Project.
- All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA).
- GBV sensitive channels for reporting in GRM shall be implemented for the Project.
- The EPC Contractor shall be required to hire a Gender/GBV officer.
- Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured.
- All workers shall be required to undergo regular training and refreshers on GBV
- The EPC Contractor shall provide separate facilities for men and women and add GBV-free signage at the Project site.

- All gender-based violence incidents shall be reported and dealt with as per the law.
- Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence.
- Daily toolbox talks prior to commencement of work activities shall be carried out.
- Construction activities shall be limited to daytime as much as possible.
- Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.
- Proper safety signs and signage shall be placed at strategic locations within the site.
- PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.
- Safety training focused on safe working practices, information on specific hazards, first aid and fire-fighting shall be included in the induction programme for workers.
- The NEP Grievance Redress Mechanism (GRM) for receiving complaints arising from damage to infrastructure and private property during construction activities shall be implemented. The EPC contractor shall receive the complaints and repair damage as quickly as possible.
- Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible.
- Public access shall be restricted to construction area via security fencing and appropriate signage.

Commissioning Phase

Mitigation measures for the potential impacts associated with the commissioning phase of the Project include:

- The Project components shall be installed in line with the pre-established standards and as per manufacturer recommendations.
- The inverters and batteries to be used for the Project shall meet industry best standard in relation to noise attenuation.
- Plant testing shall be carried out by experienced personnel.

Operation Phase

Mitigation measures for the potential impacts associated with the operation phase of the Project include:

- All lighting will be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, which is shielded and directed downward, to reduce light spillage will be used.

- Appropriate PPE shall be provided for workers.
- Training shall be provided to employees on emergency preparedness and responses.
- Provision of medical insurance scheme for employees shall be ensured.
- Appropriate safety signage shall be placed at strategic locations within the site.
- Strict compliance to the SOPs shall be ensured.
- Continuous implementation of the GBV Action Plan for EEP shall be sustained for the Project.
- All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA).
- GBV sensitive channels for reporting in GRM shall be implemented for the Project.
- The O&M Contractor shall be required to hire a Gender/GBV officer.
- Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be sustained.
- The O&M Contractor shall provide separate facilities for men and women and add GBV-free signage at the project site.
- All gender-based violence incidents shall be reported and dealt with as per the law.
- A Waste Management Plan shall be developed and implemented
- Training shall be provided for workers on safe storage, use and handling of e-waste on site.
- Damaged/expired Lithium ion batteries, solar panels, inverters and electric components shall be returned to the manufacturer based on the Extended Producer Responsibility (EPR) model. Prior to returning them to the manufacturers, they will be stored on impermeable surfaces within the site.
- Burning of waste shall be prohibited.

7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environmental and Social Management Plan (ESMP) has been developed as part of the key elements of the ESIA study to satisfy long term objectives of managing and monitoring the environmental and social impacts of the proposed Project. It covers the entire life cycle of the Project and also includes desired outcomes; performance indicators; monitoring (parameters to be monitored and frequency); timing for actions; responsibilities and cost estimates required for implementation.

REA-PMU is committed to the implementation of the ESMP and shall work with relevant agencies at local, state and national levels to ensure full compliance. REA shall have principal responsibility for all measures outlined in the ESMP, but may

delegate responsibility to its contractors, where appropriate and monitor the implementation. The relevant regulatory authorities at Federal, State and Local Government levels shall also be involved in the monitoring of the ESMP implementation.

An environmental monitoring programme, which outlines specific environmental/social components to be measured, methodology, parameters/requirement, frequency of monitoring, timelines, and estimated budget, has also been developed as part of the ESMP.

8.0 REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

Decommissioning refers to the process of removing all the operating assets of a project after completion of its life cycle. The average life span of the solar power plant to be provided as part of the proposed Project is 25 years (which can be extended through regular maintenance) while the training centre can last for 40 years or more. Even after the 25 years, the PV panels can still generate up to 90 % of the design capacity.

In the event of decommissioning, REA, in conjunction with the leadership of FUGA, shall ensure that the Project site is left in a safe and environmentally acceptable condition. A standard decommissioning, abandonment and closure programme shall be invoked. The tasks will include, amongst others:

- Evacuation of the dismantled PV panels and other related items (such as inverters, and control devices) to the manufacturers for recycling.
- Transportation of spent batteries to recycling facilities;
- Restoration of the Project site to baseline conditions (as much as practicable) in line with legislative and regulatory requirements.
- Assessing the residual impact, if any, the project has on the environment.
- Monitoring the abandoned project environment as necessary.

Decommissioning activities will only begin after due consultation with the relevant stakeholders including the regulatory authorities.

9.0 CONCLUSION AND RECOMMENDATIONS

The ESIA of the proposed Project has been conducted in accordance with the relevant requirements FMEnv and other relevant regulatory agencies in Nigeria, as well as the applicable requirements of the World Bank Safeguard Policies, specifically the Operational Policy 4.01 triggered by the proposed Project.

Consistent with the regulatory standards, the assessment of the environmental status and the socio-economic aspects of the proposed Project's area of influence

have been carefully carried out using accepted scientific methodology. Evaluation of associated and potential impacts of the proposed Project identified both positive and negative interactions with the receiving biophysical and socio-economic environment.

Based on the nature and extent of the proposed Project and the findings of the ESIA study, it is believed that the potential negative impacts associated with the proposed Project can be mitigated to as low as reasonably practicable through the implementation of the proffered mitigation measures documented in Chapter 6 of this report, while the positive impacts can also be enhanced. In addition, an ESMP has been established to assess the efficiency and effectiveness of the recommended mitigation measures and ensure long-term monitoring of the Project.

The ESIA study recommends the following:

1 The REA-PMU and FUGA management shall ensure that the proposed Project is developed and operated in an environmentally sustainable manner by properly managing the processes/activities that may bring about disturbances to the environment through the implementation of the recommended mitigation measures and the ESMP.
2 Continuous monitoring of environmental and social performance of the Project shall be ensured, including periodic consultation with the relevant regulatory authorities, the potentially affected community, and other relevant stakeholders throughout the Project life cycle.
3 Implementation of the Project's Stakeholder Engagement Plan (including grievance redress mechanism) shall be maintained.

CHAPTER ONE:

INTRODUCTION

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INTRODUCTION

1.1 Background Information

The Nigeria Federal Executive Council approved the Power Sector Reform Program (PSRP) on March 22, 2017. One of the PSRP initiatives is the Nigeria Electrification Project (NEP) which seeks to increase electricity access to households, public institutions, micro, small and medium enterprises (MSMEs) and to provide clean, safe, reliable and affordable electricity to unserved and underserved rural communities through mini-grid/off-grid renewable power solutions. The NEP is being implemented by the Rural Electrification Agency (REA), on behalf of the Federal Government of Nigeria (FGN), and co-financed by the World Bank.

One of the key components of the NEP is Energizing Education Programme (EEP). The objective of the EEP is to provide dedicated, clean and reliable power supply to 37 Federal Universities and 7 affiliated University Teaching Hospitals across the country. The scope of the EEP includes provision of off-grid, dedicated and independent power plant, rehabilitation of existing electricity distribution infrastructure, and provision of street lighting (for illumination and improved security) as well as a world class renewable energy training centre for each of the beneficiary Universities.

The EEP is being implemented in phases. The first phase (Phase I) covers 9 Universities and 1 affiliated Teaching Hospital and it is currently ongoing, while the second phase (Phase II), to be funded by the World Bank loan under the NEP, covers 7 Universities and 2 affiliated Teaching Hospitals. The Universities that benefitted on the first phase of the EEP include:

1. Abubakar Tafawa Balewa University Teaching Hospital, Bauchi State.
2. Bayero University, Kano State.
3. University of Agriculture, Makurdi, Benue State.
4. Federal University of Petroleum Resources Effurun, Delta State.
5. Federal University Ndufu – Alike, Ikwo, Ebonyi State.
6. Nnamdi Azikiwe University, Awka, Anambra State.
7. University of Lagos, Lagos State.
8. Obafemi Awolowo University and Teaching Hospital, Ile-Ife, Osun State.
9. Usman Danfodiyo University, Sokoto State.

While the list of Universities that are to benefit under the second phase include the following:

1. Federal University, Gashua, Yobe State.
2. University of Maiduguri and Teaching Hospital, Borno State.
3. University of Calabar and Teaching Hospital, Cross River State.
4. Nigeria Defence Academy, Kaduna State.
5. Michael Okpara University of Agriculture, Umudike, Abia State.
6. Federal University of Agriculture, Abeokuta, Ogun State.
7. University of Abuja, Federal Capital Territory.

The Federal University Gashua (FUGA) in Yobe State, located in the Northeast region of Nigeria is one of the beneficiary universities under the EEP Phase II. The University was founded in 2011 and took off in 2013. The FUGA campus is situated on approximately 2,000 hectares (ha) of land and the University population as at April 2019 stood at 4,493 persons (REA Energy Audit Report, 2019).

Based on the energy demand audit conducted by REA in conjunction with the National Universities Commission (NUC), a 2.5 megawatt (MW) power plant is proposed for FUGA. This is in addition to other associated infrastructure under the EEP. The proposed power plant will be solar-hybrid technology.

In compliance with the relevant requirements of the Federal Ministry of Environment (FMEnv.) and other relevant regulatory agencies in Nigeria, as well as the applicable requirements of the World Bank Safeguard Policies, an Environmental and Social Impact Assessment (ESIA[1]) of the proposed solar-hybrid power plant and associated infrastructure in FUGA, Yobe State (the "Project") has been conducted. The ESIA study is also in fulfilment of commitments documented in the Environmental and Social Management Framework (ESMF) for NEP.

The ESIA study covers the entire life cycle of the proposed Project (i.e. pre-construction, construction, commissioning, operation, decommissioning and closure).

1.2 Objectives of the ESIA Study

The overall objective of the ESIA is to identify and assess the potential and associated impacts of the proposed Project throughout its life cycle and to put in place appropriate environmental and social measures to eliminate or mitigate the identified adverse impacts and enhance the associated benefits. This is aimed at ensuring that the proposed Project is developed and operated in an environmentally and socially sustainable manner.

[1] The proposed project is being co-financed by the World Bank. If reference is made to the FMEnv procedure, the term "EIA" is used, while if reference is made to the project's broader perspective, the term "ESIA" is used. Both ESIA and EIA are synonymous.

The specific objectives of the ESIA study are to:

- Establish and document the existing environmental and social conditions of the Project's Area of Influence[2] prior to construction, including any cultural resources and sensitive components of the environment.
- Assist Project design and planning by identifying those aspects of location, construction, operation and decommissioning which may cause adverse environmental and social impacts, including occupational and community health and safety issues.
- Develop appropriate and practicable mitigation measures and environmental and social management plan (ESMP)[3] including monitoring programme, responsible parties, timeframe and cost estimates required to address the identified adverse impacts and enhance the associated Project benefits (e.g. positive climate impact).
- Identify, where required, the need for development and implementation of a Resettlement Action Plan (RAP) / Livelihood Restoration Plan (LRP).
- Conduct stakeholder consultations to capture the concerns of the various stakeholders (e.g. relevant government institutions, potentially affected persons, etc.) about the Project including gender-based violence (GBV) risks.
- Prepare a detailed report presenting clear and concise information on the findings of the ESIA study.
- Obtain FMEnv-approval for the proposed Project.

1.3 Scope of the ESIA Study

The scope of the ESIA study covers the following:

- Review of applicable local and international laws, regulations, standards and industry codes that apply to the proposed Project.
- Description of all actions/activities that will be carried out in the course of the Project development and implementation.
- Desktop review of relevant documents pertaining to the Project and the environment where the Project would be located. These documents include the NEP ESMF, amongst others.
- Field data gathering covering biophysical and socio-economic components of the Project's Area of Influence.

[2] Based on the consideration of potential environmental and social aspects/footprints of the proposed Project, the Area of Influence (AoI) for the Project covers the Project site (approximately 12.5 hectares of land within the University campus) and its surrounding environment up to 2 km radius from the centre of the site (as discussed in details in Chapter 4). This also includes the areas where the cumulative impacts of the Project may be experienced, as well as the transport route.

[3] The term "ESMP" is used in this ESIA report to ensure consistency with the World Bank requirements. The term is, however, synonymous with Environmental Management Plan (EMP) adopted by the FMEnv.

- Consultations with relevant stakeholders including government institutions, project affected persons, University management representatives, etc. Detailed information on stakeholder consultations conducted as part of the ESIA study for the proposed Project is documented in Chapter 4 of this report.
- Laboratory analysis of field samples, and data analysis.
- Impacts identification and evaluation, and development of appropriate and practicable mitigation measures and ESMP.
- Perimeter survey of the Project site, including development of survey maps.
- Report preparation and disclosure.

1.4 ESIA Study Approach / Methodology

The ESIA of the proposed Project has been carried out in line with the FMEnv-approved EIA process for mini-grid / off-grid projects being implemented under NEP. It also takes into consideration the requirements of relevant international standards and guidelines, such as the World Bank Environmental and Social (E&S) Safeguard Policies.

The illustration of general methodology adopted for the ESIA study is provided in Figure 1.1. Detailed information on each of the activities is provided in the subsequent chapters of this report.

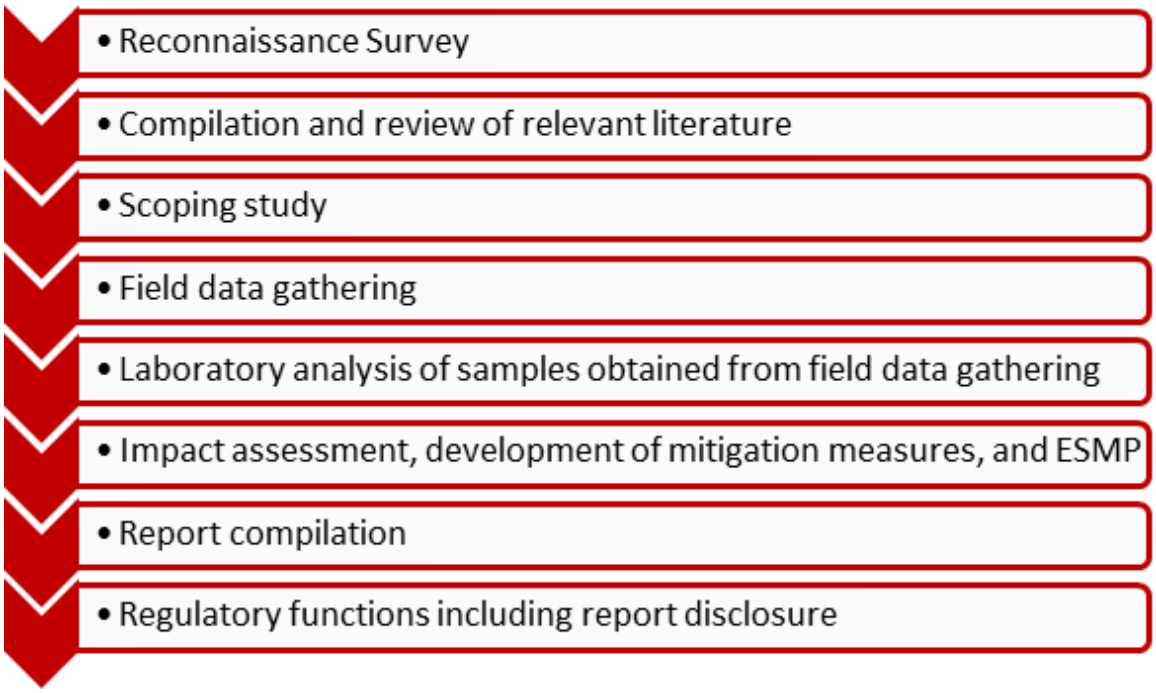


Figure 1.1: Schematic presentation of the general methodology for the ESIA

1.5 Limitations of the ESIA Study

The ESIA study has been carried out in line with the relevant local and international guidelines and regulations to identify and assess the potential environmental and social impacts of the proposed Project, and also to put in place appropriate mitigation measures to address the identified impacts. However, the inherent limitations in the ESIA process require that a few assumptions have to be made. Hence, there may be some degree of uncertainty as to the exact nature and magnitude of the environmental impacts. These uncertainties could arise from issues such as the level of available information on the proposed development at the time of the environmental assessment and limitations of the impact assessment prediction process. In view of these limitations, a robust ESMP has been put in place to ensure that the environmental and social performance of the project is monitored throughout the project's life cycle.

1.6 Legal and Administrative Framework

The proposed Project is part of the FGN's EEP, a component of NEP. Several laws and regulations apply to the energy sector in Nigeria. In addition, a number of laws, policies and instruments have been established to support environmental management and the EIA process in Nigeria.
In this section, an overview of the relevant statutory regulations, legislations and guidelines to the proposed Project and the ESIA study is provided. The Project shall ensure compliance with the applicable local and international regulations and standards throughout its life cycle.

1.6.1 National Policy, Guidelines and Regulations

1.6.1.1 Federal Ministry of Environment (FMEnv.)

The FMEnv is the primary authority for the regulation and enforcement of environmental laws in Nigeria. The Act establishing the Ministry places on it the responsibilities of ensuring that all development and industry activity, operations and emissions are within the limits prescribed in the national guidelines and standards, and comply with relevant regulations for environmental pollution management in Nigeria as may be released by the Ministry.

In furtherance of her mandate, the FMEnv developed laws, guidelines and regulations on various sectors of the national economy. The specific policies, acts, guidelines enforced by FMEnv that apply to the proposed Project are summarized in the following paragraphs:

- *National Policy on the Environment, 2017*

The National Policy on the Environment, 2017 provides for a viable national mechanism for cooperation, coordination and regular consultation, as well as

harmonious management of the policy formulation and implementation process which requires the establishment of effective institutions and linkages within and among the various tiers of government.

The objective of the policy is to achieve sustainable development in Nigeria and in particular to:

- Secure a quality environment adequate for good health and wellbeing;
- Conserve the environment and natural resources for the benefit of present and future generations;
- Raise public awareness and promoting understanding of the essential linkages between the environmental resources and developments and encouraging individual and community participations in environmental improvement efforts;
- Maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity;
- Co-operate with other countries, international organizations and agencies to achieve optimal use and effective prevention or abatement of trans-boundary environmental degradation.

❖ *The National Guidelines and Standards for Environmental Pollution Control in Nigeria*

This was launched on March 12th, 1991 and represents the basic instrument for monitoring and controlling industrial and urban pollution.

❖ *S.I. 9 National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991*

This Statutory Instrument imposes restrictions on the release of toxic substances into the environment and stipulates requirements for pollution monitoring, machinery for combating pollution, contingency plan, and safety for workers.

❖ *S.I. 15 National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991*

This Statutory Instrument regulates the collection, treatment and disposal of solid and hazardous wastes from municipal and industrial sources.

❖ *EIA Act No. 86 of 1992 (now codified as the EIA Act Cap E12 LFN 2004)*

The EIA Act is the primary Act governing the environmental and social assessment of developmental project or activity in Nigeria. Section 2(2) of the Act requires that where the extent, nature or location of a proposed project or activity is such that it is likely to significantly affect the environment, an EIA must be undertaken in accordance with the provisions of the Act.

- *National Environmental Impact Assessment Procedural and Sectoral Guidelines*

In response to the promulgation of the EIA Act, the FMEnv developed National EIA Procedural Guidelines and other set of guidelines on various sectors of the National economy. Applicable to the proposed Project is the EIA Guidelines for Power Sector, 2013. However, in line with the request by REA, an abridged EIA process has been approved by the FMEnv for proposed mini-grid/off-grid projects to be implemented under NEP. This ESIA study ensures compliance with the approved EIA process.

1.6.1.2 National Environmental Standards and Regulations Enforcement Agency

The National Environmental Standards and Regulations Enforcement Agency (NESREA) was established in 2007 by the FGN as a parastatal of the FMEnv. The Agency is charged with the responsibility of enforcing the environmental laws, guidelines, standards and regulations in Nigeria, specifically during the operational phase of developmental projects. The applicable NESREA's regulations to the proposed Project include:

- *S.I. 28 National Environmental (Sanitation and Wastes Control) Regulations, 2009*

The purpose of this regulation is the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.

- *S.I. 35 National Environmental (Noise Standards and Control) Regulations, 2009*

This regulation highlights the permissible noise levels to which a person may be exposed, control and mitigation of noise, permits for noise emissions in excess of permissible levels, and enforcement.

- *S.I. 22 National Environmental (Surface and Groundwater Quality Control) Regulations, 2010*

The purpose of this regulation is to enhance and preserve the physical, chemical and biological integrity of the groundwater and surface water resources.

- *S.I. 63 National Environmental (Energy Sector) Regulations, 2014*

The purpose of this regulation is to prevent or minimize pollution and encourage energy efficiency in all operations and ancillary activities of the energy sector in achieving sustainable economic development in Nigeria.

Other NESREA regulations relevant to the proposed Project are:

- *National Environmental (Ozone Layer Protection) Regulations, 2009, S.I.32*: The provisions of this regulation seek to prohibit the importation, manufacture, sale and the use of ozone-depleting substances.

- *National Environmental (Control of Bush/Forest Fire and Open Burning) Regulations, 2011, S.I.15*: The principal thrust of this regulation is to prevent and minimize the destruction of ecosystem through fire outbreak and burning of any materials that may affect the health of the ecosystem through the emission of hazardous air pollutants.
- *National Environmental (Electrical/Electronic Sector) Regulations, 2011, S.I.23*: The main purpose of this regulation is to ensure that best practices are applied and maintained in the operation of electrical and electronic equipment in order to safeguard the Nigerian environment against pollution hazards.
- *National Environmental (Soil Erosion and Flood Control) Regulations 2011, S. I. 12*: The overall objective of this regulation is to regulate all earthing-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.
- *National Environmental (Protection of Endangered Species in International Trade) Regulations, S. I. 11, 2011*: The major objective of this regulation is to protect species of endangered wildlife from extinction through the prohibition of trade, importation, etc.
- *National Environmental (Control of Alien and Invasive Species) Regulations, S. I. 32, 2013*: This regulation seeks to prevent the decline, minimize the modification and destruction of ecosystem, and human health caused by alien and invasive species.
- *National Environmental (Air Quality Control) Regulations, S. I. 64, 2013*: The objective of this regulation is to ensure the control of air pollutants that may affect the ambient environment.

1.6.1.3 Federal Ministry of Power, Works and Housing

The Federal Ministry of Power, Works and Housing is the policy making arm of the Federal Government with the responsibility for the provision of power in the country. The Ministry is guided by the provisions of the Electricity Act No 28 of 1988, the National Electric Power Policy, 2001, the Electric Power Sector Reform Act, 2005, the Roadmap for Power Sector Reform, 2010, the National Energy Policy, 2013 and the National Energy Efficiency Action Plans, 2015.

❖ *The National Electric Power Policy (NEPP), 2001*

In order to ensure a safe, steady, reliable and progressively improved electric power sector in Nigeria, the Electric Power Reform Implementation Committee (EPIC) was inaugurated by the BPE and resulted in Federal Executive Council (FEC) of Nigeria approving the National Electric Power Policy in September 2001, which recommended, amongst others: establishment of the electric power sector regulator and the privatization of the electric power sector.

- *Electric Power Sector Reform Act 2005*

The Electric Power Sector Reform Act No. 6 of 2005 provides for the licensing and the regulation of the generation, transmission, distribution and supply of electricity. Part IV of the Act contains requirements for licensing and stipulates that no person may construct, own or undertake any of the following activities without a license, unless the generating capacity and distribution capacity is below 1 MW and 100 kilowatts (KW) respectively for electricity generation, excluding captive generation, electricity transmission, system operation, electricity distribution and trading in electricity.

- *The National Energy Policy (NEP) 2013*

The National Energy Policy (NEP) 2013, a revised version of the NEP 2003, emphasizes the effective and efficient use of energy and proposes major areas to be considered for energy efficiency and conservation including amongst others: transportation, services/commercial sector, and energy efficient building designs.

- *The National Energy Efficiency Action Plans of Nigeria*

The first version of the National Energy Efficiency Action Plans (NEEAP) for Nigeria (2015 -2030) was approved on July 14, 2016 by the National Council on Power (NACOP). It has been formulated within the framework of United Nations' Sustainable Energy for All (SE4All) and adopted by the Inter-Ministerial Committee on Renewable Energy and Energy Efficiency (ICREEE).

The NEEAP includes baseline data and information on energy efficiency activities and programmes in Nigeria, barriers to the development and promotion of energy efficiency in the country and suggested achievable energy efficiency targets, including gender disaggregated indicators, based on national potentials and socio-economic assessments. The implementation of the NEEAP is being monitored by the Federal Ministry of Power, Works, and Housing.

- *Rural Electrification Agency*

The Rural Electrification Agency was set up by Section 88 of the Electric Power Sector Reform Act 2005 as the Implementing Agency of the FGN tasked with electrification of rural and unserved communities. The mission is to provide access to reliable electric power supply for rural dwellers irrespective of where they live and what they do, in a way that would allow for reasonable return on investment through appropriate tariff that is economically responsive and supportive of the average rural customer.

1.6.1.4 Nigerian Electricity Regulatory Commission (NERC)

The Nigerian Electricity Regulatory Commission (NERC) is an independent regulatory agency inaugurated on October 31, 2005. The Commission is mandated to carry out the following, amongst others: i) monitor and regulate the activities of the

electricity industry in Nigeria; ii) issue licenses to market participants; iii) ensure compliance with market rules and operating guidelines.

1.6.1.5 Endangered Species Act 1985

The FGN enacted the Endangered Species (Control of International Trade and Traffic) Act 11, 1985 which makes, amongst others, the provisions for the conservation, management and protection of the country's endangered species. Section 1 of the Act prohibits the hunting, capture and trade of endangered species.

1.6.1.6 Harmful Waste (Special Criminal Provisions) Act CAP H1 LFN 2004

The Harmful Waste (Special Criminal Provisions) Act CAP H1 LFN 2004 prohibits and declares unlawful all activities relating to the purchase, sale, importation, transit, transportation, deposit, storage of harmful wastes. Appropriate penalties for contravention are prescribed.

1.6.1.7 Nigerian Urban and Regional Planning Act CAP N138 LFN, 2004

This Act establishes a Development Control Department (DCD) charged with the responsibility for matters relating to development control and implementation of physical development plans at Federal, State and Local Government levels within their respective jurisdiction.

1.6.1.8 Penal Code (Northern States) Federal Provisions Act, CAP P3 LFN 2004

The Act contains the basic criminal law offences relating to endangering the life of people from various activities in the Northern region of Nigeria. These include offences relating the public health and safety, amongst others.

1.6.1.9 Labour Act CAP L1, LFN 2004

The Labour Act is the primary law protecting the employment rights of individual workers. The Act covers protection of wages, contracts, employment terms and conditions, and recruitment; and classifies types of workers and special workers.

1.6.1.10 National Policy on Occupational Safety and Health

Section 17(3c) of the constitution of the Federal Republic of Nigeria (1999) stipulates that the health, safety and welfare of all persons in employment must be safeguarded and not endangered or abused.

1.6.1.11 Land Use Act CAP L5 LFN 2004

Section 1 of the Act vests the entire land in any state in the Governor of the State. The Act also stipulates the procedures the State must follow to clear the land, and define the compensatory measures the State must implement in order to compensate any affected person. The proposed solar-hybrid power plant and associated infrastructure will be sited within the land property owned by FUGA. No additional land outside the University campus will be expropriated for the proposed Project.

1.6.1.12 Violence Against Persons (Prohibition) Act, 2015

The Violence Against Persons (Prohibition) Act (VAPP) was passed into law in May, 2015. The Act was necessitated as a result of agitations for protection of persons against different forms of violence. The Act has strengthened advocacy against rape, female genital mutilation, partner battery, stalking, harmful widowhood practices while prohibiting all forms of violence, including physical, sexual, psychological, domestic, harmful traditional practices and discrimination against persons. It also provides maximum protection and effective remedies for victims and punishment of offenders. The Act is a key instrument for addressing GBV in Nigeria.

1.6.1.13 Employees Compensation Act, 2010

The Employee's Compensation Act, 2010 was passed into law to provide comprehensive compensation to employees who suffer from occupational diseases or sustain injuries arising from accidents at workplace or in the course of employment. The Act repeals the Workmen's Compensation Act Cap. W6 Laws of the Federation of Nigeria, 2004.

1.6.1.14 National Guidelines for Decommissioning of Facilities in Nigeria (2017)

The purpose of this guideline is to provide clear directions and guidance on the step by step process involved in decommissioning a facility in Nigeria. The guideline is to aid in achieving an effective and environmentally sustainable decommissioning process that shall be compatible with intended future land use on health concerns and environmental impacts.

1.6.1.15 Natural Resources Conservation Act CAP 349 LFN 1990

The Natural Resources Conservation Act CAP 268 LFN 1990 is the most direct existing piece of legislation on natural resources conservation. The Act establishes the Natural Resources Conservation Council, which is empowered to address soil, water, forestry, fisheries and wildlife conservation by formulating and implementing policies, programmes and projects on conservation of the country's natural resources.

1.6.1.16 Public Health Law Cap 103 LFN 1990

Public Health Law examines the authority of the government at various jurisdictional levels to improve the health of the general population within societal limits and norms. The State is empowered to protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria. The law prohibits the public or private sector of the economynot to undertake or embark on or authorize projects or activities without prior consideration of the effect on the environment.

1.6.1.17 Energy Commission of Nigeria Act CAP 109 LFN 1990

The Act was promulgated to create the Energy Commission of Nigeria (ECN) with responsibility for coordinating and general surveillance over the systematic development of the various energy resources of Nigeria. Subject to this Act, the ECN is charged with the responsibility for the strategic planning and co-ordination of national policies in the field of energy in all its ramifications. The mandates of ECN includes statistical analysis of Electricity Generation, Transmission and Distribution.

1.6.2 State and Local Government Environmental Authorities

In Nigeria, States and local government councils are empowered under the law to set up their own environmental protection bodies for the purpose of maintaining good environmental quality in the areas of related pollutants under their control.

The proposed Project will be located within FUGA campus in Bade Local Government Area (LGA) of Yobe State. The key State and local government administrative authorities with statutory functions related to the Project are briefly described below:

- *Yobe State Ministry of Environment*

The Ministry is responsible for the management and protection of the environment in Yobe State. It works with other relevant agencies and authorities to ensure a conducive and sustainable development of the environment in the State.

- *Yobe State Environmental Protection Agency (YOSEPA)*

The Agency is charged with the responsibility of overseeing waste (solid and liquid) management in Yobe State. Other functions of the Agency, amongst others, are to: control industrial waste (liquid emission) and air pollution, and cooperate with federal and state ministries, local government council's statutory bodies, research and educational institutions on matters related to environmental protection.

- *Bade Local Government Council*

The Local Government Council has an Environmental Health Department which ensures compliance with environmental sanitation policy of 2005, which includes maintaining good housekeeping and proper management of waste, amongst others.

1.6.3 International Guidelines, Conventions and Industry Codes

An overview of international guidelines, conventions and industry codes that are relevant to the proposed Project is provided in the sub-sections below:

1.6.3.1 International Guidelines and Standards

- *The World Bank Safeguard Policies*

The environmental and social safeguard policies of the World Bank are the fulcrum of its support towards sustainable poverty reduction, particularly in developing countries. The policies aimed at preventing and mitigating undue harm to the people

and the environment in the development process. As indicated in Table 1.1, there are a total of ten (10) environmental and social safeguard policies of the World Bank, of which only Operational Policy (OP) 4.01 – Environmental Assessment- is triggered by the proposed Project, and its requirements have been taken into consideration in the ESIA study.

Table 1.1: Applicability of the World Bank Safeguard Policies to the proposed Project

S/N	World Bank Safeguard Policies	Scope/ Requirement	Safeguard triggered by the proposed Project	Justification	Sections of the ESIA report that address the requirements
1.	Environmental Assessment (OP/BP 4.01)	The World Bank requires Environmental Assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.	Yes	The proposed Project in FUGA under the FGN's EEP Phase II has associated environmental and social aspects which may affect the environment. Thus, this ESIA study has been conducted to ensure that the potential environmental and social impacts/ risks of the proposed Project are identified and managed appropriately.	Chapter 3 – Project Description Chapter 4 – Description of the Environment Chapter 5 – Potential and Associated Impact Chapter 6 – Mitigation Measures Chapter 7 – Environmental and Social Management Plan
2.	Forests (OP/BP 4.36)	Operational Policy on Forests (OP 4.36) is proactive in both identifying and protecting critical forest conservation areas and in supporting improved forest management in production forests outside these areas. The Forests Policy covers all projects that affect natural or planted forests, whether positively or negatively	No	There are no natural or planted forests within the Project site and its immediate surroundings environment that would be affected by the proposed Project.	-
3.	Involuntary Resettlement (OP/BP 4.12)	The Involuntary Resettlement Policy (OP/BP 4.12) applies to projects involving either (i) the involuntary taking of land for project purposes that leads to	No	The proposed solar-hybrid power plant and associated infrastructure will be sited within the land property	-

S/N	World Bank Safeguard Policies	Scope/ Requirement	Safeguard triggered by the proposed Project	Justification	Sections of the ESIA report that address the requirements
		physical relocation, loss of assets, or loss of income sources or livelihoods for the affected persons; or (ii) the involuntary restriction of access to legally designated protected areas that leads to adverse impacts on the livelihoods of the affected persons. To address these impacts, the policy requires the preparation of (i) either a Resettlement Plan or Resettlement Policy Framework in the case of involuntary land taking; and (ii) a Process Framework in the case of involuntary restriction of access to the natural resources within parks and protected areas.		owned by FUGA. No additional land outside the University campus will be expropriated for the Project. In addition, as at the time of site visits, there were no farming or livelihood activities on the Project site. The preferred site for the Project (as further described in Chapter 3) will not lead to physical and/or economic displacement.	
4.	Indigenous Peoples (OP/BP 4.10)	The Indigenous Peoples Policy (OP/BP 4.10) specifies how Indigenous Peoples need to be consulted and involved in the design of projects that may affect them (positively or negatively). Key requirements of OP 4.10 are social assessment; free, prior, and informed consultations leading to broad community support to the project; and development and disclosure of an Indigenous Peoples Plan or Planning Framework.	No	The people in the Project's area of influence are not considered as Indigenous Peoples as defined by the World Bank.	-
5.	Safety of Dams (OP/BP 4.37)	This policy (OP 4.37) applies to projects that construct, rehabilitate, or substantially depend upon large or high-hazard dams, whether these dams are for hydropower, water supply, or other functions (including mine tailings containment).	No	The proposed Project is not in any way linked to any known dam.	-

S/N	World Bank Safeguard Policies	Scope/ Requirement	Safeguard triggered by the proposed Project	Justification	Sections of the ESIA report that address the requirements
		The Bank requires that such projects adopt and implement certain dam safety measures.			
6.	Pest Management (OP 4.09)	The Pest Management Policy (OP 4.09) applies to projects that (i) involve (through World Bank or counterpart funds) the procurement of pesticides or pesticide application equipment; (ii) would lead to substantially increased pesticide use; or (iii) would maintain or expand pest management practices that are unsustainable or risky from an environmental or health standpoint. In Bank-financed projects, the borrower is required to address pest management issues in the context of the project's environmental assessment	No	The development and operation of the proposed Project will not involve substantial use of pesticides.	-
7.	Physical Cultural Resources (OP/BP 4.11)	This policy applies to projects that might affect sites and objects of archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. It is required that the physical cultural resources component of the EA includes an investigation and inventory of physical cultural resources likely to be affected by the project; documentation of the significance of such physical cultural resources; and assessment of the nature and extent of potential impacts on these resources.	No	Based on field observations, documents review and interviews, there are no cultural sites within and around the Project site.	-
8.	Natural Habitats (OP/BP 4.04)	The Natural Habitats Policy (OP/BP 4.04) covers projects that affect natural forests or	No	The Project site is characterized by secondary vegetation,	-

S/N	World Bank Safeguard Policies	Scope/ Requirement	Safeguard triggered by the proposed Project	Justification	Sections of the ESIA report that address the requirements
		other non-forest natural ecosystems, with special focus on those projects that might lead to significant loss or degradation of natural habitats. The Bank supports, and expects such projects to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development		dominated by grasses (refer to Chapter 3 of this report for sample photographs of the Project site).	
9.	Projects in Disputed Areas (OP/BP 7.60)	This policy prescribes special consultation and due diligence procedures for any projects proposed in geographic areas that are disputed between two or more countries.	No	The Project site does not fall in a disputed location.	-
10.	Projects on International Waterways (OP 7.50)	This policy (OP 7.50) covers projects that could appreciably affect international waterways, or the quantity or quality of water in more than one country.	No	There are no known international waterways within the Project's Area of Influence that could be affected by the proposed Project.	-

❖ *World Bank Group Environmental, Health and Safety (EHS) Guidelines*

The World Bank Group EHS Guidelines are technical reference documents that include the World Bank Group expectations regarding industrial pollution management performance. The EHS Guidelines are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, reducing, and controlling potential EHS impacts during the construction, operation, and decommissioning phase of a project. The EHS Guidelines serve as a technical reference source to support the implementation of the World Bank policies and procedures, particularly in those aspects related to pollution prevention and occupational and community health and safety.

The World Bank EHS Guidelines relevant to the proposed Project are:

- The World Bank Group EHS General Guidelines; and

- The World Bank Group EHS Guidelines for Electric Power Transmission and Distribution

The General EHS Guidelines provide guidance to users on common EHS issues potentially applicable to all industry sectors. It contains management measures for the following EHS issues associated with a project under the following headings:

- Air emissions
- Noise
- Ambient water quality
- Water conservation
- Energy conservation
- Hazardous materials management
- Waste management
- Occupational health and safety
- Community health and safety
- Construction and decommissioning.

The EHS Guideline for Electric Power Transmission and Distribution provides guidance applicable to the power project facilities that will involve power transmission and distribution.

The E&S management measures documented in the relevant World Bank EHS Guideline form part of the recommended mitigation measures to address the identified impacts of the proposed Project, as detailed in Chapters 6 and 7.

1.6.3.2 International Conventions

The Nigerian Government is an important player in the international support for the protection of the environment. As such, the country is a signatory to some international laws and conventions, which are targeted towards conservation and protection of the environment in order to ensure sustainable development. The international conventions (ratified by Nigeria) and regulations that are relevant to the proposed Project include:

- *African Convention on the Conservation of Nature and Natural Resources*

The African Convention on the Conservation of Nature and Natural Resources was adopted in Algiers, Algeria, on September 15, 1968 and entered into force on June 16, 1969. The Convention stipulates that the contracting States shall undertake to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interest of the people.

- *Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal*

The Convention was adopted on March 22, 1989 and entered into force on May, 1989. It focuses attention on the hazards of the generation and disposal of hazardous wastes. The Convention defines the wastes to be regulated and controlled in order to protect human and environmental health against their adverse effects.

- *The United Nations Convention on Biological Diversity*

The Convention was adopted in 1994. The objectives of the Convention include the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

- *The United Nations Framework Convention on Climate Change*

The Convention on Climate Change was adopted in 1992 during the Rio Earth Summit in Rio De Janeiro, Brazil, and entered into force in 1994 to limit Greenhouse Gas (GHG) emissions.

- *The Minamata Convention on Mercury*

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. The Minamata Convention was adopted in 2013 and entered into force in 2017. The international treaty is designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds by member countries.

- *Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa (Maputo Protocol)*

This calls on states to protect rights of women and girls, such as property rights, rights to a consensual marriage, protection against child marriage, widows' rights, inheritance rights, and protection against all forms of violence. Nigeria ratified this protocol in 2004 to address the historical discrimination and marginalization of women and girls, including GBV.

- *International Health Regulations (2005)*

The International Health Regulations (IHR) is an international legal instrument that is binding on 196 countries across the globe, including all the member states of World Health Organisation (WHO). This binding instrument of international law entered into force on 15 June 2007. The purpose and scope is "to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks and which avoid unnecessary interference with international traffic and trade".

- *Declaration of the United Nations Conference on Human Environment*

The principles of this Declaration relevant to the proposed Project are summarized below:

Principle 2: The natural resources of the earth, including the air, water, land, flora and fauna especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

Principle 3: The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.

Principle 4: Nature conservation, including wildlife, must receive importance in planning for economic development.

Principle 15: Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all.

Principle 18: Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems and for the common good of mankind.

- *International Labour Organisation (ILO): ILO-OSH 2001 – Guidelines on Occupational Safety and Health (OSH) Management Systems*

These guidelines call for coherent policies to protect workers from occupational hazards and risks while improving productivity. The guidelines present practical approaches and tools for assisting organizations, competent national institutions, employers, workers and other social partners in establishing, implementing and improving occupational safety and health management systems, with the aim of reducing work-related injuries, ill health, diseases, incidents and deaths. Nigeria ratified the guidelines in 2001.

1.6.3.3 Industry Codes and Standards

- *International Electrochemical Commission (IEC)*

The IEC Technical Specification 62257 series contains recommendations for small renewable energy and hybrid systems for rural electrification projects. It outlines international best practice solutions to support energy access in developing countries across a range of technologies. The purpose of this series is to assist renewable energy project managers, engineers and system designers as well as operators to choose the right system for the right place and to design, operate and maintain the system.

1.7 Institutional Arrangements for Environmental and Social Management

The proposed Project is under the FGN's EEP Phase II, being implemented by REA. REA was set up by Section 88 of the Electric Power Sector Reform Act 2005, and its Board and Management were inaugurated on March 16, 2006.

REA will lead the design, installation, operation, and maintenance of the Project while FUGA, through its Department of Works and Physical Planning, is responsible for land allocation for the Project. REA is responsible for selecting Engineering, Procurement and Construction (EPC) contractor (through competitive process) to build, operate and maintain the proposed power plant, and also build and equip the associated training center. The selected EPC will also be considered for a ten-year operation and maintenance (O&M) contract for the power plant. In the long run, the University will be responsible for operating and maintaining the Project.

REA has established a Project Management Unit (PMU) which includes experienced Environmental and Social Safeguard Specialists. The REA-PMU will provide oversight functions for the management of potential environmental and social issues associated with the Project throughout its life cycle. The PMU, in conjunction with the University's Department of Works and Physical Planning, will monitor the hired contractor's E&S performance.

The implementation of mitigation measures for potential environmental and social impacts associated with the Project (at various stages) will also be monitored by FMEnv, NESREA, Yobe State Ministry of Environment and other relevant regulatory agencies, as part of their statutory responsibilities.

In addition, the World Bank will provide overall supervision, facilitation and co-ordination of the Project, and monitor Project performance indicators.

Further information on E&S risk management process for the Project is provided in Chapter 7 of this report.

1.8 Report Structure

In line with the FMEnv guidelines, this report is structured as follows:

- **Preliminary Sections:** containing table of contents, lists of ESIA preparers, Executive Summary, amongst others.

- **Chapter One**: Introduction containing an overview of the proposed Project, the ESIA objectives and study approach and applicable legal and administrative framework.

- **Chapter Two**: Project Justification containing a rationale for the proposed Project as well as the analysis of Project alternatives and development options.

- **Chapter Three**: Project Description containing the technical elements of the Project. It concisely describes the proposed Project and its geographic and temporal context, including the Project's associated infrastructure.

- **Chapter Four**: Description of the Environment. It details the baseline data that is relevant to decisions about the Project location, design, development and operation.

- **Chapter Five**: Potential and Associated Impacts. This takes into account all relevant environmental and social risks and impacts of the proposed Project, including cumulative impacts.

- **Chapter Six**: Mitigation measures for the identified negative environmental and social impacts, as well as the enhancement measures for the identified positive impacts.

- **Chapter Seven**: is the ESMP. It summarizes the key environmental and social measures and actions and the timeframe including responsibility for the implementation of the recommended measures.

- **Chapter Eight**: presents an overview of remediation / decommissioning plan after Project closure.

- **Chapter Nine**: Conclusion and Recommendations

The report also includes references and appendices.

CHAPTER TWO:

PROJECT JUSTIFICATION

CHAPTER TWO

PROJECT JUSTIFICATION

This chapter presents the justification for the proposed 2.5 MW solar-hybrid power plant and associated infrastructure in Federal University Gashua (FUGA), Yobe State, as part of the Federal Government of Nigeria (FGN) Energizing Education Programme (EEP) Phase II. It also includes the description of alternatives and development options considered for the proposed Project.

2.1 Need for the Project

The Federal Universities in Nigeria remain the top choice for a large percentage of students seeking admission into tertiary institutions in the country. However, inadequate power supply from the grid is a major challenge facing many of these universities (for example, the energy demand audit conducted by REA and NUC at FUGA in 2019 reveals that the University receives an average of 2 hours of grid supplied power a day). To cope with the situation, most of the universities rely on diesel-fuel generators for power generation, with significant economic and environmental implications.

Part of the FGN's initiatives to address inadequate power supply in the country is the Nigeria Electrification Project (NEP). NEP is an innovative programme that seeks to provide electricity access to off-grid communities across the country through renewable power sources. It is being implemented by REA and co-financed by the World Bank.

One of the components of the NEP is EEP, with the objective of providing dedicated, clean and reliable power supply to Federal Universities and affiliated University Teaching Hospitals across the country. However, the current phase covers 7 universities and 2 affiliated teaching hospitals. Also, the EEP is part of measures in ensuring that Nigeria achieves its carbon emission targets (20 % - 30 % carbon emission reduction by the year 2030) as contained in its Nationally Determined Contributions (NDC), under the Paris Agreement.

The proposed Project in FUGA is part of the FGN's EEP Phase II, under NEP. The Project will help to significantly address the power supply challenges currently facing the University, which will also lead to many positive spill-over effects. The associated infrastructure such as the training centre to be provided as part of the Project would enhance learning in renewable energy leading to certification, while the street lighting will improve security within the campus as a result of proper illumination.

2.2 Value of the Project

NEP is being co-financed by the World Bank through a $350 million loan which is approximately One hundred and thirty-three billion, four hundred and twenty million naira (₦133,420,000,000[1]). However, $105 million being about forty billion, twenty-six million naira (₦40,026,000,000) has been allocated for the implementation of EEP as a component of NEP. The capital expenditure required for the proposed Project in FUGA will be obtained from the $105 million.

2.3 Project Benefits

The proposed Project is envisaged to have a range of associated benefits, since the importance of gaining access to reliable and steady power supply cannot be over-emphasized. Some of the benefits are a function of the objectives of the Project, while others are a function of the way in which the Project is designed to meet its objectives.

The potential benefits of the proposed Project include but are not necessarily limited to the following:

- Stimulation of academic and research activities within the University as a result of access to constant and reliable power supply, thereby promoting educational advancement.
- Reduction in fossil fuel consumption by the University, thereby leading to reduction in carbon emissions and improvement in eco-balance. The University's average monthly diesel consumption is 4,749 litres (REA Energy Audit Report, 2019).
- Significant reduction in the cost of power generation by the University through diesel-fuel generators. The University has 9 generators and spends ₦1,163,505 on diesel monthly to self-generate 684 kW of power 14 hours daily (REA Energy Audit Report, 2019). Such savings would be used for other undertakings that will benefit the University.
- Increase in social interactions within the University. There will be enhanced security in the University as a result of more streetlights for illumination which would help keep off opportunistic crimes and gender-based violence.
- Enhancement of learning in renewable energy leading to certification as a result of training centre to be provided as part of the Project.
- Improvement in livelihood enhancing activities within the University.
- Direct and indirect employment opportunities during Project development and operation. The employment opportunities will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects.

[1] Central Bank of Nigeria (CBN) November 2020 exchange rate of ₦381 to 1$

- Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
- Increase in financial and technical collaborations between the FGN, the University, REA, World Bank and other relevant Ministries, Departments and Agencies (MDAs).
- Contributing to the Nigeria's NDC to cut carbon emission by 20 % to 30 % by the year 2030, under the Paris Agreement.

2.4 Envisaged Sustainability

2.4.1 Technical Sustainability

The Project development shall be handled by qualified and experienced EPC contractor (to be selected by REA through a competitive process) according to pre-established standards and procedures. The design and construction phase of the Project shall be overseen by qualified engineers from REA and the Department of Works and Physical Planning in FUGA. In addition, standard operating manuals and appropriate documentation regarding the operation and maintenance of the Project shall be developed and put in place by the EPC contractor. These documents will be used as the basis for providing facility-specific training to relevant personnel prior to start-up to further ensure technical sustainability of the Project.

Upon completion of the construction phase, an O&M contractor will be engaged to operate and maintain the Project, in conjunction with the team from FUGA's Works and Physical Planning Department. In addition, adequate capacity building shall be provided to the University personnel that will work with the O&M Contractor for the day-to-day operations of the Project in the long run.

2.4.2 Environmental Sustainability

The environmental sustainability measures for the Project include the use of renewable sources of energy (such as solar) for electricity generation (with negligible greenhouse gas (GHG) emissions compared to fossil fuel-burning power plants). Using data from Azura Edo 450 MW natural gas-fired thermal power plant project (Azura 2012), about 7.5-kilo tonnes (kt) of CO_2 equivalent per year will be saved from being emitted into the atmosphere as a result of the proposed 2.5 MW Solar PV plant. The CO_2 value would even be more if the proposed plant were to be diesel or coal-fired. The avoided emissions can also be used to earn carbon credits that can be traded in the voluntary carbon market.

The project is also in line with the FGN's efforts to keep GHG emissions at the barest minimum, as part of efforts towards climate change mitigation and adaptation. According to WRI CAIT, Nigeria's GHG emissions increased by 25% between 1990 and 2014, averaging 1% annually, while GDP grew 245%, averaging 5.5% annually. Although GDP grew faster than GHG emissions, in 2014, Nigeria's emissions relative

to GDP were 1.6 times the world average, indicating the potential for improvement (USAID, 2019). Thus, the adoption of renewable energy for power generation – a critical need for Nigeria's development, is a key policy direction of the FGN.

In addition, the establishment of REA-PMU (which includes experienced Environmental and Social Safeguards Specialists) to oversee the implementation of the Project will contribute to environmental sustainability of the Project. More so, this ESIA study undertaken at the early stage of the Project development phase (and the commitment to implement the recommended mitigation measures and the ESMP developed as part of the ESIA) is geared towards ensuring the environmental sustainability of the Project.

2.4.3 Economic Sustainability

The proposed Project is part of the FGN's EEP initiative, a component of NEP. NEP is being funded by the World Bank with Three Hundred and Fifty Million US Dollars ($350,000,000) loan, of which One Hundred and Five Million US Dollars ($105,000,000) is allocated for projects under the EEP. The proposed Project in FUGA, as part of the EEP Phase II, will be financed from the NEP fund. Upon completion, the Project will significantly reduce the use of diesel generators in the University thereby saving costs on diesel fuel and generator maintenance, amongst others. Also, the monthly payment to distribution company (Yola Electricity Distribution Company) for power consumption through the grid would stop (the University consumes an average of 3,541kWh monthly from the grid). Part of such savings will be used for the maintenance of the Project facilities in the long run.

A cost-reflective service charge (to be determined based on consultation with University management and users) shall be implemented for all facilities within the University campus. Private business establishments within the University campus shall be allowed to connect to the power Project and metered for billing to generate additional revenue to the University. The generated funds shall be used to sustain the operational costs of the project as well as for the procurement of project components that may be replaced (e.g. spent batteries, panels, etc.) in the future. Additionally, the Project will enhance the University's Internally Generated Revenue (IGR) for other development activities and minimize dependency on allocation from the Federal Government.

2.4.4 Social Sustainability

Stakeholder consultation has been carried out as part of the ESIA process in ensuring that all relevant stakeholders are presented with the opportunity to provide input into the Project at the early stage. This has also assisted in laying a good foundation for building relationship with the stakeholders. In addition, initial stakeholder engagement activities carried out during the ESIA have been presented in the report. A Stakeholder Engagement Plan (SEP) shall be developed to ensure

continuous engagement with relevant stakeholders throughout the Project life cycle. In addition, a grievance redress mechanism (GRM) has been developed by REA for the Project. The GRM provides the communication channel to receive any complaints from stakeholders on the proposed Project and ensures that they are timely and adequately addressed. Details on stakeholder consultations carried out till date on the proposed Project are provided in Chapter 9 of this report.

2.5 Project Alternatives

2.5.1 Site Alternatives

An approximately 12.5 hectares of land within the FUGA campus has been allocated by the University authority for the proposed Project. The preferred site is located about 100 m from the University's Administrative building. The Project site has been selected based on a number of considerations including: i) absence of any rocky outcrops on the site that could pose constraints to the solar panels to be installed; ii) absence of any ecologically sensitive areas and/or cultural resources within and around the Project site; iii) accessibility - the Project site can easily be accessed through the existing road network within the campus; iv) direct link to the existing switch yard can easily be achieved; and v) security reasons.

Other candidate sites considered within the University campus for the proposed Project were rejected due to some factors such as: i) presence of physical structure and agricultural crops which could trigger displacement and relocation; ii) far distance from the existing switch yard; iii) poor accessibility; iv) technical considerations for installation of solar panels, for example, topography.

2.5.2 Alternatives Considered within the Context of the proposed Solar-Hybrid Power Plant

The power plant to be provided as part of proposed Project in FUGA has been conceptualized to be a renewable energy source (solar technology) since that is part of the objectives of the EEP initiative (i.e. carbon emission reduction). Thus, this section specifically focuses on the alternatives considered within the proposed solar-hybrid power plant and eliminates discussion on other possible sources of power generation in Nigeria such as the use of natural gas fired power plant, coal-fired plant, oil-fuel plant, etc.

2.5.2.1 Overview

Solar power generation is currently one of the fastest growing areas in renewable energy. Beyond panel production, it does not emit any significant GHGs. Compared to alternative renewable generation technologies such as wind turbines or biofuel generators, solar energy is produced by converting the sun's radiation – a process void of any smoke, gas, or other chemical by-product, which makes this technology to meet the clean development mechanism of the Kyoto Protocol. This is the main

driving force behind all green energy technology, as nations attempt to meet climate change obligations in curbing emissions.

The use of solar energy for the proposed power plant in FUGA will significantly avoid the generation of GHG emissions associated with fossil-fuel power plants. Thus, the proposed Project will help contribute to Nigeria's NDC on climate change. In addition, the high solar irradiation in Yobe State (as indicated in Figure 2.1) will be able to support the proposed power plant.

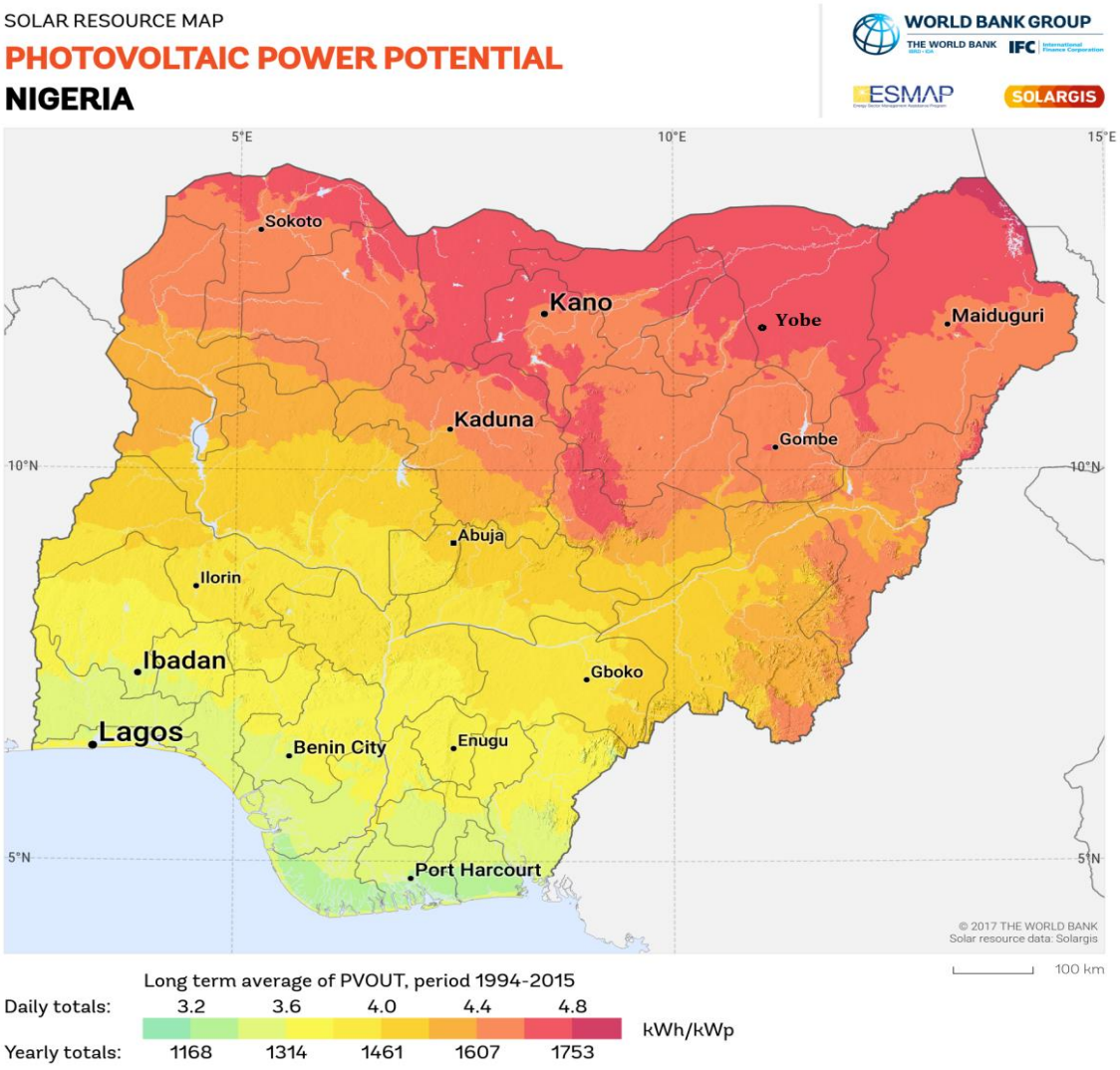


Figure 2.1: Photovoltaic power potential of Nigeria
Source: © 2017 The World Bank, Solar resource data: Solargis

2.5.2.2 Solar Power Technology Alternatives

The solar technologies considered for the proposed power plant in FUGA are:

- Concentrated Solar Power (CSP) Systems
- Photovoltaic (PV) Solar Panels

However, the preferred option for the proposed power plant is the use of PV Solar Panel, since it is highly flexible and requires low installation and maintenance cost in comparison to CSP technology. Water requirement for PV system is also low when compared to CSP system.

The comparison between CPS and PV Solar technologies considered for the Project is summarized in Table 2.1.

Table 2.1: Comparison between CSP and PV Solar Technology

Features	CSP Technology	PV Technology
Description	CSP technology uses concentrated radiation from the sun, to heat a liquid substance which is used to generate steam which in turn passes through a steam-turbine to generate electricity. CSP Technology produces electricity through indirect means. Energy output with CSP technology is of AC type.	PV technology uses sunlight through the 'photovoltaic effect' to generate direct electric current (DC). PV Technology produces electricity through direct means. Energy output with PV technology is of DC type but commonly converted to AC through an inverter.
Applications/Scale	CSP is used for utility scale power generation, mostly for Grid Connections, and also supporting conventional thermal power and desalination plants.	PV technology is suitable for off grid small and medium-sized applications, and for utility scale applications
Land requirement	CSP technology is best suited for areas of high direct normal solar radiation. CSP technology requires about 4 hectares of land per MW of capacity	PV technology has a wider geographical area of application. PV technology requires about 2 hectares of land per MW of capacity
Cost	CSP technology has an high installation and maintenance cost compared to PV	PV technology has a low installation and maintenance cost in comparison to CSP
Construction Time	CSP plant construction is technical more complex than PV	Utility scale PV plants are easier to install and require less time than CSP for Plant construction
Water Requirement	Water requirement is variable depending on the CSP technology option adopted. CSP may utilize wet, dry, and hybrid cooling techniques	Typically requires less water than CSP technology. Water is occasionally required for cleaning of dust from the panels.
Design Options	Less flexible in comparison to PV technology. Can be hybridized with fossil fuels like natural gas.	Highly flexible and adaptable to the project specific requirement
Average life span	25 years	25 years
Efficiency	Power production efficiency of CSP technology are as high as 45%	Power production fluctuates with the sunlight's intensity. For practical use this usually requires conversion to certain desired voltages or AC, through the use of inverters.
Environmental Risks	CSP systems have been recorded to pose environmental risks to bird species, which may be killed by the intense heat generated by the concentrated solar radiation which is reflected off the mirrors.	PV systems are considered to be generally benign.

Culled from different online sources

2.5.2.3 PV Panel Alternatives

Solar PV panel is an assembly of photovoltaic cells, also known as solar cells. It is an essential component of a PV system that converts sunlight directly into direct current (DC) electricity. To achieve a required voltage and current, a group of PV panels (also called PV modules) are wired into large array that called PV array. PV panels can be

wired together in series and/or parallel to deliver voltage and current in a particular system requires.

The types of solar cells that are commonly used in PV technology are: i) mono-crystalline silicon; ii) poly-crystalline silicon; iii) thin film and iv) bifacial panels. The typical appearance of each of these PV panels is shown in Figures 2.2 to 2.5.

Based on the consideration of cost and efficiency, polycrystalline silicon PV panels are envisaged to be used for the proposed Project.

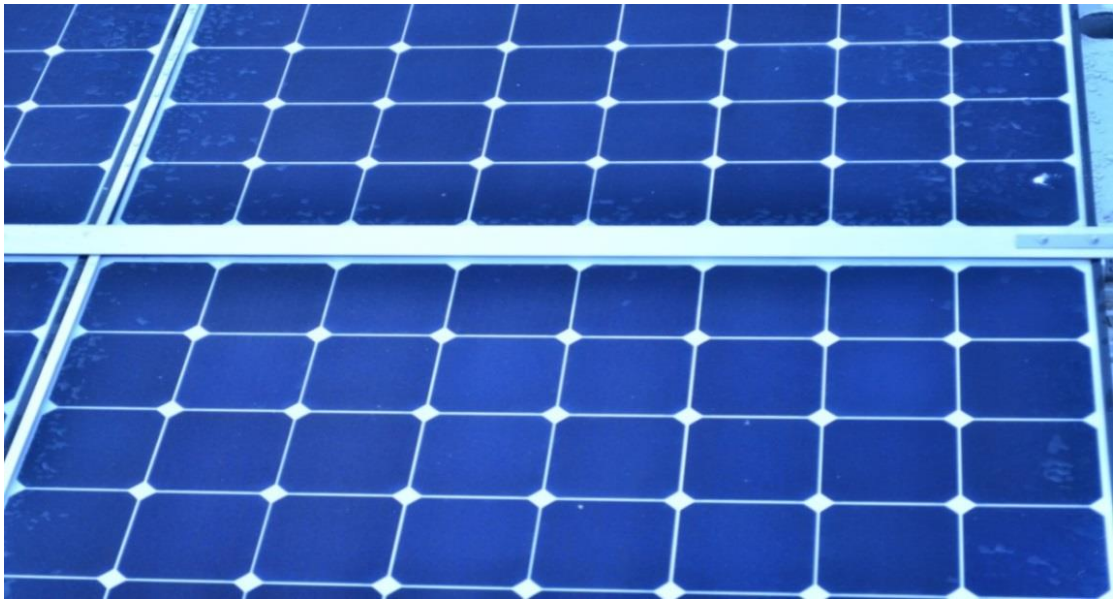


Figure 2.2: Typical appearance of mono-crystalline silicon PV panels

Figure 2.3: Typical Appearance of Polycrystalline Silicon PV panels

Figure 2.4: Typical appearance of Thin-Film CdTe panels

Figure 2.5: Bifacial Solar panels

2.5.3 Battery Types Alternative

The proposed solar-hybrid power plant in FUGA is an off-grid system, which will involve the storage of power. Storage allows the PV array to continue providing power even when the demand is down, instead of having to disconnect and refrain from generating power. The batteries for the proposed power plant would be required to meet the demands of heavy cycling (charging and discharging) and

irregular full recharging. There are a variety of battery types fitted for these requirements; however, four (4) of these batteries are the best available technology for solar power plants. These are: lead-acid, lithium-ion, flow, and nickel-cadmium batteries.

Following the careful consideration of factors such as safety, charging cycles, depth of discharge and life span, lithium-ion batteries are envisioned to be used as the preferred battery for the proposed solar power plant.

An overview of the battery types considered for the Project is provided below:

- ***Lead-Acid Batteries***

These are the oldest and cheapest form of batteries used in solar systems. They are widely used in Solar PV installations due to their wide availability and ability to work in a wide range of conditions. They internally convert hydrogen and oxygen into water and do not require maintenance (Zhang *et al.,* 2016). However, proper disposal of end-of-life lead-acid batteries is important. The lead-acid battery life is typically 3-10 years (Sun *et al.,* 2017).

- ***Lithium-Ion Batteries***

Lithium-ion batteries can deliver more cycles in their lifetime than lead-acid. They can be lighter and more self-contained than lead-acid batteries. They are solid, and do not require refills or maintenance. The most important benefit lithium-ion provides for solar is its high charge and discharge efficiencies, which help harvest more energy. Lithium-ion batteries also lose less capacity when idle, which is useful in solar installations where energy is only used occasionally. Lithium ion batteries usually have longer lifespan when compared to the lead-acid batteries, average of 5 years.

- ***Flow Batteries***

The vanadium redox flow battery (VRFB) is the most common technology in this type of batteries. In VRFB, the vanadium electrolyte does not degrade over time, so they can last much longer than other technologies. With other technologies, adding more batteries is the only way to increase hours of storage; however, adding more electrolyte (vanadium) can increase battery size in VRFB (Whitehead *et al.,* 2017).

The VRFB has no cycling limitations, and batteries can be charged and discharged completely without impact on their lifespan. They can last up to 20 years. The recycled vanadium in flow batteries is not toxic and can be reused repeatedly for other purposes, such as in making steel (Whitehead *et al.,* 2017). However, the high cost of vanadium and ion selective membrane within the cell will lead to significant cost implications for the Project.

❖ ***Nickel-cadmium Batteries***

Nickel cadmium or NiCd batteries are as old as the lead-acid batteries. Though they may not have the energy density (the power) of other technologies, they provide long life and reliability without complex management systems. They are also as cheap as lead-acid batteries (Shukla and Hariprakash, 2009).

NiCd batteries are rugged batteries with a high life span of up to 20 years (Shukla and Hariprakash, 2009). However, the major disadvantage of NiCd batteries is the relatively low energy density and susceptibility to self-discharge. Thus, making NiCd batteries an unreliable alternative for the proposed Project

2.6 Project Options

2.6.1 No Project Option

One of the reasons for the proposed Project in FUGA is that the current demand for electricity in the University significantly exceeds generation/supply and, that the current power supply through the grid is unreliable and suffers interruptions. If the Project does not go ahead, access to reliable, safe and cheaper power supply may be difficult to realize. In addition, the potential benefits associated with the Project would not be realized. Furthermore, the no project option would mean that the University will continue to significantly rely on diesel-fuel generators for self-generation of power considering the current situation of electricity supply to the University through the grid. This has serious economic implications to the University and would not also be in line the FGN's efforts in achieving its carbon emission targets. Thus, the No Project option is not considered a viable option to adopt.

2.6.2 Delayed Option

This option implies that the planned Project will be delayed until a much later date. Such option is usually taken when conditions are unfavourable to project implementation such as in war situation, or where the stakeholders are deeply resentful of the Project. Also, if the prevailing economic climate is not quite favourable to the Project, then delayed project option may be feasible. But none of these conditions is applicable.

Indeed, both the economic and the political environments are most favourably disposed towards the Project. The implication of delayed project option will mean that all the preliminary work and associated efforts/costs incurred would have come to nothing. Also, because of inflationary trends, such a delay may result in unanticipated increases in project costs, which may affect the final profit accruable from the Project. The delayed option is considered unviable for the Project.

2.6.3 Go Ahead Option

The inherent benefits of allowing the Project to go ahead as planned are multifarious. The quality of education, capacity for research and innovation, training opportunities, improved security within the University campus, job opportunities for Nigerian professionals, skilled and semi-skilled craftsmen will increase. Thus, the option to go ahead as planned does outweigh the other options as clearly highlighted above.

CHAPTER THREE:

PROJECT DESCRIPTION

CHAPTER THREE

PROJECT DESCRIPTION

3.1 Introduction

This chapter presents the technical description of the proposed Project including the Project location, associated components, power generation and evacuation approach, and development activities. Waste streams associated with the proposed Project over its life cycle, and the proposed handling techniques are also discussed.

3.2 Project Location

3.2.1 About FUGA

FUGA is a Federal Government-owned tertiary institution, with its campus situated on approximately 2,248 hectares (ha) of land in Bade Local Government Area of Yobe State, Northeast geo-political region of Nigeria (Figures 3.1 to 3.4).

In pursuance of its drive to transform the Education Sector in Nigeria, the Federal Government had, in 2010, approved the establishment of 12 new universities in the six geopolitical zones of the country. This was intended to open access to tertiary education for the teeming Nigerian youths. As part of the effective planning, the Federal Government set up an Implementation Committee which comprised of the National Universities Commission (NUC), the Tertiary Education Trust Fund (TETFUND) and other relevant stakeholders. Following a wide consultation by the Committee and the submission of its report, the implementation of the first phase of the proposal commenced in February, 2011, with the establishment of 9 universities, while the second phase involving the remaining 3 universities including FUGA commenced on February 18, 2013.

Currently, FUGA has 4 faculties namely: Faculty of Education, Faculty of Agriculture, Faculty of Science, and Faculty of Art, Management and Social Science, offering about 23 programmes. As at April 2019, the population of FUGA stood at 4,493 persons, consisting of 3,500 undergraduate and postgraduate students and 993 administrative staff (both academic and non-academic).

3.2.2 Description of the Project Site

An approximately 12.5 ha of land within the FUGA campus has been allocated for the proposed solar-hybrid power plant and the training centre. The Project site lies geographically within Latitude 12.88172°N - 12.87680°N and Longitude 11.01232°E - 11.01727°E, and its boundary is bordered to the north (about 100 m) by the University's Administrative building. Other existing infrastructure in the immediate

surroundings of the Project site include newly constructed male and female hostels (to the west of the site), the University's Information and Communications Technology (ICT) centre and the FUGA water factory unit (to the east), as indicated in Figure 3.5.

The proposed Project site is one of the undeveloped land areas within the University campus that are reserved for future development projects. The topography of the site is relatively flat and there is a rainwater harvesting trench at the southern part of the Project site. The trench is one of the rainwater harvesting points within the campus for irrigation demonstration to some of the University students in the Faculty of Agriculture as part of their coursework.

As shown in Plate 3.1, the vegetation on the site is composed of grasses and a few trees. The site is not known to fall within any gazetted grazing reserves, breeding areas, or animal migratory routes. However, during site visit, some grazing activities were observed at the proposed site. Interviews with the University representative from the Department of Works and Physical Planning revealed that the grazing activities were free range due to the presence of grasses on the site, and not exclusively limited to the site.

In addition, there is no local community encroachment (i.e. farms, residential buildings, and firewood / fruit gathering) within the site. Also, as at the time of site visit, the Project site was not being used for farming or any livelihood activities. The nearest community to the Project site is Low-Cost community situated about 1.2 km away from the University. Detailed information on the local community is provided in Chapter 4 of this report.

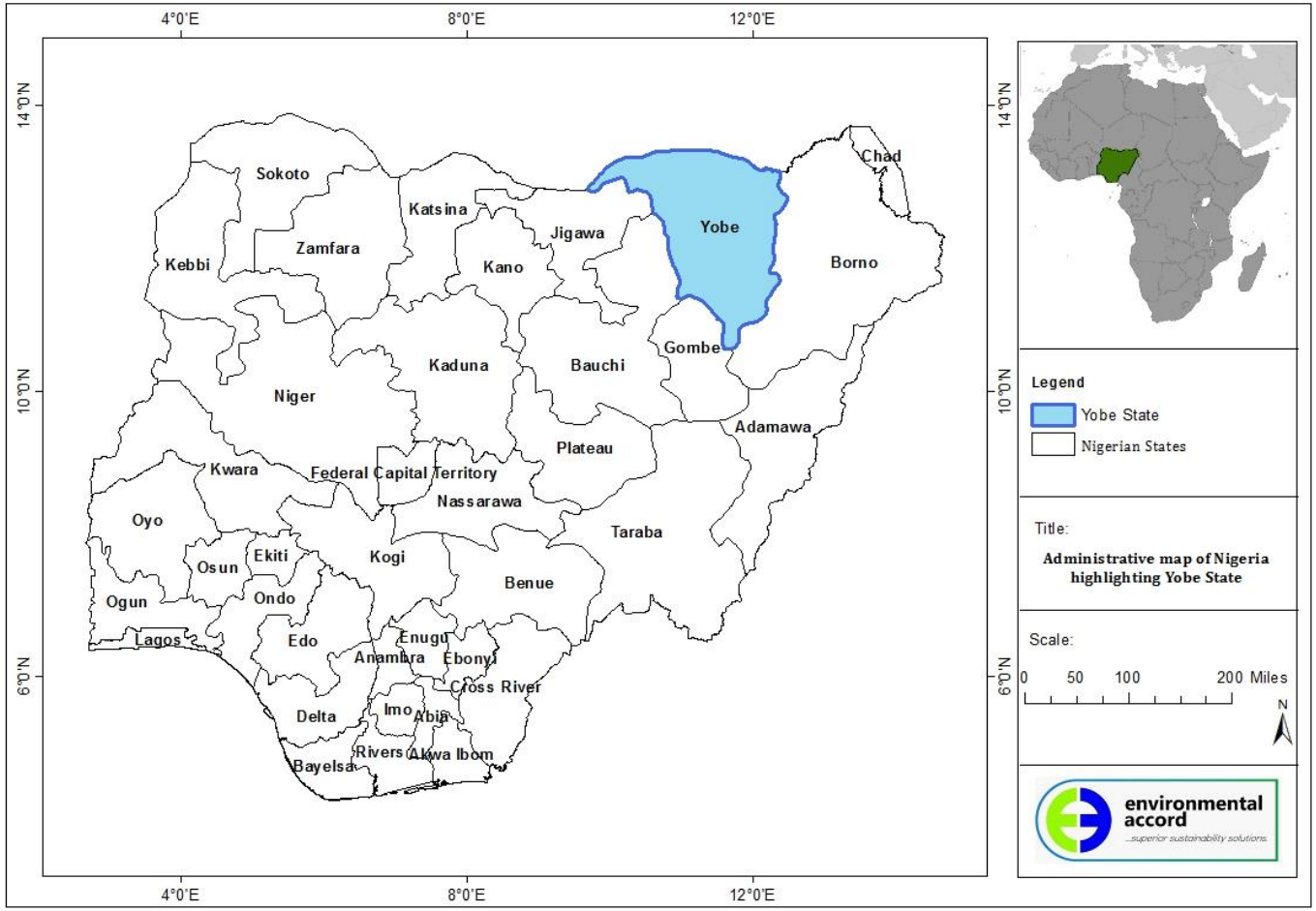


Figure 3.1: Administrative Map of Nigeria highlighting Yobe State
(Source: EnvAccord GIS, 2019)

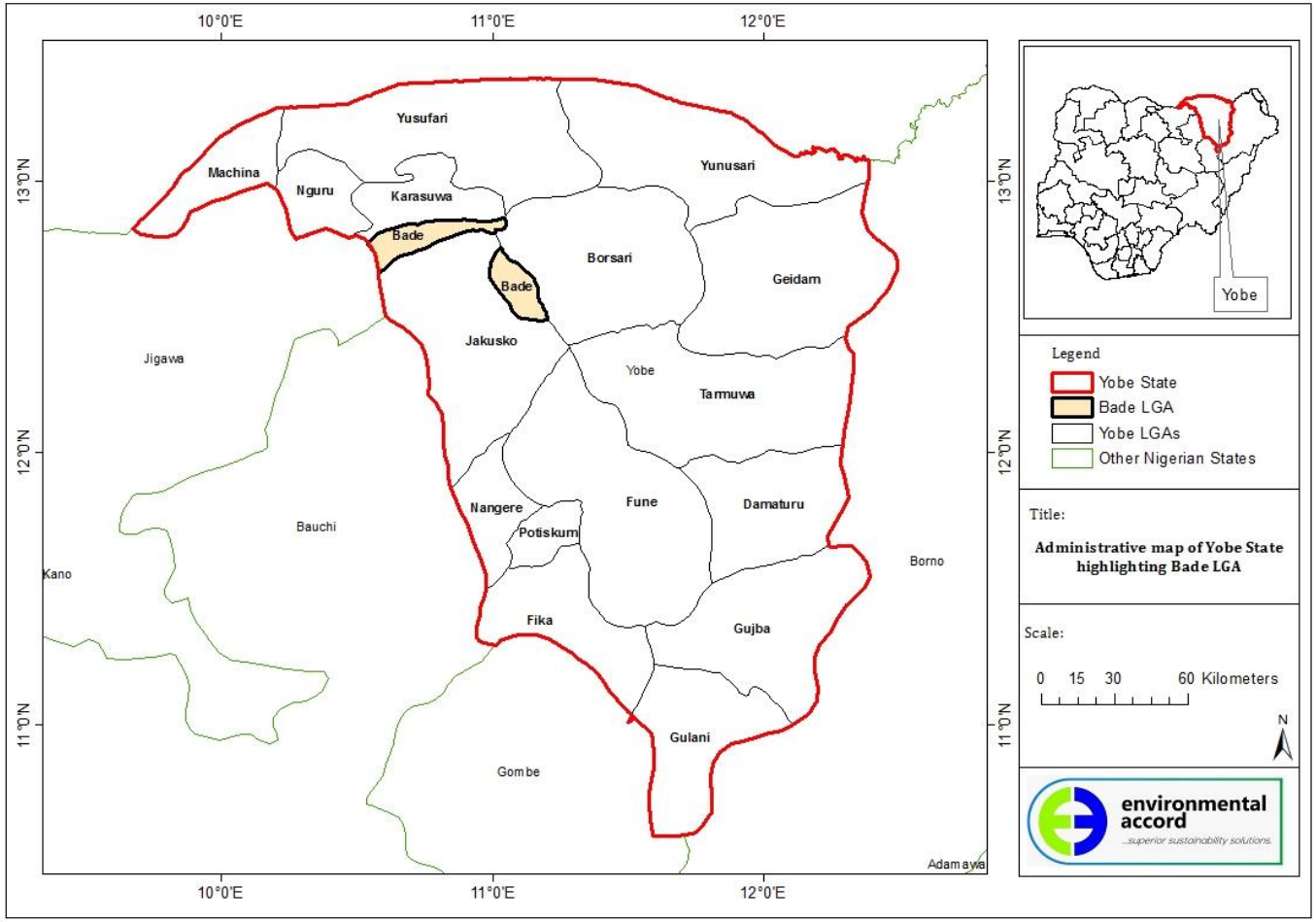


Figure 3.2: Administrative Map of Yobe State highlighting Bade Local Government Area
(Source: EnvAccord GIS, 2019)

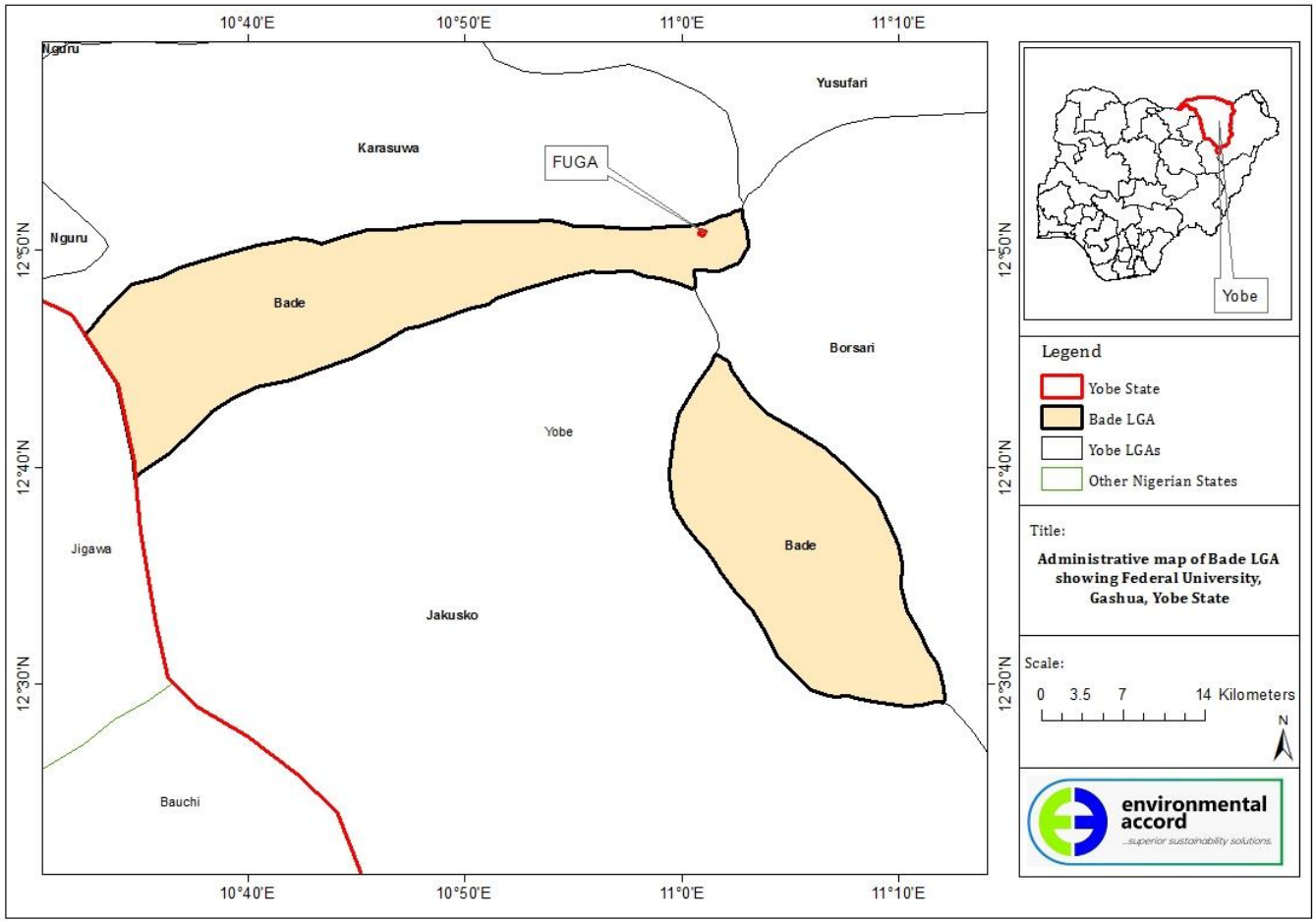


Figure 3.3: The Location of FUGA campus in Bade Local Government Area
(Source: EnvAccord GIS, 2019)

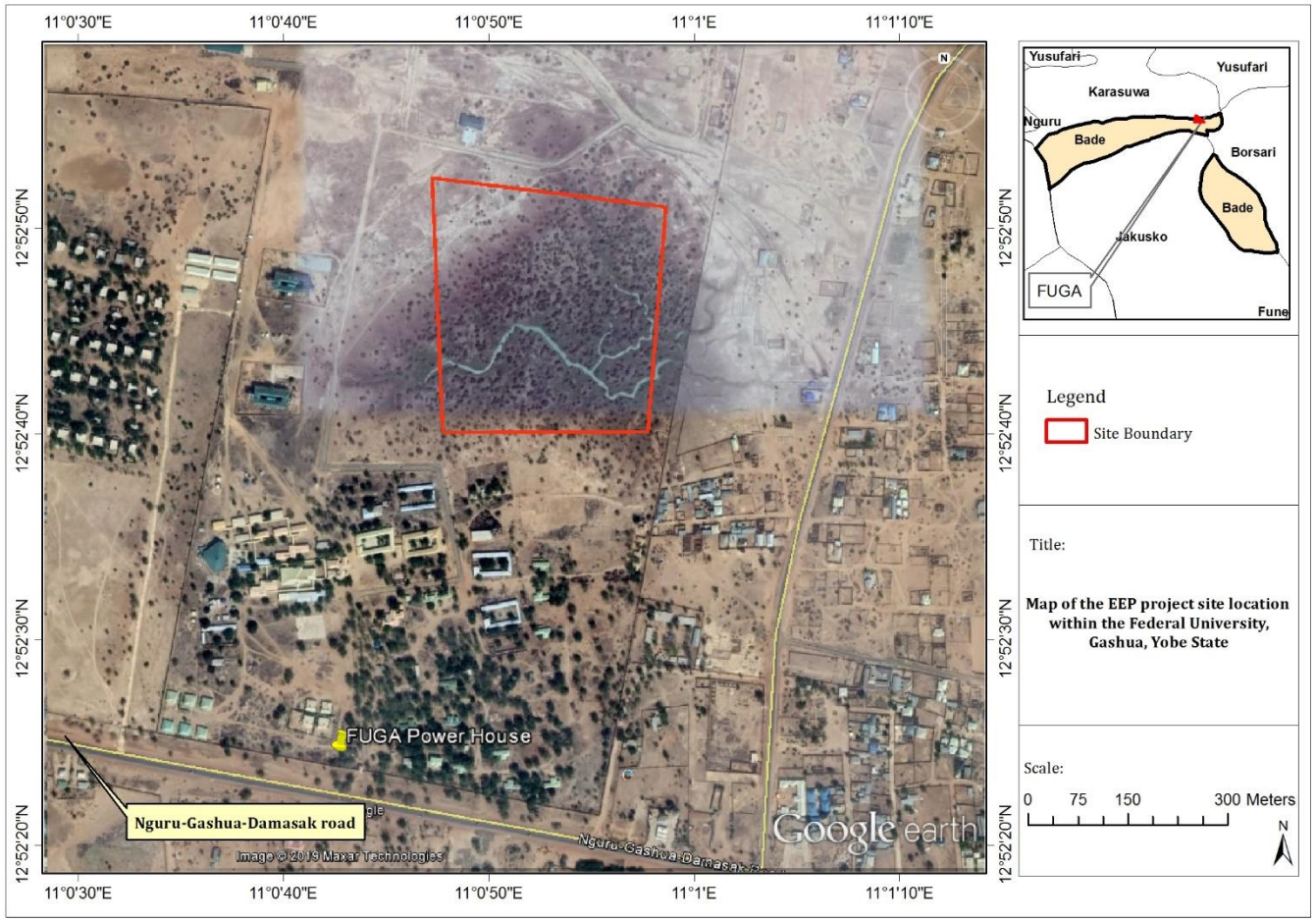
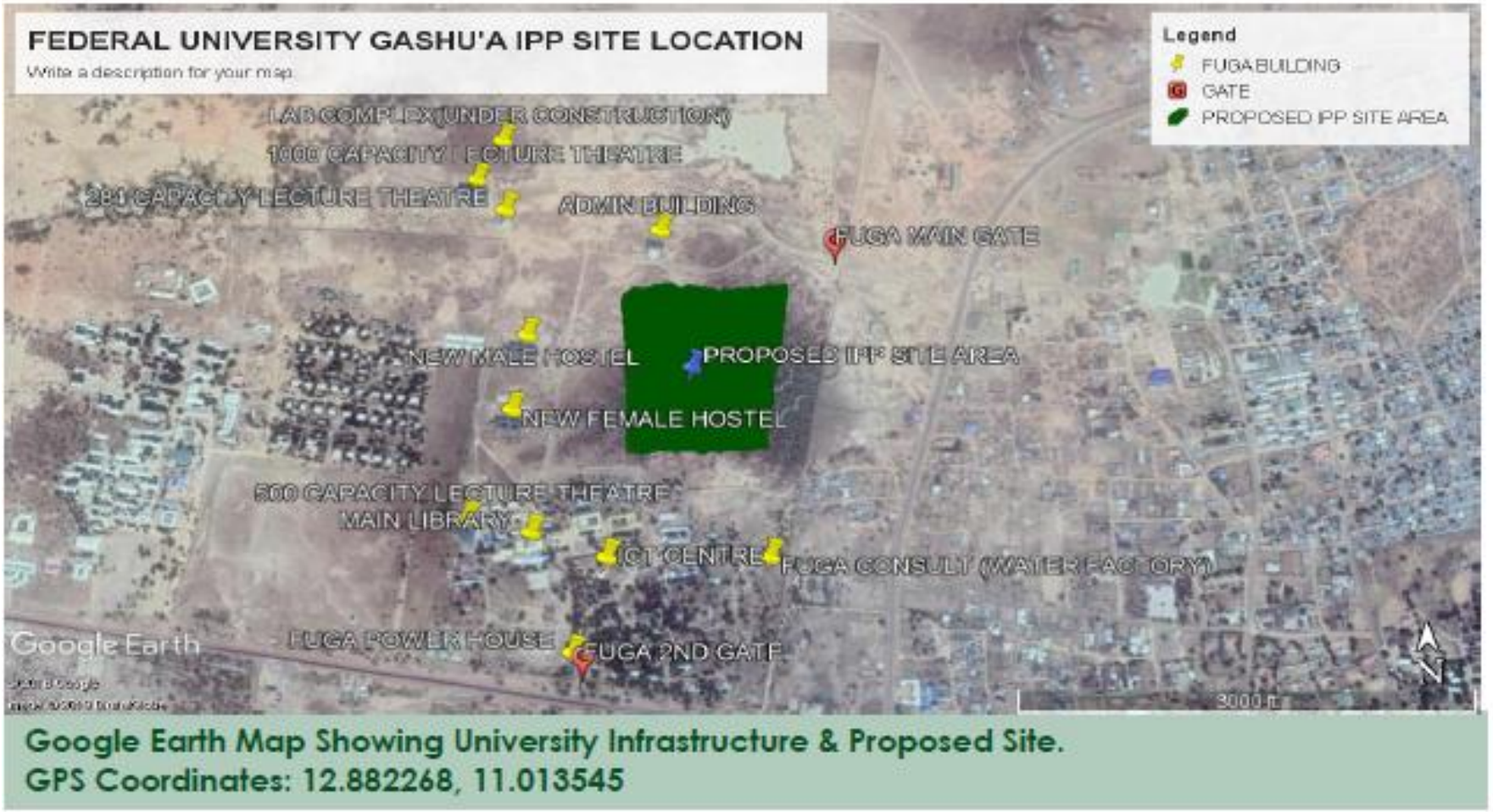


Figure 3.4: Map of the Project site within the FUGA campus
(Source: Google Earth, 2019)



Google Earth Map Showing University Infrastructure & Proposed Site.
GPS Coordinates: 12.882268, 11.013545

Figure 3.5: Aerial imagery of the Project site and the surrounding infrastructure within FUGA campus
(Source: REA energy audit report, 2019)

Plate 3.1: Cross-sectional view of the Project Site within FUGA campus (during the rainy season)
(Source: EnvAccord fieldwork, 2019)

3.3 Project Components

As previously stated, the scope of the EEP includes provision of independent power plant, rehabilitation of existing electricity distribution infrastructure, provision of street lighting as well as a renewable energy training centre. However, the Front-End Engineering Design (FEED) for the project is ongoing as at the time of this ESIA study. Therefore, the specifications and number of some of the components to be installed for the proposed project are yet to be finalized. Each of these components as they relate to FUGA solar hybrid power project are discussed below.

3.3.1 Proposed Solar-Hybrid Power Plant

As part of the initial activities, an energy demand audit of FUGA was carried out in April 2019, by REA in conjunction with the NUC. The summary of the audit findings is provided in Table 3.1.

Table 3.1: Summary of Energy Demand Audit for FUGA, April 2019

S/N	Item	Value	Duration/ Remarks
1.	Daily Energy Consumption (Measured) (kWh)	710.36	1 day
2.	Daily Energy Inductive Consumption (Measured) (kVARH, kilovolts amperes reactive hours)	0.04	
3.	Daily Capacitive Energy Consumption (Measured) (kVARH)	0.00	
4.	Daily Peak Power Demand (Measured) (kW)	110.46	10:00am to 12:00pm
5.	Daily Off-Peak Power Demand (Measured) (kW)	13.76	
6.	Daily Energy Consumption (Historical Data) (kWh)	118.03	
7.	Total energy consumed per month from grid supply (kWh)	3,541	
8.	Total capacity of self- generation (kW)	684.00	
9.	Total Number of Diesel Generating (DG) Sets	9	
10.	Estimated hours of grid supply per day (h)	2	
11.	Yearly Energy Consumption (Historical Data) (kWh)	42,490	
12.	Displacement Power Factor (DPF) (%)	0.98	Average from 2 Nos. DG sets of 250kVA (power house) and 100kVA (lecture theatre) powering different sections of the University
13.	Power Factor Total (PFT) (%)	0.98	
14.	Total Harmonic Distortion (THD) (V-N)	1.81	This is an average of the 3 phases from both DG sets
15.	Total Harmonic Distortion (THD) (V-phase)	1.66	
16.	Total Harmonic Distortion (THD) (I-phase)	13.08	
17.	Total Harmonic Distortion (THD) (I-N)	61.78	Average from 2Nos. DG sets of 250kVA (power house) and 100kVA (lecture theatre) powering

S/N	Item	Value	Duration/ Remarks
			different sections of the University
18.	Measured Power Demand (kW)	110.46	Same as peak load
19.	Estimated Annual Power Demand Growth (%)	-395.03	
20.	Planned Expansion Load for New Building, Hostels etc. (kW)	1,382	
21.	Not connected load that are considered critical with plans for re-activation (kW)	336	
22.	Estimated Power Demand Forecast in 5 Years	1,828	

Source: REA Energy Demand Audit report for FUGA, 2019

Based on the findings of the energy audit, a 2.5 MW solar-hybrid power plant is proposed for FUGA. The proposed power plant will involve the use of PV technology for power generation.

PV technology is a method of generating electricity through the use of solar panels which are composed of a number of solar cells. Such cells convert solar energy (radiation from the sun) into electricity using semiconductors such as silicon. One of the properties of semiconductors that makes them most useful is that their conductivity may be easily modified through the introduction of foreign materials into their crystal lattice, which in turn can lead to improved energy generation.

PV technology is basically comprised of:

PV Cell: This is the basic photovoltaic device which generates electricity when exposed to solar radiation due to its photo-electric effect. The absorbed solar energy excites electrons inside the cells into a higher state of energy, producing electrical energy. PV cells are commonly constructed from mono- or polycrystalline silicon or thin film technology. A number of solar (PV) cells electrically connected to each other and mounted in a single support structure or frame is called a PV panel.

PV panel or module: This is the smallest assembly of interconnected PV cells sold commercially. In the case of crystalline silicon cells, following testing and sorting to match the current and voltage, the cells are interconnected in series and encapsulated between a transparent, anti-reflective front, and a backing material to provide environmental protection to the cells. The panel is then typically mounted in an aluminium frame to provide mechanical strength to the assembly. PV panels are usually designed to supply electricity at a certain voltage, such as a 12 V system. The current produced is directly dependent on the intensity of light reaching the panel. Several PV panels can be wired together to form an array. PV panels and arrays produce Direct Current (DC) electricity.

The most likely PV panels to be used for the proposed power plant in FUGA are of poly-crystalline silicon as discussed in Chapter 2. However, the exact number of the panels is yet to be finalized. Based on the review of similar solar power projects, about 6,600 PV panels (for example, JKM340PP-72H-V) would be required to generate a power capacity of 2.5 MW.

The PV panels to be installed will have following characteristics:

- All PV panels within a PV string will have equivalent Voc (voltage at open circuit) and Vmpp (voltage at maximum power point) values and will be of same type, with same design, from the same manufacturer.
- All PV strings within a PV sub-array connected in parallel will have similar rated electrical characteristics of open circuit voltage and maximum power voltage, and temperature coefficients.
- All PV panels that are electrically in the same string will have the same orientation (azimuth and tilt angle).
- PV structural components will be corrosion resistant.

Aside the PV panels, the power plant will typically consist of the following associated components:

Mounting structure: The PV panels will be secured on a fixed structure, made up of galvanized steel or aluminium. The majority of leg structures for the frames will be fixed into the earth. Driven piles and/or screwed system will be used and the depth of driven piles is 2 m.

Inverter: An inverter converts the variable DC output of a PV panel into a utility frequency alternating current (AC) that can be used by a local, off-grid electrical network or fed into a commercial electrical grid. Solar inverters are usually designed to have in-built safety features required by PV cells as well as special functions adapted for use with PV arrays, including string current monitoring and anti-islanding protection. The number and specification of inverters to be installed as part of the proposed solar-hybrid power plant is yet to be finalized. The inverters shall however be acquired from the internationally recognized manufacturers such as WSTech, Ingeteam, Gamesa, Jema, Power Electronics, GPTech, and Helios Systems.

Battery: The number and capacity of lithium-ion batteries to be installed as part of the power plant is yet to be finalized. The batteries would be stored and operated under optimum conditions as specified by the manufacturers.

Backup Generators: Diesel-fuel generating sets (2 – 3 Nos) would be installed at the Project site for recharging the batteries during unfavourable weather conditions (e.g. at

the peak of raining season). The capacity of the proposed generators is yet to be finalized. A diesel-storage tank with appropriate bund wall on a concertized floor will also be provided on site.

Combiner Boxes: A combiner box combines the output of several solar strings into one output. Solar combiner boxes also consolidate incoming power into one main feed that distributes to a solar inverter. They are engineered to provide overcurrent and overvoltage protection to enhance inverter protection and reliability.

Underground cable for power evacuation: The power generated from the proposed plant would be evacuated to the existing power house in the University through an 11 kV underground armoured cable. The distance between the Project site and the existing power house is approximately 600 m. Information on the size of the evacuation cable is not available yet.

Low and medium voltage switchgear cabinets: Power generation and distribution during plant operation involves the use of various types of circuit breakers and surge protectors, which will be enclosed in low and medium voltage switchgear cabinets. The switch gear cabinets to be installed at the plant site will contain a combination of electrical disconnect switches, fuses and circuit breakers. These components will be used to control, protect and isolate power generation and distribution activities during operation. A typical low voltage switchgear cabinet is shown in Plate 3.2.

Plate 3.2: A typical low voltage switchgear cabinet
Source: bowerselec.co.uk/low-voltage-switchgear, 2018

3.3.2 Rehabilitation of Existing Distribution Infrastructure

The energy audit conducted at FUGA indicates that the major power equipment in the University such as transformers, distribution network are in good condition. In addition, there are high level interconnection substations in place with installed distribution capacity of 3,750 kW. Where required, the existing distribution network will be upgraded to accommodate the generated power from the proposed solar-hybrid power plant.

3.3.3 Provision of Street Lighting

Information obtained from the report of energy demand audit conducted in FUGA in April 2019 reveals that the University has 106 streetlights (solar and conventional) covering 8 major roads within the campus. Sample photographs of the streetlights are shown in Plate 3.3. As part of proposed Project, new and additional streetlights will be installed (where required) to ensure that different areas within the University campus are well illuminated.

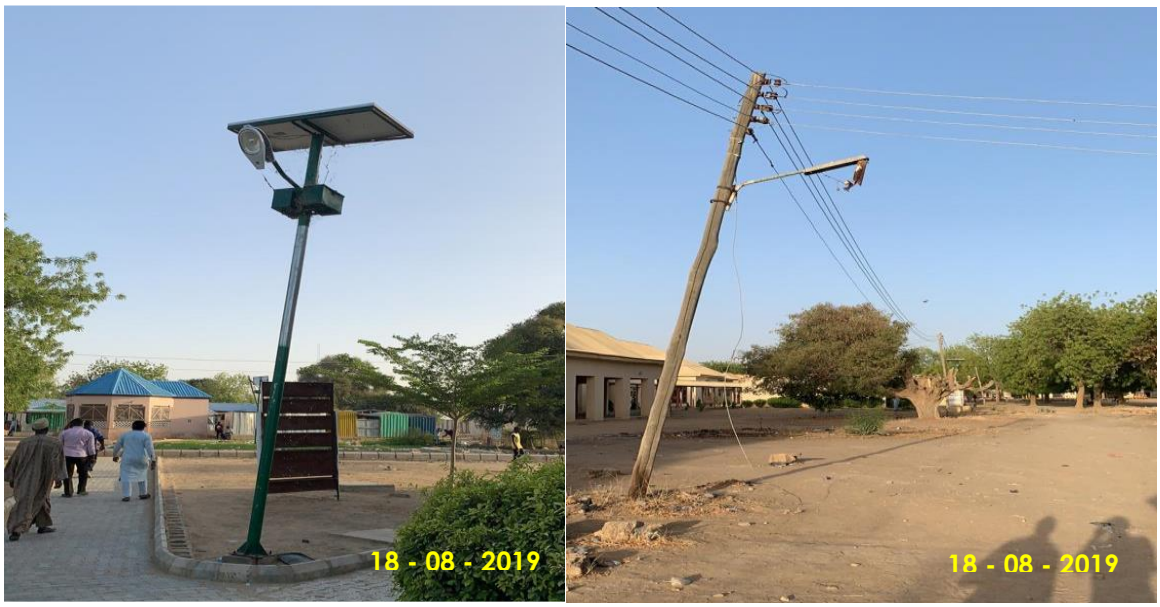


Plate 3.3: Sample of stand-alone and pole-mounted streetlights in FUGA campus

3.3.4 Renewable Energy Training Centre

Students from the University will be allowed to access the Project site for learning and training purposes. Therefore, a renewable energy training centre will be constructed within the 12.5 ha of land earmarked for the entire Project. The training centre will also include storage room, workshop and toilet facilities.

3.4 Engineering Codes and Standards

The Project components shall be designed and installed in compliance with the relevant codes and standards of the British Standard- Europe Norms (BS–EN), the

International Electrotechnical Commission (IEC), International Organization for Standardization (ISO) and the Standard Organization of Nigeria (SON). Examples of the relevant codes and standards include ISO 15673:2005 "Guidelines for the simplified design of structural reinforced concrete for buildings" and BS EN 60529:2013 "Degree of Protection by Enclosures (IP Code)", amongst others.

3.5 Project Implementation Phase

3.5.1 Pre-construction Phase Activities

Following the completion of engineering design for the Project and receipt of relevant approvals, the major activities during this phase include site clearing and preparation, and mobilization of equipment, materials and personnel to site. Clearing will involve removal of existing vegetation from the site and preparing a level working surface in readiness for construction activities.

3.5.2 Construction Phase Activities

The construction phase of the Project will include civil, mechanical and electrical works; installation of PV panels and associated plant facilities; construction of a training centre; installation of streetlights as well as underground armoured cable for power evacuation. Also, where required, an upgrade of some of the existing power distribution infrastructure within the University will be carried out.

It is envisaged that approximately 300 people would be required for construction activities. These are divided into low skilled workers (e.g. construction labour who will make up the majority of workers), semi-skilled workers (drivers, technicians, etc.), and skilled personnel (e.g. engineers and expatriates). Most of the unskilled and semi-skilled workers would be drawn from the nearby local community (located outside the University campus) to enhance the job opportunities associated with the proposed Project. Moderate level of migrant workers may also be associated with the construction phase activities (potential impacts associated with the migrant workers as well as the proffered mitigation measures are covered in Chapters 5 and 6). No workers camp is planned to be established onsite during construction.

3.5.3 Commissioning Phase Activities

The commissioning phase of the proposed Project will include testing and checking individual equipment /system, as well as the associated infrastructure to ensure they have been installed correctly and can be handed over for use.

3.5.4 Operational Phase Activities

The operational phase of the Project will involve power generation and distribution to various sections of the University as well as the preventative, corrective and predictive

maintenance of the power plant and associated facilities. In addition, the training centre will be put into use to enhance learning in renewable energy.

The EPC contractor shall develop standard operating procedures (SOPs) for the operation and maintenance of the solar panels, inverters, batteries, and other associated components of the Project. If need be, the SOPs shall be further reviewed and updated by the O&M contractor during operation. The day-to-day operations of the plant will involve both regular preventive and corrective maintenance carried out by the O&M Contractor in order to keep the power plant in optimal working condition throughout its operating life. The preventive maintenance follows a routine service schedule aimed at preventing faults from occurring and keeping the power plant operating at its optimum level. The frequency of the preventive maintenance would depend on a number of factors such as the technology selected, environmental conditions of the site, warranty terms and seasonal variances. It contains, for example, activities like PV panel cleaning, inverter servicing, and checks on structural integrity of the mounting structure.

Corrective maintenance will be carried out in response to failures, for example, the repair / exchange of damaged or faulty equipment. Maintenance will consist mostly of panel / battery replacement and other mechanical and electrical infrastructure repairs. Faulty components will be replaced as soon as the problems are identified.

The average life span of the PV power plant is 25 years which can be extended through regular maintenance. Even after the 25 years, the PV panels can still generate up to 90% of the design capacity.

Chapter 8 of this report contains detailed information on the activities associated with the decommissioning of the proposed solar-hybrid power plant and its ancillary facilities (in the event of final decommissioning), including the environmental and social measures to be implemented to address potential impacts of the decommissioning activities.

3.6 Water Use and Supply

One of the key benefits of the power plant (to be provided as part of the proposed Project) in terms of resource use is the generation of electricity using freely available solar energy to produce electricity, reducing the dependence on fossil fuels; thus, reducing carbon emission.

The use of water for construction activities will be minimal because construction works requiring cement mixing will be few on site. Water is required majorly during the operational phase of the power plant for periodic cleaning of PV panels to

prevent dust build-up (especially during the dry season), since dust can affect their performance by inhibiting the amount of irradiation that reaches the solar cells. The rate of build-up of dust on the PV panels is dependent on a number of factors including soil type, local wind speed and the mounting structure used for the panels.

Manual cleaning of the PV panels with water shall be regulated as much as practicable. During the periods of rainy season (usually from May to October in Yobe State), direct cleaning of the PV panels is estimated to occur not more than three times. However, during the dry season (November to April), the frequency of cleaning will depend on the rate of dust accumulation, and it is envisaged to be more than three times due to high dust generation usually experienced in the Northern part of the country.

Based on the review of similar solar power projects, each PV panel would require approximately 5 litres of water per cleaning cycle. This implies that about 33,000 litres of water will be needed for each cleaning cycle. The water required for the cleaning purpose would be obtained from the borehole that will be installed within the Project site. Based on observations noted during the field survey and the estimated quantity of water required for occasional cleaning of the PV panels, water abstraction for the Project is not envisaged to have significant effect on the existing groundwater aquifer of the Project area as well as the local water use. The recharge of the existing boreholes in the study area is largely due to direct precipitation. During the rainy season, the water reserve of the aquifer in the study area increases; thus, hand dug wells and boreholes yields improve significantly.

3.7 Health and Safety

The EPC Contractor shall engage dedicated personnel competent on the basis of appropriate education, training, and experience to manage and oversee the Health, Safety and Environment (HSE) aspects of the Project. The HSE personnel shall ensure that the Project and subcontractors operate in accordance with the applicable regulatory HSE requirements and plans; and also monitor implementation of environmental and social protection measures.

Occupational health and safety (OHS) plans shall be developed and maintained by all contractors involved in the implementation of the proposed Project. The contractors shall provide OHS training that may include hazard awareness, safe work practices and emergency preparedness to their workers to ensure they are appraised to project sites rules of work, personal protection and preventing injury to fellow workers. Worker activities will be managed through appropriate planning and the application of Permit-to-Work system, Job Hazard/Safety Analysis, Personal Protective Equipment (PPE) requirements and other safety-based protocols.

Also, all contractors, as a component of their contracts, will implement HSE plans which will outline procedures for avoiding health and safety incidents and for emergency medical treatment. Contractors will be required to carry our regular safety inspections to ensure measures to manage potential OHS hazards are implemented.

For example, during the construction phase, a Health and Safety (H&S) risk assessment-based approach will be taken to manage H&S risks to workers. This would involve assessing all the various risks that are involved in each aspect of the job and educating workers on how to manage these risks. The people working around the Project area shall also be warned of the risk involved i.e. warning signs shall be erected for people to see clearly. In addition, first aid equipment and PPEs for workforce will be provided onsite throughout the construction activities.
All staff, workmen, supplier and sub-contractor working on site shall be informed on the need to ensure their safety and the safety of the people working around them. Every worker will be instructed to always put on PPE whilst on site. Appropriate warning signs will be erected and checked each day. Daily health and safety tool-box meetings among workforce will be ensured. The safety briefings will be led by the onsite HSE officers. Smoking, use of alcohol or hard drugs will be strictly forbidden.

3.8 Waste Management

This section discusses the waste streams associated with the proposed Project and the intended management plan.

3.8.1 Overview

It is the goal of REA that the proposed Project is designed, developed and operated in a sustainable manner. Thus, effective waste management practices that comply with the relevant local requirements and international best practices shall be implemented during all phases of the proposed Project. To achieve this, all contractors engaged during the lifecycle of the Project will put in place and comply with a site waste management plan.

Waste management principles shall be based on an integrated approach which involves a combination of techniques and programs to manage waste. Source reduction is at the top of the approach, followed by reuse and recycling as preferred options to disposal.

Generally, wastes associated with the proposed Project shall be managed using the following prioritized program:

- **Reduction at Source** – The elimination or minimization of waste generation through equipment modifications and installation of pollution abatement equipment.
- **Reuse** – Using an item for its original purpose, or similar purpose, in its original form. Wastes generated from one operation shall be put to use in other operations where they are found useful without compromising standards and safety.
- **Recycling** – conversion of waste materials into reusable objects. This will involve using FMEnv/NESREA approved companies involved in recycling business using best available technology that meet international standards.
- **Residue Disposal** – disposal of wastes in a Government-approved dumpsite.

3.8.2 Associated Waste Streams

The waste streams associated with the proposed Project are discussed as follows:

Pre-construction Phase

The waste streams associated with the pre-construction phase of the Project include cleared vegetation (during site preparation), food waste, and general rubbish. The cleared vegetation (mostly grasses) will be removed from the site and allow to biodegrade at a portion of the site while wood from felled trees will be made available to the local community. The general rubbish will be collected within the Project site and disposed of at a government-approved dumpsite through a third-party waste contractor accredited by the Yobe State Environmental Protection Agency (YOSEPA).

Construction Phase

The planned activities during the construction phase include civil, mechanical and electrical works and installation of PV panels and associated components which will be carried out by a number of construction workers. The waste streams associated with the construction activities include excavated soil, general refuse, garbage, inert construction materials, metal scraps, concrete waste, food waste, and used packaging materials. In line with the NEP ESMF, the EPC Contractor shall put in place and comply with a site waste management plan. The plan shall be developed to address all waste streams associated with the construction activities and comply with relevant regulations. The contractor shall comply with the national requirements and building rules on storage of construction materials.

Furthermore, all concrete mixing will be undertaken on impermeable plastic lining to prevent contamination of the surrounding areas. Scrap metals generated during the construction phase will be collected for recycling in blue coloured waste receptacles for non-hazardous wastes. Excavated soil generated during the foundation work will

be arranged according to the various soil layers for reuse as backfill during landscaping and site rehabilitation.

All electronic equipment shall be supplied by credible manufacturers to reduce the risk of generating wastes from faulty equipment. All damaged PV panels generated during the installation activities shall be collected in a dedicated container and returned to the manufacturer outside the country for proper recycling since there is currently no recycling facility in Nigeria that handles PV panels.

Litter collection facilities shall be provided and all solid waste materials that are not identified for reuse or recycling will be placed in appropriate on-site storage containers (black-coloured waste receptacles for food waste, blue-coded bins for paper, and yellow-coded bins for general rubbish) and periodically disposed of (at least once a week throughout the construction period or on the need basis depending on the volume of the waste) at a government-approved dumpsite through a third party waste contractor approved by YOSEPA. It is estimated that approximately 0.225 m^3 of construction debris will be produced per week.

Hazardous wastes that could be generated during the construction activities include used oil rags, and spent filters from onsite diesel generator for power source during construction. Hazardous wastes shall be stored in a manner that prevents the commingling or contact between incompatible wastes, and stored in properly labelled, closed containers prior to evacuation by a third-party waste contractor approved by YOSEPA for treatment and disposal.

Operational Phase

Solid wastes generated during the operational phase of the Project will be incorporated into the existing FUGA waste management approach (there is a dedicated site within the University environment where solid wastes are collected for disposal). Approximately 2.25 cm^3 of solid waste (e.g. paper waste, food packaging, etc.) is estimated to be generated per week during the operational phase.

In line with NEP ESMF, the University shall be encouraged to prepare e-waste management plans that account for safe end-of-life disposal of equipment from the solar-hybrid power plant. The Extended Producer Responsibility program (EPR) will be implemented for solar panels, inverters, batteries and other electrical components to be installed for the Project. Damaged or discarded PV panels and inverters will be collected and sent to the manufacturer for recycling in line with the EPR model. Spent, damaged or expired batteries will also be returned to the manufacturer for recycling. Alternatively, the spent batteries will be recycled by local and accredited battery recycling companies in Nigeria. These batteries shall be stored in red coloured waste receptacles before they are transported to the

accredited battery recycling companies. The quantity of waste batteries generated typically depends on a number of factors such as type, capacity and number of batteries installed and depth of discharge.

Storm water and erosion will be managed through a combination of open trenches and ditches. Storm water shall drain away to the natural environment via gravity. Paved and concreted areas will be sloped to allow for proper drainage.

Sanitary wastes (sewage) generated during the facility operation shall be channelled to a septic tank to be installed onsite. The septic tank shall be of reinforced concrete and will be located away from any groundwater source. As at when due, the contents of the septic shall be evacuated by an accredited waste contractor for treatment at a sewage treatment plant approved by YOSEPA.

Decommissioning

The waste streams associated with the decommissioning phase of the Project would be similar to the construction waste. These will include refuse, e-waste, general rubbish and demolition debris. The University shall also be encouraged to prepare e-waste management plan that account for safe end-of-life disposal of equipment from solar installations. Wastes will be segregated onsite, and non-reusable / recyclable wastes will be disposed of through an accredited third-party waste contractor.

The summary of wastes stream associated with the Project is provided in Table 3.2.

Table 3.2: Summary of Wastes Stream associated with the proposed Project and Handling Techniques

Waste Stream	Sources	Project Phase Construction (C), Operation (O), Decommissioning (D)	Handling Techniques
General rubbish, refuse, and putrescible wastes (food wastes)	Wood splinter, domestic waste, food packs, used bottles	C, O, D	On-site waste segregation; disposal of non-reusable waste through a third party waste contractor approved by Yobe State Environmental Protection Agency (YOSEPA).
Cleared vegetation	During site clearing and preparation	C	Composting, collection for biomass fuel
Scrap metals	Used tubular and casings, used iron rods	C, O, D	Scrap metals will be collected for recycling
Excavated materials	Foundation works	C, D	Excavated materials generated during foundation works will be used for back-filling. Excess excavated spoil will be stockpiled and reused as part of materials for construction of plant buildings.

Waste Stream	Sources	Project Phase Construction (C), Operation (O), Decommissioning (D)	Handling Techniques
Damaged/expired PV panels	PV modules	C, O, D	Return to the manufacturer for recycling using the EPR model
Expired inverters	Electrical installation	O, D	Return to the manufacturer for recycling using the EPR model
Damaged/expired Batteries	Power generation	O, D	Return to the manufacturer for recycling using the EPR model
Sanitary waste	Training centre	C, O, D	Periodic evacuation of content of the septic tank by YOSEPA accredited third party waste contractor.

3.9 Project Schedule

The proposed Project is planned to be operational by the fourth quarter (Q4) of 2021. The tentative Project schedule is provided in Table 3.3.

Table 3.3: Tentative Project Schedule

Project Schedule	Timeline											
	2019				2020				2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Site allocation												
Energy demand audit												
Front-End Engineering Design												
ESIA study and Approval												
Selection of EPC Contractor and contract signing												
Civil, electrical, and mechanical design												
Procurement (manufacturing and transportation)												
Preconstruction and construction Phase Activities												
Commissioning												
Commencement of operation												

CHAPTER FOUR:

DESCRIPTION OF THE ENVIRONMENT

CHAPTER FOUR

DESCRIPTION OF THE ENVIRONMENT

4.1 Introduction

This chapter provides a description of the existing environmental and socio-economic conditions of the Project's area of influence, which covers the Project site and its surrounding environment up to 2 km, including the area where the cumulative impacts of the Project may be experienced.

Data and information for the environmental description of the Project area were based on field data gathering (primary data) as well as review of relevant literature (secondary data).

The field sampling was carried out from August 15 to 17, 2019 (wet season) by different specialists. Based on the consideration of the potential environmental and social footprints of the proposed Project, the observations noted during the preliminary visit to the Project site as well as the need to ensure that all the sensitive receptors that could be potentially affected by the proposed Project have been captured, a 1 km radius from the centre of the Project site was selected as the spatial boundary for biophysical sampling while the socio-economic survey was extended to approximately 2 km radius from the centre of the Project site, as illustrated in Figure 4.1.

The environmental components of the Project area described in this chapter cover the following:

- Climate and meteorology;
- Geology and hydrogeology;
- Air quality and noise;
- Groundwater;
- Surface water;
- Soil;
- Terrestrial flora;
- Terrestrial fauna;
- Land use;
- Socio-economic and health.

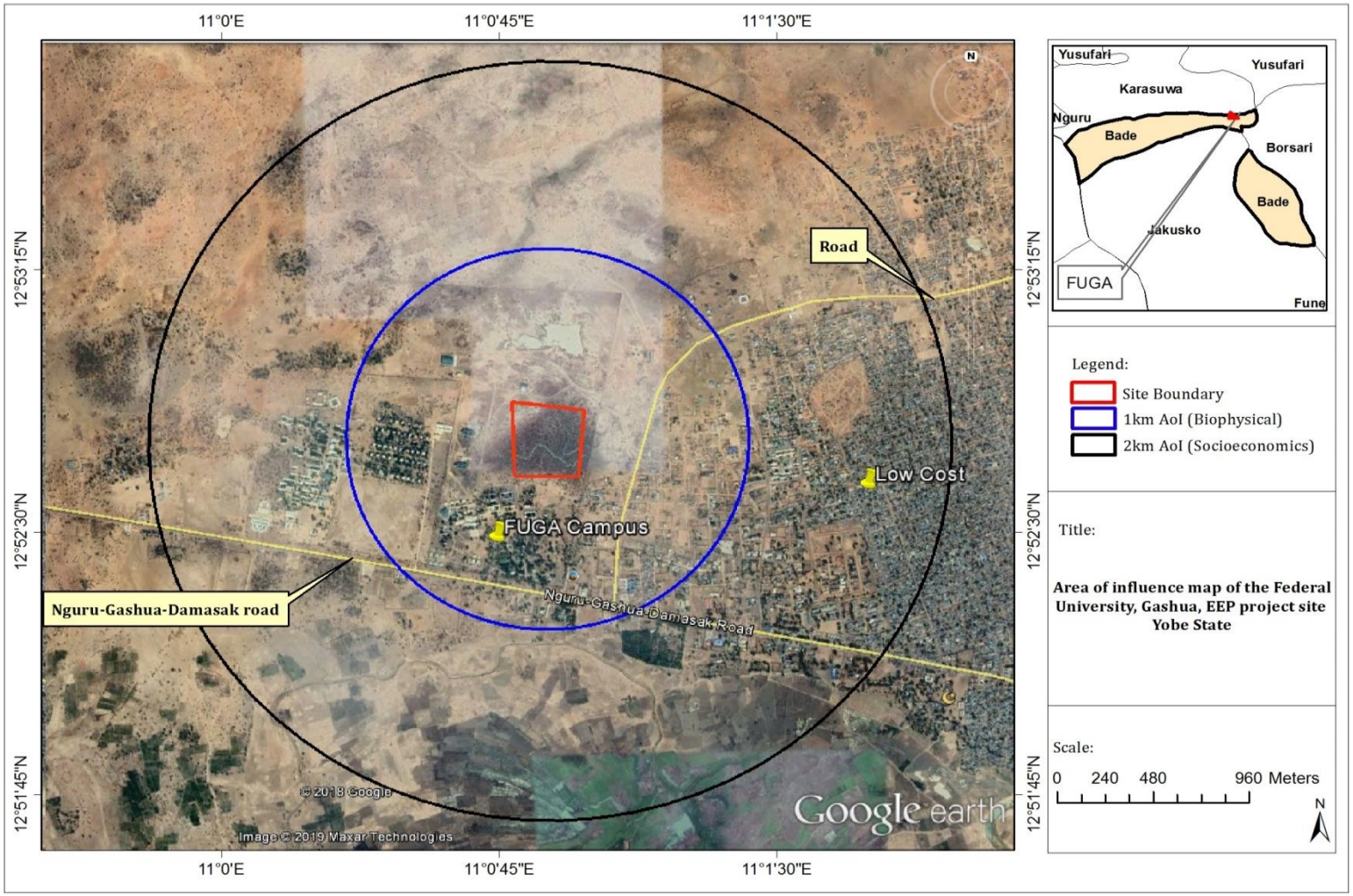


Figure 4.1: Aerial imagery of the Project's Area of Influence for biophysical and socio-economic survey
Source: EnvAccord Field Survey, 2019

4.2 Baseline Data Collection

Baseline data acquisition exercise involved a multi-disciplinary approach and was executed within the framework of Quality Health, Safety, and Environment (QHSE) management system. This approach assured that the required data and samples were collected in accordance with the approved scientific and regulatory requirements using appropriate equipment, materials and personnel.

The study approach includes the following:

- Desktop review of existing materials relevant to the Project environment;
- Designing and development of field sampling strategies to meet the scope of the ESIA study and regulatory requirements;
- Pre-mobilization activities (including calibration/pre-testing of field equipment, review of work plan with team members);
- Mobilization to site for fieldwork sampling (sample collection, in-situ measurements, sample handling, documentation, and storage);
- Demobilization from field; and
- Transfer of field samples to the laboratory for analysis.

4.2.1 Desktop Studies/Literature Review

Desktop studies involved the acquisition of relevant background information on the biophysical and socio-economic environment of the Project area. Information was sourced from the relevant government authorities including the Nigerian Meteorological Agency (NiMet), the National Bureau of Statistics (NBS) and the Federal Ministry of Environment (FMEnv). Other sources of information employed include online publications, textbooks, articles etc.

4.2.2 Field Sampling and Laboratory Analysis

4.2.2.1 Field Sampling

In order to effectively characterise the environment of the Project area, field sampling was conducted from August 15 to 17, 2019. The objective of the field survey was to obtain the baseline data of the Project's area of influence and describe its environmental and social context. Sampling locations were identified using recent satellite imagery of the Project area. The basis of the sampling design was informed by a preliminary characterization of the Project area through desktop research and nearby sensitive receptors.

Sampling locations for biophysical components were randomly selected to cover as much as possible the land area for the proposed Project as well as the surrounding environment, while the socio-economic survey focused on the potentially affected community (Low-Cost Community) identified within the Project's area of influence. All sampling locations were geo-referenced using Garmin Map-62 series Global

Positioning System (GPS) handsets. Plates 4.1 to 4.5 show sample photographs of field sampling activities in the Project's AoI.

Plate 4.1: Air quality and noise measurement within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.2: Soil sampling within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.3: Focus group discussion with male youths as part of the socioeconomic survey in Low-cost community
Source: EnvAccord Field Survey, 2019

Plate 4.4: Groundwater sampling close to the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.5: Surface water sampling at the rainwater harvesting trench within the proposed project site
Source: EnvAccord Field Survey, 2019

Quality assurance and quality control measures consistent with the relevant local and international guidelines and standards were implemented during the field sampling. These measures include, amongst others:

- In-situ measurements of parameters with short holding time in water samples immediately after collection.
- Proper calibration of all portable meters used for in-situ measurements.
- Separate samples were collected for parameters requiring different treatment/preservation before analysis.
- Field samples were adequately preserved and labelled.
- The chemical reagents used for sample preservation were adequately labelled to avoid mix-up.

The summary of sample management program put in place to safeguard the integrity of the field samples collected during the baseline data gathering is provided in Figure 4.2.

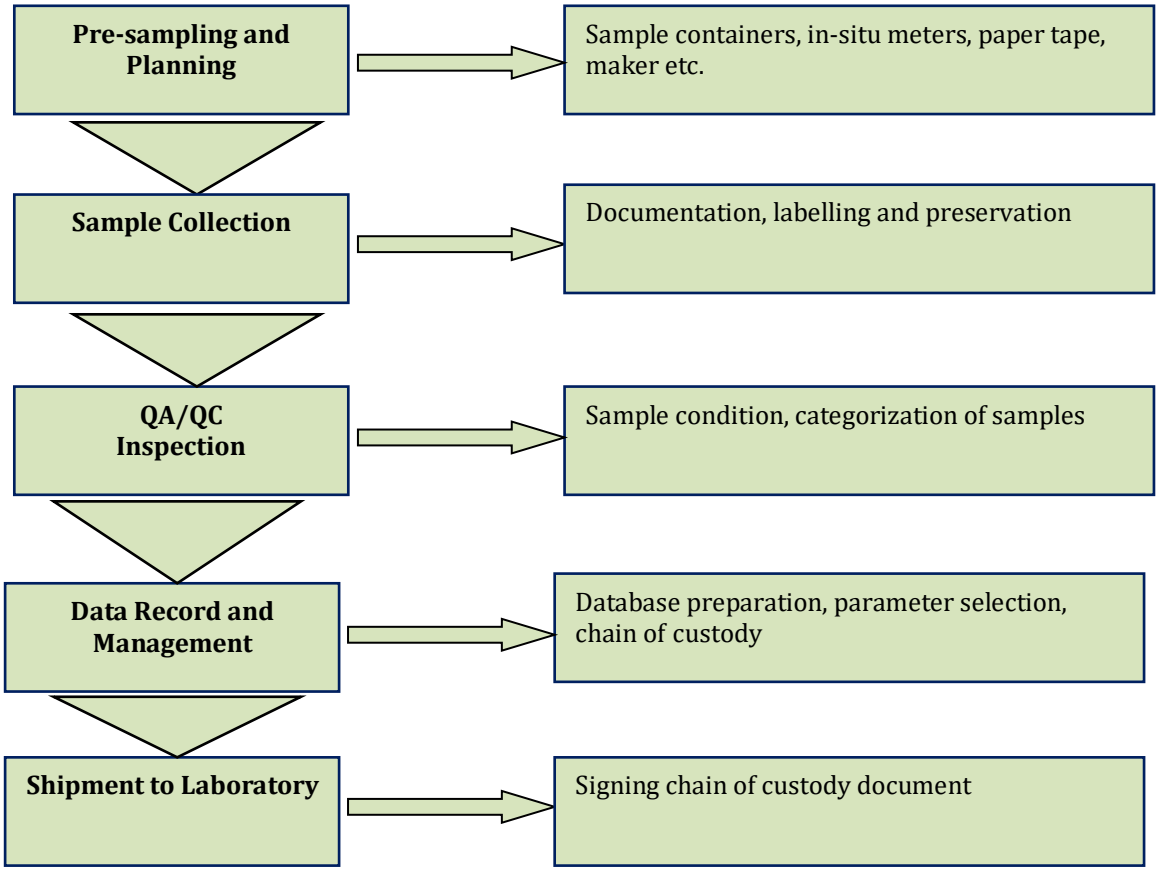


Figure 4.2: Management program employed for field sampling
Source: EnvAccord Field Survey, 2019

4.2.2.2 Laboratory Analysis of Field Samples

Field samples collected during the baseline survey were conveyed to the laboratory for analysis, along with the completed chain of custody forms. The samples were preserved with appropriate reagents (such as nitric acid and sulphuric acid), and the recommended temperature of 4^0C for the samples was maintained in-transit with the use of ice-chest and ice chips in different insulating containers.

The field samples were analysed for physico-chemical and microbial parameters at EnvAccord Laboratory located at 13 Alabi Street off Oguntona Crescent Gbagada Phase 1, Lagos. The Laboratory is accredited by the FMEnvand other relevant regulatory agencies.

The laboratory analyses were undertaken in consistent with the approved standard methodologies such as those recommended by the American Society for Testing and Materials (ASTM) International, the American Public Health Association (APHA) and the FMEnv. The summary of analytical methods employed is presented in Table 4.1.

Table 4.1: Analytical methods employed for field sample analysis

S/N	Parameters	Analytical Methods	Units	
			Water sample	Soil sample
1.	Total Suspended Solids	Gravimetric method	mg/l	-
2.	Biological Oxygen Demand	Dilution method	mg/l	-
3.	Chemical Oxygen Demand	Closed Reflux dichromate method	mg/l	-
4.	Oil and Grease	N-Hexane Extraction Method	mg/l	mg/kg
5.	Alkalinity	Titration method	mg/l	-
6.	Total Hardness	EDTA/Titration method	mg/l	-
7.	Nitrate	Spectrophotometric method	mg/l	mg/kg
8.	Sulphate	Spectrophotometric method	mg/l	mg/kg
9.	Phosphate	Spectrophotometric method	mg/l	mg/kg
10.	Nitrite	UV/VIS Spectrophotometry	mg/l	mg/kg
11.	Sodium	Flame photometric method	mg/l	mg/kg
12.	Potassium	Flame photometric method	mg/l	mg/kg
13.	Calcium	Titration with ethylenediamine tetra-acetic acid method	mg/l	mg/kg
14.	Magnesium	Titration with EDTA method	mg/l	mg/kg
15.	Lead	Atomic Absorption Spectrophotometry	mg/l	mg/kg
16.	Nickel	Atomic Absorption Spectrophotometry	mg/l	mg/kg
17.	Cadmium	Atomic Absorption Spectrophotometry	mg/l	mg/kg
18.	Zinc	Atomic Absorption Spectrophotometry	mg/l	mg/kg
19.	Copper	Atomic Absorption Spectrophotometry	mg/l	mg/kg
20.	Chromium	Atomic Absorption Spectrophotometry	mg/l	mg/kg
21.	Manganese	Atomic Absorption Spectrophotometry	mg/l	mg/kg
22.	Total Iron	Atomic Absorption Spectrophotometry	mg/l	mg/kg
23.	Mercury	Cold Vapour Atomic Absorption Spectrophotometry	mg/l	mg/kg

Source: EnvAccord Field Survey, 2019

4.3 Description of Biophysical Environment of the Study Area

4.3.1 Climate and Meteorology

Yobe State is located in the hot, dry tropical climate zone of North-east, Nigeria. The climate in the area is tropical with alternating wet and dry seasons and it is strongly influenced by Inter-Tropical Convergence Zone (ITCZ) weather patterns. Maritime tropical air masses, characterized by warm, humid south-westerly winds and the continental air mass, characterized by hot, dry north-easterly winds, converge in the ITCZ. The alternating wet season and dry season phenomenon is determined by the north-south oscillation of air masses in the ITCZ.

Movement of these air masses results in two (2) main seasons; a wet season from May to October, and a dry season from November to April. During the dry season, there are periods when the harmattan (a period characterized by dry dusty winds and relatively low temperatures) is experienced.

In this section of the report, the dominant climatic elements and factors within the regional Project area are discussed. These include rainfall, ambient temperature, relative humidity, sunshine, wind speed and wind direction. Information on the climatic data of the Project area is sourced from the Nigerian Meteorological Agency (NiMet) and it spans from 1991 to 2017.

Table 4.2 summarizes the monthly mean climatic characteristics of the Project area from 1991 to 2017.

Table 4.2: Monthly Mean Climatic Characteristics of the Project Area (1991-2017)

Month	Temperature (^{0}C)		Rainfall (mm)	Humidity (%)		Sunshine Hours	Wind Speed (m/s)
	Min.	Max.	Mean	09:00Hr	15:00Hr		
January	29.29	14.25	0	24.41	16.56	7.92	8.87
February	32.57	16.93	0.3	19.89	14.26	7.93	9.74
March	36.57	21.10	0.17	22.63	17.11	7.20	9.38
April	39.22	24.35	37.63	36.93	24.59	7.52	9.66
May	38.04	24.74	75.1	52.41	37.11	8.10	10.16
June	34.67	23.34	176.91	66.22	49.78	8.01	10.58
July	31.68	21.80	299.30	76.19	60.19	6.95	9.44
August	30.46	22.97	358.1	79.67	63.37	6.95	8.40
September	32.13	21.61	164.49	71.37	52.85	7.38	7.90
October	34.02	20.91	16.21	48.22	33.33	7.77	7.04
November	33.18	16.88	0.03	26.19	19.48	8.59	6.97
December	29.18	14.11	0	26.44	19.52	8.03	8.56
Total			1128.24				
Min	33.42	20.25	94.02	45.88	34.01	7.70	8.89
Max.	29.18	14.11	0	19.89	14.26	6.95	6.97
Mean	39.22	24.74	358.1	79.67	63.37	8.59	10.58

Source: NiMet, 2018

i) Rainfall

Overall, a total of about 1128.24mm of rain is recorded annually as shown in Table 4.2. This gives an average of 94.02mm per month. The minimum rainfall amount (0 mm) is received in the months of January and December while the maximum rainfall amount (358.1mm) is received in the month of August (Figure 4.3).

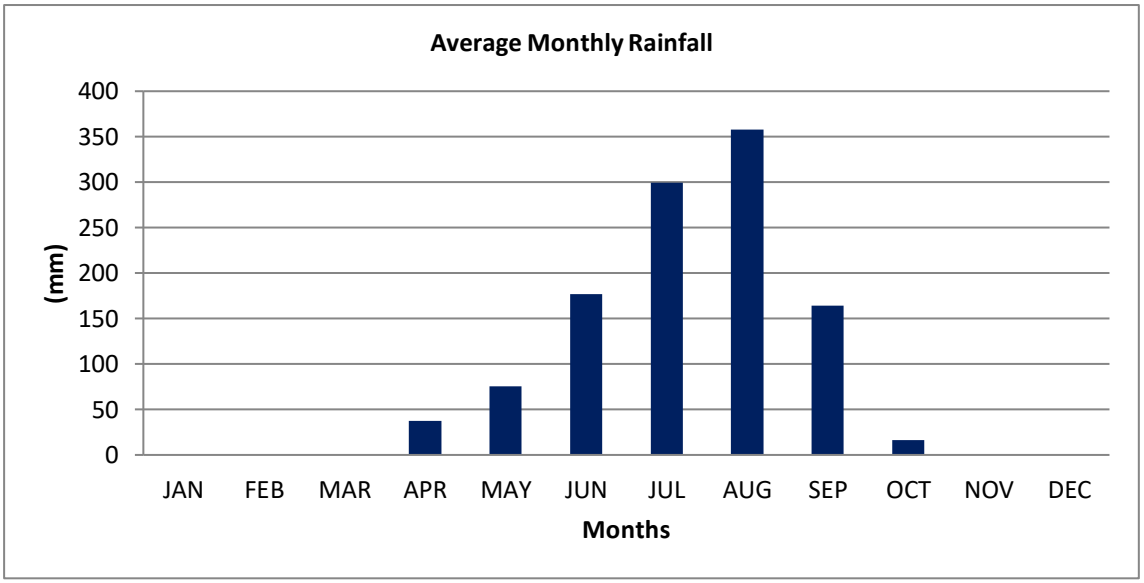


Figure 4.3: Average rainfall characteristics of the Project area (1991- 2017)
Source: NiMet, 2018

ii) Ambient Temperature

Temperature of the Project area is relatively high and stable all over the year. The overall annual average daily temperature is 33.42 ^{0}C (Table 4.2). Figure 4.4 shows the temperature characteristics of the Project area.

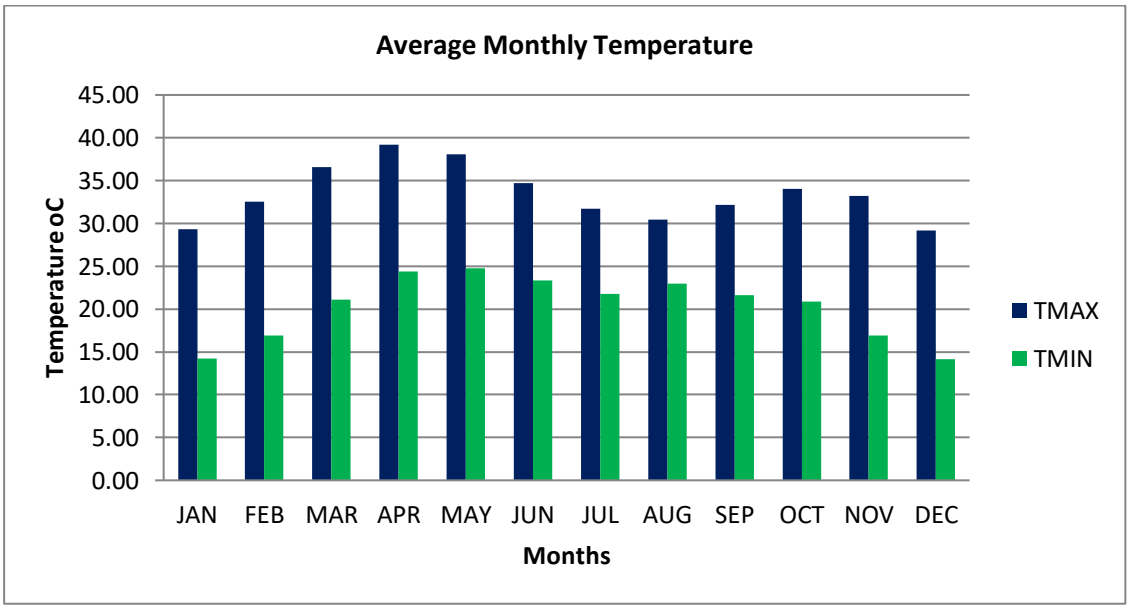


Figure 4.4: Monthly Mean Temperature Characteristics of the Project Area (1991-2017) Source: NiMet, 2018

iii) Relative Humidity

The Project area is characterized by very low relative humidity as a result of the prevailing dry north-east trade winds blowing over the area almost all the year round. Overall, the month of February recorded values of 19.89 % and 14.26 % which were the lowest relative humidity recorded over 9:00 hrs and 15:00 hrs period while 79.67 % and 63.37 % were the highest values recorded over the 9:00 hrs and 15:00 hrs period respectively in the month of August (Figure 4.5).

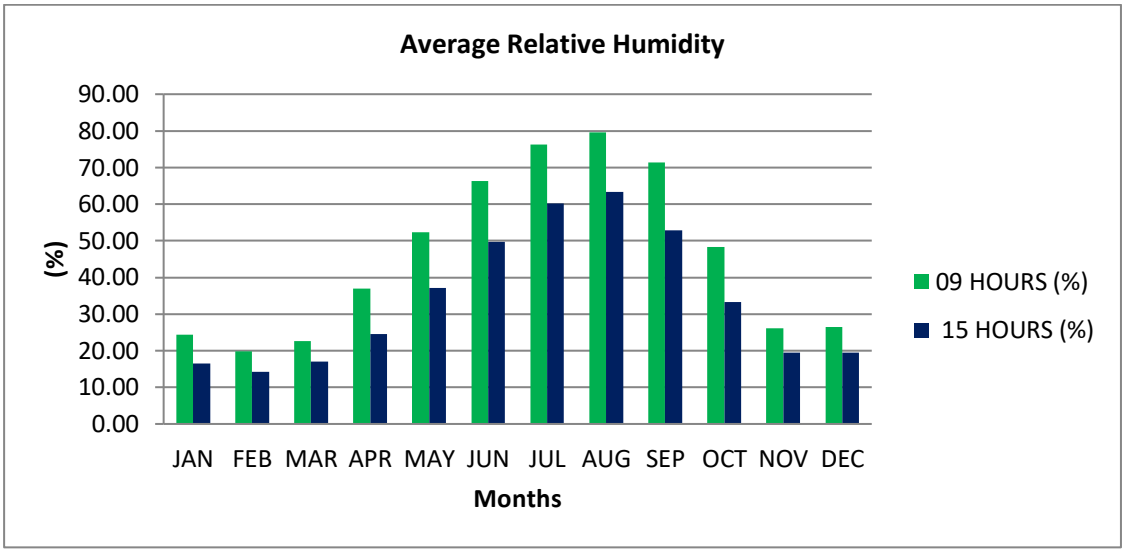


Figure 4.5: Monthly Relative Humidity Characteristics of the Project Area (1991-2017) Source: NiMet, 2018

iv) Wind Speed

Seasonal observations revealed appreciable variability. Wind speed variability is more pronounced from May to June when speeds could exceed an average of 10.16 m/s. The intensity is lowest in November with 6.97 m/s (Figure 4.6).

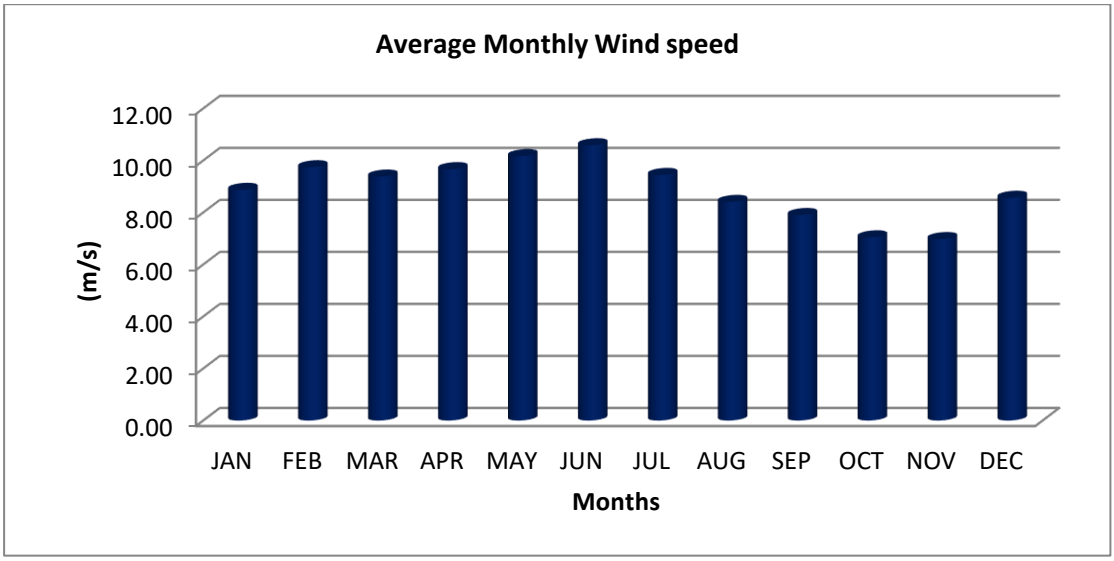


Figure 4.6: Monthly Average Wind Speeds of the Project Area (1991- 2017)
Source: NiMet, 2018

v) Sunshine Hours

An assessment of the sunshine hours of the Project area revealed that the mean monthly sunshine hour in the area is approximately 7.70 hours, while the brightest months occur in November (Figure 4.7).

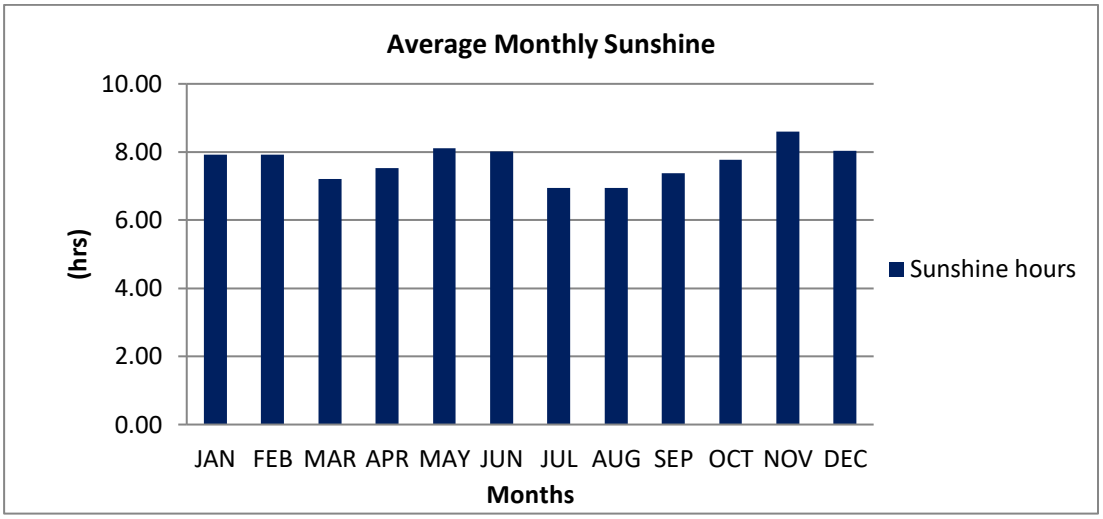


Figure 4.7: Monthly Average of Sunshine Hours for the Project Area (1991-2017)
Source: NiMet, 2018

vi) Wind Direction

The dominant wind directions in the Project area are the South-West (SW) and South South-West (SSW) winds (Figure 4.8).

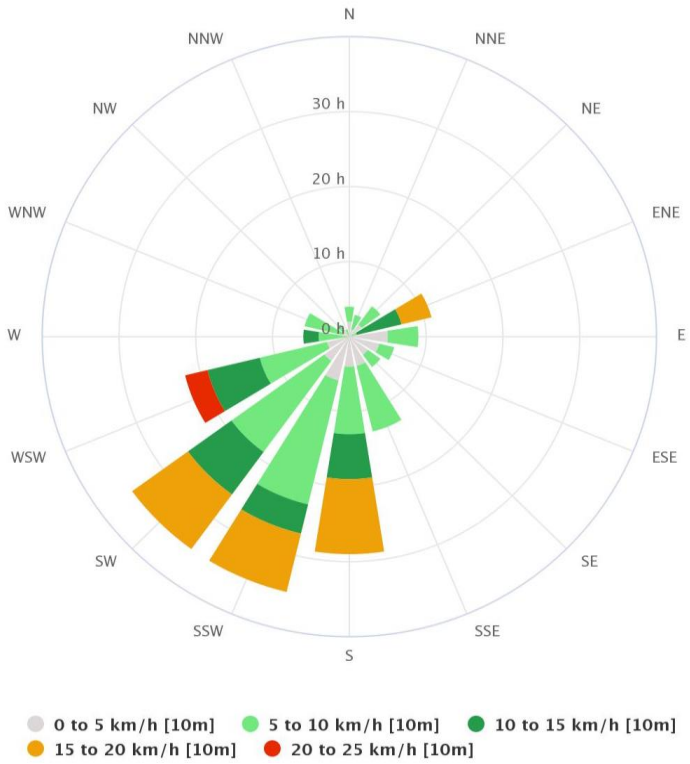


Figure 4.8: Wind rose for the Project Area in Yobe State
Source: Meteoblue, 2019

4.3.2 Geology and Hydrogeology

4.3.2.1 Geology

The geology of Yobe State principally comprises crystalline and sedimentary rocks, underlain by basement complex rocks. The crystalline rocks are represented by older granites found in pockets of places in the southern part of the State. Another crystalline rock formation of younger age is located in the northwestern tip of the state in the Machina area (Figure 4.9).

The older granite is Precambrian in origin consisting of metamorphic structures of gneiss and amphibolites. The sedimentary rocks that are found in most parts of the State were uncomfortably deposited on the basement crystalline rocks (Kwaya *et al.*, 2017).

In the southern fringe of the State, the sedimentary deposits are made up of the cretaceous Bima, Pindiga, Fika and Gombe formations. The Karekare formation is also found in this part of the State. However, in the greater part of Yobe, these sedimentary formations are overlaid by a large expanse of Quaternary Chad formation that stretches into Jigawa and Borno States.

The Biu basalts found in the southern end of the State are believed to have been extruded during the Tertiary/Quaternary periods as lava flows. However, the influence of climatic fluctuations is reflected in the superficial deposits overlaying most of Yobe State. This, for instance, has led to the deposition of series of longitudinal and traverse dunes around Yunusari, Yusufari, Machina, Geidam and Bade local government areas (Usman *et al.*, 2018).

4.3.2.2 Hydrogeology

The hydrogeology of the study area is dominated by the Chad formation. Exploitable aquifers occur at depths of up to 650 m and comprise the upper, middle and lower zones which correspond to the phreatic, lower pliocene and terminal continental aquifers described by the Lake Chad Basin Commission (LCBC) for the entire basin.

Potential deep aquifers at depths greater than 700 m are unlikely ever to become economically feasible in the area or elsewhere in the basin. For all practical purposes the development of groundwater resources is limited to the currently exploited aquifers to depths of about 650 m. The upper zone is termed the upper aquifer system because it is a heterogeneous body comprising more than one aquifer intercalated with less permeable beds. The middle and lower zones are termed separate aquifers since each is sufficiently isotropic as to be considered an individual hydrogeological unit (Zaji M., 1999).

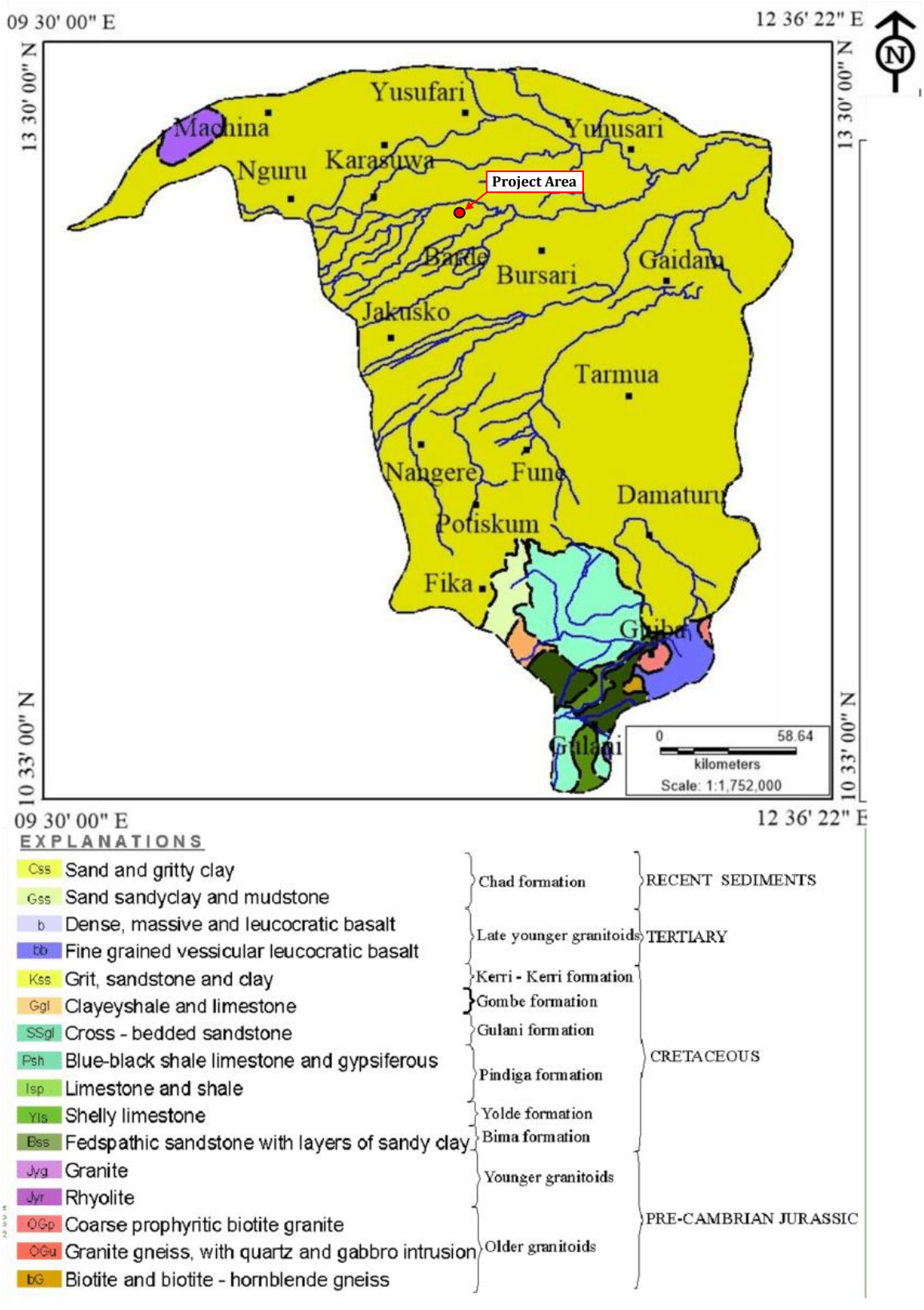


Figure 4.9: Geologic map of Yobe State indicating the Project area
Source: Kwaya *et al.*, 2017

4.3.3 Ambient Air Quality and Noise

In-situ air quality measurements were conducted in the Project's area of influence with the use of pre-calibrated digital hand-held monitoring equipment (Aeroqual series 500; Aerocet 531; Graywolf particle counter) for the following parameters: Sulphur (IV) Oxide (SO_2), Nitrogen (IV) Oxide (NO_2), Methane (CH_4), Carbon Monoxide (CO), Carbon (IV) Oxide (CO_2), Volatile Organic Compounds (VOC), Hydrogen Sulphide (H_2S) and Total Suspended Particulate (TSP).

Ambient noise levels were measured using an Extech Integrated Sound Level Meter with a detection range of 30 dB(A) to 130 dB(A). Noise Level measurements were taken at a height of approximately 2m above ground level and the response time was set to slow and read on the 'A' frequency weighting scale in unit decibels.

A total of eight (8) sampling locations (4 within the Project site, 2 within 1km radius, and 2 at control/buffer points) were established for ambient air quality and noise study. The air quality and noise sampling location map is presented in Figure 4.10.

4.3.3.1 Air Quality Standards

The concentrations of air quality parameters recorded at the Project area were compared to the Nigerian Ambient Air Quality Standards (NAAQS), World Health Organization (WHO) Air Quality Guidelines, and World Bank noise level guidelines. The summary of these limits is provided in Tables 4.3 to 4.5.

Table 4.3: Ambient Air Quality Standards

Parameter	Averaging Period	Nigeria Standards FMEnv Limit ($\mu g/m^3$)	WHO Ambient Air Quality Guideline values ($\mu g/m^3$)
CO	1-hour	11, 400	-
NO_2	1-hour	75 - 113	200
SO_2	1-hour	260	500 (10-minutes)
TSP	1-hour	250	-

Source: FMEnv, 1991; and World Bank General EHS 2007

Table 4.4: Noise Exposure Limits for Nigeria

Duration per Day, Hour	Permissible Exposure Limit dB(A)
8	90
6	92
1	105
0.5	110
0.25	115

Source: Guidelines and Standards for Environmental Pollution Control in Nigeria (FEPA {now FMEnv}, 1991)

Table 4.5: Noise Level Guidelines adopted by the World Bank

Receptor	One Hour Leq (dBA)	
	Daytime	Night time
Residential; institutional educational	55	45
Industrial; commercial	70	70

Source: The World Bank General EHS Guidelines, 2007

4.3.3.2 Air Quality of the Project Area

The geographical coordinates of the air sampling locations established in the Project area are presented in Table 4.6.

Table 4.6: Geographical coordinates of Air quality sampling locations in the Project Area

Sampling Code	Latitude (N)	Longitude (E)
Within the Project site		
A1	11.01195	12.87941
A2	11.01241	12.88066
A3	11.01338	12.88057
A4	11.01258	12.87961
Within 1km AoI (area of influence) radius		
A5	11.01464	12.88345
A6	11.01297	12.87423
Control/buffer points		
A7	12.87637	11.99474
A8	12.87465	11.02474

Source: EnvAccord Field Survey, 2019

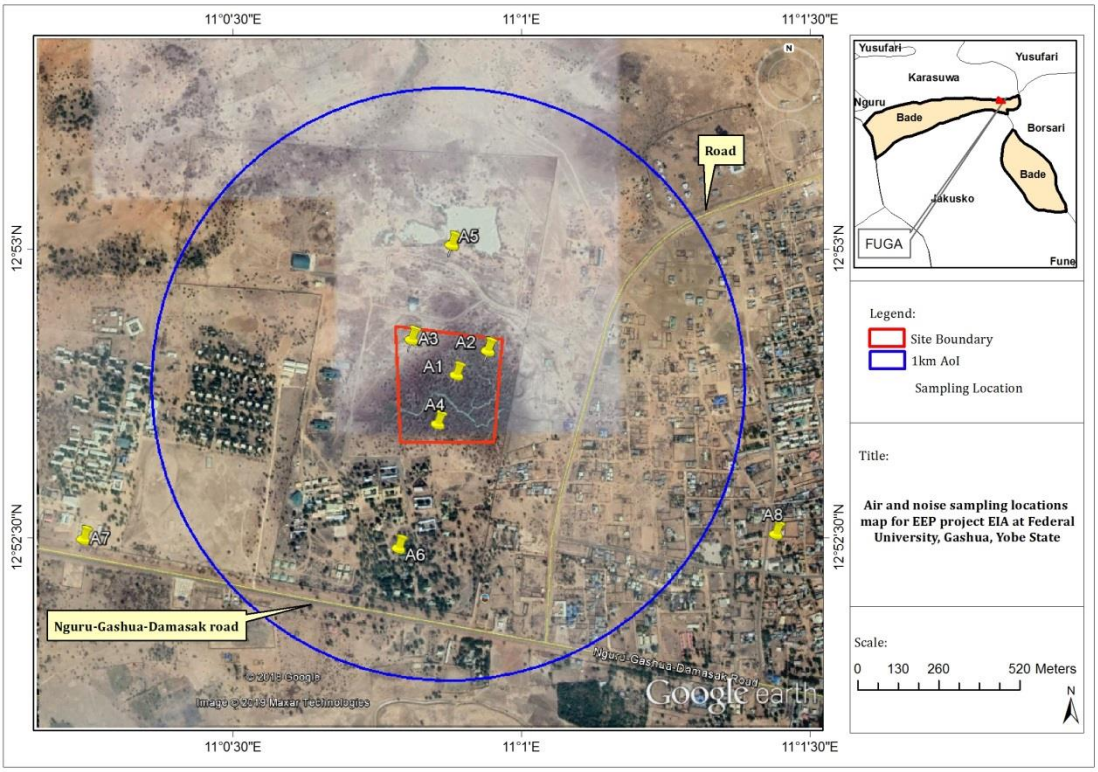


Figure 4.10: Air quality/ Noise sampling locations map

Source: EnvAccord Field Survey, 2019

The descriptive summary of the results of air quality and noise level measurements are presented in Table 4.7, while the detailed field results are presented in Appendix 4.1.

Table 4.7: Descriptive summary of results of ambient air quality and noise levels measured in the Project area

Parameters	Within the Project site			Within 1km AoI (area of influence) radius			Control/Buffer points		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
TSP (mg/m³)	0.072	0.082	0.064	0.062	0.063	0.062	0.079	0.099	0.059
NO_2 (mg/m³)	0.026	0.062	0.005	0.033	0.047	0.019	0.048	0.071	0.025
SO_2 (mg/m³)	0.0025	0.003	0.001	0.004	0.005	0.004	0.003	0.004	0.002
VOC (mg/m³)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CO_2 (mg/m³)	1580.5	1892	1134	1499	1797	1201	1370.5	1412	1329
CO (mg/m³)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CH_4 (mg/m³)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
H_2S (mg/m³)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Noise dB(A)	45.4	47.1	43.5	49.05	49.9	48.2	50.5	51.7	49.3

Source: EnvAccord Field Survey, 2019. BDL= Below Detection Limit (VOC = 0.1; CH_4, = 0.01; CO = 0.01; H_2S = 0.01)

Total Suspended Particulate (TSP): Within the Project site, the measured TSP values ranged from 0.064 mg/m³ to 0.082 mg/m³ with a mean value of 0.072 mg/m³ which is below the FMEnv 1hr averaging time limit of 0.25 mg/m³ for TSP in ambient air. This implies that the ambient air of the Project site in terms of TSP could be considered to be unpolluted.

Also, the TSP values recorded at locations established outside the Project site including the control/buffer points showed a similar trend as the values recorded fell below the FMEnv limit of 0.25 mg/m³.

Nitrogen dioxide (NO_2): NO_2 values recorded within the Project site ranged from 0.005 mg/m³ to 0.062 mg/m³ with an average value of 0.026 mg/m³ which complies with the FMEnv recommended threshold limit of 0.113 mg/m³ and the WHO guideline value of 0.2 mg/m³ respectively for 1hr averaging time of NO_2 in ambient air. Comparably, the results of NO_2 measurements conducted within 1km area of influence of the Project site as well as the control/buffer points fell below the FMEnv and WHO maximum permissible limits. This indicates the ambient air of the Project area is not polluted.

Sulphur dioxide (SO_2): At the time of field sampling, the concentrations of SO_2 recorded at four (4) different locations established within the Project site ranged from 0.001 mg/m³ to 0.003 mg/m³ with an average concentration of 0.0025 mg/m³. The SO_2 values recorded in all the sampling locations, including the control/buffer points were below the FMEnv recommended threshold limit (1-hour averaging time) of 0.026 mg/m³ for SO_2 in ambient air. The measured SO_2 values were also lower than the WHO guideline value of 0.5 mg/m³ for SO_2 in ambient air (10-minutes averaging period).

Ambient Noise Level: Within the Project site, the average noise level recorded ranged from 43.5 dB(A) to 46.3 dB(A) with an average value of 50.5 dB(A), which is lower than the World Bank limit of 55 dB(A) (1-hour Leq day time) for educational institution. In addition, the noise levels (by extrapolation) were also below the FMEnv limit of 90 dB(A) for 8-hour occupational exposure. The noise levels recorded at the sampling locations within 1 km radius of the Project site, including the control/buffer points were also below the regulatory limit.

4.3.4 Soil Quality

Soil is an important component of the ecosystem that serves as a footprint of impacts. The critical properties of soil that usually form the basis for impact evaluation include physical properties, fertility indices, and chemical composition.

4.3.4.1 Soil Sampling

A total of eight (8) soil sampling stations (4 within the Project site, 2 within 1 km radius, and 2 at control/buffer points) were established. At each of the sampling station, both top soil (0-15cm) and sub-soil (15-30cm) were collected.

Soil sampling was carried out using a stainless-steel auger. The soil samples collected were homogenized in plastic bucket lined with aluminum foil sheet, and from the homogenized soil samples, sub samples were taken for physico-chemical analysis. All samples collected were preserved and transported to the laboratory for analysis. The geographical coordinates of the soil sampling locations are presented in Table 4.8 while the soil sampling location map is depicted in Figure 4.11.

Table 4.8: Geographical coordinates of Soil Sampling Locations in the Project Area

Sampling Code	Latitude (N)	Longitude (E)
Within the Project site		
S1	11.01195	12.87941
S2	11.01241	12.88066
S3	11.01338	12.88057
S4	11.01258	12.87961
Within 1 km AoI (area of influence) radius		
S5	11.01464	12.88345
S6	11.01297	12.87423
Control/buffer points		
S7	12.87637	11.99474
S8	12.87465	11.02474

Source: EnvAccord Field Survey, 2019

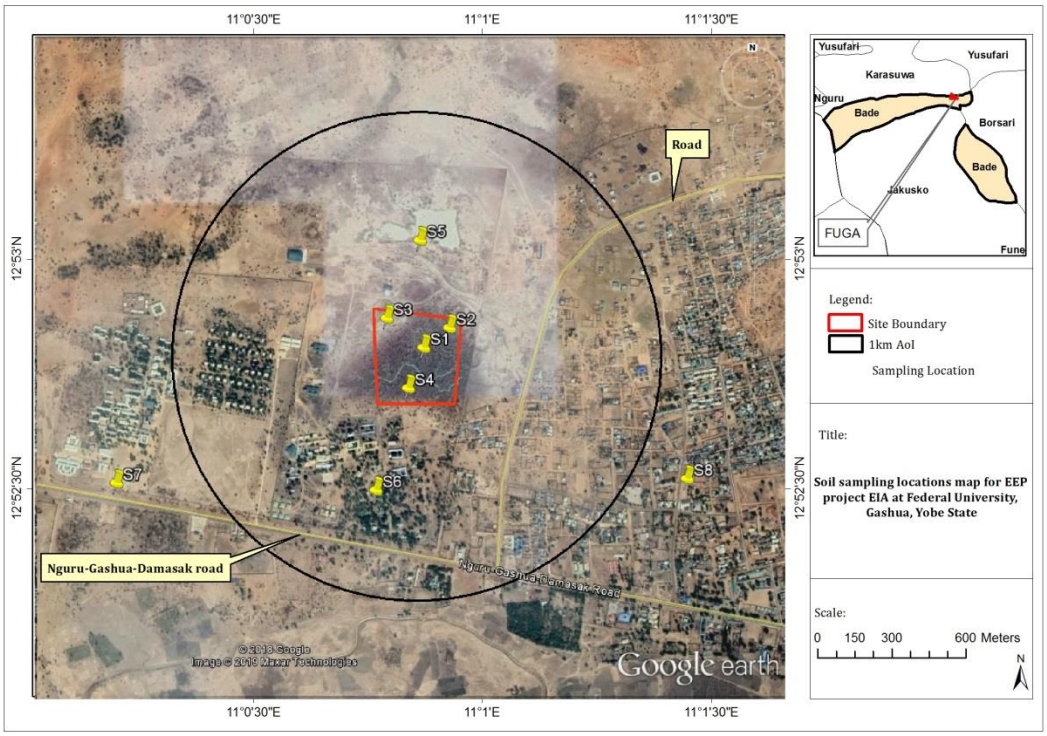


Figure 4.11: Soil Sampling Locations Map
Source: EnvAccord Field Survey, 2019

The descriptive summary of the physico-chemical and microbial analysis results of the soil samples are provided in Tables 4.9 to 4.10, while the detailed laboratory analysis results are presented in Appendix 4.1.

Table 4.9: Descriptive summary of physico-chemical and microbial properties of top soils (0 – 15cm) from the Project area

Sample ID	Within the project site			Within 1km AoI radius		Control/Buffer area		Limits - Alloway (1991); Allen *et al* (1974)
	Min	Max	Mean	Min	Max	Min	Max	
pH	6.56	7.5	6.94	6.45	6.55	6.55	7.06	-
Conductivity µS/cm	101	220	140.5	107.00	121.00	98.00	121.00	-
TOC %	1.18	2.34	1.67	0.99	1.87	1.47	2.15	-
Moisture Content %	2.42	3.44	2.82	3.66	4.09	3.68	5.21	-
Chloride mg/Kg	7.493	18.74	12.99	14.49	14.99	14.74	16.24	-
Nitrate mg/Kg	0.035	0.126	0.0795	0.15	0.15	0.104	0.153	-
Sulphate mg/Kg	21.993	30.775	25.506	23.01	25.89	17.399	19.553	-
Phosphate mg/Kg	0.09	0.41	0.2725	0.00	0.12	0	0.16	-
Carbonate mg/Kg	2.2	4.1	3.235	3.40	4.00	3	3.33	-
Cu mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	5-500
Pb mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	2-20
Zn mg/Kg	0.143	2.37	0.947	0.10	0.40	0.089	0.101	10-50
Cd mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	0.03-0.30
Hg mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	-
Cr mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	-
Ni mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	5-500
Fe mg/Kg	76.11	118.2	104.42	75.61	117.38	89.4	128.47	NS
Ca mg/Kg	17.75	43.4	31.705	31.22	42.71	11.2	32.05	-
Mg mg/Kg	1.06	3.63	2.24	1.15	2.45	2.51	2.88	-
Na mg/Kg	115.6	149.41	133.352	85.66	120.56	107.94	108.15	-
K mg/Kg	13.06	26.07	19.582	13.59	13.69	9.71	16.09	-
Sand %	14.68	23.17	19.22	17.59	23.51	14.96	18.54	-
Silt %	13.15	14.81	13.8875	12.36	12.52	16.95	18.74	-
Clay %	62.02	72.15	66.895	63.97	70.05	64.5	66.3	-
Oil and Grease, mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	-
Total Heterotrophic Bacteria cfu/g	4.0×10^5	2.0×10^7	1.1×10^7	3.0×10^6	4.0×10^7	4.0×10^6	4.4×10^5	-
Total Heterotrophic Fungi cfu/g	4.0×10^3	2.0×10^6	5.5×10^5	2.20×10^5	5.0×10^3	3.0×10^5	4.0×10^4	-
Total Coliform cfu/g	2.4×10^4	2.1×10^5	7.7×10^5	2.0×10^3	3.0×10^3	1.0×10^5	2.0×10^5	
Hydrocarbon Utilizing Bacteria cfu/g	3.0×10^1	6.8×10^2	2.7×10^3	1.8×10^2	6.8×10^2	2.80×10^1	3.0×10^2	-
Hydrocarbon Utilizing Fungi cfu/g	2.0×10^1	2.0×10^3	5.6×10^2	2.0×10^1	2.0×10^1	2.0×10^1	2.0×10^1	-
% HUB	0.0012	0.0075	0.0047	0.00	0.01	0.0006	0.0075	

Source: EnvAccord Field Survey, 2019

BDL= Below Detection Limit. Equipment Detection Limit = Cu, 0.005; Pb, 0.04; Ni, 0.05; Hg, 0.001; Cd, 0.01; Cr, 0.04; oil and grease, 0.001

Table 4.10: Descriptive summary of physico-chemical and microbial properties of sub soils (15 – 30 cm) from the Project area

Sample ID	Within the Project site			Within 1km AoI radius		Control/Buffer area		Limits - Alloway (1991); Allen *et al* (1974)
	Min	Max	Mean	Min	Max	Min	Max	
pH	6.74	7.43	6.94	6.6	6.84	6.64	7.41	-
Conductivity µS/cm	116	195	137.5	110.00	113.00	102.00	109.00	-
TOC %	1.22	2.11	1.52	1.18	1.65	1.19	1.68	-
Moisture Content %	3.62	4.23	4.02	3.44	4.58	4.53	4.61	-
Chloride mg/Kg	14.493	19.99	16.62	15.742	16.242	14.993	17.491	-
Nitrate mg/Kg	0.079	0.188	0.145	0.126	0.135	0.014	0.141	-
Sulphate mg/Kg	25.061	45.711	31.563	21.692	22.795	16.188	26.398	-
Phosphate mg/Kg	0.1	0.4	0.30	0	0.23	0	0.23	-
Carbonate mg/Kg	3.15	4.07	3.62	2.19	4.24	2.74	3.5	-
Cu mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	5-500
Pb mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	2-20
Zn mg/Kg	0.012	2.538	0.693	0.113	0.144	0.073	0.086	10-50
Cd mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	0.03-0.30
Hg mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	-
Cr mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	-
Ni mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	5-500
Fe mg/Kg	83.42	144.88	114.21	90.09	122.19	95.11	121.51	NS
Ca mg/Kg	20.76	48.1	37.88	39.79	40.74	31.38	38.44	-
Mg mg/Kg	1.13	2.65	2.03	1.04	2.7	2.16	2.72	-
Na mg/Kg	115.85	124.93	120.98	99.11	128.85	107.06	119.31	-
K mg/Kg	16.08	23.37	18.525	12.27	14.61	9.57	12.22	-
Sand %	16.15	23.91	19.21	15.48	16.53	11.22	16.3	-
Silt %	12.02	15.48	13.525	15.27	19.52	16.09	19.09	-
Clay %	64.07	68.53	67.26	65	68.19	67.6	69.69	-
Oil and Grease, mg/Kg	BDL	BDL	-	BDL	BDL	BDL	BDL	-
Total Heterotrophic Bacteria cfu/g	4.0×10^5	5.4×10^6	3.05×10^6	3.0×10^6	4.0×10^6	3.0×10^6	6.6×10^6	-
Total Heterotrophic Fungi cfu/g	2.0×10^3	3.0×10^5	1.28×10^5	1.0×10^5	4.0×10^3	1.0×10^6	2.0×10^6	-
Total Coliform cfu/g	2.6×10^3	1.4×10^4	6.00×10^3	2.0×10^3	3.0×10^4	1.0×10^3	2.0×10^3	
Hydrocarbon Utilizing Bacteria cfu/g	2.0×10^2	3.0×10^2	2.55×10^2	1.8×10^1	3.5×10^2	6.8×10^2	6.80×10^1	-
Hydrocarbon Utilizing Fungi cfu/g	1.0×10^1	5.0×10^1	2.50×10^1	1.90×10^1	3.0×10^1	3.0×10^2	5.0×10^3	-
% HUB	0.0005	0.0085	0.0055	0.006	0.0087	0.001	0.0023	

Source: EnvAccord Field Survey, 2019

BDL= Below Detection Limit. Equipment Detection Limit = Cu, 0.005; Pb, 0.04; Ni, 0.05; Hg, 0.001; Cd, 0.01; Cr, 0.04; oil and grease, 0.001

The discussion of the soil quality results is provided in the following paragraphs:

Soil Physical properties (Sand, Clay, and Silt): The soil texture is determined by the balance of clay, silt and sand particles. The soil environment of the Project site can be classified as of clay texture going by their particle size distribution when evaluated using the soil texture triangle (Figure 4.12). The laboratory analysis of soil samples from the Project site indicate that in the top soil, sand particles ranged from 14.68 % to 23.17 %, silt ranged from 13.15 % to 14.81 % while the percentage of clay particles ranged from 62.20 % to 72.15 %. In the sub soil, sand particles ranged from 16.15 % to 23.91 %, silt ranged from 12.02 % to 15.48 % while clay ranged from 64.04 % to 68.53 %. Generally, sand, sandy loam and loam textured soils tend to be less eroded than silt, very fine sand, and clay textured soils. Soil samples from the Project area of influence as well as the buffer points showed a similar composition.

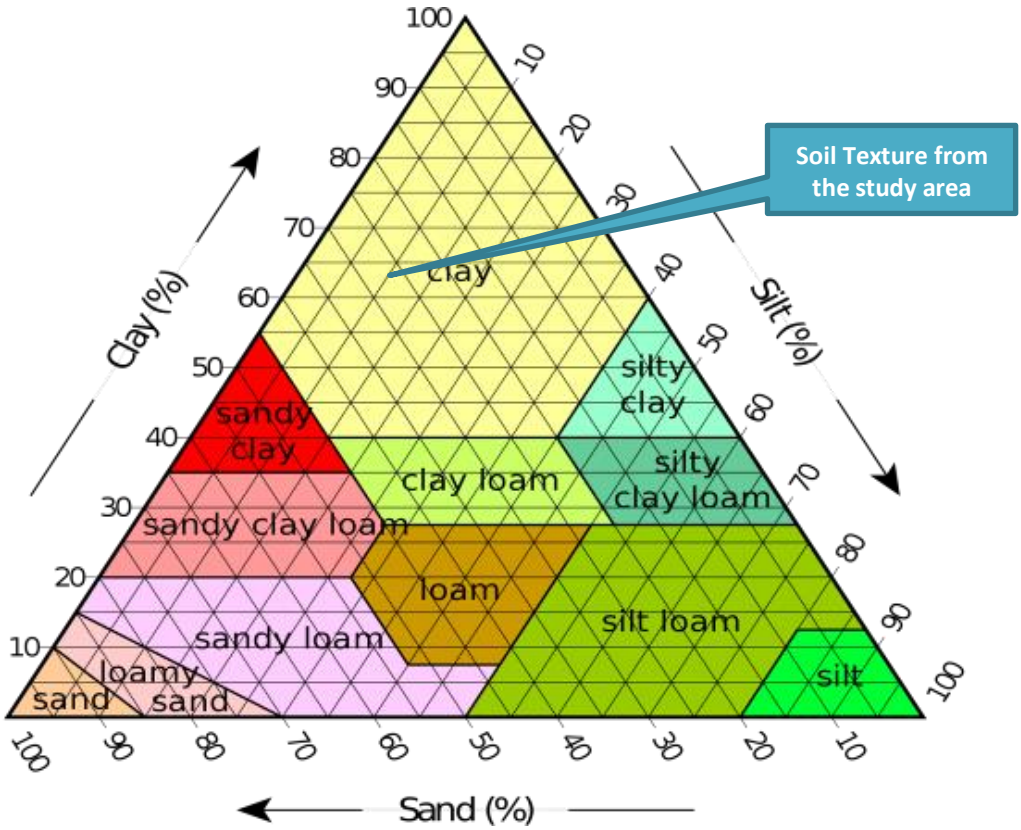


Figure 4.12: Soil texture triangle
Source: https://www.nrcs.usda.gov

Soil pH (soil reaction): The pH of soil samples from the Project site ranged from 6.56 to 7.50 (slightly acidic to neutral) for top soil and a range of 6.74 to 7.43 (slightly acidic to neutral) was obtained for the sub soil. This indicates that the soil environment of the Project site is not corrosive and can easily support the mounting structure for the solar PV panels to be installed on site. Similarly, within the 1 km

area of influence, the pH values ranged from 6.45 to 6.55 while at the control points, a range of 6.55 to 7.06 was recorded.

Soil Anions: The concentrations of anions measured in the soil from the Project site were generally within the prescribed limits for tropical soil. Among the anions, sulphate had the highest concentrations in the soil samples with a range of 21.93 mg/kg – 45.71 mg/kg while phosphate had the least concentration with a range of from 0.00 to 0.41 mg/kg. As indicated in Tables 4.9 and 4.10, the nitrate concentration in the soil samples from the Project site was also low indicating relative low nutrient. This could be expected since the Project site is dominated by grasses and it is not currently used for farming. This inference could also be supported by low percentage of total organic carbon recorded in soil samples from the Project site.

Soil Cations: The concentrations of Sodium (Na), Calcium (Ca), Potassium (K) and Magnesium (Mg) recorded in soil samples from the Project area fall within natural occurrence levels for tropical soils as prescribed by Alloway (1991). Within the Project site, Na recorded the highest concentration among the anion analyzed. In the top soil, the Na concentrations ranged from 115.60 mg/kg to 149.41 mg/kg while in the sub-soil, the measured Na values ranged from 115.85 mg/kg to 124.93 mg/kg. Similar trends were obtained in the soil samples collected within the 1 km radius of the Project site as well as the control/buffer points.

Heavy Metals: Heavy metals occur naturally in the environment at low concentrations (Table 4.11); however, elevated levels of these metals in the environment may be experienced due to anthropogenic activities. The presence of heavy metals in soil at the level within the naturally occurring concentration is, therefore, not indicative of contamination. The concentration of metals in uncontaminated soil is primarily related to the geology of the parent material from which the soil was formed (McLean and Bledsoe, 1992).

Table 4.11: Naturally Occurring Heavy Metal Concentrations

Metals	Limits (mg/kg)
Cadmium	0.03-0.3
Nickel	5-500
Lead	2-20
Zinc	10-50
Copper	5-500
Iron	NS

Source: Alloway (1991); Allen *et al* (1974) NS = Not Specified

Based on the results of laboratory analysis conducted on soil samples from the Project site and its surrounding environment, no heavy pollution was recorded in the soil samples from the Project area. Copper (Cu), Lead (Pb), Mercury (Hg),

Cadmium (Cd), Chromium (Cr) and Nickel (Ni) were below the detection limits of 0.005m/kg, 0.04mg/kg, 0.001mg/kg, 0.01mg/kg, 0.04mg/kg and 0.05mg/kg respectively. The concentrations of Zinc (Zn) recorded in the soil samples from the Project site, had a range of 0.143mg/kg – 2.370mg/kg, in the top soil while in the subsoil, a range of 0.012 mg/kg – 2.538 mg/kg was recorded. The measured Zn values in all the soil samples collected from the Project site were within the naturally occurring levels. The concentrations of Iron (Fe) in the soil samples obtained from the Project site ranged from 76.11 mg/kg to 118.2 mg/kg in the topsoil and 83.42 mg/kg to 144.88 mg/kg in subsoil. Due to the geological nature of the Project area, Iron (Fe) recorded the highest concentrations amongst the heavy metals recorded in the soil samples as indicated in Tables 4.9 and 4.10 above. This also reflected in the Fe concentration recorded in the groundwater samples from the area.

Soil Microbiology: Microorganisms are one of the major components of soil. Microbial community in soil make important contributions to biogeochemical cycling and the carbon, nitrogen, sulfur, iron and manganese cycle. The population counts of Total Heterotrophic Bacteria (THB) and Total Heterotrophic Fungi (THF) in the soil samples from the Project site ranged from 2.40×10^6 to 6.60×10^6 cfu/gm and 1.0×10^5 to 6.8×10^3 cfu/gm respectively. The percentage of hydrocarbon utilizing bacteria (HUB) recorded was less than 1 % of the total heterotrophic bacteria, indicating that the soil environment is not polluted with hydrocarbon compounds that could serve as substrates for the HUB to thrive well. Predominant species of microorganisms isolated includes *Bacillus* spp., *Corynebacterium* spp., *Nocardia* spp., *Aspergillus flavus*, *Fusarium* spp., and *Penicillium* spp.

4.3.5 Groundwater Quality

Groundwater quality refers to the state of water that is located beneath Earth's surface. Naturally, groundwater contains mineral ions. Microbial matter is also a natural constituent of groundwater (Harter 2003).

In order to assess the quality of existing groundwater in the Project area, water samples were collected from existing groundwater resources in the Project area and analyzed. The results of the physico-chemical and microbial characteristics of the groundwater samples were compared with the WHO standards (highest desirable level and maximum permissible limits for substances and characteristics affecting the acceptability of water for domestic use) as well as the FMEnv prescribed limits for drinking water as highlighted in the National Guidelines and Standards for Water Quality in Nigeria, 1999.

4.3.5.1 Groundwater Sampling

Groundwater samples were collected from two (2) different boreholes in the Project area during the field sampling; one close to the Project site and one from the nearby

local community. At each sampling location, groundwater samples were collected into a 2-litre polyethylene bottle for general physico-chemical analysis, while samples for oil & grease determination were collected in 1-litre glass bottle and preserved with concentrated sulphuric acid. Samples for heavy metals were fixed with concentrated nitric acid. Pre-sterilized 50 ml McCartney bottles were used for samples meant for microbial analysis. In-situ measurements of pH, Electrical Conductivity, Total Dissolved Solids (TDS), Temperature, and Dissolved Oxygen (DO) were taken at each location using Extech Digital DO700 meter. Table 4.12 shows the coordinates of the groundwater sampling points while Figure 4.13 shows the sampling location map.

Table 4.12: Geographical coordinates of Groundwater sampling locations in the Project Area

Sampling Code	Latitude (N)	Longitude (E)
GW 01	11.01075	12.88015
GW 02	11.02452	12.87141

Source: EnvAccord Field Survey, 2019

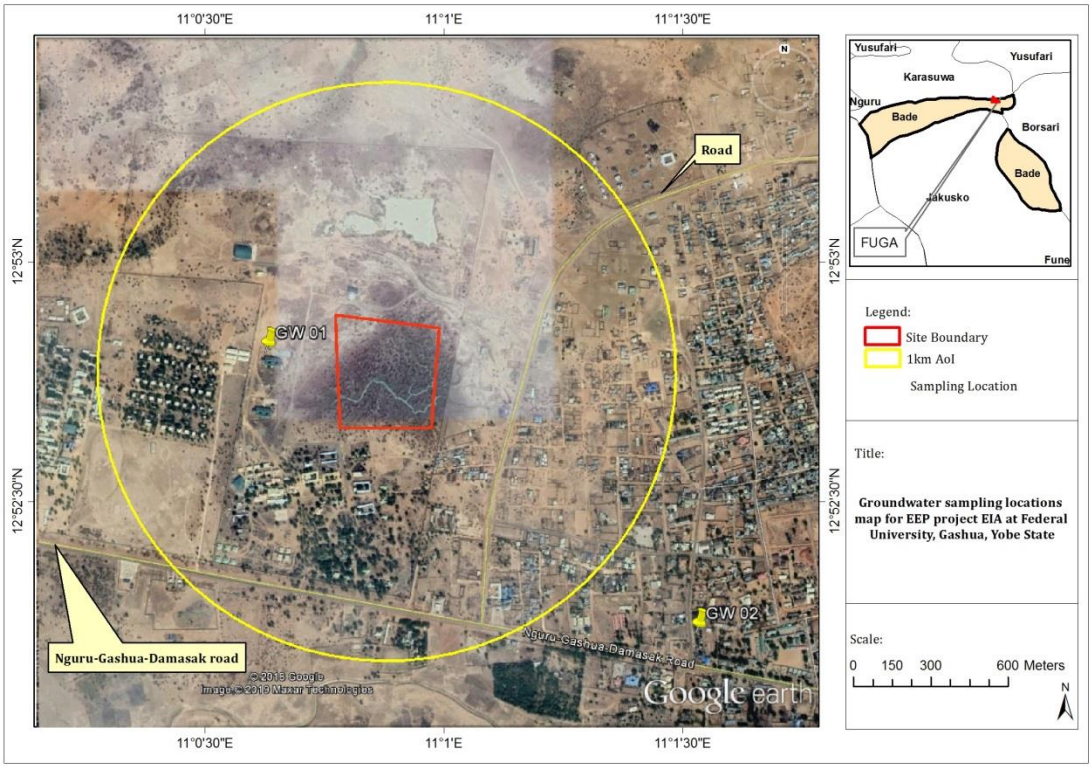


Figure 4.13: Map of Groundwater Sampling Locations in the Project Area
Source: EnvAccord Field Survey, 2019

4.3.5.2 Physico-chemical and Microbial Characteristics of Groundwater Samples

The results of physico-chemical and microbial analyses conducted on groundwater samples from the Project area are presented in Table 4.13.

Table 4.13: Physico-chemical and microbial characteristics of groundwater samples from the Project area

Parameter / Unit	GW 01	GW 02	WHO Limits		FMEnv. Limits
			Highest Desirable Level	Max. Permissible Level	
pH	7.24	7.56	7.0-8.5	6.5-9.2	6.5-8.5
Temperature ^{0}C	27.10	27.80	NS	NS	<40
Conductivity µS/cm	176.0	179.0	NS	1000	-
TDS mg/L	88.0	90.0	200	500	500
Appearance	Clear	Clear	NS	NS	NS
TSS mg/L	0.00	0.00	NS	NS	NS
Turbidity, NTU	0.40	0.42	NS	NS	1
Dissolved Oxygen, mg/L	3.00	3.20	NS	NS	7.5
BOD mg/L	0.30	0.20	NS	NS	0
COD mg/L	41.72	47.65	NS	NS	NS
Salinity ppt	0.11	0.11	NS	NS	NS
Total Hardness mg/l	50.40	60.00	100	500	200
Carbonate mg/L	1.09	2.00	NS	NS	NS
Chloride mg/L	19.99	16.59	-	-	250
Nitrate mg/L	0.00	0.00	NS	NS	10
Sulphate mg/L	0.00	0.00	200	400	500
Phosphate, mg/L	3.21	0.98	NS	NS	5
Hg mg/L	BDL	BDL	NS	NS	NS
Cu mg/L	BDL	BDL	0.05	1.5	1.0
Pb mg/L	BDL	BDL	NS	NS	0.05
Fe mg/L	1.034	1.323	NS	NS	1.0
Zn mg/L	0.037	0.016	5.0	15.0	5.0
Cd mg/L	BDL	BDL	NS	NS	0.05
Cr mg/L	BDL	BDL	NS	NS	<1.0
Ni mg/L	BDL	BDL	NS	NS	NS
Na mg/L	37.928	40.083	NS	NS	NS
Ca mg/L	12.633	10.832	75	200	NS
Mg mg/L	5.822	4.637	30	150	NS
K mg/L	4.730	3.821	NS	NS	NS
Oil/Grease mg/L	BDL	BDL	NS	NS	0.05
Total Heterotrophic Bacteria cfu/g	3.0×10^4	5.0×10^3	-	-	-
Total Heterotrophic Fungi cfu/g	1.0×10^2	2.0×10^2	-	-	-
Total coliform	Nil	Nil	-	-	-

Source: EnvAccord Field survey, 2019, NS = Not Specified BDL= Below Detection Limit. Equipment Detection Limits are as follows: Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; Mn, 0.03; Hg, 0.001; oil and grease, 0.001.

The pH of the groundwater samples ranged from 7.24 to 7.56 (*i.e.* slightly alkaline) while the in-situ water temperature ranged between 27.1 ^{0}C and 27.8 ^{0}C. The measured pH and temperature values in the groundwater samples fall within the FMEnv recommended limits of 6.5 – 8.5 and 40 ^{0}C for pH and temperature respectively for potable water.

Electrical conductivity which is a measure of the ability of water to pass an electrical current, ranged from 176.00 µS/cm to 179.00 µS/cm. The conductivity values

obtained in the groundwater samples were within the WHO limit of 1000 µS/cm. Similarly, the Total Dissolved Solids (TDS) values ranged from 88.00mg/l to 90.00mg/l which fall below the WHO and FMEnv limits of 500 mg/l for potable water. Both conductivity and TDS are indicators of how much ions are dissolved in the water samples. Salinity of the groundwater samples was very low (below 1ppm) indicating a fresh water environment, and did not indicate any salt intrusion to the groundwater aquifers. The groundwater resources in the Project are largely recharged through direct precipitation (rainfall).

Heavy metals in the groundwater samples were recorded in trace concentrations, below the regulatory limits. Copper (Cu), Lead (Pb), Cadmium (Cd), Nickel (Ni), Mercury (Hg), and Chromium (Cr) were not detected in the groundwater samples while Zinc (Zn) ranged from 0.016 mg/l to 0.037 mg/l, below the FMEnv limit of 5.0mg/l. The Iron (Fe) concentrations (1.034 mg/l to 1.323 mg/l) recorded in the groundwater samples were slightly above the FMEnv limit of 1.0mg/l. This could be attributed to the geological formation of the Project area, which principally comprises crystalline and sedimentary rocks, underlain by basement complex rocks. Generally, no heavy metal pollution was recorded in the groundwater samples from the Project area.

Similarly, the concentrations of oil and grease measured in the groundwater samples were below the detection limit of 0.001mg/l, indicating that the groundwater samples are not polluted with hydrocarbons.

The population counts of Total Heterotrophic Bacteria (THB) and Total Heterotrophic Fungi (THF) recorded in the groundwater samples ranged from 5.0 x 10^3 to 3.0 x 10^4 cfu/gm and 1.0 x 10^2 to 2.0 x 10^2 cfu/gm respectively. The percentage of hydrocarbon utilizing bacteria (HUB) recorded was less than 1 % of the total heterotrophic bacteria, indicating that the groundwater is not polluted with hydrocarbon compounds that could serve as substrates for the HUB to thrive well. Microbes are naturally found in groundwater resources. Predominant species of microorganisms isolated in the groundwater samples from the Project area are *Bacillus* spp., *Mucor* spp. and *Aspergillus niger*.

4.3.6 Surface water Quality

There is an existing rainwater harvesting trench owned by the University at the southern part of the Project site. As part of the field sampling, water samples from the trench was collected from two different locations (indicated in Figure 4.14) and analyzed. The geographical coordinates of the water sampling locations are presented in Table 4.14.

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Table 4.14: Surface water sampling locations

Sampling Code	Latitude	Longitude
SW 1	11.01169	12.87859
SW 2	11.01636	12.87878

Source: EnvAccord Field Survey, 2019

The results of the physico-chemical and microbial analyses of the water samples are provided in Table 4.15. The results were compared with the FMEnv limits for aquatic life as well as the surface water quality criteria for fisheries and recreation quality as enshrined in the National Environmental (Surface and Groundwater Quality Control) Regulations, 2011.

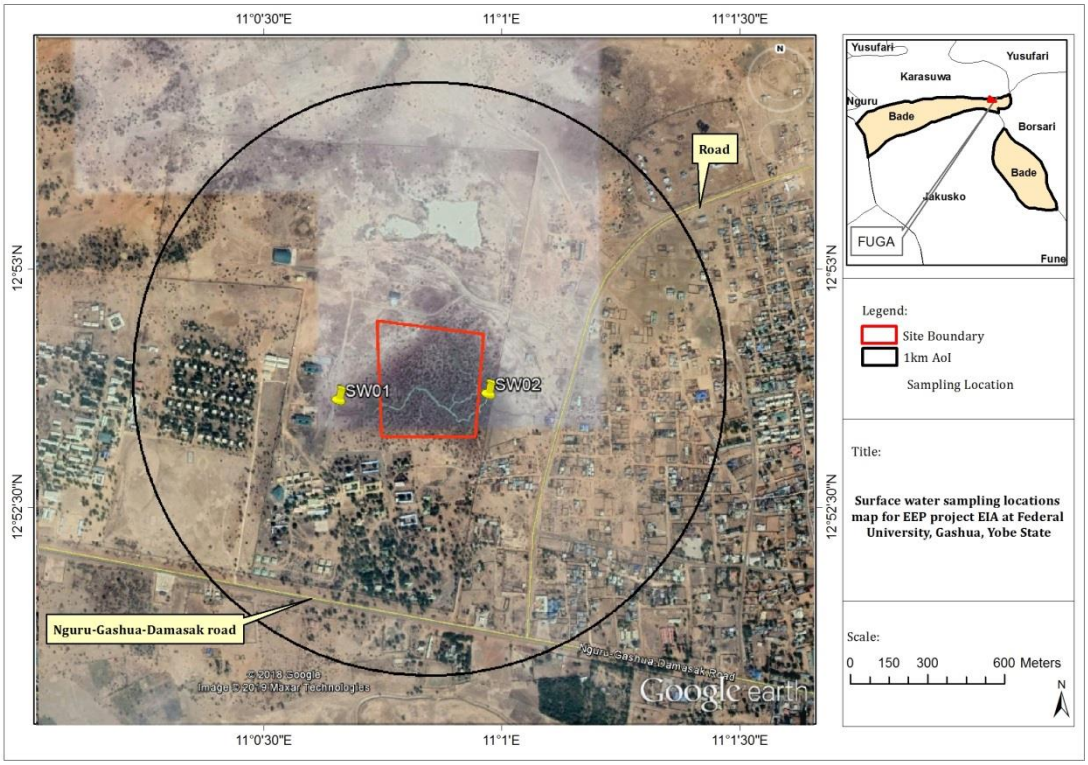

Figure 4.14: Map of Surface water Sampling Locations at the study area
Source: EnvAccord Field Survey, 2019

Table 4.15: Physico-chemical and microbial characteristics of surface water samples from the Project area

Parameter / Unit	SW 01	SW 02	*NESREA Limit	FMEnv. Limits (Aquatic Life)
pH	6.84	6.72	6.5-8.5	6.0-9.0
Temperature ^{0}C	28.4	28.3	NS	20-33
Conductivity µS/cm	172.00	168.00	NS	1000
TDS mg/L	87.00	84.00	NS	500
Appearance	Brownish	Brownish	NS	NS
TSS mg/L	2.12	1.835	NS	NS
Turbidity NTU	4.05	4.13	NS	NS
Dissolved Oxygen mg/L	2.70	3.60	6	6.8
BOD mg/L	0.40	0.60	3	4.0

Parameter / Unit	SW 01	SW 02	*NESREA Limit	FMEnv. Limits (Aquatic Life)
COD mg/L	31.82	30.72	30	NS
Salinity ppt	0.11	0.10	0.25	NS
Total Hardness mg/l	130.20	108.00	NS	NS
Carbonate mg/L	1.70	1.80	NS	NS
Chloride mg/L	13.993	11.994	300	NS
Nitrate mg/L	0.450	0.600	9.1	NS
Sulphate mg/L	41.036	15.219	0.001	NS
Phosphate	0.320	0.000	0.01	NS
Hg	BDL	BDL	NS	NS
Cu mg/L	BDL	BDL	0.001	2.4
Pb mg/L	BDL	BDL	0.01	1.7
Fe mg/L	2.436	1.426	NS	NS
Zn mg/L	1.009	0.829	0.005	0.2-1.8
Cd mg/L	BDL	BDL	0.001	0.02-2.0
Cr mg/L	BDL	BDL	300	NS
Ni mg/L	BDL	BDL	0.01	25-150
Na mg/L	32.734	39.622	120	NS
Ca mg/L	9.836	8.637	180	NS
Mg mg/L	8.057	7.228	40	NS
K mg/l	4.523	6.341	50	NS
Oil/Grease mg/L	BDL	BDL	0.01	NS
Total Heterotrophic Bacteria cfu/g	2.0×10^3	1.6×10^4	-	-
Total Heterotrophic Fungi cfu/g	3.0×10^4	4.0×10^4	-	-
Total coliform	0.00	1.0×10^2	-	-

Source: EnvAccord Field survey, 2019, NS = Not Specified
BDL= Below Detection Limit. Equipment Detection Limits are as follows: Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; Mn, 0.03; Hg, 0.001; oil and grease, 0.001.
***NESREA Limit (for Surface water for Fisheries and recreation quality criteria standards)**

The pH of the water samples ranged from 6.72 to 6.84 (*i.e.* slightly acidic) while the in-situ water temperature ranged between 28.3 ^{0}C and 28.4 ^{0}C. The temperature values fall within the FMEnv recommended limit of <40 ^{0}C for potable water.

Electrical conductivity, a measure of the ability of the water to pass an electrical current, ranged from 168.00 µS/cm to 172.00 µS/cm. The conductivity values obtained in the water samples were within the WHO limit of 1000 µS/cm. Similarly, the Total Dissolved Solids (TDS) values ranged from 84.00 mg/l to 87.00 mg/l which fall below the WHO and FMEnv limits of 500 mg/l. Both conductivity and TDS are indicators of how much ions are dissolved in the water samples.

Heavy metals in the water samples were analysed using Atomic Absorption Spectrophotometer (AAS). Copper, Lead, Cadmium, Nickel and Chromium were not detected in the samples. Zinc ranged from 0.829 mg/l to 1.009 mg/l while Iron ranged from 1.426 mg/l to 2.436 mg/l. Generally, no heavy metal pollution was recorded in the surface water samples. Similarly, no hydrocarbon contamination was recorded in the water sample. The measured values of oil and grease in the water sample were below 0.001 mg/l.

The population counts of Total Heterotrophic Bacteria (THB) and Total Heterotrophic Fungi (THF) in the water samples ranged from 2.0 x 10^3 to 1.6 x 10^4 cfu/gm and 3.0 x 10^4 to 4.0 x 10^4 cfu/gm respectively. The percentage of hydrocarbon utilizing bacteria (HUB) recorded was less than 1 % of the total heterotrophic bacteria, indicating that the water is not polluted with hydrocarbon compounds.

4.3.6 Terrestrial Flora and Fauna

4.3.6.1 Terrestrial Flora

Flora refers to all plant life forms that are found within a specific region at a particular period of time. Plants provide valuable information about site environmental conditions. By their occurrence and relative abundance, certain plant species serve as environmental indicators, through which inferences can be drawn about the state of the environment in that area. Thus, the physiological state and ecological response of plants provide evidence of changes in the environmental conditions of a project site. The array of information derived from the flora composition and vegetation structure of a site is of importance for understanding the nature of the site, potential human health and ecological risk, and the feasibility of different mitigation approaches.

The field assessment of the Project site and surrounding area was done via direct observations. The identification of flora specimen was done both in situ (field) and ex situ using appropriate manuals and monographs. Photographs were taken during survey to record relevant plant species, habitat characteristics and other features.

The results of the vegetation assessment are presented as follows:

- Habitat characterization
- Physiognomy, Floristic composition, and Biodiversity status

Habitat characterization

The vegetation zone of Yobe State is divided into two; Sahel Savanna to the north and Sudan Savanna to the south. Gashua falls within the Northern zone therefore the vegetation zone is Sahel (Wakawa *et al.*, 2017). The natural vegetation of the Project area was observed to have been modified over the years as a result of human interference; mainly development activities within the University. The vegetation within the Project site is dominated by shrubs, grasses and a few trees (Plate 4.6 to 4.8).

Plate 4.6: *Faidherbia albida* observed within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.7: *Adansonia digitata* observed within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.8: *Megathyrsus maximus* observed within the proposed Project site
Source: EnvAccord Field Survey, 2019

Physiognomy, Floristic composition, and Biodiversity assessment

Species composition, distribution and structure of the vegetation of Project site as well as the physiognomic view show few trees, shrubs, and grasses.

In terms of biodiversity assessment, the IUCN (International Union of Conservation of Nature) Red List of Threatened Species was employed. The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable).

The IUCN Red List also includes information on plants, fungi and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants, fungi and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened).

None of the plant species observed within the Project site belongs to the endangered status. In addition, there are no known protected species on the Project site under the Nigerian legislation. The IUCN status of the plant species encountered in the Project area is highlighted in Table 4.16.

Table 4.16: Plant inventory and Conservation Status

Species Encountered	Family Name	Common Name (Local name)	Plant Forms	IUCN Status
Acacia seyel	Fabaceae	Red acacia	Tree	NE
Balanite aegyptiaca	Zygophyllaceae	Desert date	Tree	NE
Faidherbia albida	Fabaceae	White acacia	Tree	NE
Adansonia digitata	Malvaceae	Baobab	Tree	NE
Azadirachta indica	Meliaceae	Neem tree	Tree	NE
Cenchrus biflorus	Poaceae	K 'arangiya	Grass	NE
Pennisetum pedicellatum	Poaceae		Grass	NE
Setaria pallide fusca	Poaceae	Geron darli	Grass	NE
Schoenefeldia gracilis	Poaceae		Grass	NE
Paspalum conjugatum	Poaceae		Grass	NE
Megathyrsus maximus	Poaceae		Grass	NE

Source: EnvAccord Field Survey, 2019; NE= Not Evaluated
IUCN – International Union for Conservation of Nature

4.3.6.2 Fauna Species

The methodology used in identifying the terrestrial fauna species within the Project site includes direct sighting, sound, nest type, and footprints. The fauna species observed at the Project site were generally few and restricted to small invertebrates such as earthworms, insects, grasshoppers, butterflies, spiders. Also, vertebrates

such as Lizards (*Agama agama*), birds and grazing animals were sighted in the surrounding environment of the Project site. Although, grazing activities were observed on the Project site during the field activities, the site is not known to fall within any gazetted grazing reserves or grazing routes. The livestock grazing noted during the field data gathering was free ranging. Table 4.17 presents a list of fauna species encountered in the Project's area of influence, while sample pictures of the fauna species are shown in Plate 4.9 to 4.14.

Table 4.17: List of Fauna Species Encountered in the Project's Area of Influence

Common (Local) Names	Species	Family	Group	IUCN status
Blue naped mousebird	*Urocolius macrourus*	Coliidae	Aves	LC
Sun lark	*Galerida modesta*	Coliidae	Aves	LC
Black Kite	*Muluus migrans*	Accipitridae	Aves	LC
Yellow fronted bird	*Pogoniulus scolopaceus*	Lybiidae	Aves	LC
Common bulbul	*Pycnonotus barbatus*	Pycnonotidae	Aves	LC
African silverbill	*Euodice cantans*	Estrildidae	Aves	LC
Black ant	*Lasius niger*	Formicidae	Insecta	NE
Earthworm	*Lumbricus terrestris*	Acanthodrilidae	Annelida	NE
Giant African mantis	*Sphodromantis viridis*	Mantidae	Insecta	NE
Green fruit Pigeon	*Treron australis*	Columbidae	Aves	LC
Lizard	*Varanus albigularis*	Varanidae	Reptilia	NE
Butterfly	*Chlosyne rosita*	Nymphalidae	Insecta	NE
Soldier ant	*Strongylognathus alboini*	Formicidae	Insecta	NE
Cattle egret	*Bubulcus ibis*	Ardeidae	Aves	LC
Cattle (cows)	*Bos Taurus*	Bovidae	Mammalia	LC
Sheep	*Ovis aries*	Bovidae	Mammalia	LC
Housefly	*Musca domestica*	Muscidae	Insecta	NE
Red headed Malimbe	*Malimbus rubricollis*	Ploceidae	Aves	LC

IUCN – International Union for Conservation of Nature
Source: EnvAccord Field Survey, 2019; NE= Not Evaluated; LC = Least Concern

Plate 4.9: *Bos Taurus* observed passing through the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.10: *Ovis aries* observed within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.11: Ant colony observed within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.12: *Urocolius macrourus* observed within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.13: *Pycnonotus barbatus* observed within the proposed project site
Source: EnvAccord Field Survey, 2019

Plate 4.14: *Pogoniulus scolopaceus* species observed within the Project site
Source: EnvAccord Field Survey, 2019

4.3.7 Land Use/Land Cover

This section discusses the existing land use / land cover type in the Project area. The land use map (Figure 4.15) was produced from a combination of ground truthing, aerial imagery (LandSat ETM+) and topographical maps covering the Project area. The study covers the land use within the Project site boundary and the wider area area (1 km from the Project site).

The land use composition of the proposed Project site was observed to be bare land reserved for future development projects (characterized by trees, grasses and a rainwater harvesting trench used for irrigation demonstration activities by the University students. At the time of the baseline study, there were no academic, residential or business structures on the proposed site. Also, there are no farming, fruit gathering, or wood gathering activities on the proposed site.

The wider area (AoI) can be categorized in three classes, namely; built-up area, dry land and waterbody (Figure 4.16). The estimated area covered by each of the land use types is presented in Table 4.18.

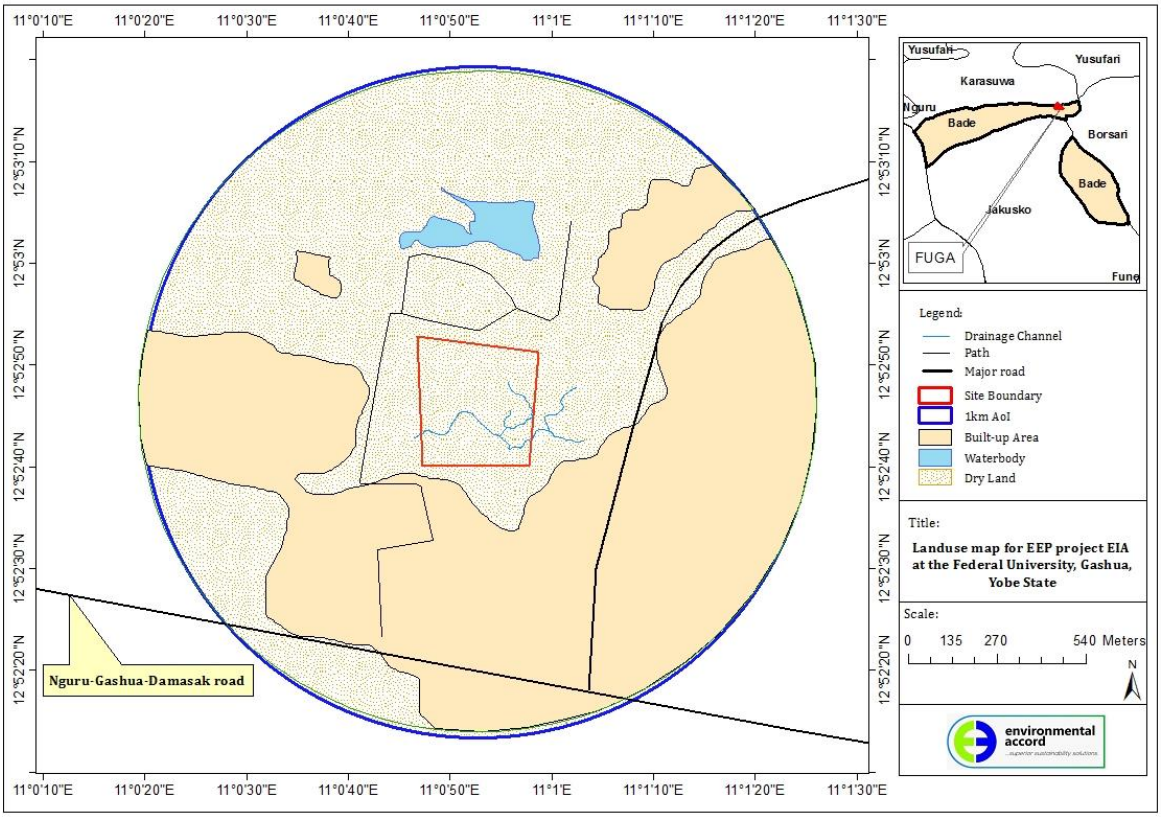

Figure 4.15: Land use map of the Project site and area of Influence
Source: EnvAccord GIS. 2019

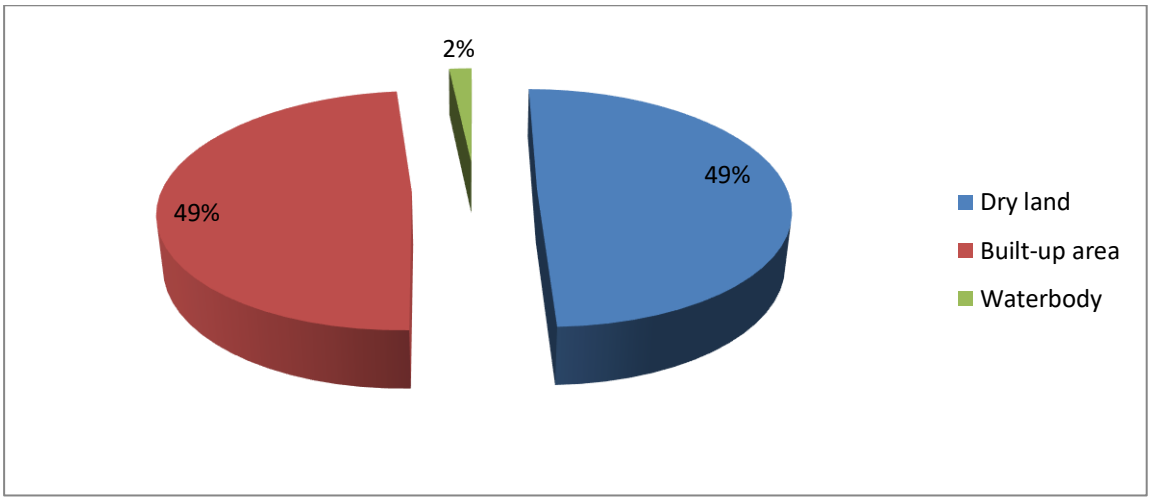

Figure 4.16: Land use composition within the Project's area of Influence
Source: EnvAccord Field Survey, 2019

Table 4.18: Existing Land Use within the wider area (outside the Project site)

S/N	Land use/ Land cover	Area (ha)	Percentage (%)
1	Bare land	156.69	49.53
2	Built-up area	154.21	48.75
3	Waterbody	5.44	1.72
	Total	**316.34**	**100**

Source: EnvAccord Field Survey, 2019

- **Bare land**

This class covers about 50% of the wider area. It entails bare soil and dry vegetal cover. The bare lands within FUGA campus are mostly undeveloped lands that have been reserved for future projects by the University. The proposed Project site falls into this category.

- **Built-up area**

This is a general name used to classify building structures within an environment. The major constituents of this class are the buildings in FUGA and the host community. This covers over 150ha of the entire wider study area. There are no built up structures (temporary or permanent) within the proposed project site.

- **Waterbody**

The waterbodies observed during the field survey are rainwater harvesting trench (owned by the University) at a section of the Project site and an artificial pond in the wider area (located about 1 km away from the Project site). This amounts to about 6 ha of the entire area under study.

4.3.8 Traffic Survey

Traffic survey was conducted as part of the ESIA study to understand the traffic nature of the Project's area of influence, including the type of vehicles plying the area, in order to put in place appropriate mitigation measures during the Project development and operation.

4.3.8.1 Survey Methodology and Analysis

There are two (2) sampling techniques for conducting traffic surveys in order to account for the number, movements, and classifications of vehicles at a given location over a period of time. The techniques are manual and automatic counts.

A manual count method was adopted for this survey. Owing to the socio-economic nature of the environment, the peak periods identified for the survey were from 7:30am to 9:00am, 12:00noon to 2:00pm, and 4:30pm to 6:00pm. The survey was carried out on 9th August, 2019.

4.3.8.2 Selection of Screen Lines

The screen lines for the traffic survey were selected based on the direction of movements that may be impacted during the phases of the Project. As presented in Figure 4.17, two (2) screen lines which were principal routes leading to the Project site, were identified and surveyed.

- *Screen Line 1 (SL 1):* to capture the traffic flow along Nguru-Gashua expressway from Nguru to Gashua.
- *Screen Line 2 (SL 2):* to capture the traffic flow along Nguru-Gashua expressway from Gashua to Nguru.

Figure 4.17: Aerial Imagery of the project site showing the screen lines
Source: EnvAccord Field Survey, 2019

The data collected by the traffic survey team (Plate 4.15) were recorded on a traffic survey designed sheets using tally system, while a stopwatch was used to monitor the count intervals. The vehicle classification schemes used for this survey are presented in Table 4.19.

Table 4.19: Vehicle Classification Scheme used for the traffic survey

S/N	Vehicle Classification	Vehicle Types
1.	Trucks/Lorries,	Tankers
		Trucks
		Pick-ups
		Trailers and Heavy duty vehicles
2.	Buses,	Private buses
		Commercial buses

S/N	Vehicle Classification	Vehicle Types
		Coaster buses
		Mini buses
		Vans
3.	Cars and Sport Utility Vehicles (SUVs),	Cars
		Jeeps
		Space buses
4.	Cycles	Motorcycles
		Bicycles
5.	Tricycles	Three wheeled vehicles

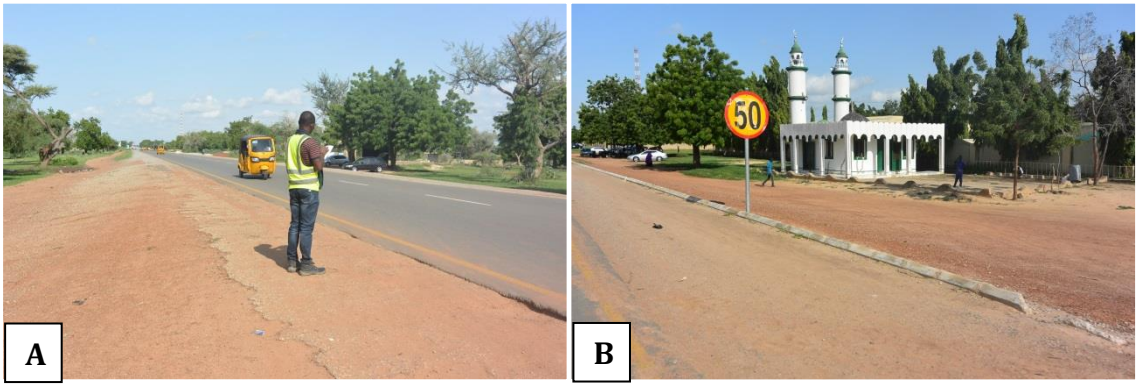

Plate 4.15: (A) Traffic count by field observers in the Project area (B) Traffic signs in the Project area
Source: EnvAccord Field Survey, 2019

Plate 4.16 shows some of the vehicle types observed during the survey.

Plate 4.16: Vehicle types observed during the survey
Source: EnvAccord Field Survey, 2019

4.3.8.3 Results and Discussion

Based on field observations, the prominent means of transportation in the Project area are tricycles, cars and motorcycles. A few heavy-duty trucks carrying farm produce, sand, gravel and livestock were also observed during the survey.

The results from the average count at the screen lines are presented in Figure 4.18 while the percentage composition of vehicles is presented in Figure 4.19.

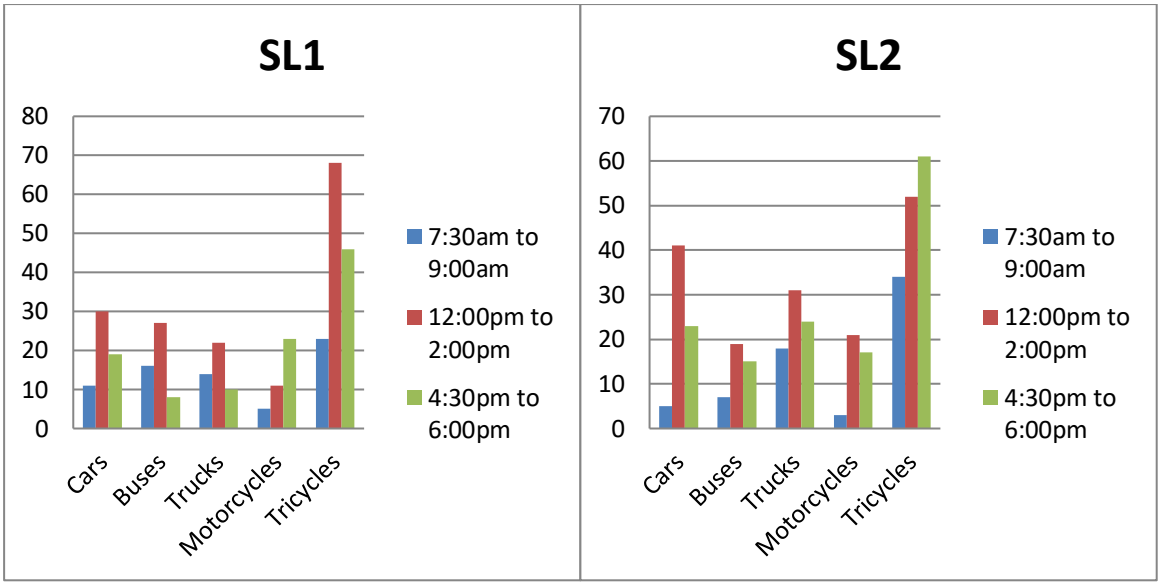

Figure 4.18: Average traffic flow result for the screen lines (SL1 & SL2)
Source: EnvAccord Field Survey, 2019

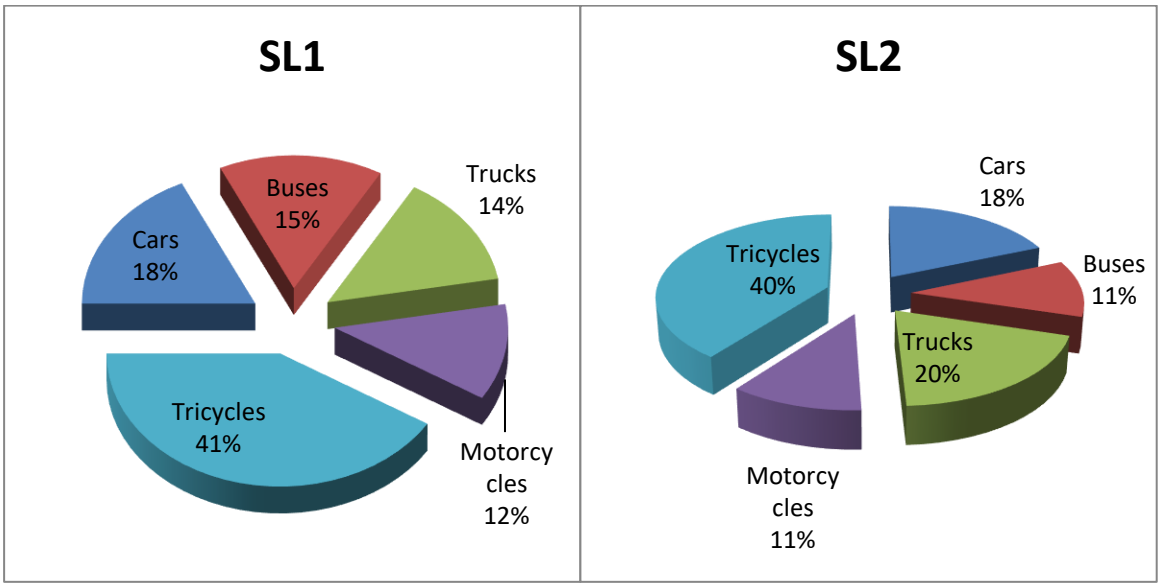

Figure 4.19: Percentage composition of vehicles for the screen lines (SL1 & SL2)
Source: EnvAccord Field Survey, 2019

Road traffic in the Project area can be described as relatively light as Gashua town is a developing area. Based on the survey, the peak traffic periods are afternoons for both screen lines. There are a few traffic signs as well as security checkpoints along the expressway. Additional traffic which might result from the Project activities is therefore envisaged to have minimal impact on the traffic situation in the Project area as further discussed in Chapter 5.

4.4 Description of Socio-economic Environment of the Project Area

4.4.1 Introduction

The proposed Project will be sited within the FUGA campus in Gashua, Bade Local Government Area of Yobe State. There is no local community presence within the Project site. However, the identified community within the 2km radius of the Project site is Low-Cost Community, Gashua. This section thus provides baseline information on the socio-economic and health survey conducted in the community.

4.4.2 Study Approach and Methodology

4.4.2.1 Study Area

The socio-economic survey was conducted in Low-cost Community, situated about 1.2km from the Project site in FUGA, Yobe State. With an estimated population of 2,000 residents (as observed by survey enumerators and corroborated by the community leaders), Low-cost community is located in Bade LGA of Yobe State. According to the 2006 National Population Census (NPC), the LGA has a population of 139,804 persons. Going by Nigeria's annual population growth rate of 3.2% (NBS, 2018) the LGA is estimated to now have a projected population of 256,627 persons.

Low-cost Community was built between 1979 and 1983 by the government of Sheu Shagari, who initiated the Federal Government mass housing programme. Low-cost community has a leader who reports directly to the District Head who also reports to the Emir of Gashua.

4.4.2.2 Study Population

The target populations for the study are the community residents who are above the age of 18 years. This study also considered community heads (often referred to as ward head), healthcare practitioners, youths and women.

4.4.2.3 Study Design

The study employed a sequential mixed methods research design using quantitative and qualitative methods of data gathering, analysis, and reporting. Information obtained during the study was investigated to separate perception from reality and to check for information consistency, reliability, and validity. The study was carried out from August 15 to 17, 2019. The study employed questionnaire administration for quantitative data gathering, while Key Informant Interview (KII), Focus Group Discussions (FGD) and stakeholders' consultation were used for the qualitative data gathering.

4.4.2.4 Sample Size and Sampling Techniques

The study population is largely homogenous with respect to ethnicity and language. The community does not have a large population. The sample size was calculated using the Cochran Formula.

$$n = \frac{Z^2 pq}{e^2}$$

Where n is the sample size

p is the estimate of the proportion of interest (i.e. 0.29)

q is 1 – p (i.e. 0.71)

e is the desired level of precision (i.e. 0.07)

Hence, n = 1.96^2 (0.29) (0.71) / 0.07

n = 180

A 10% non-response rate was added as a standard practice with the speculation that some respondents within the study area may refuse to participate or some may withdraw at the middle of the interview. Thus, the selected samples size was 200. The systematic sampling technique employed ensures a fair representation of both males and females among the respondents (Plate 4.17 and 4.18).

For the qualitative data, Focus Group Discussions (FGDs) were conducted (2 male groups, both men and youths, 1 female group) making a total of 3 FGDs. Each FGD includes a minimum of 6 and maximum of 15 participants. Different categories of respondents including youths, adults, males, females, people living with disabilities, educated and non-educated etc. were included in each FGD session (Plates 4.19 and 4.20). In-depth interview was held with healthcare practitioner of Federal University Gashua, Yobe State (Plate 4.21). Also, a Key Informant Interview (KII) was held with the Low-cost community leader (Plate 4.22). The socio-economic data gathering records (attendance sheets) are presented in Appendix 4.2.

Plate 4.17: Questionnaire Administration in Low-Cost community
Source: EnvAccord Field Survey 2019

Plate 4.18: Questionnaire Administration in Low-Cost community
Source: EnvAccord Field Survey 2019

Plate 4.19: Focus Group Discussion with youths in Low-cost community
Source: EnvAccord Field Survey 2019

Plate 4.20: Focus Group Discussion with men from Low-cost community
Source: EnvAccord Field Survey 2019

Plate 4.21: In-Depth Interview with healthcare professional at FUGA health centre
Source: EnvAccord Field Survey 2019

Plate 4.22: Key informant interview with Low-cost Community Leader
Source: EnvAccord Field Survey 2019

4.4.2.5 Data Collection, Analysis and Reporting

During data gathering, this study made use of Computer Assisted Personal Interviewing (CAPI), a SurveyCTO Software using smartphone and assisted by competent survey enumerators.

4.4.3 The Socio-Economic Baseline Report Structure

This study adopted the Social Framework Model for reporting its findings. In line with the social framework developed by Smyth and Vanclay in 2017, the socio-economic baseline report is structured as follows:

- Overview of key socio-economic indicators
- Demographic Profile;
- Administrative and socio-cultural institutions
- Livelihood Assets and Activities

- Infrastructure and Services
- Housing Structures/Settlement pattern
- Land Acquisition
- Project Affected Persons (PAPs)
- Health Profile
- Gender Assessment
- Community Concerns and Perceptions

4.4.3.1 Demographic Profile of the Study Area

- *Population Distribution*

The proposed Project will be located in FUGA campus within Bade LGA of Yobe State. Yobe State is located in Northeast Nigeria and was created on August 27, 1991. The State is bordered by Bauchi, Borno, Gombe, and Jigawa States. It also shares boundary to the north with the Republic of Niger. The State lies mainly in the dry savanna belt and the weather conditions are hot and dry for most of the year. The State occupies a total land mass of 45,502 km^2 and is ranked 6^{th} by land mass among the 36 States in Nigeria.

Using the NPC 2006 Census data and a growth rate of 3.2 % (NBS, 2018), Yobe State has a 2019 population projection estimate of approximately 3.3 million people of which 51.9 % are male and 48.1 % are female. The bulk of the State population is skewed towards people who are economically active, with the age group of 15-64 years owning approximately 50.5 % of the total population; 46.7 % of the population are within the age group of 0-14 years and 2.8 % of the population are 65 years and above.

Bade LGA occupies a land size of 772 km^2 and has a population density of 257 km^2 (NBS, 2016). Using the Nigeria population growth rate of 3.2 % per annual, the local government has 2019 population projection estimate of 256, 627.

- *Culture, Ethnicity and Religion*

The ethnic composition of Gashua is rich and diverse, with interesting historical and cultural heritage. The study area has five major ethnic groups which include the Kanuri, Fulani, Karekare, Bade and Hausa. The people of Gashua, just like many people in Yobe State are well known for their Durbar; rich culture and traditions arising from their historical connection with North Africa and Eastern Arabia. The Durbar provides illuminating perspective to the display of horses, regalia and spectacular horsemanship to bring about colour, pump and pageantry to the joy of spectators. Islam stands as the largest religion, with 98% estimate of the total population in Bade LGA while Christianity has 2 % of the population.

The language of the identified community is predominantly Bade, which has been estimated to be spoken by over 344,000 people in Nigeria (Georg Ziegelmeyer,

2015). Analysis of the data obtained from the baseline survey showed that 92%, representing one hundred and eighty-four (184) respondents are Muslims while 8% representing sixteen (16) respondents are Christians. Despite religious differences, it was gathered that there is a cordial relationship among the people.

- *Migration Status and Patterns*

During the survey, it was revealed that most residents within the community are natives of the community, who settled in the area generations ago. However, some people have emigrated from the community to other towns or state for varying reasons such as security, social and economic opportunities.

- *Crime, Security and Safety*

During the interview with the community leader, it was stated that the community is peaceful, although there are many people who are concerned about the security issue in the town as Yobe State is one of the states affected by the Boko Haram insurgency. For safety purposes, the community leader (ward head), along with the District Heads and Emir manage the affair of the town by supporting vigilante groups and Joint Task Force. The community also has a good relationship with the local police command (Plate 4.23).

Plate 4.23: Police station in the community
Source: EnvAccord Field Survey 2019

- *Vulnerable or Marginalized Groups*

Vulnerability is the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard (IFC, 2012). In the context of this report, vulnerable groups are groups who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage or social status may be more adversely affected by a Project than others. They may include

people who are limited in their ability to take advantage of a project's development benefits.

Vulnerable groups within the community were observed to be the physically challenged, elderly women and men. This classification is by virtue of their economic vulnerability based on dependency. The elderly women depend on their husbands, who often are not economically buoyant while the elderly men are often farmers with depleting strength, many of whom also depend on the remittances from their children to survive. The people living with disability within the community often resort to begging for alms or engaging in menial jobs to support themselves. However, none of the vulnerable groups identified during study have direct links or derive benefits from the proposed Project site.

Host Community Profile

The community overview is summarized below in Box 1.1.

Box 1.1: Overview of the Project AoI – Demographic Profile

- **Low-cost community is relatively homogenous in terms of ethnicity and language.**
- **Islam is the most prevalent religion in the community.**
- **The housing pattern in the community is nucleated and are built with cement blocks and aluminum roofing sheets**
- **Lands are owned by individual and can be sold, leased, shared and gifted.**
- **Trading and seasonal agricultural activities are the common livelihood activities in the community**

During the baseline survey, 52.50 % of the respondents in the community were male while 47.50 % were female representing 105 males and 95 females among the respondents.

Further analysis of the baseline data showed the age distribution among the gender, 33.33 % of respondents within the age group of 18-30 years are male, 54.74 % are female. The male respondents within the age group of 31-45 years are 46.67 % while 37.89 % are female. As shown in the Table 4.20, there are 7.37 % of female respondents within the age group of 46-65 years and 20 % of male respondents.

Table 4.20: Age-group distribution between the two genders

Gender	18-30	31-45	46-65
Female	52 (54.74%)	36 (37.89%)	7 (7.37%)
Male	35(33.33%)	49 (46.67%)	21 (20%)
Total	87 (43.50%)	85 (42.50%)	28 (14%)

Source: EnvAccord Field Survey 2019

According to the data collected during the KII and baseline survey, the community is majorly occupied by Hausa, Fulani and Bade tribes. The survey data shows the distribution of respondent's ethnicity, a large percentage are Hausa (93 %), Fulani

tribe are 3.50 % of the sampled respondents, 3.50 % are Bade. Among the respondents, there are Muslims (98 %) and Christians (2 %). Figure 4.20 shows the graphical distribution of respondent's religion in the study area.

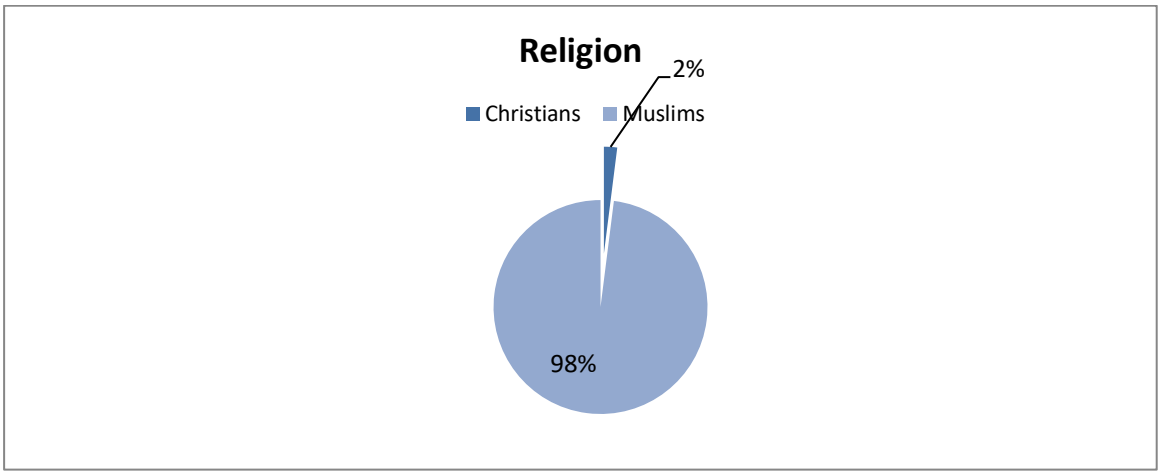

Figure 4.20: Distribution of religion among the respondents
Source: EnvAccord Field Survey 2019

The baseline survey results show that the average household size in the study area is 7.8 persons, with males averaging about 5.1 per household compared to females who average 2.9 per household. The community has an economically active and youthful population in which 43.50 % are between the age group of 18 – 30 years; 42.50 % are between the age group of 31 – 45 years and 14 % are between the age group of 46 – 65 years. With regard to education, 10.50 % of the respondents have attained secondary school level of education; 31.50 % have attained tertiary education and 58 % had no formal education.

As at the time of the survey, about 54 % of the respondents reported to be self-employed and many of them were engaged in trading of goods and services; 3.50 % are unemployed; 21 % employed; 14.50 % are farmers and 7 % are students.

50 % of the respondents had lived in the community for more fifteen years; 25 % had been living in the community for about 11-15 years and 25 % of the respondents had been living in the community for about 6-10 years. This suggests that a large percentage of respondents have a good knowledge of the community.

- *Marital Status*

The survey data revealed that about 75.50 % of respondents within the community are married; among these married people, 75.50 % are into monogamous family while 24.50 % are into polygamous family. The polygamy is supported by their religion and culture. 14 % of sampled respondents stated that they were single or soon to be married while 10 % are divorced (Figure 4.21).

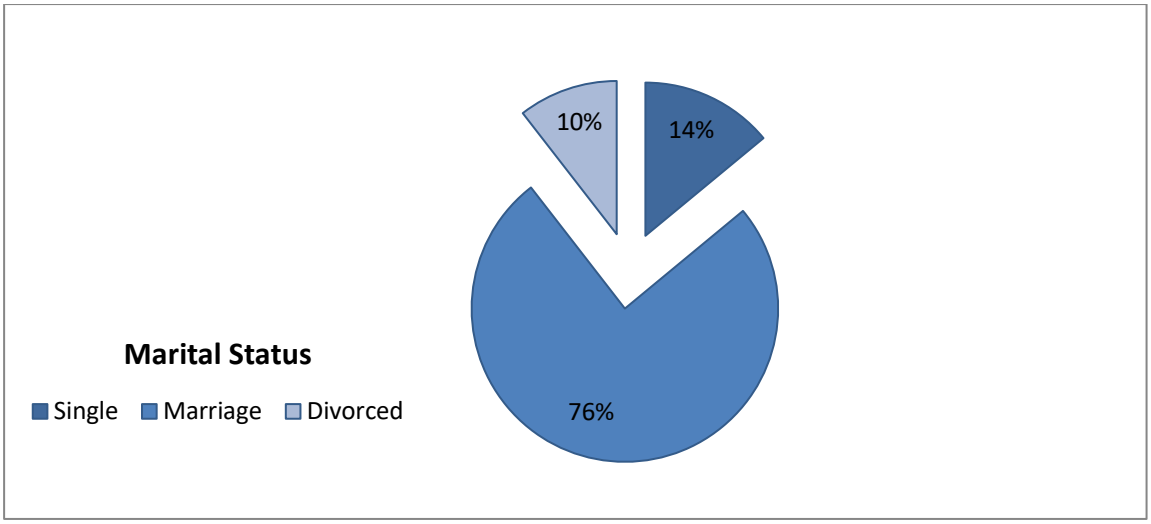

Figure 4.21: Marital status among respondents in the community
Source: EnvAccord Field Survey 2019

4.4.3.3 Administrative and Socio-Cultural Institutions

- *Government Institutions*

Nigeria is made up of 36 states and one Federal Capital Territory (FCT). Each of the states is subdivided into smaller administrative units called Local Government Areas (LGAs). There is a total of 774 LGAs in Nigeria. It has a mixed legal system of English Common law, Islamic law and traditional law.

Yobe state, which has its capital in Damaturu, comprises of 17 LGAs. The proposed Project site within the FUGA campus is situated in Bade LGA. The relevant government ministries in the State that have been consulted in respect of this Project at the State level include: Yobe State Ministry of Environment, Yobe State Environmental Protection Agency, Yobe State Ministry of Women Affairs and Yobe State Ministry of Youth, Sport and Social Development, as further discussed in Section 5 of this chapter.

- *Traditional Leadership Patterns and Representations*

Traditional leadership remains a strong and respected structure in Yobe State, just like many other states in Nigeria. The powers of traditional leaders are still much relevant in modern times, the respect and ceremony that surround these positions remain strong, and also these leaders retain significant influence over their people.

The community is governed by traditional rulers, ranging from constitutional monarchs to ceremonial ones. The Emir is an example of the constitutional monarch, while the districts heads play a supporting role and work with the Emir in the progression of the community. The power structure thus begins from the Emir to the District head, then to the ward heads (community heads). Low-cost community has a leader who reports directly to the District Head who also reports to the Emir of Gashua.

- *Community-based Organizations and Other Local Institutions*

Community groups are an important source of social capital in Nigeria, providing social, livelihood, financial and religious support. Most communities in the country typically have a variety of associations, including livelihood-based groups, saving groups, religious groups and other community-based organizations that play an important role in the management of the community. There is open membership opportunity in most of these groups, and there is the possibility of people belonging to more than one group. However, groups such as Elders Forums and Traditional Cultural Groups have restricted participation.

During the KII, the community leader stated there are several associations in the area such as Vegetable Marketer Associations and Farmers Association. Also, there are informal savings and credit groups within the community and its neighbouring wards.

- *Social Conflict*

During the data gathering survey, the survey enumerators were informed that there have been no major conflicts in the community within the last 5 years. The ward head resolves domestic and minor conflicts within his jurisdiction. However, whenever the disputes escalate, the case will be transferred to the District Head, then referred to the Emir, if necessary. The Emir has the authority to make final verdict for conflict resolution.

4.4.3.4 Livelihood Assets and Activities (Economics, Livelihoods, and Employment)

Box 4.2: Overview of the Project AoI – Livelihood Assets and Activities

- **The principal economic activity in the Project area is agriculture and trading.**
- **There is a central market close to the community**
- **Traders mostly sell goods such as farm produce, manufactured products and offering of services.**
- **Self-employment is the common livelihood activities in the community**

Yobe State economy is driven largely by agriculture with more than 80% of the citizens engaged in small scale subsistence farming. Food crops such as millet, sorghum, beans, and maize are grown by small-scale farmers to generate household income. Cash crops are commonly grown by farmers in the state such as groundnut, sesame seed, cotton and Benny seed. The State has some of the largest livestock markets in West Africa. It supplies meat, hides and skin to other parts of the country particularly to the south (Yobe State Government's Fiscal Strategy Paper, 2013).

The major occupations reported in the Low-cost Community are:

- Agriculture; and
- Trading.

- *Agriculture*

Farming is one of primary occupation of most residents in the community. The farming is done mostly by men along with their family members. Their farmlands are averagely large in size and farming equipment are crude with many farmers making use of cutlasses and hoes. The farmers practiced shifting cultivation and mixed cropping. Farming activities are mostly done during the rainy season. The farmers either sell their farm produce or consume them with their family members as opined by the community leader.

- *Trading*

There are no major trading activities within the community. Members of the community who are into trading activities do have their shop outlets in the main market, which is situated outside the community (Plate 4.24). Those who are into trading activities leave the community very early in the morning and return late in the evening. Some common products being sold by the members of the community are vegetables, fish, rice, beans, meats, peppers and other food supplements, clothes and electronics. Some of them are also into services like tailoring, barbing and computer services. From the survey data, there are 42.50 % of the respondents who are traders.

Plate 4.24: Trading activities observed close to low-cost community
Source: EnvAccord Field Survey 2019

- *Income Levels and Poverty*

During the household survey, the respondents gave an estimate of their monthly income, 25 % of the respondents stated that they earn less than 10,000 naira per month; 75 % earn between 10,000 and 50,000 naira. It is believed that poverty levels have increased over time with reference to factors such as reduction in number of people who come to community market to buy farm products, and shortage of formal employment opportunities. The cost of living in the community is low. However, food prices vary considerably according to seasons. During the rainy season, the cost of food is usually cheaper than the dry season.

4.4.3.5 Infrastructure and Services

Box 4.3: Overview of the Project AoI – Infrastructure and Services

- **The internal roads networks are smooth and well tarred.**
- **There are government hospital, private hospital, and pharmaceutical outlets.**
- **The community has existing market accessible for members and non-members.**

- *Access to Electricity*

The community is connected to national grid for electricity supply. The consistency of the electric supply is not very encouraging as reported by the respondents. During the baseline survey, 88 % of all the respondents affirmed that they have access to electricity while only 12 % did not have access to electricity. There is no communally owned generator, but a few residents have privately owned generators to provide back-up electricity for their business activities and houses. It was also observed that some residents installed solar panels in their home as alternative power supply. Some electrical infrastructure seen within the community are shown in Plate 4.25.

Plate 4.25: Electricity infrastructure observed in Low-cost Community
Source: EnvAccord Field Survey 2019

- *Access to Water*

Tap water and boreholes were found in the community. High proportion of people have access to water, however most residents in the community make use of public water supply while some buy water from water vendors, as shown in Plate 4.26. The survey data revealed that 79 % make use to public water supply and 21 % make use of private borehole.

Plate 4.26: Water supply facilities within the community
Source: EnvAccord Field Survey 2019

- *Telecommunication, Transportation and Road Infrastructure*

The community has access to all the available mobile telecommunications networks in Nigeria such as MTN, Airtel, Glo and 9mobile. This makes it quite easy to communicate socially and also carry out business transactions within any part of the community. The common forms of transportation in the community are cars, motorcycles, tricycles and bicycles (Plate 4.27). The road networks within the community are good and traffic within the community is usually light.

Plate 4.27: Road infrastructure within low-cost community
Source: EnvAccord Field Survey 2019

- *Access to Education*

Literacy level within the community is average when compared with other States in Nigeria. Large percentages (58 %) of the respondents do not have formal education, 10.50 % of the respondents have attained secondary school level of education and 31.50 % have attained tertiary education (Figure 4.22). Further analysis of education and gender revealed that female education is not a big priority among the respondents; 75.86% of those who have no education are female while 24.14 % are male. 66.67 % of respondents who have attained the secondary school level of education are male while 33.33 % were female. None of the respondents who had

attained tertiary education were female. However, there are educational facilities within the community such as primary schools, Islamic schools, and secondary schools as shown in Plate 4.28.

Plate 4.28: Educational facilities observed within low-cost community
Source: EnvAccord Field Survey 2019

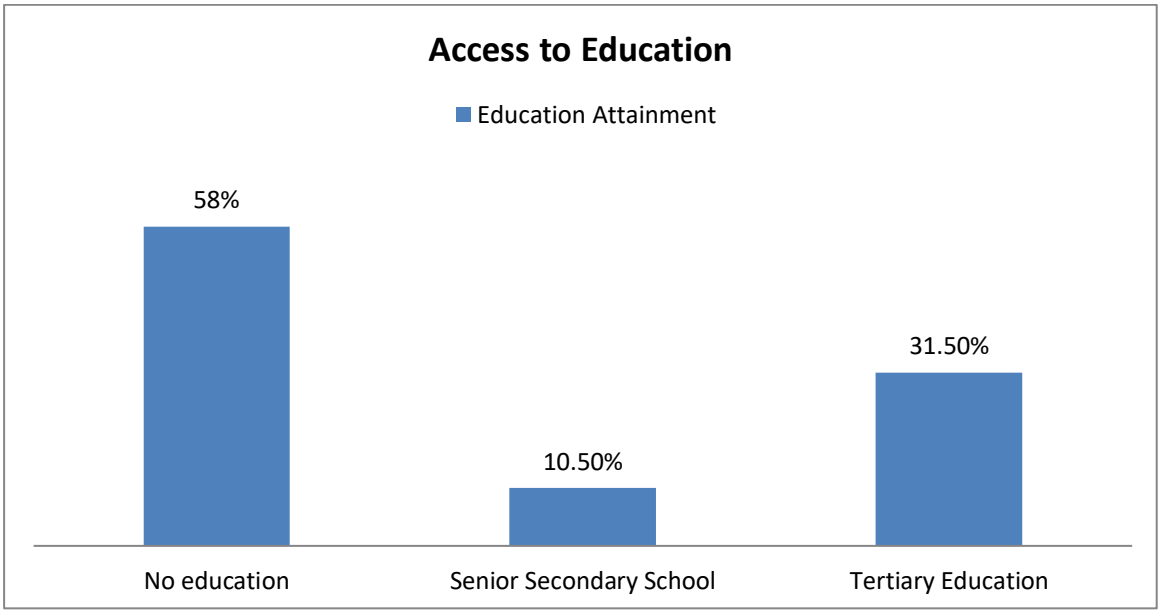

Figure 4.22: Education level among respondents in Low-cost community
Source: EnvAccord Field Survey 2019

- *Recreation*

The community is conservative. The survey enumerators observed that the community has designated playground for playing football.

- *Settlement patterns, Housing and Business Structures*

The houses in the community are arranged in nucleated and linear settlement patterns. The houses are built with fences to allow for privacy for their women and girls. Results from the household survey indicated that about 89.50 % of the houses are block of flats; 7 % are tenement houses and 3.50 % are bungalows. Some of the

houses and business structures observed in the community are shown in Plate 4.29 and 4.30. Most houses have water system (74 %), pit toilets (16 %) and those with pail system are 10 % of the houses. Materials used in construction of the houses in the community are cement blocks and corrugated iron sheets for roofing.

Plate 4.29: housing structures observed within Low-cost community
Source: EnvAccord Field Survey 2019

Plate 4.30: Housing and business structures within the community
Source: EnvAccord Field Survey 2019

The plastering materials of most houses in these settlements are cement. Overall, about 46.67 % of the houses in the community were plastered with cement. Cement block houses are generally solid and durable; majority of the houses in the community are built with cement blocks.

4.4.3.6 Land Acquisition

During the KII with the community leader, it was gathered that the land within the community originally belong to the Federal Government, but the land properties have been sold to private individuals after the government abandoned the housing intervention programme. Individuals, including indigenes and non-indigenes of the community can own a piece of land and put it to any use of their choice as long as they are able to fulfil the transaction obligations with the rightful owner.

The proposed Project site (12.5 ha) is within FUGA permanent site in Gashua. The University has a total land area covering 2,248 hectares in Bade LGA which was allocated by the Federal Government. The site for the proposed Project was authorized by the University management.

4.4.3.7 Project Affected Persons (PAPs)

Project affected persons are the people whose activities may be directly or indirectly affected by the proposed Project. Such people include farmers that may temporarily cultivate on the Project site or those who navigate the access road beside the Project site leading to their farmland. During the FGD sessions with men and women in the communities, it was discovered that no member of the community engage in farming activities on the proposed Project site as their means of livelihood. Also, there are no benefits (in terms of ecosystem services) that the local community derives from the site. In addition, none of the University staff uses the Project for livelihood activities such as farming or fishing.

4.4.3.8 Health Profile

Box 4.4: Highlight of the Community Health Profile

- **Household survey data indicate that majority of the residents have access to good medical health care.**
- **Most of the residents in the community make use of public health facilities and pharmaceutical outlets**
- **Income of the residents is a deciding factor on choice of healthcare facilities to use.**

During the socio-economic survey, it was gathered that the community have adequate access to a well-equipped healthcare facility. There are also pharmaceutical shop outlets in the community. These pharmacists' shops serve as a place for buying drugs to cure minor ailments such as headache, malaria, fever, among others. However, in the case of serious medical attention, the community residents go to the General Hospital in Gashua for medical attention (Plate 4.31).

The KII held with the healthcare practitioners in FUGA revealed that malaria, typhoid, ulcer and fever are the most reported health cases by the students. The doctor-patient ration is 1/50, meaning that there is only one (1) doctor for fifty (50) patients, rather than the acceptable standard of 1/10. The University health clinic facilities are not adequate as there are only four (4) beds in the hospital.

The baseline survey further revealed that 86 % of the respondents prefer to visit the General Hospital in Gashua while 14 % opt for pharmaceutical shop outlets to buy drugs. All respondents rated their health status as good during the survey. Figure 4.23 shows the preference of healthcare facilities by the respondents.

Plate 4.31: General Hospital, Gashua
Source: EnvAccord Field Survey 2019

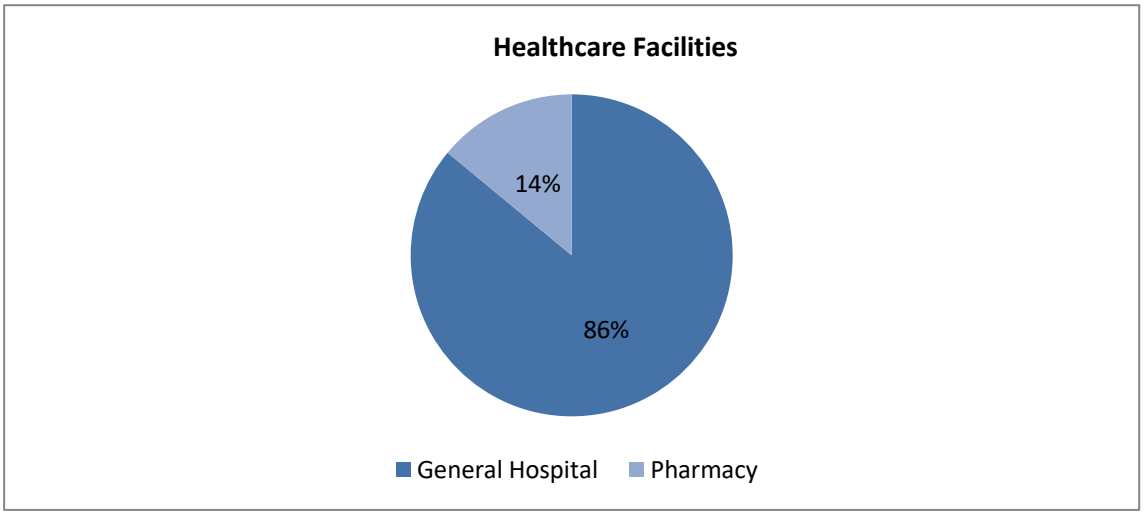

Figure 4.23: Preference of healthcare facilities of the respondents
Source: EnvAccord Field Survey 2019

4.4.3.9 Gender Assessment

Gender equality is crucial to poverty reduction and it is one of the Sustainable Development Goals (SDGs), which have been commonly accepted as a framework for measuring development progress.

- *Role of Women Within the Community*

Women are saddled with the responsibility of educating the children and also are the main house keepers within the community. Some of them also engage in petty trading to support the family.

- *Major Health, Social And Environmental Challenges Faced By Women*

There was no reported health, social and environmental challenges facing the women as at the time of the study.

- *Women Representation In Leadership*

The discussion held with women within the community revealed that many of them are not permitted to take up leadership roles. There was no measure in place to integrate women in the community leadership structure. The women also pointed out that there is one women association within the community named "Women Initiative" but the association is not well structured and also not functioning.

- *Autonomy for Decision Making*

Women within Low-Cost community do not have the autonomy for decision making except for their personal decision relating to themselves and the family. Even at the family level, consultation has to be made with their husbands. As evident from the discussion held with women in the community, they are not allowed to inherit property within the community. Neither are they permitted to own landed properties.

- *Major Grievances from The Women*

The main grievance reported by the women is the need for financial empowerment for their business. The dressing pattern of women in the community is mostly influenced by their culture. Women must not dress outside the cultural standard of "all covered cloth" and must use hijab within the community. Women's movement is restricted as they are not permitted to move around the community in the evening from 8:00p.m and above.

- *Gender Based Violence (GBV)*

According to Nigeria Demographic and Health Survey, the percentage of women who have experienced physical, sexual, or emotional violence committed by their current or most recent husband/partner in Yobe State was 28.0% which is low compared to some other states in Nigeria (Nigeria DHS, 2018).

During the data gathering, it was observed that the marginalization of women is prevalent within the community. This may be attributed to the patriarchal culture, customs, religious beliefs, and social norms that are characteristic of the region. This limits the participation of women in the various household, economic activities, and community life. It was also observed that most of the women stay indoors.

GBV cases are usually reported to the community heads or police depending on the severity. Civil Society Organizations and Non-Governmental Organizations collaborate with Yobe State Ministry of Women Affairs and Social Development to provide GBV services in Yobe State. The closest service provider identified within the area was located at the General Hospital Gashua.

4.4.3.10 Community Concerns and Perception

The survey data revealed that none of the respondents were aware of the proposed Project until the survey team explained the Project in detail to the community leader and members. During the discussion with the men, youths and women, the Project components and associated impacts were carefully explained. The reaction was positive as the participants believe that there is an impending economic advantage for them in terms of temporary jobs on site during construction.

4.5 Stakeholder Engagement

This section describes the activities that were carried out to engage and consult with key stakeholders. It describes the process by which stakeholders were identified; the means by which they were consulted; and the outcomes of the consultations to date. It describes the actions that the Project took to disclose pertinent information to stakeholders. A Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) for the proposed project are presented in Appendix 4.3. The SEP describes the plan that the Project will implement to ensure that stakeholders are continued to be engaged throughout the Project life cycle.

4.5.1 Defining Stakeholder Engagement

Stakeholder engagement is an ongoing process of sharing Project information, understanding stakeholder concerns, and building relationships based on collaboration. Stakeholder consultation is a key element of engagement and essential for effective Project delivery. Disclosure of information is equally as vital. If there are risks or adverse impacts from a Project, consultation must be inclusive and culturally appropriate and provide stakeholders with opportunities to express their views. In line with current guidance from the International Finance Corporation (IFC), consultation should ensure *"free, prior and informed consultation of the affected communities."* In other words, effective consultation requires the prior disclosure of relevant and adequate Project information to enable stakeholders to understand the risks, impacts, and opportunities. The Project's consultation program was intended to ensure that stakeholder concerns are considered, addressed and incorporated in the development process, especially during the ESIA.

4.5.2 Objectives

The stakeholder engagement process was designed to conform to the Nigerian EIA Act and international standards. For this Project, the key objectives for stakeholder engagement are:

- inform and educate stakeholders about the proposed Project;
- gather local knowledge to improve the understanding of the environmental and social context;
- better understand the locally-important issues;

- provide a means for stakeholders to have input into the Project planning process;
- take into account the views of stakeholders in the development of effective mitigation measures and management plans; and
- lay the foundation for future stakeholder engagement.

Table 4.21 is a summary of the process and stages of consultation for this ESIA study.

Table 4.21: Summary of the process and stages of consultation for the ESIA

Stages/Procedure	Goals	Objectives
Project Scoping and Design	• Registration with FMEnv. • Discu ss Project design • Ensure compliance with FMEnv regulations and guidelines	• Adequate consultation with authorities • Reduce conflict areas
Field Consultations	• Consult neighbouring communities on socio-economic aspects	• Ensure that the public, being the primary stakeholders, understand the Project and its benefits • Ensure the Project developer understands the concerns and issues raised by the local communities so that appropriate mitigation measures can be taken.
Environmental reviews, analysis, reporting and public presentation	• Present results of field study • Discuss the potential impact/mitigation measures with regulators • Present the report for public review	• Ensure stakeholders concerns are adequately addressed through the EIA report review process
Final Report	• Bridge the gaps observed at the in-house review	• Implement mechanism to ensure continuous consultation
Production of Final Report	• Finalize mitigation and disclose to stakeholders	• Mechanisms in place to ensure ongoing consultation and compliance with agreements
Implement EMP	• Disclose result of monitoring • Implement public complaints/ grievance process	• Implement audit of proponent's Project to assess social performance. • Ensure meaningful on-going consultation with stakeholders. • Evaluate lessons that could enhance proponent services to public
Final Evaluation	• Assess effectiveness of consultation process • Consult stakeholders for their assessment	• Lessons learnt might be transferred to other Projects.

The following sections describe the stakeholder engagement activities that have been carried out so far. The activities that are planned for later stages are also described.

4.5.3 Scoping Activities

At the scoping stage, Project stakeholders were identified in order to understand the individuals, groups, and organizations that may be affected by or may influence Project development positively or negatively. Initially, a broad list of potentially affected and interested parties (AIPs) was considered, such as:

- National, regional and local government;
- Local businesses/cooperatives and associations;
- Local communities and individuals; and
- Civil society organizations

4.5.3.1 Initial EIA Scoping Consultations

The initial consultations were carried out from August 9 to 17, 2019 with the following:

- Yobe State Ministry of Environment
- Yobe State Environmental Protection Agency
- Yobe State Ministry of Women Affairs and Social Development
- Yobe State Ministry of Youth and Sports
- FUGA Vice Chancellor
- FUGA Director of Works
- FUGA Student Union Government President
- Bade Local Government
- Ward Leader of Low-Cost community

The consultations served to provide stakeholders with information about the proposed Project and to gather information important to the EIA. The objective was to identify any key concerns or high-level issues that the stakeholders had at this early stage. Prior to the consultation, notification letters and Background Information Documents (BID) were sent to the stakeholders to provide high level information about the proposed Project. The notification letters and BID are provided in Appendix 4.4, as well as the records of consultation meetings. Table 4.22 below summarizes the findings of the scoping consultation, and Plates 4.32 to 4.37 shows some sample photographs of the stakeholder consultation exercise carried out during the ESIA.

Plate 4.32: Meeting with representatives of Yobe State Ministry of Environment
Source: EnvAccord Field Survey 2019

Plate 4.33: Meeting with Acting Vice Chancellor of FUGA
Source: EnvAccord Field Survey 2019

Plate 4.34: Meeting with representatives Bade LGA
Source: EnvAccord Field Survey 2019

Plate 4.35: Meeting with FUGA Department of Physical Planning
Source: EnvAccord Field Survey 2019

Plate 4.36: Meeting with the President of FUGA Student Union Government
Source: EnvAccord Field Survey 2019

Plate 4.37: Meeting with Ward Leader of Low-Cost community
Source: EnvAccord Field Survey 2019

Table 4.22: Initial Stakeholder Consultation Findings

Stakeholder	Priority Issues	Quotes/Comments during stakeholder consultation	How the comments have been addressed in the ESIA report
Yobe State Ministry of Environment	ESIA process and stakeholder consultation	– The ESIA should be carried out in line with best practice – All the relevant laws and regulations should be considered in the ESIA – The Project should make considerations for the local community by providing employment – A waste management plan should be developed and incorporated into the for the Project design	– The ESIA study has been carried out in line with the FMEnv ESIA process as well as the relevant requirements of the World Bank Safeguards Policies, especially OP 4.01 (Environmental Assessment) triggered by the proposed Project. – Relevant laws, regulations and international guidelines are considered and documented in the ESIA report (refer to chapter 1) – Labour would be drawn from local communities during the Project development and operation. – Different waste streams associated with the Project have been identified and appropriate waste management practices that comply with the relevant local and international standards and guidelines shall be adopted.
FUGA Vice Chancellor	Stakeholder consultation, Sustainability of the Project,	– The Project is a welcome development that will enhance the quality of education, research, and living conditions within the University. – The University is ready to provide the necessary support to ensure the sustainability of the Project – Female students of the University would be allowed to benefit from the Project	– Measures to enhance the positive impacts of the Project are documented in the ESIA report (refer to chapter 6).
FUGA Director of works	Stakeholder consultation	– The land selected for the Project site has been approved by the University.	– Roles and responsibilities of the Department of Works and Physical Planning

Stakeholder	Priority Issues	Quotes/Comments during stakeholder consultation	How the comments have been addressed in the ESIA report
		– The are no security issues within the University that could threaten the Project – There are no Land issues associated with the Proposed site – The local community do not farm on the proposed site or derive any benefits from the land. – The Department is ready to provide support to ensure the successful completion of the Project	with regard to environmental, technical and social sustainability of the Project are documented in the ESIA report.
President of FUGA Students Union Government	ESIA process and stakeholder consultation	– The power situation in FUGA is poor but the School management is working on it – Security within the school is satisfactory but can be improved with the installation of streetlights – The Project is a welcome development that will benefit the students. – The student union is willing to participate wherever necessary	– Measures to enhance the positive impacts of the Project are documented in the ESIA report (refer to chapter 6).
Bade Local Government	ESIA process and stakeholder consultation	– The Project is a welcome development – Indigenes from the host community should be employed to work at the Project site	– A percentage of the workforce for the Project will be drawn from the host community
Ward leader of Low-Cost community	ESIA process and stakeholder consultation	– The Project is a welcome development. – They would appreciate it if youths from the communities can be given employment – Local from the community do not farm on the site	– A percentage of the workforce for the Project will be drawn from the host community

Engagement activities in the EIA study stage included consultations designed to introduce the Project to stakeholders that could potentially be affected by the Project. This was intended to refine the EIA scope by generating additional feedback on the EIA approach, key issues and key stakeholders to be consulted, as well as to inform the development of mitigation for the Project.

Consultation with the identified stakeholders (including regulators and potentially affected communities) showed general acceptance of the proposed Project. Regulators such as the Yobe State Ministry of Environment made suggestions relating to the proposed Project which were duly noted to be implemented accordingly. Community members also showed enthusiasm about the Project and shared their expectations from the Project including provision of jobs for the youth, skill acquisition opportunities for women and children, etc. These expectations were also noted for Corporate Social Responsibility (CSR) considerations.

CHAPTER FIVE:

ASSOCIATED AND POTENTIAL IMPACTS

CHAPTER FIVE

ASSOCIATED AND POTENTIAL IMPACTS

5.1 Introduction

This chapter presents the potential environmental and social (E&S) impacts and risks associated with the proposed 2.5 MW solar-hybrid power plant and associated infrastructure in the Federal University Gashua (FUGA), Yobe State, under the Federal Government's Energizing Education Programme (EEP), a component of the Nigeria Electrification Project (NEP). It also includes the methodology employed to assess the significance of the E&S impacts and risks.

5.2 Impact Assessment Overview

The potential for an E&S impact exists where an environmental aspect has been identified i.e. where a project activity has been determined to have the potential to interact with the biophysical and socio-economic environment. The significance of each impact is then determined. Figure 5.1 illustrates the general overview of the impact assessment process employed for this ESIA.

The primary objectives of the impact assessment process are to:

- Establish the significance of identified potential impacts that may occur as a result of the proposed Project activities;
- Differentiate between those impacts that are insignificant and those that are significant (; and
- Apply mitigation hierarchy measures for the identified significant impacts and assess residual impacts, including periodic monitoring of the effectiveness of the proffered mitigation measures through the entire life cycle of the Project.

The assessment of impact significance is both in qualitative and quantitative terms. Qualitatively, the impact significance is ranked on four (4) widely accepted levels: **Major**, **Moderate**, **Minor** and **Negligible.**

The impact assessment covers the entire life cycle of the Project. i.e.: pre-construction; construction; commissioning; operation; and decommissioning. However, environmental and social issues including mitigation and management plans related to decommissioning activities are discussed in Chapter 8.

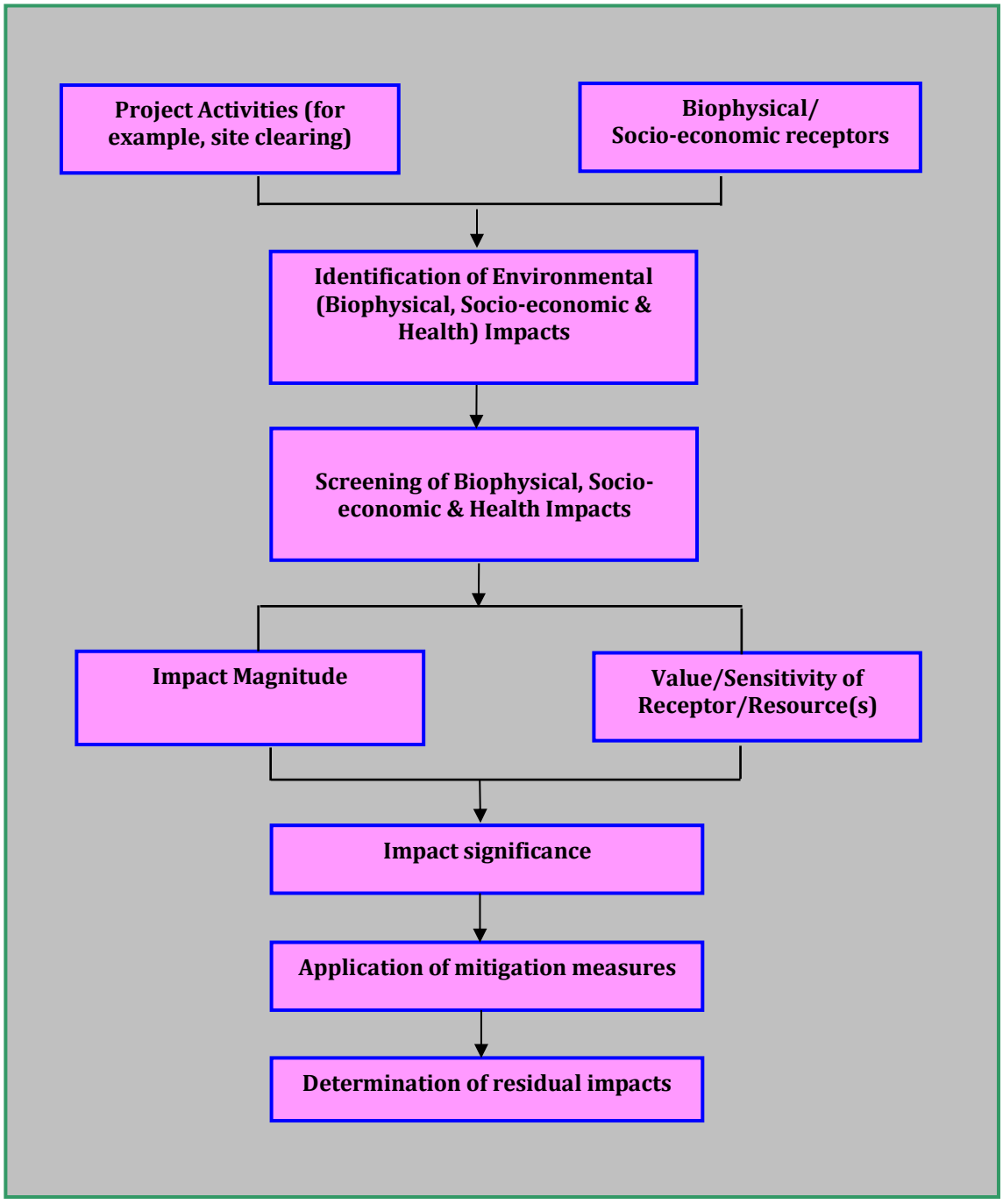

Figure 5.1: Overview of the Impact Assessment Process

5.3 Identification of Environmental and Socio-economic Aspects and Impacts

5.3.1 Defining Environmental and Socio-economic Aspects and Impacts

The International Organization for Standardization's Environmental Management Systems (EMS), ISO 14001, defines an environmental aspect as: *"An element of an organization's activities, products or services that can interact with the environment."* while an environmental impact is defined as: *"Any change to the environment,*

whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services."

To identify environmental and social aspects of the Project, the proposed Project activities were considered in terms of their direct or indirect potential to:

- Interact with the existing natural environment including its physical and biological elements;
- Interact with the existing socio-economic environment; and
- Breach relevant policy, legal and administrative frameworks including national legislation, relevant international legislation/conventions, standards and guidelines, and corporate environmental policy and management systems.

Activities assessed covered planned and non-planned events.

Table 5.1 illustrates the links between project activity, environmental aspect and potential impact.

Table 5.1: Example of a Link between Activities, Environmental Aspects and Impacts

Project Activity	Environmental Aspect	Potential Impact
Site clearing and grading	Removal of vegetation	Loss of biodiversity
Installation of PV panels	Soil excavation	Soil erosion and degradation
	Noise generation	Disturbance to surrounding environment and/or sensitive receptors

5.3.3 Potential Impact Characteristics

The following characteristics were also used to define potential impacts that may be associated with the proposed Project:

i. *Negative:* An impact that is considered to represent an adverse change from the baseline or to introduce a new undesirable factor.

ii. *Positive:* An impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.

iii. *Direct*: Impacts that result from the direct interaction between a planned project activity and the receiving bio-physical and socio-cultural environment.

iv. *Indirect:* Impacts that result from other activities that are encouraged to happen as a consequence of the project.

v. *Temporary:* Temporary impacts are predicted to be of short duration, reversible and intermittent/occasional in nature

vi. *Short-term:* Short term impacts are predicted to last only for a limited period but will cease on completion of the activity, or as a result of mitigation measures and natural recovery

vii. *Long-term:* Impacts that will continue for the life of the project, but cease when the project stops operating.

viii. *Permanent:* Potential impacts that may occur during the development of the project and cause a permanent change in the affected receptor or resource that endures substantially beyond the project lifetime

ix. *On-site:* Impact that is limited to the project site.

x. *Local:* Impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community.

xi. *Regional:* Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries.

xii. *National:* Impacts that affect nationally important environmental resources; affect an area that is nationally protected; or have macro-economic consequences

xiii. *Reversible:* An impact that the environment can return to its natural state

xiv. *Irreversible:* An impact that the environment cannot return to its original state, e.g. the extinction of an animal or plant species

xv. *Cumulative/Synergistic*: Potential impacts that may result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. This also includes synergy with other projects/infrastructure in the project area

xvi. *Residual:* Both environmental and social impacts that will remain after the application of mitigation measures to project impacts during each of the project phases.

5.4 Screening and Scoping for Potential Impacts

A modified version of the Leopold Interaction-matrix technique was employed to screen and scope for the potential impacts of the proposed Project on the environment. The basis for the screening was derived from the following:

- Knowledge of the Project activities as summarized in Table 5.2.
- Detailed information on the environmental and socio-economic setting of the Project's area of influence as documented in Chapter 4. The potential environmental and social receptors/resources that could be affected by the proposed Project are summarized in Table 5.3.
- Consultation with relevant stakeholders.
- Review of other ESIA reports on similar projects/environments.
- Series of experts group discussions, meetings and experience on similar projects.

Table 5.2: Summary of the proposed Project Activities

S/N	Project Phase	Associated Activities
1.	Pre-Construction	Site selection
		Site clearing and preparation
		Mobilization of construction equipment and materials to site
2.	Construction/ Installation	Civil work activities including excavation, trenching, cable laying, foundation, construction of building (e.g. training centre)
		Installation of power plant facilities such as PV panels, mounting structures, inverters, power storage batteries; upgrade of existing distribution infrastructure; installation of streetlights
		Waste generation and disposal
3.	Commissioning	Testing of power plant and associated infrastructure
4.	Operation	Power generation (through PV panels) and distribution; provision of training on renewable energy
		Routine maintenance including occasional cleaning of PV panels; waste generation

Note: Activities related to decommissioning are discussed in Chapter 8

Table 5.3: Resource/Receptors and Impacts Indicators Considered

Environmental Receptor/Medium	Comment	Impact Indicators
Physical		
Air	Ambient air quality within the Project's area of influence.	Increase in concentration of gaseous and particulate pollutants.
Noise	Ambient noise level within the Project's area of influence.	Increase in ambient noise level; day and night-time disturbance; communication impairment, etc.
Soil	Soil environment the Project's area of influence.	Changes in physical, chemical and biological properties of the soil; loss of soil ecology and fertility; soil erosion, etc.
Groundwater/ aquifers	Underground water resources in the Project's area of influence.	Decrease in underground water/aquifer reservoir level; groundwater contamination.
Surface water	Surface water body in the Project's area of influence	Surface water contamination.
Landscape/	The geomorphological land forms	Alteration in drainage pattern;

Environmental Receptor/Medium	Comment	Impact Indicators
topography	and terrain of the Project site and its surrounding environment.	changes in landscape.
Biological		
Terrestrial flora and habitats	Plant species (vegetation) in the Project's area of influence.	Loss of terrestrial flora; introduction of new species.
Terrestrial fauna	Terrestrial fauna in the Project's area of influence.	Loss of terrestrial fauna; involuntary migration.
Socio-economic Environment		
Land use	Existing land use within the Project site and its surrounding environment.	Loss of existing land use.
Visual prominence	The aesthetic quality of the proposed Project on the surrounding visual catchment.	The compatibility of the Project with the character of the locality; visual nuisance through reflection of panels.
Demography	Demography of community in the Project's area of influence.	Changes in demography, gender ratio, age distribution, socio-economic structure, etc. of the local community
Utilities	The existing utilities (e.g. power supply, water, sewer services, etc.) in the Project's area of influence.	Changes in existing utilities; potential damage to public utilities.
Infrastructure	The existing infrastructure such as road, waste handling facilities, etc. within the Project's area of influence.	Potential damage to road infrastructure; road traffic and accidents; increased pressure on waste management facilities.
Employment/income	The employment situation in the Project's area of influence.	Opportunities for local employment; changes in income level.
Gender	Gender and disproportionate gender impacts	Potential for gender-based violence (GBV); marginalization of women; gender pay gaps; discrimination, etc.
Other (Health and Safety)		
Construction workers	Health and safety of construction workers.	Accident, injury, fatality, exposure to nuisance (dust, noise), fire, etc.
Workplace health and safety	Health and safety of employees involved in the operational phase of the Project operation.	Accident, injury, fire, explosion, etc.
General public	Health and safety of the general public	Accident, fire, explosion, etc.

Identified Project activities, biophysical and socio-economic receptors were integrated into a matrix. The Project activities are on the y-axis while the biophysical and socio-economic receptors are on the x-axis. The matrix was completed for each of the Project elements. The Leopold's Interaction matrix was subsequently assessed to identify every possible case of activity-receptor interaction. Where it was considered that an activity-receptor interaction was possible, the cell was marked denoting an identified environmental aspect (denoted as "X" in Table 5.4).

Table 5.4: Activity-Receptor Interaction for Impact Screening

Summary of Project Activities at various Phases	Receptors																
	Physical						Biological		Socio-economic						Others (Health and Safety)		
	Air Quality	Ambient Noise	Soil	Groundwater and Aquifers	Surface Water	Landscape/ Topography	Terrestrial Flora	Terrestrial Fauna	Land Use	Population	Utilities	Infrastructure	Employment/ Income	Gender	Construction workers	Workplace health and safety	General Public
Pre-construction Phase																	
Site selection									X								
Site clearing and preparation	X	X	X			X	X	X					X		X		
Mobilization of construction equipment and materials to site	X	X										X	X				X
Construction Phase																	
Civil work activities including excavation, trenching, cable laying, foundation, construction of building (e.g. training centre)	X	X	X	X	X					X			X	X	X		X
Installation of power plant facilities, upgrade of existing distribution infrastructure, installation of streetlights	X	X	X											X	X		
Waste generation and disposal			X	X								X	X		X		X
Commissioning Phase																	
Testing of power plant and associated infrastructure		X								X		X			X		X
Operational Phase																	
Power generation and distribution and provision of training on renewable energy		X											X	X		X	X
Routine maintenance; waste generation and disposal	X		X	X		X					X	X	X	X		X	X

Note: Decommissioning is separately covered in Chapter 8

5.5 Determination of Impact Significance

Once all environmental aspects (and interactions between a receptor/resource and Project activity) were identified, the levels of impacts that may result from the proposed Project activities were assessed. Three (3) stages were utilized to establish significance of impacts as follows:

- **Impact Magnitude** which is a function of the combination of the following impact characteristics: extent, duration, scale and frequency;
- **Value/Sensitivity/Fragility and importance of the relevant Receptor**;
- **Identification of the impact significance,** which is the "product" of a combination of the above two (2) key variables.

The magnitude of an effect is often quantifiable such as the extent of land take or predicted change in noise levels while the sensitivity, importance or value of the affected resource or receptor is derived from:

- Legislative controls;
- Designated status within the land use planning system;
- Number of affected individual receptors;
- An empirical assessment based on characteristics such as rarity or condition;
- Ability of the resource or receptor to absorb change; and
- Public perception about the criticality or sensitivity of the receptors.

The determination of significance also includes consideration of performance against environmental quality standards or other relevant pollution control thresholds, and compatibility with environmental policies.

Further details on the criteria used for determining the impacts significance are provided in the sub-sections below:

5.5.1 Impact Magnitude

The magnitude designations employed for potential negative impacts are: **Negligible**; **Low**; **Medium**; and **High**. In the case of a positive impact, it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact, thus no magnitude designation is assigned.

The magnitude of an impact takes into account the various dimensions of a particular impact in order to make a determination as to where the impact falls on

the spectrum from Negligible to High. These criteria are discussed further as follows:

5.5.1.1 Determining Magnitude for Biophysical Impacts

For biophysical impacts, the quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used are summarized in the following paragraphs:

A **High Magnitude Impact** is considered to affect an entire area, system (physical), or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations when compared with national or international limits s specific to the receptors) or a decline in species abundance beyond which natural process would not return that population or species, to its former level within several generations.

A **Medium Magnitude Impact** affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (when compared with national or international limits and standards specific to the receptors) and may bring about a change in species abundance, but does not threaten the integrity of that population or any population dependent on it.

A **Low Magnitude Impact** affects a specific area, system, aspect (physical), group of localized individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (when compared with national or international limits and standards specific to the receptors) over a short time period, but does not affect other trophic levels or the population itself, and localized area.

A Negligible Magnitude Impact: Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact, and are characterized as having a very low or negligible magnitude.

5.5.1.2 Determining Magnitude for Socio-economic Impacts

For socio-economic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact. Table 5.5 below presents the impact magnitude criteria for socio-economic and health impacts.

Table 5.5: Impact Magnitude Criteria for Socio-economic Impacts

Category	Ranking	Definition
High	4	▪ Major impacts on human health (e.g. serious injury). ▪ Significant impact on the livelihoods of individuals (i.e. access to income source restricted over lengthy period of time). ▪ Serious impact on access to community facilities and utilities ▪ Breach of economy social policy and/or regulation.
Medium	3	▪ Modest impact on human health and well-being. ▪ Moderate impact on individual livelihoods (e.g. restricted access to income source). ▪ Medium impact on access to community facilities and utilities (e.g. access to utilities restricted for long periods (weeks) of time). ▪ Potential breach of company social policy and/or legislation.
Low	2	▪ Limited impact on human health and well-being (e.g. occasional dust, odour, traffic noise). ▪ Some impact on the livelihoods of individuals (e.g. isolated incidents related to ethnic tensions and some restrictions on access to income source). ▪ Some impact on access to community facilities and utilities (e.g. access to cultural centers restricted to a limited extent, i.e. (days).
Negligible	1	▪ Possible nuisance to human health and well-being (e.g. occasional unpleasant odours) ▪ Inconvenience experienced in accessing community facilities and utilities (e.g. electricity supply disruption for short (hours) period of time). ▪ No impact on livelihood, community facilities and human health.
Positive	+	▪ Beneficial improvement to human health. ▪ Benefits to individual livelihoods (e.g. additional employment opportunities). ▪ Improvements to community facilities/utilities. ▪ Increased economy (e.g. local procurement, sourcing of supplies).

5.5.2 Determining Receptor Sensitivity

In addition to characterizing the magnitude of impact, the other principal variable necessary to assign significance for a given impact is the value, and sensitivity/fragility of the receptor. This refers to economic, social, and/or environmental/ecological importance of the receptor, including reliance on the receptor by people for sustenance, livelihood, or economic activity, and to the importance of direct impacts to persons associated with the resource.

Impacts that directly affect people or vital natural resources are deemed to be more important than impacts that indirectly affect people or vital resources. The sensitivity of the receptor criterion also refers to potential impacts to Environmentally Sensitive Areas (ESAs) and impacts to species, including loss of endangered species, effects of introduction of invasive species, and similar environmental/ecological impacts as well as the public perception about the criticality or sensitivity of the receptors.

There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human:

- Where the receptor is physical (for example, soil environment) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered.
- Where the receptor is biological (for example, the aquatic environment), its importance (for example, its local, regional, national or international importance) and its sensitivity to the specific type of impact are considered.
- Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered.

The receptors-sensitivity designations employed in this impact assessment process are **Low**, **Medium** and **High** which are universally acceptable.

The sensitivity/fragility/value/importance criteria for biophysical and socio-economic receptors are defined in Table 5.6.

Table 5.6: Bio-physical and Socio-economic Receptor-Sensitivity/ Fragility/ Value Criteria

Category	Ranking	Definition
Physical (for example, air quality)		
High	3	All ambient conditions/concentrations exceed guideline limits and are indicative of the resource being impacted or polluted. There is no (or very little) assimilation capacity for increased concentrations/ change in conditions.
Medium	2	Some ambient conditions/concentrations exceed guideline limits while others fall within the limits. There is some small assimilation capacity for increased concentrations/ change in conditions. Resource use does affect other users
Low	1	All ambient conditions/concentrations are significantly lower than guideline limits and there is capacity for assimilation for additional concentrations/ change in conditions. Resource use does not significantly affect other users.
Biological (for example, terrestrial ecology)		
High	3	Specifically protected under Nigerian legislation and/or international conventions such as International Union for Conservation of Nature (IUCN); considered to be of critical importance to the local use; and totally dependent on for livelihood or means of survival.
Medium	2	Not protected or listed but may be a species common globally but rare in Nigeria with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline; considered to be of moderate importance to the local use; and partially dependent on for livelihood or means of survival.
Low	1	Not protected or listed as common / abundant; or not critical to other ecosystem functions; considered to be of minor importance to the local use; and local communities do not depend on the resources for livelihood.

Category	Ranking	Definition
Physical (for example, air quality)		
Socio-economic and Health		
High	3	Those affected will not be able to adapt to changes and continue to maintain pre-impact status.
Medium	2	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.
Low	1	Those affected are able to adapt with relative ease and maintain pre-impact status.

5.5.3 Significance

The significance of the impact is determined by calculating the "product" of impact magnitude and severity/fragility/value/importance of the relevant receptor(s). Figure 5.2 illustrates the process for combining the impact magnitude with the receptor sensitivity.

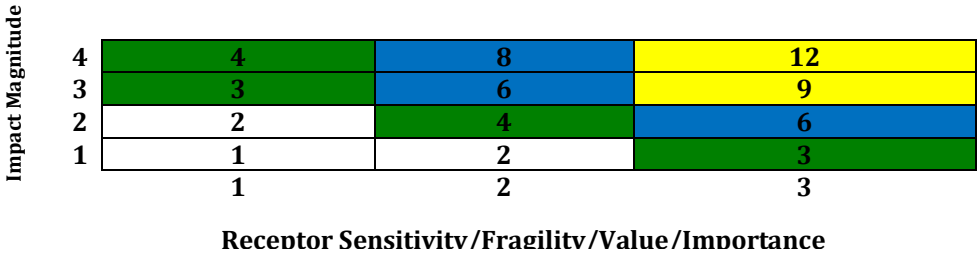

Figure 5.2: Impact Magnitude-Receptor Sensitivity Product Results

Based on its impact magnitude-receptor sensitivity/fragility/value score, each impact was again ranked into four (4) categories of significance as illustrated in Table 5.7 below.

Table 5.7: Environmental Impact Significance Rankings

Ranking (Impact Magnitude x Sensitivity of Receptor)	Significance
9 - 12	**Major**
6 - 8	**Moderate**
3 - 5	**Minor**
1 - 2	**Negligible**

Negligible Significant impacts are where a resource or receptor will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations.

An impact of minor significance is one where an effect will be experienced, but the impact severity is sufficiently low (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.

An impact of moderate significance is one within accepted limits and standards. Moderate impacts may cover a broad range, from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP).

An impact of major significant is one where an accepted limit or standards may be exceeded, or high magnitude impact occurs to highly valued/sensitive receptors/resources.

5.5.3.1 Determining the Significance of Potentials Impacts of the Project

To assist in calculating the overall significance of each of the identified potential impacts, expert discussions were constituted. They employed extensive use of screening matrices and predefined criteria for impact magnitude and sensitivity/fragility/value/importance of resources/receptors. The significance was then developed as seen in Table 5.8.

Table 5.8: Leopold's Activity-Receptor Interaction Matrix (Impact Significance Matrix)

Summary of Project Activities at various Phases	Receptors																
	Physical						Biological		Socio-economic						Others (Health and Safety)		
	Air Quality	Ambient Noise	Soil	Groundwater and Aquifers	Surface Water	Landscape/ Topography	Terrestrial Flora	Terrestrial Fauna	Land Use	Population	Utilities	Infrastructure	Employment/ Income	Gender issues	Construction workers	Workplace health and safety	General Public
Pre-construction Phase																	
Site selection									2(1)								
Site clearing and preparation	2(2)	2(2)	2(2)			2(1)	3(1)	3(1)					+		2(2)		
Mobilization of construction equipment and materials to site	2(2)	2(2)										2(2)	+				2(2)
Construction Phase																	
Civil work activities including excavation, trenching, cable laying, foundation, construction of building (e.g. training centre)	2(2)	2(2)	3(1)	2(2)	2(2)					3(2)			++	2(3)	2(3)		2(3)
Installation of power plant facilities, power storage batteries, upgrade of existing distribution infrastructure, installation of streetlights	2(2)	2(2)	3(1)											2(3)	2(3)		
Waste generation and disposal			2(2)	2(2)								2(1)	+		2(2)		2(2)
Commissioning Phase																	
Testing of power plant and associated infrastructure		2(1)								1(1)		1(1)			2(3)		2(2)
Operational Phase																	
Power generation and distribution and provision of training on renewable energy		2(1)											++	2(3)		2(3)	2(3)
Routine maintenance; waste generation and disposal	2(2)		2(2)	2(2)		2(2)					2(1)	1(2)	+	2(1)		2(2)	2(2)

Note: Decommissioning is separately covered in Chapter 8

The value assigned to each cell in the matrix is in the form "x (y)": where "x" denotes the impact magnitude and "y" the sensitivity/fragility/importance of receptor

Impact magnitude ranking: 1 = Negligible; 2 = Low; 3 = Medium; 4 = High.

Impact sensitivity raking: 1 = Low; 2 = Medium; 3 = High.

5.6 Impacts Discussion

5.6.1 Potential Positive Impacts

The proposed Project seeks to provide independent and reliable power supply to Federal University Gashua (FUGA) through a renewable (solar) energy source and thus, enhance learning and institutional operations. It also forms part of the measures in ensuring that Nigeria achieves its carbon emission reduction targets (20 % - 30 % carbon emission reduction by the year 2030) as contained in Nigeria's Nationally Determined Contributions (NDC) on climate change. In line with the Federal Government's plans for Power Sector reform, the Project will assist to promote stronger relationship and collaboration between the Federal Government of Nigeria (FGN), Nigerian Universities, REA, and other relevant regulatory bodies.

Another component of the proposed Project is the construction of a world-class renewable energy workshop/training centre within the Project site. The facility will enhance learning in renewable energy in the University thus leading to certification. Also, the installation of streetlights as part of the proposed Project will boost safety and security within the University.

In addition, the Project will improve social economic activities within the University and help to enhance internally generated revenue. Furthermore, there are employment opportunities associated with the proposed Project for skilled, semi-skilled and unskilled workforce. The employment opportunities will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects. For example, during the construction phase, about 300 workers would be engaged. The larger portion (60 %) of the workforce (especially semi-skilled and unskilled craftsmen) would be drawn from the Project area.

Other potential benefits of the proposed Project include increase in local and regional economy through award of contracts and purchase of supplies for Project development as well as waste management.

5.6.2 Potential Negative Impacts

The potential negative impacts associated with the proposed Project are discussed under the following headings:

- Potential impact of the proposed 2.5 MW solar-hybrid power plant and associated infrastructure
- Potential cumulative impacts

It is important to note that the significance of potential environmental and social impacts discussed in this section is without mitigation measures except those

already built into the Project design. Implementation of additional mitigation measures (presented in Chapter 6 of this report) are expected to further reduce the impact rating as low as reasonably practicable.

5.6.2.1 Potential Impacts of the proposed Project

5.5.2.1.1 Pre-Construction Phase Activities

The pre-construction phase of the proposed Project includes the following activities:

- Site selection
- Site clearing and preparation
- Mobilization of equipment and materials to site

❖ ***Site Selection***

Approximately 12.5 ha of land within the FUGA campus has been allocated by the University management for the proposed 2.5 MW solar-hybrid power plant and the training center. No additional land either from private or public property outside the University will be expropriated for the Project. The Project site is an undeveloped area within the University and it is characterized by vegetation which includes grasses and a few trees. There is no community presence within the Project site, and as at the time of site visit there was no farming or livelihood activity on site. The Project site is also not known to fall within any designated grazing reserves or grazing routes. Thus, the impact significance of the proposed Project on the existing land use within the Project site is **negligible**. However, in a situation where the Project site is temporarily put into use for farming activities by the University staff prior to commencement of the Project, such persons will be allowed to harvest their crops before construction activities begin.

❖ ***Site Clearing and Preparation***

The Project site will be cleared of vegetation prior to construction activities. The site clearing activities would likely involve the use of earth moving equipment such as tractor. The potential impacts associated with the site clearing activities are discussed as follows:

Potential Impact on Terrestrial Flora and Fauna

Site clearing activities associated with the proposed Project will lead to loss of terrestrial flora on the Project site. The potential impact on the terrestrial flora is considered to be negative, direct, site specific and largely irreversible. The impact magnitude is considered to be medium considering that not all the land area (12.5 ha) will be cleared for the Project. However, the sensitivity/importance of the receptor is regarded as low since the Project site is a modified habitat, and none of the plant species identified within the Project site during the baseline survey was found to be endangered or threatened based on the International Union for

Conservation of Nature (IUCN)-2018 classification scheme. Also, the local community has no direct or indirect ecosystem services that they benefit from the site. Furthermore, there are no protected/conservation areas within the site. The significance of the potential impact of site clearing on the existing terrestrial flora species of the Project site is therefore regarded as **minor.**

While the plant species are unable to avoid the point of impact, most fauna species may be able to migrate away from unfavourable areas. Animals are generally mobile and, in most cases, can move away from a potential threat. The tolerance levels of some animal species are of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact.

With regard to the clearing of the Project site for construction purpose, the potential impact on terrestrial fauna species may include loss of individual or localized population of fauna species or disturbance to avifauna species. This is unlikely to lead to a change in conservation status of the species since none of the fauna species (including avi-fauna) encountered or reported in the Project site belongs to the IUCN classification of threatened animal species which include those classified as critically endangered, endangered or vulnerable. The major fauna species observed on the site were mostly the birds nesting on some of the trees within the site. However, the site is not a designated bird nesting area. The sensitivity of the fauna species recorded on the Project site is thus regarded as low. The impact magnitude is considered to be medium given that the site clearing activities would not cover all of the approximately 12.5 ha of land allocated for the Project. The impact significance is thus considered **minor.**

<u>Potential Impact on Soil</u>

The proposed site clearing and preparation activities could potentially impact the soil environment of the Project site. The potential effects on soil include degradation due to site preparation e.g. compaction of soil as a result of the movement of earth moving equipment. Soil degradation is the removal, alteration, or damage to soil and associated soil forming processes, usually related to human activities. The stripping of vegetation or disturbance to the natural ground level over disturbance areas will negatively affect soil formation, moisture levels, soil density, soil chemistry, and biological activity. Uncontrolled site clearance of vegetation could lead to direct surface soil exposure and hence erosion of soil which could be significant.

The impact magnitude is considered as medium as the extent of soil erosion could be high, especially if the site clearing activities are carried out in the wet season. However, based on the results of laboratory analysis conducted on soil samples from the Project area, the Project site is not considered to be significantly prone to land-based erosion. The soil texture analysis of soil samples collected at the Project site

and its surrounding environment showed high percentage of clay followed by sand and then silt. For example, at the Project site, sand particles ranged from 14.68 % to 23.17 %, silt ranged from 13.15 % to 14.81 % while the percentage of clay particles ranged from 62.20 % to 72.15% in the top soil, while in the sub soil, sand particles ranged from 16.15 % to 23.91 %, silt ranged from 12.02 % to 15.48 % while clay ranged from 64.04 to 68.53 %. This revealed that the near-surface ground of the area was formed of compacted fine-grained sediments, such as clays and silts and a conglomerate with lateritic matrix. In addition, the no heavy metal pollution was recorded in the soil samples from the Project site and it surrounding environment. Copper (Cu), Lead (Pb), Cadmium (Cd), Chromium (Cr) and Nickel (Ni) were below the detection limits of 0.005 mg/kg, 0.04 mg/kg, 0.01 mg/kg, 0.04 mg/kg and 0.05mg/kg respectively while the concentrations of Zinc (Zn) recorded in the soil samples from the Project site, the 1km area of influence and the control/buffer points had a range of 0.143 mg/kg – 2.370 mg/kg, 0.102 mg/kg – 0.396 mg/kg, 0.089 mg/kg – 0.101 mg/kg respectively in the top soil and a range of 0.012 mg/kg – 2.538 mg/kg, 0.073 mg/kg – 0.144 mg/kg, 0.073 mg/kg – 0.086 mg/kg respectively was recorded in the sub soil. The measured Zn values in all the soil samples from the Project area were below the recommended limit of 50 mg/kg. Thus, the impact significance of site clearing on soil environment of the study area is considered **minor**.

Potential Impact on Air Quality and Ambient Noise

The pollutants which could impair air quality during site clearing activities are particulate matter in form of dust, and NOx, CO, Total Suspended Particulates (TSP), SOx from combustion engines of the earth moving equipment that will be used for clearing. Intermittent noise emissions could also occur from the operation of the machinery. The impact magnitude is considered to be low since the activities will be short-termed, intermittent, localized and reversible. The site clearing activities will take less than 1 week. The sensitivity of the air shed of the Project area is also regarded as low based on the results of air quality measurements conducted in the area during the field data gathering. No elevated concentrations of air pollutant criteria beyond the FMEnv, WHO, and the World Bank Ambient Air Emission Limits were recorded in the Project site and its surrounding environment. For example, within the Project site, the measured TSP values ranged from 0.064 mg/m^3 to 0.082 mg/m^3 while the TSP values recorded at locations established outside the Project site but within its 1km radius ranged from 0.062 mg/m^3 to 0.063 mg/m^3. At the control/buffer points, the measured TSP values ranged from 0.059 mg/m^3 to 0.099 mg/m^3. The TSP values recorded in all the sampling locations were below the FMEnv 1hr averaging time limit of 0.25 mg/m^3 for TSP in ambient air. The impact significance of site clearing on the ambient air environment of the Project site is considered to be **minor**.

Potential Impact on Workers Safety

Site clearing and preparation are potentially hazardous activities involving manual labour and the use of mechanized equipment. Accidents may occur when those involved are unskilled. Such accidents may result in loss of man-hours which may ultimately affect the scheduled date of completion of the site clearing activities. The site clearing activities should take less than one week, and the number of workers required would be less than fifty (50). Thus, the likelihood of the impact is considered low, and the significance of the impact is rated **minor**.

Moreover, there are potential health risks associated with the influx of workers who may be infected with various diseases (e.g. COVID-19) and spread it to other workers on site. An outbreak of infectious diseases during site clearing could significantly impact the project timelines and activities by causing disruptions and delays. For example, confirmed cases of the recent COVID-19 expand exponentially if health and safety controls are left unheeded. However, based on the low number of worker and the duration of the site clearing activities, the significance of the impact is rated **minor**.

- ***Mobilization of Construction Equipment and Materials to Site***

Potential Impact on Air Quality and Ambient Noise

Construction equipment and materials will be moved to the Project site prior to commencement of main construction activities. The potential biophysical impacts associated with the mobilization activities include decrease in ambient air quality of the Project area as a result of emissions from vehicles that will convey materials and equipment to site.

It is anticipated that the potential impacts will be similar to those experienced during site clearing activities. The capacity for assimilation of vehicular emissions and dust associated with the mobilization activities in the Project's area of influence is considered to be high. The overall impact significance of mobilization activities on the ambient air quality and noise of the Project area is rated **minor**.

Potential Impact on Infrastructure (Road)

Regarding community health and safety, the mobilization activities during the pre-construction phase of the Project could increase the traffic volume in the Project area (and potential for road accident) as a result of movement of vehicles in and out of the Project site. The social aspects of these activities could lead to accident, traffic congestion and annoyance from other road users in the area. The magnitude of the impact is considered low since the mobilization activities would be less than 1 week. The sensitivity of the receptors is adjudged as medium given that the existing vehicular movement in the University environment is high. The prominent means of

transportation are cars, tricycles, and motorcycles while buses/trucks are rare. The impact significance is considered to be **minor**.

Potential Impact on Workers Safety

Mobilization of construction materials will involve off-loading of heavy consumables such as cement, gravel, etc. Injuries and accidents may occur especially when those involved are unskilled. It is expected that the potential impacts will be similar to those experienced during site clearing and preparation activities. The impact significance is considered to be **minor**.

- ***Summary of Potential Negative Impacts Associated with Pre-Construction Phase***

Table 5.9 below summarizes the potential impacts associated with the pre-construction phase of the proposed Project.

Table 5.9: Summary of Potential Negative Impacts Associated with the Pre-Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Site Selection	Existing land use of the Project site	• Restriction on the use of the Project site by third party	Negligible
Site clearing and preparation	Terrestrial flora and fauna	• Vegetation loss • Direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species in the immediate surroundings of the Project site	Minor
	Soil	• Loss of top soil • Soil compaction and degradation • Increased erosion potential • Reduction in structural stability and percolative ability of soil	Minor
	Air Quality and Noise	• Air quality impacts due to emission from site clearing equipment • Increase in ambient noise levels	Minor
	Workers Safety	• Injuries and accidents to workers during site clearing and preparation. • Exposure to infectious diseases (e.g. COVID-19)	Minor
Mobilization of construction equipment and materials to site	Air Quality and Noise	• Air quality impacts from vehicular emissions (TSP, NO_x, CO, SO_x) • Increase in noise levels	Minor
	Infrastructure (road)	• Increase in vehicular movement and traffic including potential for road accident	Minor
	Workers Safety	• Injuries and accidents to workers during loading and offloading of construction materials.	Minor

5.6.2.1.2 Construction Phase

The construction phase of the proposed Project will include activities such as civil and electrical works (excavation, trenching, concrete mixing, etc.), installation of PV panels and associated components; construction of training centre; installation of streetlights, upgrade of existing electricity distribution infrastructure; and waste waste generation and disposal.

The potential environmental and social impacts associated with the construction phase of the proposed Project are assessed and discussed as follows:

- ***Civil and Electrical Works, and Installation of Plant Facilities and Associated Infrastructure***

Potential Impact on Air Quality

Air quality could be impacted due to dust generation from earth moving equipment and emissions (like SO_2, TSP, CO, NO_x, VOC) from internal combustion of construction equipment. Dust is also likely to be generated during extraction and removal of overlying materials as well as a windblown dust generated from cleared land and exposed materials stockpiles.

It is proposed that the construction phase of the Project would take up to approximately 6 months (less than 1 year). Although emissions from the construction equipment and operations of construction vehicles could increase the existing concentrations of gaseous pollutants in the ambient air of the Project site beyond the permissible limit, the potential impact is considered to be short term, infrequent, localized and reversible. The impact magnitude is considered to be medium. The sensitivity of the air shed of the Project site and its surrounding environment is considered to be low judging by the results of in situ measurements obtained during the baseline data gathering. There are no heavy industrial activities in the Project area. The impact significance of construction activities on ambient air quality of the Project site and its surrounding environment is rated **minor**.

Potential Impact on Noise Levels

The planned activities during the construction phase of the Project have the potential to increase the ambient noise levels at the Project site and its surroundings. Based on in situ measurements conducted as part of field survey in August 2019, the day-time noise level recorded in the Project site ranged from 43.5 dB(A) to 46.3 dB(A); at the 1km, it ranged from 48.2 dB(A) to 49.9 dB(A) while at the control/buffer points, a range of 49.3 dB(A) to 51.7 dB(A) was obtained. The measured noise levels at the Project site and its surrounding environment were within the World Bank noise limit of 55 dB(A) (1hour Leq day time) for educational institution. In addition, the noise levels (by extrapolation) were also below the FMEnv limit of 90 dB(A) for 8-hour occupational exposure.

The potential source of noise during the construction phase of the Project includes civil work and installation activities, vehicular movement and operation of construction equipment may lead to elevated noise levels beyond the baseline concentration. The noise levels from construction activities would be intermittent and localized and are not envisaged to result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location offsite. The sensitivity of the

receptor is regarded as medium. Aside the existing University facilities such as Administrative building, FUGA water factory and new male and female hostels within 500 m radius of the Project site, the identified local community in the Project area – Low Cost Community – is situated about 1.2 km away from the Project site. The potential impact magnitude is regarded as medium considering that the construction activities may take up to about 6 months. The impact significance prior to mitigation is rated **moderate.**

Potential Impact on Soil

The proposed construction activities will include excavation, loosening of soil, stockpiling, mixing, filling, etc. These activities can directly impact soil environment negatively contributing to soil degradation and possibly accelerated erosion.

Soil environment of the Project site could be impacted in terms of removal of topsoil and soil compaction, reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms resulting from compaction during excavation and installation activities. These activities also have the potential to increase siltation as a result of accelerated erosion. The impact magnitude is considered to be medium considering that foundation works would only be required for the proposed training centre while the trenching for the underground power evacuation cable to be installed would be minimal. The sensitivity of the soil environment of the Project area is considered to be low based on the laboratory results. No evidence of heavy metal and/or hydrocarbon pollution was recorded in soil samples from the Project area. Thus, the impact significance is considered to be **minor**.

Potential Impact on Surface water

The surface water body noticed around the Project site at the time field sampling was a rain harvesting trench constructed by the University. The waterbody is therefore man-made Rainwater from the trench is often used for irrigation demonstration to students of agriculture in the University. During the peak of rainy season, water from the trough flows to the immediate surroundings.

The quality of water in the trough could be impacted due to increased sediment load a result of accelerated erosion from the Project site during construction. Also, any contaminated run-off from the construction site as well as improper handling of construction wastes could pose adverse impact on the quality of the water. The potential impact on the man-made water body would be localized, indirect and reversible. The impact magnitude is considered to be medium. In terms of receptor sensitivity/importance, the results of laboratory analysis conducted on the water sample did not indicate heavy metals and hydrocarbon loads. This implies that although there may be some minor effect on the ecological balance of the water

body, it will not impact the overall integrity of the ecosystem. Thus, the impact significance is rated **minor**.

Potential Impact on Terrestrial Flora and Fauna

The construction activities may potentially cause disturbance to flora and fauna species as a result of increase in human activity, noise level, creation of areas of bare soil, etc. which may alter the composition and diversity of plant species around the Project site and drive many fauna species away from the area. In addition, the potential for plant species invasion is likely to increase as a result of increase in areas of bare soil around the Project site.

Also, the disturbance associated with noise and movement of construction equipment and personnel at the Project site may deter bird species from the area and disrupt the breeding of avifauna. It may also lead to increased risk to species such as snakes, rodents and mammals. The sensitivity of the receptor is adjudged to be low. The Project area is not known as a migratory route for avifauna species based on desktop reviews and field observation. The impact significance is regarded as **minor**.

Potential Impact on Hydrogeology and Groundwater Quality

The construction activities could lead to potential impacts on hydrogeology of the Project area. These include increased sediment load in the drainage channels as a result of erosion; increased storm water runoff from a decrease in infiltration; and increased runoff from hardstanding areas.

Groundwater may be impacted as a result of infiltration of contaminants associated with spills or leaks of fuels, oils and lubricants from construction vehicles and/or storage containers. Currently, there are no boreholes within the Project site and the nearest borehole to the Project is over 150m away. The results of laboratory analysis conducted on groundwater samples from existing boreholes in the Project area did not reflect any heavy metal and hydrocarbon pollution. It is not anticipated that construction activities will have any direct impacts on the underground aquifer in the project area. Therefore, the potential for groundwater contamination as result of construction activities is rated **minor**

The potential impact on the existing underground aquifer (water reserve) of the Project area as a result of water abstraction for construction activities such as concrete mixing and washing of construction equipment is considered to be **negligible** since the use of water for construction activities would be minimal. There are several boreholes within the University campus as noted during the site visit. The recharge of the existing boreholes in the Project area is largely due to direct precipitation. During the rainy season, the water reserve of the aquifer in the

study area increases; thus, hand dug wells and boreholes yields improve significantly.

Potential impact on Gender

Construction activities in Nigeria are typically dominated by males which presents a major challenge for equal opportunities for women. Generally, the Nigerian construction sector has a particularly low participation rate for women, both in industry and academia. Key Informant Interviews (KII) and Focus Group Discussions (FGD) conducted within the local community revealed that although women are allowed to work and trade freely; they are underrepresented in leadership positions.

During construction activities, women may experience discrimination as most employment and training opportunities will be provided to men, while women will be left with menial jobs. This may result in marginalization thereby reinforcing gender stereotypes and gender pay gaps. Furthermore, there is the possibility that the proposed Project may increase the risk of GBV, as a result of shifting existing power dynamics and financial relationships. However, this is considered a moderate risk as a few women in the community are engaged in economic activities.

The women in the local community also revealed that GBV incidents have been reported within the community. Such incidents are either addressed internally by the traditional community leaders or reported to the police. Furthermore, Yobe State ministry of Women affairs and NGOs are available in the case to handle such incidents. During the study, GBV service providers were identified at FUGA health center and Gashua general hospital. FUGA management expressed their commitment to providing a safe and conducive environment for all women within the institution. The sensitivity of gender impacts is rated high due to cultural and religious doctrine that is deeply rooted in the belief and customs of an average Nigerian therefore; the impact significance is regarded as **moderate**.

Potential Impact on Socio-economic and Health

Impacts associated with the construction phase of a project are usually of a short to medium term in nature, but could have long term effects on the surrounding environment. During construction, the proposed Project has the potential to affect the nearby community.

With regard to the presence of construction workers on site, the manner in which the workers conduct themselves can affect the local community in terms of disruption of existing family structures due to influx of migrant workers. The potential behaviour of construction workers, most especially male construction workers, may lead to an increase in levels of crime and drug and alcohol abuse, and an increase in incidence of casual sexual relations, which may result in increase in

sexually transmitted disease (such as HIV/AIDS infections) and unwanted pregnancies. There are also potential risks of construction workers infected with diseases (e.g. COVID-19) moving to the community, and infecting the local population. Additional pressure may also be placed on existing social infrastructure. Considering that the proposed number of workers (approximately 300) for the construction phase of the Project is relatively high, the potential risk to local family structures is regarded as high. Given that the majority of the construction workers, especially unskilled labour force would be drawn from the local community, the impact significance is considered to be **moderate.**

Potential Impact on Infrastructure (Road)

Regarding road infrastructure, the movement of construction vehicles in and out of the Project site during construction has the potential to increase road traffic and accidents. The impact magnitude is considered as low due to the minimal (about 2-3 daily) number of Project vehicles and trucks to be used during the construction phase. Also, traffic survey conducted at the screen lines leading to the University indicated that the existing road traffic in the Project area can be described as relatively light as Gashua town is a developing area. Therefore, the impact significance is considered **minor**.

Potential Impact on Construction Workers Safety

Construction sites are potentially hazardous place. Occupational accidents may occur especially when those involved are unskilled. Such occupational accidents may result in loss of man-hours which may ultimately affect the scheduled date of completion of the Project development especially if the man-hour losses are high. Potential impacts on construction workers include an increase in noise level and air emissions from construction activities, injuries, electrical shocks, accident, and denial of rights. The impact significance is considered **moderate**.

Furthermore, there are potential health risks associated with the construction workers who may be infected with various diseases (e.g. COVID-19) and spread it to other workers on site. An outbreak of infectious diseases could significantly impact the project timelines and activities by causing disruptions and delays during construction. For example, during the COVID-19 pandemic lockdowns, many construction projects were affected as they were forced to shut down activities or work under restricted conditions. The impact significance is considered **moderate**.

- ***Waste Generation and Disposal***

Potential Impact on Soil

Construction activities are associated with waste generation. The potential wastes to be generated during the construction phase of the Project include scrap metals, electrical cables, spent oils, damaged batteries, wood/planks, paper waste, food

remnants, leftover sand and gravel, etc. The waste streams if not properly handled, could contaminate the soil environment within the Project site and its surrounding environment. The impact sensitivity of the soil environment of the Project area is low judging by the results of laboratory analysis conducted on the soil samples. The impact significance is considered to be **minor**.

Potential Impact on Groundwater

Groundwater may be impacted as a result of infiltration of contaminants associated with liquid wastes especially from damaged batteries and spent oils. The impact magnitude is considered low; the nearest existing groundwater source to the Project site is over 150 m away. The results of laboratory analysis conducted on groundwater samples from existing boreholes in the Project area did not reflect any heavy metal and hydrocarbon pollution. The potential for groundwater contamination as result of waste disposal is rated **minor**.

Potential Impact on Infrastructure (Waste Management Facility)

Construction wastes can potentially have impact on the existing waste management facility of the Project area. However, as part of the Project design, construction wastes such as scrap electrical components, batteries, damaged/defective PV panels are planned to be returned to the manufacturers based on a take-back scheme or local recycling companies (approved by regulatory authorities) for proper recycling. The quantity of domestic wastes to be disposed of would be minimal. It is estimated that approximately 0.225 m^3 of construction debris will be produced per week. Thus, the impact of construction wastes disposal on the waste management facility of the Project area is considered **negligible**.

- ***Summary of Potential Negative Impacts Associated with Construction Phase***

Table 5.10 summarizes the potential negative impacts associated with the construction phase of the proposed Project.

Table 5.10: Summary of Potential Negative Impacts Associated with the Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Civil and Electrical Works/ Installation Activities	Air Quality	• Air quality impacts due to emission from construction equipment (SPM, NOx, CO, SO_x) • Increase in dust from cleared land and windblown stockpiles	Minor
	Ambient Nosie	• Increase in noise level due to construction activities	Moderate
	Soil	• Increased erosion potential as a result of construction activities such as excavation • Reduction in structural stability and percolative ability of soil resulting from	Minor

Activity	Receptor	Associated Impact	Significance
		compaction during civil works and installation activities	
	Terrestrial Flora and Fauna	• Loss of plant species as a result of introduction of alien plants which may prevent the natural recovery of the natural vegetation on the site and power evacuation route. • Loss of fauna as a result of increased human activity and associated noise.	Minor
	Hydrogeology and Groundwater	• Decrease in groundwater aquifer as a result of groundwater abstraction for construction activities e.g. concrete mixing, equipment washing, etc. • Groundwater contamination	Minor
	Surface water	• Surface water contamination	Minor
	Gender	• Discrimination of women during employment • GBV	Moderate
	Socio-economic and health	• Influx of migrant workers, increase in sexual transmitted diseases. • Exposure to infectious diseases (e.g. COVID-19)	Moderate
	Infrastructure (road)	• Road damage, traffic and safety impacts.	Minor
	Construction workers safety	• Injury to construction workers during construction activities. • Exposure to infectious diseases (e.g. COVID-19)	Moderate
Waste Generation and Disposal	Soil	• Decrease in soil quality	Minor
	Groundwater	• Groundwater contamination	Minor
	Infrastructure (waste management facility)	• Disposal of construction wastes to existing waste management facility in the Project area.	Negligible

5.6.2.1.3 Commissioning Phase

Once the construction phase of the proposed Project is completed, the power plant and associated infrastructure will be tested to ensure that they have been installed according to the pre-design and operational requirements. During the commissioning, there could be increase in noise level due to humming noise emission from the plant components (inverters and batteries), vehicular movement (transportation of commissioning officials), crowd noise, and other ceremonial activities. The ambient noise levels recorded in the area during baseline data gathering were generally below the FMEnv and World Bank recommended limits. Also, considering that the commissioning activities would be short-termed and localized, the impact significance is rated **minor**.

Also, there is potential for occupational hazards during the facility testing as a result of any wrong electrical connection. The impact significance is considered to be **moderate** on the workers' health and safety.

The commissioning phase will lead to an influx of guest and officials which will have an impact on the existing population and infrastructure (road) of the Project area. Due to the short duration of the commissioning activities, the impacts are considered to be **negligible**.

Table 5.11 summarizes the potential negative impacts associated with the commissioning phase of the proposed Project.

Table 5.11: Summary of Potential Impact Associated with the Commissioning Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Plant testing	Ambient noise	• Increase in ambient noise level	Minor
	Workers	• Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as a result of any wrong electrical connection.	Moderate
	Population influx	• Increase in population during commissioning	Negligible
	Infrastructure (road)	• Road traffic and risk of accidents	Negligible

5.6.2.1.4 Operational Phase

❖ ***Power Generation and Distribution***

Potential Impact on Air Quality

The operation of the backup diesel generators to be installed for charging the batteries will have associated gaseous emissions. The use of diesel as fuel has associated exhaust emissions containing Carbon monoxide (CO), Sulphur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). However, since the generating sets are to be used only during unfavourable weather conditions (i.e. low sunlight) for charging the batteries, the associated air emissions will be minimal, localized and infrequent. Also, not all generators will be operated concurrently for backup charging purposes during operations to avoid general failures and reduce emissions. Thus, the significance of the impact is regarded as **minor**.

Furthermore, some potential factors that can impact negatively on the proposed project include the build-up of dust and cloud cover, which may reduce the efficiency of the solar panels during operations. Dust accumulation may increase during the dry season periods of harmattan (a period characterized by dry and dusty winds and relatively low temperatures). Heavy rainfalls and cloud cover associated with the wet season may also impact on the daily energy yields of the solar panels. The effect of cloud cover is immediate, leading to declining in solar irradiance, while the effects of dust accumulation may have long-term impacts if unmanaged. However, considering that these impacts are mainly reversible in

nature and managed through the application of inherent operational controls, the impact significance is rated as **minor**.

Potential Impact on Noise

The potential sources of noise during the Solar Power project operations are inverters and the diesel generating sets. Typically, the designed noise level from an inverter is approximately 30-35 dB(A), while uncovered diesel generators produce up to 85 dB(A). The associated noise levels from the inverters are not envisaged to result in a maximum increase in background levels of 3 dB(A) within the project area. The anticipated noise emission from the operation of diesel generators will not exceed 70-75 dB(A), since the generators will have soundproof covering. Also, the use of the diesel generator will not be continuous but mainly for backup purposes. Thus, the significance of the noise impact on the nearby receptors is regarded as **minor**.

Potential Impact on Gender

Women have conventionally been under-represented in the energy sector; they are often marginalized from many power sector employment and training opportunities. There is a potential that this situation may come to play during the operations phase of the Project as women may experience discrimination during employment and training opportunities. Also, GBV related issues such as sexual harassment, intimate partner violence, assault (physical and psychological), could potentially occur during operation. Although the number of personnel working at the Project site would be minimal, the likelihood of gender-based impacts predicted during the construction phase may exists. Therefore, the impact significance is regarded as **moderate**

Potential Impact on Socio-economic and Health

The potential negative impacts on the socio-economic environment (community health and safety) during the operational phase of the Project are related to visual impact and the generation of electromagnetic field (EMF) radiation.

For visual impact, the Project site is not known to be a tourist route or to have any special scenic characteristics, hence it has a limited potential for visual impacts on the receiving environment. However, the facility (primarily the PV panels) will be visible during operation. The impact significance is considered **negligible**.

Regarding EMF radiations, Solar PV panels, inverters, batteries, and other components that make up solar PV arrays produce extremely low frequency EMF when generating and transmitting electricity. To protect the general public from health effects from short-term high-level magnetic fields, the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 2010) advised an

exposure limit for extremely low frequency magnetic fields at 2000 mG (milligauss – the unit used to measure magnetic field strength).

Solar PV panels produce low levels of extremely low frequency (ELF) EMF, with measured field strengths of less than one mG. The measured EMF level decreases as the distance from the PV panel increases (Chang and Jennings, 1994).

Research has not been able to prove that the ELF-EMF radiations generated from PV arrays or transmission line have an adverse impact on human health, as most studies show a weak association between magnetic field and adverse health effects. The World Health Organization (WHO) has designated ELF-EMF as a possible carcinogen (WHO, 2007). The use of the label "possible carcinogen" indicates that there is not enough evidence to designate ELF-EMF as a "probable carcinogen "or "human carcinogen," the two indicators of higher potential for being carcinogenic in humans. Thus, the potential impact of EMF radiation from the proposed Solar-hybrid Power Plant on community health and safety is considered to be **negligible**.

Potential Impact on Occupational Health, Safety and Welfare of Workers

During the Plant operation, workers could be exposed to occupational health and safety issues (e.g. electrical and field exposure, shock hazards and mechanical injuries) including work-related issues such as discrimination, denial of rights, unfair treatment, poor working conditions, etc. The impact significance is considered to be **moderate,** primarily due to the low number of staff (approximately 10) required for operation.

Also, there are potential risks of the spread of infectious diseases (e.g. COVID-19) among workers at the solar power plant. This may be transmitted by infected workers working at the facility or from external visitors. The impacts may range from the shutdown of operations at the power plant and/or reduction in the number of personnel at the facility which can ultimately affect the power plant operations. Therefore, the impact significance is also rated **moderate**.

- ***Routine Maintenance, Waste Generation and Disposal***

Potential Impact on Soil

Routine maintenance of the Project facilities has the potential for waste generation. The waste stream will be e-waste generated from spent/damaged components of the Project such as batteries, inverters and PV panels. Such wastes if not handled appropriately, could lead to soil contamination. The wastes will be stored within the Project site according to the manufacturer's instructions and with secondary containment. All components to be used for the project will incorporate buy-back agreements with the manufacturers as specified in the Extended Producer Responsibility Program (EPRP). The significance of the impact is considered **minor**.

Also, fuel spills and used oil from the backup diesel generators for the proposed project are potential sources of soil contamination. However, the solar hybrid power plant facility will be concretized, which will minimize the risk of soil contamination from leaks and spills. Thus, the significance of the impact is rated **minor**.

Potential Impact on Groundwater

Potential impacts may include decrease in amount of groundwater reservoir as a result of water abstraction for cleaning of the PV panels. Cleaning of the PV panels is envisaged to be carried out at three (3) times during the raining reason and this would be more than three times during the dry season.

Based on previous experience, each panel would require approximately 5 litres of water per cleaning cycle. With an estimated number of 6,600 panels for 2.5MW generation, it is envisaged that the proposed Project would consume approximately 16,500 litres of water per cleaning cycle. The water required for the cleaning purpose would be obtained from a new borehole to be installed on the project site. Based on observations noted during the field survey and the estimated quantity of water required for occasional cleaning of the PV panels, water abstraction for the Project is not envisaged to have serious effect on the existing groundwater aquifer of the Project area as well as the local water use. Thus, the impact significance is considered **minor**.

Potential Impact on Occupational Health, and Safety of Workers

During routine maintenance, workers may be exposed to occupational health and safety issues (e.g. electrical and field exposure, shock hazards and mechanical injuries). The impact significance is considered to be **minor** primarily due to the low number of staff (approximately) required for maintenance activities and low frequency of maintenance.

❖ ***Summary of Potential Negative Impacts Associated with Operation Phase***

Table 5.12 below summarizes the potential negative impacts associated with the operational phase of the proposed Project.

Table 5.12: Summary of Potential Negative Impacts Associated with Operational Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Power Generation and distribution	Air Quality	• Air emissions from the Diesel Generators	Minor
	Noise	• Noise from diesel generators and inverters during power generation and evacuation	Minor
	Gender	• Discrimination of women during employment • GBV (sexual harassment, assault and poor working condition)	Moderate

Activity	Receptor	Associated Impact	Significance
	Socio-economic (visual prominence)	• Landscape alterations resulting in unpleasant changes in the visual character of the area	Negligible
	Socio-economic (health issues)	• Community health and safety impact due to electromagnetic field (EMF) radiation from the Solar-hybrid Power Plant	Negligible
	Health, safety and welfare of staff during Plant operation	• Electric shock, injuries to personnel associated with the Power Plant operations, • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions. • Exposure to infectious diseases (COVID-19)	Moderate
Routine Maintenance, Waste Generation and Disposal	Soil	• Soil contamination from spent batteries and inverters • Soil contamination from leaks and spills from the diesel generators	Minor
	Groundwater	• Groundwater abstraction from cleaning of PV panels	Minor
		• Groundwater and soil contamination	Negligible
	Health, safety and welfare of staff during maintenance	• Electric shock, injuries to personnel during maintenance	Minor

5.6.2.2 Potential Cumulative Impacts

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions owing to the project aspects and activities outside the project (GSI, 2003). The concept of cumulative effects is an important one. It holds that, while impacts may be small individually, the overall impact of all environmental changes affecting the receptors taken together can be significant. When a resource is nearing its tolerance threshold, a small change can push it over.

The major existing developments around the Project area are the University facilities such as Administrative building, FUGA water factory, and male and female hostels. Given the nature of the activities associated with the proposed Project and the existing activities around the project area, the potential cumulative impacts of the Project on road traffic, ambient noise levels and groundwater availability is considered **low**.

5.7 Risk and Hazard Assessment

5.7.1 Overview

Risk assessment is the determination of quantitative or qualitative estimate of *risk* related to a concrete situation and a recognized threat (also called hazard). The assessment of the risks and hazards associated with the proposed Project involves the following steps:

- Identification of hazards/risks
- Likelihood of occurrence
- Consequence/severity of the hazards

The risk assessment matrix is then developed as presented in Figure 5.3.

0 – 5 = Low Risk 6 – 10 = Moderate Risk 11 – 15 = High Risk 16 – 25 = extremely high unacceptable risk		Severity of the potential injury/damage				
		Insignificant damage to Property, Equipment or Minor Injury 1	Non-Reportable Injury, minor loss of Process or slight damage to Property 2	Reportable Injury moderate loss of Process or limited damage to Property 3	Major Injury, Single Fatality critical loss of Process/damage to Property 4	Multiple Fatalities Catastrophic Loss of Business 5
Likelihood of the hazard happening	Almost Certain 5	5	10	15	20	25
	Will probably occur 4	4	8	12	16	20
	Possible occur 3	3	6	9	12	15
	Remote possibility 2	2	4	6	8	10
	Extremely Unlikely 1	1	2	3	4	5

Figure 5.3: Risk Assessment Matrix

5.7.2 Project Specific Risks and Hazards

The potential risks and hazards associated with the proposed Project are described below:

5.7.2.1 Fire and Explosion

The major risk associated with the operational phase of the Project is fire and explosion. PV systems are subject to electrical faults like any other electrical installation such as short circuits, ground faults and reverse currents. These faults and other failures of the system, including cable insulation breakdowns, rupture of a module, and faulty connections, can result in hot spots that can ignite combustible material in their vicinity. Wrongly installed or defect DC/AC inverters have been the reason of several photovoltaic fires as well.

Fire could possibly occur during operation of the power plant. Overcharging, high temperatures and physical stress to Lithium ion battery cells can cause thermal runaway, which commonly leads to the destruction of the battery, fire and even explosions. In addition, deep discharging can also cause battery fires. Any outbreak of uncontrolled fire in the area can escalate to dangerous dimensions which could be critical. The hazard is classified as **high risk**.

5.7.2.2 Electrocution

Electrocution from direct contact with high-voltage electricity or from contact with tools, vehicles, ladders, or other devices that are in contact with high-voltage electricity could occur during the Plant operation. The likelihood of the hazard happening is remotely possible and its severity if occurs may result into marginal consequence. The hazard is classified as **moderate risk**.

5.7.2.3 Occupational Hazards

Workers may be exposed to occupational hazards when working at elevation during construction. Also, there could be electrical hazards to workers. Common electrical accidents result in shocks and/or burns, muscle contractions, and traumatic injuries associated with falls after the shock. The likelihood of the hazards occurring is considered to be possible while its severity is considered to be marginal. The hazard is classified as **moderate risk**.

5.8 Summary

In summary, the key potential impacts and risks associated with the proposed Project have been evaluated in this chapter. From such, the significance of the identified negative impacts/risks will be minimized to as low as reasonably practicable with the implementation of appropriate mitigation measures presented in the next chapter of this report. Enhancement measures for the identified positive impacts are also contained in the chapter.

CHAPTER SIX:

MITIGATION MEASURES

CHAPTER SIX

MITIGATION MEASURES

6.1 Introduction

Following the detailed description of the associated and potential impacts of the proposed Project in Chapter 5, the recommended mitigation measures for the identified negative impacts are presented in this chapter as well as the enhancement measures for the potential positive impacts. The implementation of the mitigation measures shall be overseen by the Rural Electrification Agency's Project Management Unit (REA-PMU).

6.2 Mitigation Measures Approach

Mitigation refers to measures or interventions necessary to avoid, minimize, reduce or offset adverse impacts. Approach for selecting appropriate mitigation measures followed the framework stated by the World Bank (2018):

- Anticipate and avoid risks and impacts;
- Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels;
- Once risks and impacts have been minimized or reduced, mitigate;
- Where significant residual impacts remain, compensate or offset them, where technically and financially feasible.

In proffering mitigation measures for the various negative impacts identified in the previous chapter, preference was given to avoidance or prevention of adverse impacts and where not feasible, measures which are practicable and cost-effective using best available technology were suggested to reduce and/or minimize the impacts while rehabilitation, restoration or compensation was considered as the last resort.

6.3 Mitigation Measures for the Identified Significant Negative Impacts

The recommended mitigation measures for the identified negative impacts associated with the proposed Project are highlighted in Table 6.1. The recommended mitigation measures are considered adequate to address the adverse impacts identified in the Chapter 5 of this report. There are no potential long-term impacts associated with the Project that cannot be mitigated to acceptable levels of residual impact. The residual impacts of the proposed Project, following the

implementation of the proffered mitigation measures highlighted in Table 6.1, are of negligible to minor significance.

6.4 Mitigation Measures for the Identified Project Risks and Hazards

The mitigation measures for the identified Project risks and hazards are highlighted below:

Fire and Explosion

- Only PV modules which comply with international and local standards for electrical performance and safety shall be used.
- Only solar cables suitable for outdoor applications and severe weather conditions shall be used
- Inverters shall not be mounted on combustible walls such as wood panels or combustible sandwich panels
- Inverters shall be easily accessible and protected from severe weather conditions.
- The local fire department shall be informed of and familiarized with the photovoltaic installation.
- PV systems shall only be installed by qualified contractors.
- PV systems shall be inspected regularly by qualified professionals.
- PV systems shall be regularly checked for damage from rodents and other pests, which could compromise wiring or insulation.
- Batteries installed for the power plant shall be monitored regularly to prevent overcharging and deep discharging during operations
- Protection devices (e.g. Current interrupt devices (CIDs), positive temperature coefficient (PTC) thermistors, current-limiting fuses, diodes, battery management systems (BMSs), etc.) shall be installed to protect the batteries
- The batteries shall be housed in well ventilated, dust free containers under optimal conditions.
- Emergency response plan shall be developed and implemented.
- Fire extinguishers, fire notices, warning signs) shall be installed at different locations within the Plant site.

Electrocution

- Use of signs, barriers and public outreach to prevent public contact with distribution cables shall be employed.
- Grounding conducting objects (e.g. fences or other metallic structures) shall be installed where required to prevent shock.

Occupational Hazards

- Provision of an adequate work-positioning device system for workers shall be ensured.

- Hoisting and lifting equipment shall be rated and maintained and operators trained in their use.
- Appropriate Personal Protective Equipment shall be worn.
- Electrical installation shall be carried out by trained personnel in line with the approved procedures.

6.5 Enhancement Measures for Identified Positive Impacts

6.5.1 Reduction in Carbon Emissions

The Project will enhance Nigeria's intention of reducing its carbon emissions by 20 % in the year 2030 as contained in its NDC on climate change. To enhance this impact, the following measures shall be implemented:

- In cases where the power generated (2.5 MW) is insufficient to meet the power demands of the University in the next 10 to 20 years (due to expansion), power shall be distributed to high priority areas so as to reduce/eliminate the use of diesel-powered generators. In addition, The Project will be designed and constructed to allow for further expansion in power generation and distribution capacity to meet the University's demands.
- The University shall implement energy conservation measures such as encouraging switching off appliances, use of energy-saving bulbs, purchase of low-energy appliances such as printers, computers, refrigerators, etc.
- The project shall explore opportunities for carbon credits trading in the voluntary carbon market.

6.5.2 Enhancement of Learning

The Project will help to overcome the barrier on research and learning posed by epileptic power supply to the University. To enhance this impact, the following measures shall be implemented:

- Power distribution priority shall be given to all classrooms, lecture theatres, research centers, libraries, laboratories, and other academic buildings especially during learning hours.
- Research centres, laboratories, and libraries shall have 24-hour power supply.

6.5.3 Direct Employment and Training

The Project will give rise to direct employment opportunities across different skill levels, from unskilled to highly skilled labour. It is estimated that during construction phase, at least 3,000 job opportunities would be created. Training for local people from skilled technicians shall also be carried out.

The following measures shall be implemented to ensure that direct employment and training opportunities are maximized:

- A Labour and Employment Management Plan (LEMP) shall be developed prior to construction, detailing percentages and numbers of the workforce to be sourced from the local area and various demographics as well as influx management. The plan shall follow local and international employment guidelines.
- The EPC contractor shall provide notification to different groups in the community on specific jobs and skills required for the project, prior to the commencement of construction. Subsequently, the group leaders shall notify the local population prior to the commencement of construction of job opportunities and relevant skills/qualifications required to be employable on the Project.
- A Gender Management Plan (GMP) shall be developed and implemented to ensure that the Project does not increase women's burden and that women not only contribute, but also benefit from it.
- The EPC contractor shall initiate training and skills development programmes prior to the commencement of construction, as a means of ensuring that members of the local workforce are up-skilled and can be employed on the Project.

During the operational phase of the Project, job opportunities will also be created. About 15 people shall be employed. This will be a mixture of skilled labour (such as electrical and mechanical technicians) and unskilled labour (such as PV module cleaners and security personnel). Periodic capacity building will be offered to the workforce.

6.5.4 Procurement and Indirect Employment

The construction and operation of the proposed Project will create opportunities for the supply of goods and services to the Project and in turn, indirect employment will be created in the supply chain. Other opportunities for local companies to provide catering, waste / recycling and landscaping facilities, etc. will also be created. Local and regional procurement targets shall be included in the Project's LEMP to enhance this potential opportunity.

6.5.5 Improvement in Power Supply

As part of the Corporate Social Responsibility (CSR) activities for the proposed project, there are plans to extend the power generation to the host communities in the near future. Thus, increasing their access to reliable power supply and leading to improved standard of living for the host communities.

Table 6.1: Mitigation Measures for the Potential Negative Impacts of the proposed Project

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Pre-construction Phase					
Site Selection	Land Use	• Loss of access to land	Negligible	▪ To prevent any encroachment on the Project site, perimeter fencing and signposts shall be erected around the site ▪ Where new encroaching activities (e.g. farming) are observed, the affected persons shall be given adequate time to harvest their crops before commencement of construction activities.	Negligible
Site clearing and preparation	Terrestrial flora and fauna	• Vegetation loss • Direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species in the immediate surroundings of the Project site	Minor	▪ To avoid the direct impacts of Vegetation loss, site clearing shall be limited to the areas within the site needed for the Project. ▪ The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited. ▪ Bush burning shall be avoided. ▪ Use of herbicides for site clearing shall be avoided. ▪ Any cleared areas which are not used will be re-vegetated using plants or seeds of locally occurring species. ▪ Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection.	Negligible
	Soil	• Removal of top soil and soil compaction associated with site clearing	Minor	▪ Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
		• Loss of top soil • Increased erosion potential • Reduction in structural stability and percolative ability of soil		the remediation of disturbed areas. ▪ Disturbed areas will be rehabilitated as soon as possible to prevent erosion. ▪ The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited. ▪ Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	
	Air quality and noise	• Air quality impacts due to emission from site clearing equipment • Increase in ambient noise levels	Minor	▪ Site clearing equipment / machinery shall be operated and maintained under optimum fuel efficient conditions. ▪ Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr) ▪ Equipment/machinery with lower sound power levels shall be selected and used for site clearing. ▪ A procedure for receiving and addressing noise complaints shall be developed and implemented	Negligible
	Workers Safety	• Injuries and accidents to workers during site clearing and preparation. • Exposure to infectious diseases (e.g. COVID-19)	Minor	▪ Site clearing shall be limited to the day time as much as possible. ▪ Unregistered labourers and touts shall not be engaged for off-loading materials ▪ Provision of adequate personal protective equipment (PPE) such as nose masks shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				▪ The EPC contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations. ▪ Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during site clearing works	
Mobilization of personnel, materials and equipment to site	Air quality and noise	• Air quality impacts from vehicular emissions • Increase in ambient noise levels	Minor	▪ Construction vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance. ▪ All materials with potential to result in dust emissions shall be covered during transport. ▪ Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Negligible
	Infrastructure (road)	• Increase in vehicular movement and traffic around the project site; • Potential for road accident.	Minor	▪ A traffic management plan (TMP) shall be developed by the EPC contractor and implemented. ▪ Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided. ▪ The local community shall be sensitized about the Project activities and the need to comply with the traffic management plan put in place. ▪ Project related vehicles shall be regularly serviced and maintained. ▪ Drivers' competency shall be assessed and where required, appropriate training shall be	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				provided. This will include training on safe driving measures such as adherence to speed limits (of less than 10 km/h) in the Project area. ▪ A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented. This will include date/time, location, reason for accident, corrective measures, etc.	
	Workers Safety	• Injuries and accidents to workers during loading and off-loading construction materials.	Minor	▪ Mobilization of materials shall be limited to the day time as much as possible (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr) ▪ Provision of adequate PPE especially gloves and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties. ▪ Unregistered labourers and touts shall not be patronised for off-loading materials. ▪ The site shall be secured with perimeter fencing and/or security. ▪ Separate sanitary amenities and potable water facilities for men and women shall be provided	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Construction Phase					
Civil and Electrical Works/ Installation Activities	Soil	• Increased erosion potential as a result of construction activities such as excavation • Reduction in structural stability and percolative ability of soil resulting from compaction during civil works and installation activities	Minor	▪ Excavation works shall not be executed under aggressive weather conditions. ▪ Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion. ▪ Disturbed areas shall be rehabilitated with erosion control plants (using native plant species) as soon as possible to prevent erosion. ▪ Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint.	Negligible
	Air Quality	• Air quality impacts due to emission from construction equipment • Increase in dust from cleared land and windblown stockpiles	Minor	▪ Regular maintenance and servicing of construction equipment /machinery shall be ensured. ▪ Only modern and well-maintained equipment and machinery shall be used for construction activities. ▪ Routine water sprinkling shall be carried out to minimize dust generation during construction.	Negligible
	Ambient Noise	• Increase in noise level due to construction activities; • Disturbance to neighbouring community and local ecology	Moderate	▪ Noise suppression equipment (e.g. mufflers) shall be fitted on construction machinery. ▪ Construction activities shall be limited to day-time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr). In the event that noisy activities are undertaken outside of the specified working hours, all noise receptors in the Project area shall be informed	Minor

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				of such activities in advance. ▪ Construction machinery shall be turned off when not in use. ▪ Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation. ▪ Construction equipment shall be properly maintained and serviced. ▪ Major construction activities shall be limited to a particular area within the site. ▪ Construction-related vehicles shall be limited to access areas. ▪ Noise complaints related to the construction activities shall be assessed and appropriately addressed. ▪ Noise monitoring at locations with persistent noise complaints shall be maintained.	
	Infrastructure (road)	• Road damage, traffic and safety impacts.	Minor	▪ A TMP shall be developed by the EPC contractor and implemented. ▪ Speed limits for all construction-related vehicles shall be established and enforced. ▪ Construction related vehicles shall be regularly serviced and maintained. ▪ Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active. ▪ Drivers' competency shall be assessed and where required training shall be provided. ▪ A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented. This will include	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				date/time, location, reason for accident, corrective measures, etc. ▪ The NEP Grievance Redress Mechanism (GRM) shall be implemented for receiving complaints arising from damage to infrastructure and private property during construction activities. The EPC contractor shall receive the complaints and repair damage as quickly as possible.	
	Groundwater and surface water	• Groundwater and surface water contamination	Minor	▪ Training shall be provided for workers on safe storage and handling practices and rapid spill response and clean-up techniques during induction. ▪ Spill control and response plans to respond to spills and leaks shall be implemented. ▪ Waste receptacles shall be provided within a secured area within the project site for collection of solid waste. ▪ General wastes that cannot be reused shall be periodically evacuated by the government accredited waste contractor	Negligible
	Terrestrial Flora and Fauna	• Loss of plant species as a result of introduction of alien plants which may prevent the natural recovery of the natural vegetation on the site. • Loss of fauna as a result of increased human activity and associated	Minor	▪ Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities. ▪ All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. ▪ If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
		noise.		germination of alien species and will be regularly cleared during construction. ▪ Regular monitoring shall be undertaken to ensure that alien plants are not increasing as a result of the disturbance that has taken place. ▪ Hunting or deliberate killing of animals by construction workers shall be prohibited and monitored. ▪ In order to reduce collision of vehicles with fauna, a 10 km/hr speed limit by construction-related vehicles shall be enforced in the Project area.	
	Gender	• Discrimination during employment and training opportunities • GBV (sexual harassment, intimate partner violence, poor working conditions)	Moderate	▪ Equal treatment of workers shall be ensured. ▪ The GBV Action Plan for EEP shall be implemented for the Project ▪ All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA) ▪ GBV sensitive channels for reporting in GRM shall be implemented for the Project ▪ The EPC Contractor shall be required to hire a Gender/GBV officer. ▪ Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured. ▪ All workers shall be required to undergo regular training and refreshers on GBV ▪ The EPC Contractor shall provide separate facilities for men and women and add GBV-	Minor

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				free signage at the project site. ▪ All gender-based violence incidents shall be reported and dealt with as per the law.	
	Construction workers safety	• Injury to construction workers during construction activities. • Exposure to infectious diseases (e.g. COVID-19)	Moderate	▪ Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence. ▪ Construction workers shall be sensitized and monitored on the need to be safety conscious. ▪ Daily toolbox talks prior to commencement of work activities shall be carried out. ▪ Construction activities shall be limited to daytime as much as possible. ▪ Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules. ▪ Proper safety signs and signage shall be placed at strategic locations within the site. ▪ PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored. ▪ Safety training focused on safe working practices, information on specific hazards, first aid and fire-fighting shall be included in the induction programme for workers.	Minor

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				▪ A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented. ▪ The site shall be secured with perimeter fencing and/or security. ▪ Sanitary amenities and potable water shall be provided. ▪ The EPC contractor shall implement the NCDC "Guidelines for employers and businesses in Nigeria" during construction works. ▪ A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented. ▪ The EPC contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate. ▪ Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	
	Socio-economic and health	• Influx of migrant workers, increase in sexual transmitted diseases. • Influx of workers with infectious diseases (e.g. COVID-19)	Moderate	▪ Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. ▪ No person under the age of 18 shall be engaged to work on the project. The EPC Contractor shall ensure that children and minors are not employed directly or indirectly on the project ▪ Any child dropout should be reported to the relevant government agency ▪ The local community shall be informed of the Project activities prior to commencement of work. ▪ An induction and sensitization programme, including a Code of Conduct, for all construction	Minor

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				workers shall be carried out prior to construction activities. This will increase sensitivity to local norms and customs, provide awareness to construction workers of appropriate and acceptable behaviours, and will govern worker interactions with the local community. ▪ Awareness education about GBV/SEA/HIV/AIDS and other sexually transmitted diseases shall be created among the workforce and extended to the local community. ▪ The CoC shall include provisions to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse by workers within the local community. ▪ Public access shall be restricted to construction area via security fencing and appropriate signage. ▪ Substance abuse prevention and management programs shall be implemented for workers. ▪ Sanctions (e.g., suspension and dismissal) shall be introduced for workers involved in criminal activities ▪ Procedure for receiving and addressing community concerns shall be developed and implemented. ▪ The EPC contractor shall implement the NCDC "Guidelines for employers and businesses in Nigeria" during construction works. ▪ The EPC contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate. ▪ Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	
Waste Disposal and Generation	Infrastructure	• E-waste generation	Minor	▪ A Waste Management Plan shall be developed and implemented	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	(waste management facility)	• Disposal of construction wastes to existing waste management facility in the Project area.		▪ Training shall be provided for workers on safe storage, use and handling of e-waste on site. ▪ E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal ▪ Waste receptacles shall be provided within a secured area for collection of solid waste. ▪ Construction vehicles and equipment shall be serviced regularly.	
	Soil	• Soil contamination from solid and liquid construction waste streams. • Soil contamination from leaks and spills from the diesel generators	Minor	▪ Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. ▪ Portable spill containment and clean-up kits shall be available onsite. ▪ Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Negligible
	Groundwater	• Groundwater contamination of liquid construction waste streams.	Minor	▪ Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site. ▪ Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. ▪ Portable spill containment and clean-up kits shall be available onsite. ▪ Waste management plan (WMP) shall be	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				developed by the EPC Contractor and implemented. ▪ Waste bins shall be provided at designated locations on site for temporary storage of different waste streams. ▪ Construction waste, as much as practicable, shall be reused or recycled. ▪ Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite.	
Commissioning Phase					
Plant Testing	Ambient noise	• Increase in ambient noise level	Minor	▪ The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations. ▪ Strict compliance to the Standard Operating Procedures shall be ensured. ▪ The inverters and batteries to be used for the Project shall meet industry best standard in relation to noise attenuation.	Negligible
	Workers	• Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as a result of any wrong electrical connection.	Moderate	▪ Plant testing shall be carried out by experienced personnel. ▪ Adequate PPE shall be worn. ▪ The Project components shall be installed in line with the pre-established standards and as per manufacturer recommendations. ▪ The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project. ▪ Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured. Prior to the Plant commissioning, appropriate	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				emergency equipment (such as first aid box, fire extinguishers) shall be provided onsite. ▪ Plant testing shall be restricted to the daytime. ▪ The site shall be secured with perimeter fencing and/or security ▪ Sanitary amenities and potable water shall be provided	
Operational Phase					
Power Generation and Evacuation	Air Quality	• Air emissions from the diesel generators • Effects of cloud cover and dust on the PV panels	Minor	▪ Strict compliance to the standard operating procedures for the diesel generators shall be ensured. ▪ Regular maintenance of diesel generators shall be ensured as required by the manufacturer. ▪ A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations. ▪ The solar panels shall be inspected regularly for dust and rain damages and maintained according to manufacturer's instructions.	Negligible
	Noise	• Noise from diesel generators and inverters during power generation and evacuation	Minor	▪ Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications. ▪ The diesel generators shall be operated with the sound proof covers at all times. ▪ Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact. ▪ Periodic maintenance of the diesel generators shall be carried out.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Socio-economic (visual prominence)	• Landscape alterations resulting in unpleasant changes in the visual character of the area	Minor	▪ All lighting will be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, which is shielded and directed downward, to reduce light spillage will be used.	Negligible
	Health, safety and welfare of staff during Plant operation	• Electric shock, injuries to personnel associated with the Power Plant operations, • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions • Exposure to infectious diseases (e.g. COVID-19)	Moderate	▪ Appropriate PPE shall be provided for workers. ▪ Training shall be provided to employees on emergency preparedness and responses. ▪ Provision of medical insurance scheme for employees shall be ensured. ▪ Appropriate safety signage shall be placed at strategic locations within the site. ▪ Strict compliance to the SOPs/ code of conduct shall be ensured. ▪ A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in place and implemented. ▪ The O&M contractor shall implement the NCDC "Guidelines for employers and businesses in Nigeria" during operations at the power plant. ▪ A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented. ▪ The O&M contractor shall develop policies and procedures for the identification and	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				isolation of people with symptoms, as well as testing where appropriate. ▪ Provision of functional hygiene facilities and implementation of basic infection prevention measures during operations shall be ensured by the O&M contractor.	
	Gender	• Discrimination during employment and training opportunities • GBV (sexual harassment, intimate partner violence, poor working conditions)	Minor	▪ Equal treatment of workers shall be ensured. ▪ Continuous implementation of the GBV Action Plan for EEP shall be sustained for the Project ▪ All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA) ▪ GBV sensitive channels for reporting in GRM shall be implemented for the Project ▪ The O&M Contractor shall be required to hire a Gender/GBV officer. ▪ Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be sustained. ▪ All workers shall be required to undergo regular training and refreshers on GBV ▪ The O&M Contractor shall provide separate facilities for men and women and add GBV-free signage at the project site. ▪ All gender-based violence incidents shall be reported and dealt with as per the law.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Routine Maintenance, Waste Generation and Disposal	Soil	• Soil contamination from fuel, used oil, spent batteries and inverters	Minor	▪ General housekeeping to ensure the site is not overgrown with grasses shall be maintained ▪ Waste bins shall be provided at designated locations on site for temporary storage of different waste streams. ▪ General waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. ▪ WMP shall be implemented. ▪ Burning of waste shall be prohibited. ▪ Damaged/expired Lithium ion batteries, solar panels, inverters and electric components shall be returned to the manufacturer based on the Extended Producer Responsibility (EPR) model. Prior to returning them to the manufacturers, they will be stored on impermeable surfaces within the site. ▪ Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment. ▪ Portable spill containment and clean-up kits shall be available onsite. ▪ Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Negligible
	Health, safety and welfare of staff during maintenance	• Electric shock, injuries to personnel during maintenance	Minor	▪ Appropriate PPE shall be provided for workers. ▪ Maintenance workers shall imbibe the workplace safety rules via proper	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (without mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				sensitization procedures. ▪ Strict compliance to the SOPs shall be ensured.	
	Groundwater	• Groundwater abstraction from cleaning of PV panels	Minor	▪ Water conservation plan shall be implemented ▪ Manual cleaning of the PV panels with water shall be regulated as much as practicable. The frequency of cleaning of PV panels with water is dependent on the rainfall pattern in the project area. During rainy season, cleaning is estimated to occur not more than thrice; however, during dry season the interval shall depend on the rate of dust accumulation. ▪ Periodic monitoring of groundwater resources in the Project's area of influence shall be implemented.	Negligible

CHAPTER SEVEN:

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

CHAPTER SEVEN

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.1 Introduction

The potential and associated impacts of the proposed 2.5 MW solar-hybrid power plant and associated infrastructure in the Federal University Gashua (FUGA), Yobe State, as part of the Federal Government's Energizing Education Programme, have been analyzed and documented in Chapter 5 of this report. The results show that if the recommended mitigation measures (presented in Chapter 6) are implemented, the identified impacts of the Project are not severe and can be reduced to as low as reasonably practicable. It is thus important that those recommended mitigation measures be translated into practical management actions, which can be adequately resourced and integrated into the Project phases.

Hence, this chapter presents the management measures and actions required to address the potential environmental and social impacts of the proposed Project. It also includes monitoring programme as well as performance indicators, responsible parties, timeframe and cost estimates for the implementation of recommended measures to address the associated impacts of the project throughout its life cycle. In addition, the framework for the contents of additional management plans to be developed and implemented as part of this ESMP is provided.

7.2 Objectives of the ESMP

The ESMP is essential for successfully implementing the Project's environmental and social performance throughout the life of the Project. Having this framework in place ensures a systematic approach to bringing environmental and social considerations into decision-making and day-to-day operations. It establishes a framework for tracking, evaluating and communicating environmental and social performance and helps ensure that environmental risks and liabilities are identified, minimized and managed including roles, responsibilities, and budget.

The ESMP will be a living document and will continue to develop during the design and construction phases to enable continuous improvement of the Project's environmental performance.

The specific objectives of the ESMP are to:

- Promote environmental and social management and communicate the aims and goals of the ESMP;
- Ensure that all workers, subcontractors and others involved in the Project meet legal and regulatory requirements with regard to environmental

management including financial implications;

- Incorporate environmental and social management into Project design and operating procedures;
- Serve as an action plan for environmental and social management for the Project;
- Provide a framework for implementing Project environmental and social commitments (i.e. mitigation measures identified in the ESIA);
- Prepare and maintain records of Project environmental and social performance (i.e. monitoring, audits and non-compliance tracking).

7.3 Environmental and Social Management Measures

Tables 7.1 to 7.4 present the recommended environmental and social management measures required to mitigate the identified impacts of the Project development and operation. Environmental and social measures for the decommissioning are documented in Chapter 8.

Table 7.1a: Environmental Management Plan for Pre-construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project. Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) FUGA (Site Engineer)	500
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re-vegetated using plants or seeds of locally occurring species.	Inspection	Monthly after the site clearing phase	Re-vegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly before the site clearing activities	Adherence to measures			
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily before the site clearing activities	Adherence to measures			
Removal of top soil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas.	Inspection	Daily	Re-vegetated land			
	Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Monthly before the site clearing activities	Re-vegetated land			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Mobilization of Materials and Equipment to Site							
Air quality impacts from vehicular emissions; Increase in ambient noise levels	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) FUGA (Site Engineer)	2000
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Table 7.1b: Social Management Plan for Pre-construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Exposure to infectious diseases (e.g. COVID-19)	The EPC contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to mobilization to site / site clearing and construction	Adherence to measures	FUGA Management EPC Contractor	REA (PMU)	500
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during site clearing works	Hygiene facilities and implementation of infection prevention measures	Prior to mobilization to site / site clearing and construction	Adherence to measures			
Injuries and accidents to workers during loading	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	500

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
and off-loading construction materials.	ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.					FUGA (Site Engineer)	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor	REA (PMU) FUGA (Site Engineer)	1000
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	Speed limit around community areas shall be limited to a maximum of 20 km/hr	Evidence of consultation with local community	Before and during mobilization	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required; appropriate training shall be provided.	Drivers' competency assessments; training records	Once before commencement of mobilization	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Table 7.2a: Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment; Increase in dust from cleared land and windblown stockpiles	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	1000
	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
	Only modern and well-maintained equipment and machinery shall be used for construction activities.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Increase in noise level	Construction activities shall be limited to day-time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	500
	Construction machinery shall be turned off when not in use.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	World Bank Good Practice Note on Addressing Grievances	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FMEnv Noise limit World Bank Noise Limit	EPC Contractor	FMEnv Yobe State Ministry of Environment	
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	Adherence to measures	EPC Contractor		
Increased soil erosion potential; reduction in structural stability and	Excavation works shall not be executed under aggressive weather conditions.	Inspection	Daily during excavation activities	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site	-

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
percolative ability of soil	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor	Engineer)	
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU FUGA (Site Engineer)	-
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Regular monitoring shall be undertaken to ensure that alien plants are not increasing as a result of the disturbance that has taken place.	Monitoring records	Monthly during construction phase	Adherence to measures	EPC Contractor	FMEnv Yobe State Ministry of Environment	
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU FUGA (Site Engineer)	500
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction	Incident forms	Daily during	Completed	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	related traffic incidents/accidents shall be developed and implemented.		construction phase	incident forms			
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							
E-waste generation	A Waste Management Plan shall be developed and implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	2000
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
	E-wastes generated shall be stored in appropriate locations at the Project site prior to recycling.	Waste consignment notes, waste receptacles on site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily during construction phase	Adherence to measures World Bank General EHS Guidelines	EPC Contractor	REA-PMU FUGA (Site Engineer)	200
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA-PMU FUGA (Site Engineer)	500
	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill	Inspection	Daily during construction phase	Adherence to measures World Bank	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	containment and clean-up kits shall be available onsite.			General EHS Guidelines			

Table 7.2b: Social Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project site.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	-
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU FUGA (Site Engineer) Yobe State Ministry of Women Affairs and Social Development GBV/SEA service providers	2500
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular onsite training and refreshers	Monthly during construction phase	Records of regular training and attendance	EPC Contractor		
	All workers on the project shall be required sign a code of conduct (CoC) to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor		
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish accessible GRM reporting channels	Monthly during construction	GRM records	EPC Contractor		
	The EPC Contractor shall be required to hire a Gender/GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor		
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
				with GBV service providers			
	The EPC Contractor shall provide separate facilities for men and women and add GBV-free signage at the project site	Erection of separate convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
• Influx of infected workers to the community. • Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC "Guidelines for employers and businesses in Nigeria" during construction works.	Implementation of NCDC guidelines	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	500
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Risk assessment records	Weekly during construction phase	Adherence to measures	EPC Contractor		
	The EPC contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Inspections	Once before start of construction	Policies and procedures	EPC Contractor		
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during site clearing works.	Inspections	Weekly during construction phase	Hygiene facilities, masks, and visible infection prevention measures.	EPC Contractor		
Influx of people, increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible.	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	3000
	An induction and sensitization programme, including a Code of Conduct, for all construction workers shall be carried out	Induction records and training on the	Once before start of construction	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	prior to construction activities. This will increase sensitivity to local norms and customs, provide awareness to construction workers of appropriate and acceptable behaviours, and will govern worker interactions / fraternization with the local community.	code of conduct					
	Awareness education about GBV/SEA/HIV/AIDS and other sexually transmitted diseases shall be created among the workforce and extended to the local community	Training records	Once before start of construction	Adherence to measures	EPC Contractor		
	Public access shall be restricted to construction area via security fencing and appropriate signage	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	All workers on the project shall be required to sign a code of conduct that prohibits any form of Gender Based Violence/Sexual Exploitation and Abuse	Signed code of conduct records	Once before start of construction	Adherence to measures	EPC Contractor		
	The NEP Grievance redress mechanism procedures for receiving and addressing community concerns shall be developed and implemented.	Consultations and grievance records	Weekly during construction phase	World Bank Good Practice Note on Addressing Grievances	EPC Contractor		
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU FUGA (Site Engineer)	4000
	Construction workers, including hire local workers, shall be sensitized and monitored on the need to be safety conscious. Daily toolbox talks prior to commencement of work activities shall be carried out for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as	Benchmarks stated in Health and Safety Plan	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			part of engagement				
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire-fighting shall be included in the induction programme for workers.	Training records	before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		
	A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented.	Completed grievance forms	Weekly during construction phase	Adherence to measures	EPC Contractor		

Table 7.3a: Environmental Management Plan for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	500
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Table 7.3b: Social Management Plan for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as a result of any wrong electrical connection.	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	200
	Adequate PPE shall be worn	Availability of PPE	Once before commissioning	Adherence to measures			
	Prior to the Plant commissioning, appropriate emergency equipment shall be installed at the Project site.	Availability of emergency response equipment	Once before commissioning	Adherence to measures			
Wrong electrical connection leading to explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	REA-PMU FUGA (Site Engineer)	-

Table 7.4a: Environmental Management Plan for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
Air emissions from the diesel generators,	Strict compliance to the standard operating procedures for the diesel generators shall be ensured.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	REA-PMU FUGA (Site Engineer)	-
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
	The solar panels shall be inspected regularly for dust and rain damages and maintained according to manufacturer's instructions.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
Noise from diesel generators and inverters during power generation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	REA-PMU FUGA (Site	-

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
and evacuation	The diesel generators shall be operated with the sound proof covers at all times.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	Engineer)	
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
Landscape alterations resulting in unpleasant changes in the visual character of the area	All lighting will be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, which is shielded and directed downward, to reduce light spillage will be used.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	REA-PMU FUGA (Site Engineer)	-
Routine Maintenance, Waste Generation and Disposal							
E-waste generation and disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA-PMU FUGA (Site Engineer)	2000
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on site	Continuous during operations	Adherence to measures	O&M Contractor		
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on site	Continuous during operations	Adherence to measures	O&M Contractor	FMEnv Yobe State Ministry of Environment	
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	World Bank General EHS Guidelines	O&M Contractor	REA-PMU FUGA (Site Engineer) FMEnv	1000
	WMP shall be implemented.	WMP implementation records	Quarterly during operation	Benchmarks stated in WMP	O&M Contractor	Yobe State Ministry of	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			phase	World Bank General EHS Guidelines		Environment	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures World Bank General EHS Guidelines	O&M Contractor	REA-PMU FUGA (Site Engineer)	
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor	REA-PMU FUGA (Site Engineer)	
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor	REA-PMU FUGA (Site Engineer)	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan and measures shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan World Bank General EHS Guidelines	O&M Contractor	REA-PMU FUGA (Site Engineer) FMEnv Yobe State Ministry of Environment	500

Table 7.4b: Social Management Plan for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA-PMU FUGA (Site Engineer) Yobe State Ministry of Women Affairs and Social Development GBV/SEA service providers	2500
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular onsite training and refreshers	Monthly during operation phase	Records of attendance			
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms			
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records			
	The EPC Contractor shall be required to hire a Gender/GBV officer	Hire GRM Officer	Once before start of operations	Employment records and job description			
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of operations	Records of ongoing engagement and consultation with GBV service providers			
	The EPC Contractor shall provide separate facilities for men and women and add GBV-free signage at the project site	Erection of separate convenience facilities and display of GBV signage	Once before start of operations	Inspection of facilities to ensure adequacy			
Exposure to infectious diseases (e.g. COVID-19)	The O&M contractor shall implement the NCDC "Guidelines for employers and	Implementation of NCDC	Continuously during	Adherence to measures	O&M Contractor	REA-PMU	500

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	businesses in Nigeria" during operations at the power plant.	guidelines	operations			FUGA (Site Engineer)	
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Risk assessment records	Weekly during operation phase	Adherence to measures			
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Inspections	Continuously during operations	Policies and procedures			
	Provision of functional hygiene facilities and implementation of basic infection prevention measures during operations shall be ensured by the O&M contractor.	Inspections	Continuously during operations	Hygiene facilities, masks, and visible infection prevention measures.			
Health, safety and welfare of staff during Plant operation	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU FUGA (Site Engineer) FMEnv Yobe State Ministry of Environment	3000
	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence to measures			
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures			
	A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in place and implemented.	Completed grievance forms	Monthly during operations	Adherence to measures			
Routine Maintenance, Waste Generation and Disposal							
Electric shock, injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU FUGA (Site Engineer)	500
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			operations			FMEnv Yobe State Ministry of Environment	

7.4 Roles, Responsibilities and Accountabilities

The main responsibility for overseeing the implementation of the ESMP lies with the REA PMU throughout the project life span. However, conformance with the specific environmental measures detailed in Chapter Six of this report will be ensured by the EPC contractor during the construction phase and Operations and Maintenance (O&M) contractor at the operational phase of the Project.

7.4.1 Pre-construction Phase

The key personnel and institutions with major roles in the implementation of the ESMP during pre-construction phase are:

FUGA Director of Physical Planning

- Select the land for the proposed Project
- Appoint a Site Engineer
- Arrange and ensure adequate training is carried out for the Site Engineer
- Review the ESMP from the consultant
- Ensure the University's commitment to the ESMP implementation

REA-PMU

- Provide technical support to the University in selecting sufficient and suitable land for construction of power plant and training center
- Appoint an EPC contractor
- Supervise the activities of the EPC contractor
- Review the ESMP from the consultant
- Ensure REA's commitment to the ESMP implementation

FUGA Site Engineer

- Attend adequate training on ESMP implementation
- Supervise the activities of the EPC contractor and ensure compliance ESMP with mitigation measures
- Report to FUGA Director of Physical Planning on ESMP compliance and non-compliance issues

EPC Contractor

- Familiarize with ESMP requirements
- Ensure that all personnel are made aware of the management measures/plans that are to be implemented
- Report to the REA-PMU and FUGA Site Engineer on ESMP compliance and non-compliance issues
- Implement ESMP requirements relevant to work being undertaken

7.4.2 Construction Phase

The key personnel and institutions with major roles in the implementation of the ESMP during construction phase are:

FUGA Director of Physical Planning

- Supervise the activities of the Site Engineer by reviewing reports on ESMP issues
- Suggest ESMP improvements to REA-PMU to address non-compliance and upcoming issues

REA-PMU

- Supervise the activities of the EPC contractor by reviewing reports on ESMP issues
- Discuss ESMP improvements with FUGA Director of Physical Planning to address non-compliance and upcoming issues.
- Monitors the implementation of the ESMP

FUGA Site Engineer

- Supervise the activities of the EPC contractor and ensure compliance ESMP with mitigation measures
- Report to FUGA Director of Physical Planning on ESMP compliance and non-compliance issues

EPC Contractor

- Implement ESMP requirements relevant to work being undertaken
- Hire a Gender/GBV officer
- Report to the REA-PMU and FUGA Site Engineer on ESMP compliance and non-compliance issues

FMEnv Representatives

- Monitor the implementation of ESMP requirements (impact mitigation monitoring) relevant to work being undertaken
- Discuss ESMP improvements with FUGA Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

Yobe State Ministry of Women Affairs and Social Development; and GBV/SEA Service Provider

- Monitor the implementation of Gender mitigation measures relevant to work being undertaken
- Discuss ESMP improvements with the Gender/GBV officer, FUGA Director of Physical Planning, and REA-PMU to address non-compliance and upcoming issues

Yobe State Ministry of Environment Representatives

- Monitor the implementation of ESMP requirements (impact-mitigation monitoring) relevant to work being undertaken
- Discuss ESMP improvements with FUGA Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

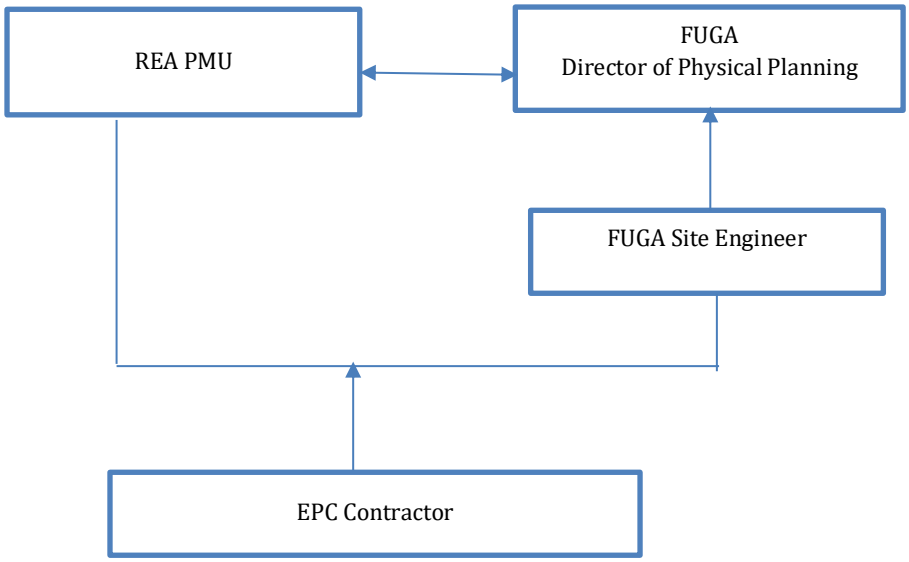

Figure 7.1: Roles and Responsibilities for the Pre-Construction and Construction Phase

7.4.3 Operational Phase

FUGA Director of Physical Planning

- Supervise the activities of the Site Engineer by reviewing reports on ESMP issues
- Suggest ESMP improvements to O&M Contractor and REA-PMU to address non-compliance and upcoming issues

REA-PMU

- Appoint an O&M Contractor
- Supervise the activities of the O&M Contractor by reviewing reports on ESMP issues
- Discuss ESMP improvements with FUGA Director of Physical Planning to address non-compliance and upcoming issues

FUGA Site Engineer

- Supervise the activities of the O&M Contractor and ensure compliance ESMP with mitigation measures
- Report to FUGA Director of Physical Planning on ESMP compliance and non-compliance issues

O&M Contractor

- Implement ESMP requirements relevant to work being undertaken
- Report to the REA-PMU and FUGA Site Engineer on ESMP compliance and non-compliance issues

FMEnv Representatives

- Monitor the implementation of ESMP requirements (environmental compliance monitoring) relevant to work being undertaken
- Discuss ESMP improvements with O&M Contractor, FUGA Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

NESREA Representatives

- Monitor the implementation of ESMP requirements (environmental compliance monitoring) relevant to work being undertaken
- Discuss ESMP improvements with FUGA Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

Yobe State Ministry of Women Affairs and Social Development; and GBV/SEA Service Provider

- Monitor the implementation of Gender mitigation measures relevant to work being undertaken
- Discuss ESMP improvements with the Gender/GBV officer, FUGA Director of Physical Planning, and REA-PMU to address non-compliance and upcoming issues

Yobe State Ministry of Environment Representatives

- Monitor the implementation of ESMP requirements (environmental compliance monitoring) relevant to work being undertaken
- Discuss ESMP improvements with O&M Contractor, FUGA Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

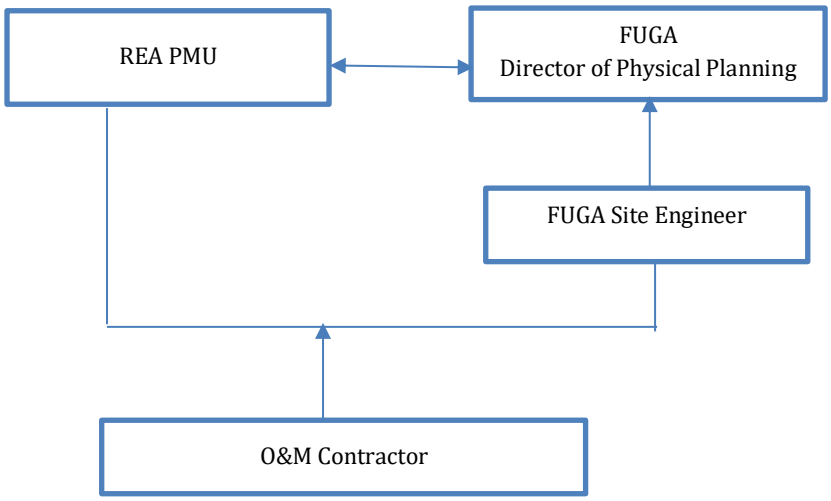

Figure 7.2: Roles and Responsibilities for the Operational Phase

7.5 Additional Management Plans

This section provides a framework for the contents of additional management plans to be developed and implemented, in support of this ESMP, for the proposed Project. As the Project progresses, the management plans will be expanded to include specific procedures to guide implementation by the relevant Project personnel including contractor and subcontractors.

The documents will be prepared strictly in line with the requirements set out in the relevant international standards and guidelines such as the World Bank General EHS Guidelines as well as other applicable national and local regulations and guidelines.

7.5.1 Stakeholder Engagement Plan

A Stakeholder Engagement Plan (SEP) shall be developed and implemented throughout the lifecycle of the proposed Project. The objectives of developing SEP for the proposed Project include the following:

- Ensuring stakeholder inclusion and involvement across the various phases of the project;
- Ensuring clarity and understanding through an open, inclusive and transparent process of culturally appropriate engagement and communication undertaken to ensure that stakeholders are well informed about the proposed Project;
- Building and maintaining productive relationship between REA and its various stakeholders through supporting open dialogue;
- Engaging vulnerable groups through an open and inclusive approach to consultation, thereby increasing the opportunity for stakeholders to provide comment and voice their concerns on the proposed Project;

- Managing expectations to ensure that the proposed Project does not create or allow unrealistic expectations to develop amongst stakeholders about proposed Project benefits. The engagement process will serve as a mechanism for understanding and managing stakeholder and community expectations, where the latter will be achieved by disseminating accurate information in an accessible way.
- Ensuring compliance with both local regulatory requirements and international best practice.
- Ensuring stakeholders are free of external manipulation or coercion.

REA is committed to implementing stakeholder management as part of its operations. As such REA will ensure that the responsibility for implementing the SEP is duly assigned and all components of the plan are well-defined within its organizational processes. REA shall also commit to providing the necessary support to implement the SEP.

In line with the Environmental and Social Management framework (ESMF) for NEP, an effective SEP should:

- ❖ Describe regulatory, lender, company, and/or other requirements for consultation and disclosure.
- ❖ Identify and prioritize key stakeholder groups, focusing on Affected Communities.
- ❖ Provide a strategy and timetable for sharing information and consulting with each of these groups.
- ❖ Describe resources and responsibilities for implementing stakeholder engagement activities.
- ❖ Describe how stakeholder engagement activities will be incorporated into a company's management system.

A sample SEP is outlined in the Environmental and Social Management framework (ESMF) for NEP (NEP ESMF, 2019).

7.5.1.1 Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) has been developed for NEP. The proposed solar-hybrid power plant and associated infrastructure in FUGA is part of the NEP. The GRM provides a framework for addressing Project-related complaints, including logging, tracking, and grievances resolution. The GRM will be communicated to all stakeholders in the course of Project development and implementation and will make publicly available a record documenting the responses to all grievances received. The GRM shall be maintained throughout the project life cycle.

7.5.2 Emergency Preparedness and Response Plan (EPRP)

An Emergency Preparedness and Response Plan (EPRP) shall be developed and implemented for the proposed Power Plant. As part of the EPRP, the fire protection system for the Project will be designed to meet the requirements of the local fire codes under the National Fire Protection Association. Also, the grounding and lightning strike protection systems for the Project shall be installed in a manner that will limit the effect of ground potential gradients to such voltage and current levels that will not endanger the safety of people or equipment under normal and fault conditions. Lightning arrestors and surge protectors shall also be installed with the grounding systems to protect electronic equipment by absorbing electrical surges in the event of lightning strikes.

The EPRP shall include procedures for addressing all reasonably foreseeable and possible emergencies such as: fire, spill or release of hazardous wastes, medical and weather-related emergencies (e.g. lightning strikes). It shall address the following aspects, amongst others:

- Identification of the emergency scenarios and the development of appropriate and specific emergency response procedures for each scenario;
- Training of emergency response teams on the appropriate procedures and the use of emergency response equipment;
- Identification of emergency contacts and support services and the development of effective communication systems / protocols;
- Emergency equipment and facilities must be provided (e.g., first aid stations, fire-fighting equipment, personal protective equipment);
- Development of decontamination / clean-up procedures and identify critical remedial measures to contain, limit and reduce pollution;
- Identification of potential risk relating the uncontrolled release of hazardous materials and the preparation of a spill prevention, control, and response plans including:
    - Training of operators on spill prevention.
    - Implementation of inspection programmes to confirm the integrity of secondary containment structures and equipment.
    - Development of standard operating procedures for filling containers or equipment and the transfer of hazardous materials.
    - Identification and availability of the appropriate personal protective equipment and equipment.

7.5.3 Traffic Management Plan (TMP)

The purpose of this plan is to adopt best transport safety practices across all the aspects of the Project (especially at the construction phase) with the goal of preventing traffic accidents and minimizing injuries suffered by Project personnel and the public. The measures to be included in the TMP should include the

following, amongst others:

- Emphasizing safety aspects among drivers;
- Improving driving skills and requiring licensing of drivers;
- Adopting limits for trip duration and arranging driver rosters to avoid overtiredness;
- Avoiding dangerous routes and times of day to reduce the risk of accidents;

7.5.4 Waste Management Plan (WMP)

The primary purpose of the WMP is to ensure that wastes (hazardous/non-hazardous) are avoided or minimized, and any wastes that are generated are properly managed and disposed in an environmentally sound manner. The waste management hierarchy is expressed as follows:

- Prevention: avoid waste generation;
- Reduction at source - minimization of waste generation through installation of pollution abatement equipment;
- Reuse - Using an item for its original purpose, or similar purpose, in its original form;
- Recycling – conversion of waste materials into reusable objects;
- Disposal - disposal of wastes in an environmentally sound manner.

7.5.5 Occupational Health and Safety (OHS) Plan

The OHS plan must include the following elements, amongst others:

- Identification of potential hazards and development of responses to eliminate sources of risk or minimize workers' exposure to hazards;
- Provision of Personal Protective Equipment (PPE) to workers at no cost;
- Provision of training to all workers on all relevant aspects of occupational health and safety issues associated with their daily work, including emergency arrangements;
- Third parties (visitors and external service providers) must be briefed on the relevant aspects of health and safety and emergency response when accessing the site premises;

7.5.6 Local and Employment Management Plan (LEMP)

The LEMP should aim to promote employment opportunities and training for local people in the Project's area of influence and include, amongst others:

- Targets for employing local labour;
- Targets for work experience opportunities;
- Notification of all employment and training opportunities prior to them being advertised elsewhere;

- Measures to provide verifiable monitoring information regarding training and employment. The training status for all workers must be recorded;

7.5.7 Erosion Control Management Plan

This Plan should aim to control soil erosion in the Project area. The timing of works and the installation of control measures has a major influence on the management of storm water. The Plan should include the following measures, amongst others:

- Clearing of only those areas necessary for construction works shall be ensured.
- Slopes of all cut and fill areas shall be rigorously controlled and will at no time be allowed to be greater than the slope established in the final design;
- Piles of soil or other materials shall be allowed for short periods of time and will be located only in flat areas and away from any storm water courses;
- Temporary protection of exposed soil surfaces with measures such as plastic film, bio-membranes or other means, will be implemented whenever necessary;

7.5.8 Water Conservation Plan

The Plan will address the appropriateness of water conservation, and efficient use of groundwater for construction activities and cleaning of PV panels during the operational phase of the Project.

7.5.9 EEP Gender-Based Violence (GBV) Action Plan

The EEP GBV action plan shall be implemented throughout the project lifecycle. The components of the plan include:

- A GBV risk assessment; which has been conducted as part of the ESIA.
- Integration of GBV risk management in the ESMP.
- REA-PMU shall define GBV requirements in the contractor bid documents including the hiring of a Gender/GBV officer.
- REA-PMU shall evaluate GBV response protocol of the contractors before finalizing engagement contract.
- Contractors shall ensure that there are GBV-sensitive channels for reporting in GRM.
- Contractors shall inform Project affected communities about GBV risks.
- Contractors shall ensure code of conducts (CoC) forms are signed and understood by all workers. Workers shall be trained on CoC including regular training and refreshers
- Contractors shall ensure separate facilities for men and women and install GBV-free signage at the Project site.

Timely implementation of the EEP GBV action plan shall reduce GBV/SEA risks that may arise during Project development and operation.

7.5.10 Summary of Additional Management Plans

Table 7.5 summarizes the additional management plans required for the Project, including the cost estimate for developing each of the plans.

Table 7.5: Additional Management Plans and Timing for Development

S/N	Plan	Timing for Development	Cost Estimates (US Dollars)
1.	Emergency Preparedness and Response Plan	Pre-construction	2000
2.	Traffic Management Plan	Pre-construction	2000
3.	Waste Management Plan	Pre-construction	3000
4.	Occupational Health and Safety	Pre-construction	2000
5.	Local and Employment Management Plan	Pre-construction	1500
6.	Erosion and Sediment Control Plan	Pre-construction	2000
7.	Water Conservation Plan	Pre-construction	1000
8.	EEP Gender Action Plan	Pre-construction	2,000
Total			15,500

7.6 Environmental Monitoring Programme

Monitoring shall be conducted to ensure compliance with regulatory requirements as well as to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts. Table 7.6 summarizes the environmental monitoring programme for the Project.

Table 7.6: Environmental Monitoring Programme for the proposed Project

Environmental Components/ Matrix	Sampling Locations	Sampling Method	Environmental/ Social Parameters to be monitored	Compliance Requirement	Frequency of Monitoring	Responsible Party	Project Development Phase	Estimated Cost (US Dollars)
Atmosphere (Air Quality & Noise)	• Project Site • Power evacuation route	• Air Quality Monitoring Equipment • Sound level meter	TSP, CO, NO_X, SO_X, Noise Level (dBA)	FMEnv/ WHO/ World Bank	Monthly monitoring; Monthly reporting	EPC Contractor	• Construction Phase	1000
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, pH, salinity, TDS, conductivity, DO, BOD, TOC, COD, NO_3, PO_4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO	Quarterly monitoring and reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	4000
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO_3, PO_4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ World Bank	Quarterly monitoring and reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	4000
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste tracking documentation.	Operational solid wastes including used packaging waste.	FMEnv/NESREA/ World Bank	Monthly monitoring; Quarterly reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	2000
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/NESREA/ World Bank	Daily monitoring; Quarterly reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	2000
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/NESREA/ World Bank	Quarterly monitoring and reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	2000
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/NESREA/ World Bank	Daily monitoring; Quarterly reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	2000
Stakeholder Engagement	• Local community • Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/NESREA/ World Bank	Quarterly monitoring and reporting	EPC Contractor REA Project Manager	• Construction Phase • Operations Phase	2000

7.7 Training, Awareness and Capacity Building

REA shall identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environmental or social conditions. The Project recognizes that it is important that employees at each relevant phase of the Project are aware of the potential impacts of their activities; and roles and responsibilities in achieving conformance with the management measures documented in this ESMP. This will be achieved through a formal training process.

In addition, training for local community on general environmental awareness and ESMP mitigation measures pertaining to community health, safety and security shall as be provided as indicated in Table 7.7.

Table 7.7: Institutional Capacity Strengthening Plan

Target Audience	Training Overview	Cost Estimates (US Dollars)
Site Engineer, REA-Project Manager, EPC contractor and their sub-contractors, O&M contractor	In-depth understanding of the mitigation measures proffered by the EMP. Training on implementation of all emergency response procedures; training on Health, Environment, Safety, and Security Management Plan	2000
Local community	General environmental awareness and mitigation measures proffered by the ESMP pertaining to community health, safety and security.	1000
Total		**3000**

7.8 Implementation Schedule and Reporting

The implementation of the ESMP will take place from the planning stages to ensure quality equipment and support services is sourced, through construction, commissioning, operation to decommissioning phases. Once monitoring of the ESMP begins the officers responsible will report all issues identified to respective authorities in REA and corrective/ remedial actions taken without delay to ensure optimal performance of the Project while promoting environmental sustainability.

Also, REA shall keep the regulatory authorities (FMEnv, NESREA, Yobe State Ministry of Environment) informed of the Project performance with respect to E&S related matters through reports that will be made available to the regulators when required. REA will provide appropriate documentation of HSE related activities, including internal inspection records, training records, and reports to the relevant authorities.

7.9 ESMP Costing

Table 7.8 provides the summary of cost estimate required to effective and efficiently implement the recommended mitigation measures and management plans required to address the potential and associated impacts of the proposed Project.

Table 7.8: ESMP Costing

S/N	Fundamental ESMP Activities	Cost Estimates (US Dollars)
1.	Pre-construction phase E&S management activities	3,000
	Construction phase E&S management activities	14,700
	Commissioning phase E&S management activities	700
	Operational phase E&S management activities	10,000
2.	Preparation of additional management plans	15,500
3.	Institutional Capacity Strengthening Plan	3,000
4.	Monitoring and Evaluation Programme	19,000
Total		**65,900**

CHAPTER EIGHT:

REMEDIATION PLAN AFTER DECOMMISSIONING / CLOSURE

CHAPTER EIGHT

REMEDIATION PLAN AFTER DECOMMISSIONING / CLOSURE

8.1 Introduction

This chapter discusses the activities associated with the decommissioning of the proposed Project, including the potential impacts associated with the decommissioning activities as well as the environmental and social measures to address the issues. In addition, the overview of remediation plan after the decommissioning/closure of the Project is provided.

8.2 Decommissioning Activities

Decommissioning refers to the process of removing all the operating assets of a project after completion of its life cycle. The average life span of the solar-hybrid Photovoltaic (PV) power plant to be provided as part of the proposed Project is 25 years (which can be extended through regular maintenance) while the training centre can last for 40 years or more. Even after the 25 years, the PV panels can still generate up to 90 % of the design capacity.

The decommissioning activities will typically include the following:

- Dismantling and removal of PV panels and associated infrastructure (mounting structure, power evacuation cable, inverters, transformers, batteries, etc.);
- Removal of any sub-surface installations (e.g. underground cables);
- Waste generation and management;
- Rehabilitation of any impacted environmental component (e.g. soil).

8.3 Management of Decommissioning Activities

In the event of decommissioning, REA, in conjunction with the leadership of FUGA, shall ensure that the Project site is left in a safe and environmentally acceptable condition. A standard decommissioning, abandonment and closure programme shall be invoked. The tasks will include, amongst others:

- Evacuation of the dismantled PV panels and other related items (such as inverters, and control devices) to the manufacturers for recycling.
- Transportation of spent batteries to recycling facilities;
- Restoration of the Project site to baseline conditions (as much as practicable) in line with legislative and regulatory requirements.
- Assessing the residual impact, if any, the project has on the environment.

- Monitoring the abandoned project environment as necessary.

Decommissioning activities will only begin after due consultation with the relevant stakeholders including the regulatory authorities. The decommissioning activities shall be carried out in line with the relevant provisions of the National Guidelines for Decommissioning of Facilities in Nigeria (2017) issued by the FMEnv.

Typically, the following actions shall be undertaken for decommissioning:

- An updated plan which takes into account the most cost-effective and best practicable methods, legal requirements and industry practices at that time for the facility decommissioning shall be developed and submitted to the FMEnv and other relevant regulatory authorities for approval. The plan shall include, but not limited to the following:
    - Description of the site and components to be decommissioned.
    - Description of the decommissioning scope, objectives, end state and strategy;
    - Activities to be performed during the decommissioning;
    - Schedule of decommissioning activities;
    - Estimate of the decommissioning cost;
    - Estimated inventory of waste streams to be generated during the decommissioning and handling techniques;
    - Decommissioning team (qualifications, roles and responsibilities)
- To ensure that due consideration is given to all options a detailed evaluation of facility decommissioning options shall be carried out. The options will include facility mothballing, partial facility decommissioning or complete site decommissioning. The evaluation will consider environmental issues in conjunction with technical, safety and cost implications to establish the best practicable environment friendly options for the Project decommissioning.
- A risk assessment shall be conducted to ensure that nothing, which could be constituted as a hazard for other users of the site or for the environment in general, will be left at the site. The Project site shall be left in a safe and environmentally acceptable condition.
- Hazard identification and analysis shall be conducted to determine special safety concerns to be addressed.
- An appropriate Health, Safety and Environment (HSE) plan shall be implemented to ensure that the decommissioning activities are carried out in an environmentally sound manner and in conformity with relevant laws and regulations guiding such operations
- Third party notifications shall be carried out before any demolition and shall be conducted in a phased sequence.

- Socio-economic considerations of facility decommissioning shall be carried out. These will include assessment of potential effects associated with termination of employment (at the end of operational phase) and the measures to minimize the effects by:
    - Ensuring that employees are fully informed about the decommissioning and how it will affect them before the project finally closes.
    - Building community capacity to manage opportunities and impacts arising from the decommissioning and post-decommissioning phase of the Project.
    - Providing training to build local skills tailored to project decommissioning and post-decommissioning activities (e.g. equipment dismantling, rehabilitation activities, monitoring, etc.).
    - Providing training to transfer project-learned skills to alternative and secondary industries tailored to respond to market economy.
- An effective waste management plan shall be developed for the decommissioning activities. The decommissioning options for redundant structures and equipment will include: the complete dismantling of structures and equipment and the return of all components to the equipment manufacturer for recycling. A detailed record of all suitable recycling materials shall be maintained.

The environmental and social management measures for the identified potential impacts of the decommissioning activities are presented in Table 8.1.

8.3.1 Used Battery Management at Decommissioning Phase

Lithium-ion batteries that have reached the end of their life spans are classified as hazardous waste. The used batteries decommissioned from the power plant shall be packed separately from other materials. Damaged batteries in a critical stage, in particular, require special expertise in handling, as they can be flammable. Currently, Lithium-ion battery recycling in Nigeria is at the infancy stage as most local recycling companies specialize in recycling lead-acid batteries. This presents a challenge to the recycling of used batteries locally. Therefore, the Extended Producer Responsibility (EPR) policy shall be adopted for the project. It includes the take-back, recycling and final disposal of the product including its packaging. The manufacturers / suppliers of the batteries shall be responsible for the recycling and safe disposal of the used batteries. The costs of recycling and disposal will be internalized in the price of the batteries or take-back agreements will be provided. During decommissioning activities, the batteries shall be removed, discharged, and packaged according to the manufacturer / supplier's instructions before transportation to the endpoint.

Conversely, the University shall be encouraged to develop end-of-life management plans for the batteries and other electrical components. The plan shall include the development of procedures for safe handling, storage, and transport of the used batteries generated during Project operations. Also, procedures for identification and engagement of NESREA-certified battery recycling companies based in Nigeria shall be developed and implemented for the Project.

8.4 Abandonment Plan

Prior to site abandonment, REA shall establish a standard procedure for incorporating the following practices:

- Identification of the components of the Project that will be abandoned and/or removed;
- The proposed methods for abandonment or re-use of the Project equipment/material applicable;
- Processes put in place to mitigate potential environmental impacts associated with the abandonment process; and
- Appropriate site rehabilitation programs (including re-vegetation of the site with native plant species) to return the Project site to its original status (as much as possible).

The decommissioning, abandonment and/or closure programme shall generally be managed by a team of competent personnel from REA-Project Management Unit, the Department of Works and Physical Planning in FUGA, the Federal Ministry of Environment and the Yobe State Ministry of Environment. A close out report shall be prepared and archived for future reference.

8.5 Roles, Responsibilities and Accountabilities for Decommissioning Phase

The key personnel and institutions with major roles in the implementation and monitoring of environmental and social measures for the Project decommissioning/closure are as follows:

<u>Contractor(s) Engaged for Decommissioning Activities</u>

- Implement environmental and social measures and management actions put in place for the decommissioning activities.

<u>REA-PMU</u>

- Supervise the activities of the contractor(s) engaged for decommissioning purpose by ensuring that the recommended environmental and social measures and management actions are implemented.

- Discuss environmental and social management plan improvements with the Director of Works and Physical Planning Department in FUGA to address non-compliance and upcoming issues.

FUGA Site Engineer/Manager

- Directly monitor the activities of the contractor(s) engaged for decommissioning and ensure compliance to the implementation of environmental and social measures and management actions put in place to address potential impacts and risks associated with the decommissioning activities.
- Report to the Director of Works and Physical Planning Department in FUGA on contractor's performance regarding the implementation of environmental and social measures.

Director of Works and Physical Planning Department in FUGA

- Jointly supervise the activities of the contractor(s) engaged for decommissioning
- Suggest environmental and social management plan improvements to REA-PMU to address non-compliance issues and upcoming issues.

FMEnv/Yobe State Ministry of Environment Representatives

- Approve the decommissioning plan for the Project.
- Monitor the implementation of environmental and social measures and management actions documented in the decommissioning plan.
- Discuss environmental and social management plan improvements to REA-PMU to address non-compliance issues and upcoming issues.

Table 8.1: Environmental and Social Management Measures for Decommissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Removal of PV panels, batteries and inverters; demolition of buildings and associated facilities							
Soil contamination due to waste generation; soil compaction;	Excavation works shall not be executed under aggressive weather conditions.	Inspection	Daily	Adherence to measures	Contractor(s) engaged for facility decommissioning	REA-PMU FUGA (Site Manager and Director of Works and Physical Planning)	5000
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion	Inspection	Daily	Adherence to measures			
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment (bund wall). Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily	Adherence to measures World Bank General EHS Guidelines			
	PV panels, batteries and inverters shall be collected and returned to the manufacturer for recycling. The take-back scheme shall be based on the EPR model.	Consignment notes for batteries to recycling plants	Daily	World Bank General EHS Guidelines			
	All impacted soil area	Inspection	Daily	Re-vegetated land			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	shall be re-vegetated with native plant species						
	A decommissioning plan approved by the relevant regulatory authorities shall be developed and implemented.	Implementation records of decommissioning plan	Daily	Benchmarks in decommissioning plan			
Air quality impact; increase in dust level.	Dust suppression measures shall be implemented.	Inspection	Daily	Adherence to measures	Contractor(s) engaged for facility decommissioning	REA-PMU FUGA (Site Manager and Director of Works and Physical Planning)	1000
	Decommissioning equipment shall be properly serviced and maintained.	Inspection; Maintenance records	Before commencement of decommissioning activities	Adherence to measures			
Discomforting noise from decommission-ing equipment and related activities	Noise suppression equipment (e.g. mufflers) shall be fitted on decommissioning equipment / machinery.	Inspection	Daily	Adherence to measures	Contractor(s) engaged for facility decommissioning	REA-PMU FUGA (Site Manager and Director of Works and Physical Planning) FMEnv Yobe State Ministry of Environment	2000
	Decommissioning activities shall be limited to day-time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily	Adherence to measures			
	Equipment shall be turned off when not in use.	Inspection	Daily	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Equipment shall be properly maintained and serviced.	Inspection; Maintenance records	Once before commencement	Adherence to measures			
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly	World Bank Good Practice Note on Addressing Grievances			
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly	FMEnv Noise limit World Bank Noise Limit			
Groundwater and surface water contamination due to waste generation	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement	Certificates of completion of trainings	Contractor(s) engaged for facility decommissioning	REA-PMU FUGA (Site Manager and Director of Works and Physical Planning) FMEnv Yobe State Ministry of Environment	1500
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily	Adherence to measures World Bank General EHS Guidelines			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Waste Management Plan shall be implemented.	WMP implementation records	Daily	Benchmarks stated in WMP World Bank General EHS Guidelines			
Traffic due to transportation of dismantled equipment and materials from site including wastes	TMP shall be implemented.	TMP implementation records	Daily	Benchmarks stated in the TMP	Contractor(s) engaged for facility decommissioning	REA-PMU FUGA (Site Manager and Director of Works and Physical Planning) FMEnv Yobe State Ministry of Environment	2500
	Appropriate barriers and signage shall be provided to demarcate areas in which traffic is active.	Safety signs and barriers	Once before commencement	Adherence to measures			
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement	Passing of competency assessment or training completion certificates			
	A procedure for recording all decommissioning related traffic incidents/accidents shall be developed and implemented. This will include date/time, location, reason for accident, corrective measures, etc.	Incident forms	Daily	Completed incident forms			
	The EPC contractor shall	Incident forms,	Daily	Completed	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	promptly repair damage to public infrastructure and repair or compensate for damage to private property.	GRM	during decommissioning phase	incident forms			
Exposure to injuries, electrical shock, slip, trip and fall	All workers involved in the decommissioning activities shall be sensitized and monitored on the need to be safety conscious. Daily toolbox talks prior to commencement of work activities shall be carried out.	Daily toolbox records	Daily	Benchmarks stated in Health and Safety Plan	Contractor(s) engaged for facility decommissioning	REA-PMU FUGA (Site Manager and Director of Works and Physical Planning) FMEnv Yobe State Ministry of Environment	2500
	Appropriate PPE shall be provided for workers.	Availability of PPE	Daily	PPE compliance			
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement	Adherence to measures			
	Health and safety plans shall be implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan			

CHAPTER NINE:

CONCLUSION AND RECOMMENDATIONS

CHAPTER NINE

CONCLUSION AND RECOMMENDATIONS

9.1 Conclusion

The ESIA of the proposed 2.5 MW solar-hybrid power plant and associated infrastructure in FUGA, under the EEP Phase II, has been conducted in accordance with the relevant requirements of the FMEnv guidelines and the applicable World Bank Safeguard Policies, specifically the Operational Policy 4.01 triggered by the proposed Project.

The ESIA study consists of a number of key steps including: desktop review, scoping, consultations with relevant stakeholders including relevant government authorities and potentially affected community in the Project's area of influence, field data gathering, laboratory analysis of field samples, potential impact identification and evaluation, development of mitigation measures and environmental management plan, report writing and disclosure.

The essence of the ESIA process is aimed at ensuring informed decision-making and environmental accountability, and to assist in achieving environmentally sound operation and social acceptance throughout the life cycle of the proposed Project.

Consistent with the regulatory standards, the assessment of the environmental status and the socio-economic aspects of the proposed Project's area of influence have been carefully carried out using accepted scientific methodology. Evaluation of associated and potential impacts of the proposed Project identified both positive and negative interactions with the receiving biophysical and socio-economic environment.

The positive impacts associated with the Project include:

- Stimulation of academic and research activities within the University as a result of access to constant and reliable power supply, thereby promoting educational advancement.
- Reduction in fossil fuel consumption by the University thereby leading to reduction in carbon emissions and improvement in eco-balance.
- Significant reduction in the cost of power generation by the University through diesel-fuelled generators. Such savings would be used for other undertakings that will benefit the University.
- Increase in social interactions within the University. There will be enhanced security in the University as a result of more streetlights for illumination which would help keep off opportunistic crimes and gender-based violence.

- Enhancement of learning in renewable energy leading to certification as a result of training centre to be provided as part of the Project.
- Improvement in livelihood enhancing activities within the University.
- Direct and indirect employment opportunities during Project development and operation. The employment opportunities will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects.
- Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
- Increase in financial and technical collaborations between the FGN, the University, REA, World Bank and other relevant Ministries, Departments and Agencies (MDAs).
- Contribution to the Nigeria's NDC to cut carbon emission by 20 % to 30 % by the year 2030, under the Paris Agreement.

The identified negative impacts of the proposed Project were mostly of minor to moderate significance, and they are largely site-specific and localized. The preferred site for the proposed Project within the University campus does not trigger any physical and economic displacement and relocation. In addition, there are no cultural resources within and around the Project site that would be affected during the Project development and operation. The identified potential negative impacts include:

- Decreased in ambient air quality due to construction and decommissioning activities.
- Increase in ambient noise level due to construction and decommissioning activities.
- Decrease in soil quality due to improper management of generated wastes during construction, operation and decommissioning.
- Minimal loss of terrestrial flora species (largely grasses) during site preparation for construction activities.
- Environmental nuisance due to improper disposal of e-waste including spent/damaged batteries.
- Influx of potential job seekers during construction which could pose indirect impacts on the nearby local community.
- Occupational health and safety issues during construction, operation and decommissioning.

Based on the nature and extent of the proposed Project and the findings of the ESIA study, it is believed that the potential negative impacts associated with the proposed Project can be mitigated to as low as reasonably practicable through the implementation of the proffered mitigation measures documented in Chapter 6 of this report, while the positive impacts can also be enhanced. In addition, an ESMP

has been established (refer to Chapter 7 of this report) to assess the efficiency and effectiveness of the recommended mitigation measures and ensure long-term monitoring of the Project.

9.2 Recommendations

The ESIA study recommends the following:

1 The REA, through its Project Management Unit (PMU), as well as the leadership of FUGA, through its Department of Works and Physical Planning, shall ensure that the proposed Project is developed and operated in an environmentally sustainable manner by properly managing the processes / activities that may bring about disturbances to the environment through the implementation of the recommended mitigation measures and the ESMP.
2 Continuous monitoring of environmental and social performance of the Project shall be ensured, including periodic consultation with the relevant regulatory authorities, the potentially affected community, and other relevant stakeholders throughout the Project life cycle.
3 Implementation of the Project's Stakeholder Engagement Plan (including grievance redress mechanism) shall be maintained.

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APPENDICES

APPENDIX 4.1

Biophysical Baseline Results

Appendix 4.1a – Concentration of ambient air quality and noise level in the Project's AoI

Sampling Code	TSP	NO_2	SO_2	VOC	CO_2	CO	CH_4	H_2S	Noise (dBA)
	(mg/m^3)								
	Within the Project site								
A1	0.082	0.029	0.003	BDL	1806	BDL	BDL	BDL	46.3
A2	0.069	0.062	0.001	BDL	1490	BDL	BDL	BDL	44.7
A3	0.064	0.011	0.003	BDL	1134	BDL	BDL	BDL	43.5
A4	0.073	0.105	0.003	BDL	1892	BDL	BDL	BDL	47.1
Within 1km AoI radius									
A5	0.063	0.047	0.004	BDL	1797	BDL	BDL	BDL	49.9
A6	0.062	0.019	0.004	BDL	1201	BDL	BDL	BDL	48.2
Control/Buffer area									
A7	0.059	0.025	0.002	BDL	1329	BDL	BDL	BDL	49.3
A8	0.099	0.071	0.004	BDL	1412	BDL	BDL	BDL	51.7

Source: EnvAccord Field Survey, 2019. BDL= Below Detection Limit (VOC = 0.1; CH_4, = 0.01; CO = 0.1; H_2S = 0.01)

Appendix 4.1b – Results of laboratory analysis of soil samples from the project area

Physico-chemical and microbial parameters in soil samples from the study area (Top soil: 0-15 cm)

Sample ID	Within the project site				Within 1km AoI radius		Control/Buffer area		Limits - Alloway (1991); Allen *et al* (1974)
	S01	S02	S03	S04	S05	S06	S07	S08	
pH	6.80	6.90	6.56	7.50	6.45	6.55	7.06	6.55	-
Conductivity µS/cm	137.00	101.00	104.00	220.00	107.00	121.00	121.00	98.00	-
TOC %	1.68	1.48	1.18	2.34	0.99	1.87	2.15	1.47	-
Moisture Content %	3.44	2.42	2.85	2.57	3.66	4.09	5.21	3.68	-
Chloride mg/Kg	12.494	7.493	18.740	13.244	14.493	14.993	14.743	16.242	-
Nitrate mg/Kg	0.035	0.101	0.126	0.056	0.149	0.149	0.153	0.104	-
Sulphate mg/Kg	25.431	30.775	23.825	21.993	23.011	25.891	17.399	19.553	-
Phosphate mg/Kg	0.300	0.290	0.410	0.090	0.000	0.120	0.000	0.160	-
Carbonate mg/Kg	3.20	3.44	4.10	2.20	3.40	4.00	3.33	3.00	-
Cu mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5-500
Pb mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2-20
Zn mg/Kg	0.251	0.143	2.370	1.025	0.396	0.102	0.089	0.101	10-50
Cd mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03-0.30
Cr mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Ni mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5-500
Fe mg/Kg	113.72	118.20	76.11	109.65	75.61	117.38	89.40	128.47	NS
Ca mg/Kg	17.75	29.64	36.03	43.40	31.22	42.71	32.05	11.20	-
Mg mg/Kg	1.06	3.63	1.22	3.05	2.45	1.15	2.88	2.51	-
Na mg/Kg	126.53	149.41	115.60	141.87	120.56	85.66	107.94	108.15	-
K mg/Kg	18.71	20.49	26.07	13.06	13.69	13.59	9.71	16.09	-
Sand %	16.47	14.68	23.17	22.56	23.51	17.59	14.96	18.54	-
Silt %	13.15	13.17	14.81	14.42	12.52	12.36	18.74	16.95	-
Clay %	70.38	72.15	62.02	63.03	63.97	70.05	66.30	64.50	-
Oil and Grease	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Total Heterotrophic Bacteria cfu/g	$2.40X10^6$	$4.0X10^5$	$2.0X10^7$	$2.0X10^7$	$4.0X10^7$	$3.0X10^6$	$4.0X10^6$	$4.4X10^5$	-
Total Heterotrophic Fungi cfu/g	$6.8X10^3$	$2.0X10^6$	$2.0X10^5$	$4.0X10^3$	$2.20X10^5$	$5.0X10^3$	$3.0X10^5$	$4.0X10^4$	-
Total Coliform cfu/g	$2.4X10^4$	$4.2X10^4$	$2.1X10^5$	$3.2X10^4$	$3.0X10^3$	$2.0X10^3$	$2.0X10^5$	$1.0X10^5$	
Hydrocarbon Utilizing Bacteria cfu/g	$1.6X10^2$	$3.0X10^1$	$2.4X10^2$	$6.8X10^2$	$6.8X10^2$	$1.8X10^2$	$3.0X10^2$	$2.80X10^1$	-
Hydrocarbon Utilizing Fungi cfu/ml	$2.0X10^1$	$4.0X10^1$	$1.9X10^2$	$2.0X10^3$	$2.0X10^1$	$2.0X10^1$	$2.0X10^2$	$2.0X10^3$	-
% HUB	0.0067	0.0075	0.0012	0.0034	0.0017	0.0060	0.0075	0.0006	

Source: EnvAccord Field Survey, 2019

BDL= Below Detection Limit. Equipment Detection Limit = Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; oil and grease, 0.001

Physico-chemical and microbial parameters in soil samples from the study area (Sub soil: 15-30 cm)

Sample ID	Within the project site				Within 1km AoI radius		Control/Buffer area		Limits - Alloway (1991); Allen *et al* (1974)
	S01	S02	S03	S04	S05	S06	S07	S08	
pH	6.75	7.43	6.74	6.85	6.60	6.84	7.41	6.64	-
Conductivity µS/cm	118.00	116.00	121.00	195.00	113.00	110.00	109.00	102.00	-
TOC %	1.28	2.11	1.22	1.47	1.18	1.65	1.68	1.19	-
Moisture Content %	4.15	3.62	4.11	4.23	4.58	3.44	4.53	4.61	-
Chloride mg/Kg	17.491	14.493	19.990	14.493	15.742	16.242	14.993	17.491	-
Nitrate mg/Kg	0.188	0.185	0.079	0.128	0.126	0.135	0.141	0.014	-
Sulphate mg/Kg	25.061	45.711	26.191	29.291	21.692	22.795	16.188	26.398	-
Phosphate mg/Kg	0.350	0.380	0.400	0.100	0.000	0.230	0.000	0.230	-
Carbonate mg/Kg	3.15	3.36	3.90	4.07	2.19	4.24	2.74	3.50	-
Cu mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5-500
Pb mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2-20
Zn mg/Kg	0.012	0.044	2.538	0.178	0.144	0.113	0.073	0.086	10-50
Cd mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03-0.30
Cr mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Ni mg/Kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5-500
Fe mg/Kg	101.50	127.04	83.42	144.88	90.09	122.19	95.11	121.51	NS
Ca mg/Kg	20.76	37.12	48.10	45.56	39.79	40.74	38.44	31.38	-
Mg mg/Kg	1.13	2.65	1.88	2.46	2.70	1.04	2.72	2.16	-
Na mg/Kg	122.26	124.93	115.85	120.91	128.85	99.11	107.06	119.31	-
K mg/Kg	23.37	18.10	16.08	16.55	14.61	12.27	9.57	12.22	-
Sand %	16.15	17.85	18.96	23.91	15.48	16.53	16.30	11.22	-
Silt %	15.48	14.09	12.51	12.02	19.52	15.27	16.09	19.09	-
Clay %	68.37	68.07	68.53	64.07	65.00	68.19	67.60	69.69	-
Oil and Grease	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Total Heterotrophic Bacteria cfu/g	$3.40X10^6$	$5.40X10^6$	$3.0X10^6$	$4.0X10^5$	$4.0X10^6$	$3.0X10^6$	$6.6X10^6$	$3.0X10^6$	-
Total Heterotrophic Fungi cfu/g	$1.9X10^5$	$3.0X10^5$	$2.0X10^3$	$2.0X10^4$	$1.0X10^5$	$4.0X10^3$	$1.0X10^6$	$2.0X10^6$	-
Total Coliform cfu/g	$4.0X10^3$	$3.7X10^3$	$2.6X10^3$	$1.4X10^4$	$2.0X10^3$	$3.0X10^4$	$1.0X10^3$	$2.0X10^3$	
Hydrocarbon Utilizing Bacteria cfu/g	$2.90X10^2$	$3.0X10^2$	$2.3X10^2$	$2.0X10^2$	$3.5X10^2$	$1.8X10^1$	$6.8X10^2$	$6.80X10^1$	-
Hydrocarbon Utilizing Fungi cfu/ml	$5.0X10^1$	$3.0X10^1$	$1.0X10^1$	$1.0X10^1$	$1.90X10^1$	$3.0X10^1$	$3.0X10^2$	$5.0X10^3$	-
% HUB	0.0085	0.0055	0.0076	0.0005	0.0087	0.0060	0.0010	0.0023	

Source: EnvAccord Field Survey, 2019

BDL= Below Detection Limit. Equipment Detection Limit = Cu, 0.005; Pb, 0.04; Ni, 0.05; Cd, 0.01; Cr, 0.04; oil and grease, 0.001

APPENDIX 4.2

Socio-Economic Data Gathering Records

Key Informant interview guide with Low Cost Community leader

Key Informant Interview Guide for Community Leader

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for Energizing Education Programme (EEP) with this community. Your honest answers to the questions will, in no small way, assist in ensuring highly quality data.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment of Energizing Education Programme (EEP) Proposed Power Plant in this community. The study is important in order to have baseline information of your community before the full operation of the proposed power plant and any other associated facilities. Your participation in this study is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Respondent's Name: ABUBAKAR U. MURIMA

Position in Community FED. LOW-COST, ILASHA COMMUNITY LEADER.

Questions:

1. Can you provide a summary of the history of this community?
2. How did you emerge as a leader and how long have you been in this position as a community leader?
3. Can individual own and sell land in the community?
4. What are the roles assigned to women within your community?
5. How do you handle cases of ender based violence against women in your community?
6. Is there any land issues currently ongoing in the community?
7. Are there schools, hospitals, electricity, telecommunication, public and markets in the community?
8. What is the established mechanism for conflict resolution in the community?
9. What are the notable vices common about the youths of the community?

Focus Group discussion guide and attendance with men of Low Cost community

environmental accord

Focus Group Discussion Guide for Community Members
Group: Men within the host community

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for Energizing Education Programme (EEP) with this community. Your honest answers to the questions will, in no small way, assist in ensuring that we have a reliable gender disaggregated data suitable for analysing gender based issues in the community.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment of Energizing Education Programme (EEP) Proposed Power Plant in this community. The study is important in order to have baseline information of your community before the full operation of the proposed power plant and any other associated facilities. Your participation in this study is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Socio-Demographic Characteristics of Respondents

Name of Community: Low-Cost Housing Community
Name of Moderator: Abiola Bolarinwa
Date of Interview: 09 — 05 — 2019

S/N	Name	Sex	Ethnic Origin	Religion	Educational level	Marital status
1	Mohd Galkaye Akuya	m	Ngamo	Christian	M Ed Eng	Married
2	Samaila Kura	m	Bade	Muslem	Pg. Edu.	Married
3	Isa S. Ibrahim	m	✓	✓	Graduate	✓
4	ALHAJI ADAMU GAMCHO	✓	Bade	✓	B.Sc.,	✓
5	Abubakar Murima	m	Bade	✓	Graduate	✓
6	Aisha Galadima	m	Bade	✓	Graduate	✓
7	Musa S. Bizi	m	Bade	✓	B. ENG-ELECTRICAL	✓
8	SALI JAMKO	✓	✓	✓	✓	✓
9	ALHAJI GAMBO ISYAKU	✓	MANGA	✓	—	—
10	Auwalu Inusa	—	—	✓	✓	✓
11	Jamilu Adamu	✓	—	—	✓	✓
12	ISA ADAMU	✓	✓	✓	✓	✓

Focus Group discussion guide and attendance with women of Low Cost community

Focus Group Discussion Guide for Community Members

(Women living in the staff quarters)

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for Energizing Education Programme (EEP) with this community. Your honest answers to the questions will, in no small way, assist in ensuring that we have a reliable gender disaggregated data suitable for analysing gender based issues in the community.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment of Energizing Education Programme (EEP) Power Plant in this community. The study is important in order to have a baseline information of your community before the full operation of the proposed power plant and any other associated facilities. Your participation in this study is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Socio-Demographic Characteristics of Respondents

Name of Community: Low - cost
Name of Moderator: OMOTOSHO ABIOLA.
Date of Interview: 09-08-2019

S/N	Name	Sex	Ethnic Origin	Religion	Educational level	Marital status	Marital Age
	HARINA ABUBAKAR	F	BADE	MUSLIM	–	MARRIED	1983
	AISHATU ABDULLAHI	F	BADE	MUSLIM	–	MARRIED	2002
	RUKAYYA ABUBAKAR	F	KANURI	MUSLIM	–	MARRIED	2010
	SARATU GAMBARYE	F	[illegible]	CHRISTIAN	–	MARRIED	1991
	HAUWA ABUBAKAR	F	BADE	MUSLIM	UNIMAID	SINGLE	

Focus Group discussion guide and attendance with youth of Low Cost community

Focus Group Discussion Guide for Community Youths

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for Energizing Education Programme (EEP) with this community. Your honest answers to the questions will, in no small way, assist in ensuring that we have a reliable data.

Consent

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment of Energizing Education Programme (EEP) Proposed Power Plant in this community. The study is important in order to have baseline information of your community before the full operation of the proposed power plant and any other associated facilities. Your participation in this study is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Socio-Demographic Characteristics of Respondents

Name of Community: Fed low-cost community
Name of Moderator: Abiola Bolarinwa
Date of Interview: 09-05-2019.

S/N	Name	Sex	Ethnic Origin	Religion	Educational level	Marital status
1	Sheriff Muhammad	M	IGALA	Islam	Undergraduate	Single
2	Ahmad A Hassan	M	BADE	Islam	under gra.	Single
3	Abdullahi Dathatu [illegible]	M	Bade	Islam	ND undergrad	single
4	Sultan Muhammad	M	Igala	Islam	undergra	single.
5	Bashir Musa Grema	M	Bade	Islam	〃	〃
6	Aliyu Abubakar	M	Bade	Islam	ND undegrad	〃
7	Shafiu Abubakar	m	Bade	Islam	Secondary	〃
8	MUSA Ali Goni	M	Bade	Islam	Secondary	Single
9	SANI A GHUNDOM	M	Bade	Islam	Secondary	Single
10	Sadisu I. Ibrahim	M	Bade	Islam	Secondary	Single

KII with FUGA Clinic Health care practitioner

Key Informant Interview Guide for Community Health Care Practitioner

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for Energizing Education Programme (EEP) with this community. Your honest answers to the questions will, in no small way, assist in ensuring highly quality data.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment of Energizing Education Programme (EEP) Proposed Power Plant in this community. The study is important in order to have baseline information of your community before the full operation of the proposed power plant and any other associated facilities. Your participation in this study is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Respondent's Name: MRS. FATIMA ADU GARBA

Position in Community AG. HEAD, CLINIC

Questions:

1. How many health care facilities are available within the community?
2. What is the health status of this community? *Mortality and morbidity information.*
3. What is the ratio of health care workers per patient in this community?
4. What are the common diseases in the community and causes?
5. Are there facilities available for reporting and handling cases of gender based violence in this healthcare centre?
6. What are the local factors affecting community members' health?
7. Are there special health facilities for pregnant women and nursing mothers in the community?
8. Are there other unorthodox/traditional health care facilities available in the community?
9. What are your suggestions for harmonious relationship between EEP Power Plant Project and the community's healthcare personnel?

KII with FUGA Students Union Government President

Key Informant Interview Guide for Student's Union Leader

Overview

This instrument is designed to collect information on the Environmental Impact Assessment (EIA) study for Energizing Education Programme (EEP) with this community. Your honest answers to the questions will, in no small way, assist in ensuring highly quality data.

Consent form.

Hello, my name is Abiola S. Bolarinwa, a social scientist from Environmental Accord Nigeria Limited. I am conducting an Environmental Impact Assessment of Energizing Education Programme (EEP) Proposed Power Plant in this community. The study is important in order to have baseline information of your community before the full operation of the proposed power plant and any other associated facilities. Your participation in this study is voluntary but we would very much appreciate your participation by your response to our questions. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Respondent's Name: ABUBAKAR M. SALEH

Position in the School's Student's Union Body PRESIDENT

Questions:

1. What is the history of this school's Student Union Body?
2. How did you emerge as a leader of this Student's Union Body?
3. How many females are within the student's union executive organization? In what capacity/position?
4. What are the social, environmental and health challenges prevalent in this school?
5. How is water supply in the school's environment and do students have access to clean water?
6. What are the major challenges in this school that the power plant will help to resolve?
7. Are there security challenges in the school?
8. What is the approach to conflict resolution among the students in this school?
9. What are the notable social vices common in this school?

APPENDIX 4.3

STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESS MECHANISM

STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESS MECHANISM

This section describes the Stakeholder engagement activities as well as the grievance mechanism to be implemented for the proposed 2.5 megawatts (MW) solar-hybrid power plant and associated infrastructure in the Federal University Gashua (FUGA), under the Federal Government's Energizing Education Programme.

1.1 Stakeholder Engagement

Stakeholder engagement is an ongoing process of sharing Project information, understanding stakeholder concerns, and building relationships based on collaboration. Stakeholder consultation is a key element of engagement and essential for effective Project delivery. Disclosure of information is equally as vital and must focus on informed consultation and participation with the local community and relevant stakeholders. If there are risks or adverse impacts from a Project, consultation must be inclusive and culturally appropriate and provide stakeholders with opportunities to express their views. In line with current guidance from the World Bank, consultation should ensure "*that appropriate project information on environmental and social risks and impacts is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format*" In other words, effective consultation requires the prior disclosure of relevant and adequate Project information to enable stakeholders to understand the risks, impacts, and opportunities. The Project's consultation program was intended to ensure that stakeholder concerns are considered, addressed and incorporated in the development process, especially during the ESIA.

1.2 Legal and Administrative Framework Guiding Stakeholder Engagement

The stakeholder engagement was carried out to ensure compliance with both Nigerian legislative requirements, as well as international standards (as defined in the World Bank's Safeguard Policy – Operational Policy 4.01, Environmental Assessment). This section presents the relevant standards and legislation that relate directly to the public participation and stakeholder engagement requirements for the proposed Project.

1.2.1 Nigerian Legislative Requirements

1.2.1.1 EIA Act No. 86 of 1992 (as amended by the EIA Cap E12 LFN 2004)

The EIA Act is the primary Act governing the environmental and social assessment of developmental projects or activities in Nigeria. Section 2(2) of the Act requires that where the extent, nature or location of a proposed project or activity is such that it is likely to significantly affect the environment, an EIA must be undertaken in accordance with the provisions of the Act.

Section 55 of the EIA Act provides for the maintenance of a Public Registry to facilitate public access to records relating to environmental assessments. Public hearings to which interested members of the public are invited are a key part of the approval process for EIA reports by the Federal Ministry of Environment (FMEnv). However, this project shall not be subject to a public hearing but rather an in-house review to be conducted by the FMEnv. This arrangement was adopted based on the abridged EIA process for the Nigeria Electrification Projects (NEP), which has been approved by the FMEnv.

1.2.2 International Requirements

1.2.2.1 World Bank requirements for Stakeholder Engagement and Information Disclosure

The project will endeavour to meet standards and requirements set out by the World Bank safeguard policies as defined below:

- *World Bank OP 4.01 - Environmental Assessment*

If there are risks or adverse impacts from the Project, engagement must be inclusive and culturally appropriate and provide stakeholders with opportunities to express their views. Engagement should ensure 'free, prior and informed engagement of the affected communities (1).' The World Bank Operational Policy (OP) 4.01 requires at least one round of engagement early in the Environmental and Social Impact Assessment (ESIA) process, and again one on the final ESIA report before decision-making. In other words, effective engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities.

1.3 Objectives of Stakeholder Engagement

The stakeholder engagement process was designed to conform to the Nigerian EIA Act and international standards. For this Project, the key objectives for stakeholder engagement are:

- inform and educate stakeholders about the proposed Project;
- gather local knowledge to improve the understanding of the environmental and social context;
- better understand the locally-important issues;
- provide a means for stakeholders to have input into the Project planning process;
- take into account the views of stakeholders in the development of effective mitigation measures and management plans; and
- lay the foundation for future stakeholder engagement.

2.1 Stakeholder Identification and Analysis

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively (IFC, 2007). Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community, or other businesses.

Proper stakeholder identification forms the basis on which the stakeholder engagement was conducted for the Project as well as the development of the stakeholder engagement plan. It is necessary to determine who the stakeholders of a project are and understand their priorities and objectives. In addition, it is also essential that stakeholders are classified based on their position, influence, capacity and interests in order to develop a functional Stakeholder Engagement Plan (SEP) that is tailored to meet the individual and group needs of the identified stakeholders.

The EPC Contractor shall develop and implement an effective SEP which shall be maintained throughout the lifecycle of the project. A sample format for the SEP is outlined in the Environmental and Social Management framework (ESMF) for NEP.

A list of identified stakeholders for the Project is shown in Table 2.1. This consists of individuals, groups, and organizations that may be affected by or may influence project development positively or negatively. The list was developed using international guidance and considered the following groups: national and local governments; Local community leaders; community members including potentially vulnerable sub-groups such as women, youth and elderly; international, national and local environmental and social Non-Government Organizations (NGOs); Potential contractors and service suppliers; and local businesses/cooperatives and associations.

Table 2.1: Identified stakeholders associated with the Project

Stakeholder Group and Interest in the proposed project	Stakeholder Name	Stakeholder Level				Connection to the Proposed Project
		International	National	State	Local	
Project Sponsor	World Bank	✓				Provide financial and technical support to Project development and operation
Regulatory Authorities	Federal Ministry of Environment (FMEnv)		✓			Has the responsibility for overseeing EIA process for the proposed Solar Projects and ensuring compliance to

Stakeholder Group and Interest in the proposed project	Stakeholder Name	Stakeholder Level				Connection to the Proposed Project
		International	National	State	Local	
						relevant environmental laws and regulations
	National Environmental Standards and Regulations Enforcement Agency (NESREA)		✓			Has the responsibility of enforcing the environmental laws, guidelines, standards and regulations in Nigeria, specifically during the operational phase of developmental projects.
	Federal Ministry of Power (Department of Renewable Energy)		✓	✓		The Department of the Renewable Energy and Rural Power Access of the Federal Ministry of Power, Works and Housing is charged with the responsibility to coordinate all issues relating to renewable energy and energy efficiency
	Nigerian Electricity Regulatory Commission (NERC)		✓	✓		Responsible for granting operating licences for the Solar Projects
	Yobe State Ministry of Environment			✓		The Ministry oversees the protection of environment in Yobe State
	Yobe State Environmental Protection Agency			✓		Responsible for waste management in Yobe State
	Yobe State Ministry of Women Affairs and Social Development			✓		Promotes the development of women with equal rights and corresponding responsibilities including gender inclusion
	Yobe State Ministry of Sports and youth development			✓		Responsible for the inclusion of youths in Nigeria's development as well as the coordination of sports and recreational activities in the state
	Bade Local Government Authority			✓		

Stakeholder Group and Interest in the proposed project	**Stakeholder Name**	**Stakeholder Level**				**Connection to the Proposed Project**
		International	**National**	**State**	**Local**	
Communities	Low Cost Community				✓	Households, communities and groups that may be directly or indirectly affected by the proposed Project and its activities.
University Representatives	Management of FUGA				✓	Direct Project beneficiaries.
	Physical Planning Office				✓	
	FUGA Student Union Body				✓	

2.1.1 Stakeholder Register

The project shall maintain a stakeholder engagement register for recording stakeholder information such as contact details, dates of engagement with comments and follow up requirements. A sample stakeholder engagement register is provided in Table 2.2.

Table 2.2: Sample Stakeholder Engagement Register

Stakeholder category (choose from the list)	Individual or group (choose from list)	Stakeholder name	Organization	Position in their organization /	Location	Contact address	Contact phone	Contact email	Stakeholder interest	Stakeholder priority	Engagement objectives	Method of engagement	Date of engagement	Issues raised	Follow-up action

2.1.2 Stakeholder Engagement Process

REA shall adopt a proactive approach towards building and maintaining mutually beneficial relationships with all relevant stakeholders, throughout its operations. The engagement program shall be implemented to comply with national and international standards. The stakeholder engagement will be free of manipulation, interference, coercion, and intimidation. It shall be conducted on the basis of timely, relevant, understandable and accessible information.

Effective stakeholder engagement depends on mutual trust, respect and transparent communication between the Project and its stakeholders. It thereby improves REA's decision-making and performance by:

- **Managing costs:** Effective engagement can help project REA avoid costs, in terms of money and reputation;
- **Managing risk:** Engagement helps project REA and communities to identify, prevent, and mitigate environmental and social impacts that can threaten project viability;
- **Enhancing reputation:** By publicly recognising human rights and committing to environmental protection, REA and financial institutions (World Bank) involved in financing the project can boost their credibility and minimise risks;
- **Avoiding conflict:** Understanding current and potential issues such as land rights and proposed project activities;
- **Improving corporate policy:** Obtaining perceptions about a project, which can act as a catalyst for changes and improvements in REA corporate practices and policies;
- **Identifying, monitoring and reporting on impacts:** Understanding a project's impact on stakeholders, evaluating and reporting back on mechanisms to address these impacts; and
- **Managing stakeholder expectations:** Consultation also provides the opportunity for REA to become aware of and manage stakeholder attitudes and expectations.

Table 2.3 presents elements of the stakeholder engagement program to be implemented by REA.

Table 2.3: Stakeholder Engagement Process

Stakeholder Engagement Activity	Approach
Stakeholder Identification and Analysis	An initial stakeholder identification and analysis has been conducted as part of this ESIA. REA shall maintain a register of identified stakeholders and undertake periodic review on a need basis.
Information Disclosure	REA shall ensure that information is provided to relevant stakeholders on an on-going basis over the course of the Project lifecycle. REA shall maintain regular communication with its stakeholders throughout the

Stakeholder Engagement Activity	Approach
	project lifecycle.
Stakeholder Consultation	REA shall consult with its various stakeholders on mutual concerns to fulfil its compliance obligations in line with industry best practice. REA shall maintain records of its consultation with its various stakeholders.
Negotiation and Partnerships	REA shall adopt a stakeholder management process that fosters the mutual interest of all parties and adds value to its operation.
Grievance Management	REA shall provide appropriate channels for stakeholders to raise their concerns and grievances about its operations
Stakeholder Involvement	This entails procedures that allow the direct involvement of stakeholders in project related functions in order to foster transparency and credibility.
Reporting to Stakeholders	REA shall establish reporting procedure that allows information disclosure to stakeholders about the environmental social and economic performance of its operations.
Management Functions	REA shall build and maintain management capacity within the company to manage the process of stakeholder engagement, track commitments and report on progress.

2.1.3 Stakeholder Engagement Tool and Communication

REA recognizes the need to tailor its stakeholder engagement approach and information disclosure to suit the needs of each of its stakeholder. REA shall adopt a variety of communication and engagement methods to ensure continuous engagement, dialogue and feedback is established during its engagement activities. Table 2.4 presents various tools and methods to be adopted by REA during its stakeholder engagement process.

Table 2.4: Stakeholder Engagement Tools and Communication

Medium	Most Appropriate Application
Stakeholder meetings	
One-on-one consultations	REA shall on a need basis hold consultation meetings with its individual stakeholders. These meetings will be held to: • Solicit views and opinions; • Discuss freely and confidently about stakeholder concerns and provide feedback etc.; • Build personal relations with stakeholders.
Focus group discussions	REA shall on a need basis hold focus group discussions (FGDs) to pull together a small group of people with the same interest into a single meeting to engage them on common issues. FGDs would have specific objective and be aligned with the expectations and interest of the stakeholders present.
Workshops	REA shall on a need basis hold workshops with its various stakeholders. Workshops are ad-hoc outcomes based meetings that seek to find solutions for specific issues facing the environment and social aspects. When conducting a workshop, REA shall use participatory exercises to facilitate group discussions, brainstorm issues, analyse information, and develop recommendations strategies.
Forum	REA shall on a need basis use forums to engage with various stakeholders. Participatory tools and methodologies such as workshops, town hall meetings, and FGDs will continue to be utilized, as they are more likely to increase stakeholder involvement in the process and elicit alternative responses, especially if there is controversy or complexity, or a need to build a consensus around possible solutions.

Medium	Most Appropriate Application
❖ Written / visual/electronic communication	
	REA shall use a variety of communication methods to disseminate information to its stakeholders. The approach adopted shall be based on the nature of the issue and the concerned stakeholder. External communications will include: ○ Project newsletters ○ Emails ○ Meetings ○ Executive Summary of the Environmental Impact Assessment ○ Mass Media, newspapers print etc. ○ Surveys

Table 2.5 presents a stakeholder analysis with respect to appropriate levels of consultation for each of the major stakeholder groups. REA shall determine the frequency of these interactions.

Table 2.5: Stakeholder Group Consultation Methods

STAKEHOLDER GROUP	CONSULTATION METHOD
Government and Regulators	• Email exchanges and letters • One-on-one consultations • Formal meetings • Print media • Compliance reporting • Performance report (Audits)
Project beneficiaries (FUGA Management, Physical Planning, Students)	• Formal meetings • One-on-one consultations • Print media • Strategic collaboration • Information Centre
Employees	• Phone / email / text messaging/ WhatsApp • Print media • Workshops • Focus group meetings • Surveys • Management/departmental meetings • Performance appraisal • Trainings
NGO's	• Phone / email • One-on-one interviews • Town hall meetings • Focus group meetings • Information Centre

2.1.4 Principles for Effective Stakeholder Engagement

Stakeholder engagement is usually informed by a set of principles defining core values underpinning interactions with stakeholders. Common principles based on International Best Practice include the following:

- **Commitment** is demonstrated when the need to understand, engage and identify the key stakeholders is recognized and acted upon;
- **Integrity** occurs when engagement is conducted in a manner that fosters mutual respect and trust;

- **Respect** is created when the rights, values and interests of stakeholders and neighbors are recognized;
- **Transparency** is demonstrated when stakeholder concerns are responded to in a timely, open and effective manner;
- **Inclusiveness** is achieved when broad participation is encouraged and supported by appropriate participation opportunities; and
- **Trust** is achieved through open and meaningful dialogue that respects stakeholder's values and opinions.

2.2 Summary of Previous Stakeholder Engagement Activities

This section describes the initial Stakeholder engagement activities carried out during the ESIA. The initial consultations were carried out from August 9 to 17, 2019 with the following:

- Yobe State Ministry of Environment
- Yobe State Environmental Protection Agency
- Yobe State Ministry of Women Affairs and Social Development
- Yobe State Ministry of Youth and Sports
- FUGA Vice Chancellor
- FUGA Director of Works
- FUGA Student Union Government President
- Bade Local Government
- Ward Leader of Low-Cost community

The consultations served to provide stakeholders with information about the proposed Project and to gather information important to the ESIA. The objective was to identify any key concerns or high-level issues that the stakeholders had at this early stage. The comments received from the stakeholders consulted have been presented in Chapter 4 of this ESIA report.

3.1 Management Function and Grievance Mechanism

3.1.1 Management Commitment

REA is committed to implementing stakeholder management as part of its operations. As such REA will ensure that the responsibility for implementing the SEP is duly assigned and all components of the plan are well-defined within its organizational processes. REA shall also commit to providing the necessary support to implement the SEP. The management structure for the SEP shall include the following elements.

Systems: REA will pursue its Stakeholder engagement activities as scheduled in a systematic manner that creates predictability in the eyes of the stakeholder in order to support and foster a relationship that is based on trust.

Structure: REA will establish a Stakeholder focused-structure within its organizational processes to provide the needed decision-making authority to enable quicker turnaround time on Stakeholder engagement activities and grievance feedback.

Skills: REA will ensure that the required internal capacity for effective Stakeholder engagement is provided for the implementation of the stakeholder engagement plan.

3.1.2 Roles and Responsibilities

REA shall assign the responsibilities of conducting and organizing stakeholder consultation and involvement to competent individuals. The individuals shall be qualified professionals with relevant skills and experience. The REA Project Management Unit shall have the overall responsibility of overseeing the implementation of the SEP. The role of managing stakeholder engagement shall be given to the University's Community Liaison Officer (CLO). The CLO shall monitor the implementation of the Project's stakeholder engagement program and report findings to the REA Project Management Unit.

3.1.3 Grievance Redress Mechanism (GRM)

A grievance redress mechanism (GRM) has been developed by REA which is applicable to all components of the NEP; including the EEP Projects (Available in Section 3.2). The NEP GRM was developed to provide project affected persons (including interest groups) directly affected by its development activities with access to mechanisms for them to present their grievances and find solutions through avenues that are legitimate, reliable, transparent, cost-effective and easily accessible at the lowest level, without allowing them to escalate into unmanageable levels. This access will be all inclusive with consideration for people living with disabilities and vulnerable groups.

With respect to the EEP component of the NEP, the GRM has identified potentials for grievance associated with the proposed project. The GRM also outlines the following:

- Identification of core institutional blocks for the EEP;
- Provision of grievance uptake points, including a description of communication channels, actions, and timeframe;
- Composition of the Project Management Unit (PMU) Grievance redress committee, with details about their activities;
- Composition of the community-based Grievance redress committee; and
- GRM structure to be implemented for the EEP Projects.

3.2 Grievance Redress Mechanism (GRM) for the Nigeria Electrification Project (NEP)

(Insert NEP GRM Here)

Access link - https://rea.gov.ng/wp-content/uploads/2019/08/GRM-FOR-NEP-7_08_2019.pdf

APPENDIX 4.4

Stakeholder Engagement Documents

Stakeholder engagement letter to Yobe State Ministry of Environment

environmental accord

July 29, 2019

The Honourable Commissioner,
Yobe State Ministry of Environment,
Damaturu,
Yobe State.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 9, 2019

Time: 9 a.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

9/8/19

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

Attendance of meeting with Yobe State Ministry of Environment

ENVIRONMENTAL ACCORD NIGERIA LIMITED
36B, Oguntona Crescent, Gbagada (Phase 1), Lagos
0802-360-9591; 0813-636-3762
info@envaccord.com
http://www.envaccord.com

ATTENDANCE SHEET

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PROJECT TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR ENERGIZING EDUCATION PROGRAMME (PHASE 2) PROJECTS

DATE: 09-AUG 2019
VENUE: YOBE STATE MINISTRY OF ENVIRONMENT

S/N	Name	Designation	Organization	Phone Number	Email	Signature
1	HABU YUSUF AMSH	DIRECTOR, ENV.	MENV. YOBE	08038613868	habuamshi@gmail.com	[signature]
2	UMAR MAI KAIGAMA	H EIA UNIT	MIN. ENV	08034076740	Umarkaigama1966@g-mail	[signature]
3	Albright Olaitan	Environmental Scientist	Env Accord	08075331833	aolaitan@envaccord.com	[signature]
4.	Onatosho Phido	Gender based specialist	Env. Accord	08109438110	Temitolu.wetfunmi1988@gmail.com	[signature]

Stakeholder consultation letter to Yobe State Environmental Protection Agency

environmental accord

July 29, 2019

The Director,
Yobe State Environmental Protection Agency,
Attahiru Bafarawa Green House, Gujba Road,
Damaturu, Yobe State.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 9, 2019

Time: 10:00 a.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

Stakeholder consultation letter to Federal University Gashua Vice Chancellor

environmental accord

OFFICE OF THE VICE CHANCELLOR
RECEIVED
DATE 08/08/2019
FEDERAL UNIVERSITY GASHUA

July 29, 2019

The Vice Chancellor,
Federal University, Gashua,
Yobe State.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 8, 2019

Time: 11 a.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

Environmental Accord Limited
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(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

Attendance of meeting with FUGA Vice Chancellor

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http://www.envaccord.com

ATTENDANCE SHEET

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PROJECT TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR ENERGIZING EDUCATION PROGRAMME (PHASE 2) PROJECTS

DATE: 08-08-2019
VENUE: FEDERAL UNIVERSITY, GASHUA (UNIVERSITY MGMT)

S/N	Name	Designation	Organization	Phone Number	Email	Signature
1	Prof J.S. Alao	DVC (Acad)	Fed. University Gashua	08062078098	jsalao909@gmail.com	[signature]
2	Engr Isa S. Ibrahim	CDW HPP	FUGA	08024385005	Isag108@gmail.com	[signature]
3	Omotosho Phoda	Gender specialist	Env. Accord	08109238110	Temitoluwatofunmi1998@gmail.com	[signature]
4	Albright Olaitan	Env Scientist	Env Accord	08075331833	aolaitan@envaccord.com	[signature]

Stakeholder Consultation letter to Director of Works and Physical Planning, FUGA

environmental accord

July 29, 2019

The Director,
Works and Physical Planning,
Federal University, Gashua,
Yobe State.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 8, 2019

Time: 9 a.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Recieped original copy of this letter
09/08/19

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

Attendance of meeting with FUGA's Director of Physical Planning

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http://www.envaccord.com

ATTENDANCE SHEET

environmental accord ...superior sustainability solutions

PROJECT TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR ENERGIZING EDUCATION PROGRAMME (PHASE 2) PROJECTS

DATE: 09-08-2019
VENUE: DIRECTOR OF WORKS, FEDERAL UNIVERSITY, GASHUA

S/N	Name	Designation	Organization	Phone Number	Email	Signature
1.	Engr. Bldr. Samuel S. Shuele	Ag DOWPP	Fed. Uni. Gashua	[illegible]	samuelsule882@gmail.com	[signature]
2	Engr Isa S. Ibrahim	C.O.W IPP	Fuga	[illegible]	Isa0108@gmail.com	[signature]
3.	Onotu Oho Rhoda	Gender Based Specialist	Env. Accord	08109438110	Jeminlowo@gmail.com	[signature]
4.	Abiola Bolanmo	Social Expert	Env Accord	08166455291	abolanmo@envaccord.com	[signature]

Stakeholder Consultation letter to Yobe State Ministry of Women Affairs and Social Development

environmental accord

RECEIVED
SIGN
DATE 2/8/19

July 29, 2019

The Honourable Commissioner,
Yobe State Ministry of Women Affairs,
Damaturu,
Yobe State.

Dear Ma,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 9, 2019

Time: 11 a.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

Stakeholder consultation letter to Yobe State Ministry of Youth, Sports, and Social Development

July 29, 2019

The Honourable Commissioner,
Yobe State Ministry of Youth, Sport, and Social Development,
Damaturu,
Yobe State.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 9, 2019

Time: 1:00 p.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1). Lagos, Nigeria.

Tel: +234-802- 360 - 9591
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Website: www.envaccord.com

Stakeholder consultation letter to His Royal Highness, Emir of Gashua

environmental accord

July 29, 2019

His Royal Highness,
EMIR of Gashua,
Gashua,
YobeState.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissionedby Rural Electrification Agency (REA)to carry out an Environmental and Social Impact Assessment (ESIA)for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIAprocess is stakeholderconsultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIAStudy team propose to meet with you(as one of the identified key stakeholders)at your officeas scheduled below:

Date: August 10,2019

Time: 9:00a.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.comshould you require further information.

Thank you.

Yoursfaithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Received by
Usman Sulaiman

Albright Olaitan
Project Manager

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
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Website: www.envaccord.com

Stakeholder consultation letter to Bade Local Government

environmental accord

July 29, 2019

The Honourable Chairman,
Bade Local Government,
Bade Local Government Area Secretariat,
Gashua, Yobe State.

Dear Sir,

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT, YOBE: STAKEHOLDER CONSULTATION MEETING

Environmental Accord Nigeria Limited (EnvAccord) has been commissioned by Rural Electrification Agency (REA) to carry out an Environmental and Social Impact Assessment (ESIA) for the Federal University, Gashua Solar Power Project, Gashua, Yobe State.

An important aspect of the ESIA process is stakeholder consultation. The consultation meeting provides an opportunity for notifying stakeholders of the project intention and receiving valuable feedback and participation. In this regard, representatives of the ESIA Study team propose to meet with you (as one of the identified key stakeholders) at your office as scheduled below:

Date: August 8, 2019

Time: 2:00 p.m prompt

In addition, please kindly find attached a Background Information Document (BID) containing background information about the project.

Please kindly contact the ESIA Project Manager on +2348075331833 or via email on aolaitan@envaccord.com should you require further information.

Thank you.

Yours faithfully,
For: ENVIRONMENTAL ACCORD NIGERIA LIMITED

Albright Olaitan
Project Manager

c/o Vice chairman - the project is also approved see we have no objection
8/8/2019

Environmental Accord Limited
36B Oguntona Crescent, Gbagada
(Phase 1), Lagos, Nigeria.

Tel: +234-802- 360 - 9591
Email: info@envaccord.com
Website: www.envaccord.com

Attendance of meeting with representatives of Bade Local Government Area

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info@envaccord.com
http://www.envaccord.com

ATTENDANCE SHEET

environmental accord ...superior sustainability solutions

PROJECT TITLE: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR ENERGIZING EDUCATION PROGRAMME (PHASE 2) PROJECTS

DATE: 08-08-2019
VENUE: BADE LGA SECRETARIAT

S/N	Name	Designation	Organization	Phone Number	Email	Signature
01	HON. DADA MAI AGO	V/C BADE	BADE L.G.C	08069486383		[signature]
02	Musa Suleiman Bizi	Engineer (Electrical)	FUGA	07036255398	bizi10065@gmail.com	[signature]
03	Omotosho Rhoda	Gender based specialist	Env. Accord	08109438110	Temitolu(...)1998@gmail.com	[signature]
04	Albright Olatun	Env. Scientist	EnvAccord	08075331833	aolatun@envaccord.com	[signature]

Background Information Document Sent to Stakeholders

RURAL ELECTRIFICATION AGENCY

BACKGROUND INFORMATION DOCUMENT (BID)

FOR

FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT IN YOBE STATE

JULY, 2019

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF THE FEDERAL UNIVERSITY, GASHUA SOLAR POWER PROJECT

A1.1 Introduction

Energizing Education Programme (EEP) is an initiative of the Federal Government of Nigeria (FGN), to provide sustainable and clean power supply to 37 Federal Universities and 7 University Teaching Hospitals across the country. The EEP project includes the provision of an independent power plant, upgrading existing distribution infrastructure, street lighting to improve security within the universities' campuses, as well as the development of a world class training centre on renewable energy for each university. Federal University, Gashua (FUGA) in Yobe State is one of the beneficiaries of the programme.

The project is being implemented by the Rural Electrification Agency (REA) and developed in Phases. The Phase 2 Projects involve the deployment of solar technology for generation of power supply to meet the current demands and future needs in some selected tertiary institutions and teaching hospitals across Nigeria.

REA proposes the installation of a 2.5MW Solar Power Plant for the generation and distribution of power to facilities and buildings within the university. The aim of this document is to provide background information about the solar power project and to receive comments on any issues you may have, as one of the identified key stakeholders.

A1.2 Project Location

FUGA is located along Nguru-Gashua road, Gashua, Yobe State. The land allocated as the project site within the university (GPS Latitude 12.87851^{0}N and Longitude 11.01419^{0}E) is located behind the male and female hostel of the university (Figure 1). The land size is approximately 12.4 hectares of greenfield area characterised by mostly grasses and Neem trees (Plate 1).

Figure 1: Satellite imagery of the proposed site within FUGA.

Plate 1: Aerial picture of the proposed site within FUGA

A1.3 Overview of the Project

The FUGA Solar power project will involve the installation and operation of Solar panels and ancillary facilities to generate power for faculties, classrooms, laboratories, libraries, hostels, streetlights, etc. Solar panels will be installed on the site using piling foundations and the power generated will be transmitted to FUGA power house (also the switch yard) located about 700m to the Project site.

Storage facilities will be constructed for the batteries and inverters to be installed for the Project. Power distribution within the institution will be via the existing power infrastructure (overhead cables). The power generated will be distributed within the university using the existing distribution networks within the university. Additional streetlights will be installed and powered by the proposed Project. Furthermore, a training and development centre for renewable energy will be constructed on the allocated land for the proposed Project.

Upon completion of the Project, the University will be disconnected from the national grid. Also, the generating sets present within the university will be maintained as backup sources of power.

A1.4 Project Justification

Access to uninterrupted power supply in federal universities in Nigeria is a major challenge and barrier to effective research, student learning and institutional operations. Constant supply of electricity is of strategic importance in the conduct of research. In Nigeria, it has been extremely difficult to meet international research standards due to epileptic power supply in our tertiary institutions, which is a reflection of the generally poor supply of electricity in the country.

In view of this, the Federal Government of Nigeria through the Rural Electrification Agency set up the Energizing Education Programme (EEP) for Federal Universities. Tertiary institutions that will benefit from this programme will be able to generate the power needed for all their operations. The EEP, is also a key programme to be implemented towards achieving a part of the Power Sector Recovery Programme (PSRP) objectives and provides a measure in ensuring that Nigeria achieves its carbon emission targets (to cut back on its carbon emission by 20 % on its own and 27 % with assistance from the climate change fund, in the next 15 years) as contained in its Nationally Determined Contributions (NDC), under the Paris Agreement.

The FUGA solar power project will ensure the provision of clean, affordable and uninterrupted power supply which would boost research, learning, and academic activities within the university and also contribute to improving the safety and quality of the environment.

A1.5 Project Activities

The project activities can be divided into pre-construction and construction, operation and decommissioning phase.

Pre-Construction Phase Activities:

- Mobilization of personnel and materials to site;
- Site clearing and land preparation.

Construction/Installation Phase Activities:

- Erection of piling foundations;
- Solar PV panels and ancillary component installation;
- Upgrading of existing power distribution infrastructure;
- Installation of additional streetlights;
- Construction of training and development center.

Operation Phase Activities:

- Testing and commissioning;
- Power generation and distribution;
- Equipment maintenance;
- Utilities consumption.

Decommissioning Phase Activities:

- Dismantling of equipment and associated facilities;
- Scrapping and dismantling of equipment;
- Restoration of site to pre-existing conditions.

A1.6 Preliminary Impacts and Mitigation Measures

Preliminary Potential Impacts

Potential and associated impacts of the project preliminary identified at this stage include the following:

Air Quality

- Vehicular emissions during mobilization of personnel and equipment to the site. (impact would be localized).

Noise Emissions

- Noise emissions during the site clearing, panel installation, and fixture of other ancillary components (impact is site-specific).

Groundwater Quality

- Potential contamination of groundwater during operations as a result of washing the solar panels (the impact is site specific and negligible).

Flora and Fauna

- Site clearing may lead to loss of fauna due to destruction of habitats;

- Clearing of the land in preparation of erecting piling foundations may lead to loss natural vegetation and destruction of habitats.

Waste Generation

- Wastes from the installation activities may arise from a range of sources including the following: packaging materials; wastes from workers, equipment, and materials (impact would be localized);
- General and hazardous wastes (spent batteries, damaged/discarded solar panels) produced as a result of the operational processes (impact is site-specific).

Transport and Access

- Increased road traffic during installation of the project (impact is localized).

Occupational Health and Safety

- Potential impacts to workers during installation and operation phases include;
  - Safety and fire hazards;
  - Electric shock during electrical works.

Community Health and Safety

- Increase in risk factors associated with communicable diseases;

Peoples Way of Life and Business

- Loss of farmlands;
- Training and employment opportunities;
- Stimulation of educational activities thereby promoting research and development;
- Acquisition of new skill due to technology transfer.

Mitigation Measures

In the light of the preliminary potential impacts identified, appropriate mitigation measures has been incorporated in the Project design and additional mitigation measures will be recommended in the ESIA report which will be put in place throughout the life cycle of the Project to minimize its environmental footprint.

"We would like to meet with you to discuss any opinions and concerns you may have about any of these potential impacts".

FEDERAL UNIVERSITY GASHUA SOLAR POWER PROJECT: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

We would like you to take part in this ESIA process so you can raise any issues and comments you may have about the Solar Power Project. Your comments are a key part of the study to see whether the Project should proceed and it is important that REA understands your comments so that they can be answered and dealt with in the ESIA.

To receive regular information throughout the ESIA process, you must register as an Interested and Affected Party. To register please send this form to Rural Electrification Agency (through its consultant, EnvAccord) at the address given below. If you want to make any comments at this stage please use this form. Alternatively, please do not hesitate to send an email or write separately to the e-mail address provided below.

You can make additional comments for the study team to record on a separate page or on the reverse side of this form. Please post this comment sheet to the address below as soon as possible and preferably on or before August 30, 2019 so that we can take your comments into consideration in the ESIA. The comments could also be emailed to the address below.

Please fill in your details	
Name:	Organization:
Telephone:	Position:
Cell phone:	Email:
Address:	

Please post or fax this form to the address below:

Environmental Accord Nigeria Limited
Attention: Albright Olaitan
Tel: +234 807-533-1833, +234-813-636-3762
Email: aolaitan@envaccord.com
Address: Environmental Accord Nigeria Limited
36B, Oguntona Crescent, Gbagada (Phase 1),
Lagos, Nigeria

RURAL ELECTRIFICATION AGENCY

ENERGY = EMPOWERMENT = EFFICIENCY

NIGERIA ELECTRIFICATION PROJECT

DESIGN AND ESTABLISHMENT OF A GRIEVANCE REDRESS MECHANISM (GRM) FOR THE NIGERIA ELECTRIFICATION PROJECT (NEP)

FINAL REPORT

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ABREVIATIONS

ADR: Alternative Dispute Resolution

CBO: Community-based Organisation

CCU: Customer Care Unit

CSO: Civil Society Organisation

DISCO: Distribution Company

PDO: Project Development Objective (PDO)

EEP: Energising Education Programme

E&S: Environmental and Social

ERGP: Economic Recovery and Growth Plan

ESS: Environmental and Social Safeguards

EUCS: Electricity Users Cooperative Society

FGD: Focus Group Discussions

FGN: Federal Government of Nigeria

FMEnv: Federal Ministry of Environment

GRM: Grievance Redress Mechanism

GRC: Grievance Redress Committee

KII: Key Informant Interviews

MD: Managing Director

NERC: Nigerian Electricity Regulatory Commission

NESREA: National Environmental Standards and Regulations Enforcement Agency

NEP: Nigeria Electrification Project

NEPA: National Electric Power Authority

PCC: Public Complaint Commission

PMU: Project Management Unit

REA: Rural Electrification Agency

SE: Stakeholder Engagement

ToR: Terms of Reference

UTH: University Teaching Hospital

EXECUTIVE SUMMARY

ES 1: INTRODUCTION AND BACKGROUND

This report is the Draft Final Report of the Grievance Redress Mechanism for the Nigeria Electrification Project (NEP).

There are three distinct investment components to the project:

Component 1 - Solar Hybrid Mini Grids for Rural Economic Development will provide subsidies and/or performance-based grants to private mini grid developers to build solar hybrid mini grids in unserved and underserved rural areas.

Component 2 - Standalone Solar Systems for Homes, Enterprises and Farms will provide market-based incentives to standalone private sector solar system providers to install solar home systems (SHS) for underserved households and SMEs in dedicated areas.

Component 3 - Power Systems for Public Universities and Teaching Hospitals will support the construction and operations of solar mini-gird for beneficiary universities and teaching hospitals. This component will be implemented by REA in collaboration with universities under the Energising Education Programme (EEP). Contractor(s) will be engaged directly by REA to construct the power systems under this component, which will then be operated by the universities.

The NEP Grievance Redress Mechanism (GRM) shall provide community members directly affected by its development activities with access to mechanisms for them to present their grievances and find solutions through avenues that are legitimate, reliable, transparent, cost-effective and easily accessible at the lowest level, without allowing them to escalate into unmanageable levels. This access will be all inclusive with consideration for people living with disabilities.

ES 2: STUDY AREA, SCOPE OF WORK AND EXPECTED OPERATIONAL OUTCOME

The Component 1 subprojects will predominantly focus on selected sites in rural areas in four states: Sokoto, Ogun, Niger and Cross River. The states present a wide range of physical characteristics with varying socio-cultural and socio-economic activities. Component 2 has a more national spread and will focus on market penetration of the grantees, while Component 3 will focus on seven Federal Universities and two Teaching Hospitals across the geo-political zones of the country.

The focus of the outcome of this consultancy service will be limited to the areas of operation of the NEP, and if applicable, to the terms of other projects of the PMU. The broad objectives of the assignment are to: Develop a Grievance Redress Mechanism for

the project, identify personnel required for collecting, analysing, collating and documenting complaints and other necessary information relating to project activities and to Support the NEP-PMU to operationalize the Feedback and Grievance Redress Mechanism.

The outcome will help to facilitate access to information for all stakeholders, enable more systematic identification and resolution of emerging issues and trends, resolve all emerging grievances in the project areas and provide channels for appropriate beneficiary feedback, including best practices, thus promoting programme ownership and avoiding litigation and project delays.

ES 3: POTENTIAL ISSUES AND COMPLAINTS

In the course of actualising the project objectives, it is anticipated that, among other likely issues, subprojects under Components 1 and 3 (Component 1: Solar Hybrid Mini Grids for Rural Economic Development and Component 3 Power Systems for Public Universities and Teaching Hospitals) will lead to the acquisition of land and various construction and installation activities, which could result in displacement of persons, restriction of access or loss of livelihood.

Other potential issues and grievances to monitor include:

- Equipment installation e.g. poles and cables running through or above homes and other privately-owned properties
- Environmental concerns due to presence of batteries and other equipment or waste management (e.g. battery disposal)
- Land acquisition, restriction of access and displacement
- Non-inclusion of community members in paid labour/workforce
- Non-inclusion of community members in decisions regarding design of the Mini Grid, its operation and billing process
- Existing political divisions in the communities and the consequent perception of project citing as more favourable to one divide
- Unrealistic Corporate Social Responsibility (CSR) expectations from the contractors by community members
- High cost of services e.g. community members are usually required to pay a one-off ‘connection fee’ covering cost of a breaker and cables to connect power from poles to the user’s house or business premise
- Conflicts arising from by-passing meters to use free electricity

- Complaint related to High tariff
- Commercial electricity users having a higher tariff than others
- Prolonged downtime in electricity supply due to faulty equipment
- Delay in execution of project leading to breakdown of trust e,g delay in take-off after contractor has mobilised equipment to site
- Disruption of public access and disturbance resulting to loss of business days and associated income
- Disagreements over product warranty
- Accidents or injuries due to construction
- Loss of vegetation
- Potential risk of Gender based violence/sexual harassment of locals as a result of labour influx
- Potential risk of social conflict with communities as a result of labour influx, including forms of Gender Based Violence (GBV)

Interest Groups

The key interest groups in this regard are:

- Electricity Users' Corporative Societies (EUCS)
- Mini Grid Developers
- Relevant Local Government Authorities
- Solar Home Systems companies
- Community-based influencers supporting the project who are liable to be accused of benefit capture, exclusion and marginalization
- Touts seeking employment, extortion and opportunity for other vices around project site; capable of starting unprovoked conflict
- Local Vigilantes, Police, National Security & Civil Defence Corps
- Students
- Women groups
- Community Leaders
- Youth groups

- Persons whose properties are acquired, trespassed or damaged by project activities
- Local NGOs focused on Renewable Energy or Environment

Key vulnerable groups identified are:

- Employed labour from within the communities
- Women (especially girls and widows)
- Potential child labourers and hawkers
- Potential victims of GBV, sexual exploitation, harassment and abuse who are made vulnerable due to poverty and unemployment
- Unemployed youth open to violence

ES 4: EVALUATION OF EXISTING DISPUTE RESOLUTION SYSTEMS

During the NEPA era and up till date, there has always been conflict between members of the public and electricity providers. This is often a result of fallout of consumer – provider relations or due to the technical activities of the public power supplier, which could have adverse effects on private interests. This trend has been carried over to successor companies of NEPA and even to off-grid electricity suppliers. This further backs the need for an effective GRM in a project such as the NEP.

Existing structures for feedback or complaint uptake and redress in the Rural Electrification Agency (REA) are not suited to fit into the proposed NEP GRM, hence a framework that would leverage on structures such as the Electricity Users Cooperative Society (EUCS) in the beneficiary communities of Components 1 and 3 have been proffered for the GRM.

Alternative Dispute Resolution (ADR) institutions in the identified project states have also been built in, particularly the Citizens' Rights/Mediation Centres.

ES 5: PROPOSED GRIEVANCE REDRESS STRUCTURE

Component 1

The main institutional blocks for the Component 1 grievance redress structure are the Mini Grid Developers' Customer Care Unit, Electricity Users Cooperative Societies established in the beneficiary communities, the PMU Grievance Redress Committee (GRC), including the Zonal Liaison Officers, the Citizens Rights/Mediation Centres and

the law courts. Other institutions included specifically for cases of GBV/SEA are the departments of Women Affairs in the states Ministry of Women Affairs, women leaders in the communities, women's rights focused NGOs and the Police. These institutions will form the appeal levels from bottom up, feedbacks on the resolutions of grievances shall also pass through same channels to get to the complainant within the stipulated time frame.

The NEP PMU GRM Committee shall manage the entire mechanism, including the Social Safeguards Specialist as the key staff and the Environmental Specialist, Communications team and M&E Specialist as team members.

Uptake of complaints and grievances shall be done through:

- EUCS designated base or Secretaries
- Women leaders
- Traditional leaders
- Mini Grid Operator office
- PMU toll-free hotline and email addresses
- Town hall meetings (where available and regular as a tool for community development)

Modes of reporting grievances are:

- Written petitions
- Telephone hotlines
- Email
- Physical presentation of complaints

Dedicated telephone lines shall include:

- Mini Grid Developer Customer Complaint Unit (CCU)
- Community-based GRC (EUCS) secretary and chairman's telephone lines
- PMU hotlines

Component 2

Component 2 GRM Structure

An open market arrangement such as the bedrock of the NEP Component 2 mainly requires a traditional market system of customer service. This is more as the SHS companies will not be fronting as NEP or government sales agents during transactions.

The following strategies have been put in place to further mitigate the possibilities of any project threatening grievances sprouting up in the implementation phase:

- The application structure for interested companies clearly caters for environmental management by requiring evidence that environmental and social risks are mitigated.
- Products must also pass the NEP quality verification process and the Lighting Global standard.
- Evidence of ability to effectively provide pre- and post -sales service to acquired customers, including easy and practical warranty service.
- Must pre-qualify both company and product to claim grant as often as once a month.
- Claims are submitted online then installations of systems are verified by the Independent Verification Agents (IVA)

Core Institutions for the Component 2 GRM

- The SHS Operator Company
- The Independent Verification Agents (IVA)
- PMU GRM Team
- Ministry of Women Affairs, Women's Right Focused NGO and the Police
- Zonal Liaison Officers

Although all grievances shall be received, recorded and feedback given to complainant, only grievances presented by a certified SHS beneficiary, related to the project and within the product terms of warranty or sales agreement by the SHS company shall be prioritised for mediation by the Grievance Redress Committee (GRC). For such cases an immediate resolution could be provided and case closed.

Component 3

The likelihood of sabotage or other similar actions by competing interests and previously existing electricity distribution entities to the universities and health institutions are of higher concern to the GRM consultant under this component, especially as these actions

could be masqueraded as genuine grievances where there are none, which could ultimately cause delays for the project. This of course does not rule out potential issues regarding land acquisition, restriction or legacy land acquisition or any other grievances that may spring up.

Core Institutions

The core institutional blocks for the REA NEP Component 3 GRM Structure are:

- University Authority (office of the Vice Chancellor)
- Dean of Students' Affairs
- Teaching Hospital Authority (Office of the Chief Medical Director)
- Corporate Affairs/Public Relations Unit of Teaching Hospital
- Engineering Procurement and Construction (EPC) Contractors
- PMU Social Safeguards Specialist (GRM Coordinator)
- PMU Environmental Safeguards and M&E Specialist
- Ministry of Women Affairs, Women's Right Focused NGO and the Police
- Representative of the Head, NEP PMU
- Zonal Liaison Officer

Grievance Uptake Points:

Being a more academic environment, operators of the solar hybrid plants shall be mandated to display complaints procedures and available uptake channels for complaints in ways that are clearly visible to their customers, including on their websites, placement of grievance submission boxes at their office and via other communication channels, the same procedure shall be applied in the Students' Affairs Department of the universities and the Corporate Affairs unit of benefitting teaching hospitals for all to see. Any complaints pertaining to the project and its subprojects shall be channelled to this uptake points. All complaints shall be resolved and the customer notified **within 15 Days** of receipt of the complaint by the operator Customer Care Unit (CCU). Where additional time is required, the complainant is updated of actions being taken within **every 7 Days** until the complaint is resolved. Where either the customer or the operator are not satisfied with the resolution by the CCU, the complaint is referred to the NEP community-based Grievance Redress Committee (GRC) through the committee Secretary or to the NEP Project Management Unit (PMU) GRC, as the case may be.

Composition of the central Grievance Redress Committee for component 3

- PMU GRM Team
- Representative of the Head, NEP PMU
- Representative of the Component Coordinator

The Component 3 Community-based GRC

The GRM Coordinator at the PMU shall ensure that a community-based GRC is constituted in each benefiting university/teaching hospital and shall refer any minor grievances or misunderstanding submitted to the PMU directly via the publicised NEP hotlines, emails etc to the appropriate community-based GRC, such grievances shall first be certified as relating to the implementation of the EEP. The Secretary of the community-based GRC shall receive and record all grievances. Feedback from the community-based GRC to a complainant **shall not exceed 7 work days**. A complainant who is not satisfied with the feedback on outcome of the mediation by the community-based GRC shall have their grievance reverted to the PMU GRC for mediation. A complaint referred back to the PMU GRC shall be mediated upon and feedback communicated to the complainant **within 14** days. In the event that a complainant is still not satisfied with the mediation, the complaint is referred to the state Citizens' Rights/Mediation Centre in a state where such facility exists for Alternative Dispute Resolution. In a case where such a facility for ADR does not exist, a member of the Institute of Chartered Mediation and Conciliation (ICMC) of ranking not less than a 'Fellow' shall be engaged by the NEP or assigned holders to the rights of operation of the electrification project, in the case that the NEP has handed over the project, to mediate in the matter for not more than 14 days. Where the grievance is not resolved after this, the complainant shall be given the option of referral to a competent court of law outside the project.

Members of the community-based GRC under this component shall consist of:

- Representative of the office of the VC or CMD
- Bursar or Head of Accounts
- Dean of Students' Affairs Department OR
- Head of Corporate Affairs Unit of a University Teaching Hospital
- Representative of the Solar Hybrid plant operators

ES 6: GRIEVANCE REDRESS PROCEDURES

1. Receipt, Acknowledgement and Registration of Feedback or Grievance

2. Verification/Screening

Complaints in the NEP Component 1 GRM would be classified under the following categories.

Category 1: Exclusion claims

Category 2: Physical and/or economic displacements caused by land acquisition or any other project activities

Category 3: Billing, metering or cost of service equipment

Category 4: Security, Crime and Enforcement Issues (including GBV or sexual harassment)

Category 5: Labour issues

Category 6: Environmental Management lapses (including consequent mishaps)

3. Implementation and Case closing

4. Feedback

At the time of acknowledgement of the feedback or grievance, the complainant will be provided with the following information:

(i) Grievance Reference Number to facilitate monitoring and reminders by complainants.

(ii) Expected time of redress (As prescribed for each component).

(iii) If not addressed within expected time, action to be taken by complainant

If the grievance is not redressed within the expected time, the complainant should be provided with the following information:

(i) Information on reasons for delay

(ii) Updated expected time of redress

(iii) If not addressed within expected time, action to be taken by complainant

At the time of final redress, the complainant will be provided with information on

(i) Final action taken for redress and

(ii) Avenues for pursuing the matter further

ES 7: IMPLEMENTATION OF THE NEP GRIEVANCE REDRESS MECHANISM

Communicate to Build Awareness

1. Educating local people, contractors and mini grid developers about the grievance mechanism is an essential and on-going responsibility. It does no good to have a perfectly designed GRM that no one knows about.

2. For an effective operation of the Project GRM, the objectives of it, its procedures, available channels for submitting complaint and responsible officers will have to be properly communicated to those who will use it so that they will not only be eager to access it but also to own it, taking cultural peculiarity of each community into consideration.

3. There is the need for a sensitisation / validation forum with the various communities, to acquaint the stakeholders of the project with the guideline and workings of the GRM. This workshop will rally representatives of the states, local governments, traditional institutions as well as key groups and personalities in the project areas including community members.

4. Accessing the grievance redress system will depend so much on the level of awareness about the mechanism among potential users. This therefore will require both group and mass methods as well as all the media forms available.

Basic Communication Channels:

- Mass Media
- 'Face-to-face' Communication
- Social media
- Mid-Media and IEC Materials
- Grassroots Mobilisation

ES 7.1: TRAINING AND SUPPORT TO PARTICIPANTS

This will involve orientation and training for beneficiaries, GR implementers, relevant staff of the contractors, security personnel etc. and provision of external consultancy and support staff to strengthen organizational capacity.

The training requirements for the GRM are multifaceted, diverse and layered through the orientation and implementation phases.

Training Outlay

S/N	GR Implementer	Training
1	Social Safeguards Specialist (GRM Administrator)	Training in conflict resolution, Alternative Dispute Resolution (ADR) and grievance management. Members of the Chartered Institute of Mediators and Conciliators (ICMC)
2	PMU GRM Team (including GRM Administrator)	To include procedural training on receiving, registering, and sorting grievances; training in management of the grievance redress process (developing flow charts) particularly GBV/SEA related complaint, assigning roles, monitoring performance of staff dealing with complaints, and providing incentives.
3	Community-based Grievance Redress Committee (GRC)	Basic ADR “decide together” problem-solving skills. Skills for conducting receipt and registration, referral processes, communication to complainants, GR logging, monitoring and record keeping etc.
4	Secretary of the Community-based GRC	Effective communication, negotiation, and facilitation skills; problem solving; dispute resolution, decision making and their respective parameters, standards, and techniques
5	Mini Grid Operators Community Liaison officer	Effective communication, negotiation, and facilitation skills; problem solving; dispute resolution, decision making; and their respective parameters, standards, and techniques
6	Citizens’ Rights/Mediation Centres	ADR Training for staff lawyers. Membership of the Chartered Institute of Mediators and Conciliators (ICMC)

7	All GRM officers	Training on confidential, respectful and survival centred response to GBV complaints.

ES 8: SUMMARY ACTION PLAN AND BUDGET ESTIMATE FOR IMPLEMENTATION

Project Management Unit and Mini Grid Developer:

Conduct All Preliminary Stakeholder Engagements/Awareness Building on GRM

Set up GRM (Social Infrastructure and Processes), including Grievance Redress Committees (set up and inauguration, with considerations for gender balance), Uptake points & materials, grievance drop boxes, registers, telephone hotlines, emails and publicity materials, including GBV related complaint uptake points.

Conduct training and capacity building for GRCs

Work with GBV Expert or Consultant to create all linkages and modalities for handling of potential GBV/SEA complaints

Initiate Grievance Redress Processes - Operate GRM

On-going monitoring, training and Capacity Building

Community-based Grievance Redress Committees:

Elect principal officers (consider gender balance)

Agree on meeting/mediation days, venues and other logistics requirements e.g. location of complaint drop boxes

Participate in training/capacity building sessions (including GBV case handling)

Receive work tools and materials from PMU

Initiate Grievance Redress Processes

Participate in monitoring and on-going trainings/capacity building

ES 8.1: BUDGET

A provisional budget estimate of twenty million, two hundred thousand naira (N20,200,000) is proposed as one-off budget for operationalizing the Grievance Redress Mechanism for the ear-marked states, as presented in this report. A summary breakdown is provided in 7.1.

CHAPTER 1

BACKGROUND

1.1 Introduction

In line with the Economic and Recovery Growth Plan 2017-2020 (ERGP) and the objectives of the Power Sector Reform Program (PSRP, Nigeria's Federal Government set out a series of medium-term structural reforms to diversify the nation's economy, including the expansion of power sector infrastructure as one of the top priorities. The ERGP recognizes the fundamental role of power to the development of all sectors of the economy, hence the push by government to actualise a spread in off-grid power supply through the Nigeria Electrification Project under the Rural Electrification Agency (REA). The Nigeria Electrification Project (NEP) will provide electricity access to serve households, enterprises, community facilities, and small businesses in a cost-friendly manner. A private sector driven initiative of government, it is expected that most of the power under the project will be generated by solar technology.

The NEP is nationwide in broad scope, and most of the earmarked project funds will be used to stimulate private construction and operation of off-grid electricity supply systems by providing financial incentives and technical support. Some of the project funds will be used to acquire, by competitive tender, supply systems for selected Federal universities.

There are three distinct investment components to the project:

Component 1 - Solar Hybrid Mini Grids for Rural Economic Development will provide subsidies and/or performance-based grants to private mini grid developers to build solar hybrid mini grids in unserved and underserved rural areas.

Component 2 - Standalone Solar Systems for Homes, Enterprises and Farms will provide market-based incentives to standalone private sector solar system providers to install solar home systems (SHS) for underserved households and SMEs in dedicated areas.

Component 3 - Power Systems for Public Universities and Teaching Hospitals will support the construction and operations of solar mini-gird for beneficiary universities and teaching hospitals. This component will be implemented by REA in collaboration with universities under the Energising Education Programme (EEP). Contractor(s) will be engaged directly by REA to construct the power systems under this component, which will then be operated by the universities.

For a project supported by the World Bank Group, the execution of which is likely to trigger the Bank's social safeguard policy, there is an urgent need to put in place corporate governance tools and mechanisms that will not only ensure project sustenance but will

maintain a social licence for the continuous execution of the sub-projects. In the light of these, an effective Grievance Redress Mechanism (GRM) becomes unavoidable for the project.

The NEP Grievance Redress Mechanism (GRM) shall provide people directly affected by its development activities with access to mechanisms for them to present their grievances and find solutions through avenues that are legitimate, reliable, transparent, cost-effective and easily accessible at the lowest level, without allowing them to escalate into unmanageable levels.

1.2 Project Description

Component 1: Solar Hybrid Mini Grids for Rural Economic Development

This consists of both solicited and unsolicited tracks. The solicited track will request proposals from private sector to bid for minimum subsidies required to deliver electricity services on commercial basis for 200 rural centres. Unsolicited track will develop a market-based approach to support eligible companies to expand their electrification business / projects in rural areas with Sub-component 1.A: Investments on Solicited Tracks and Sub-component 1.B: Investment on Unsolicited Track.

Component 2: Standalone Solar Systems for Homes, Enterprises and Farms

This will provide better energy services at lower cost using standalone solar system in different size and level of service. The solar market will be made up of two main business models i.e. Sub-component 2.A: Output Based Investment Fund and Sub-component 2.B: Market Scale-up Challenge Investment Fund. The Sub-component 2.C: Technical Assistance will help to mitigate market and regulatory barriers in form of financial support to the private sector.

Component 3: Energizing Education Programme (EEP)

This EEP initiative will provide off-grid captive power plants for the generation and provision of dedicated and uninterrupted power supply to thirty-seven (37) Federal Universities and seven (7) adjoining university teaching hospitals (UTHs) across the six Geopolitical zones in Nigeria.

The scope of the EEP project shall include the provision of streetlights within the university campuses, a renewable training program for electrical students as well as provide power to the rural communities surrounding the universities in the long run.

It will use off-grid system ranging from 1 MW to 10 MW and shall be implemented in phases.

The socio-economic benefits attached to this rural electrification access intervention are significant and largely impacts not just the power, education and healthcare sectors but also provides as a measure to ensure Nigeria achieves its targets as contained in Nigeria's Intended Nationally Determined Contributions (INDCs) under the Paris Agreement.

The EEP is a key programme to be developed towards achieving the objectives of the PSRP.

1.3 Study Area

The Component 1 subprojects will predominantly focus on selected sites in rural areas in four states: Sokoto, Ogun, Niger and Cross River. The states present a wide range of physical characteristics with varying socio-cultural and socio-economic activities. Component 2 has a more national spread and will focus on market penetration of the grantees, while the third component will focus on seven federal universities and two teaching hospitals across the geo-political zones of the country.

1.4 Scope of Work

The focus of the outcome of this consultancy service will be limited to the areas of operation of the NEP, and if applicable, to the terms of other projects of the PMU. The broad objectives of the assignment as contained in the ToR are to:

i. Develop a Grievance Redress Mechanism for the project;

ii. Identify personnel required for collecting, analysing, collating and documenting complaints and other necessary information relating to project activities

iii. Support the NEP-PMU to operationalize the Feedback and Grievance Redress Mechanism

1.5 Expected Operational Outcome

The outcome will help to facilitate access to information for all stakeholders, enable more systematic identification and resolution of emerging issues and trends, resolve all emerging grievances in the project areas and provide channels for appropriate beneficiary feedback, including best practices, thus avoiding litigation and project delays. This, in the end will reduce costs and improve the quality of work.

In putting the grievance redress mechanism together for the REA NEP PMU, the consultant is required to broadly:

- Survey existing formal and informal GRMs in project beneficiary communities by evaluating the scope of these systems and identify the potential to build on them

while integrating them into the project's integrated GRM from communities to states, and to the REA.

- Develop operating procedures, guidelines, and flowcharts detailing how the grievance redress process will unfold within the project's operating structures, more broadly from community level to the REA system, and how it will be reported, monitored and recorded.

- Estimate the number of citizens that are likely to use the GRM and assess the resources human, financial, and technological—that are available (and may be required) for the GRM to function effectively within the project.

- Design approaches for REA to publicize the GRM system by working with REA to develop a grievance redress policy that clearly states that management embraces grievance reports and views them as opportunities for improvement.

- Identify staff/units in the REA to manage the GRM system.

- Identify and describe the roles and responsibilities of private sector entities participating in the project (Mini Grid developers, SHS companies, contractors) in the structure of the overall GRM for the project.

- Evaluate dynamics working for or against the introduction of a grievance mechanism inside and outside the project and develop a GRM framework and plan.

1.6 Methodology

A multi-pronged qualitative method of data gathering was employed to arrive at various conclusions in this report, namely internal stakeholder engagement, key informant interviews (KII), periodic feedback meetings with NEP PMU and focus group discussions (FGD).

The work proceeded with the identification of relevant stakeholders. The first leg of it was carried out by gleaning through the project documents, including the Project Appraisal Document (PAD), Resettlement Policy Framework (RPF) and the Environmental and Social Management Framework (ESMF). This helped to draw up a list of internal stakeholders, mostly personnel of REA and all ancillary MDAs in the electricity sector mentioned in the documents. These primary stakeholders were then engaged in brainstorming sessions, to identify all stakeholders in the Project, followed by a classification of the stakeholders and then consultation in their various locations.

Key informant interviews were carried out among key stakeholders and knowledgeable selected primary stakeholders. It was meant to establish their understanding of the project, the concept of GR, their stake in the project, the existing method of dispute resolution among them as well as the role that their cultural background would necessarily play in any effort geared towards engaging them. The KII is also designed to help gauge the perception of potential persons affected by the project (PAPs) and their own involvement in the success or otherwise of the project.

The adoption of Key informant interviews (KII) is largely necessitated to understand the norms as well as ideas on grievance redress and stakeholder engagement in their locality. The Key informants were deliberately selected based on their ability to provide a unique perspective on the subject or issues under discussion and as well, their relationship with it. A semi-structured interview guide was used to elicit information from the respondents. These guides contained a substantive list of themes on the knowledge and awareness, attitudes and key influencers/mobilizers and determinants of attitudes and practices/initiatives, recommendations and suggestions.

The interviewers took care to record the responses of each of the participants and this formed the basis of the qualitative analysis. Responses to different questions were coded into categories and subcategories that related to the questions guiding the consultation.

1.7 Key Stakeholder Identification

This was done in two main stages. The first step was to glean from the various policy documents of the Project, the internal stakeholders. Identified internal stakeholders are those who are statutorily mandated to be involved, concerned and interested in the successful implementation of the project. The identified stakeholders are:

Federal Government of Nigeria

State Governments (beneficiary states)

Local Governments

Rural Electrification Agency

NEP PMU

The World Bank

Federal Ministry of Power, Works and Housing

Office of the Accountant General of the Federation

Federal Ministry of Environment

National Environmental Standards and Regulations Enforcement Agency (NESREA)

Nigeria Electricity Regulatory Commission (NERC)

State Ministries of Environment

State Environmental Agencies

Project Affected Persons (PAPs)

Traditional leaders of identified beneficiary communities

Vice Chancellors and Managements of beneficiary universities

Chief Medical Directors of beneficiary teaching hospitals

Engineering, Procurement and Construction (EPC) contractors

Independent Verification Agent (IVA)

Electricity Users Cooperative Societies

Association of Mini Grid Developers (AMDA)

Existing Women & Youth groups in affected communities

Civil Society/NGOs in the affected States

Media

CHAPTER 2

POTENTIAL GRIEVANCES AND INTEREST GROUPS

2.1 Potential Grievances

The NEP is designed to bring about positive social impacts like improved well-being of community members through provision of access to constant electricity and providing livelihood security for the overall populations in targeted areas. Though private sector driven, in the course of actualising these noble objectives, it is anticipated that, among other likely issues, subprojects under Components 1 and 3 (Component 1: Solar Hybrid Mini Grids for Rural Economic Development and Component 3 Power Systems for Public Universities and Teaching Hospitals) will lead to the acquisition of land and various construction and installation activities, which could result in displacement of persons, restriction of access or loss of livelihood.

The project activities will include the installation/construction of Mini Grid Systems, which are likely to have both temporal and permanent effects. Permanent effects will result in a loss of use of property, vegetation and land by the affected persons. Temporal effects will result to interruption in the current use of property or temporary loss of access to land as a result of the subproject activities. These are likely to occur during construction and rehabilitation of existing infrastructure.

Selected Mini Grid developers are expected to lead the land acquisition drive in their earmarked sites but would be strictly required to adhere to the NEP GRM. Although communities visited during the cause of this exercise expressed appreciation and longing for the project, and in some cases expressed willingness to donate the required land, this does not eliminate the fact that people will be displaced, or their livelihoods interrupted. Therefore, displacement of people within the project areas is expected although it is not possible to determine the number of people that are likely to be impacted.

Other grievances are likely to come up in the following cases, or as a result of the following activities/inactivity:

- Equipment installation e.g. poles and cables running through or above homes and other privately-owned properties
- Environmental concerns due to presence of batteries and other equipment or waste management (e.g. battery disposal)
- Non-inclusion of community members in paid labour/workforce
- Non-inclusion of community members in decision regarding design of the Mini Grid, its operation and billing process

- Existing political divisions in the communities and the consequent perception of project citing as more favourable to one divide
- Unrealistic Corporate Social Responsibility (CSR) expectations from the contractors by community members
- High cost of services e.g. community members are usually required to pay a one-off ‘connection fee’ covering cost of a breaker and cables to connect power from poles to the user’s house or business premise
- Conflicts arising from users by-passing meters to use free electricity
- High cost of tariff
- Commercial electricity users having a higher tariff than others
- Prolonged downtime in electricity supply due to faulty equipment
- Delay in execution of project leading to breakdown of trust e,g delay in take-off after contractor has mobilised equipment to site
- Disruption of public access and disturbance resulting to loss of business days and associated income
- Disagreements over product warranty
- Accidents or injuries due to construction
- Loss of vegetation
- Potential risk of Gender based violence/sexual harassment of locals as a result of labour influx
- Potential risk of social conflict with communities as a result of labour influx, including forms of Gender Based Violence (GBV)

2.2 Interest Groups

The key interest groups in this regard are:

- Electricity Users’ Corporative Societies (EUCS)
- Mini Grid Developers
- Relevant Local Government Authorities
- Solar Home Systems companies
- Community-based influencers supporting the project who are liable to be accused of benefit capture, exclusion and marginalization
- Touts seeking employment, extortion and opportunity for other vices around project site; capable of starting unprovoked conflict
- Local Vigilantes, Police, National Security & Civil Defence Corps
- Students
- Women groups
- Youth groups
- Persons whose properties are acquired, trespassed or damaged by project activities

- Local NGOs focused on Renewable Energy or Environment

2.3 Vulnerable Groups

Key vulnerable groups identified are:

- Employed labour from within the communities
- Women (especially girls and widows)
- Potential child labourers and hawkers
- Potential victims of GBV, sexual exploitation, harassment and abuse who are made vulnerable due to poverty and unemployment
- Unemployed youth open to violence.

Pic 1: Sensitisation before selection of community members for KII, Malgam, Binji LGA, Sokoto

Pic 3: FGD with community youths, Ofonekom, Obubra LGA, C/River

CHAPTER 3

CONTEXT AND LEGAL/POLICY BACKGROUND TO GRM

3.1 Context

A locally based **Grievance Redress Mechanism** (GRM) provides a result-oriented channel by offering a reliable structure and set of approaches where local people and the project implementation unit can find effective solutions together. It is one of many social accountability instruments that can help enhance good governance in projects allowing for quick reforms in the areas where feedbacks and concerns from beneficiaries can impact a project or any of its components. The grievance redress mechanism is a citizen engagement system by which queries or clarifications about the project are responded to, problems with implementation are resolved, and complaints and grievances are addressed efficiently and effectively. The concept has evolved as a citizen engagement platform in World Bank projects over the years as a means of empowering stakeholders and especially beneficiaries of Bank projects.

A well-functioning grievance mechanism:

• Increases the likelihood that small disputes can be brought to a conclusion relatively quickly before they become deep-seated grievances

• Keeps ownership of the dispute in the hands of local people

• Offers an early, efficient, and less costly way to address concerns

• Promotes a more stable business climate for projects, that reduces risk and enhances accountability to the host communities

Without the feedback loop that a good grievance mechanism can provide, the PIU may miss crucial opportunities to identify ways to improve project operations.

3.2 Legal and Policy Background to GRM in Nigeria

The law courts at their different levels are the ultimate formal system for grievance redress in Nigeria. But the bureaucracy, the cost of litigation for both the aggrieved and the perceived aggressor, and the time-taking tendencies of the courts have always served as disincentives for most citizens seeking redress, which result sometimes in people either taking the laws into their hands, or resigning to a passive victim's position. Also, the social impact of litigation, especially among people living within the same communities or who still must maintain interactions after settlement or redress, makes a post-litigation life

together a new challenge. The law courts would have effectively adjudicated in matters, but social interactions and good neighbourliness would have been affected.

To address this effect of the justice system, state governments across the country have been encouraging redress seekers to adopt the Alternative Dispute Resolution (ADR) options for a quicker, more cost effective and more inclusive redress of grievances. This is in tandem with the provision of Arbitration and Conciliation Act, Chapter 19, Laws of the Federation of Nigeria 1990.

ADR is fast gaining acceptance in Nigeria, especially in the states that have established multi-door court rooms, which leaves litigants with the option of seeking redress in arbitration, (which, though not less bureaucratic, disposes of matters more swiftly) or mediation or conciliation, which are even cheaper. According to the law, while an arbitration award is final and binding and accepted as judgement, the result of mediation is open and contingent on the honour of the disputant. Alternative dispute resolution procedures are however non-binding but voluntarily accepted or negotiated solutions to disputes. (Rhodes Vivour, 2013).

For redress at the systems level, with a view to protecting citizens from official highhandedness and discourage official corruption in government, the Nigerian military government of old also set up a Public Complaints Commission, by the promulgation of Decree 31 of 1975, which at the advent of democratic administration became The Public Complaints Commission Act Cap P37 LFN.2004 (PCC Act).The law gives the power to the public Complaints Commissioner to investigate, based on any complaints lodged before her, any administrative action taken by any functionary or organ of government at any level of the federation that the complainants perceives impinges on their human rights as citizen.

The law was backed up by the 1999 Constitution of the Federal Republic in Section 315(5) which states that “Nothing in this Constitution shall invalidate the enactment of Public Complaints Commission Act, and the provisions of the Act “shall continue to apply and have full effect in accordance with their tenure and to the like extent as any other provisions forming part of this Constitution and shall not be altered or repealed except in accordance with the provisions of Section 9(2) of this Constitution”.

The Public Complaints Commission was set up to have offices and officers in every state of Nigeria, headed by an appointed commissioner as the custodian of the powers that the constitution granted, and act the role of the ombudsman across the country. But its presence in most states, even in the focal states of the NEP, is unknown to members of the communities. The roles of the ombudsman in any place where it is established vary from culture to culture. But its clear role of a place to seek official redress, protecting citizens from administrative malfeasance is universal.

The laws that set up the ombudsman in Nigeria also create a lot of limitations for it, which makes it less effective than required. Nothing compels any government office or official to grant redress to a grievant after investigation to confirm the complaints (Osakede & Ijimakinwa, 2014). To get redress through PCC, the grievant will need to rely on the goodwill of the offending party or resort to the law courts. The time that the process would take as well as the cost and the logistics implication of seeking out the commission, usually makes the option of the PCC unattractive to the redress seeker. A review of the operations of the ombudsman in Nigeria has therefore been recommended (Afegbua and Adejumo, 2015).

CHAPTER 4

EVALUATION OF EXISTING COMPLAINT AND REDRESS CHANNELS AND TOOL(S) AVAILABLE TO CITIZENS IN THE RURAL ELECTRIFICATION AGENCY (REA)

During the NEPA era and up till date, there has always been conflict between members of the public and electricity providers. This is often a result of fallout of consumer – provider relations or due to the technical activities of the public power supplier, which could have adverse effects on private interests. Unfortunately, during this period, conflict resolution was also not at its best. The challenge with this uncomplimentary relationship is that most electricity consumers have developed a ready-for-conflict attitude towards the electricity provider, leaving them with the difficult task of winning the consumer to the side of the provider. Some of these conflicts may also continue to afflict the successor companies to NEPA and even off-grid electricity providers.

Also, unlike what is obtainable in the relationship between electricity users and Mini Grid operators, the repealed National Electric Power Authority Act gave far reaching powers to NEPA, which if abused (as was indeed done at times) had the potential to adversely affect the interest of many of its stakeholders, including NEPA itself. For instance, as it regards land acquisition, the Act setting up NEPA provided an express power to acquire land needed for operations or expansion. The Minister of Power, after attempts to reach a settlement for any required piece of land is not achieved, may declare that the land is required for the service of the Authority, earmark an amount of money to be paid as compensation to the landowner, and then make use of that land. This was backed by the public interest acquisition provisions of the Land Use Act of 1978. Disputes coming out of such transactions were often in law courts for several years, especially where such a land in question belonged to a family and not an individual.

According to the NEP Project Appraisal Document, key Environmental and Social risks on the project are limited and their magnitude is mostly proportionate to the size of subprojects. However, these risks are systemic, and are expected to manifest themselves in all components. The most important are safe disposal/recycling of used batteries (both lead-acid and lithium ion), land acquisition/land use changes (with the exception of Component 2 where this is not expected), as well as risk of exclusion and community safety. Additionally, for Components 1 and 3, stress on local water use and supply, construction impacts and waste management (in addition to batteries) can become systemic risks. Community engagement and an effective GRM has been identified as critical for project sustainability.

4.1 Rural Electrification Agency (REA)

A review of the REA existing systems for uptake of complaints, feedback channels and method showed that there was largely no structured system or policy in place. Interviews with the relevant units and personnel revealed a widely held hope that the outcomes of this consultancy for the NEP would also be useful for adaptation by the REA.

There is a directorate of Promotions at REA, which leads the public engagements and marketing drives of the agency. The department, alongside an existing Communications Consultant, provides support to the NEP-PMU for engagement with stakeholders, especially project beneficiary communities.

4.2 Nigeria Electricity Regulation Commission (NERC)

Pic 2: Consultation with Asst. Gen. Manager Renewable Policy, Research & Strategy, NERC, Abuja

Section 24 of the NERC Mini Grid Regulations of 2016 sets out complaint procedures and guidelines for customers and establishes the standards for developers.

Every Mini Grid Operator is required to establish a Customer Complaint Unit (CCU) within its business premises, saddled with the responsibility of receiving and resolving complaints. The regulation also requires that the operator maintains a Customer Complaint Log for NERC review where and when necessary. The specified CCU shall be headed by a senior officer of the operator and shall have a central office in the Operator head office or more than one offices in different areas of operation.

Customers make written complaints or e-mails directly to the CCU or via a Community Power Committee. A Community Power Committee (CPC) is described in the regulations as a committee established by a community to coordinate all electricity customers, address enquiries and take up complaints where necessary.

The NERC regulations requires the Operator to display complaints procedures and available uptake channels on the operator's website and other communication channels. All complaints shall be resolved and the customer notified within 15 Days of receipt of the written complaint by the CCU. Where additional time is required, the complainant is updated of actions being taken within every **7 Days** until the complaint is resolved. Where either the customer or the operator are not satisfied with the resolution by the CCU, there is an Electricity Forum for customer complaints established by the Commission under the

NERC Customer Complaints Handling Standards and Procedures, which is empowered to resolve issues beyond the operator CCU.

There are Electricity Forums in the various states set up to resolve complaints for both On and Off-Grid power consumers and operators and their offices are publicized by the NERC and in the offices of Operators for the attention of customers. All decisions of the Forum are legally binding and are taken by majority of the members present at a hearing and signed by the Chairperson. The Mini Grid Operator is required to implement the decisions of the Forum within the time specified in the directive and to report its compliance or reasons for any delays within 5 working days.

A customer or Operator who is not satisfied with the decisions of the Forum may appeal to NERC within 10 days of the directive by the Forum. At the NERC there is a Dispute Resolution Mechanism in place consisting of a Dispute Resolution Counsellor and a Dispute Resolution Panel, following which a matter could then be taken before a court of competent jurisdiction by an unsatisfied party.

4.3 National Environmental Standards and Regulations Enforcement Agency (NESREA)

NESREA has responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

The agency, which is the regulatory arm of the Federal Ministry of Environment, has offices in all the states of the federation which accepts environmental complaints from the public and investigates same. The state offices are manned by State Coordinators who report to the agencies headquarter in Abuja.

4.4 Alternative Systems of Grievance Redress Available and Utilised by the Public in Nigeria, Particularly in NEP Component 1 States of Cross River, Niger, Ogun and Sokoto

There are Formal and Informal systems.

4.4.1 Formal systems

Formal systems consist of the following:

- Court of law
- Citizens' Rights/Mediation Centres
- Legislature (House of Assembly)
- The Nigeria Police

- Public Complaints Commission
- National Human Rights Commission

4.4.2 Informal Systems

Major informal systems of dispute resolution include:

- Interpersonal and family level dispute resolution
- Traditional rulers and community heads
- Associations and Groups E.g. Electricity Users Corporative Society
- Religious leaders

4.4.3 Other informal systems

Other informal systems of dispute resolution, which are less visible are:

- Neighbourhood vigilante groups
- Age grade associations
- NGOs
- Professional unions e.g. Traders Unions, NURTW etc.
- Students' Union Government

A summary of the evaluation of these systems in the context of adoption or adaptation for the NEP GRM is presented below.

4.5 Evaluation of Some of the Existing Dispute Resolution Systems Available to the NEP in Project Communities

4.5.1 Weaknesses

Law Courts

Superficially, the formal law court system meets majority of the technical requirements for grievance redress. However, there is constant pressure on the courts and they are further limited in the areas of (i) Expensive cost for the services of qualified lawyers (ii) repeated delays and adjournment of sittings. The majority of persons interviewed in the course of this exercise find formal litigation in courts to be unattractive, cumbersome, technical, time-consuming and expensive; hence the increasing demand for Alternative Dispute Resolution (ADR) mechanisms. It is also established that a good number of Judges now prefer to direct some disputants and cases to Multi-Door-Court Houses for an attempt to settle via mediation and save all parties the time and the stress of prolonged litigation. The concept of the Multi-Door-Court, though a relatively new concept to Nigeria, is quickly gaining ground in the Nigeria judicial system and available in the Ministries of Justice in about two third of states, including in Ogun, Cross River, Niger and Sokoto states. It is when the parties fail to reach a resolution that the case is channelled back to the usual

courtroom for either a continuation of hearing or a fresh start, where mediation is the first point of call.

The Nigeria Police

When it comes to government sponsored project related complaints, the Police is mostly seen by the public as an appendage of the government in power and very often half-hearted or ineffective to provide sufficient and acceptable resolutions that would be favourable to the citizen. Several respondents attested to this. Even though the NEP has private sector actors in front, the obvious role of REA, coupled with a widely held perception that electricity supply is government business, operators are seen as operating with “orders from above”, as such the police is not often the best point of call for a project based complainant.

Traditional rulers & Systems

While this approach may be effective in the semi-urban areas where members of the community adhere to the general ethics and governance structure of communal living, it is often neither a popular nor effective tool for GR in the urban areas (such as state capitals), or in an academic environment like a university community. In other cases, where there are no assigned chiefs overseeing smaller groups or communities, the public perceives the main traditional monarch as too high an authority for the presentation of certain levels of complaints. People also prefer to move along with the times and would rather seek more modern approaches to grievance redress. Even more limiting here is the highly technical nature of the electricity industry; it is not everyone that can understand the intricacies and be able to adjudicate fairly.

4.5.2 Strengths

Electricity Users Cooperative Society (EUCS)

The Electricity Users Cooperative Society is an initiative of the REA NEP which is primarily aimed at mobilizing benefitting communities of the NEP Component 1 to achieve sustainability of electrification projects. Its goals are to create a forum and a platform to (i) Encourage all relevant stakeholders to work together to solve common community electricity issues (ii) Educate community members about energy conservation and efficiency (iii) Ensure that community members work together to protect electricity equipment against theft and/or vandalization and (iv) Enable community members to learn about productive usage of electricity. The EUCS is also intended to serve as a first point of contact for receipt and possible resolution of complaints presented by members. As the name implies, every electricity user in the community is welcome to join.

A vital objective of the NEP-PMU's community engagement and sensitisation, preparatory to project kick-off, has been the drive towards the formation of the EUCS in the project areas of influence. Community members in Component 1 beneficiary states signed documents indicating interest and intention to join the cooperative society in their communities and were sensitised on how to start meetings.
If supported with the right instruments and capacity building, the sheer proximity of such an association to the project beneficiaries as well as their ability to link the Mini Grid developers with the customers, makes the executive members of the EUCS viable as a hinge for the community level Grievance Redress Committee for Component 1.

Citizens' Rights and Mediation Centres
These Alternative Dispute Resolution centres are set up by state governments to provide free dispute resolution services for all and sundry, especially indigent or vulnerable residents like women, widows, students, the unemployed, retirees, the elderly and persons with physical disabilities, who may not have the wherewithal to pursue litigations or other capital intensive approaches to grievance resolution. The Centres are designed to assist disputing parties in arriving at amicable settlement through Alternative Dispute Resolution methods. They are most frequently manned by Directors sourced from the state ministries of justice and have a number of lawyers or trained ADR specialists who attend to complaints by members of the public. Lagos state was the first to set up a Citizens Mediation Centre in 1999. In 2015 alone 34,511 cases were received, 20,966 were successfully mediated and over N700,000,000 were collected by the centre on behalf of disputing parties. Following the success of the Lagos experiment, other states started to set up these centres side by side Multi-Door-Court Houses, for speedy dispute resolutions. These centres also exist in Ogun, Niger and Cross River states and are funded by state governments, donations from corporate organizations, NGOs and other donor agencies.

The Mediation process is guided by Conciliation Rules in the Third Schedule to the Arbitration and Conciliation Act Cap A 18 Laws of the Federal Republic of Nigeria, 2004. These centres should have been adequate to be adopted for the NEP GRM in the state project areas of influence, but are largely limited by factors like the need for on-going capacity building on ADR, operational funding and unavailability in some states, including Sokoto state as well as limited or no knowledge of the electricity industry.
Where they exist, the centres will however be suitable to serve as referral points for unresolved grievances from each project component before a complainant is left with the option of walking through a formal court door to seek legal redress.

CHAPTER 5

THE NIGERIA ELECTRIFICATION PROJECT (NEP) GRIEVANCE REDRESS MECHANISM

As a project-based mechanism, the NEP GRM is taking into cognizance the components and the subcomponents of the project design as well as the culture of immediate environments of the proposed project sites. The mechanism will assume responsibility for occurrences and issues that have direct relation to, or bearing on the activities that are being carried out for achieving the components and all the subcomponents of the project in the intervention sites. It must be noted that the NEP GRM does not apply in any way to matters predating the project in project areas of influence.

Developing a GRM for the NEP involved sets of activities. The first was to appraise the nature of project components and review the current situation of grievance handling in the beneficiary locations, through a review of extant literature on the social, and environmental contexts of the project and its various areas of influence. Already prepared policy documents for the project, such as the Environmental and Social Management Framework (ESMF) as well as laws, conventions and policies as they relate to development, especially World Bank projects were reviewed for this task. This was supported by consultations in the already identified project states among stakeholders, to reconfirm some of the findings in the literature as well as establish the variables that would determine the structure of the GRM and its key components.

The desk review established the socio-economic context of persons in the established project host communities and the un-established, as well as the legal and policy environment that necessitates the establishment of grievance redress mechanism for the project. The field consultations were done to appraise the prevalent situation around the project areas of influence, as well as to get understanding of the operational environment of the project and the issues that may emerge.

A tour of parts of the planned project areas of influence was also conducted to engage stakeholders on ground, gauge reactions and glean any emerging or potential grievance trends, this included visits to beneficiary institutions of the EEP phase 1. Contacts and respondents engaged included some key community members, legal institutions, women, youths and relevant government agencies and officials.

The field visits also enabled a hands-on appraisal of existing dispute resolution cultures in existence, as well as public understanding of likely grievances concerning the project.

5.1 GRM Framework

To ensure an effective operation of the GRM, potential grievances, tools for presentations and responding authority are classified according to the three project components below.

Component	Project intervention activity	Potential nature of grievances	Tools for presentation	Ultimate responding authority
1	**Solar Hybrid Mini Grids for Rural Economic Development** will provide subsidies and/or performance-based grants to private mini grid developers to build solar hybrid mini grids in unserved and underserved rural areas.	-Land related matters, including trespass e.g. poles and cables running through or above homes and private lands -Environmental concerns due to presence of batteries and other equipment -Waste management (e.g. battery disposal) -Non-inclusion of community members in paid labour/workforce -Perception of project citing as more favourable to one divide within a larger community -Unrealistic Corporate Social Responsibility (CSR) expectations from contractors -High cost of services	Physical complaint, Written petitions, Official Emails, Phone calls & SMS to GRM hotlines, Use of designated drop boxes as well as channels for confidential and safe complaints for GBV/SEA related grievances	Mini Grid Developers, Head, NEP PMU

		-Conflicts arising from users by-passing meters to use free electricity -High cost of tariff -Commercial electricity users having a higher tariff than others -Prolonged downtime in electricity supply due to faulty equipment -Delay in execution of project leading to breakdown of trust -Gender based violence/Sexual exploitation of locals as a result of labour influx	See **5.6.3** for more on GBV/SEA	
2	**Standalone Solar Systems for Homes, Enterprises and Farms** Will provide market-based incentives to standalone private sector solar system providers to install solar home systems (SHS) for underserved households and SMEs in dedicated areas.	-Supply of equipment considered by consumers as substandard -Insufficient sensitisation on the use of supplied equipment -Perceived lop-sidedness or bias in selection of beneficiaries	Physical complaint, Written petitions, Official Emails, Phone calls & SMS to GRM hotlines	Head, NEP PMU, MD REA

3	**Power Systems for Public Universities and Teaching Hospitals** Will support the construction and operations of solar Mini Grid for beneficiary universities and teaching hospitals. This component will be implemented by REA in collaboration with universities. A contractor(s) will be engaged directly by REA to construct the power systems under this component, which will then be operated by the universities.	-Accidents or injuries to student or community member as a result of construction works -Litigation by competing electricity DISCOs -Prolonged down time or power failure at critical periods -Gender based violence/Sexual Exploitation as a result of labour influx	Physical complaint, Written petitions, Official Emails, Phone calls & SMS to GRM hotlines See **5.6.3** for more on GBV/SEA	Head, NEP PMU, MD REA

Table 5.1: Potential grievances, presentations and responding authority

Diverse methods for reporting grievances that are culturally appropriate are to be used and they should permit for self-identified, confidential, or anonymous procedures (professional letter writers, suggestion boxes, Email, toll-free telephone etc).

Avenues for verbal complaints are:

- Complaints to members of the local Grievance Redress Committee (GRC)
- Social Safeguards & Communications desks at the NEP-PMU
- Open community mediation sessions
- Operators' Customer Care Unit
- Town hall meetings

Avenues for written complaints are:

- Complaint Boxes in the community, operator's office or by hand
- Letters or Email to the NEP-PMU

Dedicated telephone lines shall include:

- Community EUCS secretary and chairperson's telephone lines
- NEP-PMU hotlines
- Operator Costumer Care hotlines

An email feedback system shall be established at the PMU. This will link the GRM Coordinator with potential complainants. This email will be designed to auto respond/ acknowledge complaint emails.

5.2 The REA NEP GRM Structure

It is very vital that the GRM covers the various project components. For a holistic and an effective approach to the formation of this GRM infrastructure, the consultant has taken into consideration the intervention activities across board and has visited the established beneficiary states.

Overall responsibility for the coordination of the REA-NEP GRM will lie with the Environmental & Social Safeguards (E&S) Unit at the PMU. The Social Safeguard will be responsible for the collection of grievances of higher severity that may come directly to the PMU office based on the procedure and grievance classification and framework below. However, the uptake of grievances and recording will be done at the communities' level, after the complaint has passed through the operator Customer Care Unit (CCU) and is not resolved.

Considering that the three project components have unique operational attributes, a one size fits all approach to the design of this GRM will not be effective, especially for uptake at the project beneficiaries' level.

5.2.1 Component 1 GRM Structure

Core Institutions:

The core institutional blocks for the REA-NEP Component 1 GRM are:

- Electricity Users Cooperative Society (EUCS)
- NEP Project Management Unit, including Zonal Liaison Officers
- Local Traditional Authority
- Operator Customer Care Unit (Mini Grid Developer)
- Nigeria Electricity Regulatory Commission (NERC)
- Citizens' Rights/Mediation Centres in beneficiary states
- NEP-PMU Social Safeguards Specialist (GRM Coordinator)
- Department of Women Affairs in the state Ministry of Women Affairs

- Women Leaders in the various beneficiary communities
- Women's right focused NGOs
- The Nigeria Police

Considering that there are minimum required standards for customer care by Mini Grid developers and operators prescribed and monitored for compliance by the Nigeria Electricity Regulatory Commission, and having in mind that the NEP seeks to entrench effective customer care services as prerequisite for selected developers, operators must ensure that they display complaints procedures and available uptake channels in ways that are easily accessible to their customers, including on the operator's website and other communication channels. All complaints shall be resolved and the customer notified within **15 Days** of receipt of the complaint by the operator Customer Care Unit (CCU). Where additional time is required, the complainant is updated of actions being taken within every **7 Days** until the complaint is resolved. Where either the customer or the operator are not satisfied with the resolution by the CCU, the complaint is taken up by the NEP community-based Grievance Redress Committee (GRC) or the NEP Project Management Unit (PMU) GRC, as the case may be. The NEP GRM as an instrument is utilised in cases where a project beneficiary (or beneficiaries) is not satisfied with the mini grid operator or company's handling of a grievance, where the mini grid operator or company, for any reasons, prefer that a complaint is specially mediated at a referral level outside its Customer Care Unit or where the aggrieved project beneficiary has no trust in the operator's customer service and prefers to go straight to the Grievance Redress Committee for redress. Gender Based Violence (GBV) and Sexual Exploitation/Abuse (SEA) complaints shall be STRICTLY handled as prescribed in **5.6.3** below.

The NEP Component 1 GRM structure shall consist of two main units, a community-based Grievance Redress Committee (GRC) and a Central Grievance Redress Committee based at the NEP PMU.

5.2.2 The Component 1 Community-based GRC

This unit of the NEP Component 1 GRM structure shall be established leaning on the Electricity Users Cooperative Societies (EUCS) in each proximate cluster of beneficiary communities or standalone community serviced by a Mini Grid and shall comprise of nominated executive members representing a well spread out demography, including women, youth and minority group representatives (where applicable). The nomination of members of the GRC shall involve a participatory process to take place in well publicised town hall meetings and driven jointly by the EUCS and representatives of the PMU. Local interest groups such as relevant NGOs/CSOs, respected citizens in the communities and reputable community associations shall also participate in the selection of the GRC members. A representative of the local traditional authority shall be included as a key member of the GRC.

The community-based GRCs will (through their secretaries) register reported grievances, categorise them in accordance with the grouping of grievances (as highlighted in the following framework) and refer them as appropriate, in accordance with the stipulated procedure and timelines. This processes and roles of implementers shall be further described below.

GRCs shall consist of an average of 7 to 8 members per Mini Grid serviced cluster, with 2-3 positions assigned to women. Communities with more residential quarters or population shall be considered and permitted to have one or two more members. A Chairman, Secretary and P.R.O shall constitute the ranking members of the GRC.

5.2.3 The NEP-PMU Grievance Redress Committee

A standing central Grievance Redress Committee shall be established within the NEP-PMU, chaired by the NEP Social Safeguards Specialist, and comprising mainly of:

1. NEP-PMU Environmental Safeguards Specialist
2. NEP-PMU Communication Specialist
3. NEP-PMU M&E Specialist
4. Energy Gender Specialist (if available)

Supported by a nominee each from:

4. Office of the Head, NEP-PMU
5. NEP-PMU Procurement Unit
6. Project Engineers
7. Office of the REA Director of Promotions
8. Zonal Liaison Officer
9. NERC

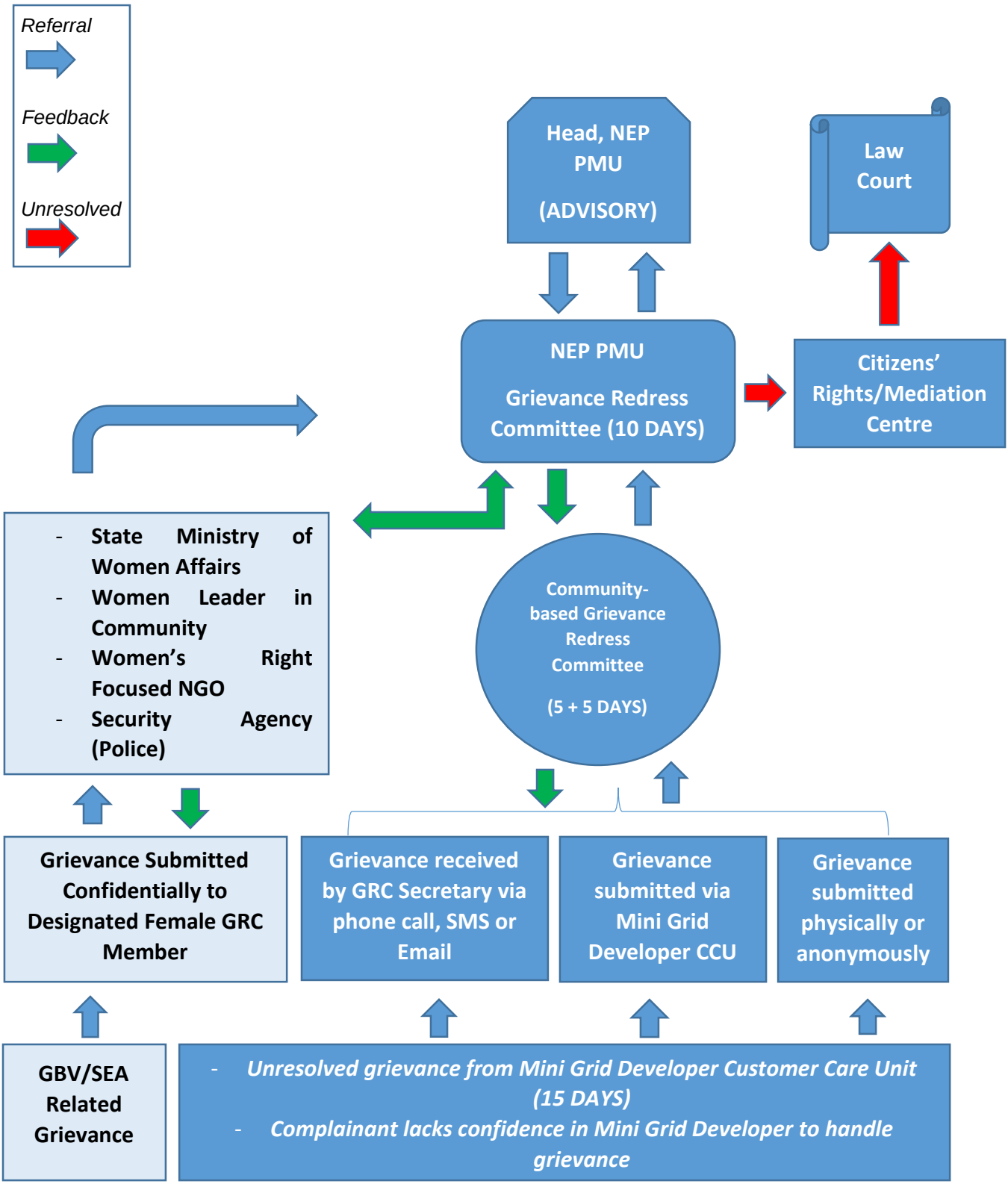
This committee shall be the apex authority of the NEP GRM, which will make recommendations for action to the Head of Project Management Unit in the case of issues of extreme importance, or make referral to the Citizens' Rights/Mediation Centre in the Ministry of Justice of an applicable state in the case of grievances that are either unresolvable at the committee level or found to be extraneous to the execution of the NEP.

5.2.4 Grievance Uptake Points

There shall be at least three major uptake points for grievances arising from the NEP Component 1 subproject activities:

- EUCS office or secretariat
- Mini Grid developers' office/site
- PMU
- NEP State Offices

Fig. 5.1: Component 1 GRM Structure



5.2.5 Roles and Responsibilities of Grievance Redress Implementers

The NEP GRM shall be driven and coordinated by the ESS and community relations' team comprising of the PMU Social and Environmental Safeguards specialists as well as the Communication and M&E specialists. However, it is essential to create a home or focal point for the GRM and integrate such into a Project's Management Framework. The Nodal officer or GRM Administrator shall be the Social Safeguard Specialist. The M&E officer shall be responsible for compilation and reporting of all beneficiary complaint and feedbacks tracked in the process of grievance reporting and redress by the central GRC. Additional support shall be provided to this team through external social experts and firms where and when required.

5.2.5(i) Responsibilities of the Social Safeguard Specialist/Grievance Redress Coordinator include:

- Coordination of the entire GRM
- Documentation of the GRC proceedings, decisions, and recommendations
- Registration of grievances using a prescribed form; Keep a log
- Facilitation and provision of information and services to resource persons as required by the grievance redress committee (GRC) to deal with reported grievances
- Maintenance of grievance-related documents, reports, and attendance and payment registers of GRC members
- Coordination of the grievance uptake channels, ensuring that they are adequately resourced
- Liaise with the Communications Specialist of the PMU for publicising the NEP GRM channels, structure and other essential project communication strategies
- Liaise with community-based GRC to track and record complaint and resolution reached
- Liaise with the Citizens' Rights/Mediation Centres in the project states, for possible referral of unresolved grievances and tracking of reported complaints
- Facilitating arrangements for field inspections
- Handling all payments and expenses related to GRM operations
- Providing feedback to affected persons and agencies involved in grievances
- Reporting progress to the PMU and World Bank in required formats

- Planning and executing GRM trainings
- Planning and executing GR evaluation and refining the GRM process for continuous improvements

5.2.5(ii) Roles and responsibilities of Mini Grid Developer Customer Care officer

- Operate and manage uptake points for complaints and resolving complaints
- Promptly refer grievances certified as UNRESOLVABLE to community-based GRC
- Monitor and provide feedback on environmental and social impacts and effectiveness of mitigation measures at community level
- Provide monthly/quarterly report on grievances to the PMU through the social safeguards specialist
- Partake in development and implementation of grievance prevention sub-plans

5.2.5(iii) Roles and responsibilities of the community-based GRC

- Settle disputes at community level
- Operate dedicated telephone hotline(s) for complaints
- Partake in training programs
- Partake in participatory planning with contractors for conflict prevention e.g. on-site food vendors plan, local labour engagement plan etc.
- Project information dissemination
- Coordination of town hall meetings and other stakeholder engagements

5.2.5(iv) Roles and responsibilities of the community-based GRC Secretary

- Manage day to day operations of GRC in project beneficiary community
- Arrange and partake in Grievance Resolution Sessions
- Register new complaints using agreed formats
- Manage complaint boxes and other grievance uptake channels
- Provide monthly/quarterly report on complaint to the PMU through the social safeguards specialist
- Facilitate pasting of posters, distribution of brochures and other information dissemination materials in communities

- Operate dedicated telephone hotline(s) for complaints

5.2.5(v) Roles and responsibilities of state Citizens' Rights/Mediation Centres

- Settle disputes that are referred from PMU
- Second arbitrators to Community-based GRC sessions when requested by GR Administrator

5.2.5(vi) Roles of the External Consultant

Relevant Consultants shall be engaged periodically (when necessary) for the following:

- Generate performance indicators for grievance redress at stages of project
- Develop reporting and management formats to support PMU ESS Team
- Conduct independent monitoring of GRM operation
- Support the development of Stakeholder/Beneficiary Engagement Plan
- Carry out Beneficiary Satisfaction Survey
- Work with communities in developing Grievance Prevention Plans

5.3 Stages of Complaints and Appeal Levels

An effective GRM must provide the opportunity for a complainant to seek a higher level of redress if they are not satisfied at the lower level. After a complaint is certified unresolvable by the Mini Grid Developer CCU, there are four levels of redress in the NEP Component 1 GRM. It is important to state that ANY complaint of GBV at any level of the GRM should immediately be referred to the stipulated GBV services providers with clear information provided on other available choices for referral, the decision for which choice to take should be left to the survival.

5.3.1 Referral to Community-based GRC Secretary

Complaints presented via any of the uptake channels in the community or from the Mini Grid Developer CCU are directed to the secretary of the community GRC. Where the issue bothers around basic lack of information by the complainant, the secretary is empowered to resolve it at that level by providing the required enlightenment. Where the secretary alone cannot resolve the complaint and a further confirmation is required, two or more members of the GRC are invited to hear the issue and provide redress ***within 5 days***. Where the matter is not adequately resolved to the satisfaction of the complainant or the issue goes beyond correcting a misinformation and requires arbitration, the GRC secretary refers it to stage two, which is the *Community Mediation Session.*

5.3.2 The Community GRC Mediation Session

This stage in the grievance redress involves all members of the community GRC meeting with the complainant(s) to mediate and attempt to resolve the grievance. The GRC then refers the case to the PMU GRC if it is still not resolved ***within a further 5 days***. The community GRC mediation sessions are expected to resolve issues like trespass into private property by project activity, exclusion claims, labour or workforce related issues and any other grievances that could be nipped in the bud before they escalate.

5.3.3 Referral to the NEP-PMU Grievance Redress Committee

Typical cases that go beyond the community-based GRC could involve actions for (i) regulation of Mini Grid Developer activities and (ii) resettlement and compensation for damages (iii) Gender Based Violence (GBV) or sexual exploitation by Mini Grid Developer staff. The Social Safeguard Specialist registers the grievance and may resolve same if it is within his/her influence to do so, otherwise an expanded meeting of the central GRC is convened. The involvement of the Head, Project Management Unit (PMU) or any other project executives could be necessary when there is a need to get quick approvals and enforce contractor compliance in situations of contractor impunity, highhandedness, or in the case of GBV related complaints.

The PMU GRC is expected to finalise mediation on grievances ***within 10 working days***. The complainant/survivals confidentiality should also be kept in mind when reporting any incidences to the police or service provider.

5.3.4 State Citizens' Rights/Mediation Centre

Cases referred here are usually unresolved prolonged cases that is deemed fit for referral by the PMU GRC. The complainant is adequately briefed at this point of the need for a higher level of independent and transparent mediation.

In the case where a project beneficiary state does not have a citizens' mediation centre, an official letter shall be written by the PMU to the Registrar of the Institute of Chartered Mediators and Conciliators (ICMC) of Nigeria to second a reputable mediator, not lesser than a Fellow of the institute, to provide professional service on the case.

5.3.5 Law Court

The PMU is expected to exhaust all available avenues for settlement based on the principles of Alternative Dispute Resolution before allowing a complainant decide that they are not convinced about the resolution reached and would wish to take the matter up to a law court. Referral to a law court should ordinarily be done at the level of the Citizens' Rights/Mediation Centre.

The above steps are however not cast in stone, to prevent grievances from escalating and bringing delays to the project execution, a complainant could proceed to register a

case at the Community Mediation Session involving the full GRC, if they are not comfortable dealing with the GRC secretary or with the agreement of the secretary. A grievance may also go directly from the community to the PMU level if it is deemed as requiring urgent project or contractor correction. Cases of serious mishaps, accidents or fatalities will also be reported directly to the central GRC.

5.4 Conflict of Interest

Where a complaint has a member of the GRC as complainant, respondent, accused, party or is seen as having any form of conflict of interest, the affected member or members shall not participate in the mediation of such grievances. The decision shall be communicated to such a party and to the complainant in writing and be documented.

5.5 Voluntary Resignation of GRC Member

Where a member of the GRC at any level voluntarily withdraws their membership for any reasons, the GRM Administrator at the PMU shall be informed officially by the Chairman of the GRC or Secretary and an open consultation involving members of the community is held to nominate a replacement, who must be from the group/constituency the withdrawing member previously represented in the GRC.

5.6 Grievance Redress Procedure

Procedure for grievance redress are as follows.

5.6.1 Receipt and Registration of Feedback or Grievance

The first step for any project beneficiary or complainant to benefit from the NEP GRM is the presentation of a grievance or feedback at a grievance uptake point after the Operator CCU has failed to reach a resolution. The GRC Secretary will receive grievances from the complainant via the Operator CCU Officer, drop boxes placed at pre-arranged easy-to-locate points in the community, telephone calls, Email, physically/verbally etc and acknowledge. The complaint will then be registered and a logbook of grievances will be maintained. Cases related to GBV and personal details of the complainant will however, not be documented in the public grievance log book in case a GBV complainant decides to provide any information. The complainant/survivals confidentiality should be kept in mind when attending to any GBV/SEA related complaint. reporting any incidences to the police or service provider.

The receiver (preferably Secretary) will clarify primary information, register and acknowledge receipt of it to the grievant immediately or **within a maximum of 2 days**. The acknowledgement is to give the complainant assurance that the complaint has been received and is receiving necessary attention or has been resolved. The registration will capture the following data: Reference Number, Date of the feedback or grievance, Name of the complainant, Gender of complainant, Address, Contact Phone Number (& Email, if

applicable), Category of the grievance and Signature. A complaint or feedback can also be submitted anonymously or via a third party.

Complaints and feedbacks made in writing and those made verbally by persons that cannot read or write shall be transcribed by the receiver as appropriate and read back to the complainant to ensure agreement. All complaint submitted irrespective of its sources shall be acknowledged with a corresponding acknowledgement sent to the complainant.

5.6.2 Verification/Screening of Grievances

The receiver of grievance will then consult and make enquiries within the areas of grievance. The investigation will determine among other things whether the matter has any relationship with the Project or whether the level at which it is presented can handle it. In the case of GBV/SEA complaint, this will not be investigated but rather referred to the appropriate authority and GBV service provider around the project area. If the complaint is rejected, the complainant is informed of the decision and the reasons for the rejection within 2 days of registration of the complaint or feedback. Any complaint that is rejected shall have the benefit of a first hearing at the Community GRC level and then referred to the appropriate level/authority for redress.

Reasons why a complaint or feedback may be deemed not eligible and rejected include: (i) The complaint does not pertain to the project (ii) The issues raised in the complaint does not fall within the scope of issues the grievance mechanism is authorized to address and (iii) The complainant has no standing to file e.g. not a member of the project community and not affected by the project activities.

Facts must be established against the interest and goal of the grievant, to build trust. Fact finding is essential to redress, but not applicable to GBV/SEA cases under this GRM. Grievances spring from differences in expectations, interests, knowledge or lack of it, needs and fears.

Complaints in the NEP Component 1 GRM should be classified under the following categories.

Category 1: Exclusion claims

Category 2: Physical and/or economic displacements caused by land acquisition or any other project activities

Category 3: Billing, metering or cost of service equipment

Category 4: Security, Crime and Enforcement Issues (including GBV)

Category 5: Labour issues

Category 6: Environmental Management lapses (including consequent mishaps)

5.6.3 Gender Based Violence (GBV) and Sexual Exploitation and Abuse (SEA)

All complaints related to GBV shall be treated in a private and confidential manner, limiting information to what the survival or complainant is freely willing to provide. A separate register shall be opened for this category of cases and shall ONLY be accessed by the community-based GRC secretary, the GRM coordinator at the PMU (and any female GRC member empowered to handle GBV cases where the Chairman and Secretary are all male). The complainant (if a survival) shall be attended to with empathy, assurance of safety and confidentiality. In the event that the complainant is not willing to divulge any information, this view should be respected by the GRM officer, and the complainant referred to the appropriate nearest medical centre, approved available GBV service provider or police, depending on the complainant's choice. Such a complaint should be reported to the World Bank Task Team as well by the PMU GRC.

Other considerations for the handling of GBV/SEA grievances include:

No GBV data on anyone who may be a survival should be collected without making referral services available to support them

All GBV complaint should be referred to the right service provider and other relevant institutions, information to be requested should be limited to:

- The nature of the complaint (what the complainant says in her/his own words without direct questioning)
- If, to the best of their knowledge, the perpetrator was associated with the project; and,
- If possible, the age and sex of the survivor

5.6.4 Implementation and Case Closing

This is the period where the complaint or feedback passes through the full cycle and a feedback is agreed. The resolution of the committee at the various level is documented. Where there is need for external referral of the matter the complainant is appropriately guided on the next steps.

The result of the process can vary. The request of the complainant may be turned down, compensation may be recommended, or Management may simply apologise to the grievant. The Head, PMU, provides oversight for timely and adequate resolution.

5.6.5 Feedback

At the time of acknowledgement of the feedback or grievance, the complainant will be provided with the following information:

(i) Grievance Reference Number to facilitate monitoring and reminders by complainants.

(ii) Expected time of redress (Prescribed maximum time limit for redress is three months).

(iii) If not addressed within expected time, action to be taken by complainant

If the grievance is not redressed within the expected time, the complainant should be provided with the following information:

(i) Information on reasons for delay

(ii) Updated expected time of redress

(iii) If not addressed within expected time, action to be taken by complainant

At the time of final redress, the complainant will be provided with information on

(i) Final action taken for redress and

(ii) Avenues for pursuing the matter further

All responses to the complainant in a grievance redress process must be communicated in writing to the complainant. The officer responsible for the uptake of the grievances will follow up on the responding authorities for cases referred to be able to establish when each grievance has been resolved.

5.7 Component 2 GRM Structure

The NEP Component 2 is designed to enable households and micro enterprises access better energy services at lower average cost, by providing support to the private sector-led market for standalone solar systems. The structure permits flexibility, by allowing participating solar companies to design and run their business in the most viable ways, leveraging on natural market techniques.

An open market arrangement such as this would also require, first and foremost, traditional market systems of customer service. This is more so as the SHS companies will not be fronting as NEP or government sales agents during transactions.

5.7.1 Grievance Prevention Measures

To ensure that the subproject objectives are met and to prevent any incidents that may hamper effective operations of participating companies or by extension the PMU, the following strategies have been put in place.

- The application structure for interested companies clearly caters for environmental management by requiring evidence that environmental and social risks are mitigated.
- Products must also pass the NEP quality verification process and the Lighting Global standard.
- Evidence of ability to effectively provide pre- and after-sales service to acquired customers, including easy and practical warranty service.
- Must pre-qualify both company and product to claim grant as often as once a month.
- Claims are submitted online then installations of systems are verified by the Independent Verification Agents (IVA)

5.7.2 Core Institutions for the Component 2 GRM

The core institutional blocks for the management of any grievance that may arise as a result of the activities of a grantee and require NEP intervention are:

- The SHS company (grantee)
- The Independent Verification Agents (IVA)
- PMU Social Safeguards Specialist (GRM Coordinator)
- PMU Environmental Safeguards Specialist
- PMU M&E Specialist
- Representative of the Component Coordinator
- Representative of the Head, NEP PMU
- Zonal Liaison Officers
- Ministry of Women Affairs
- Women's Right Focused NGO
- Nigeria Police

The above institutions, with the exception of the SHS Company, Ministry of Women Affairs, Women's Right Focused NGO and the Nigeria Police, shall constitute the PMU GRC for component 2 and shall receive, log and mediate on grievances received directly or referred after the SHS Company has failed to reach a resolution with a complainant within the stipulated time. The company must ensure that customers are provided with sufficient information on after-sales services, including the company's complaints procedures and uptake channels, this information must be provided in ways that are easily accessible to their customers, including on product fliers, product manuals, website and other communication channels. All complaints shall be resolved and the customer notified **within 15 Days** of receipt of the complaint by the company. Where additional time is required, the complainant is updated of actions being taken **within every 7 Days** until the complaint is resolved. Where a customer is not satisfied with the resolution of a

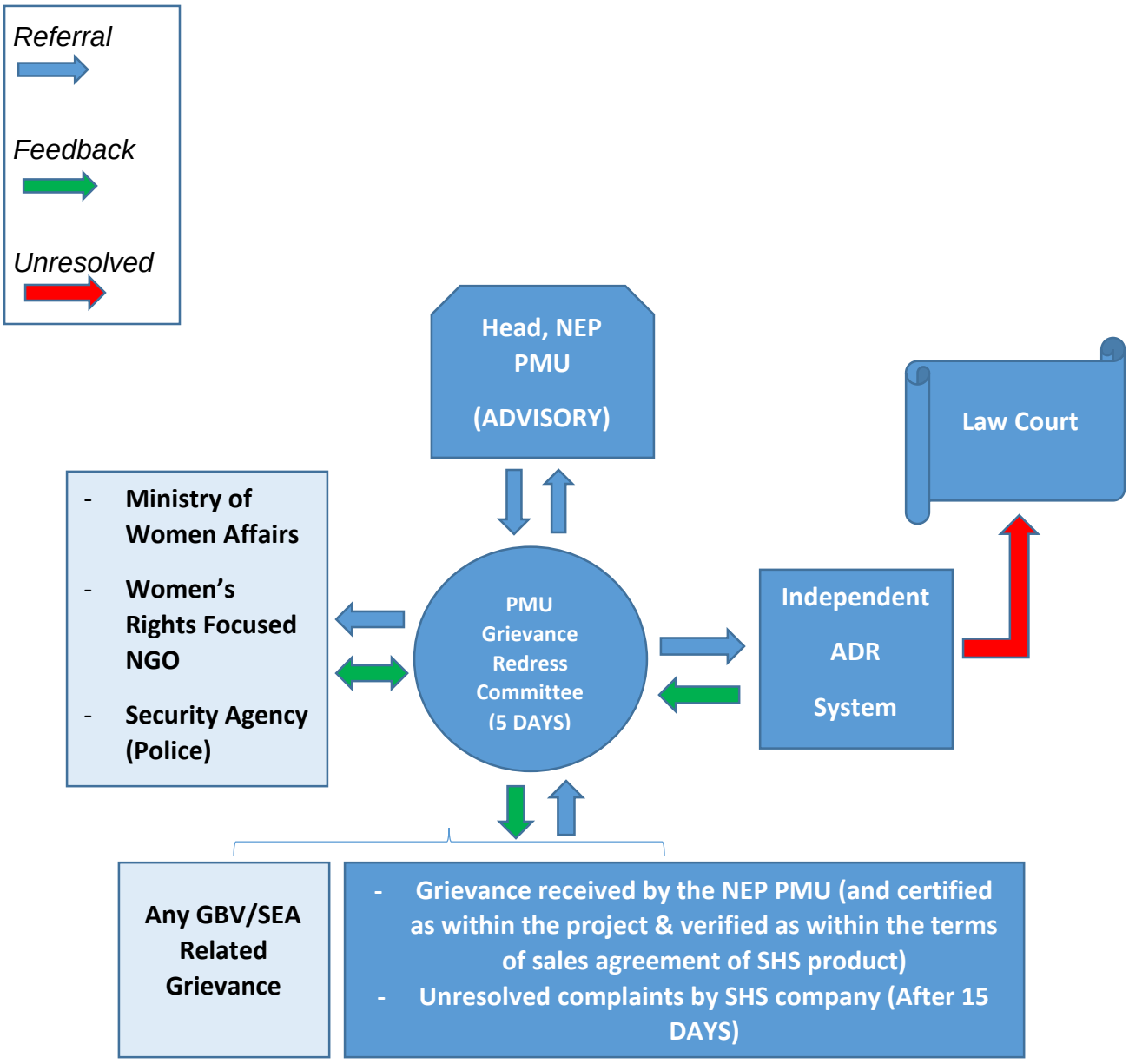
complaint and such a customer is aware that the SHS company is a beneficiary of the REA NEP, such a complainant is eligible to contact the NEP Project Management Unit (PMU) directly via the publicised NEP hotlines, email, written letter or physically for redress.

Although all complaints reaching the NEP PMU under this component shall be received, recorded and feedback given to complainant, only grievances presented by a certified SHS beneficiary, related to the project, and within the SHS product terms of warranty or sales agreement by the SHS company shall be prioritised for mediation by the PMU GRC. For other complaints, an immediate clarification and resolution that is acceptable could be provided and case closed. A representative of the SHS company is also invited to participate in the PMU GRC mediation if necessary. The NEP GRM Coordinator shall be responsible for recording and acting on complaints received at the PMU.

The GRC shall mediate and provide feedback on redress to the complainant ***within 5 days***. Where such a project beneficiary is not satisfied with the feedback and insists on seeking further options for redress, the option of an independent mediator sought from the Institute of Chartered Mediators and Conciliators (ICMC) (not less than the rank of a Fellow of the institute) is presented. Where the complainant is still not satisfied they are referred to seek higher redress in a competent court of law.

Although GBV/SEA related complaints are less likely to occur under this component, a pathway for the referral of any such grievances, if they are observed in any form, has been built into the GRM structure. On receipt of any such complaint by the PMU GRC, it is strictly subjected to the procedures enumerated in **5.6.3**, this may include potential grievances emanating from relationships between staff of an SHS company and the Independent Verification Agents.

Fig. 5.2: Component 2 GRM Structure



5.8 Component 3 GRM Structure

This component, otherwise referred to as the Energising Education Programme (EEP) is envisaged to have relatively limited grievances, especially as the project areas of influence are relatively smaller and a little regimented by authorities of the benefitting tertiary institutions. Land for the development of subprojects are expected to be provided by the institutions and within the campuses or hospitals, reducing social concerns like displacement and loss of sources of livelihood or vegetation. The project is also designed for hand over and to be sustained by the benefiting institutions after the NEP. This of course does not rule out potential issues regarding land acquisition, restriction, legacy land acquisition or any other such grievances that may spring up, especially as most universities in Nigeria are located side by side with communities.

The likelihood of sabotage or other similar actions by competing interests and previously existing electricity distribution entities to the institutions is a higher concern to the GRM consultant, especially as these actions could be masqueraded as genuine grievances, which could ultimately cause delays for the project. Communities around the universities and teaching hospitals who are underserved or without access to electricity could also put pressure on the project for inclusion, leading to grievances which may be considered extraneous to the NEP but directly impacting. This of course does not rule out potential issues regarding land acquisition, restriction or legacy land acquisition or any other grievances that may spring up.

Other potentials for grievance include the expected influx of staff of the EPC contractors and labourers into the university community, raising concerns of GBV and SEA of students, especially young school girls. Protests and demonstrations by students who may become agitated by poor electricity supply, perceived mismanagement of project infrastructure or delays in project completion is also not a negligible grievance factor.

5.8.1 Core Institutions

The core institutional blocks for the REA NEP Component 3 GRM Structure are:

- University Authority (office of the Vice Chancellor)
- Office of the Dean of Students' Affairs
- Teaching Hospital Authority (Office of the Chief Medical Director)
- Corporate Affairs/Public Relations Unit of Teaching Hospital
- Engineering Procurement and Construction (EPC) Contractors
- PMU Social Safeguards Specialist (GRM Coordinator)
- PMU Environmental Safeguards Specialist
- PMU M&E Specialist
- Energy Gender Specialist (if available)
- Representative of the Head, NEP-PMU

- Ministry of Women Affairs
- Women Focused NGO
- The Nigeria Police
- Zonal Liaison Officers

5.8.2 Grievance Uptake Points

Being a more academic environment, operators of the solar hybrid plants shall be mandated to display complaints procedures and available uptake channels for complaints in ways that are clearly visible to their customers, including on their websites, placement of grievance submission boxes at their office and via other communication channels, the same procedure shall be applied in the Students' Affairs Department of the universities and the Corporate Affairs unit of benefitting teaching hospitals for all to see. Any complaints pertaining to the project and its subprojects shall be channelled to this uptake points. All complaints shall be resolved and the customer notified **within 15 Days** of receipt of the complaint by the operator Customer Care Unit (CCU). Where additional time is required, the complainant is updated of actions being taken within **every 7 Days** until the complaint is resolved. Where either the customer or the operator are not satisfied with the resolution by the operator CCU, the complaint is taken up by the NEP community-based Grievance Redress Committee (GRC) or the NEP Project Management Unit (PMU) GRC, as the case may be.

Any emerging gender Based Violence (GBV) and Sexual Exploitation/Abuse (SEA) complaints shall be STRICTLY handled as prescribed in **5.6.3** above.

5.8.3 Composition of the PMU Grievance Redress Committee

- PMU Social Safeguards Specialist (GRM Coordinator)
- PMU Environmental Safeguards Specialist
- PMU M&E Specialist
- Representative of the Head, NEP-PMU
- Representative of the Component Coordinator

The PMU GRC shall log, investigate, mediate and provide feedback **within 14 days** in grievances certified by GRC members as serious or pertaining to the project governance and administration e.g. threat to project infrastructure. A complainant who is not satisfied by the outcomes of the mediation and feedback by the central GRC shall have the option of an independent mediator sought from the Institute of Chartered Mediators and Conciliators (ICMC) (not less than the rank of a Fellow of the institute) presented. Where the complainant is still not satisfied, they are referred to seek higher redress in a competent court of law.

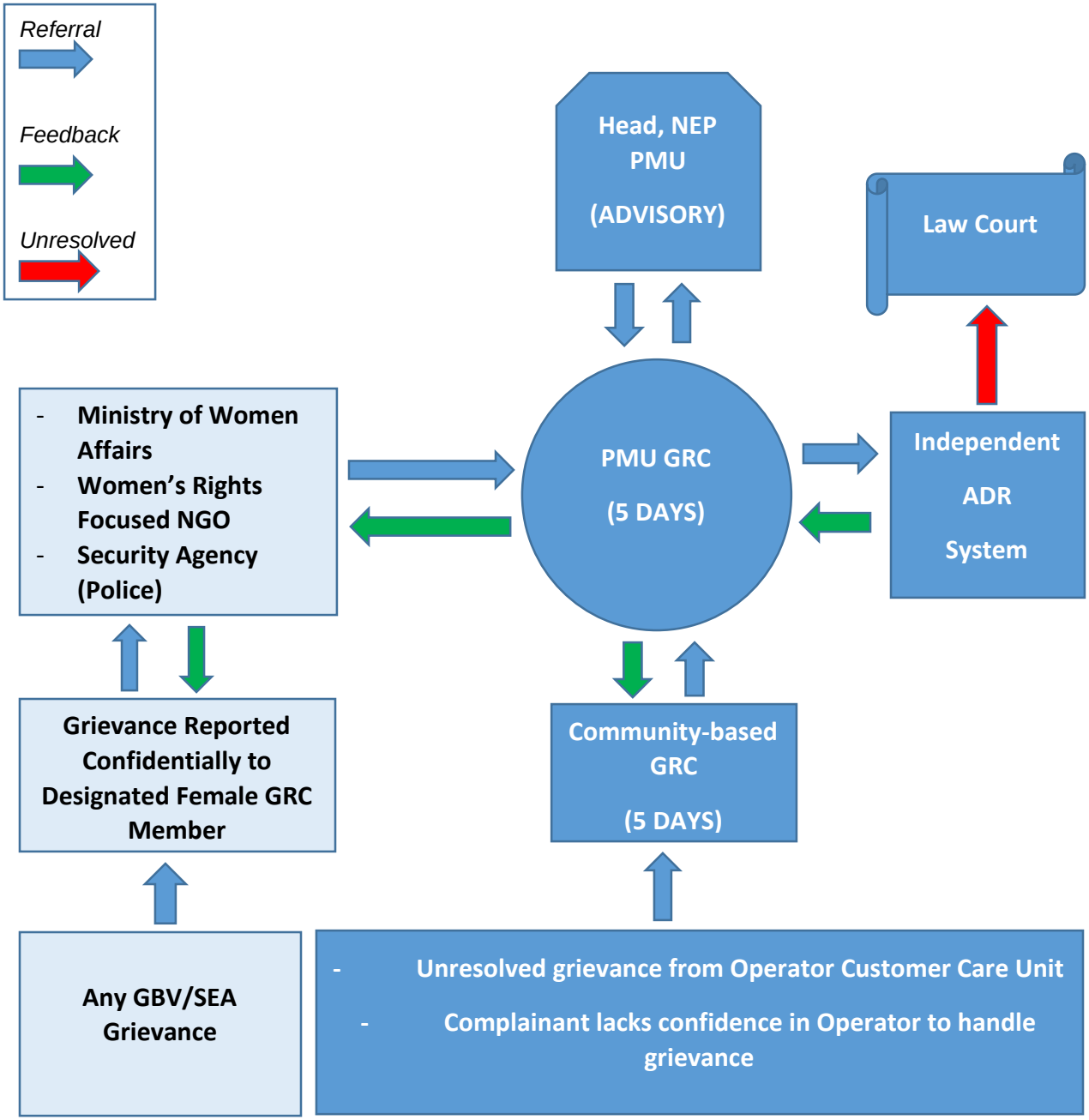
5.8.4 Community-based GRC

A community-based GRC shall be constituted in each benefiting university/teaching hospital, which shall receive, acknowledge and mediate on complaints that are not resolved by the operators and referred to it. The Secretary of the community-based GRC shall receive and record all grievances. Feedback from the community-based GRC to a complainant **shall not exceed 5 workdays**. A complainant who is not satisfied with the feedback on outcome of the mediation by the community-based GRC shall have their grievance referred to the PMU GRC. A complaint referred to the PMU GRC shall be mediated upon and feedback communicated to the complainant **within 5 days**. In the event that a complainant is still not satisfied with the mediation by the PMU GRC, the option of an independent mediator sought from the Institute of Chartered Mediators and Conciliators (ICMC) (not less than the rank of a Fellow of the institute) is presented. Where the complainant is still not satisfied they are referred to seek higher redress in a competent court of law.

- Representative of the office of the VC or CMD
- Bursar or Head of Accounts
- Dean of Students' Affairs Department
- Director, Department of Physical Planning/Works (where available or equivalent)
- President of the Students' Union Government (SUG)
- Representative of the Owner's Engineer (OE)

Considering that the subprojects under this component involves some level of construction and physical infrastructure installations similar to the NEP Component 1, relevant and applicable procedures for grievance redress, roles of common implementers and other variables under the Component 1 GRM structure shall be leveraged for the operationalizing of the EEP component grievance redress structure.

Fig 5.3: Component 3 GRM Structure



CHAPTER 6

IMPLEMENTATION OF THE NEP GRIEVANCE REDRESS MECHANISM

6.1 Communicate to Build Awareness

Educating local people and contractors about the grievance mechanism is an essential and on-going responsibility. It does no good to have a perfectly designed GRM that no one knows about

6.1.1 Communicating with Stakeholders/Beneficiaries

For an effective operation of the Project GRM, the objectives of it and procedures will have to be properly communicated to those who will use it so that they will not only be eager to access it but also to own it, taking cultural peculiarity of each community into consideration.

The goal of communicating the GRM to stakeholders is to create awareness at a general level, to build skills and capacity at leadership level as well as to cause adjustment in behaviours and attitudes at the level of all stakeholders with a view to entrenching inclusion.

To entrench this GRM as an efficient management tool for the NEP-PMU, a combination of methods and media should be employed. The communication plan must take into account the awareness creation and the behavioural change need of the stakeholders.

There is the need for a sensitisation forum with the various communities, to acquaint the stakeholders of the project with the guideline and workings of the GRM. This workshop will rally representatives of the states, local governments, traditional institutions as well as key groups and personalities in the project communities.

Accessing the grievance redress system will depend so much on the level of awareness about the mechanism among potential users. This therefore will require both group and mass methods as well as all the media forms available.

6.1.2 Basic Communications Channels

Mass Media: Findings of this study revealed that the greater number of stakeholders engaged get their information from the various media of mass communication, it is pertinent therefore to continue to engage stakeholders via the traditional media, especially electronic (local radio & TV).

‘Face-to-face’ Communication Channel: It is also clear that specific information about the state of the project in specific sites cannot always be captured through the mass media. A large part of information dissemination must be carried out by word-of-mouth in face to face encounters. This can be made possible by the periodic presence of project personnel in the communities for town hall meetings and other stakeholders’ forum.

Social media: The creation of online communities around the project to improve participation, inclusion and ownership should be encouraged and supported. Platforms like WhatsApp, Facebook, Twitter and other new media channels can be engaged to get information about the project out and attract discussions and contributions. For alerts and emergency communication, the use of targeted bulk SMS to stakeholders in the area concerned will be very valuable.

Project Website: All necessary information on the project activities for the consumption of the public, including avenues for grievance redress and feedback should be publicised on the project website

Mid-Media and IEC Materials: The use of outdoor advertisements, flyers, brochures, branded shirts and gift items, branded training materials with crafted messages is also very effective and should be explored.

Grassroots Mobilisation: The consultant observed an existing relationship between the PMU and the Component 1 project communities, including engagement with EUCS and State Energy Working Groups. Periodic telephone conversations with the leadership of communities and the GRC should be encouraged. Women and Youth leaders should be specifically targeted and encouraged to open up on issues affecting them with regards to the project.

6.2 Training and Support to Participants

This will involve orientation and training for beneficiaries, GR implementers/GRM officers, relevant staff of the contractors, security personnel etc. and provision of external consultancy and support staff to strengthen organizational capacity.

6.2.1 Conduct Training

The training requirements for the GRM are multifaceted, diverse and layered through the orientation and implementation phases.

The training requirements during the GRM introduction/orientation phase are:

- Orientation and training workshop for GRC members
- Preliminary training and capacity building for GR managers and implementers to launch GRM

- Training on GRM implementation and participation for other stakeholders, including contractor staff and other identified field workers

The training requirements during the implementation phase are:

- Continued training for beneficiaries and GRM users in the implementation phase
- Training and retraining of mediators of the states Citizens' Rights/Mediation Centres

An external consultant shall be identified to support these training prerogatives at different phases of project development. The outlay of the preliminary training program is elaborated below.

S/N	GR Implementer	Training
1	Social Safeguards Specialist (GRM Administrator)	Training in conflict resolution, Alternative Dispute Resolution (ADR) and grievance management. Members of the Chartered Institute of Mediators and Conciliators (ICMC)
2	PMU GRM Team (including GRM Administrator)	To include procedural training on receiving, registering, and sorting grievances; training in management of the grievance redress process (developing flow charts) particularly GBV/SEA related complaint, assigning roles, monitoring performance of staff dealing with complaints, and providing incentives.
3	Community-based Grievance Redress Committee (GRC)	Basic ADR "decide together" problem-solving skills. Skills for conducting receipt and registration, referral processes, communication to complainants, GR logging, monitoring and record keeping etc.
4	Secretary of the Community-based GRC	Effective communication, negotiation, and facilitation skills; problem solving; dispute resolution, decision making and their

		respective parameters, standards, and techniques
5	Mini Grid Operators Community Liaison officer	Effective communication, negotiation, and facilitation skills; problem solving; dispute resolution, decision making; and their respective parameters, standards, and techniques
6	Citizens' Rights/Mediation Centres	ADR Training for staff lawyers. Membership of the Chartered Institute of Mediators and Conciliators (ICMC)
7	All GRM officers	Training on confidential, respectful and survival centred response to GBV complaints.

Table 6.1: Training Outlay

6.3 Monitor, Report and Learn

The goal of ongoing monitoring is not only to improve the system, but also to improve the PMU capacity. Monitoring GRM will promote checks, stability and effective delivery of the project. Reporting GRM will help documentation of emanating issues from sites, best practices and improve organizational relationship with communities. Learning will showcase case studies, success stories, knowledge management and research. Energy Management Information System (EMIS) - database of NEP will be used to capture, archive, analyse and report data on GRM. Key officers to collect data report in real time to NEP GRM Committee will use data collection tools. Analysed data will be triangulated and used for planning, reprogramming, support policy development or review as well as decision-making.

The goal of on-going monitoring is not only to improve the system, but also to improve the PMU capacity.

6.4 Basic tips to aid implementation

- Create a grievance advisory committee: an oversight group with advisory authority, composed of PMU and community representatives who monitor performance and provide strategic advice about the grievance mechanism. Involve appropriate stakeholders and community members like complainants who have used the grievance process satisfactorily.

- Utilise internal PMU forums such as staff meetings, community relations meetings etc. to review the performance of the GRM. Do not censor or discourage discussion about the performance of the system and possible suggestions for changes in REA.
- Solicit input from community members and, where appropriate, engage them in deliberations on appropriate changes to the mechanism.
- Consider appropriate venues and processes to secure the best citizen suggestions on the functioning of the mechanism, and shape these according to local cultural norms.

6.4.1 Establish Clear Standards and Criteria for Evaluation

Identify which aspects of the grievance mechanism to evaluate: the whole mechanism, the performance or behaviour of implementers, the time required to process complaints, kinds of resolutions, patterns of settlements, structural issues posed by the system and its operation, settlement costs, and so forth. Questions should be developed in two broad areas: the performance of the grievance mechanism, and lessons related to NEP PMU operations that have emerged. Some possible questions to pursue are listed below.

6.4.2 Questions targeted to the grievance mechanism's performance

- How well is the system accomplishing its purpose and goals?
- Is the system making a difference? How?
- Is the mechanism saving money and reducing risk?
- Does the mechanism enable complainants to raise their concerns, engage in a fair process, and obtain a satisfactory settlement to their issues (when appropriate)?
- Where are the gaps? What works and not working?
- What types of problems is the system addressing?
- Do people know where to go? Is the mechanism accessible and easily understood?
- Do those who receive and register complaints document the complaints?
- Can complainants readily determine the status of their complaint and how the PMU is responding?
- To what extent is the system actually used by a wide cross-section of men, women, and youth from the beneficiary community?

- How well does the mechanism address the power imbalance between the project and complainant and assure that the complainant is not always merely receiving a judgment from the company?
- Does the mechanism provide adequate opportunities for face-to-face participation and discussion and joint development of mutually acceptable solutions to issues in question?
- Does the mechanism allow and facilitate, when appropriate, complainants' pursuit of external and independent means to redress their grievances?
- What conflict trends, community issues, and project operations could influence the kinds of conflicts that might be expected in the future?
- Is the grievance mechanism set up to handle such issues?
- What actions would increase effectiveness?

CHAPTER 7

SUMMARY ACTION PLAN, SOP AND BUDGET FOR IMPLEMENTATION

7.1 Project Management Unit and Mini Grid Developers:

- Conduct Preliminary Stakeholder Engagements/Awareness Building
- Preliminary Town Hall meetings and pre-implementation beneficiary engagement
- Identify and engage consultant or relevant staff to develop communication materials (TV/Radio, fliers, billboards, brochures, other awareness and instructive materials)
- Set up GRM (Social Infrastructure and Processes)
- Conduct office team meetings to assign roles
- Set up GRM desk office in PMU with a dedicated staff
- Disseminate GRM to mini grid developer customer care unit staff and management
- Ascertain any impediments to effectiveness within the mini grid developers and at the REA NEP PMU and correct
- Conduct Town hall meetings and EUCS meetings for preliminary briefing and participatory nomination of GRC
- Establish and inaugurate Community-based GRCs
- Support Community GRCs to establish complaints uptake channels
- Establish telephone hotlines, Internet, Email, Facebook, WhatsApp where applicable
- Develop grievance prevention sub-plans
- Conduct orientation training and capacity building for GRCs
- Create all linkages and modalities for handling of potential GBV/SEA complaints
- Initiate Grievance Redress Processes - Operate GRM
- On-going monitoring, training and Capacity Building
- Conduct ongoing consultations and community engagements
- Conduct Town hall community Briefing & Feedback sessions

- Facilitate workshop for participation and collaboration on project development plans, progress, challenges and complaints.
- Conduct mid-project beneficiary engagement to brief beneficiaries on activities and obtain open feedback from communities.
- Conduct post-project Beneficiary Engagement
- Maintain communication systems (local radio and TV jingles etc)

7.2 Community-based Grievance Redress Committees

- Elect principal officers
- Agree on meeting/mediation days, venues and other logistics requirements e.g. location of complaint drop boxes
- Participate in training/capacity building sessions
- Receive work tools and materials from PMU
- Initiate Grievance Redress Processes
- Participate in monitoring and on-going trainings/capacity building

7.3 Training and Capacity Building

- Continued training for beneficiaries and GRC users
- Training and retraining of mediators of the Citizens' Rights/mediation Centres
- ADR training for PMU In-house team
- ADR Training for GRC members

7.4 Monitor, Evaluate and Refine

- Conduct PMU GRM Team technical retreat to review successes and obstacles with the view to revising prescribed processes and update of budget
- Identify external consultant to conduct GRM user satisfaction survey
- Establish multi-layered M&E framework. Implement community/beneficiary Co-monitoring
- Conduct Town hall meetings and FGDs for GRM user feedback on performance
- Conduct regular BF and GRM evaluation retreats

7.5 Summary Budget Estimate for GRM

A provisional budget estimate of twelve million, three hundred and fifty thousand naira (N12,350,000) is proposed for operationalizing the Grievance Redress Mechanism presented in this report. A summary breakdown is provided in Table 7.1 below

TASK	AMOUNT	PERSON RESPONSIBLE
Preliminary stakeholder engagements/awareness building	1,500,000	GRM Coordinator, Mini Grid Developers, SHS Independent Verification Agent and EEP Operators
Orientation and training workshop, involving external consultant	4,000,000	GRM Consultant, GRM Coordinator, Head NEP-PMU
Preparation of communication materials (awareness and instructive materials), including complaint boxes	2,000,000	GRM Coordinator, Communication Consultant
Establish Telephone hotlines, Internet, Email, Facebook, WhatsApp portals and maintenance	500,000	GRM Coordinator, NEP Telephone Hotline Operators, Developers and Operators Customer Care Units, Community-based GRC Secretaries
Set up of GR infrastructure at NEP PMU, including meetings and logistics	200,000	Head NEP-PMU, GRM Coordinator
Funding of states Citizens' Rights/Mediation Centres for optimal support to GRM	2,000,000	Head NEP-PMU, GRM Coordinator
Procurement of Consultancy Services of Independent Mediators & Conciliators	3,500,000	Head NEP-PMU, GRM Coordinator
Logistic support to key community-based GRC members	1,500,000	GRM Coordinator, Developers and Operators

Maintenance of communication systems, including Radio and TV jingles where necessary	1,000,000	GRM Coordinator
ADR Training for GR Administrator	500,000	Head NEP-PMU
External consultant to conduct GRM user satisfaction survey and effectiveness of mechanism	2,000,000	Head NEP-PMU, NEP M&E Specialist, GRM Coordinator
Quarterly town hall meetings and FGDs for GRM user feedback on performance	1,500,000	Head NEP-PMU, NEP M&E Specialist, GRM Coordinator
TOTAL	**20,200,000**	

TABLE 7.1 – Summary budget for GRM

ANNEX 1

SAMPLE GRIEVANCE REGISTERING AND MONITORING FORM

Complainant Information (Person Reporting)

1. Name (Surname first):

2. Address:

3. Acceptable Means of Identification presented:

4. Gender:

5. Phone Number:

6. Email:

7. Category of complainant:

- Affected person/s (AP)
- Intermediary (on behalf of the AP)

8. Assigned Complaint Registration Code:

9. Complaint Details (Describe in summary):
……
……
……
……
……
……
……
……
……

10. Complaint Presentation channel:

- Letter
- Phone call
- SMS
- Email
- Verbal complaint (walk-in)
- Suggestion box
- Others (specify): …….

11. Location of the issue specified in the complaint:

- LGA:
- Project Site:
- Community:

12. Short description of the factors causing the problem:
……
……
……
……

13. Stakeholder/Person/agency accused of being responsible for grievance:

14. Past action/s taken by the complainant (if any):
……
……

15. Details of the grievance uptake point (where this report is made):

Name of the person who received the complaint:

Position:

Date:

16. Action(s) taken by the grievance receiving officer:
……
……

17. Next Actions taken:

Action 1	Action 2	Action 3	Action 4
Short Description	Short Description	Short Description	Short Description

Name of Action Officer	Name of Action Officer	Name of Action Officer	Name of Action Officer
Office	Office	Office	Office
Date	Date	Date	Date

18. Final Resolution

19. Proposed date of feedback to complainant:

20. Mode/Channel of feedback:

21. Officer completing the form:

22. Signature:

23. Date:

Sample Grievance Registration Form

Grievance Redress Registration Form

Date…… Community: ……

Name of Complainant

……

Address

……...

Summary of Grievance

……

……

……

……

Project Component: …….

Category of Grievance: ……

Supporting Documents: ……

Complainant Signature (Thumbprint)/Date: ……

Receiving Officer's Signature/Date: ……

ANNEX 2

FORMAT FOR RECORDING THE PROCEEDINGS OF GRIEVANCE REDRESS COMMITTEES (GRC)

1. Name of the complainant/s:
2. Date complaint was recorded:
3. Means of Identification of complainant
4. Address of complainant:
5. Date of mediation by GRC:
6. Complainant participated in mediation? Yes or No
7. Summary of grievance:
8. Complainants statement:
9. GRC recommendation:
10. Participants at the mediation (GRC Members):

ANNEX 3

PMU MONITORING FRAMEWORK FOR GRM

S/N	OUTPUT	INDICATOR	SOURCES OF INFORMATION	FREQUENCY OF DATA COLLECTION	RESPONSIBLE ENTITY
1	Conduct Preliminary stakeholder engagements/awareness building	Number of stakeholders' engagement meetings conducted	Meeting minutes or reports	1st Quarter	GRM Administrator, M&E officer
		Awareness building and communication materials (fliers, billboards, Bills, other awareness and instructive materials) distributed	Monthly reports of NEP Communication Specialist and GRM Coordinator	Monthly	

2	Set up GR mechanism	Community GRC established Complaints uptake channels set up: Complaint drop boxes, Telephone hotlines, Email, WhatsApp etc. in place	Reports with photographs submitted to the PMU monthly and to the World Bank quarterly	Monthly/ Quarterly	GRM Administrator, M&E Specialist
	Initiate and Operate GR mechanism	Town hall Community Briefing conducted as at when due Grievance receipt and registration (logging); screening; sorting; and feedback to complainants on grievances are being carried out on schedule Communication systems Radio , TV, posters, fliers etc. maintained and effective	Participation/coverage Photographic evidences Report submitted to the PMU monthly and to the World Bank quarterly	Quarterly	GRM Administrator, M&E Specialist, PM
3	GRM processes are working effectively and	Beneficiaries aware and encouraged to	Reports from In-house evaluation	Quarterly	M&E Specialist

	identifying needs for refinements and changes	participate in GRM Beneficiaries actively participating and using GRM			
4	Refinements and changes	Beneficiaries actively participating and using GRM	Reports from In-house evaluation Results from GRM user satisfaction survey by external consultant Results from Independent survey and audit of GRM performance and effectiveness by external consultant	Project mid-term review	M&E Specialist External consultant

ANNEX 4

KEY CONSULTATIONS BY CONSULTANT

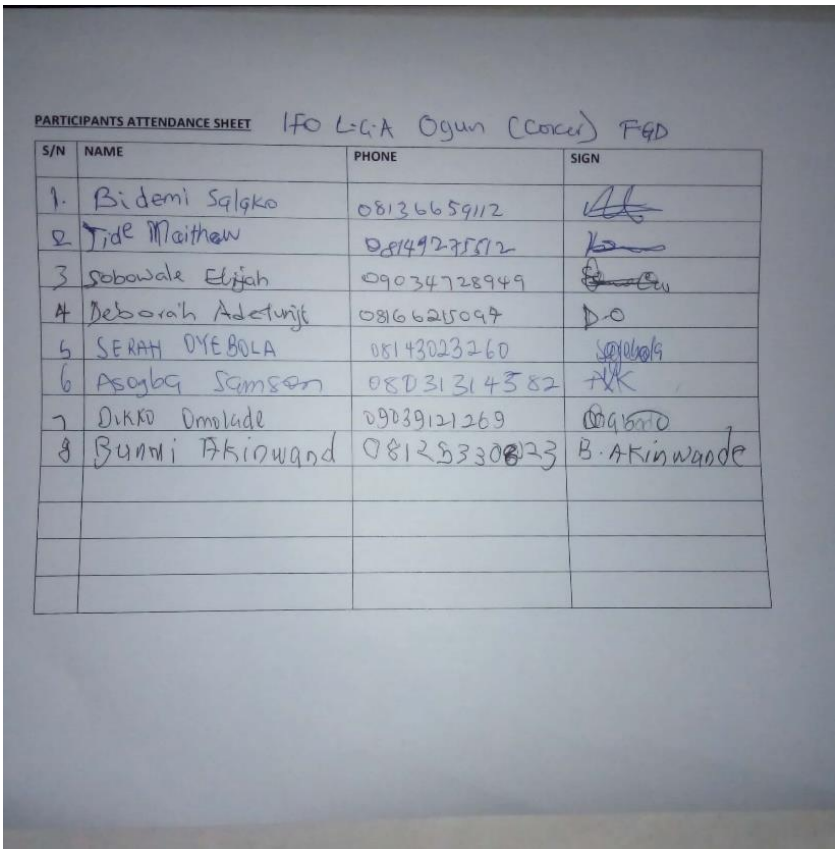
S/No	NAME	ORGANISATION	DESIGNATION	CONTACT No.
REA				
1.	AYANG Ogbe	REA	Director of Promotions	08092292277
2.	OTUBU Anita	REA	Head of Special Duties (EEP Component Coordinator)	08138822835
3.	NWANDU Ifunanya	REA	SHS Component Coordinator	08177777447
NERC				
1.	SHITTU M.	NERC	General Manager, Consumer Affairs	07031022233
2.	Dr ABDUSSALAM Yusuf		Asst. General Manager Renewable Policy, Research & Strategy	08032907889
Federal Ministry of Environment				
1.	ODETORO K.	FMoE	Deputy Director	07032747723
Mini Grid Developers				
1.	Mr Odunaiya	Association of Mini Grid Developers	Secretary	08034078347

Sokoto State				
1.	Barr. Ifeanyichukwu M.	Legal Practitioner/Mediator		08066954034
2.	IBRAHIM Muntari		NEP Coordinator	08096969797
3.	IBRAHIM Hauwa	Tudun Kose – Malgam Community	Women Influencer	09067892008
4.	DANKANI Mohammed	Soron Yamma Alela Community	Community Leader	08188019558
Ogun State				
1.	ADEBAYO 'Bukoa	State Ministry of Justice	Staff Lawyer	08130745617
2.	BAMIDELE Adebayo	Ogun State Citizen's Rights/Mediation Centre	Director	08035651377
2.	FALOLA Hassan	Eruku Community	Community Youth Leader	08067647349
3	KAYODE Toyin	Coker 3 Community	Community Women Influencer	
Cross River State				
1.	ATAMBI E.	Legal Practicioner/Mediator		07035754154
2.	IZAMA Pius	State Electrification Agency		08037577305
3.	Rev. Fr (Barr) John Ebebe	Citizens' Rights Department	Director	08028523222
4.	Ebigha Goodness	Ofonekom Community	Youth Leader	09074015088
Niger State				
1.	ETSU Safiya	Ministry of Justice	Staff Lawyer	08065656666
2.	Dr LEMU Mustapha	State Energy Working Group	Chairman	08037313509

3.	TWAKI Rachel	State Ministry of Women Affairs	Asst. Director	08065562030
4.	MUNI Mohammed	Etsu Tasha Community	Community Leader	

ANNEX 5

ATTENDANCE SHEETS (FGD)



PARTICIPANTS ATTENDANCE SHEET Ifo L.G.A Ogun (Coded) FGD

S/N	NAME	PHONE	SIGN
1.	Bidemi Salako	08136659112	
2	Tide Maithew	08149275512	
3	Sobowale Elijah	09034728949	
4	Deborah Adetunji	08166215097	D.O
5	SERAH OYEBOLA	08143023260	
6	Asaolu Samson	08031314382	
7	Dikko Omolade	09039121269	
8	Bunmi Akinwande	08125330823	B. Akinwande

Edasti L.G.A (Etsy Tasha) F.G.D

PARTICIPANTS ATTENDANCE SHEET

S/N	NAME	PHONE	SIGN
1.	Hajara Umar	—	
2.	Fatima Liman	08168379957	
3	Argawu Ummi	/	
4	salamatu Isa	/	
5	Aisha Mohammed	07055797706	
6	Bilkisu Ibrahim	—	
7.	Aishatu Gims	/	
8	Fati Abu	/	
9	Inaleya Ramatu	/	
10	Amina Ahmed	/	
11	Hawa Suraja	/	
12	Raciya Danlami	/	
13.	Cumba Aishatu	/	
14	Talatu Dangana	—	

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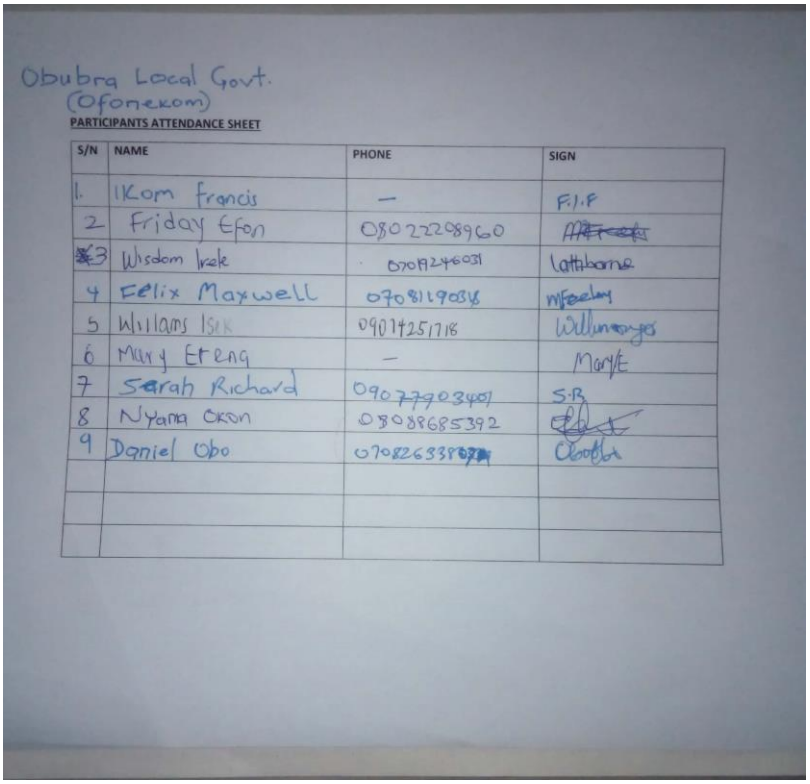


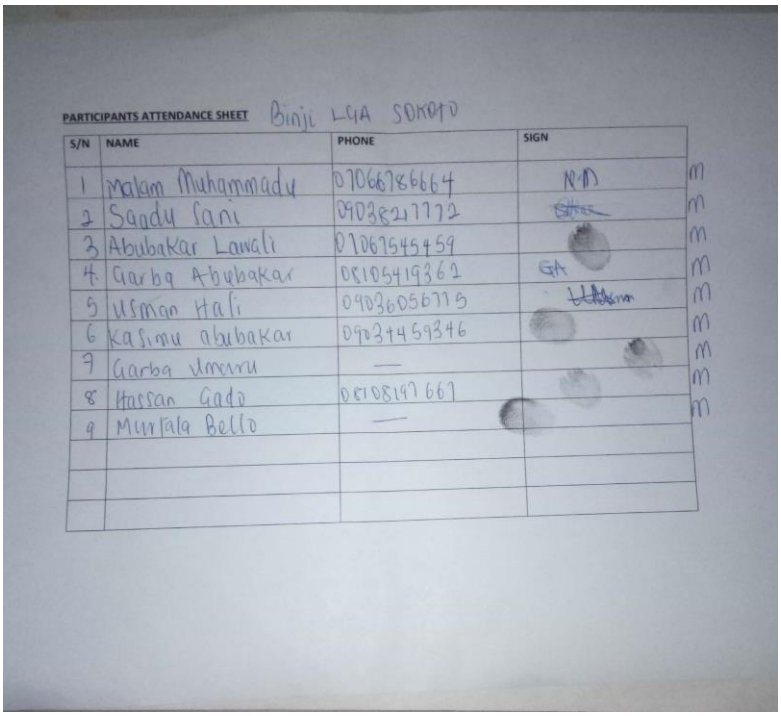
Obubra Local Govt.
(Ofonekom)

PARTICIPANTS ATTENDANCE SHEET

S/N	NAME	PHONE	SIGN
1.	IKom Francis	—	F.I.F
2	Friday Efon	08022289660	
3	Wisdom Irek	07019246031	
4	Felix Maxwell	07081190818	
5	Williams Isik	09074251718	
6	Mary Eteng	—	
7	Sarah Richard	09077903401	S.R
8	Nyama Okon	08088685392	
9	Daniel Obo	07082633807	

PARTICIPANTS ATTENDANCE SHEET Binji LGA SOKOTO

S/N	NAME	PHONE	SIGN	
1	Lami Taniru	—		f
2	Aisha Yusuf	—		f
3	fatima Mohammed	07066786664		f
4	Hussaina Lawali	08102731652		f
5	Sutara Altine	—		f
6	Nefisa Bello	09072612174		f
7	Amina Hali	—		f
8	Salamatu Abu	—		f
9	Zaharau Kabir	08138063920		f
10	Aisha sani	—		f
11	Jamila sanusi	—		f
12	Hauwa Jemilel	09030799016		f



PARTICIPANTS ATTENDANCE SHEET Binji LGA SOKOTO

S/N	NAME	PHONE	SIGN	
1	Malam Muhammadu	07066786664		m
2	Sandy Sani	09038217772		m
3	Abubakar Lawali	07067545459		m
4	Garba Abubakar	08105419362		m
5	Usman Hali	04036056775		m
6	Kasimu abubakar	09037459346		m
7	Garba Umaru	—		m
8	Hassan Gado	08108197667		m
9	Murtala Bello	—		m

CHECKLIST OF HARMONISED COMMENTS RECEIVED FROM FEDERAL MINISTRY OF ENVIRONMENT ON THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) OF THE PROPOSED 2.5 MW SOLAR-HYBRID POWER PLANT AND ASSOCIATED INFRASTRUCTURE IN FEDERAL UNIVERSITY, GASHUA YOBE STATE

S/N	COMMENTS/ISSUES	RESPONSE	REFERENCES
	PRELIMINARY PAGES		
1.	The following key components are not included in this report; • Table of content. • List of tables. • List of figures. • Acronyms and abbreviations. • Executive Summary. They should be included in the final report.	All sections of the draft ESIA report were submitted to the FMEnv for review. However, they have been updated in the final report.	Preliminary Pages
	CHAPTER ONE: INTRODUCTION		
2.	Page 6, National Policy of Environment 2017 not 1989 as revised.	This section has been revised	Page 1-6
3.	Page 7, 1.6.1.2 National Environmental Standards and Regulation's' Enforcement Agency.	This section has been revised	Page 1-7, *1.6.1.2*
4.	Page 9, 1.6.1.3 Federal Ministry of Power should be captured as 'Federal Ministry of Power, Works and Housing' in the updated report. • There is need to give a brief introduction of the Environmental Consultant, Office Address as well as Branch office across the country and the abroad if any.	This section has been revised The contact details of the consultant have been provided in the preliminary pages.	Page 1-9, *1.6.1.3*
	CHAPTER THREE: PROJECT DESCRIPTION		
5.	Page 12 para 1, it reads 'about 6,600 PV panels (for example, JKM340PP-72H-V) would be required to generate a power capacity of 2.5 MW.' • What is the electric generation capacity of each PV Panel? • What is the dimension of the panel? • At what angle is the panel going to be installed? • Is it an auto rotary panel or fixed in one direction installed panel? • What is the distance between two panels?	The Front-End Engineering Design (FEED) was still ongoing as at the time of this ESIA study. Therefore, the model and number of panels to be installed for the project were unavailable. The number of panels provided in the report was based on a review of similar projects	Page 3-10, Para 1
6.	Page 12, Backup Generator: The number of Generators required for recharging of the batteries was mention however; the capacity of each Generator is not mention there is need to present the capacity of the Generators.	The FEED for the project was still ongoing as at the time of the ESIA study. This information was provided by the REA design team, and there is no specific information about the model and number of generators and diesel	Page 3-12, Para 6

S/N	COMMENTS/ISSUES	RESPONSE	REFERENCES
	• Same applies to the Diesel storage tank, the capacity and number of tanks to be installed should be stated.	tanks to be installed for the proposed project at this time.	
7.	Page 16, para 2, it stated that 'It is envisaged that approximately 3,000 people would be required for construction activities. These are divided into low skilled workers (e.g. construction labour who will make up the majority of workers), semi-skilled workers (drivers, technicians, etc.), and skilled personnel (e.g. engineers and expatriates). • Where would this number of workers stay? • Is there provision of workers camps site? • How do you intend to convey these workers to the site if they are not residing within the project site?	The number of workers has been revised, and a large percentage of the workers are to be drawn from local communities located close to the project site. Thus, there will be no need to provide accommodation or transportation for workers.	Page 3-16, Para 2
8.	Page 16, Section 3.5.4 Operational Phase Activities How many workers (skilled and unskilled) is going to be involved during the operational phase of the project?	The breakdown of workers (skilled and unskilled) to be engaged for the operational phase of the project has not been finalized as it is part of the FEED.	Page 3-16, *Section 3.5.4*
9.	Page 17 Section 3.6 Water Use and Supply It was stated that water for the cleaning of the PV Panels will be source from a borehole that will sunk within the project area. There is need to state the number of boreholes to be drilled? What is the volume of water required to clean the panels?	The number of boreholes to be sunk in the project site has not been finalized as it is part of the FEED. An estimate of the volume of water required to clean the panels has been updated in the report	Page 3-17, *Section 3.6*
10.	Considering the nature of the project site and the number of the PV Panels, this required a large volume of water during cleaning. How do you intend to manage erosion?	Trenches will be constructed within the power plant to drain water away from the PV panels area as part of measures to control erosion and stormwater.	Page 3-21, Para 5
11.	Page 21, second to the last paragraph on the page it reads 'Storm water will be managed through a combination of open trenches and ditches. Storm water shall drain away to the natural environment via gravity. Paved and concreted areas will be sloped to allow for proper drainage.' It is expected that the storm water could have been channel to a collection centre e.g. Pond for storage and later be used to clean the panels than solely depend on the underground water.	During the rainy season, the frequency of panel cleaning activities is envisaged to minimal as the rain will wash the dust particles from the panels. Also, storm water is not suitable for panel cleaning as it may contain particles which can be abrasive to the solar panels.	Page 3-21, Para 5